PSYCHOANALYSIS AS AN INTERDISCIPLINARY SCIENCE: FROM 19th CENTURY NEUROPSYCHOLOGY TO MODERN NEUROPSYCHOANALYSIS

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Abstract

This dissertation explores interdisciplinarity from three perspectives. It emphasizes the intellectual foundations of Sigmund Freud's *Project for a Scientific Psychology* (1895) and Alexander Bain's *Mind and Body* (1872). It argues that these neural networks were similar and created via borrowed and integrated knowledge. This thesis contributes to the scholarship on Bain and Freud by presenting an analysis of their models, thus, providing a qualitative comparative analysis to make explicit the continuities and discontinuities in their ideas. In comparing their works, this study finds that there is no evidence that Freud borrowed directly from Bain when he created the *Project*; the similarities in their models are likely due the common academic milieus they emerged from. The discontinuities, however, were due to the neuron doctrine and the new scientific methods that emerged between 1872 and 1895.

Part two of this thesis posits that psychoanalysis began as an interdisciplinary field founded on the *Project*, and that this interdisciplinarity continues today in the field of neuropsychoanalysis. This study finds that psychoanalysis has had a long history of interaction with the various psy-disciplines, particularly experimental psychology, and that the connection between the creation of the *Project* and the emergence of the field of neuropsychoanalysis was not a linear one. A conceptual bibliometric citation analysis demonstrates that, while experimental academic psychologists were testing the validity of Freudian concepts via empirical methods, they were actually borrowing knowledge from psychoanalysis. This analysis expands on the work of Hornstein (1992) and presents the first quantitative analysis of the intense relationship between psychology and psychoanalysis as psychologists were testing Freudian concepts.

This thesis ends with an exploration of the recently created field of neuropsychoanalysis and provides the literature with the first bibliometric citation analysis of the field. In so doing, this portrait of the discipline presents an analysis of the psychological concepts this field is interested in studying, the methods used, and an examination of the extent of collaboration between psychoanalysts and neuroscientists. This is followed with a brief discussion on the clinical and theoretical relevance of neuroscience to psychoanalysis and the increasing concern regarding the validity of imaging techniques.

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Introduction

During the late 20th century there was a sizeable rise in publications emphasizing the importance of interdisciplinary research as a way to advance knowledge (Klein, 1990). I would argue that this trend continues today in academic and professional realms due to an increased call for interdisciplinary projects by government funding agencies in both the United States and Canada. For example, the National Science and Engineering Research Council (NSERC), in their recommendations for funding applications, promote interdisciplinarity and define it on their application website, which states,

> Research that involves the interaction among two or more different disciplines and occurs at the interface between disciplines. This may range from the sharing of ideas to the full integration of concepts, methodology, procedures, theory, terminology, data, organization of research and training. (NSERC, 2015)

Whitfield and Reid (2004) also note the Canadian Institute of Health Research (CIHR) encourages applicants to submit projects that are interdisciplinary in nature. There has been an explicit appeal for disciplines to work together so that knowledge can be transferred from academia to praxis; *Knowledge Translation,* which involves the movement of research from "research producers to research users," is on the rise (Mitton et al., 2007, p. 729).

Although interdisciplinarity appears to be a vibrant new topic in the natural and social sciences today, working with others within and between various fields, and learning within an interdisciplinary educational system, is not a new practice to advance knowledge. Although the term is a 20th century construction, many philosophers such as, Aristotle, Kant, and Plato, to name only a few, have been described as interdisciplinary thinkers (Klein, 1990). These examples demonstrate that the sharing and integration of knowledge, and the "conceptual spillage" that occurs within and between areas of knowledge was more serendipitous and natural in the past (Klein, 1990, p. 86). Knowledge synthesis from this perspective was not a formalized process, at least before the emergence of the modern university.

Klein (1990) explores the concept of disciplinarity and notes, "By the late Middle Ages, the idea of disciplines was being applied to preeminently in three areas: at Paris, to theology and the arts; at Bologna, to the law; and at Salerno, to medicine" (p. 20). The creation of these disciplines was owing to external factors, a push to meet "professional, ecclesiastical, and governmental needs" (Klein, 1990, p. 20). But this philosophy of education changed in the 19th century, particularly in Germany, where educational reforms were triggered after the country's loss to France in the Napoleonic war; Academic institutions moved away from training professionals from a religious point of view and promoted a "modern and secular" perspective, and "the pursuit of higher learning" (Pickren and Rutherford, 2010, p. 47).

These changes within the German institutions played a significant role in the development of specialized scholars or researchers; students were allowed to chart their own research paths, take courses in more than one discipline at various institutions, and "By the end of the 19th century, the German university system was characterized by a highly respected philosophical tradition and emphasized independent research" (Pickren and Rutherford, 2010, p. 49). The German pedagogical standpoint carried over to the United States in the early 1900s (Pickren and Rutherford, 2010).

However, interdisciplinarity emerged in an attempt to solve problems that disciplinarity could not. For example, in the early 20th century one of the first formal attempts at interdisciplinarity was in the United States with the creation of general education programs in the social sciences. General education was to be an "antidote" to the closed-ness of disciplinarity.

At the University of Chicago, John Dewey (1859 – 1952), James Rowland Angell (1869 – 1949), and Franz Boas (1858 -1942), to name only a few, were supporters of interdisciplinary education, however, the "interdisciplinarity was undermined in the postwar era both externally, by a depression, and internally, by ever-increasing specialization" (Klein, 1990, p. 24).

Still, the University of Chicago continued to promote an "interactionist framework" into the 1930s and 1940s (Klein, 1990, p. 24). In general, there were some key moments in the history of the social sciences that drove interdisciplinarity. One movement, from WWI to the 1930s, focused on the borrowing of techniques and methods from the natural sciences, which increased the use of quantitative methods. Klein (1990) also suggests that the 1960s and 1970s were seen as watershed moments in interdisciplinarity, with major universities promoting conferences to bring disciplines together. Furthermore, major education reforms encouraged cross-fertilization, due to student demands, the requirements for specific vocational and professional training, and the growing interest in fields that were naturally interdisciplinary, such as environmental studies. Additionally, privately funded philanthropic programs that promoted cross-disciplinary[1] research were on the rise.

This brief history outlines only a few of the key factors that played a role in the development of interdisciplinarity today, and one can make connections between some of these factors and the creation of the psy-disciplines (see Danziger, 1997; Richards, 2010). However, this dissertation is not meant to be an exposition of interdisciplinarity in and of itself, nor is it a history of the concept; rather interdisciplinarity is the contemporary lens through which I have chosen to explore how Bain and Freud interacted with the knowledge that existed in their

[1] The terms cross disciplinarity and interdisciplinarity will be use interchangeably.

respective worlds, and to study some specific examples of knowledge sharing and boundary crossing between psychoanalysis and some of the psy-disciplines.

Selecting this frame of reference is based on the field of neuropsychoanalysis, which integrates psychoanalysis and neuroscience, and epitomizes the modern view of an interdisciplinary field. Further, Freud's *Project for a Scientific Psychology* (1895*),* as a significant aspect of neuropsychoanalysis' lineage, is an excellent example of theory creation based on the integration of physiology and psychology. Although Freud's creation of this model was perhaps just a natural integration and synthesis of his clinical and research experiences, I view it from a contemporary perspective, as an example of interdisciplinary theorizing based on borrowed knowledge. Similarly, I apply this frame of reference to Alexander Bain's neuropsychological model.

In so doing, I rely primarily on Choi and Pak's (2006) and Klein's (1990) definitions of interdisciplinarity. For example, Choi and Pak define interdisciplinarity in the following manner: (a) "A synthesis of two or more disciplines, establishing a new level of discourse and integration of knowledge; (b) Joint, coordinated, and continuously integrated research done by experts with different disciplinary backgrounds, working together and producing joint reports, papers, recommendations, and/or plans; (c) Interdisciplinary projects involve closer and more frequent collaborative exchanges among researchers drawn from different fields who are working together on a common problem; (d) Interdisciplinary research is a collaboration of several disciplines, but in this case, concepts, methodologies, or epistemologies are explicitly exchanged and integrated, resulting in a mutual enrichment" (pp. 354-355). Finally, they suggest that interdisciplinarity involves two disciplines working on joint projects that have common goals and where participants "learn about and from each other," and it is an interactive, collaborative, and integrative process (p. 355). Klein provides a similar account of the term, and these contemporary definitions of interdisciplinarity map well onto the field of neuropsychoanalysis, primarily because it is a purposeful attempt to create a collaborative discipline.

But interdisciplinarity does not always mean collaboration. The various ways in which knowledge and methods can be transferred between fields has been explored (see Choi and Pak, 2006; Klein, 1990; Pierce, 1999; Porter and Chubin, 1985; Rinia, 2007). Accordingly, I look to Kellert (2008) and Klein (1990) in reference to a specific type of interdisciplinarity that involves the borrowing or transferring of knowledge. Kellert (2008) defines borrowed knowledge, particularly when borrowed from the natural sciences, as “the attempt to transfer concepts, methods, and results to other disciplines,” and he uses Chaos Theory as an example of knowledge transfer and knowledge consumption by researchers in other disciplines (p. 2). Thus, Alexander Bain’s and Sigmund Freud’s models of the mind are more akin to interdisciplinary knowledge transfer or borrowing, since they were created in isolation.

In another example, Klein (1990) states, “From its beginning, experimental psychology borrowed from physics, physiology, and mathematics. The necessity of borrowing was so compelling it was not considered interdisciplinary: it was simply the thing to do…not a matter to be argued about” (p. 105). Thus, knowledge sharing between the disciplines has moved from being a natural, unspoken, perhaps even unconscious disciplinary practice, to the deliberate methodical one we see today.

Because the goals of this dissertation are to analyze Bain’s and Freud’s theories, and provide specific examples of psychoanalysis’ engagements with some of the other psy-disciplines, using the contemporary interdisciplinary lens of knowledge transfer and borrowing[2]

[2] Knowledge transfer and knowledge borrowing will be used interchangeably moving forward in the dissertation.

allows me to make clear the blurred boundaries that reside with these historical examples.

Bain, Freud, and Neuropsychoanalysis

In 1872, Alexander Bain's *Mind and Body: The Theories of their Relation* was published as part of D. Appleton and Co.'s International Scientific Series (ISS). It was the fourth in this ninety-eight book series and sold for fifteen cents at that time. Lightman (2010) argues, "The International Scientific Series was one of the most famous of all Victorian attempts to codify and popularize scientific knowledge in a systematic fashion to a wide reading public across national boundaries and…[it was] composed of the finest work of the most important, current scientific thinkers." (p. 27). When asked to submit his work for this project, Bain (1904) stated that he decided,

> On a volume on Mind and Body, for which, by this time, I had a considerable accumulation of materials…more particularly was the attempt made to deal with the connexion of mind and brain by numerical estimates; namely, by taking, on the one hand, the number of psychical situations, and, on the other hand, the nervous groupings rendered possible by the approximately assignable number of nerve cells and fibres. The primary object of the work being to establish by conclusive evidence the thorough-going connexion of mind and brain (senses and muscles being co-operating factors). (pp. 312-313)

Bain, already having this material on hand, cobbled it together into a book, and within a year of Appleton's request, it was published.

Alexander Bain (1818-1904) is well known in the history of psychology for his two influential textbooks, *The Senses and the Intellect* (1855) and *The Emotions and the Will* (1859), which were the most widely used psychology textbooks in Britain during the last half of the 19th century (Robinson, 1977). In comparison to these two texts, *Mind and Body* received much less attention at the time of its publication and has been of limited interest to historians of psychology since. This lack of historical interest is the motive for three research questions regarding Bain: 1) What are the key foundations and conceptual elements of Bain's neural network model of psychological functioning? 2) How and what knowledge did he borrow to create this model? And 3) why has this interdisciplinary effort, to some extent, been omitted from history?

These questions become particularly relevant in light of the fact that Bain provided the first detailed neural network that integrated philosophical psychology (associationism) with neurophysiology in an explicit attempt to understand the neurological foundations of pleasure and pain, conscious and unconscious processes, thought, learning, and memory. His was a hypothetical energy model that theorized how neurons communicate when they are in a network of connected cells and, to date this has not been detailed in the literature; most histories of neural networks begin with Santiago Ramón y Cajal's (1852-1934) contributions to the neuron doctrine and end with Donald Hebb's (1904-1985) theory of (Hebbian) learning and memory. In filling in this breach the literature, chapter one of this dissertation will detail Bain's *Mind and Body*, extract and explain the key concepts that Bain was attempting to more fully understand, and explore the interdisciplinary foundations of Bain's neural network model.

In the 1890s, with the advent of the neuron doctrine, a small number of comparable models followed Bain's, but without direct reference to *Mind and Body*. For example, in the field of psychology William James (1842-1910), in his *Principles of Psychology* (1890), illustrated his "stream of consciousness" theory as an associative neural network, and although James cited Bain's two textbooks (1855 and 1859), he did not reference *Mind and Body*. Sigmund Exner (1894), in *Entwurf zu einer physiologischen Erklärung der psychischen*

Erscheinungen (*Draft of Physiological Explanation of Mental Phenomena*), sketched neural network models of sensory-motor and cellular connections in the visual system. However, he is more widely known in the history of neurology for his discovery of Exner's area, a localized area of the middle frontal gyrus known as the "writing center," (Roux, Draper, Köpke, and Démonet, 2010) and Exner bodies, a type of tumor cell. Exner's connection to the history of psychoanalysis is his association to Freud; Exner was one of Freud's teachers and inspired him to create his own version of a neural network model.

Because Bain assimilated knowledge from at least two disciplines and tried to explain so many psychological processes, his network theory was multifaceted and more intricate than the above noted networks. However, Sigmund Freud's 1895 neural network model as outlined in *Project for a Scientific Psychology*, was a complex expansion on Bain's.

Twenty-three years after Bain wrote *Mind and Body*, during the fall of 1895 on a train ride from Berlin to Vienna, Freud feverishly began scribbling out *Project for a Scientific Psychology* into two notebooks. The *Project* was a handwritten 100-page manuscript that contained forty thousand words and was literally free of alterations; it contained only 20 corrections. The work, which was not published in Freud's lifetime but was sent to his friend Fliess in the form of letters, described the hypothetical workings of the nervous system and presented three parts describing normal psychological processes, pathology, and thought processes. In 1895, neurology was still in its infancy and Freud's aim was to create a "psychology for neurologists" (letter to Fliess, April 27, 1895, cited in Freud et al, 1954, p. 127). Although Freud believed that his theory was really just "imaginings, transpositions, and guesses" (Strachey, 1966, p. 284), his neural network model was founded on borrowed knowledge that he amended and integrated in an attempt to neurologically explain emotion, thought, conscious and unconscious processes, dreams, and memory.

The first interdisciplinary perspective in this dissertation explores the integration of neurology and psychology in the late 19th century with specific reference to Alexander Bain's *Mind and Body* (1872) and Sigmund Freud's *Project for a Scientific Psychology* (1895), and each model will be outlined in chapters one and two, respectively. Detailing Bain's little known theories in light of Freud's provides an opportunity to see these models from a new point of view. One that demonstrates how these theorists integrated knowledge from various disciplines to create interdisciplinary models of the mind, at a time when this type of integrative theorizing was not the norm.

A full comparison of these two works is presented in chapter three, something that does not exist in the current literature. Investigating whether the commonalities in these works are due to coincidence, the influence of similar scientific milieus, or because Freud had some kind of indirect exposure to Bain's ideas is a question that to date has not been asked. Accordingly, this chapter will explore the continuities and discontinuities in the concepts Bain and Freud theorized about and consider whether Freud borrowed from Bain. Hence, Freud's library is explored to test this "inspiration hypothesis." Specifically, I consider Freud's readings of David Ferrier, Theodor Meynert, John Hughlings Jackson, Franz Brentano, Jean-Martin Charcot, and Théodule-Armand Ribot; all are examined as possible sources of knowledge transfer between Bain and Freud. In addition, Freud's direct citing of Bain and Freud's translation work will be considered.

In addition, chapter three will consider why Bain's *Mind and Body* has been overlooked in the history of psychology and neuroscience, and why Freud's was never taken seriously as a useful model by the psychological and neurological scientific communities. The idea that Bain's and Freud's theories have been somewhat lost in history led me to find parallels in Wozniak's (2005) "Lost Classics and Forgotten Contributors" theory, which suggests there are definitive reasons why psychological theories survive over time, disappear, and/or are rediscovered at a later time in history. Specifically, Wozniak's theory will be used to consider why Bain's and Freud's theories were lost and how both authors actually contributed to the disappearance of their own works.

Although both theories have been neglected, in comparison to Bain, Freud's *Project* has had a much larger profile in the academic scholarship. The bulk of this literature concentrates on the fact that Freud's *Project,* when published posthumously in 1950, presented Freud's psychoanalytic theories in a new light; it was discovered that, "The *Project*, or rather its invisible ghost haunts the whole series of Freud's theoretical writings to the very end" (Strachey, 1966, p. 290). After the *Project* was posthumously published in 1950 its historical significance was quickly recognized and written about. However, forty years later, in the 1990s, Freud's neurological model became further identified as an important and fundamental source for a new interdisciplinary field called neuropsychoanalysis. Therefore, this thesis argues that the *Project* engendered the creation of two interdisciplinary fields, psychoanalysis in 1899 and neuropsychoanalysis, one hundred years later.

Thus, the second foray into interdisciplinarity in this study considers classical Freudian psychoanalysis, as a clinical-theoretical outgrowth of the *Project*, and its complex relations with other mental sciences; particular emphasis is placed on experimental academic psychology. More specifically, a number of vignettes are presented that illuminate specific moments in time where psychoanalysis' interaction with other psy-fields was intensified, if only briefly, as conceptual knowledge and methods were transferred back and forth between them. In chapter four, these reciprocal relationships will be assessed from five frames of reference throughout the history of psychoanalysis from 1900 to 2016.

I begin by discussing Freud and Jung and their early relationship with experimental psychology via empirical methods. Jung's borrowing of experimental methods to test Freud's theory of repression, and Freud's waxing and waning support for the use of empirical methods, are highlighted. This is followed by an exploration of Freud's first and only trip to America in 1909, when he was invited to attend Clark University's 20th Anniversary Celebration. Freud received an honorary degree here and presented his ideas to an audience that today might be called interdisciplinary; presenters and attendees at the conference were from the fields of psychology, physiology, psychiatry, anthropology, physics, chemistry, zoology, physiology, religion, and linguistics. In light of this, when Freud presented his five lectures on psychoanalysis at Clark, he discussed empirical research that supported his theories of psychic functioning. The motivation for his integration of science into his psychological talk is also considered in this section.

The third interdisciplinary connection considers psychology's "co-opting" (Hornstein, 1992) of psychoanalytic theories and concepts. This historical moment takes up the bulk of chapter four and employs a bibliometric citation analysis of seven academic surveys of empirical studies, spanning from the 1940s to the 1990s, to investigate which Freudian concepts intrigued psychologists the most. I argue that as experimental psychologists were testing psychoanalytic concepts and theories, primarily to prove Freud wrong, they were actually transferring psychoanalytic knowledge into their field; it was disseminated by psychologists in psychology journals and transferred to many areas of psychology such as social psychology and personality psychology, to name only a few. In ending this chapter, I delve deeply into this historical period primarily because it is a moment in time when psychoanalysis and psychology were in an intense interdisciplinary entanglement. In analyzing the conceptual trends in these surveys I employ Danziger's (1993) idea of historically changing "psychological objects" and include a timeline of the specific concepts that were of primary interest to psychologists over a fifty-year time period.

The final example of interdisciplinarity presented in this dissertation analyzes neuropsychoanalysis, a discipline that, alongside the use of psychoanalytic therapy, employs contemporary neuroscientific methods to explore psychoanalytic processes and concepts that began in the *Project* and Freud's classical formulation of psychoanalysis. More specifically, this section of the study will test Choi & Pak's (2006) hypothesis that a "synthesis of two or more disciplines [can establish] a new level of discourse and integration of knowledge," and sometimes the creation of new fields (p. 355). Consequently, the idea of borrowed and integrated knowledge, and the influence of history on psychological objects, is used as a framework to investigate the history and development of the field of neuropsychoanalysis.

Neuropsychoanalysis' status as an interdisciplinary venture will be compared with that of its predecessors a century earlier. In addition, this examination will argue that psychoanalysis and neuroscience are very compatible; psychoanalysis looks at the brain from a subjective viewpoint, from the inside out, while neuroscience's mission is to understand the brain from the outside in as it measures behaviors and investigates the physical mechanisms of function (Solms, cited in Schwartz, 2015, p. 49). It is the amalgamation of these two disciplines that allow for both a qualitative and quantitative exploration of psychological concepts, as these concepts relate to real human experiences.

This chapter will also use a bibliometric citation analysis, using the discipline's journal, *Neuropsychoanalysis*, to provide a portrait of the discipline by assessing the psychoanalytic concepts this field is interested in studying, the methods it uses, and the collaborative work between psychoanalysts and researchers in the neuro fields. A comparison between the concepts studied in the historical surveys summarized in chapter four and those explored in the field of neuropsychoanalysis today is presented, arguing that there are continuities and discontinuities in the concepts studied, and that advances in brain science and technology have played a significant role in changing how Freudian concepts are now investigated.

The chapter ends with a brief discussion of some of the pros and cons of integrating psychoanalysis with neuroscience and asks, does mind equal brain? Bain and Freud also asked this question, however, today we have some advantages they did not; namely brain imaging technology. But is there an over reliance on these methods? This section discusses the case both for and against the interdisciplinary field of neuropsychoanalysis and evaluates both the clinical and theoretical relevance of this field.

Chapter One

Alexander Bain's *Mind and Body* (1872) as a Case Study in Key Concepts and Borrowed Knowledge

> Many persons, mocking, ask-What has Mind to do with brain substance, white and grey? Can any facts or laws regarding the spirit of man be gained through a scrutiny of nerve fibres and nerve cells?
>
> (Alexander Bain, 1872, p. 1)

To date, there has been no thorough examination of Alexander Bain's 1872 *Mind and Body: The Theories of their Relation*, from either a historical or theoretical standpoint. This dissertation attempts to remedy this by evaluating Bain's theory as a case study in borrowed knowledge. This chapter will expand on the previous shorter work of Wilkes and Wade (1997) by first discussing how this book came to fruition and considering some of the key figures that Bain may have directly or indirectly borrowed from in creating his neural network.

In *Mind and Body*, Bain integrated associationism and physiology as he theorized about emotion, thought, learning, memory, and conscious and unconscious, thus making these concepts his "objects of study." The idea of integrating two fields to systematically solve specific problems or answer particular questions about the mind-body relationship was a unique endeavor, particularly in light of the fact that it had been almost one hundred years since David Hartley had theorized that brain particles vibrated as sensory information entered the brain (1749); Bain's use of more recent neurological findings gave him a strong advantage over Hartley. This chapter will evaluate Bain's attempt and consider why *Mind and Body* did not stimulate further elaboration by him, or receive the historical notice his earlier works attained (1856; 1859).

Alexander Bain

Alexander Bain (1818-1904) is well known for founding the first psychological journal, *Mind* in 1876, for his scholarly writings in education, rhetoric, and logic, and for his two-volume book, *The Senses and the Intellect* (1855) and *The Emotions and the Will* (1859). These texts went through numerous editions and became the standard psychology texts used in Britain and the English-speaking world for nearly fifty years, until William James (1842-1910) published *The Principles of Psychology* in 1890 (Robinson, 1977). Additionally, Bain was among the first to provide a chapter on the functioning of the brain and nerves in these texts, and he has been called one of the first philosopher-psychologists who attempted to integrate neurophysiology and psychology (Young, 1968).

As a figure of historical interest in psychology, Bain has been studied from a biographical point of view (Flesher, 2000; Hearnshaw, 1964) and from the perspective of his impact on British psychology, philosophy, and culture (Brett, 1921; Mischel, 1966; Murphy, 1932; Rylance, 2000; Staley, 2004). Accounts and the impact of Bain's association theories have also been published (Boring, 1950; Cardno, 1956; Greenaway, 1976; Robinson, 1976; Shearer, 1974; Warren, 1921). Almost all of these references to Bain focus on his two influential textbooks.

Although *Mind and Body* was quite popular in its day, going through nine editions and several translations, it has received surprisingly little explicit historical attention; most often being referenced only in passing (Boring, 1950). Many histories of neural networks begin with the associative writings of Aristotle and jump to the 1949 work of Donald O. Hebb (1904-1985) with little or no consideration given to Bain (Quinlan, 1991; Valentine, 1989). However, on occasion, *Mind and Body* has been noticed. Cardno (1956) made two references to Bain's nerve-cell arrangement theory in his discussion of Bain's physiology and, in 1966, Mischel, when exploring Bain's theory of emotion and motivation,[3] provided examples of Bain's neurophysiological theories from the book. Greenway (1973) made one notation regarding Bain's nerve theory of memory in her paper on the integration of Bain's associationism and action, and Gage and Hickok (2005) made many references to Bain's neurological theories.

While these scholars in psychology have made note of *Mind and Body*, some historians of neuroscience have also recognized it. For example, Macmillan (2000; 2004) compared Bain's neurological theories to that of Freud and Ferrier in two seminal papers, and Finger (1994; 2000) briefly mentioned Bain's theory of memory stating, "The idea that synaptic growth could account for memory was anticipated in 1872 by Alexander Bain, David Ferrier's teacher in Scotland and a leading mental associationist. Bain, however, proposed his theory before scientists had the mind-set to give it serious consideration" (2000, p. 213). More recently, however, there has been wind of Bain's neurophysiological model (1872) in contemporary empirical neuroscience studies (Arendt, 2003, 2009; Dudai, 2009; Kim, Koo, Lee, & Han, 2005; Leff, Roma-Parra, Medicigo, Gutierrez, & Anton, 2001; Rosenzweig, 1996; Tyler, Alonso, Bramham, & Pozzo-Miller, 2002). These papers all make brief mention of Bain's synaptic memory theory, noting its existence in *Mind and Body* in 1872, but they do not elaborate on its relevance.

Wilkes and Wade (1997) appear to be the first to recognize Bain's *Mind and Body* as an early neural network model and detail particular aspects of his theory. Their goal is to give Bain some form of historical recognition by comparing his work to that of Hebb (1949). More specifically, they see continuities between Bain's theory and Hebb's idea that neurons that fire together go on to be wired together; they state, "Bain anticipated certain aspects of connectionist

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[3] Bain never used the word "motivation," Mischel applies this word to Bain's work. Bain did however use the word "motive" which Danziger (1997) argues is different; this issue will be discussed later in this chapter.

ideas that are normally attributed to 20th-century authors—most notably Hebb" (Wilkes and Wade, 1997, p. 295).

Bain's Borrowing: A Case Study in Important Figures and Theories

John Stuart Mill. Bain's work came at a very important time in the history of British psychology when a move toward scientific definitions of psychological theory began. He cited the associative theories of John Locke (1632-1704), David Hume (1711-1776), David Hartley (1705-1757), and was also highly influenced by his friend and colleague John Stuart Mill (1806-1873).

At the age of 24, after attaining an undergraduate degree from Marischal College[4] in Aberdeen, Scotland, Bain submitted his first article to the *Westminster Review*, entitled, "Electrotype and Daguerreotype" (September 1840), which was a review of two papers; one by Thomas Spencer (on voltaic electricity) and the other by J. S. Memes (on new methods of photogenic drawing). Bain's second article for the Review was published in July of 1841 and was entitled, "On the Constitution of Matter." These two papers caught the attention of Mill, who was the former editor of the *Westminster Review*, and Mill spoke favorably of Bain's papers. In a letter to Bain, Mill, acting like a mentor, suggested he read Herschel and Whewel's works as well as that of Comte (Bain, 1904). Snyder (2010) argues that Mill's interest in Bain's paper on "Matter" may have been due to Bain's citing of Faraday, which drew Mill into a new area of scientific interest.

In addition, Rosen (2014) suggests that Mill admired Bain and perhaps saw a younger version of himself in the fledgling scholar. Thus, in 1842, after reading Bain's two papers, but before meeting him in person, Mill wrote to the editor of the *Edinburgh Review* and stated, "As

[4] Marischal College later merged with King's College to form the University of Aberdeen.

for Bain, I completely understand him, because I have been, long ago, very much the same sort of person, except that I did not have half his originality" (Rosen, 2014, p. 123). The feeling was apparently reciprocated and Bain stated, "There was a mass of entirely novel thinking, and I devoured the volumes greedily. Mill's political and other articles, as might be expected, had a wonderful fascination for me" (1904, p. 67). In light of their mutual admiration, Robertson, Mill's assistant at the *Review*, suggested that Bain write to Mill directly and so, on September 7, 1841, their correspondence began.

The letters between Bain and Mill consisted of recommendations on books and articles of mutual interest, and Mill sent Bain a copy of this father's book *Analysis of the Phenomena of the Human Mind* (1829), and kept him up to date on the progress of his book, *A System of Logic*, which was published in 1843. After seven months of correspondence, Bain boarded a steamer in Edinburgh and headed for London to meet Mill in person. Bain stayed in London for the summer of 1842 where he got to know Mill, did some sightseeing, and took advantage of reading from Mill's library; Bain was particularly interested in Mill's readings on associationism and the sciences, where he was drawn to anatomy, physics, and chemistry. Mill was also very connected in London and he introduced Bain to many physiologists and scientists who Bain would later borrow from to create his 1872 neural network model. Bain returned to London each summer for the next seven years to spend time with Mill, edit and revise Mill's manuscripts, teach at the London Mechanics Institute, and attend lectures in physiology and anatomy. Bain's London summers were evidently his "hands on" introduction to associationism and physiology and the beginnings of his interest in integrating these two fields. Bain remained a close friend of Mill for the rest of the latter's life.

Clearly Mill was a great mentor to Bain and had great respect for his work. Mill took a particular interest in Bain's integration of physiology and psychology and upon the publication of *The Emotions and the Will* (1859) Mill stated that he "…was pleased at the amount of reference made to physiology" (Bain, 1904, p. 159). Among the first to include a physiological chapter in his psychology texts, Bain set a precedent for how psychology texts were written thereafter by others (Boring, 1950). He also continued this trend in many of his own works that followed. For example, his *Mental and Moral Science* (1868) and *Mental Science: A Compendium of Psychology* (1880) were often used as textbooks and both began with chapters on the nervous system. In these neurological chapters, which ran about 60 pages, Bain referred to the most up to date research and, with each new edition of his texts, he revised the physiology to keep it current, referencing only the most eminent physiologists.

Edward Youmans and Balfour Stewart. In addition to the influence of Mill, the publishing invitation by Edward Youmans, the editor for the Appleton Company, was also a factor that contributed to Bain's development of *Mind and Body*. Between 1863 and 1864 Bain wrote three papers for the Philosophical Society. In referring to these papers Bain (1904) stated, "In connexion with Psychology, I wrote for the Philosophical Society - three successive papers on the physical accompaniments of the mind - which formed the most prominent psychological topic in my thoughts for several years; the final outcome being seen in the volume on Mind and Body" (p. 277). Although Bain wrote these papers ten years before the publication of *Mind and Body*, the actual inception of book did not begin until 1871 when Bain attended a meeting of the British Association in Edinburgh where he met Dr. Edward L. Youmans (1821-1887).

Youmans was best known for creating and editing *Popular Science Monthly*, a magazine that brought science to the lay public, and for his work as an agent for the publishing firm

Appleton & Company of New York. Appleton and Company had wanted to start an International Scientific Series, obtaining contributions from members of the British Association, and offered Bain a chance to submit *Mind and Body* as part of this series.

Along with *Mind and Body*, Bain also produced *Education as Science* (1897) as a contribution to the series, which became volume 25. In addition to Bain, other contributors included biologist Herbert Spencer (1820-1903) with the fifth edition entitled *The Study of Sociology* (1874) and asylum medical superintendent Henry Maudsley (1835-1918) contributed *Responsibility in Mental Disease* (1874), which became volume nine. In addition to psychological topics, the series also included volumes from the hard sciences with books such as, *The New Chemistry* (1882) by Josiah Cooke (1827-1894) and *The Conservation of Energy* (1873) by physicist Balfour Stewart (1828-1887), to name only a few. Under Youmans editorship, the series went on to publish 57 volumes from all areas of science and technology.

I make special note of Balfour Stewart's (1873) contribution above primarily because in 1867 Bain wrote an article for *Macmillan's* magazine, a British monthly periodical that focused on 19th century English literature, history, and criticism, entitled "On the Correlation of Force in its Bearing on Mind." This paper was then included in Stewart's book as the appendix with the title somewhat altered to "The Correlation of Nervous and Mental Forces." Stewart explained in the preface why he had asked Bain to include this section in his physics book. Stewart (1873) stated,

> Professor A. Bain, the celebrated Psychologist of Aberdeen, who has done so much to advance the study of the mind in its physiological relations, prepared an interesting lecture not long ago on the "Correlation of the Nervous and Mental Forces," which was read with much interest at the time of its publication, and is now reprinted as a suitable

exposition of that branch of the subject. These two essays, by carrying out the principle in the field of vital and mental phenomena, will serve to give completeness and much greater value to the present volume" (p. vi).

Evidently, Stewart thought highly of Bain's ability to integrate the mental and the physical and Bain would go on to use this same mental force theory in his 1872 neural network model. Furthermore, in looking at the opinions of Youmans and Stewart, it is clear that Bain was a leader in his field at the time, making it even more peculiar that, even though *Mind and Body* went through many editions and sold well, it did not have a long-term impact on the field of psychology in comparison to his earlier textbooks.

Bain's Borrowing: Physiology

In referring to his earlier book, *The Senses and the Intellect,* Bain stated, "The anatomy portion of these texts was principally taken from Quain's Anatomy" (1904, p. 234).[5] Bain had attended anatomy and physiology lectures by Richard (1800-1887) and Jones Quain (1796-1875) and William Sharpey (1802-1880) during his London summer visits, and he went on to reference the fifth edition of their book *The Elements of Anatomy (1843).* More specifically, Bain used Quain and Sharpey's work to explain nerve cells and fibres, the hemispheres, the functions of the nerves, the lobes of the brain and the spinal cord. He also included four diagrams from *Quain's Anatomy* detailing the nucleated nervous cell and attached fibres, a section of spinal cord, the hemispheres, and the lobes of the brain.

In addition to meeting Quain and Sharpey in London, Bain was also introduced to anatomist William Carpenter (1813-1885). In reflecting on this meeting, in his autobiography

[5] *Quain's Anatomy* was the book *The Elements of Anatomy (1843),* written by brothers Richard and Jones Quain, Irish anatomists and physiologists, who were professors at University College London from 1850-1866. William Sharpey, the Scottish anatomist, edited the fifth edition of this book.

Bain stated, “I believe it was during this summer [1842] that I made the acquaintance of Dr. Carpenter, through Mill…I never failed to see Carpenter in the London summer visits. Mill had been very much impressed from the outset by his writings on physiology” (1904, p. 133). The knowledge Bain borrowed from Quain, Sharpey, and Carpenter for his earlier textbooks was later integrated into his 1872 model of the mind.

Bain also relied upon the work of Charles Bell (1774-1842) to explain the spinal root motor nerves and included one of Bell’s diagrams of this. More specifically, Bain extended the Bell-Magendie law, which stated that the ventral spinal roots transmitted motor impulses, while the posterior spinal roots received sensory stimulation. Bain agreed on the role of the roots of the spinal cord, but he also suggested that the thalamus was the highest sensory center and that other higher brain centers also contained motor fibers (Young, 1970, p. 268). In addition, Bain drew on the work of Robert Todd (1809-1860) and William Bowman (1816-1892); he referenced their book, *The Physiological Anatomy and Physiology of Man, Vol I* (1845) and explained the importance of cortical matter to consciousness, feeling-prompted action, and volition as he stated, “Mind is thus preeminently associated with the hemispheres” (1855, p. 54). From the physiological writings of Johannes Müller (1801-1858), Bain adopted an interest in motion and the motor system, which was a novel approach in the associationist tradition where sensation had been the focus.

Young (1970) suggested that this new motor emphasis provided psychology with a balanced sensory-motor view for the first time. Finally, in his earlier texts and in *Mind and Body*, Bain also quoted the work of British physicist, Michael Faraday (1791-1867), borrowing from his electromagnetic induction theory to create his neural network energy model, and Hermann von Helmholtz’s (1821-1894) and Emil du Bois-Reymond’s *(1818-1896)* reflex and nerve impulse studies, respectively, to try to assess just how many nerve cells were needed for biological functioning.

Dr. Smith Lionel Beale. Bain's theories were also partially borrowed from the 1864 work of clinical pathologist Dr. Lionel Smith Beale (1828-1906). Beale, a physician from Covent Garden and professor of physiology and of general and morbid anatomy at King's College, London, became well known in the field of medicine owing to the popularity of his books on the clinical uses of the microscope. In 1854, he published *The Microscope and its Application to Clinical Medicine*, which went on to go through four editions, the last published in 1878. A companion volume, *How to Work with the Microscope,* was published in 1857 and went through five editions, the final published in 1880.

Beale was a tireless researcher and a prolific writer in the areas of microscopy, histology, and pathology. He developed various techniques for the staining and fixing of cells to facilitate the differentiation of the component parts of neural cells and tissues, and was also well known for his identification of the pyriform nerve ganglion cells, now called "Beales" cells. Beale, along with Todd and Bowman were leaders in British pathology for almost 25 years (O'Connor, 1988).

Although Beale had numerous publications, it was his 1864 work entitled "Indications of the Paths taken by the Nerve-Currents as They Traverse the Caudate Nerve-Cells of the Spinal Cord and Encephalon" that most strongly influenced Bain's neural network. This paper was published in the 1863-1864 edition of the *Proceedings of the Royal Society of London* and, although Bain never met Beale or corresponded with him directly, he very much respected his work and theories. Beale's strength was illustrating; he did not theorize about the psychological consequences of these connections, as Bain did. Beale's intention, however, was to take a closer look at the internal structure of the nerve cells and fibers, examine the fibrous connections, and theorize about how currents moved throughout the network of cells in the brain. Beale included numerous neurological diagrams in this paper, many of which resonated with Bain, so much so that he borrowed and elaborated on them in *Mind and Body*.

In examining these diagrams, comparing figures 1 and 2 below, there are similarities in terms of the existence of cells bodies that have fibrous extensions, which reside within a network where the fibers cross paths with each other, however, some major differences do occur. Beale argued that, *b, b,* and *b,* on the left side of his diagram, were fibers that emerged from cells *a* and *a,* on the right. He gathered that when numerous fibers emerged from the cell bodies on the right (*a*), they all merged to become single fibers on the left (*b*).

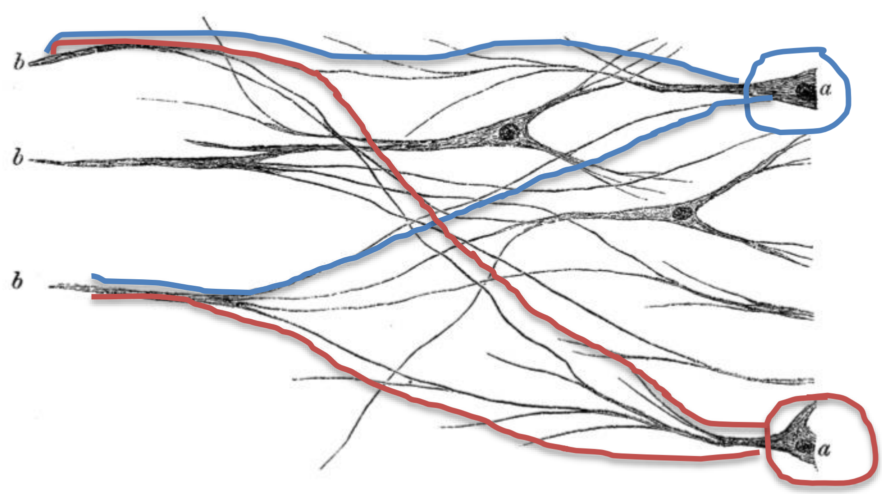


Figure 1. Beale (1863-64, p. 390). Coloured directional lines added to demonstrate the fiber pathways.

Below, Bain altered Beale's functional theory by suggesting first, the fibers did not merge from many into one: Bain argued that *a, b, and c,* on the left were different fibers that represented three different incoming sensory sensations. Second, he suggested that intermediate nerve cells were necessary to propagate this stimuli forward though the network; cells *á*, *b′, ć*, then passed this stimuli to numerous other cells; stimuli *a* triggered cell *á* which caused responses Z and X, while stimuli *b* triggered cell *b′* which caused responses X and Y, and stimuli *c* triggered cell *ć* which caused responses Y and Z. Bain sated, “these cells, X, Y, Z, are supposed to be the commencement of motor fibers, each communicating, with a separate muscular group, and rousing a distinctive movement. By this plan we comply with the primary condition of assigning a separate outcome to every different combination of sensory impressions” (Bain, 1872, p. 111). The next section of this chapter will detail Bain’s functional theories in light of his borrowing of Beale’s structural descriptions.

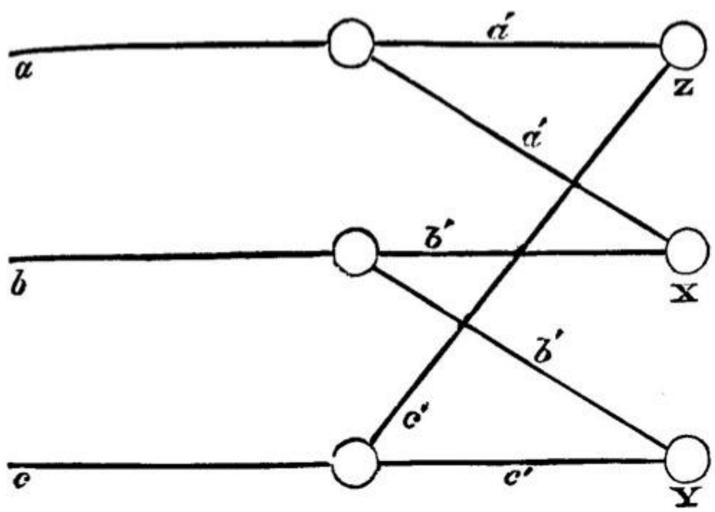


Figure 2. Bain (1872, p. 110).

Mind and Body (1872): Bain's "Objects" and Objectives

The Manuscript: A 19th Century Context

During the last quarter of the 19th century, there was a surge in research that sought to understand the structure and function of nerve cells, which also marked the beginning of the neuron doctrine. It was during this time that Bain also theorized about the cellular structure and function of nerve cells.

In the beginning of *Mind and Body* Bain explained the scientific method and the importance of looking for cause and effect processes when studying the nerves and their relationship to behavior and psychological function. He briefly touched on phrenology and noted his agreement with the idea that larger brains produced higher intellect.[6] But this discussion was short-lived and he moved on to discuss the elements of nerve tissue where he stated, "Under the microscope, the White matter, constituting nerve-threads wholly and the centres in great part is seen to consist of fibres or very minute threads, every visible nerve being a bundle of these fibres…and the Grey matter is a mixture of these fibres with a distinct class of bodies called cells, vesicles, or corpuscles – small bodies, round, pear-shaped, or irregular, with prolongations to connect them with the nerves" (p. 28). Finally, he noted, "these two elements – fibres and cells together with the enclosing membranes, blood vessels and cellular tissue, make up the nervous system, both centres and ramifications" (p. 28).

To provide an example of how detailed Bain was, he theorized that there were two varieties of fibers, "the chief are white or tubular fibers and consist of 1) an outer structureless membrane, 2) an interior surrounding layer of fatty matter, and 3) a central core or cylinder –

[6] In 1861 Bain published, *On the Study of Character Including an Estimate of Phrenology*.

which is not fatty – but albuminous (nitrogen or protein)" (p. 28). He also estimated the thickness of the fibres as ranging from 1/1500 to 1/12,000 of an inch, with the average being about 1/6000 of an inch. He used these findings to set the stage for his discussions on neural cells and connections in the later chapters of this book.

***Mind and Body* (1872*)*: A New Direction for Associationism**

In *The Senses and the Intellect,* Bain had followed the introductory chapter on the nervous system with separate chapters on the five senses, the appetites, movement, instincts, intellect, and the emotions. His second volume, *The Emotions and the Will* categorized the emotions and included a chapter on each individual emotion, which included, terror, the self, power, conflict, desire, sympathy and imitation, emotions of intellect, tender emotions, aesthetic emotions, ideal emotions, morality, and emotions of action and pursuit. I call attention to these earlier texts (1855; 1859) because, although Bain's work in *The Senses and the Intellect* covered the anatomy of the nervous system, much of this was not coordinated with the later psychological chapters in these texts. The physiological chapters in all of his texts appear to have been stand alones, providing the reader with the most current research on anatomy and physiology, while the chapters that followed were written from a mental philosophy framework. In *Mind and Body*, however, Bain more explicitly attempted to integrate physiology and psychology by conceiving a neurological network that could explain thought processes, learning, memory, emotion, and consciousness.

Mind and Body contained 200 pages and seven chapters, making it a much smaller book than Bain's earlier texts (1855; 1859), which both ran almost 700 pages each. From a historiographical perspective, *Mind and Body* expanded on the work of David Hartley and John Stuart Mill in three ways. First, Bain's application of the recent sensory-motor physiology to associationism took his work away from philosophy and more toward empirical theorizing about philosophical ideas. This interdisciplinary effort was based on Bain's deep desire to create a scientific explanation of the mind.

Looking to Newton for inspiration, Bain provided the following parallel: "…with regard to the nature of Gravity– we have, since the Newtonian discovery, learned to consider that as a solved problem, and a good example of what constitutes finality in scientific enquiries: namely when we have generalized a natural connexion to the utmost, ascertained its precise law, and traced its consequences" (p. 88). So, Bain emphasized the importance of specific laws of psychological functioning and observing cause and effect relationships in the mind and body; he posited that the sense organs could be correlated with their affiliated "moving organs." For example, he argued that small amounts of sensory input caused small movements by the body, while larger amounts of stimulation caused significantly bigger movements (e.g. a light tickle on the hand versus a painful pinch caused proportional reactions).

Second, Bain incorporated an energy model into associationist theories. Prior to Bain the English philosopher David Hartley (1705-1757) was among the first to expand on associationism by integrating it with physiology. Bain steered away from Hartley's vibration model and toward a theory that focused on currents of nerve energy, a theory that had materialized during Bain's lifetime via the work of Helmholtz, du Bois-Reymond, and others. Consequently, Bain was able to provide a more advanced and more accurate neuronal theory than Hartley.

Third, Bain expanded on Mill's laws of association by similarity, contiguity, and intensity in his attempts to explain consciousness. Although Mill noted that innate factors may have some small impact on mental functioning, he was fairly rigid with his empiricist notions, often providing associationist explanations for the various innate theories proposed by others

(Fancher, 1985). In *Mind and Body*, Bain stretched Mill's work by creating physiological laws, such as the Laws of Relativity and Diffusion, which argued that both innate and experiential factors played a role in the development of associative thought, memory, and consciousness.

Mind and Body (1872): The Key Concepts (Objects) Explored by Bain

In chapter one of *Mind and Body*, Bain put forth the thesis of his book, that mind and body were inseparable and that every mental act had a concurrent bodily change. Bain (1872) stated, "There is no example of two agents so closely united as the mind and body, without some mutual interference or adaptation…yet the two modes of operation may be so different that they throw no light on each other" (1872, pp. 2-3). Moreover, Bain posited that the mind consisted of three separate but connected entities, the emotions (feelings), the will, and the intellect. He stated,

> These are a trinity in unity; they are characteristic in their several manifestations, yet so dependent among themselves, that no one could subsist alone; neither Will nor Intellect could be present in the absence of Feeling; and Feeling manifested in its completeness carries with it the germs of the two others. Hence, although, in tracing out the bodily accompaniments of the mind, we shall view the three powers in separation, we may expect to find certain great laws pervading the whole. (1872, p. 44)

Bain also proposed that lower mental functions (basic sensations – sight, sound, taste, touch, and sensation) might be dependent on the higher ones (thought, memory, intellect) and that a full understanding of the brain did not necessarily contribute to a complete knowledge of the mind.

Overall, Bain was pleased that physiological knowledge to date had already improved the knowledge of mental workings and he was hopeful that if physiology continued to advance, knowledge of psychic functioning would also continue to improve. He went on to discuss the physiological processes of emotion, conscious/unconscious processes, thought, learning, and memory, as well as the role of the motor system in psychological processes. I will deal with each of these concepts in turn.

Bain on the Concept of Emotion

Bain argued that the emotions were the best evidence for a relationship between body and mind; he suggested that the language of emotion resided in facial expression and that unregulated emotion caused bodily changes. He cited Darwin's recently published *The Expression of Emotion in Man and Animals* (1872), which suggested that the connection between the feelings and their associated bodily and facial expressions were one aspect of the mind-body connection. Bain and Darwin knew each other personally from having attended the same hydropathic establishment for the treatment of stomach problems, and they had a cordial relationship despite the fact that they did not always agree with each other's theories. In his autobiography Bain (1904) noted that he admired the adaptive aspect of Darwin's theory of facial expressions, but was critical of the latters classification of the emotions as separate and specific. Bain believed that the emotions were subsumed under two prevailing modes of expression, that of pleasure and pain (p. 319). When Bain had written of his concerns to Darwin, Darwin cordially replied saying that he admired Bain's work, but that they must agree to disagree on these points. Indeed, in the introduction to his *Expression of the Emotions* Darwin cited Bain's emotion theory but criticized it as "too general to throw much light on special expressions" (1904, p. 8).

One point on which Bain and Darwin did agree was that emotions such as fear, anxiety, and stress could interfere with the digestion, that outbursts of emotion could "derange" bodily functions, and that emotions could interrupt thought (1872, p. 11). In *Mind and Body* Bain provided his own personal anecdotal examples of his gastrointestinal troubles as they related to the stress in his life. He also argued that exhaustion, fatigue, insanity, and old age could not only impair one's emotional functioning, but also memory and thought. Nonetheless, Bain proceeded to theorize about the emotional elements of pleasure and pain as the primary categories of emotion.

Pleasure and pain. Borrowing from the British associationists and hedonism, Bain theorized that two laws, the Law of Pleasure and a Law of Pain, embodied emotion. He argued that humans were drawn toward pleasure and had a natural tendency to avoid pain.[7] Likewise, Bain suggested that emotional states of pleasure were linked to an increase in well-being and vitality, while states of pain decreased these. These Laws of Pleasure and Pain were also referred to as the Laws of Self-Conservation with the idea that emotion was an innate adaptive survival mechanism. In explaining these laws, Bain again referenced Darwin but he also cited the work of Spencer, Müller, and Charles Bell, who theorized about the relationship between facial expressions and the emotional feelings of pleasure and pain. Thus, Bain borrowed and transformed the work of these thinkers and, in so doing, argued that there were lawful connections between the emotions of pleasure and pain and other faculties, such as intellect, thought, and memory. He would go on to explain these concepts and the laws employing them from both psychological and neurological perspectives, which I will deal with next.

Bain on the Concept of Consciousness

The Law of Relativity: A psychological view. For Bain, the emotions of pleasure and pain were associated with an edict he called the Law of Relativity/Discrimination/Change[8],

[7] Bain's thoughts on this would come to be immortalized as the Bain-Spencer principle, named because Spencer wrote about the concept at about the same time, and this theory would go on to influence Thorndike's Law of Effect.
[8] Bain used these three terms interchangeably.

which applied to both feelings and thought and referred to the idea that we become conscious or aware when there is a change in our sensory perception. Bain argued that we become aware of the transition from the feelings of sickness to health or from ignorance to insight or from anxious to calm, we discriminate or notice the change and this shift in feelings triggers our conscious awareness. Metaphorically, Bain used the term "contrast" as an illustration of relativity, describing it as a term used by artists in creating artistic works. He provided another example, "To use a familiar illustration, a watchmaker is not conscious of the unintermitted ticking of his clocks; but were they all suddenly stopped, he would at once become aware of the blank" (Bain, 1872, p. 45). Bain provided a few psychological examples, but he also described these laws neurologically.

The Law of Relativity: A neurological view. Physiologically, conscious attention occurred when existing nervous currents were increased or decreased or when any new nerve currents were stimulated. Bain believed that new nerve currents, generated by incoming sensations, were different from repetitious ones, thus, he proposed the Law of Novelty, to explain this one specific aspect of the Law of Relativity/Change/Discrimination. This law proposed that, "every sensation or emotion is most lively when first excited, becomes fainter after a time, and at last is so completely worn out that the continuation of the stimulus has no effect" (1872, p. 39). Bain continued, "The features of those experiences given from the mental side of Relativity, this stands out prominent, namely, that no second occurrence of any great shock or stimulus, whether pleasure, pain, or mere excitement, is ever fully equal to the first, notwithstanding that full time has been given for the nerves to recover from their exhaustion"(p. 51).

Hence, Bain believed that new currents stimulated conscious awareness, whereas repetitious nerve transmissions could be unconscious and/or leave a "retentive trace" or memory. Moreover, new incoming stimulations could trigger thoughts and ideas that could be compared and contrasted to those already in memory. This, Bain argued was the reason why we have the most vivid degrees of consciousness during the first moments of a stimulus, or throughout the first moments of a change in stimulus (emotional intensity or type of emotion). The Law of Relativity/Discrimination/Change also had two other characteristics, one being the *degree* of the transition or change and the other being the *intensity* of the stimulus, which he called the Law of Diffusion.

The Law of Diffusion. For Bain, consciousness also occurred when energy moved along main nervous channels and then diffused along collateral channels. Thus, consciousness depended on how far the energy spread or diffused throughout the system, which was contingent on: 1) the intensity of the current, 2) the quality of the nervous current, that is the number and type of neurons stimulated 3) the bodily sense that was affected (i.e. hearing, sight, touch, taste, smell), and 4) on the amount of resistance between the nerve cells. These contingencies are schematized in the Figure 3.

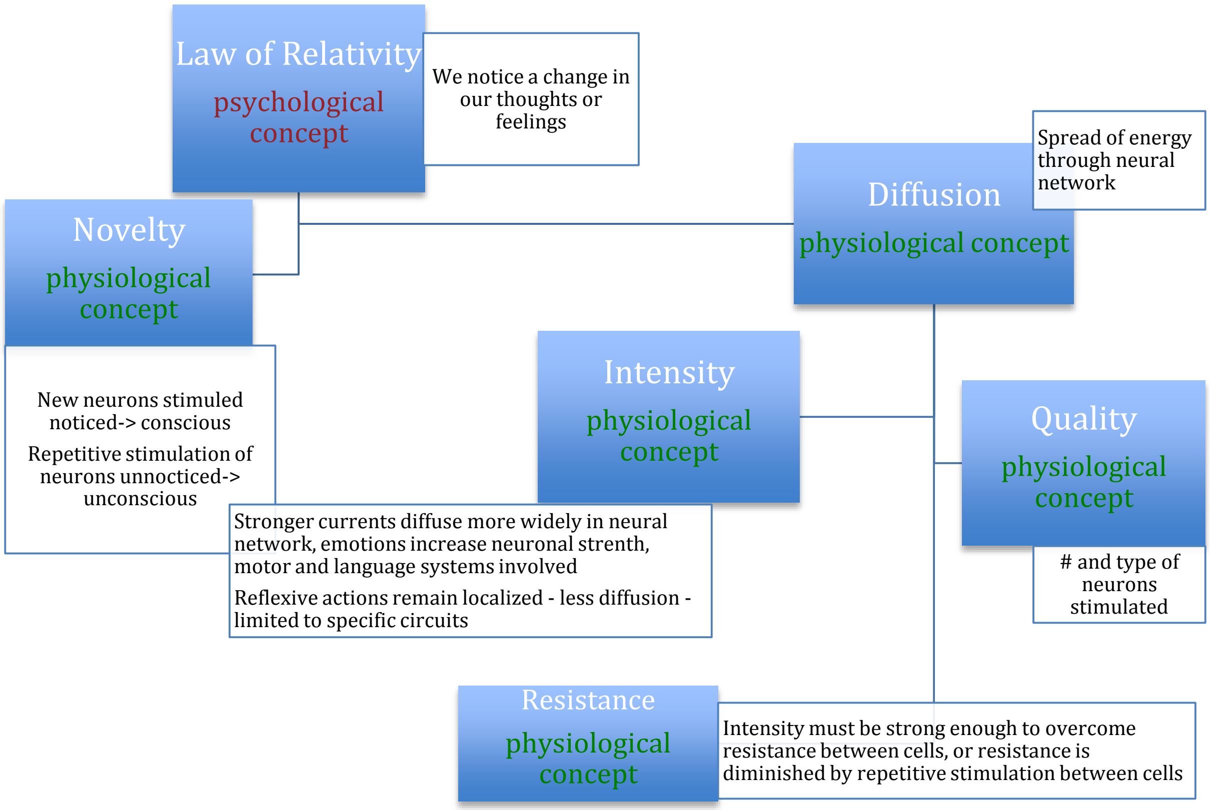


Figure 3. Schematic of Bain's Theories.

Bain believed the strength of the stimuli or the degree of change in the nervous system was connected with the degree and strength of the nervous current, so whether it be an acceleration of the nerves from a dormant condition or the down regulation of nerves from an active state, consciousness was activated. Secondly, Bain argued that the nervous system was never exclusively "quiescent." He believed that there was always a nerve-force present, but that consciousness emerged or disappeared according to the degree of intensity in the system (p. 48).

The motor system and consciousness. For Bain, the motor system and emotions were correlated; he cited the British psychiatrist and asylum superintendent Henry Maudsley's (1835-1918) 1870 paper, "Body and Mind: An Inquiry into their Connection and Mutual Influence," specifically in reference to Maudsley's discussion of the influence of emotions and the motor system on the mind-body interactions. In entitling his own book *Mind and Body: The Theories of their Relation,* Bain was clearly influenced by Maudsley's work. In contrast, however, Bain's focus was on normal psychological functioning, while Maudsley explored the physiological underpinnings of various mental diseases.

Bain posited that when a sensory stimulus was accompanied by feelings, electrical currents were diffused freely throughout the brain, that is, energy was widely spread through a number of nerve cells that acted like a "spreading wave" coursing through numerous channels, leading to consciousness and a stimulation of the moving organs and the viscera, Bain stated,

> Nervous action consists of a stimulus on a sensitive surface that affects a sensitive nerve. It thence proceeds to some ganglionic centre, there liberating still more energetic force, which passes by motor nerves to muscles. The completed fact of a nervous shock is a muscular movement but, owing to the numerous cross connexions that make up the aggregate of corpuscles, or the grey central matter, the sensory stimulus first proceeds to one corpuscle, then is diffused to others successively, until it affects a great many, before it reaches motor nerves; and when these are reached they are so numerous as to actuate a wide circle of movements. (1872, p. 52)

Bain also suggested that when groups of nerve cells transmitted strong intensities, a motor impulse would result. More importantly, however, this motor impulse was directly related to consciousness, particularly when language processes were involved. Bain saw some forms of conscious thought as inhibited or suppressed forms of language and, for this to occur, he suggested that there had to be unique nerve cell groupings and unequal strengths of stimulation to cellular networks. To summarize, Bain (1872) believed that, "It is by combining the two laws - Relativity and Diffusion – that we obtain the comprehensive statement of the physical conditions of all consciousness: - *An increase or variation in the nerve-currents of the brain sufficiently energetic and diffused to affect the combined system of the out-carrying nerves (both motor nerves and nerves of the viscera*)" (italics in original, p. 57).

Stream of consciousness. In *Mind and Body*, Bain also described a "stream of consciousness," by metaphorically relating the nerve cell flow of energy to "ebullitions," a term used in physics to describe the irregular flow of liquids when boiled. Bain stated, "The stream of consciousness is a series of ebullitions rather than a calm or steady flow. The calmness that we actually experience belongs to a low or moderate excitement; let there be any considerable intensity of feeling, and the ebullition character will start out convincingly prominent" (1872, p. 50). Nevertheless, Bain also suggested that there was a need for more research on this hypothesis. Although he did not "research" this idea, William James, in his *Principles of Psychology* (1890), quoted Bain's stream of consciousness theory, stating, "the stream of thought is not a continuous current, but a series of distinct ideas, more or less rapid in their succession; the rapidity being measurable by the number that pass through the mind in a given time" (Bain 1859, cited in James, p. 245). So, although James is often cited as the originator of the "stream of consciousness" theory, he in fact borrowed this idea from Bain; thus James popularized the concept. This seems to be a natural case of knowledge borrowing on James' part, particularly because he had used Bain's *Senses and the Intellect* and *The Emotions and the Will* as his course textbooks from 1878-1879 (Fisch, 1954).

The intellect (thought, memory & learning). In addition to exploring emotion and consciousness, Bain also considered the neurological foundations of the intellect, which consisted of thought, memory, and learning. Bain opened chapter five of *Mind and Body*, entitled *The Intellect*, with "I now approach the most difficult part of the subject of the physical basis of the mind – namely, with regards to the Intellect" (1872, p. 80). Bain believed that emotions were easier to explain because of their physical manifestations, facial expression, and their link to activating the motor system, even though at times they could be suppressed. Further, Bain suggested that thought, like emotion, had the ability to exhaust the nervous system, just as physical activities could, but he suggested that that thought was easier to hide than emotion from the external world.

Reflexes versus thought. Bain believed that thought, like the emotions, followed the Laws of Relativity, Diffusion, and Pleasure/Pain. In the case of the Law of Relativity, Bain believed that when we noticed a change in sensation or emotion, a conscious thought would come to mind. The Law of Diffusion, the idea that conscious thought emerges when there is a diffuse spreading of energy among many cells in the brain, provided Bain with a theory that allowed him to differentiate consciousness from automatic bodily reflexes. For Bain, impulses that went round in a single line or narrow circuit correlated with reflexes; reflexes relied on localized nerve cell systems, or small groups of sensory cells connected to motor cells that had been habitually stimulated and, as such, had only limited cellular diffusion throughout the larger neural network. For Bain, all nervous states, after becoming repetitive, diffused energy less widely within the network. Thus, repetitive emotional states, from a neurological perspective, have the potential to become reflexive repetitive circuits that can be altered by conscious thought. That is, intellectual trains of thought can allow more energy to disperse throughout the network, thus, overriding excessive emotion. In this respect, thought may act as a form of novel stimulation, which can then generate a wider diffusion of energy throughout the network.

Bain also suggested that thought developed from and operated under the Law of Self-Conservation; the idea that we are drawn towards pleasure and we withdraw from pain and that through trial and error our thought processes and intelligence develop for our own survival. Bain categorized intelligence into a number of faculties - memory, reason, judgment, imagination, learning, and thought. For Bain, these were not separate distinct processes, but different applications of the collective forces of intelligence, arguing that, for example, there could be no memory without imagination or reason (p. 83). Bain noted, however, that these faculties could be separated by the powers of Discrimination (feeling the conscious sense of difference), Similarity (the sense, feeling, or consciousness of agreement), and Retentiveness (the power of memory or acquisition), holding that each was the foundation of a different superstructure (p. 83).

Although being able to discriminate between changes of impressions and having the ability to become consciously aware of new stimuli were key aspects of Bain's concept of thought, he also recognized the importance of Similarity or Agreement; it was this associative concept that laid the foundation for his theory of memory. Accordingly, discrimination and similarity, as foundations of learning and memory, allow us, when looking at a tree for example, to identify it as similar to other trees, while also being able to differentiate it from other objects and other species of trees based on our past experiences, associations, and memory. In using "old facts in new circumstances," Bain suggested that the brain was adaptively efficient and this was the foundation of his theory of memory (1872, p. 86).

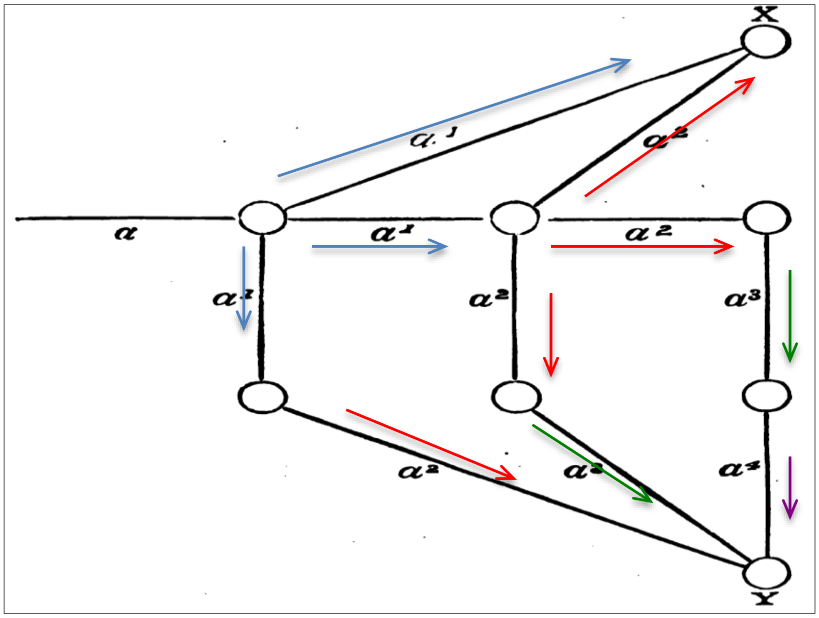
Bain on the Concept of Memory

Bain had numerous words for memory, including retention, retentive power, and acquisition. He stated, "The power of the continuing of impressions in the mind long after the stimulating agent has been removed, and recalling them by purely mental forces" (1972, p. 89). For Bain, in a time of localization research, the brain was not a place where memories could be poured in and stored up in specific areas. He argued that associative processes, the transmission of electrical energy between nerve cells, and the unique connections between cells and groups of cells, resulted in the laying down and recalling of memories. Bain maintained that one set of nerve currents could induce another set and during this process a special point of connection occurred between the two neurons or groups of neurons. The result being the establishment of preferential nerve current pathways with "special growths" that accompany memory operating on these cells at the junction OR operating on the junctions themselves.

On the neurological underpinnings of memory, Bain argued that when two or more ideas, sensations, or thoughts entered the mind at the same time, followed one another in close succession, or with repeated occurrences, there was a physical change in the cellular connections which allowed the cells to be more strongly affiliated in the future; simultaneous stimulation weakened any obstruction between cells. Thus, the electrical stimulation of one nerve cell affected neighboring cells or groups of cells.

Nerve cell groupings and energy: Memory and learning. In addition to theorizing about the function and arrangement of nerve cells and fibers, Bain also offered two hypotheses about the construction of memories. He suggested that connections between neurons had "plastic" qualities and that nerve cells and connections were continually changing as new thoughts, ideas, and emotions entered the nervous system. These changes were due to 1) specific nerve cell groupings, where there were specific and distinct nerve pathways associated with "each separate sensation, emotion, or other conscious state" (p. 117), and 2) unequal strengths of stimulation where separate outcomes resulted depending on the different combinations and strengths of sensory impressions. Thus, with increased energy or higher intensities of stimulation, larger sweeps and connections were made throughout the network and more cells are involved or interconnected. Consequently, due to the associative process, nerve cell groupings might converge at one point and each meeting point resulted in the emergence of unique memories, ideas, and thoughts. Bain then suggested that these connections were permanently fixed in the several tracks that were made; this was the physical bond underlying memory, recollection, or the retentive power of the mind.

In Figure 4 below, the convergence of nerve cells is depicted. The stimulation of cell *a* causes energy to initially be transferred in three different directions (blue arrows), via primary pathways a^1, a^1, and a^1, heading toward 3 different cells. Following this, secondary (in red) and tertiary (in green) pathways begin to emerge as new cells are stimulated from the three a^1 cells. Thus, a^1 and a^2 converge on cell *X* resulting in response X. Bain believed this scenario was lowest/weakest degree of intensity and this mild stimulation of *a* resulted in response X. According to Bain, higher degrees of intensity made larger sweeps of the network. He illustrated how neural transmissions from cell to cell, could affect the second, third, and fourth branchings of cells with a strong enough transmission, thus, a^2, a^3, and a^4, result in response *Y*. Here there are 11 fiber pathways – primary, secondary, tertiary, quaternary, and 8 cells. A next higher degree would involve many more cells and fibers so that a definite grouping might converge at again another point.



a^1 and a^2 give X
a^2, a^3, a^4 give Y

Figure 4. Bain (1872, p. 115, amended).

Bain on the Concept of Will (Volition) – An Energy Model

In addition to discussing the neurological foundations of the emotions and the intellect, Bain also had a theory will or volition (voluntary movement/action). He defined the Will as action that is prompted by feelings. He stated, “The distinguishing peculiarity of our voluntary movements is that they take their rise in Feeling, and are guided by Intellect” (1872, p. 76). The Will contained three elements, two that were primitive, instinctive, or primordial (not guided by feelings or intellect) and one that was experiential or based on education (guided by feelings or intellect). Bain suggested that “spontaneous energy” or “surplus activity” resided in the nervous system and that this energy emerged organically and was not due to stimulation of the senses or the feelings (p. 76). Bain believed that this spontaneous energy could be tamed or directed through trial and error learning as it became associated with the feelings of pleasure and pain. Bain spoke of feelings as motives that guided our behavior away from pain for the sake of survival.

Although the term motivation was not used until the beginning of the 20th century, Bain used the term motive, which at the time alluded to the idea that actions were influenced by the feelings of pleasure and pain. The term motive in this case had a very specific definition, which Danziger (1997) notes is very different from our current view of the concept of motivation. He states,

> There had always been words referring to different facets of human intentionality, wish, desire, want, will, motive, and so on. These were usually invoked when it was a matter of accounting for one's own, or others,' deviation from the automatic habitual patterns of action that characterize everyday life. Motivation, however, departs from this usage in setting up an abstract category that groups all the older referents together, implying that they all have something in common. (p. 114)

The older term "motive" referred to the more to internal aspects of the psyche, while the more contemporary term "motivation" is connected to influencing and manipulating the social world.

Bain on Unconscious Processes, Sleep, and Dreams

While much of Bain's discussion focused on conscious processes, he believed that nervous action also had unconscious properties. For Bain, unconsciousness occurred when there was little diffusion of energy throughout the neural network and when there was little energetic force. Bain suggested that consciousness required higher diffusion and higher energy distribution so that a wider circle of cells was affected; the nerve currents needed to be intense so that the diffusion was far-reaching. Bain elaborated that when sensations were "monotonous or invariable," we become unaware or unconscious of them (1872, p. 49).

He also noted, "Two views may be taken of the physical adjuncts of the state of unconsciousness, the state opposed to mental wakefulness. Either the nervous mass as a whole is quiescent, that is, unagitated by currents of nervous energy, which might be supposed to be the condition of profound slumber; or currents are still kept up, but at an even, settled, unfaltering pace" (pp. 48-49). Although Bain did not write extensively on sleep and dreams, he did correlate these processes with the unconscious. Furthermore, he stated, "We know as a fact that our thoughts follow in trains, and we can resolve many of the successions into general laws of succession; which is, up to a certain point, to explain the phenomena. We are less acquainted with the laws governing the successions in dreaming; these successions are by comparison mysterious to us" (1872, p. 126).

Conclusion

The aim of this chapter was to explore a little known aspect of Alexander Bain's psychology, namely his neural network theory as set forth in *Mind and Body*. The intent was to provide an exposition of the key concepts he developed in this book, firstly, because this has not been done before, and, secondly, so that I could assess the mind-body questions Bain attempted to solve by integrating physiology and psychology. Moreover, describing Bain's neural network model will allow for the upcoming comparison to Freud, who some 23 years later created a rather similar neurological model in his *Project for a Scientific Psychology*.

Chapter Two

Sigmund Freud's *Project for a Scientific Psychology* (1895) as a Case Study in Key Concepts and Borrowed Knowledge

> No other document in the history of psychoanalysis has provoked such a large body of discussion with such a minimum of agreement as has Freud's *Project*
> Sulloway (1979, p. 118)

Chapter one outlined Alexander Bain's neural network model as presented in *Mind and Body*. It was in reading this book and exploring the foundations of Bain's theories that I was struck by the similarities this work had to Freud's *Project.* In analyzing both of these texts, it became evident that they were both interdisciplinary in nature, and that both Bain and Freud had borrowed knowledge from various disciplines and integrated them to create unique neural network models. This chapter will take an in depth look at Sigmund Freud's 1895 *Project for a Scientific Psychology*. The goal is to evaluate Freud's *Project* as an interdisciplinary model and point out the key concepts (objects) Freud attempted to explain so that they can be compared to those of Bain and the field of neuropsychoanalysis in later chapters.

In so doing, this chapter will begin with an explanation about how the *Project* came about and consider some of the key theories and figures that Freud directly or indirectly borrowed from when he created his model of the mind. Because Freud's development of the *Project* was so strongly influenced by his pre-analytic period, particular attention is paid to his neurological education, his early neurological publication, and the theoretical assumptions of his most influential teachers. These teachers included Ernst Brücke (1819-1892), Theodor Meynert (1833-1892) and Franz Brentano (1838-1917), all of whom will be viewed as instruments of knowledge transfer for Freud.

History of the Manuscript

Sigmund Freud's (1856-1939) *Project for a Scientific Psychology* represented one of the earliest neural network models and, at a time when localization theories dominated, it was one of the first models to neurologically describe psychic processes as separate but dynamically integrated systems. Jones (1953) called the *Project* Freud's "Tour de Force," reflecting on Freud's excitement and obsession with drafting it in such a short period of time (p. 383). However, Freud's actual mood as he created this document was "…alternately proud and happy or ashamed and miserable…" (Jones, 1953, p. 382).

The manuscript was composed as part of an extensive correspondence Freud carried on with his Berlin friend and confidant Wilhelm Fliess. On October 20 1895, Freud wrote to Fliess, "Everything fell into place, the cogs meshed, the thing really seemed to be a machine which in a moment would run of itself. The three systems of the neurones, the free and bound states of quantity, the primary and secondary processes…the whole thing held together and still does. I can naturally hardly contain myself with delight" (Freud, 1895, p. 129). Freud's excitement and enthusiasm, however, was quickly dampened when he was unable to complete the fourth section of the *Project,* the "Psychopathology of Repression," and when he wrote to Fliess a month later (November 8, 1895) he stated,

> From now on my letters will be comparatively empty. I have bundled the psychological drafts into a drawer where they must slumber until 1896. What happened was this. First of all I laid the psychology aside to make time for the children's paralyses, which has got to be finished before 1896. I also started on migraine [drafting a paper on etiology and symptoms]…. and I felt overworked, irritated, muddled, and incapable of mastering the

thing…I have bundled the psychological drafts into a drawer, where they must slumber. (Freud, 1895, p. 133)

The letters between Freud and Fliess indicate that Freud put the *Project* aside due to other professional obligations and out of his frustration at being unable to fit the concept of repression into his three-apparatus model. Although Freud put the *Project* aside in 1895, Wilhelm Fliess and Marie Bonaparte were responsible for ensuring that the *Project* was not lost.

Wilhelm Fliess (1858-1928)

By 1887, Freud had already published his first neurological paper under the tutelage of comparative anatomist Carl Claus and worked in the laboratories of Brücke and Meynert. By the age of 31, Freud had also acquainted himself with family physician Joseph Breuer (1842-1925), with whom he would later co-author *Studies on Hysteria* (1895), and studied in Paris with French neurologist Jean-Martin Charcot (1825-1893). In addition, he had graduated from medical school, opened his private practice in neuropathology, and began lecturing at the University of Vienna (Jones, 1953). These events and relationships are noteworthy in that they provide evidence of Freud's many accomplishments at such a young age. However, they become more significant when one explores the nature of these relationships and the role they played in the development of psychoanalysis and the *Project*.

Although 1887 was significant for Freud's personal life, in that his first child was born, and his professional activities were apparently understated; he was enjoying married life, working with clinical patients, and teaching. In retrospect, the year is relevant to historians of psychoanalysis in that Freud met Wilhelm Fliess, an ear nose and throat specialist from Berlin. Fliess attended one of Freud's neuropathology lectures in November of that year at the University of Vienna and this meeting sparked the beginning of a 17-year friendship that produced a compilation of nearly 300 pieces of correspondence from Freud to Fliess, which included letters, notes, postcards, and drafts of Freud's scientific manuscripts, including *Project for a Scientific Psychology*.

Fliess was an important figure for Freud, firstly, because Freud confided in him and received friendship and intellectual support as he struggled through his personal life and during the development of his psychoanalytic theories. Secondly, Fleiss became a sounding board for Freud; he provided counsel, suggestions, and contributions that affected or may have altered some of Freud's theorizing as the *Project* was drafted. Thirdly, from and interdisciplinary perspective, Masson (1986) points out that one of the things that drew Freud and Fliess together was that "they were both interested in aspects of medical science that lay outside the customary channels of research" (p. 2). In addition, both Freud and Fliess had visited Charcot at the Salpêtrière and were mutually intrigued by his work with hysterics. Finally, Fliess is vital to this story because, although Freud had a penchant for destroying his own work, Fliess kept the correspondence that Freud has sent to him from 1887-1904; this correspondence was both personal and professional and contained many of Freud's theories, including *Project for a Scientific Psychology*.

Fliess, Bonaparte, and Freud

Fliess died in 1928, his friendship with Freud having ended twenty-five years earlier. It has been suggested that a scientific disagreement ended their relationship; although Jones (1953) argues that emotional factors contributed to their separation and that the correspondence between the two men foreshadowed their parting years earlier. Moreover, it is interesting that Fliess held on to his correspondence with Freud long after they had grown apart. Sometime after Fliess' death, his widow sold Freud's correspondence to a Berlin bookseller, Reinhold Stahl. Ida Fliess had considered giving the documents to the Berlin National Library; however, she feared that anti-Semitism would ensure their destruction by the Nazis, who had already begun burning Freud's works. Consequently, she sold the packet of 284 letters to Stahl with the condition that they were not to be passed on to Freud, who surely would have destroyed them (Jones, 1953). Marie Bonaparte (1882-1962) purchased these letters for 12,000 francs (about $2600 CAD today).

Marie Bonaparte, the great grandniece of Napoleon, Princess of Greece and Denmark, and heir to the François Blanc fortune that built Monte Carlo, was a client and later colleague of Freud. Freud's association with a monarch of such stature and wealth on its own is impressive, however, it is her friendship with Freud and her unending support of psychoanalysis that make her such a remarkable woman in the history of psychoanalysis. Moreover, had it not been for her dedication to the survival of the Freud-Fliess papers during the Second World War, *Project for a Scientific Psychology* and the neurological origins of psychoanalysis may have never surfaced.

Bonaparte purchased the letters on December 30, 1936 from Stahl and she was determined that the letters not land in the wrong hands; she wanted them to be published only by the appropriate people or left in the national library in Geneva. When Freud heard from Bonaparte that she had the letters, he suggested that she destroy the correspondence, however, she refused and deposited them in a safety-deposit box in the Rothschild Bank in Vienna during the winter of 1937-1938. It was her intention to return to Vienna the next summer to review the letters, however, on March 14, 1938, Hitler invaded Vienna and shortly thereafter, Bonaparte retrieved the letters from the bank in the presence of the Gestapo; Bonaparte's royal status allowed her this privilege.

She returned to Paris and kept the letters close until 1941, when she left for Greece in anticipation of a Nazi invasion. She deposited the letters at the Danish embassy in Paris, which was spared from destruction, and on October 9, 1944, she received word by telephone that the manuscripts, notes, letters, and the Fliess papers were safe (Bertin, 1982). In 1945, the letters, wrapped in waterproof buoyant material, took one final journey across the English Channel, through the German mines, to London (Jones, 1953). Bonaparte passed the letters on to Anna Freud and in 1950 Bonaparte, Anna Freud, and Ernst Kris published an untranslated German version of the Freud-Fliess correspondence. In 1954 James Strachey published an English version of the work as *The Origins of Psycho-Analysis: Letters to Wilhelm Fliess, Drafts and Notes, 1887-1902, by Sigmund Freud.* In both the German and English editions, only 168 of the 284 letters available were published (Masson, 1986), *Project for a Scientific Psychology* being one of them.

Freud's Borrowing: Important Figures and Theories

In summarizing Freud's pre-analytic years, from 1873 to 1897 Freud's focus was on his medical education (1873-1881), his histological research in Brücke's laboratory (1876-1882), and his clinical neurological practice (1883-1897). During this period of almost 25 years, while he was making a name for himself in the field of neurology, Freud was also creating *Project for a Scientific Psychology* and the discipline of psychoanalysis.

Ernst Brücke (1819-1892). In the autumn of 1873 Freud entered medical school at the University of Vienna. During his second semester, from April until the end of July 1874, he began taking a physiology course on voice and speech taught by Brücke. In the winter of that year Freud continued with Brücke, taking a general physiology course accompanied by a physiology laboratory. Bernfeld (1944) suggests that Freud continued with Brücke's classes and laboratories because of his growing attachment to Brücke rather than a compulsory obligation to the medical school curriculum. Furthermore, Freud enrolled in classes and seminars on nerve physiology taught by Brücke's assistants Sigmund Exner (1846-1926) and Ernst Fleischl von Marxow (1840-1891), who studied the electrophysiology of the nerves and muscles. In addition, in 1874, Brücke published *Lectures on Physiology* and the vision put forward in this book was most likely what drew Freud to construct his own energy model of psychological functioning. Brücke stated:

> Physiology is a science of organisms as such. Organisms differ from dead material entities in action - machines - in possessing the faculty of assimilation, but they are all phenomena of the physical world; systems of atoms, moved by forces, according to the principle of the conservation of energy discovered by Robert Mayer in 1842, neglected for twenty years, and then popularized by Helmholtz. The sum of forces (motive forces and potential forces) remains constant in every isolated system. The real causes are symbolized in science by the word "force." The less we know about them, the more kinds of forces do we have to distinguish: mechanical, electrical, magnetic forces, light, heat. Progress in knowledge reduces them to two- attraction and repulsion. All this applies as well to the organism of man. (Cited in Jones, 1953, p. 41)

Borrowing from physics. In addition to taking physiology classes with Brücke, Freud took specific courses in physics, which provided him with more foundational theories on force and energy as it applied to biological systems. During the first semester of Freud's second year (1874-75) he enrolled in two physics courses, one entitled "Magnetism, Electricity, and Heat" and the other "Theory of Magnetic Forces." Throughout the second semester of this same year, Freud took "Optics" and "Theory of Heat Conduction." Thus, it is likely that Freud's exposure to both the Helmholtzian school and Fechner's theory of "psychophysics" came during this time in medical school and, as such, he borrowed and integrated this knowledge into his neural network model. Furthermore, Brücke's neuronal theory of summation of excitation also found its way into the *Project* (Fancher, 1976).

Freud's early publications. In the fall of 1876, Freud formally joined Brücke's Physiological Institute, where he focused on histological research. During the next six years here, Freud did various histological studies and, with grants from the Austrian Ministry of Education, visited the Zoological Station in Trieste, where he studied more than 400 specimens of eels. Between 1877 and 1879, Freud published five scientific papers while under Brücke's supervision that explored the neuroanatomy and spinal columns of fish, eels, and crayfish and he also created a new chemical staining technique so that nerve tissues could be more easily identified during microscopic examination.[9]

In 1882 Freud left Brücke's laboratory having finally completed his medical degree and began a residency working in various departments at the Vienna General Hospital (VGH) to gain clinical experience. However, Freud did not completely give up his career as a biologist and, for the next fifteen years, he published a number of neurological papers that focused on the human central nervous system, rather than fish and eels (Sulloway, 1979). For example, from 1882 until 1897 he wrote histological papers on the central nervous system, the medulla, and the nerve-tracts of the brain and spinal cord (1884, 1885, and 1886), cocaine (1884), three books on cerebral palsy and paralysis in children (1891, 1893, 1897) and aphasia (1891). Freud combined his neurophysiological research interests with his clinical work at VGH and it was here where he was reunited with Theodor Meynert (1833-1892).

[9] See Gamwell and Solms (2006) for a detailed and impressive analysis of Freud's diagrams.

Theodor Meynert (1833-1892). During Freud's fourth year in medical school, in the winter semester from 1877 to 1878 (October – March,) he attended a course taught by Meynert on clinical psychiatry. The course ran five hours per week and, according to Bernfeld (1951), "At the end of this period he [Freud] was still not interested in any one of the medical specialties with the exception of Meynert's psychiatry" (p. 205), and later, during his residency at VGH, Freud was able to spend a five month rotation working in Meynert's psychiatry clinic. In addition, from 1883-1886 Freud worked in Meynert's Cerebral Anatomy Laboratory. "Meynert, who is recognized as one of the founders of cerebral anatomy, was at the time looked up to with awe and admiration as unquestionable the greatest man in his field…as a student Freud had been fascinated by the work and the personality of this man…Freud always recalled him as the most brilliant genius he had ever met" (Bernfeld, 1951, p. 210).

In Meynert, Freud found a mentor who integrated pathophysiology and clinical psychiatry as he attempted to understand the mind-brain connection. Meynert had detailed the functional significance of the thalamus, hypothalamus, hippocampus, lateral geniculate nucleus, and the cerebral cortex, and demonstrated that the corpus striatum served as a relay station between the brain stem and the cortex (Benton, 2000). More directly relevant to Freud's *Project*, Meynert also put forth some associative hypotheses for neuronal functioning. He theorized that the cortex of the brain contained specific cells in the sensory and motor areas that were part of an interconnected network; he believed that these specific cells represented specific thoughts and ideas and, when simultaneously excited, could be interconnected via association fibres. Thus, Meynert provided Freud with an anatomical model of the associative process. Moreover, Meynert posited that every individual had different experiences and, therefore, would have a unique pattern of associations that represented their own thoughts, ideas, and memories.

Meynert suggested that each person's "individuality" was derived from these associations and he referred to them collectively as the ego (*das Ich*). Accordingly, Meynert introduced Freud to the associative processes and provided him with a hypothesis for how one's ego (individuality) might develop (Fancher, 1976).[10] Freud followed Meynert's lead and incorporated these ideas into the *Project*.

Although some aspects of Meynert's associational ego theory were transferred into Freud's *Project*, Meynert's was limiting to Freud because it did not account for the motives that drive human thought and action (Fancher, 1976). In order to account for motivations in the *Project*, Freud borrowed from Franz Brentano, whom he had studied with during his medical school years.

Franz Brentano (1838-1917). During Freud's second year of medical school (1874-1875) he enrolled in Brentano's course "Reading Philosophical Works" and continued studying Brentano throughout the course of his medical school training, taking five seminars with him from 1874-1876 (Bernfeld, 1951). In addition, Freud's relationship with Brentano went outside the classroom on two occasions when Brentano invited Freud to his home for further philosophical discussions (Fancher, 1977, p. 207). It is through his interactions with Brentano that Freud was introduced to an interesting theory of motivation.

In *Psychology from an Empirical Standpoint* (1874), Brentano suggested that mental phenomena were intentional acts directed toward an object. He differentiated these from physical phenomena, the objects themselves, and suggested that physical phenomena were neutral in nature but were contained within intentional acts that have a component of feeling or desire about them. These feelings could influence the flow of ideas. For example, the idea of

[10] Meynert's theories relied heavily the earlier psychology of J. F. Herbart (1776-1841), and the associationist theory of James Mill (1773-1836).

food arouses very different associations depending on whether you are hungry or feeling ill (Fancher, 1977). In addition, Brentano argued that judgment was a mental act that served to differentiate internal (mental phenomena) from external perceptions (physical phenomena). Freud adopted this idea in the *Project* when he argued that in order to survive, organisms must be able to differentiate reality from wishful or hallucinatory ideation.

Freud's *Project for a Scientific Psychology* was a synthesis of knowledge that came from his course and laboratory work in medical school and a variety of research areas that included, biology, physics, philosophy, and psychology. At the University of Vienna, during the last quarter of the 19th century, Freud learned about neuro-anatomy, studied neural cell functioning, and absorbed and modified the ideas his mentors, Brücke, Meynert, and Brentano, who introduced him to the School of Helmholtz, the work of the psychophysicists, and associationism. In having considered the foundations of Freud's thought, this chapter will now continue with a brief history of the manuscript pointing out specific areas of knowledge transfer.

Project for a Scientific Psychology: Freud's "Objects" and Objectives

The Manuscript

The *Project* described the relationship between energy flow within the brain and the normal, abnormal, and thought processes that result from various neuronal energy transfers; the model illustrated how electrochemical and neuronal energy transmissions could occur between neurons and within a neural network. Freud described theoretically and diagrammatically the lawful systems of various psychological phenomena. More explicitly, he identified the workings of the nervous system and attempted to neurologically explain the following processes: consciousness (attention and the role of speech and the motor system) and unconscious processes, thought (symbol formation, critical thought, judgment and thought errors, abstract thinking, problem solving, and secondary processes), memory (remembering, forgetting and repression due to emotion), emotion (pleasure and pain, anxiety, repression, defense mechanisms, primary processes, and how emotions can interfere with various types of thought). Freud also theorized about the neurological foundations of wish fulfillment, the mechanisms of sleep and dreaming, hysteria, and pathological defence.

The *Project* was divided into three parts. Parts one and two of the manuscript were begun by Freud on a train ride home from a visit with Fliess on September 23, 1895 and completed within two days. Part 3 was begun on October 5, 1895 and all three parts were sent to Fliess on October 8, 1895 (S. Freud, Fliess, Bonaparte, Kris, A. Freud, Mosbacher, and Strachey, 1954). I will selectively deal with the most important concepts that emerged from each of these three parts.

The Manuscript: Objectives

In part I of the *Project* Freud established what he referred to as *The General Scheme*. His intent here was to present the foundational theories of his model of the mind and provide the groundwork for understanding the other three parts of the *Project*, Part II (pathology), Part III (normal psychological processes such as thought, memory, learning), and part IV (repression-which Freud never ended up writing). It is in Part I where Freud explicitly stated his objectives, foundational scientific assumptions and theories, and described three integrated psychic systems, the *Phi*, *Psi*, and *Omega* systems.

Freud's objective in writing the *Project* was to describe quantitatively the mechanisms of psychic functioning and to establish his psychology as a natural science. In so doing, Freud wanted to understand both normal and pathological psychic functioning from a neurological perspective. On May 25th 1895, he wrote to Fliess, "…I am tormented with two aims: to examine what shape the theory of mental functioning takes if one introduces quantitative considerations, a sort of economics of nerve forces; and, second, to peel off from psychopathology a gain for normal psychology" (Freud, 1954, p. 129). Hence, Freud's aim was to bring science into psychology, thereby integrating the two disciplines.

The *Project* was guided by three primary assumptions. First, Freud maintained that the neuron was the basic unit of psychological functioning and that it was a cell that was capable of receiving, holding, and transferring varying amounts of energy. Second, he incorporated an energy model, hypothesizing that quantities of energy and energy transmissions within the brain were responsible for all normal and abnormal mental processes; he defined this quantity of energy as *Q or Qή*.[11] Third, he argued that contact barriers were the primary cellular structure that controlled the dispersion, distribution, and flow of energy *Q* throughout the brain.

These three theoretical assumptions were based on two principal theorems or laws that would be the cornerstone of the *Project* and many of his later psychoanalytic theories. The *First Principal Theorem* Freud called the *principle of neuronal inertia*, which was based on the laws of thermodynamics. The *Second Principal Theorem* was Freud's *neurone theory*[12] and was based on the neuron doctrine. I will deal with each of these theorems in turn.

The Manuscript: Theories

Freud's First Principal Theorem (inertia). In explaining sensory-motor processes, Freud suggested that the "primary" function of the nervous system was to release energy. He

[11] For Freud, *Q* referred to energy in a general sense as an external quantity, whereas *Qή* was energy within the nervous system and often referred to psychical energy (eta being the Greek letter most similar to the roman "n"). However, Freud was inconsistent in his use of *Q* and *Qή* (Strachey, 1966, p. 289) – thus, this dissertation will use *Q* and *Qή* interchangeably.

[12] "Neurone" was the spelling adopted by Freud's translator Strachey, equivalent in meaning to "neuron." The concept of neuron or neurone as the most basic cellular unit of the nervous system had just recently (1888) been introduced by Heinrich von Waldeyer-Hartz, based on anatomical studies by Santiago Ramon y Cajal (Finger, 1994).

argued that energy, or "*Q"* as he referred to it, entered the nervous system through sensory processes and was then transferred into the motor system (musculature) for discharge and release. This release of energy was a biological mechanism for survival and was in Darwinian terms "adaptive" (1895, p. 303). In addition to considering Darwinian ideas, Freud's theory of inertia corresponded to Helmholtz's fairly recently formulated law of the conservation of energy, as well as Fechner's modification of that law.

Gustav Theodor Fechner. Fechner (1801-1887) applied the principle of conservation of energy to psychological processes. Fechner's Law described the mathematical relationship between the intensity of stimulation and the resultant sensation, whereby energy was conserved. Sulloway (1979) suggested that the Breuer-Freud theory of hysteria, in *Studies on Hysteria* (Breuer and Freud, 1895), was actually more reflective of the "Fechnerian School" of psychophysics rather than the "Helmholtzian School" of biophysics (p. 67). Similarly, Kitcher (1995) argued that Freud's constancy principle (*principle of inertia*), which suggested that the primary role of the nervous system was to divest itself of energy, was "…intimately related to Fechner's hypothesis about the relation between pleasure and pain and neural equilibrium" (p. 24). Furthermore, Freud directly referenced Fechner's Law in the *Project* (p. 315) and the former's theory of inertia was associated with the concept of *Q*. But what exactly was *Q* in Freud's theory and where did it come from?

The nature of *Q*. For Freud, *Q* was a form of energy and had three properties. Most importantly it was capable of summating and accumulating in small increments within cells until a threshold was reached (hypercathexis) within the neuron. "Cathexis" is Strachey's (1966) translation of the everyday German term "Besetzung," meaning occupation or "filling up" (p.

298).[13] Second, based on the Helmholtz's law of conservation of energy, Freud established that energy within the nervous system could never be lost; it could only be converted or changed from one form to another. Thus, a conversion occurred when neurons became hypercathected and energy *Q* was discharged into the motor system; the activation of the motor system caused various hysterical symptoms or reflex responses. Thus, *Q* could accumulate in the cell to a threshold, that is, hypercathect and then discharge causing primary process type symptoms such as that found in hysteria. In terms of reaching a threshold, Freud argued that after discharge some types of neurons returned to their initial uncathected state.[14]

Third, Freud asserted that the transmission of *Q* played a role in establishing association pathways within the neuronal community, thereby, facilitating the laying down of memories and the creation of a neuronal network. More specifically, rather than hypercathecting and discharging into the musculature causing hysterical symptoms, Freud suggested neurons could regularly transmit *portions* of the energy *Q* to its neighbors, thus activating several neurons to moderate but sub-discharge levels of cathexis. Finally, in Freud's model some neurons could be more highly cathected than others from one moment to the next and the level of cathexis depended on the state of the psychic system. This was primarily because one group of specific neural locations represented specific ideas, memories, or perceptions and because the sources *Q* could be either exogenous or endogenous.

Exogenous Q. Exogenous *Q* was energy that constantly impinged on the nervous system and came from the external environment, entering the nervous system through the sensory

[13] Freud's term *Besetzung* was an everyday German word translatable as "an occupation (as by a victorious army)" or "filling up." For some reason his English translator James Strachey abandoned everyday usage and coined the new term "cathexis" for this concept.

[14] Although Freud was only able to write hypothetically about this process in 1895, his understanding sounds very similar to behavior of an action potential, where cells return to their initial state after the discharge of a nerve impulse.

neurons. Exogenous stimuli, for example, included sources such as light, heat, sound, smell, and pressure; external energy that initially registered with the senses. Thus, when this form of *Q* becomes too intense, flight from the stimulus or a reflex action may occur so that the organism can remove itself from the stimulus to return to a state of homeostasis. Consequently, once *Q* entered the nervous system, it would become subject to Freud's principle of inertia and could then be discharged into the motor nerves with the result being a motor reflex. As noted, this motor reflex could be, for example, a hysterical conversion or, in more normal circumstances it could be something that allowed the organism to retreat from an external stimulus, such as moving your hand quickly away from a hot fire or moving into the shade to get out of the heat of the sun.

Endogenous Q. On the other hand, endogenous *Q* originated from internal sources, representing what Freud (1895) called the "exigencies of life," and he suggested that these sources of energy included hunger, respiration, and sexual urges (p. 297).[15] In addition, Freud believed that along with electrical processes, there were also "chemical" ones, which he could not elaborate on at the time (p. 321).[16] The difficulty with endogenous sources of *Q*, however, was that they could not be escaped from by simple flight responses as exogenous sources could; therefore, "specific actions" were necessary to remove such stimuli. For example, if hunger was the endogenous stimulus that imparted pressure on the nervous system, this pressure could not be escaped from. A behavioral action had to be taken to obtain and ingest food so there could be a decrease the level of endogenous *Q* impinging on the nervous system. Moreover, endogenous stimulation caused a problem in some respects in that it went against Freud's first principal

[15] Strachey suggests the "exigencies of life" are precursors of Freud's concept of the instincts (1966, p. 297).
[16] Today we talk of "potentials" resulting from neuro-chemical processes rather than as "quantities of energy" to be stored up. When potentials reach a certain magnitude/threshold, discharge occurs – i.e. an action current or nerve impulse occurs and the cell returns to its former state.

theorem, because there had to be some kind of reservoir of *Q* available such that the organism would have energy at the ready to follow through with the specific action. Freud dealt with this problem by defining two types of *Q*.

Bound and unbound Q. For Freud, the nervous system must be able to tolerate a small amount of *Q* while simultaneously being able to abide by its primary function, to liberate excessive amounts of *Q* (via theory of inertia). The contradiction here, however, was that there were small quantities of *Q* available for diversion to the motor system while simultaneously there were high quantities of *Q* within neurons. How can neurons be highly cathected (because they are unable to pass through a contact barrier), yet still allow for small transmissions of *Q*? Freud reconciled this paradox by suggesting that the neurons had either the ability to be in a bound or an unbound state. He argued that within the neural network there were areas that were subject to constant pressure from *Q*, due to the paths of conduction, and other areas that underwent oscillating levels of *Q*. Thus, a bound system occurred when a neural network was highly cathected, that is, it had a high amount of total energy *Q*, but most of the energy was bound or stored within individual neurons; many neurons were partially cathected and energy was relatively evenly distributed throughout the network. In contrast, an unbound system occurred when *Q* moved quickly in and out of the system, discharging along paths containing few neurons. In this case, individual cells hypercathect often and the overall network has low energy because *Q* discharges and exits the system before being able to be distributed widely throughout the network.

Freud's Second Principal Theorem: Contact barriers and the neurone theory. Although Freud's first Principal Theorem and his concept of *Q* provided a strong general foundation for his neural network, his contact barrier theory explained how energy passed from one neuron to the next. Freud argued that the nervous system consisted of a network of interconnected neurons, each capable of transmitting and receiving *Q* from other neurons through its cell-processes. Freud theorized that "contact barriers" were the point of connection between neurons, which is now referred to as the synapse.[17] Contact barriers controlled the flow of *Q* between neurons; flow could be facilitated or inhibited.

Freud went beyond his contemporaries in theorizing that neurons were not just reflexive dichotomous firing systems that oscillated between inhibitory and excitatory states.[18] He put forward the suggestion that there were graded responses within the cells when he theorized that a neuron could have a number of events going on within it simultaneously; resistance could be occurring at one contact barrier (preventing the linking of memories and associative thoughts – unconscious repression), while facilitation occurred in another (promoting the linking of associative thoughts and conscious recall of memories). Consequently, transmitted excitations were not the complete picture and he argued that excitation or a quantity of *Q* could build up within a neuron without necessarily discharging it.

Resistance and facilitation. Freud's contact barrier theory provided him with a mechanism to explain the development of neuronal architecture. To elaborate on the machinery underlying the contact barriers Freud theorized that there were preferred pathways of energy flow between neurons, and that most often *Q* took the path of least resistance. The degree of cathexis within a neuron was also variable, and Freud argued that each neuron had several contact barriers, thereby suggesting that the direction of energy flow could fluctuate, as if by choice. However, that choice was dependent on the resistance state of the contact barriers due to their level of cathexis because of previous experience (the repetition of *Q* between neurons). In

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[17] Waldeyer confirmed in 1888 that the branches of the nerve cells did not fuse to each other (anastomosis).
[18] This was Sherrington's theory.

addition, the magnitude of the impression, that is the strength of *Q*, could also increase facilitation at the contact barrier; strong amounts of *Q* were more likely to pass through a contact barrier than weaker quantities. See diagrams below.

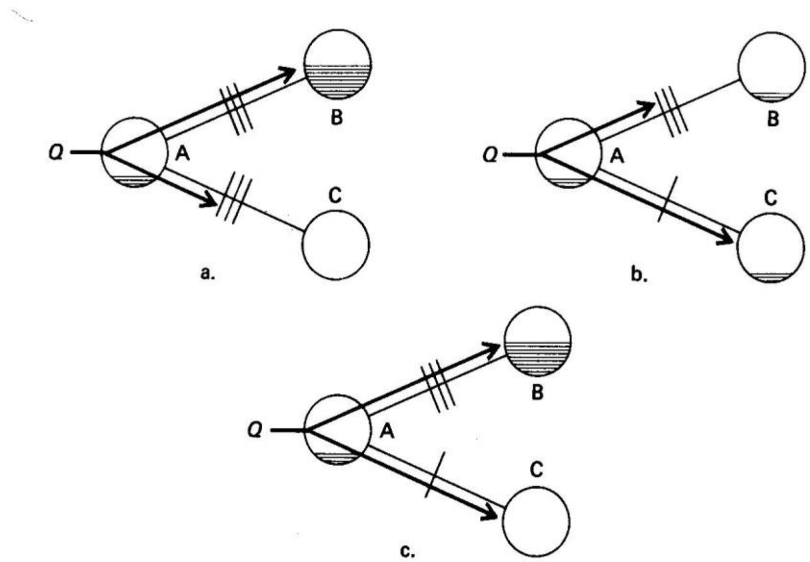

Figure 5. From Fancher (1973, p. 74).

In diagram a, *Q* enters cell A and is transferred to cell B. Note that Cell B is partially or "pre-cathected," as indicated by the horizontal lines, while cell C appears devoid of *Q*. The three straight lines indicate the strength of the contact barriers and we can see that, because cell B is pre-cathected, it draws *Q* towards it, lowering the resistance at the contact barrier for future transmissions. In diagram b, note that cells B and C are equally pre-cathected, but the contact barrier between cells A and B is stronger than that between cells A and C. In this case, *Q* chooses the path of least resistance and traverses between cells A and C. In diagram c, *Q* enters cell A and then transmits equal portions of *Q* to both cells. Note, that cell B is pre-cathected, thus, drawing Q towards it, and the contact barrier between cell A and C is weakened, allowing *Q* to pass with little resistance.

Phi, Psi, and Omega Systems. Freud's conceptualization of the contact barrier was clearly at the heart of his neural network model. However, it was not the entirety of his theory. In addition to detailing the nature of *Q* and his two principal theorems, Freud also speculated that the mind and its various mental products emerged from the interrelation of two types of neurons, perceptual neurons and mnemic (memory) neurons. However, he did note (1895), "It will be objected against our hypothesis of contact-barriers that it assumes two classes of neurones with a fundamental difference in their conditions of functioning, though there is at the moment no other basis for the differentiation. At all events, morphologically (that is, histologically) nothing is known in support of the distinction" (p. 302). Thus, Freud's cellular differentiation theory was hypothetical. In addition, he suggested that if there were two kinds of neurons, there must be at least two psychological systems at work within the neural network. Freud went one better and contended that there were three psychological systems. The *Phi* system (φ) was responsible for *sensation* - i.e. the resistance-free energy transmissions in sensory and perceptual cells. The *Psi* system (ψ) was so designated because it underlay the major *psychic functions* such as memory, learning, and unconscious processing. Finally Freud hypothesized an Omega (ώ) system, that resided in the cortex of the brain and whose functioning produced consciousness (see Figure 6 below).

The Phi system (φ). For Freud, the *Phi* system contained perceptual neurons that dealt with the exterior world and provided neuronal pathways for the reception of sensory information. "In fact we know from anatomy a system of neurones (the grey matter of the spinal cord) which is alone in contact with the external world…"(Freud, 1895, p. 303). These perceptual cells, such as those activated for vision, had worn down contact barriers and therefore remained unchanged after being stimulated. Freud called these cells "permeable" because energy just passed through them. This system and these cells have direct contact with the environment and are exposed to exogenous stimuli such as light, sounds, heat, pressure etc. Thus, when the sense organs are stimulated, the cells do not discriminate the varying patterns of stimulation and they are not permanently altered after stimulation, for example, visual cells admit all visual stimuli and auditory cells admit all sound stimuli and both types of cells are unchanged after these event.

In addition, because organisms are exposed to extreme environmental stimuli, Freud believed that large quantities of *Q* were screened out, that is, they were converted to lesser magnitudes as they entered the body. Consequently, Freud supposed that the axons of these sensory *Phi* neurons were located primarily in the spinal cord, through which sensory excitation initially entered the nervous system. Freud argued that perceptual cells in the *Phi* system may have at one time had active or impermeable contact barriers, but due to the excessive and repetitive exposure to strong quantities of *Q*, these cells were altered to become permeable.

The Psi system (ψ). While the *Phi* system coped with external/exogenous stimuli, Freud posited that "…the system ψ is out of contact with the external world; it only receives *Q*, on the one hand from the φ neurones themselves, and on the other from the cellular elements in the interior of the body, and it is a question now of making it probable that these quantities of stimulus are of a comparatively low order of magnitude" (1895, p. 304). In addition, Freud believed the *Psi* system resided in the grey matter of the cerebral cortex and had many more cells than the *Phi* system. He also suggested that the *Psi* system had two components; he separated this system into the *Nuclear Psi*, which received *Q* from endogenous sources, including the instincts, and the *Mantle* or *Pallium Psi*, which received exogenous *Q* from the *Phi* system after it had been screened or dampened in magnitude. Moreover, Freud argued that the cortical neurons in the *Psi* system were the anatomical underpinnings of ideas and memories and suggested that these neurons made up a vast interconnected network with "contact barriers" separating them from each other. In accounting for the reason for the existence of *Psi* neurons, Freud had an adaptive theory; he suggested that the establishment of the impermeable *Psi* neurons was perhaps due to "…Darwinian line of thought and to appeal to the fact of impermeable neurones being indispensable and to their surviving in consequence" (1895, p. 303).

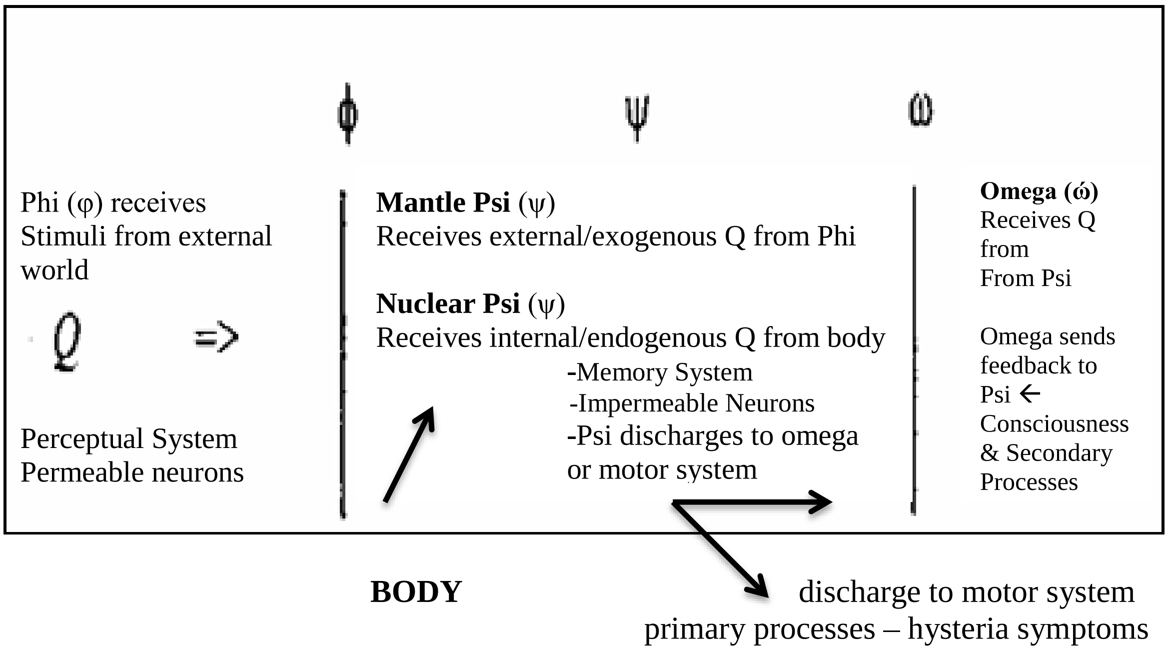

Figure 6. Freud's Psychological Systems

Freud on the concept of memory. In Freud's model, the *Psi* system (ψ) was responsible for the major psychological functions, such as learning and memory, and was composed of neurons that functioned as mnemic or memory cells. Mnemic cells, unlike perception cells, had active contact barriers that controlled the flow of energy between cells and, as such, were relatively impermeable, having varying levels of resistance. His argument was that as the *Psi* system encountered stimuli *Q*, it was permanently altered, thereby accounting for learning and memory by laying down new associative pathways. To elaborate, the mechanism of memory was highly correlated with facilitation. Freud suggested that the resistance of a contact barrier becomes reduced after the neurons on either side of it have been simultaneously stimulated and ideas experienced together at one point in time were likely to be associated again in the future, by means of leaving memory traces. Here Freud incorporated the associative laws of simultaneity or contiguity.

However, Freud also differentiated memory from remembering. More specifically, during the process of laying down memories, he believed that *Q* moved in an advancing direction and was bound within the system. In this case, memory was often unconscious because perceptual neurons would not always be triggered. On the other hand, remembering occurred when *Q* followed the associative pathway in the reverse direction and the energy was said to be unbound within the system. In this case, perceptual neurons would be activated and conscious remembering would result following the involvement of the Omega system (as shall be explained shortly).

Freud on the concept of learning. To explain learning, Freud argued that it was a process that developed due to associative memory and the experience of satisfaction. For example, when an infant is in a state of hunger or becomes cold in an environment, there is a build up of endogenous *Q* that produces a "distress" response of crying and thrashing that attracts the attention of its caregiver. This person, most often the mother, then provides the nourishment or the warm blanket that allow the infant to carry out the specific action that will provide satisfaction, and terminate the distressful state. The caretaker now becomes an object associated with satisfaction; thus, the child learns that gratification will come when they show signs of distress.

Freud argued that babies are essentially primary process organisms, their neural networks acting as relatively unbound systems where *Q* builds up easily within single neurons and fires into the musculature causing motor movements such as crying and flailing. A bound neural network system (secondary processes) develops with experience, due to the associative processes of learning and memory. As children develop, they learn to satisfy their own needs and carry out their own specific actions. During this learning, via trial and error processes, the neuronal architecture changes and, rather than having single cells fire into the musculature, *Q* becomes more widespread throughout the entire network as thought processes ensue.

After repeated experiences, new associations are created in *Psi* so that when, for example, hunger arises it activates *Psi* neurons representing memories of those previous occasions when mother has provided its satisfaction. In short, instead of immediately producing a distress response, the endogenous *Q* now produces a *wish* for the specific conditions that have previously alleviated its pressure.

The arousal of a specific need gratifying wish is an important first step in the child's learning how to adapt independently to its needs, for it defines the end goal of an adaptive need gratifying response. It also represents a possible danger, however, because if the neurons representing memories of the satisfying situation become hypercathected they will discharge and, in the absence of the actual satisfying conditions, produce inappropriate responses. With intense hunger, for example, the discharges might produce sucking and swallowing actions that bring no nourishment, or in certain cases, *hallucinated* experiences of feeding (One sees here one of the foundations for Freud's wish-fulfillment theory of dreams.) In either case there is no genuine alleviation of the hunger, so the endogenous *Q* buildup resumes with ever-greater intensity. For adaptive learning to occur, Freud's model had to provide three further things: First was a mechanism allowing the system to differentiate between purely endogenously originating cathexes and those having exogenous sources i.e. to differentiate wishes from objective reality. Second was some kind of a moderating or inhibiting mechanism to prevent hypercathexes from building up in neurons representing merely wished-for conditions. And third was a means by which the memories of wished for satisfactions can be linked to specific memories.

Freud on the concept of conscious processes: The omega system. For Freud, the functioning of the *Psi* and *Phi* systems occurred outside of consciousness. For consciousness to occur he contemplated a third system, called the *Omega* (ώ) system. Although the *Phi* and *Psi* systems dealt with "quantities" of Q, the *Omega* system coped with "qualities," something Freud called "quality or temporal periods" of stimulation (e.g. the frequency of sound or light waves), which gave rise to conscious sensations. Freud defined "qualities" as, "sensations which are different in a great multiplicity of ways and whose difference is distinguished according to its relations with the external world" (1895, p. 308). The psychological results of stimulation of *Omega* are conscious sensations of quality; these sensations were dependent on the specific nerve energies of the neurons involved.

For Freud, the *Phi* system managed large external magnitudes of *Q*, while the *Psi* system handled smaller, summative, intercellular quantities of *Q*. The *Omega* system, Freud believed, handled even smaller quantities of *Q* than the *Psi* system and consisted of permeable non-mnemic neurons; neurons that returned to their original state after excitation, making them similar to those found in the *Phi* system. Furthermore, Freud argued that *Omega* was really a system necessary for transforming "quantities" of *Q* into "qualities" or "periods" of *Q*. More importantly, however, was that for these "qualities" to be felt psychologically, that is for consciousness to occur, the *Psi* system needed to receive feedback from *Omega* after it had been excited.

Freud on Primary and Secondary Processes[19]

Primary processes. For Freud, primary processing occurred when *Q* entered *Psi* and was not transferred to *Omega*, but discharged into the motor system. Psychologically, Freud would regard infants as primary processing beings; they are not capable of thought but rely on reflexes (motor discharges) to alert others to have their needs and wishes met. This system is created via the initial passages of *Q* associated with pleasure and/or pain; essentially, primary processing is wishful in nature (wishful cathexes) and is created by association. Moreover, this system comprises "unbound" neurons made up of the existing resistances at the contact barriers, where neurons often fill to capacity and discharge because they are not connected to many other neurons in the network. Through development, primary processing should diminish as we learn to gratify our own needs, however, in the case of hysteria, a regression or retreat to primary process functioning occurs, where wishful thinking or fantasy results in hysterical symptoms rather than thoughts based in reality.

Secondary processes. For Freud, secondary processes were, "…by contrast [to primary processes], those processes which are only made possible by a good cathexis of the ego…" (1895, p. 327). Hence, when *Q* was distributed widely throughout the neural network thought processes occurred, Freud called this the ego. The ego emerged through development as one learned to gratify their own needs, modulate their emotions, and use thought processes rather

[19] For Freud, *Secondary Processes* began as neurological constructs; they were pathways that diverted (Q), dispersing energy so that it would not build up to the point of hypercathexis and would, therefore, inhibit the firing of (Q) into the musculature. The mis-firing of (Q) into the musculature was neurologically termed a *primary process* action, because it was based on the nervous systems primary goal - inertia - to divest itself of (Q).

than wishful thinking. Neurologically, this maturation resulted in an expanded neural network, which Freud called a side-cathexis. A side-cathexis was a new branch of neural connections that diverged or became an offshoot from a main branch (1895, p. 324).

In the diagram below, Freud argued that exogenous *Q* entered *Psi* neuron ***a***, from the *Phi* system and that, under the theory of least resistance due to past associations, it should travel to neuron b. However, in this case, *Q* transferred instead from cell **a** to the numerous cells in the **α-β** side-cathexis chain at the top,[20] rather than to cell ***b***. Freud argued that the movement of *Q* from cell ***a*** to cell ***b*** was the path of least resistance and that ***a*** and ***b*** were common associates or ideas (neurons) that had been simultaneously cathected at some point in the past. However, a side-cathexis when cognitive thought, or new learning, for example could override this pathway.

Freud believed that when *side cathexes* were active, and *Q* was spread more widely throughout the network, the Ego had the ability to "inhibit" primary processes, that is to inhibit the cathecting and discharge of only a small group of neurons. He used the term "primary defence" to explain the creation of this derivative pathway when the psyche wanted to defend against the release of "unpleasure" by way of thought processes.

[20] The diagram does not indicate that the neurons in the side-cathexis chain are already partially pre-cathected, thus lowering their resistance at their contact barrier with a.

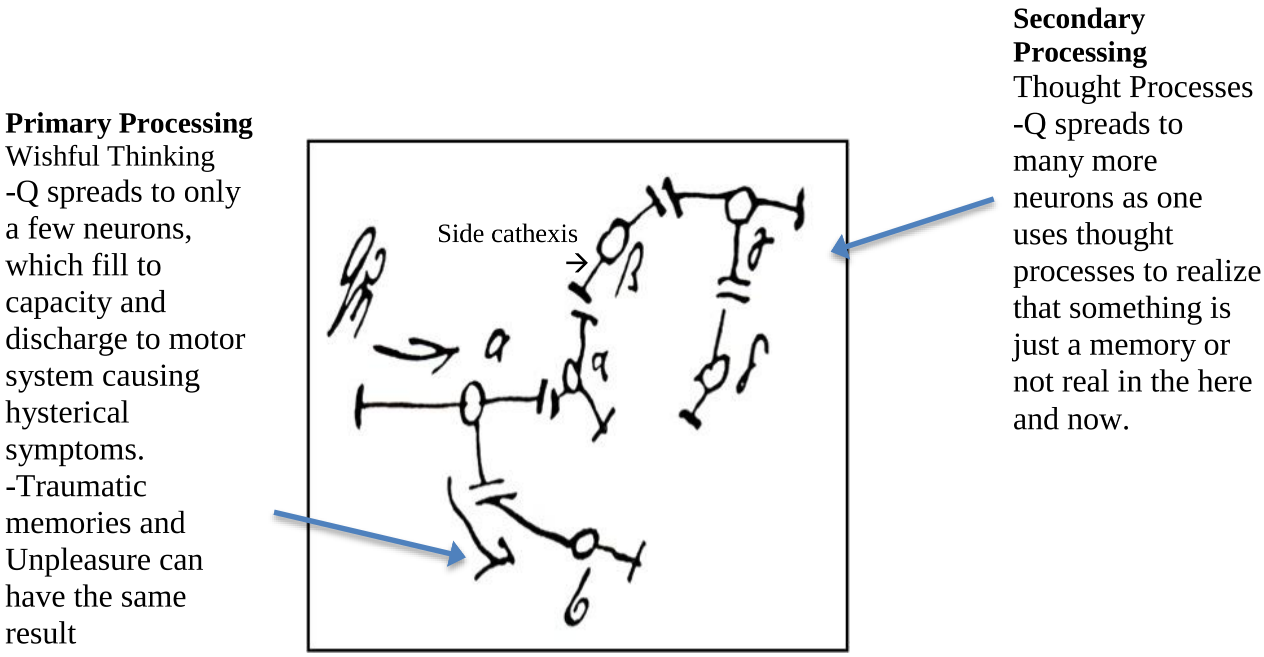

Figure 7. Freud (1895, p. 324, amended).

Freud on the Concepts of Emotion and Hysteria

From a neurological perspective, Freud believed that emotions could arise from endogenous *Q* building up (cathecting) within the *Psi* system. More specifically, he suggested that intense emotions due to newly sexualized ideas or past traumatic experiences were the cause of many hysterical symptoms. In the *Project*, he described the case of “Emma” as an example of how an act of childhood molestation, which was not originally experienced as “sexual” (because in 1895 Freud still believed that the sexual drive was absent in children and did not arise until puberty) became a sexualized memory after puberty; at that point the memory become highly cathected "after the fact" by the new (sexual) energy source and thus created excessive affect (pp. 352-356). Furthermore, Freud believed that resolving hysterical symptoms was complicated because “…hysterical compulsion is (1) unintelligible, (2) incapable of being resolved by the activity of thought, (3) incongruous in its structure” (Freud, 1895, p. 348). Thus, hysteria was a presentation of symptoms derived from the repression of intense emotional ideation, which forced energy to hypercathect within the neuron or the neuronal network, eventually discharging into the musculature causing “conversion” symptoms that indirectly symbolized the intensely cathected ideas. Freud’s theory of hysteria also had a connection to dreams.

Freud on Sleep and Dreams

Freud’s personal interest in dreams dates back to his childhood when he observed and recorded his own dreams in a notebook (Fancher, 1973) - which he discussed in letters to his fiancée Martha Bernays but which has subsequently been lost (Jones, 1953). His serious professional interest in them began years later in *Project for a Scientific Psychology,* where he devoted three separate subsections to "Primary Processes - Sleep and Dreams," "The Analysis of Dreams," and "Dream Consciousness" (Freud, 1895, 397-404).

He began by theorizing that there were biological reasons for sleep and dreaming and that in order to sleep the organism needed to rid itself of endogenous Q. The presence of strong drives, such as hunger, thirst, and sexual needs - originating from endogenous *Q* - made it difficult to fall asleep. Thus, to sleep well, one needed to have gratified these internal needs. Freud’s second assumption was that a physical paralysis occurred during sleep, and thirdly, he noted that there was a reduction in exogenous *Q* prior to sleep (lights are turned off, eyes are closed and a quiet environment is sought). Because external stimulation was minimized during sleep, Freud theorized that dreams emerged from internal sources, endogenous *Q*. But how could this be if a lowered level of *Q* was needed to fall asleep? Freud suggested that *Q* was lowered in order to fall asleep, but that it gradually increased during the night, thus, stimulating the nervous system into dream activity.

As previously noted, after repeated experiences, the arousal of a recurrent endogenous need comes inevitably to arouse memories of how it was satisfied in the past; that is, of a *wish* for its satisfaction. Therefore, since the only major sources of *Q* were endogenous during sleep, and that *Q* inevitably cathected wishes, any mental activity occurring during sleep must have to do with wishes. Here was the origin of Freud's famous hypothesis that dreams must represent the fulfillment of wishes

A second important hypothesis expressed in this manuscript was that dreams result from a “retrogressive” flow of excitation. For example, when endogenous *Q* cathected the nervous system the weakened ego made it almost inevitable that primary process discharges would occur. In sleep, however, the normal pathways for the discharge into the musculature were blocked because of the motor paralysis Freud has presumed as one of the preconditions for sleep. Thus instead of discharging “progressively” into the musculature, the energy discharged “retrogressively” into the perceptual apparatus. Freud speculated that this retrogressive flow was facilitated by the lack of progressively flowing energy into the nervous system, because of the closing off of the sensory receptors. The end result was the stimulation of the perceptual apparatus from within, resulting in the subjective impression of a hallucination, or dream. Because the discharges are from neurons in *Psi* representing wishes, the perceptual experiences in the dream represented these wishes.

Thirdly, Freud noted that dreams were less memorable and less harmful than other primary processes, at least from a biological or adaptive standpoint. Consequently, Freud suggested that dreams were difficult to remember because during dreaming the transfer of *Q* occurs along permeable pathways of existing facilitation and, therefore, memory traces do not occur, making dreaming harmless to the dreamer.

Finally, Freud described the tendency of neurons excited in the state of sleep to be associated with one another, regardless of the lack of logic in doing so. Later in *The Interpretation of Dreams* (1900), Freud would define this as condensation; the tendency for several unrelated ideas to link together by means of a single symbol or idea that serves to unite them.

The *Project* also provided Freud's first written analysis of one of his own dreams. Historically, it is known as the "Irma Dream,"[21] and in it Freud analyzed his own associations to the remembered dream. Those associations and memories, like those later produced by his neurotic patients, provided a new and more significant level of "meaning" for the dream. Thus it was here where Freud began theorizing about the *latent content* (unconscious meaning of the dream) and *manifest content* (narrative of the actual dream) of dreams.

Freud went on to discuss these concepts from the *Project*, and the Irma dream, at more length in *The Interpretation of Dreams*. Jones (1953) noted that many of the ideas found in *IOD* had already been considered in the *Project*, four years earlier, albeit with some modification to the language; the *Project*'s quantity "*Q*" was translated to a "cathexis of energy" in IOD, and the psychical principle of "inertia" was transformed into the pleasure/unpleasure principle. However, many other terms had been maintained, such as his description of the *Psi* system and his theory of "retrogressive energy flow" in the production of dreams. In his summary Jones asserted that in the *IOD* Freud "employed here a working model of the mind very similar to the one he had in the *Project* and also a good many of the same fundamental conceptions…. [but] in comparison with the *Project* it is both simpler and more lucid; one reason for this is that he was writing for a wider less informed audience" (Jones, 1953, p. 395). Nonetheless, it was in the

[21] For more on Freud's *Project* and the Irma dream see Fancher (1971, 1973).

Project where Freud first formulated some key aspects of his theory of dreams and then transferred and synthesized these ideas into his larger work.

Dreams and Hysteria

Freud was working on the *Project* and *Studies on Hysteria* (with Breuer) in and around the same time period in 1895; however, it was not until his later studies on sleep that he realized the similarity between dream states and hysteric states. According to Freud, hysterical symptoms and dream processes both stemmed from primary processes and both were open to interpretation and analysis. He also argued that both were susceptible to resistance, hallucinations, and wishful thoughts that were latent and unclear. Freud's theory that dreams were motivated by wishful thoughts enabled him re-evaluate hysteria and eventually he concluded that the alleged memories found in neurotic patients might also originate from wishful motivations rather than reality (Fancher, 1971, 1973).

Freud also noted that hysteria and dream states both had physiological symptoms (i.e. temporary paralysis occurred in sleep and could occur in hysteria) and psychological states, such as, amnesia, dissociation, and paralysis. As Freud re-visited Breuer's case of "Anna O.," he recognized that her infatuation with Breuer, and her hallucination that she was carrying his child, were clearly representative of the power of wish-fulfilling thought processes in hysteria. In addition, Freud clarified that many of these wish-fulfilling fantasies were often sexual or "Oedipal" in nature and were "repugnant" or distasteful to one's consciousness. He also theorized that the repression of these unconscious wishes caused neurotic symptoms in hysterics and the creation of a disguised latent content in the dreams of sleepers (Fancher, 1973).

Although Freud's theory on wish fulfillment and its relationship to dreaming was in and of itself quite remarkable; the implications of this discovery were widespread. Wish fulfillment went on to be incorporated into many of his later theories and became the foundation of his elaborated dream theory. It also forced him to retrospectively re-evaluate his thoughts on hysteria and his theories regarding sexual seduction in childhood. Later, Freud's thoughts on religion (as mass fantasy) and civilization (in its quest to control the forces of nature in an attempt to recreate the hallucination of safety reminiscent of a mother's womb) were again integrated with wish-fulfillment theory. The transfer of this knowledge to his later works provides evidence that many essentials from Freud's early neurological theory remained stable and were applied to each of the scientific, psychological, and philosophical disciplines he embedded them in.

Conclusion

This chapter aimed to explain the historical foundations of Freud's *Project for a Scientific Psychology* and the key concepts and theories that emerged from it. Freud's early neurological education and his academic and professional mentors provided him with the foundations to create and interdisciplinary model of the mind. Like Bain, Freud attempted to answer some specific questions about how the mind and body were related and how the psychological concepts of conscious and unconscious processes, thought, learning, emotion, and memory emerged from neurological processes. While there were brief notations about the similarity of some of Freud's ideas to those of Bain, the next chapter will provide a more systematic comparative analysis of their theories.

Chapter Three

Alexander Bain's *Mind and Body* (1872) and Freud's *Project for a Scientific Psychology* (1895): Knowledge Borrowed and Integrated from 19th Century Psychology, Science, and Philosophy

Alexander Bain (1818-1903) and Sigmund Freud (1856-1939) differed in age by almost 40 years, and Freud's neurological model was created 23 years after Bain's. Both works emerged from a similar psycho-physiological scientific milieu and had many parallels - but there were also some differences in their theories because psychology, medical psychology, and the neurosciences had been evolving and changing between the first and second halves of the 19th century. Still, Bain and Freud had similar goals: they both integrated physiology with psychology in order to more fully explain the psychological processes of thought, learning, memory, emotion and conscious and unconscious processes. In addition, they were both interested in making psychology more scientific, and they both anticipated neurological theories that were later confirmed by others who had the advantage of technological advances.

This chapter will explore the more specific ways in which Bain and Freud tried to connect the disciplines of neurophysiology and psychology as I systematically examine the continuities between their theories based primarily on their mutual 19th century influences and assess their differences from a view that focuses on the knowledge advancements that took place between Bain's publication of *Mind and Body* and Freud's *Project*. In so doing, I take into consideration the fact that Bain's training led him in the direction of academia, while Freud's was clinical in nature; these differing trajectories played a role in their theorizing, their views on the "concepts" they were attempting to understand, and contributed to Freud's theory being more detailed and complex.

Methodology

In order to analyze Bain's and Freud's theories, a comparative content analysis was done that utilized a qualitative technique that has been described by Onwuegbuzie, Leech, & Collins (2012) this way: "Systematically analyzing similarities and differences across sources, typically being used as a theory building approach, allowing the reviewer to make connections among previously built categories, as well as to test and to develop the categories further" (p. 12). In following this framework, a side-by-side listing of relevant quotations was prepared and keywords were bolded to emphasize corresponding ideas. This became the raw data for this analysis. This chapter presents the primary results of that analysis accompanied by some illustrative quotes to: 1) look for similarities and differences in the neurological foundations of their theories and review their reference citations in these works, and 2) review and compare their conceptual theories.

In addition, this section of the dissertation will consider whether Bain had any direct or indirect influence on Freud, and discuss the fact that both Bain and Freud created neural network theories that went relatively unnoticed, while other aspects of their work flourished. This chapter will lay the foundation for chapter four, which explores the development of psychoanalysis as an interdisciplinary field that began with the *Project*, and chapter five, which explores the history and development of the still later field of neuropsychoanalysis.

Frames of Reference for Bain and Freud

The 19th century was a time of vast knowledge accumulation on psychological phenomena and brain function. Accordingly, both Alexander Bain and Sigmund Freud were exposed to an amalgam of 19th century philosophy, psychology, and science when they embarked on creating their neural network models. Bain trained prior to the 1850s in the United

Kingdom where associationism dominated and physicalistic psychology was just beginning to be imported from Germany, while Freud trained in the German tradition during the last quarter of the 19th century after Fechner had invented psychophysics and neuroscience had advanced.

Bain and the British context. Richards (1996) argues that the period from 1600-1850 was a period of pre-psychology and that during the first half of the 19th century three philosophical schools dominated; rationalism, associationism, and Scottish common-sense realism significantly influenced the emergence of psychology as a field. During the 1830s, at Marischal College (University of Aberdeen), Alexander Bain was immersed in the traditions of mental and moral philosophy and logic, but he spent every spare moment he had teaching himself mathematics and the sciences. Danziger (1982) suggests that most mental philosophers of the Victorian era have been held in little regard because of their lack of empirical methods, making this one of the key reasons that British psychophysiology, in general, was such a failure (p. 140). Nevertheless, Daston (1978) and Danziger (1982) argue that within this milieu, a few key theorists in mental philosophy did traverse disciplinary boundaries, making a name for themselves as psychophysiologically inclined, for example, William Carpenter, Henry Maudsley, Herbert Spencer, and Alexander Bain.

In addition to a lack of empirical methods during the first half of the 19th century, Danziger also cites the strong influence of utilitarianism and the fact that universities such as Oxford, London, and Cambridge had not bought into science and medicine at this time. Scottish universities, where Bain resided, had a “more favorable climate, but had extremely limited resources” (1982, p. 140). Furthermore, Daston (1978) suggests that,

> In Britain attempts to create a characteristically psychological approach toward phenomena of mind were strongly influenced by a deep and persistent concern over the

> possible moral implications of the new discipline...Because late Victorian accounts of science were predominantly reductionist and mechanistic, a "scientific" psychology was regarded by many as a threat to the traditional bases of morality. Advocates of a scientific psychology (the description is their own) were accordingly scrupulous in defining the relationships of their discipline to the extant natural sciences on the one hand and to moral philosophy on the other. (p. 192)

Although the issues of morality and the lack of empirical research played a significant role in the stifling of British psychology, Alexander Bain was an exception to this general trend in Britain. A transitional figure, Bain's theorizing shifted markedly as the 19th century progressed. In the 1830s and 1840s his publications, lectures, and unpublished manuscripts were clearly in the realm of mental and moral philosophy. In 1836 he gave a speech on civil and religious liberty, and in 1839 he wrote about the “Sin of Cruelty to Animals” (Bain, 1904). In the summer of 1840, after graduating with his MA, Bain commenced his formal writing career. His early writings were unpublished manuscripts, speeches, and articles for the *Westminster Review* which included an 1842 article on the use of toys as a mechanism to trigger the senses, the emotions, the motor system, and the imagination; Bain was trying to understand the developing mind via association psychology and he theorized that the Law of Similarity played an important role in children’s intellectual development, as they learn to compare and remember similar toys. During this time, he began teaching moral philosophy and wrote papers on the human senses, English university education, health, travel, logic, moral philosophy, and wit and humour (Bain, 1904). However, after this, Bain moved toward physiology. Before the mid-19th century, and before Bain, there was a clear separation between the mental and physical sciences. Danziger has noted, however:

> The 1840s were a period during which the human toll of primitive industrial capitalism became impossible to ignore. It was a period of social violence and political confrontation, a period during which the medical profession was increasingly mobilized to make its contribution to combating psychosocial evils such as mass alcoholism. Psychiatric institutions …were expanded and in the 1850s medical psychology textbooks began to be published. (1982, p. 121)

Danziger added that James Braid, a well-known medical authority on hypnosis at the time, also wrote on psycho- and electro- physiology, and general interest in the psychophysiology of the reflex ramped up.

During the time Danziger speaks of, Bain was progressing from student to professor and scholar, and he began spending time outside of Scotland learning from anatomists and physiologists working in medicine. Bain also met with James Braid for an afternoon in Manchester, where he "took me round among his patients, and showed me his experiments" (Bain, 1904, p. 237). Bain thus became part of the London medical scene that was connecting the mental and the physical, and these experiences became crucial in the development of his thought on mental physiology.

Danziger (1982) and Daston (1978) both compare the 19th century British and German schools of psychology, positing that the British mental philosophers dominated during the first half of the century, while medical psychology and German psychology dominated the latter half. I would suggest, however, that after the publication of his two highly influential textbooks (1855; 1859), Bain himself became an influential part of the mid-century changes that were occurring, not only in Britain, but also in parts of Europe and America because these books became the primary psychology textbooks used during the last half of the 19th century.

Bain was one of the few mental philosophers to latch on to the emerging physiology and from 1855 onward he cited the most recent physiological findings in his works. At the same time, between 1860 and 1900, psychology was attempting to become a discipline in its own right, becoming the "new psychology" (Daston, 1978, p. 193), based on the work of Wundt and the psychophysicists, which Bain fully embraced; he cited Helmholtz, Weber, Fechner, Weber, and Wundt, and on "the recent German materialism" Bain stated,

> As regards the recent materialistic movement, scientific men first broke ground. Emphatic utterances made by such men as Mueller, Wagner, Liebig, and Du Bois-Reymond, all tending to rehabilitate the powers of matter…having written intelligible books, easily appealing to a palpable and determinate class of facts, they have been extensively read; and their ideas or the scientific facts that they are based on, are modifying even the highest transcendentalism of that remarkable country. (1872, p. 196)

The second half of the 19th century brought with it an increased emphasis on physiology, Darwinian theory, and the German experimental movement. Danziger (1982) noted, in general scientific psychology in Britain lagged far behind that of France and Germany for much of the 19th century; it was not until the last quarter of the 19th century that Britain absorbed the German experimental scene and Bain is a good exemplar of this fact. Bain's progressive adoption of the German school of thought into his later works was evident, and one year after he expressed these views in *Mind and Body*, Freud entered medical school at the University of Vienna.

Freud and the German Context

Freud entered medical school in 1873, training at a time when research interest in neuro-anatomy and neuro-physiology was becoming widespread. Bernfeld (1944) suggested that in the case of physiology, "Physicalistic physiology - although not by itself - overthrew philosophy and took its place" (p. 354), and that German *Natürphilosophie* contributed to this. Bernfeld elaborated:

> Physiology was a part of the general trend of western civilization. Slowly, continuously, it had been coming up everywhere through the preceding two or three hundred years, steadily gaining momentum from the end of the eighteenth century and increasing rapidly in velocity and expansions after the [18] thirties. In Germany, it had an additional emphasis, a special emotional coloring. (p. 353)

Smith noted that by 1850 there had been "a large institutional investment in the natural sciences, including experimental physiology" (1997, p. 494), and during the last two decades of the 19th century experimental psychology was also endowed with this institutional commitment. This trend toward quantification and physiology was reflected in university programs, where scientific research became a priority, particularly in the mental sciences. In light of this, it should not be surprising that Freud, and others working in anatomy, physiology, and the mental sciences, also fell under its spell (Smith, 1997).

At medical school, Freud focused on laboratory work and clinical practice that was highly influenced by both the German and French medical traditions, where the German school stressed the importance of mechanistic anatomical explanations for clinical syndromes, while the French school focused on in-depth clinical descriptions. These differences have also been categorized as classical science versus romantic science: laboratory exploration versus hospital/clinical exploration, or as the Helmholtz school versus the Charcot school, respectively (Solms, 2002)

The pathoanatomical German school was particularly strong in dealing with psychiatric syndromes associated with specific neuro-anatomical lesions. In the early 1880s, however, difficulties with this approach arose mainly because psychiatrists were finding patients with disorders where no anatomical lesions could be found. Emil Kraepelin (1856-1926) and Jean Martin Charcot (1825-1893) were among those opposed to the German approach, insisting that the clinical course of mental disorders needed to take priority over the autopsy table if a more thorough understanding of these illnesses were to occur (Levin, 1978).

Hysteria emerged as a cultural disorder that challenged the German school because it had no physical etiology and, conversely, the French school was able to take hysteria in stride; it was just another clinical problem that needed a clinical therapy. The French clinical school influenced Freud during his four-month sabbatical to the Salpêtrière in 1885-1886. Before this Freud had spent twelve years in the German tradition, so when he arrived in Paris he began working in Charcot's laboratory doing an anatomical study of the brains of children with cerebral palsy (Gay, 1988). Soon, however, "Charcot... propelled him away from the microscope in a direction in which he had already shown some telling signs of going: psychology" (Gay, 1988, p. 48). Ten years later, Freud's desire to understand the psychology of hysteria drove him to fashion his neurological model of the disorder in *Project for a Scientific Psychology*.

Scientific Advancements between Bain's and Freud's Works

Bain and Freud: Neurophysiology and the neuron doctrine. Freud's varied clinical and laboratory experiences provided him with the foundation to create a more complex neural network model, in terms of structure and function in the *Project,* than Bain had presented in *Mind and Body*. The last quarter of the 19th century also provided Freud with some significant advantages over Bain in terms of new knowledge about the gross anatomy of the brain and the brain-behavior relationship. Benton (2000) suggests that the period from 1861-1875 was one of very rapid progress when clinical neurology, anatomy, physiology and psychology combined to transform the mental sciences. During this time, Paul Broca (1824-1880) and Carl Wernicke (1848-1905) established that the brain contained localized speech and recognition centers, and concurrently, the latter half of the 19th century brought with it a more clear understanding of neurons.

Freud and Bain both diagramed neural network models to explain psychological processes, but Freud produced more detailed drawings from his microscope than Bain did, primarily because of improved microscopes and microscopic techniques; Gerlach's (1820-1896) 1872 gold chloride method, and Golgi's (1843-1926) 1873 silver nitrate discovery allowed the morphology of nerve cells to be visualized much more clearly. These technological advances allowed Santiago Ramón y Cajal (1852-1934) and Wilhelm von Waldeyer (1836-1921) to confirm that nerve cells did not fuse to each other. This was the first step in the development of the *neuron doctrine*, and having access to this new knowledge, gave Freud a leg up on Bain, in terms of complex theorizing. Accordingly, these later advances limited Bain's theorizing to description of cells and neurons but allowed Freud to hypothesize about function; Freud's increased level of detail alongside his integration of the neuron doctrine is evident from the quotes below.

> *Bain stated*, "Under the microscope, the White matter… consist of fibres or **very minute threads**…the Grey matter is a mixture of these **fibres with a distinct class of bodies**, called cells, vesicles, or corpuscles – small solid bodies, round, pear-shaped, or irregular with prolongations to connect them with the nerves…**fibres and cells**…(1872, p. 28)

> *Freud stated*, "…**Recent histology** is the second pillar of this thesis…the nervous system consists of distinct and similarly constructed neurones, which have contact with one another through the medium of a foreign substance…in which certain lines of conduction are laid down in so far as they [the neurones] **receive [excitations] through cell-processes [den-drites] and [give them off] through an axis-cylinder [axon]…"** (1895, p. 296-297).

Besides having the most recent neurophysiological findings at his fingertips, Freud also had another advantage over Bain: namely, he specialized in the area of neuroanatomy, created his own drawings from the microscope, and in 1884 wrote a paper entitled, "A New Histological Method for the Study of Nerve-Tracts in the Brain and Spinal Chord," which was published in the journal *Brain.* Although Bain was well versed in neurophysiology, he obtained his knowledge secondhand from Quain's textbook and lectures on the topic and never did his own laboratory work.

Alexander Bain and Sigmund Freud

Similar objectives. Bain and Freud had similar objectives in that they both wanted to understand the mind by exploring its physiological foundations, they both borrowed knowledge from the scientific climate of their perspective times, and they both wanted to create a science of the mind, using physiology to support their ideas. Freud's goal was explicit and disciplinary; he wanted to create a scientific psychology. Bain had a similar goal but focused more on integrating science and psychology to better understand the mind and the mind-body connection; in spite of this, or as a consequence of this, Bain's work still ended up having a strong disciplinary significance.

> *Bain stated*, "…the time has now come when many of the **striking discoveries of physiologists** relative to the nervous system should find a recognized place in the **science of the mind**" (Bain, 1855, p. iii).
>
> *Freud stated that his aim was*, "…to furnish a psychology that shall be a **natural science**…" (1895, p. 295).

Thresholds, gaps, and cellular communication. Bain and Freud both anticipated some contemporary concepts in neurophysiology (thresholds, action potentials, the synapse, and neurotransmitters) when they theorized about the structure and function of neurons. For example, they both suggested that neurons had limits (Bain) or thresholds (Freud used the German word schwelle), and returned to their original state after being stimulated.

> "It is a safe conclusion that…nerve centres make an alteration of substance that soon reaches a **limit**, **incapacitating the nerves for further change, until, by rest** and assimilation, there has been a **renewal of the old condition**" (Bain, 1872, p. 38).
>
> "the behaviour of a material that permits the passage of a wave-movement and thereafter **returns to its former condition**" (Freud, 1895, p. 299).
>
> *On the connections between neurons Freud stated*, "Every barrier has a **threshold-value**, below which no Q at all can pass-let alone, therefore, a quotient of it" (1895, p. 375).

In addition, both Bain and Freud discussed the links between neurons and both of their explanations do not contend that neurons were connected. This becomes important, particularly in terms of Bain, because it demonstrates that he may have understood the nervous system to be made up of discrete cells that had gaps between them, rather than being reticulum or fused cells, long before Cajal's discovery of this in 1888.

> *Bain suggested*, "the nerve fibres proceed from the nerve centers to the extremities of the body, and without a break, and **without uniting or fusing with one another**…" (1872, p. 30).
>
> *Freud stated*, "…the nervous system consists of distinct and similarly constructed neurones, which have **contact with one another** through the medium of a foreign substance" (1895, p. 268).

Alongside thresholds and gaps between cells as structural mechanisms for cellular functioning, both Bain and Freud argued that, in addition to electrical activities, there were also chemical processes involved in neural communication.

> *Bain posited*, "In these imperfectly understood changes of the nerve-tissue, we have the embodiment of what is called the nerve-force. This is an agent with various powers – mechanical, heat, and **chemical**; all which are due to the molecular alteration of the nerve substance" (1872, p. 33).
>
> *Freud stated,* "At the same time a suspicion forces itself on us that in both instances the endogenous stimuli consist of ***chemical products***, of which there may be a considerable number" (1895, italics in original, p. 321).

The statements above have some parallels to today's understanding of neuron structure and function, where neurons go through electrochemical changes, have threshold capacities or limits, return to their original state after alteration, and have a refractory or rest periods. Although Freud's ideas extended Bain's, both men provided thoughtful hypotheses about the process of neural transmission that were limited by the scientific knowledge of their times.

Energy models. During the last half of the 19th century, relating energy concepts to physiological and psychological functioning started to emerge, and both Bain and Freud made use of this knowledge known as the *energy doctrine*; from this, the concept of psychic energy emerged. Bain and Freud both agreed that the nervous system had a strong and natural tendency to expend or divest itself of energy.

> *Bain Stated*, "it springs in a very great degree from inherent active power with **no purpose at first, but merely to expend itself** … It is the **surplus nervous power of the system discharging itself** without waiting for the promptings of sensation" (1872, p. 77).
>
> *Freud Stated,* "This is the principle of neuronal inertia: **that neurones tend to divest themselves of Q**. On this basis the structure and development as well as the functions [of neurones] are to be understood…this discharge represents the primary function of the nervous system" (1895, p. 296). *Freud elaborated,* "…Thus the structure of the nervous system would serve the purpose of keeping off Qή from the neurones and its function would serve the **purpose of discharging it**" (1895, p. 306).

In addition to the nervous system discharging energy, both Bain and Freud believed that a constant level of energy was also necessary, but for different reasons.

> "It would seem natural to suppose that the nerves pass from the state of perfect repose to a state of **greater or less activity or excitement,** according as they are roused by stimulation, and that we are made **conscious accordingly**; while the remission of the stimulus, and their own exhaustion tend to quiescence and to **unconsciousness**… But there are facts pointing the other way. **The nervous system is rarely allowed to fall into entire somnolence"** (Bain, 1872, p. 49).
>
> "In consequence [of endogenous/internal stimuli], the nervous system is obliged to abandon its original trend to inertia (that is, to bringing the level of *Q* to zero). **It must put up with maintaining a store of Qή sufficient** to meet the demand for a specific

> action…at least to keep the Qή as low as possible and to guard against any increase of it - **that is, to keep it constant**… All the functions of the nervous system can be comprised either under the aspect of the **primary** function [discharge] or of the **secondary** one imposed by the **exigencies of life**" (Freud, 1895, p. 297).

A further complexity to Freud's theory arises in his discussion of the different types of energy that the body has to deal with; Bain's view on this was much more implicit and was at times perhaps more philosophically than neurologically grounded, compared to that of Freud.

Moderate energy levels. Bain and Freud both discussed the importance of moderate energy flow in the brain for optimum psychological functioning and both suggested that excessive energy could lead to "unpleasure" and that a moderate filling of many neurons was an optimal neurological state for consciousness to occur.

> *Bain stated*, "when new currents occurred, or existing **currents were increased in intensity but were not extreme, we become "mentally alive [conscious]"** (1872, p. 86). *He continued,* "…it is **not agreeable** to push this expenditure **beyond a certain point**…the great value of the stimulants that are **not intense but voluminous**—that **moderately** affect a large sensitive surface, **or many nerves at once**." (1872, p. 72).
>
> *Freud stated*, "It should further be suspected that an **intense current** of Qή is **not** favourable to the generation of consciousness" (1895, p. 342). *He continued,* "…by contrast, those processes which are only made possible by a good cathexis of the ego [many neurons moderately filled], and which represent a **moderation** of the foregoing, are described as *psychical secondary processes* **[consciousness/thought]"** (1895, p. 326).

Accumulation of energy in neurons. While Freud's theory of summation, the idea that neurons slowly cathect through the process of continued or repeated stimulation is very explicit, there are hints of this idea in Bain's theory as well. Freud provides a more comprehensive view of the role of energy as a product that can slowly build up within neurons as it enters these systems. Bain, on the other hand, focused on the "boosting" or increasing of energy as it related to the stimulation of consciousness. The more the energy “filliped [boosted]” the neurons in the brain, the more likely consciousness would occur.[22]

> “…when all the currents of the brain are equally balanced, and continue at the same pitch-when no one is commencing, increasing or abating-consciousness or feeling is null, mind is quiescent. A disturbance of this state of things wakens up the consciousness for a time; another disturbance gives it another **fillip [boost/stimulation**]…” (Bain, 1872, p. 50).

> “A process of this kind is **termed summation**. The ψ paths of conduction are filled by summation till they become permeable [more conductive]. It is evidently **the smallness of the separate stimuli that permits summation**… (Freud, 1895, p. 315).

Types of stimulation, energy, and neurons. Bain’s view of how the body handled external stimuli suggested that external agents, depending on the strength of their energy, could stimulate conscious awareness of one’s thoughts and feelings, which could then go on to drive the will or voluntary behaviors. Bain did not suggest a systems theory, nor did he explore the idea that specialized types of neurons were linked to external or internal forms of energy, as Freud did.

Freud’s model was more intricate than Bain’s as he detailed primary and secondary processes and his three systems of psychological processing (*Phi*, *Psi*, and *Omega*). In addition, Freud posited that neurons in different parts of the brain had specialized roles. Energy that entered the *Psi* system from external sources entered the outer layer of the cerebral cortex and what he called pallium neurons, while neurons cathected from the body's intercellular processes were called nuclear neurons. Freud also differentiated the permeable neurons, constituting the *Psi* system, from the impermeable ones in the *Phi* system.

> *Bain on external sources of stimulation stated,* “In the employment of **external agents**, as warmth and food, all will admit that the **sensation rises exactly as the stimulant rises**, until a point is reached, when the agency changes its character…there is a definite change of feeling, a uniform **accession of pleasure or of pain**…It is this definite relation

[22] The term fillip comes from Late Middle English and is defined as “Something which acts as a stimulus or boost to an activity” (para. 1, http://www.oxforddictionaries.com/definition/english/fillip, retrieved Mar 5, 2016).

between **outward agents** and the human feelings that renders it possible to discuss human interests from the objective side" (1872, p. 35).

Freud on Two sources of Q (external and internal) stated, "But ψ [psi/perception] receives cathexis as well from the **interior of the body**; and it is probable that the ψ neurones should be divided into two groups: **the neurones of the *pallium* which are cathected from ϕ [phi/external] and the *nuclear* neurones**, which are cathected from the endogenous [**internal**] paths of conduction" (1895, p. 315).

Freud further stated, "Thus there are ***permeable*** **neurones [phi ϕ neurons]** - offering no resistance and retaining nothing), which serve for perception, and ***impermeable*** **ones** [psi ψ] (loaded with resistance, and holding back *Q*ή), which are the vehicles of memory and so probably of psychical processes in general" (1895, p. 299).

Bain and Freud: Conceptual Comparisons

Conscious Processes

Bain and Freud both had a keen interest in explaining conscious processes from a neurological perspective.

"There are two very distinct natural phenomena, the one we call **consciousness or mind**; the other we call **matter and material arrangements**; they are united in the most **intimate alliance**"(Bain, 1872, p. 88).

"…psychological theory, apart from what it achieves from the point of view of **natural science,** must fulfill yet another major requirement. It should explain to us what we are aware of… **through our 'consciousness'**" (Freud, 1895, p. 307).

Laws of association. Bain's and Freud's models both included theories of association.

On similarity and consciousness:

Bain stated, "Similarity…**If a certain sensation… recurs**, there is a flash of recognition, a re-instatement of the first experience together with **a feeling of recognition or identification**. This is the feeling or **consciousness of Agreement**…Our reason essentially consists in using an old fact in new circumstances, through the power of discerning the agreement" (1872, pp. 85-86).

Freud stated, "that the goal in such cases is to arrive at an ***identity [similarity]*** **between the two images**, such that what is **wished for is what is perceived**… **two cathexes coincide**…[and] the indication of **reality [consciousness**] arises from ω."(1895, p. 327).

Regarding difference and consciousness, *they noted*,

> “The Principle of Relativity…is called Discrimination—the Sense or Feeling of Difference…**Our knowledge [consciousness] begins, as it were, with difference**; we do not know any one thing of itself, but only the **difference between it and another thing**” (1872, p. 81). *He continued,* “the most precise and characteristic feature of the Law of Relativity [is that]…the **degree of transition [difference] is connected with the degree of disturbance of the nervous currents**, whether it be the quickening of the nerves from a dormant condition, or the alteration of a settled pace, to which the system has accommodated itself” (Bain, 1872, p. 48).

> “Judging [conscious thought]… occurs only when **dissimilarity occurs between a wishful cathexis of a memory** and a perceptual cathexis. Similarity, between a wish and a perception, **ends the act of thought** and encourages discharge, while dissimilarity triggers an occurrence of thought, inhibiting discharge” (Freud, 1895, p. 328).

Diversified Mental Processes: Resistance, Neuronal Pathway Preference, and Memory

Reflexive discharge versus energy transfer. Bain and Freud both suggested that mental activity was specific, diversified, and complex, and they both theorized that facilitated energy flow, or diminished resistance, was pivotal to the development of conscious processes. They also both suggested that reflexes in the body were produced by energy that remained within a limited circuit or small group of cells and quickly discharged, while more complex higher functions of the brain require that energy be transferred to more cells and were distributed more widely throughout the neural network.

> *Bain stated*, “When an impression is accompanied with Feeling, **the aroused currents diffuse themselves freely over the brain**, leading to a general agitation of the moving organs, as well as affecting the viscera. The so-called **reflex actions** (breathing, swallowing, etc.) are commonly said to have no feeling; at the same time, **they are accomplished in a limited circuit or channel**” (1872, p. 52).

> *Freud stated, “*The quantity of the ϕ [phi-external] stimulus excites the nervous system's trend to discharge, by transforming itself into a proportionate **motor excitation [reflex]…**The quantities which are translated in this way produce an effect far superior quantitatively to themselves, by entering the muscles, glands, etc., **acting there, that is, by a *release* [discharge of quantity],** whereas **between neurones** only a ***transference*** takes place” (1895, p. 314).

Neuronal connections. Both Bain and Freud argued that cellular connections were diversified because energy made “choices” in directionality within their neural network. Bain suggested that this was due to unique neuronal groups and unequal strengths of stimulation at neuronal junctions, while Freud suggested that each cell had numerous contact barriers, all of which could be in varying states of facilitation.

> *Bain stated*, "These two circumstances [unique neuronal groups and unequal strengths of stimulation], namely, the **separate consciousness of separate nerves**, and the changing intensity of currents, we may regard as the primitive modes of diversifying the consciousness; but it is in the **countless combination of these simple elements** that we are to look for the physical concomitants of our **ever-varying consciousness**. The union of different stimulations in different fibres and in different degrees, would unavoidably give birth to a complex and **modified consciousness**" (1872, p. 86)

> *Freud stated*, "Every ψ [Psi] neurone must in general be presumed to have several paths of connection with other neurones-that is, **several contact-barriers**. On this, indeed, depends the possibility of the choice that is determined by facilitation. It now becomes quite clear that the state of facilitation of **one contact-barrier must be independent of that of all the other contact-barriers of the same ψ neurone**, otherwise there would once again be no preference and thus no motive" (1895, p. 301).

Cellular resistance. For Freud, resistance between neurons was the natural orientation of the nervous system at birth, and through experience, these resistances were broken down, allowing energy to spread widely throughout the neural network, increasing its complexity. Although Freud had an explicit name for his theory (contact barrier), Bain proposed a very similar idea; that resistance between connections, after stimulation, repeated stimulation, and with strong intensities, was diminished.

> *Bain stated*, "Now, a **more energetic current** necessarily takes a **more extended sweep, and affects a number of cells and fibres** that are left quiescent under a feebler current. The cells being viewed as crossings – **where a current in one circuit induces a current in another adjoining circuit – there is at each crossing, a certain resistance to overcome**, and a feebler current is sooner exhausted and stops short of the distance reached by stronger" (1872, p. 114).

> *Freud stated,* "The secondary function [of the nervous system], however, which calls for the accumulation of Qή is made possible by the assumption of **resistances** which oppose discharge; and the structure of neurones makes it probable that the **resistances are all to be located in the contacts [between one neurone and another],** which in this way assume the value of barriers" (p. 298). Further, he states, "…Endogenous stimuli may…arise continuously and only periodically become psychical stimuli… there is an

> accumulation [which] necessitates the view that on their path of conduction to ψ they **come up against resistances** which are overcome **only when** there is an **increase in quantity**" (1895, p. 316).

Memory

In association with their cellular resistance theories, Bain and Freud advocated that permanent changes that occurred between neurons and that memory resided within the variable connections between cells.

> *Bain stated,* "We know what are the conditions…of **fixing two or more things together in the memory.** The **separate impressions** must be **made together**, or **flow in close succession**; and they must be held together for a certain length of time, either on one occasion, or on repeated occasions"(1872, p. 117).

> *Similarly, Freud noted*, "Now there is a basic law of **association by simultaneity [contiguity**]…We find that [cathexis from… a, passes over to another, b, if a and b have at **some time been simultaneously** cathected from ϕ (or from elsewhere). Thus a contact-barrier has been facilitated through the **simultaneous cathexis** a-b" (1895, p. 319).

Memory: Synaptic growth. Both Bain and Freud theorized that "special growths" occurred at the junctions between neurons, and that the connections between stimulated neurons could be permanently altered. Thus, they anticipated these concepts years before Hebb (1949). Today, this is called synaptic growth or Long-term potentiation, and I have included a quote from Hebb below for comparison between the historical and more recent findings.

> Bain stated, "For every **act of memory**, every exercise of bodily aptitude, every habit, recollection, train of ideas, there is a **specific grouping**, or co-ordination of sensations and movements, by virtue of **specific growths in the cell junctions**" (1872, p. 91).

> *Bain continued*, "When two **impressions concur**, or closely succeed one another, the nerve-currents find some **bridge or place of continuity**…In the cells or corpuscles where the currents meet and join, there is, in consequence of the meeting, **a strengthened connexion or diminished obstruction** – **a preference track for that line over other lines where no continuity has been established**… As to the precise **plastic growth** that unites separate impressions into **trains** and **aggregates in the memory,** - we know that the corpuscles or crossings are the points that must be operated upon" (1872, p. 117).

> *Freud stated*, “If we introduce the theory of contact-barriers: their contact-barriers are brought into a **permanently altered state**. And since psychological knowledge shows that there is such a thing as a **re-learning on the basis of memory,** this alteration must consist in the **contact-barriers becoming more capable of conduction, less impermeable, and so more like those of the ϕ system**. We shall describe this state of the contact-barriers as their degree of facilitation. We can then say: **Memory is represented by the facilitations existing between the ψ neurones”** (1895, p. 300). *Finally,* “when two neurones are linked and simultaneously cathected, conduction [between them] is favoured” (1895, p. 374).

> *Hebb stated*, “When an axon of cell A is near enough to excite a cell B and repeatedly or persistently takes part in firing it, some growth process or metabolic change takes place in one or both cells such that A’s efficiency, as one of the cells firing B, is increased” (1949, p. 62). *He expands,* “**Any two cells or systems of cells that are repeatedly active at the same time will tend to become ‘associated,’ so that activity in one facilitates activity in the other** (1949, p. 70). *Finally*, “When one cell repeatedly assists in firing another, the axon of the first cell develops **synaptic knobs (or enlarges them if they already exist) in contact with the soma of the second cell**” (1949, p. 63).

Memory, remembering, and repetitive stimulation. Freud and Bain both discussed the concept of remembering and proposed that, although a strong intensity of energy may have been needed for a conscious event to occur, recalling that event in one’s mind required a much weaker force of stimulation. Freud’s more elaborate theory, however, included a focus on traumatic memories and the notion that energy could flow backwards, while Bain restricted himself to more general explanations of remembering and memory.

> *Bain stated*, “The nerve-fibres and corpuscles, on being stimulated, undergo a process of change, whereby their power is gradually exhausted; in consequence of which they need remission and repose. Hence, **the first moments of a stimulus are always the freshest, and give birth to the most vivid degrees of consciousness**.” (1872, p. 46). “We have made allowance for the **decay of an impression after a certain continuance**; leaving still the possibility that, after a suitable remission or interruption, **the impression may be renewed** in all its fullness” (1872, p. 51).

> *He continued*, “…**no second occurrence of any great shock or stimulus, whether pleasure, pain, or mere excitement, is ever fully equal to the first**…there is a certain amount of decay in the force of every impression, on the after-occasions when it is revived…We need to suppose that the system accommodates itself to every new state of things, that a **permanent trace is made** (through the operation of retentive power), and **that under a fresh shock this accommodation operates by diminishing the interval** of

> the transition; the difference between the present impression and the pre-established attitudes and arrangements of the nervous system" (1872, p. 51).
>
> *Freud stated*, "…With fresh [traumatic] memories…If the cathexis of the memory is repeated, the unpleasure is repeated too, but the ego-facilitations are there already as well; **experience shows that the release [of unpleasure] is less the second time**, until, after further repetition, it shrivels up to the intensity of a signal acceptable to the ego. (1895, p. 326).

With painful or traumatic memories,

> *Freud stated*, "We are obliged to see in [the state of] being hallucinated, **a backward flow of Q to ϕ and also to ω**. Here, however, we must recall that a large Q of this kind is **only present the first time**, at the actual experience of pain. **On repetition**, we are only dealing with a cathexis of ordinary strength, which nevertheless brings about hallucination and in the end, then, it becomes possible to cathect the memory of the pain in such a way that it cannot exhibit any backward flow and can release only minimal unpleasure… **It is now tamed…[and] owing to disuse gradually…decay (forgetting)**" (1895, p. 381).

Unconscious Processes

For Bain, unconsciousness occurred when there was little diffusion throughout the neural network and when there was little energetic force. Freud, however, saw unconscious processes partly as a failure of conscious processes. This failure of consciousness was really an indication that Q had been diverted to the unconscious system.

> *Bain stated*, "We often become almost unconscious of either the activity or the sensations…The most likely interpretation to be put upon so familiar an experience would seem to be that there are always **currents of nerve-force**, **but that consciousness disappears according as these are varied in their degree**" (1872, p. 48).
>
> *Bain continued*, "…We assume, as a fundamental fact, that with nervous action, feeling begins. We cannot draw a line between nervous action without feeling, and nervous action with feeling; **we can only indicate a scale of degree**. Yet to all intents and purposes, there is a division of nervous actions into **unconscious and conscious**" (1872, p. 53).
>
> *Freud stated*, "Such is a passage of **perception without attention [consciousness],** as it must **occur countless times every day**" (1895, p. 363).

Unconscious processes: Repression Bain did not use the term "repression" in his model, however, he did use the term "suppression," which indicated that the quantity of energy in the nervous system was weakened and did not diffuse widely within the neural network. Here, Bain blends physiological and psychological explanations and appears to be explaining something similar to dissociation.

> *Bain stated*, "That in **very mild states of feeling**, or…**faint degree of excitement**, the diffused wave [of energy] is **not strong enough** to excite the muscles in an open display; **the will may suppress it**; that habit may suppress it; that, when the system is so strongly **pre-engaged by another influence** as to resist a new diffusion, impressions are not felt (as in the insensibility to wounds in a battle). I will not dwell on this illustration, and will merely add a reference to the operation of habit in **deadening the feeling that accompanies our actions**, to show that, wherever this deadening influence has occurred, the diffused wave is proportionably contracted and suppressed" (1872, pp. 55-56).

> *Freud stated*, "It is plausible to suppose that **repression has the quantitative meaning of being denuded of Q**...The pathological process is one of **displacement**…What is the operative force in this? In what state are the neurones of the excessively intense idea and those of the repressed one? First, **repression is brought to bear invariably on ideas, which evoke a distressing affect (unpleasure)** in the ego…It may already be suspected that it is this **unpleasurable affect which puts repression into operation**" (1895, p. 350).

Emotion

Pleasure and unpleasure. Bain and Freud both focused on pleasure and unpleasure as the foundational emotions for their studies. Freud's elaboration on the pleasure/unpleasure theory, by incorporating his instinct theory (sexuality in particular), demonstrates a key difference between Bain's and Freud's works. Freud's instinct theory suggested that as bodily needs increased, for example, hunger, thirst, sexuality, pleasure was reduced and gratifying these bodily needs would reduce this tension and increase pleasure. At the time of the *Project*, Freud's views on sexuality were not fully developed; he discussed sexuality in reference to hysteria and repression, but he had not yet explicated his theory of infantile sexuality.

Neurologically, the instincts could cause the filling of neurons to their maximum; indiscriminate hypercathexis of neurons caused unpleasure, either mentally or physically. Similar to Bain, Freud suggested that strong quantitates of energy could evoke unpleasure, but he expanded on Bain by proposing that gratification of bodily needs played a key role in our psychological development.

> *Bain stated,* "The law now illustrated is named the Law of Self-Conservation [Law of Pleasure and Pain], because without it the system could not be maintained. Inasmuch as we follow pleasure and avoid pain…**to stimulate or excite the nerves, with a due regard to their condition, is pleasurable, to pass this limit, painful**" (1872, p. 69-70). *He elaborated*, "Extreme intensity of shock, whatever be its character, **is unhinging**; but there is a wide difference in the consequences, according as it the intensity of pain or the intensity of pleasure" (1872, p. 64).

> *Freud stated*, "Since we have certain knowledge of a trend in psychical life towards **avoiding unpleasure**… when **the cathexis is stronger they produce unpleasure**, when it is weaker, pleasure - till, with a lack of cathexis, their capacity for reception vanishes" (1895, p. 312). He elaborates, "**Pain gives rise in ψ to a large rise in level**, which is **felt as unpleasure**…Moreover, there is no question but that pain has a peculiar quality, which makes itself felt along with the unpleasure…" (1895, p. 318).

Bain's and Freud's views on emotion differ significantly in terms of their neurological explanations. Freud provided a much more detailed analysis of unpleasure and pleasure. First, we look at their general views on emotions, in terms of the mind-body connection.

> *Bain stated*, "The Sense Organs, usually reckoned five in number, are all more or less open to view…**By a sense organ is meant a portion of the body exposed to certain agents, and, when stimulated, giving birth to feelings of the mind**" (1872, p. 23). *Bain continues*, "The influence of mental changes upon the Body is supported by an equal force of testimony. **Sudden outbursts of emotion derange the bodily functions**. Fear paralyzes the digestion. Great mental depression enfeebles all the organs…On the other hand, happy outward circumstances are favourable to health and longevity" (1872, p. 11).

> *Freud stated*, "Since we have certain knowledge of a trend in psychical life towards **avoiding unpleasure**, we are tempted to identify that trend with the primary trend towards inertia. In that case **unpleasure would have to be regarded as coinciding with a raising of the level of Qή or an increasing quantitative pressure**: it would be the ω sensation when there is an increase of Qή in ψ. **Pleasure would be the sensation of discharge**" (1895, p. 312).

Second, we can assess their views on emotions as and energy process,

> *Bain stated*, “The-currents of Feelings or **Emotions have a wider diffusion** and more forcible impetus…evoking what is called the Expression of feeling…yet every intellectual exertion has an emotional side, every emotional outburst an intellectual side. **The association of objects with Feelings is an immense power in the Mind;** it governs very largely the **pleasurable and painful** susceptibilities of mature life. (1872, pp. 104-105).
>
> *Bain continued*, “When an **impression is accompanied with Feeling**, the aroused currents **diffuse themselves freely** over the brain…Now it is found that consciousness or feeling increases with the extent of the wave, or the number of the central corpuscles excited,” (1872, p. 53).
>
> *Freud stated*, “Firstly, that when there is a release of **affect the releasing idea itself gains in intensity**…a special reason for it can be found - namely, in the origin of these memories with their capacity for **affect**…they have been cathected…and have acquired an excessively strong facilitation to the release of **unpleasure and affect**.” (p. 381).

Thought Processes

Both Bain and Freud theorized about thought processes and both explored the idea that strong emotions can block thinking.

> *Bain stated:* “**Our cogitations usually induce some bodily attitudes**…as well as movements; and **if anything occurs to disturb these, the current of thinking is suspended or diverted** (Bain, 1872, p. 10).
>
> *Freud stated*: “It is quite an everyday experience that the generation of **affect inhibits the normal passage of thought,** and in various ways…Thus, for instance, it happened to me during the agitation caused by a **great anxiety** that I forgot to make use of the telephone, which had been introduced into my house a short time before. The recent pathway succumbed in the **affective state:** facilitation - that is, what was old-established-gained the upper hand…” (Freud, 1895, p. 367)…“With a feeling of unpleasure and an inclination to discharge, the combination of which characterizes a **particular affect, and the passage of thought is interrupted**” (p. 380).

In addition, both Bain and Freud theorized that thought was correlated to new or different pathways of connection in the neural network. Moreover, Bain’s idea that conscious thought allows one to control their emotions sounds very similar to Freud’s’ view of thought as the foundation of the ego.

> *Bain stated*, "The failing intensity of renewed impressions might be connected with a narrower and weaker diffusion. Now our study of the physical basis of Retentiveness …shows the tendency of all nervous states, by **repetition, to narrow their compass of action, and to run into special channels of connection** with the states that happen to succeed them; **substituting intellectual trains for emotional outbursts** (1872, p. 56).

> *Freud stated*, "If an adjoining neurone is simultaneously cathected, this acts like a temporary facilitation of the contact-barrier lying between the two, and modifies the course [of the current], which would otherwise have been directed towards the one facilitated contact-barrier. **A *side-cathexis* thus acts as *an inhibition of the course of Qή*"** (1895, p. 324).

Thus, for Freud, the side-cathexis represented the creation of a new pathway, via thought processes (secondary processes), that inhibited the expression of strong emotions and hysterical symptoms (primary processes). This went on to become Freud's explanation for the development of the ego.

Sleep and Dreams

For both Bain and Freud (at least at first) dreams and sleep were somewhat mysterious, however, they both agreed that dreams were linked with unconscious processes (Bain) and a silencing of the Ego (Freud),

> *Bain (1872) stated*, "Towards the end of the day lassitude sets in, and fades into the deep unconsciousness of healthy sleep" (p. 9), and "**In profound sleep, the reflex actions go on**; these, however, we may disregard, as **having detached themselves from conscious circles**" (p. 49).

Bain suggested that trains of thought and bodily functions were correlated and he used dreams as one example of this, as did Freud.

> *Bain stated*, **"**Why should sleep suspend all thought except the incoherency of **dreaming**… if a certain condition of the bodily powers were not indispensable to the intellectual functions…**In sleep, there is a diminution of the supply of arterial blood to the brain.** General depletion lowers all the functions generally, mind included" (1872, p. 10).

> *Freud (1895) stated*, '**Sleep is characterized by motor paralysis (paralysis of the will**)…In sleep the spinal tonus is in part relaxed…" (p. 400). "It is not certain whether in adults the ego is completely relieved of its burden in sleep. In any case it [the ego]

> **withdraws an enormous number of its cathexes,** which, however, are restored on awakening, immediately and without trouble" (p. 336). "The presence of strong drives, such as hunger, thirst, and sexual needs, essentially endogenous Q, made it difficult to fall asleep. **To sleep well, one needed to have gratified these internal needs**" (p. 400) and "It is an important fact that ψ **primary processes**, such as have been biologically suppressed in the course of ψ development, are daily **presented to us during sleep** (p. 289).

Finally, Freud described dreams as the fulfillment of wishes.

> *Freud stated*, "[dreams] are wish-fulfilments - that is, **primary processes** following upon experiences of satisfaction…That this is their nature is, however, very easily shown. It is precisely from this that I am inclined to infer that primary wishful cathexis, too, was of a hallucinatory nature" (1895, p. 400).

Pathology

Bain and Freud both dealt with normal and abnormal mental processes, but Freud devoted particular attention to hysteria. Bain's theory of pathology was often linked to a blow to the head, nutrition, and blood flow and was limited to the mind-body connection and the idea that mental health affected the body and the body affected the mind. Let's begin with Bain's view on mental illness.

> "**brain changes affecting the mind**, mental changes affecting the brain…the commonest observation is the effect of **a blow on the head,** which suspends for the time consciousness and thought; at a certain pitch of severity it produces a permanent injury of the faculties, impairing the memory, or occasioning some form of mental derangement. It may also remedy derangement…where a blow on the head has cured Idiocy…Many instances of **imbecility of mind** are distinctly traced to causes affecting the **nutrition of the brain**… **Most decisive of all, under this head, is the wide experience of the insane**. Among the chief causes of insanity must be reckoned excessive drafts on the mind— as, **for example, long and severe mental exertion, and sudden mental shocks, usually of disaster and misfortune**, but occasionally even of joy" (Bain, 1872, p. 13-14).

For Freud, high levels of energy *Q* played a role in the development of hysteria. He hypothesized that an unconscious memory (or memories) could trigger excessively intense ideas, which transferred high levels of energy *Q* to a very small group of neurons. Because these few neurons were filled to their maximum (cathexis), they discharged into the motor system causing hysterical symptoms. This primary process activity needed to discharge the energy if it could not be more highly distributed among many neurons in the neural network.

> *Freud stated*, "Every observer of hysteria is struck in the first place by the fact that hysterical patients are subject to a *compulsion* which is exercised by *excessively* ***intense*** **ideas**. An idea will, for instance, emerge in consciousness with particular frequency without the passage [of events] justifying it; or the arousing of this idea will be accompanied by psychical consequences that are unintelligible. The emergence of the **excessively intense idea** brings with it consequences which, on the one hand, cannot be suppressed and, on the other hand, cannot be understood [such as] release of affect, motor innervations, impediments. The subject is by no means unaware of the striking character of the situation. **Excessively intense ideas …appear to us as intruders and usurpers, and accordingly as ridiculous**" (1895, p. 347).

> *He elaborated*, "...From pathological clinical observation especially where excessively intense ideas were concerned - in hysteria and obsessions…processes such as stimulus, substitution, **conversion and discharge**, which had to be described there [in connection with those disorders], directly suggested the conception of neuronal excitation as quantity in a state of flow" (1895, p. 296).

Bain and Freud: Connections

The qualitative quotation analysis above demonstrates the similarities and differences in Bain's and Freud's theories. This comparison quite naturally raises the question: did Freud borrow from Bain, either directly or indirectly? Was any knowledge transferred from Bain to Freud via Freud's reading? Or, more simply, just how aware might Freud have been of Bain's work? This section of this dissertation will explore some possible connections by looking at Freud's library to assess which aspects of Bain's work Freud may have been exposed to.

Freud's library

> Then when I became a student, I had developed a passion for collecting and owning books […] I had become a bookworm. I had always, from the time I first began to think about myself, referred this passion of mind back to a childhood memory…And I had early discovered, of course, that passions often lead to sorrow. When I was seventeen I had run up a largish account at the booksellers and had nothing to meet it with; and my father had scarcely taken it as an excuse that my inclinations might have chosen a worse outlet. (Freud, 1900, pp. 172-3)

Davies and Fichtner (2006) argue that in 1939 Freud's sorrow regarding his passion for books came true when he was forced to dismantle his personal library, which at some point contained 4500-5000 books, manuscripts, offprints, pamphlets, and articles. In preparing to leave Vienna for England, Freud gave about one third of his library to Paul Sonnenfeld, a friend of the family, who kept about 70 titles for himself but then sold the rest (primarily neurological and psychiatric books) to bookseller, Heinrich Hinterberger. Hinterberger put the collection of 935 books on the market and advertised it as a collection of books "brought together in nearly fifty years by a famous Viennese scientific explorer," which was purchased by the New York State Psychiatric Institute, which went on to become affiliated with Columbia University (Davies and Fichtner, 2006, p. 23). Sonnenfeld's 60 books went to the Washington Library of Congress. Luckily, Freud was able to take about two thirds of his collection to England and these 2522 books now reside at the Freud Museum in London. Private citizens own 166 Books, and 35 books are at the Sigmund Freud Museum in Vienna. However, about 500 items that were at one time thought to be in this collection are now missing and the Nazis destroyed some works that were in the hands of private citizens (Davies and Fichtner, 2006).

In 2006, Davies and Fichtner took on the monumental task of creating a catalogue, in the form of a book and CD ROM, which itemizes every known item in the various collections from Freud's original library, about 4000 items. Not only does this catalogue contain a list of the items, by author, title, and publisher, it also lists any hand written notes that Freud made in margins, signatures, dedications, and photographs of the book covers, personalized bookplates, and signatures (Davies and Fichtner, 2006). To date, Malcolm Macmillan is the only scholar to attempt to make some connections between Freud and Bain by exploring Freud's library; Macmillan (1992; 2000; 2004) looked for connections between Bain and Freud by examining their theories of inhibition and through the work of David Ferrier. I utilize this catalogue by Davies and Fichtner, and venture to expand on Macmillan's excellent research in this area.

David Ferrier (1843-1928) and Theodor Meynert (1833-1892)

Macmillan (1992; 2000a; 2000b; 2004) suggested that Freud might have learned of Bain through the work of *David Ferrier* (1843-1928). Before graduating from medicine in 1868, Ferrier "had been so influenced by Alexander Bain…that he travelled to Heidelberg in 1864 to study psychology. He also began the study of anatomy, physiology, and chemistry" (MacMillan, 1992, p. 87). In 1868 Ferrier graduated from medical school at the University of Edinburgh and then moved to London to work as a professor of neuropathology. There he went on to be one of the leading figures in expanding knowledge regarding the localization of functions in the brain.

Macmillan explained that Freud's library (now at Columbia University) contained three of Ferrier's books, *The Functions of the Brain* (1876), *The Croonian Lectures on Cerebral Localisation Delivered Before the Royal College of Physicians* (1890), and *The Localisation of Cerebral Disease* (1880); according to Davies and Fichtner (2006) all three of these books came from the Hinterberger collection. Freud would have known of Bain, and the Bain-Ferrier Theory,[23] from these works, particularly because Freud annotated some of the pages in these books (Macmillan, 1992; 2000; 2004). Furthermore, while Macmillan (2000, 2004) agrees that Brücke, Meynert, and Jackson influenced many of Freud's neurological theories, he maintains that Freud's theory of thinking as inhibited action comes directly from the Bain-Ferrier theory, suggesting there are no remnants of this idea in the works of these other mentors. Like

[23] Ferrier was influenced by Bain's (1855) hypothesis that there was a functional division between the spinal root motor and sensory nerves and similar systems higher up in the brain. He argued that the major parts of the thalamus received sensory information and that the grey matter of the cortex consisted of principally motor neurons (Greenwood, 2015). Ferrier went on to confirm this with electrical stimulation studies and credited Bain.

Macmillan, Fancher (1977) argues that Freud's and Meynert's theories were similar in many respects and that Freud borrowed from Meynert. Fancher (1977) states,

> He borrowed heavily from his teacher, Theodor Meynert, who had published one version of such a model in 1885. According to Meynert, specific cortical cells are the anatomical substrates of specific ideas, so that excitation of a particular cell results in the arousal of its own particular idea. The individual cells or ideas are interconnected in a vast network by "association fibers," which open themselves up to excitation after the cells they connect have been simultaneously excited. This is the neural basis for association. Once two ideas have been simultaneously excited, subsequent excitation in one of them may be transmitted by the association fiber to the other idea. A "train of thought" may be conceptualized as the flow of excitation through a series of cells that have been associated because of prior simultaneous excitation. (p. 211)

Supporting both Macmillan (2004) and Fancher (1977) is the fact that Meynert's neural network theories do sound very close to that of Freud, which in turn sound similar to Ferrier and Bain's. Breidbach (2001) states,

> The neuroanatomist Meynert (1867-68) and Alexander Bain (1868, 1875) proposed functional organization of neuronal computation that made use of James Mill's concept of associative psychology. According to that concept, a certain sensation was transferred from the sensory organ via a sensory pathway into the brain. Because of the connectivity of neurons, the stimulations, depending on sensations of the corresponding neurons, would then disperse throughout the brain tissues, following pathways laid out by the connections of the specific neurons. (p. 16)

This statement suggests separate but simultaneous creations of a neural network model. In *Sammlung von populär-wissenschaftlichen Vorträgen über den Bau und die Leistungen des Gehirns* (1892),[24] a book found in Freud's library, Meynert advocated the he and Bain simultaneously and independently estimated that the brain had approximately one billion neurons with associated fibres (1892, p. 24). However, Meynert did not cite Bain on anything more specific than the number of neuronal cells, which would not be unusual considering the lack of connection at that time between German and British psychology, as discussed earlier. Although the basic architectures that Bain and Meynert hypothesized about were similar, Meynert's conception of a primary and secondary ego contained within the associative network went beyond Bain.

What Bain called the "intellect" was formed by the creation of new neuronal pathways that allowed for thought, thus keeping emotions under control. This was similar to Freud's psychological ego or neurological side-cathexis and acted as an offshoot or new neuronal pathway that also allowed for thought (secondary processes) to keep emotions and hysterical symptoms at bay. Accordingly Bain and Meynert's "simultaneous" findings may have been just that, with Freud possibly being influenced by both Bain (via Ferrier) for his architecture, and Meynert (for his theory of the ego).

Ferrier and the Sensory-Motor System (via Bain)

In support of Macmillan's view that Ferrier transmitted Bain's theories to Freud (1992; 2000a; 2000b; 2004), Ferrier's *Functions of the Brain* (1876) referenced Bain 14 times and specifically discussed Bain's sensory-motor system in general and his idea that the motor system, inhibition, and language were linked to consciousness as part of the *Bain-Ferrier* theory of will

[24] Translated to: *Collection of Popular-Scientific Lectures on the Construction and Performance of the Brain*.

(Ferrier, 1876, p. 447). In positing the sensory and motor systems as separate but integrated entities, Ferrier borrowed from Bain, and Freud seemingly followed Ferrier on this point.

> *Ferrier stated,* “It is, however, maintained by Bain…that we have a muscular sense, or **consciousness of muscular contraction**, **independently of centripetal** [afferent nerves moving from sensory organs to brain] impressions originated by the act of muscular contraction itself. **Bain... was the first to enunciate this doctrine** (p. 219)

> *Freud stated*, “In the first place, the principle of inertia explains the structural **dichotomy** [of neurones] into **motor and sensory** as a contrivance for neutralizing the reception of Qή by giving it off” (1895, p. 296).

On the relationship between the physical and mental, objective and subjective,

> *Ferrier stated*, “We may succeed in determining the exact nature of the molecular changes, which occur in the brain cells when a sensation is experienced**… The one is objective and the other subjective**…we cannot say that they are identical… but…the two are correlated, or, **with Bain,** that the physical changes and the psychical modifications are the objective and subjective side of a ‘double-faced unity’ (1876, p. 256).

> *Freud stated*, According to another theory, consciousness is the **subjective** side of all **psychical events** and is thus inseparable from the physiological mental process… consciousness is the **subjective** side of one part of the physical processes in the nervous system” (p. 311).

Ferrier on the Laws of Association and Memory (via Bain)

> *Ferrier stated*…According to Bain’s ‘Law of Continguity,’ actions, sensations and states of feeling, **occurring together or in close succession**, tend to grow together, or cohere, in such a way that when any one of them is afterwards presented to the mind, the others are apt to be brought up in idea [**memory**]…”(1876, p. 225)…”This **organic memory** is the physical basis of Retentiveness, and the property of re-excitability is the organic basis of Recollection and Ideation. We have thus a physiological foundation for the law arrived at on other grounds **by Bain,** viz. that ‘**the renewed feeling occupies the very same parts, and in the same manner as the original feeling**” (p. 258).

> *Freud stated*, The necessary condition for indications of thought being aroused at all is, of course, their being cathected by attention; they come about in that case in virtue of the law that, when two neurones are linked and **simultaneously cathected**, conduction [between them] is favoured [memory]” (1895, p. 374). “A main characteristic of nervous tissue is memory: that is, quite generally, a capacity for being **permanently altered by single occurrences**… that neurones are permanently different after an excitation from what they were before” (1895, p. 299).

Ferrier on Consciousness, Language, and the Motor System (via Bain)

The quote below suggests that Ferrier not only cited Bain, but also agreed with his idea that the sensory-motor system was an input/output circuit, in which incoming sensory input triggered muscular output, and that the motor system was imperative for consciousness. Further, speech was also considered an important motor activity that correlated with conscious thought.

> *Ferrier stated,* "**Thought**, as has been observed by Bain, is in a great measure carried on by **internal speech**, i.e., through the ideal or faint re-excitation of the articulatory processes which are symbolic ideas…The fact that **attention [consciousness] involves the activity of the motor powers** has been clearly enunciated by **Bain…Bain** seems to me to have clearly indicated the elements of attention, which I conceive to be a combination of the activity of the motor, and of the inhibitory-motor centres. In calling up an idea, or when engaged in the attentive consideration of some idea or ideas, we are in reality throwing into action, but in an inhibited or suppressed manner, the movements with which the sensory factors of ideas are associated in organic cohesion (p. 285).[25]
>
> *Freud stated,* "Thus we have found that it is characteristic of the process of **cognitive thought**[26] that during it attention is from the first directed to the indications of thought-discharge, to the indications of speech. As is well known, indeed, what is called conscious **thought** takes place to the accompaniment **of slight motor expenditure**" (1895, p. 367).

Macmillan also suggested that Freud's and Bain's theories of inhibition were similar. Macmillan (1992) considered the development of inhibition from Gall to Freud and explored Phineas Gage's accident, which established that damage to the frontal lobes did not cause any sensory-motor deficiencies, thus confirming the theory put forth by "Magendie, Flourens, and Hall, and which Mueller had elaborated, that the lower areas of the brain and spinal cord managed this system" (p. 85). Macmillan (2000b) stated that Bain and Freud both: 1) suggested that mental processes were "dependent concomitant[s] of the physiological;" 2) were influenced by reflex physiology; 3) argued that the nervous system discharged energy; 4) proposed that the

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[26] Freud did not use the term *Cognition or Cognitive.* Freud's *"Das Erkennen u[nd] reproduzirende Denken,"* which translates to Reflective and Reproductive Thought was translated by Strachey as Cognitive and Reproductive Thought.

avoidance of unpleasure was the primary learning and development process, over the pleasure seeking pleasure; 5) saw drive as a natural process that sought an object of discharge; 6) noted that memory needed to be differentiated from reality; and 7) said that conscience was motivated by fear. Finally, Freud's secretory neuron was similar to Bain's idea that secretions were part of emotional reactions, Freud's theory of inhibition - the idea that thought can inhibit discharge into the musculature - is very similar to both Ferrier and Bain's hypotheses (pp. 270-271).

In light of the analysis above, the connection between Bain and Freud through Ferrier is a plausible one, primarily because we know that Freud made notations in the copies of Ferrier's books that were in his library. Freud also commented on Ferrier's contributions directly when he reflected on his development of psychoanalysis:

> Psycho-analysis may be said to have been born with the twentieth century… But, as may well be supposed, it did not drop from the skies ready-made. It had its starting-point in older ideas, which it developed further; it sprang from earlier suggestions, which it elaborated… under the influence of the findings of Hitzig and Fritsch, of Ferrier, Goltz and others, who seemed to have established an intimate and possibly exclusive connection between certain functions and particular parts of the brain. (Freud, 1924, p. 191)

Evidently Freud had no trouble admitting that he borrowed and integrated neurological knowledge from those he highly regarded in the field, or that psychoanalysis did not just drop out of the sky (or his head) readymade.

John Hughlings Jackson (1835-1911)

In addition to knowing about Bain through Ferrier, Freud may have also known of the Bain and the Bain-Ferrier theory through the work of John Hughlings Jackson (Macmillan, 2000). Although there are no books by Jackson in Freud's library, Jackson was an important influence on Freud during his work with neurological patients and when he wrote *On Aphasia (1891)*.

Ferrier had met Jackson at Kings College Hospital and embarked on a research program to experimentally test Jackson's clinically based theories of localization. Ferrier went on to work closely with Jackson and together they created the journal *Brain* in 1878. Freud submitted a histology paper to the journal, entitled *A New Histological Method for the Study of Nerve-Tracts in the Brain and Spinal Chord*, which was published in the journal's seventh volume in 1884. Here was a clear professional contact between Freud and the British neurologists, further enhancing the probability of an intellectual link between Bain and Freud via Ferrier.

Franz Brentano (1838-1917)

Macmillan (2004) suggests that Freud may have become aware of Bain's work during his university career when he studied with Franz Brentano. Fancher (1977) has also described some of the possible general influences of Brentano on Freud, but I will focus here on a few select examples from Brentano's work that may have alerted Freud to Bain. Brentano (1874/1973) cited Bain twenty-two times in his *Psychology from an Empirical Standpoint* (1874) and in many places discussed him extensively.

Macmillan (2000) notes that although Brentano had great respect for Bain, he also disagreed with some aspects of his work. In the forward to his book Brentano (1874/1973) stated, "In these investigations and in those which will follow I assail quite frequently and with great tenacity even the most outstanding investigators such as Mill, Bain, Fechner, Lotze, Helmholtz and others… not only when I have accepted them, but also when I have had to challenge them" (p. xxvi).

Brentano referenced Bain's *The Senses and the Intellect* (1855), *The Emotions and the Will* (1859), and *Mental Science* (1872), and disagreed with Bain's contention that physiology could completely explain mental processes. Writing about Bain, Brentano asserted, "Although we now hope and earnestly wish that brain physiology will one day be developed to the point where it is applicable to an explanation of the highest laws governing the succession of mental events, we believe nevertheless that the acknowledgements of the very people who most ardently advocate the utilization of physiology show with indubitable clarity that this day has not yet arrived" (1874/1973, p. 48).

Similarly to Freud's later views on pleasure and pain, Brentano gave a nod to Bain when he stated, "The most eminent English psychologists of the empiricist school hold that the pleasure or displeasure, which accompanies a sensory act, is contained in the act itself. This view, for example, is expressed by…Bain who distinguishes only two parts or two characteristics in sensation…A. Bain, for example, and J. S. Mill are of the opinion that every sensation is accompanied by a feeling" (1874/1973, p. 112-114).

Brentano further cited Bain while suggesting that the motor system was important for consciousness: "In purely passive feeling, as in those of our sensations that do not call forth our muscular energies, we are not perceiving matter" (Brentano, 1874/1973, p. 59). Freud also later adopted this suggestion that the motor system is an essential element of conscious perception. Brentano also cited Bain in support of a further idea later adopted by Freud, namely that "specific actions" are needed to satisfy our biological drives (i.e. when we are hungry we take the action of going to get food):

> Bain…distinguishes…cognition…feeling…and volition or the will…he declares that volition or the will embraces all of our activity insofar as it is controlled by our

> feelings…Eating, running, flying, sowing, building, speaking-are operations rising above the play of feeling. They all originate in some feelings to be satisfied which give them the character of proper mental actions. (1874/1973, p. 148)

Another anticipation of Freud is found when Brentano refers to Bain's instinct theory: "[Bain] divides mental phenomena into primitive phenomena and…includes sensations, desires resulting from the needs of the organism, and instincts, by which he means actions, which are carried out without having been learned or practiced…"(1874/1973, p. 149). The similarity of this to Freud's primary processes and instinctual drives suggests another possible important link between Bain and Freud through Brentano.

The only book by Brentano in Freud's library was one that he wrote under the pseudonym, Aenigmatias. The book was entitled, *Neue Räthsel* (1879) and was a series of 400 word puzzles, without answers, written by Brentano. Most of the pages have Freud's handwriting on them as he attempted to solve the puzzles. *Empirical Standpoint* is not in Freud's library, but this is not unusual considering many of Freud's books were sold or lost. Further, Freud was sitting in Brentano's class in 1874 and undoubtedly got much of the material first hand. Like the connection between Freud and Bain via Ferrier, the one through Brentano is plausible but inevitably largely conjectural and interpretive.

Jean-Martin Charcot (1825-1893)

Freud's library contained 14 publications by Charcot, and according to one historian "Charcot's library contained original language and French translations of the British empirical philosophers. In discussing the relationship of the nervous system to the mind, particularly in connection with the mechanisms of hysteria, he drew heavily on British philosophers as well as physicians, citing James Mill, Spencer, Bain, Maudsley, Hughlings Jackson, and others" (Goetz, 1985, p. 264). The question arising here is did Freud learn of Bain's work through Charcot?

In his 1889 volume of his *Lectures on the Diseases of the Nervous System, Vol 3,* Charcot cited Bain's view of the motor system and its relationship consciousness: "It is well known [via Bain's "Ideal recall of the movement to be executed"]…that the production of an image, or of a mental representation, no matter how summary or rudimentary it may be of the movement to be executed, is an indispensable preliminary condition to the execution of that movement (Charcot, 1889, p. 309). Further, "the nature and seat of the psycho-physiological process... originates deliberate movements…To think is to restrain oneself from speaking or acting… Mental actions take place in the same centres as physical actions" (Charcot, 1889, pp. 396-397).

Elsewhere in the *Lectures* Charcot stated, "Hughlings Jackson adheres to the views of Bain, Wundt, and others, that our 'consciousness of muscular activity' is in great part initial, central, and realisable in the motor centres" (p. 398). It is at least remotely possible then that Freud's ideas about the connection between the motor system and consciousness came to him from Bain through his reading of reading Charcot.

Théodule-Armand Ribot (1839-1916)

Freud's library contained three of Ribot's books, *Les Maladies de la Volonte´* (1891), *Les Maladies de la Mémoire (1891),* and *La Psychologie des Sentiments* (1903). Bain is extensively referenced in Ribot's book on emotions (1903) but this was after Freud's creation of the *Project*. Macmillan (2000) stated, "Freud may also have known about Bain's theory a little more directly…in Freud's library…there is a copy of the 1891 edition of Theodore Ribot's *Les Maladies de la Volonte´*. In it, Ribot outlines the Bain-Ferrier theory of the will (p. 211).

However, in examining Ribot's book on Memory, he did cite Bain; Ribot stated, "The first point to be established is with regard to the seat of memory. This question can give no room for serious controversy. The law, as formulated by Bain…is that 'the renewed feeling occupies the very same parts, and in the same manner, as the original feeling" (1891, p. 20).

Ribot also cites Bain's idea of inhibition and the relationship between the motor system and language when he writes: "It is this close association of the idea, the sign (vocal or written), and the motor element, which renders it so difficult to establish in a definite and indisputable manner that amnesia of signs is, above all, a motor amnesia…. [A]ccording to Bain, thought is only restrained expression, it is not possible by analysis alone to show definite separation among these three elements" (Ribot, 189, p. 162).

In sum, it seems clear that Freud could have been exposed to Bain's ideas in several different authors's works contained in his library.

Freud Cites Bain

As previously noted, Bain's two-volume work, *The Senses and the Intellect* (1855) and *The Emotions and the Will* (1859), were the standard psychology texts used in Britain for nearly fifty years, and these publications contained the foundational theories that Bain later included in *Mind and Body*. Freud briefly referenced Bain's two earlier works in his 1905 publication *Jokes and their Relations to the Unconscious,* citing "the formula proposed by Bain…that laughter [is] a release from constraint" (Freud, 1905/1960, p. 147); in a later footnote he quoted Bain as saying "The occasion of the Ludicrous is the Degradation of some person or interest, possessing dignity, in circumstances that excite no other strong emotion" (p. 200). Freud also made a passing reference to Bain's book *Logic* (1870) in his 1910 paper *The Antithetical Meaning of Primal Words.*

Thus, Freud's publications reveal a general awareness of Bain's work, but no direct evidence that he read *Mind and Body* or had direct knowledge of Bain's neurological theory in 1895. Keeping this in mind, we can only speculate about the extent of Freud's knowledge of Bain's work during his creation of *Project for a Scientific Psychology*.

Freud's Translation Work

An exploration of any connections between Bain and Freud would not be complete without looking at some of the works that Freud translated for others - particularly his translations of a number of works by John Stuart Mill, at the request of Theodor Gomprez (1832-1912). Bernfeld speculated about why Freud accepted this job, noting that

> In his later years, Freud heartily abhorred philosophy and it is not likely that he ever had much interest in it. But Mill's philosophical work is in distinct contrast to the metaphysical systems, which were specifically called 'philosophy.' Mill's work was very close to the empirical physicalistic spirit of the Brücke Institute. It is quite possible that Freud was attracted by the topics of the essays and by the writer as well. (Bernfeld, 1949, p. 189)

Of course it is possible that young Freud took the job simply because he needed the money - but in any case it is noteworthy that Bain was cited in the works that Freud translated. One occurrence was in Mill's *An Examination of William Hamilton's Philosophy* (1865), which Freud translated in 1889. In this work, Mill cited Bain's *The Senses and the Intellect* thirty times and compared his work to that of Hamilton, Reid, and Stewart. More specifically, Mill argued that Bain took a different approach, and had advanced the work of these other scholars: "The answer [to questions in psychology] of the opposite school I will present in its latest and most improved form as given by Professor Bain, in the First Part of his great work the Mind" (1865, p.

273). Consequently, Mill described Bain as a "high authority" on the issue of consciousness and clarified Bain's theory of relativity, the idea that "all consciousness is of difference," thus, we do not become conscious unless we notice a change in feeling, emotion, sensation, or impression (p. 6). Mill explained that Bain's view of extension involved the motor system and one's conscious awareness of muscles moving in space, and he added that Bain's theory was unique because it incorporated an energy model; Bain noted that the intensity of the energy, "the mass or volume of sensation," or "the quantity of sensation," and the "duration" of the stimulus to sensory-motor system were important considerations for consciousness (Mill, 1865, pp. 300-301).

Further, Mill quoted Bain's ideas on conscious sensory motor sensations, which seem rather reminiscent of Weber, "If we suppose a weight raised, by flexing of the arm, first four inches, and then eight inches, it is obvious that the mere amount of exertion or expanded power will be greater, and the sensibility increased in proportion" (Bain, cited in Mill, 1865, p. 275). In continuing to refer to Bain's work, Mill cited Bain's associative theory of simultaneity; "impressions which were successive in sensation become coexistent in thought" (1865, p. 286). Finally, Mill noted some of Bain's views on pleasure, unpleasure, and pain, and commented that he supported Bain's idea that it was much more difficult to identify internal unpleasure versus external sources. In translating this work, Freud was evidently exposed to Bain's theories.

Bain and Freud: Theories Lost and Found in History?

Forgotten: Bain's *Mind and Body*

As noted, Bain had many accomplishments in the field of psychology, however, *Mind and Body*, despite its numerous editions and translations, and Bain's notoriety at the time, seems to have gone by the wayside in its own time and is only referenced in passing today. Wilkes and Wade (1997) suggested that Bain's neuronal model received little attention, firstly, because he wrote and lectured on *Mind and Body* ten years before it was published, at a time when little was known about neuronal functioning. Secondly, they suggest that because Bain's student, David Ferrier, did not expand on Bain's neural network model in a detailed manner, it faded into history. Wozniak (2005) would agree and call this the "infertility effect;" the idea that the work of a key person in a field may not get passed down to or by his or her students (p. 41). Thus, Bain's ideas did not clearly translate into Ferrier's work and this may be one reason why Bain's theories did not become more influential.

Wozniak (2005) argues that there are a number of reasons why some theories die and others survive. First, he suggests that social impact plays a role in how significant a theory becomes in the broader cultural/social sense. The widespread use of a textbook, for example, can allow a theory or theorist to become significant throughout an entire field. In light of this, because *Mind and Body* (1872) did not become a textbook, as Bain's earlier books (1855; 1859) did, his neural network theory did not have the opportunity to gain wider attention. Secondly, the "time-warp" effect may be in play; Wozniak (2005) states, "All things being equal, ideas that are born before their time has come, either because the intellectual ground has yet to be prepared or, more frequently, because relevant technological innovations have yet to emerge, disappear" (p. 44).

Finally, Wozniak's (2005) "method effect" may have occurred: Bain's ideas were theoretical and he did no empirical research. Danziger (1993) argues that before experimental psychology (1879 roughly), "theoretical claims based on everyday experience" were acceptable. Danziger adds, "To establish its credentials as a serious candidate, a modern psychological theory must be able to point to some empirical domain in which it seems to work particularly well, or to some practical results which would not have been obtained without it" (p. 17). Thus, a lack of empirical footing is likely one of several reasons Bain's and Freud's theories did not become prominent.

Wilkes and Wade (1997) and Wozniak (2005) make good points, but I suggest that a lack of interest in Bain's neural theories may also have been due to his own inability to pursue his ideas more thoroughly. In his autobiography (1904), Bain reminisces about the theories he set forth in *Mind and Body* stating, "…a hypothetical enumeration of psychical elements was attempted, and this was compared with the possibilities of nervous groupings in the cells and fibres of the brain. The hypothesis was a legitimate one; but subsequent reflection led to the belief that the number of psychical elements, although run up to hundreds of thousands, was still inadequate" (p. 313). Thus, it may have been Bain's own reservations about it that contributed to his model of the mind's being overlooked.

Perhaps it was also because his psychology was halfway between the mental philosophy of the 18th and early 19th centuries and the scientific psychology of the 20th century. Bain believed in observing the self and others in ordinary circumstances of life, and although he also believed in experimental and quantitative methods, he never used them directly. Thus, his lack of experimental data may have contributed to the lack interest in his neural network theory. Moreover, some scholars (Boring, 1950; Robinson, 1977, Shearer, 1974; Young, 1968) believe that Bain never quite made the full transition from mental philosopher to scientific psychologist, again another reason why his theories may not have been elaborated on. Finally, it has been suggested that although Bain anticipated some of the ideas that grew out of the neuron doctrine, his significance only becomes clear in retrospect of the knowledge on neuronal functioning.

That being said, Bain's work was the first systematic neurophysiology that was based on reasonably sound physiology. He recognized the importance of the work physiologists were doing and believed that this form of science had a place in understanding the mind. And although *Mind and Body* may not have directly contributed to the neurophysiology of psychic functioning at the time, his other contributions to the field of psychology have been clearly noticed. Because of this Alexander Bain will always hold a distinguished place in the history of psychology.

Freud's *Project for a Scientific Psychology*

Like Bain, Freud never pursued his neurological ideas. Because the *Project* so strongly emphasized the neurological interpretation of psychic functioning, its publication fifty-five years after it was written generated new questions about the foundations of psychoanalysis. However, some believe that Freud's neuropsychoanalytic theories seem to have died with him. Like the death of Bain's neurological theories, Freud's may have become lost for similar reasons: the Time-Warp Effect, the Method Effect, and the Infertility Effect. Wozniak (2005) also talks about the Pendulum Effect, "all things being equal, ideas that are out of phase with the prevalent trend of the science tend to disappear" (p. 43). The publication of Freud's *Project* in the 1950s may have fallen into this category, particularly because of the strong behaviorist viewpoint in psychology during this time. However, the 1950s also saw the beginnings of cognitivism, which could be one of the reasons that the *Project* was published in the first place. However, Wozniak (2005) might call this the Heuristic Value Effect, a theory about why some theories are re-discovered. He states,

> It is possible in principle to mine the past for ideas to be used in the future. This is of particular relevance when methods or technological advances have become available that make it possible to study phenomena suggested by old, speculative, but intellectually generative ideas. Current connectionist use of Donald Hebb's (1949) concepts of neural

circuitry and the many references in the literature to William James's (1890) ideas about attention, emotion, and the self are obvious examples of the value of looking backward in order to look forward. (p. 45)

In assessing the reasons why Bain's and Freud's theories did not take flight, there are obviously many variables to consider. Nevertheless, their interdisciplinary theories provide us with evidence of how they borrowed and integrated knowledge from various philosophical and scientific milieus as they attempted to understand the mind-body relationship.

Conclusion

Thus far, this dissertation has explored the psychological objects that Bain and Freud were interested in understanding and compared and contrasted their approaches. The focus has been on how Bain and Freud did the borrowing and integrating of previous ideas. After them, however, others went on to borrow and integrate ideas from them. In this regard, Bain and Freud have been considered foundational to the development of modern psychology; and although this reputation is not based specifically on their neural network models it is still difficult to separate their physiology from their psychology, primarily because they were so intertwined. A key difference between Freud's *Project* and Bain's *Mind and Body* is that Freud's model set the stage for the creation of a new discipline in the mental health sciences (see chapter 5 of this dissertation for more on this) and, thus, garnered much more attention than Bain's did. Accordingly, a deeper analysis of Freud's *Project*, as a theory lost in time and revived again, is a legitimate topic of discussion that cannot be explored in isolation from the discipline of psychoanalysis or the objects of interest that emerged from this field. Moreover, in considering psychoanalysis' interdisciplinarity nature, it is essential to explore its closest and sometimes adversarial co-discipline, psychology.

Part II

Chapter Four
A Brief History of Knowledge Exchange and Interdisciplinarity between Psychoanalysis and the Psychological Sciences

Part one of this thesis focused on the interdisciplinary neuropsychological work of Alexander Bain and Sigmund Freud and analyzed Freud's *Project* and Bain's *Mind and Body* as examples of borrowed and integrated knowledge. Chapter three compared and contrasted the work of Bain and Freud and sought connections between them. Part two of this dissertation will now focus on the field of psychoanalysis, its founding via Freud's *Project,* its interdisciplinarity with other fields, and the link between Freud's *Project* and the recently created field of neuropsychoanalysis. Thus, this section of the thesis will now set aside the work of Bain to focus on some of the interdisciplinary relationships between psychoanalysis and psychology, psychosomatic medicine, neurology, and cybernetics.

The present chapter will pay particular attention to knowledge transfer and borrowing between psychoanalysis and some of the other specific psy-disciplines. Although there has been extensive scholarship on the influence of Freud on psychology and other fields (e.g. Hale, 1971, 1995; Hornstein, 1992, Kitcher, 1992; Rosenzweig, 1985, 1992), this part of the study aims to explore psychoanalysis as an interdisciplinary field, that was founded on borrowed and integrated knowledge (Freud's *Project*), from an empirical, historical, and bibliographic framework; something that, to date, has not been done.

The instances of knowledge borrowing or transfer, or moments of connection, between psychoanalysis and other mental sciences are assessed from five perspectives throughout the history of psychoanalysis. This chapter will analyze each of these perspectives with the goal of elucidating both the subtle and bold efforts by groups or individuals to borrow or transfer knowledge. In seeking links between the disciplines this chapter focuses specifically on the borrowing of concepts and methods. By assessing which fields are researching and publishing on which concepts at certain points in history provides an opportunity to understand just how and perhaps why knowledge was borrowed or methods imported.

For example, during the first half of the 20th century Freud's theories of sexuality and the Oedipal complex were studied much more frequently than they are today; currently there is a strong emphasis on Freud's theories of affect and unconscious processes in the field of neuropsychoanalysis. In assessing why there has been a shift in research interests and objects of study, my goal is to understand these "psychological objects" as social constructs that can only be understood as products of history (Danziger, 1993). According to Danziger (1993), "Their content [historical products] comprises 'psychological objects', which are things psychologists take themselves to be investigating and theorizing about" (p. 15). Linking Danziger's philosophy to the transfer of these concepts between the psy-disciplines provides for a clearer understanding of the concept in its own time and our understanding of the concept over time.

For example, as we have seen in this dissertation, how Freud and Bain understood the concept of emotion, and how they attempted to explain it via neurophysiology, may be very different (or similar) to our understanding of this concept today in the field of neuropsychoanalysis. Advances in technology and neuroanatomy and paradigm shifts, to name only a few elements, have all contributed to the changed "culture in psychology" that Danziger speaks of; this changed and changing landscape will be emphasized in the discourse presented here. Because I have chosen to use a contemporary interdisciplinary lens, keeping this historiographical perspective in mind will help to control for any propensity toward presentism.

Interdisciplinarity Framework 1: Freud and Jung - An Early Relationship with Experimental Psychology and Empirical Methods (1876-1904)

In 1879, as Wundt was establishing the first experimental psychology laboratory at Leipzig, Freud was working as a neuroanatomist in Brücke's physiological laboratory at the University of Vienna. It is through Brücke that Freud first became acquainted with empirical methods and the psychophysics of Wundt, Helmholtz, and Fechner (Rosenzweig, 1985). From 1876-1882 Freud found success in Brücke's laboratory, where his work focused on microscopy, staining techniques, the histology of nerve cells, and neuro-anatomy of the brain and spinal cord. Although Freud was never formally trained in the methods of experimental psychology, in 1885 he embarked on the only empirical study he would ever publish; the paper was entitled, "Contribution to the Knowledge of the Effect of Cocaine." Freud, with the assistance of Austrian chemist Josef Herzig (1853-1924), explored the effects of cocaine on muscular strength and reaction time. Methodologically, they borrowed from experimental psychology and used a dynamometer and a neuro-amoebimeter, created by his colleague Sigmund Exner (1846-1926), to measure the variations in psychical reaction time and muscular force after ingesting cocaine (Bernfeld, 1953). Jones (1953) noted that this form of research was not Freud's forté and that it was Herzig who set up the experimental conditions for the study (p. 92).

Although Freud did not continue to do empirical research, he was keenly aware of the influence and importance of experimental psychology. In a letter to Fliess, in reference to the *Project*, Freud stated,

> I am writing so little to you only because I am writing so much for you; namely, what I started on the train, a summary account of the φψω which you can take as a basis for your critique…Apart from the need to adapt the theory to the general laws of motion, which I

expect from you, it is incumbent upon me to test it against the individual facts of the new experimental psychology. (Freud, 1895, cited in Masson, 1986, pp. 139-140)

The "new psychology" Freud was referring to was the psychophysical work of Wundt, Fechner, and Helmholtz. Thus, the link between Freud and experimental psychology appears to have been significant and positive between 1876, when he joined Brücke's lab, and 1895 when he wrote the *Project*. However, Freud departed from physiological and experimental psychology after he put the *Project* aside in order to focus on the more clinical aspects of his theories; between 1895 and 1904 Freud appeared to have little interest in experimental or academic psychology. That changed with Jung's creation of word association studies, when he became quite excited and supportive of the idea of applying experimental methods to psychoanalytic concepts.

Carl Jung's Association Studies (1904-1912)

In 1904, Eugen Bleuler (1857-1939), a Zurich psychiatrist known for coining the term schizophrenia, wrote to Freud telling him that one of his assistants, Carl Jung (1875-1961), had been doing empirical research on psychoanalytic concepts. More specifically, using association tests, Jung and his colleagues had found that emotions could interfere with memory; they had found empirical support for Freud's theory of repression. Although the word association method originated with Galton, and was later used by Wundt, Rosenzweig (1985) argued that Jung's use of word association tests to diagnose unconscious complexes were the first attempts to systematically examine psychoanalytic concepts (in this case repression) with experimental methodology. Jung also employed the use of the psycho-galvanometer, a device used for determining changes in the electrical resistance of the skin, to empirically examine unconscious responses to emotionally laden words (Taylor, 1998). These "Zurich experiments," as they were called, were conducted between 1903 and 1908 and utilized both normal and abnormal subjects (Makari, 2008). Being able to quantify unconscious processes was a sizeable leap away from the Wundtian School, where association studies were limited to conscious processes (Makari, 2008). Regarding these association studies, Freud (1914) recalled,

> In the alliance between the Vienna and Zurich schools the Swiss were by no means mere recipients. They had already produced very creditable scientific work, the results of which were of service to psycho-analysis. The association experiments started by the Wundt School had been interpreted by them in a psychoanalytic sense, and had proved applicable in unexpected ways. By this means it had become possible to arrive at rapid experimental confirmation of psycho-analytic observations and to demonstrate directly to students certain connections which an analyst would only have been able to tell them about. The first bridge linking up experimental psychology with psychoanalysis had been built. (1914, p. 28)

Thus in 1914, as he reflected on the early days of psychoanalysis, Freud was eager to connect psychoanalysis and experimental psychology by incorporating their methods; Freud and many of his supporters were not opposed to having psychoanalytic theories put to the empirical test. For example in 1909, Ferenczi presented a paper to the Galileo Society at the University of Budapest to about three hundred medical students where he criticized standard empirical methods, inferring “that experimental psychologists are not scientists, that those who are concerned with it are handymen and machinists” (Freud et al, 1993, p. 91-92). Of course, Ferenczi was criticized by the *Privatdozent* in psychology for this implication, but in the end, Ferenczi stated to Freud,

> Having the last word, I held true to my convictions, invited him [*Privatdozent]* and the experimental psychologists not to stand there with open mouths but to participate in *Freud's* work. They can also bring their instruments along, for all I care. Or he should try, as *Jung* has done, to extend experimental psychology to the psychology of the unconscious…The medical students surrounded me and wanted me to promise them, at any price, to tell them more about these things. (Freud et al, 1993, p. 91-92)

Three years later, Freud wrote to Jung to let him know about an empirical study of his dream theory. Freud (1912) stated, "Recently a young Viennese (Dr. Schrötter) provided experimental confirmation of our dream symbolism—more or less against his will. He suggested to his hypnotized patients that they dream of sexual or homosexual intercourse, and they did so in the symbols known to us, of which, I am assured, they had no knowledge whatever. This marks the beginning of a new branch of experimental psychology" (Freud and Jung, 1977, pp. 484-486).

These letters between Freud and his colleagues suggest that he was open to borrowing from experimental psychology. Moreover, he was supportive of psychoanalytic concepts being put to the empirical test and, when he arrived in America in 1909 to lecture on psychoanalysis, he integrated empirical research into his talks to support his cause.

Interdisciplinarity Framework 2: Freud's 1909 Trip to America - An Interdisciplinary Meeting of the Minds at the Clark Conference

> In Europe I felt as though I were despised; but over there I found myself received by the foremost men as an equal. As I stepped on to the platform at Worcester to deliver my Five Lectures on Psycho-Analysis [1910a] it seemed like the realization of some incredible day-dream: psycho-analysis was no longer a product of delusion, it had become a valuable part of reality. It has not lost ground in America since our visit; it is extremely popular among the lay public and is recognized by a number of official psychiatrists as an important element in medical training. (Freud, 1925, p. 52)

Throughout his life and still today Freud has been influential in culture, science, and psychology. However, one pivotal event in the history of psychoanalysis impacted the fields of psychology, neurology, psychosomatic medicine, and psychiatry. This event also popularized Sigmund Freud, making him a household name.

In 1908, G. Stanley Hall, the president of Clark University, began organizing the University's 20th anniversary celebration for the next year. In so doing, Hall planned an interdisciplinary conference and sent invitations to distinguished lecturers in the physical and social science. Freud was one of those lecturers and in September 1909, he delivered his "Five Lectures on Psychoanalysis" during his first and only visit to America. Although today the subject matter of these lectures would not be regarded as shocking, in 1909 Freud's ideas were novel, revolutionary, and to some disturbing. Moreover, Freud was keenly aware of some of the critiques of his theories from experimental psychology and he knew the Clark audience would be filled with experimental psychologists; thus, he ensured that empirical research was incorporated into these lectures. During this conference, Freud introduced America to psychoanalysis and presented a new line of scientific inquiry into the mind-body relationship. The Clark lectures would put this new discipline on the same playing field as psychology, neurology, and psychiatry (Hale, 1971).

The Lectures

Freud's paper, "The Origin and Development of Psychoanalysis," also known as his "Five Lectures on Psychoanalysis," was first published in the *American Journal of Psychology* in 1910. This article was a written representation of Freud's oral lectures that had been presented one year earlier at Clark University's Twentieth Anniversary Conference. Freud's lectures began on Tuesday September 7th and continued until Saturday the 11th. The lectures were presented in Freud's native German language and he spoke daily at 11 in the morning (Rozenzweig, 1992).

Freud's first lecture focused on the origins of psychoanalysis and he gave much of the credit for its development to his colleague, Josef Breuer (1842-1925). Freud presented the story of Anna O, who had been Breuer's patient, and utilized her as a case study to explain the origin and development of psychoanalysis. Hysteria was explained and differentiated from organic brain diseases, and Freud discussed hypnosis and his eventual elimination of its use in psychoanalytic practice. At the end of this lecture, Freud acknowledged that this was a new area of scientific inquiry and that it needed to be further explored, he stated (1910),

> We are dealing with novel and difficult considerations, and it may well be that it is not possible to make them much clearer—which shows that we still have a long way to go in our knowledge of the subject… But complete theories do not fall ready-made from the sky and you would have even better grounds for suspicion if anyone presented you with a flawless and complete theory at the very beginning of his observations. Such a theory could only be a child of his speculation and could not be the fruit of an unprejudiced examination of the facts. (p. 20)

Freud’s second lecture opened with a communication about Jean-Martin Charcot’s research. He stated, “At about the same time at which Breuer was carrying on the ‘talking cure’ with his patient, the great Charcot in Paris had begun the researches into hysterical patients at the Salpêtrière which were to lead to a new understanding of the disease” (1910, p. 21). Freud explained why hypnosis was unfavorable as a psychoanalytic tool and discussed why he moved to the cathartic method and free association. He went on to differentiate his theories from Janet’s and he explained repression, resistance, and ego defense and how these could impact the treatment of a hysterical patient. Again, in this lecture Freud noted that his theory was still new and not yet complete. In asking the audience to be patient, he stated, “I will also readily grant you that the hypothesis of repression leaves us not at the end but at the beginning of a psychological theory. We can only go forward step by step however, and complete knowledge must await the results of further and deeper researches” (p. 26).

Lecture three focused on the specific techniques of psychoanalysis and Freud demonstrated that wit, humor, slips of the tongue, dreams, and free association all had a role in this new psychological paradigm. Here, Freud addressed the elephant in the room, and noted that his techniques had been criticized in Europe because they fell outside the classical objective scientific framework. However, in countering this, he provided empirical evidence for free association as a technique to get at repressed ideas. He discussed Jung’s 1906 association studies on repression and, while he admitted that he was biased toward his theory of repression, he argued that Jung’s research supported his theory. Freud stated, “I clung to a prejudice which years later was proved by my friend C. G. Jung of the University of Zürich, and his pupils to have a scientific justification” (Freud, 1910, p. 29). Later, Freud again quoted Jung’s empirical research as he noted, “If you are anxious to gain a rapid and provisional knowledge of a patient's repressed complexes…you will employ as a method of examination the ‘association experiment’ as it has been developed by Jung (1906) and his pupils…which has been embarked on with so much success by the Zurich school” (p. 32).

On day four, Freud “…introduced and explored the most controversial of his theories-the development of sexuality beginning in infancy” (Rosenzweig, 1992, p. 127). He defined the psychosexual stages of development and discussed auto-eroticism and the significance of sexual pathogenic wishes, repression, and sublimation. Furthermore, Freud defined sexuality in very broad terms and explained that it encompassed much more than just the act of procreation. Here, again, Freud was inclined to support his claims with empirical research. He stated, “The first scientific observer of this phenomenon [thumb sucking]… Lindner (1879), interpreted these rightly as sexual satisfaction and described exhaustively their transformation into other and higher forms of sexual gratification” (Freud, 1910, p. 44). Freud also discussed the 1902 study by Dr. Sanford Bell, published in the *American Journal of Psychology*, which confirmed Freud’s hypothesis that children were sexual beings before adolescence. Freud stated, “He [Bell] has, as we should say in Europe, worked by the American method, and has gathered not less than 2,500 positive observations in the course of fifteen years, among them 800 of his own” (1910, p. 42). Finally, the last lecture emphasized Freud’s thoughts on artistic creation, regression to infantile stages of development, and transference. He also clearly defined mental health as a continuum “…Neurotics fall ill of the same complexes with which we sound people struggle” (Freud, 1910, p. 50).

Evidently, it was important for Freud to take his listeners day by day through his theories and hypotheses. However, it was equally important for him to keep the interdisciplinary audience in mind as he quoted empirical research. Incorporating psychoanalytic theory with the empirical research of others, and stating that more research was needed, might suggest that this was Freud's public declaration of support for empirical methods and that psychoanalysis had the potential of becoming an interdisciplinary field. However, in looking at these early internal attempts to make psychoanalysis interdisciplinary, one must also look at the external context in which it emerged.

Coming to America: Freud's Reception and the American Context

The end of the 19th century featured an outcropping of experimentalism in both America and Europe. Wundt had opened his Leipzig laboratory in Germany in 1879 and, by the end of the 19th century, the United States had adopted the "New Psychology" which blended "...Wundtian psychology, French clinical work, evolutionary theory, and Scottish realism…" (Pickren & Dewsbury, 2002, p. 59). In spite of the similarities between the American and European approaches, the Americans, both in the professional and public sectors, were far more open-minded with Freud's less objective and revolutionary method (Hornstein, 1992), but why?

First, interdisciplinary influence contributed to Freud's reception within psychology. Before 1900, Freud was virtually unknown in America*;* The *Readers' Guide to Periodical Literature* shows no evidence of Freud or psychoanalysis before its 1910-1914 issues, where suddenly four entries appear (Guthrie et al., 1915). The *New York Times* index also denotes no evidence of Freud's name before an article dated April 5, 1912. He had published frequently in Europe; his work on sexuality and its role in hysteria was somewhat controversial, but he had no trouble getting published there (Fancher, 2000). It seems ironic that with all Freud's European publications, his popularity there was meager and that with only one visit to America, psychoanalysis took off and became more influential in the history of American psychology than Freud or the discipline ever expected. The Clark conference was thought to provide a quick spread of new ideas primarily because “present at Clark were three major agents of cultural diffusion – professionals, laymen, and the press” (Hale, 1971, p. 17).

G. Stanley Hall was highly influential in bringing Freud and his ideas to the American public and to the discipline of psychology (Rosenzweig, 1992). Hall was the president of Clark University and had trained as an experimental psychologist (Hale, 1971). He also had a strong personal interest in psychoanalysis; he had begun lecturing about Freud’s ideas at Clark in 1904, and was specifically interested in Freud’s psychosexual theories (Evans & Koelsch, 1985). More importantly, Hall wanted to “effect a reconciliation between the field of psychological knowledge, grudgingly acknowledged in Europe, with the rest of psychology – the experimental science that he knew and had attempted to foster in America” (Rosenzweig, 1986, p. 17). In wanting to bridge psychoanalysis and experimental psychology, Hall made a point of inviting both Wundt and Freud to the conference. Having an experimentalist latch onto Freud’s subjective science led others within this circle to give credence to psychoanalysis, or at least give it consideration, where without Hall they might not have given Freud a second look (Rosenzweig, 1992).

In addition to Hall, Freud had given Lewis Terman (1877-1956) some food for thought. Terman stated in a letter to Hall, a few months after the lectures, “the lectures had stirred up his thoughts more than anything he had recently read. If Jung and Freud were right, their work is the biggest bomb that has struck the psychologists’ camp in recent years” (cited in Hale, 1971, p. 19). Moreover, in 1938, Terman did a study that looked at oedipal issues; he found that women who had a greater attachment to their fathers in early life had better sexual relationships with their husbands. Furthermore, others such as Hugo Munsterberg and William James, while perhaps providing strong critiques of Freud's hypotheses, encouraged him to continue his work as it had the possibility of throwing new light on human nature (Hale, 1971, p. 19).

Second, Richards (1996) suggests one reason for the cultural and psychological success of psychoanalysis was that Freud's ideas appealed to the layperson. This may have accounted for the public's positive acceptance of this new method; American culture was ready for a framework that allowed them to re-evaluate their own human nature in a new light. The press coverage at this conference, contrived and to some extent manipulated by Hall, was also instrumental in catching the public's interest in psychoanalysis (Evans & Koelsch, 1985) and, consequently, the public began re-shaping the direction of psychology in the early 1900's (Hornstein, 1992). Psychotherapists may also have been ready for a method that helped them evaluate themselves and their patients through similar lenses (Richards, 1996). Moreover, "Freud emphasized the practicality, the optimism, and the comparative simplicity of psychoanalysis…He also displayed his literary style, personal charm, and appeal to the layman…" (Hale, 1971, p. 5).

Third, "…it was about sex" (Richards, 1996, p. 85). Civilized morality was created by the religious doctrines of the 19th century. Clergy, doctors, and community leaders cultivated these religious virtues in society and established the social and sexual roles of men, women, and children. This dogma emphasized the importance of prudery and correct behavior; men were to be manly and women were to be womanly in a civilized society (Hale, 1971). The European and American versions of civilized morality had been similar until 1900, but then the American outlook took a cultural turn. "The American version of civilized morality, molded the American conscience and thus prepared the social ground for the reception of psychoanalysis" (Hale, 1971, p. 42). Freud's coming to America coincided with a breakdown of the American civilized morality that had ensconced its culture since the early 19th Century, creating another reason for the cultural and psychological success of psychoanalysis in America.

However, in spite of this early success launched by the Clark conference, it would be an uphill climb for psychoanalysis with many obstacles along the way. While Freud's supporters were hoping to provide confirmation of his theories through empirical means, many experimental psychologists were radical in their attempts to discredit him using these same methods.

Interdisciplinarity Framework 3: The 1909 Aftermath - Knowledge Exchange between Experimental Psychology and Psychoanalysis (1909-1990s)

Hornstein's (1992) insightful article, "The Return of the Repressed: Psychology's Problematic Relations with Psychoanalysis, 1909-1960," takes the reader through psychology's struggles with psychoanalysis after the 1909 conference at Clark. Hornstein pays particular attention to the numerous attempts by psychologists to discredit Freud, the co-optation of psychoanalysis by psychology, and the popularization of psychoanalysis because of these two events. I would suggest these events provide examples of knowledge exchange and/or an implicit interdisciplinarity between experimental psychology and psychoanalysis.

In assessing the early acceptance of psychoanalysis by experimental psychologists, it is clear that from 1909 to about 1915 both psychologists and psychoanalysts were writing about psychoanalytic topics in four key psychology journals. For example, *The Journal of Abnormal Psychology* (which later became *The Journal of Abnormal and Social Psychology*), *The American Journal of Psychology*, *Psychological Review* and *Psychological Bulletin* published psychoanalytic articles, which ranged from book reviews to research on the therapeutic efficacy of psychoanalytic treatment (Hornstein, 1992). Criticisms were also published, but they were "…fair-minded and well within the spirit of scientific repartee…on the whole, however, psychologists were initially supportive of psychoanalysis…" (Hornstein, 1992, p. 255). Although these journals published opinions both for and against psychoanalytic theory, they provide evidence that psychology was open-minded and somewhat accepting of psychoanalytic theory and therapy during the first two decades of the 20th century. However, by the 1920s, Hornstein proposed that the criticism became less than fair-minded when researchers such as Christine Ladd-Franklin avowed that psychoanalysis was "a product of the undeveloped German mind" and others argued that it was an "uncanny religion" (p. 256). The influential psychologists William James (1842-1910) and Edward Bradford Titchener (1867-1927) respected Freud as a person but were critical of theories, while others such as Robert Woodworth, Knight Dunlap, John Watson, and James McKeen Cattell quite outspokenly denigrated Freud and his theories (Fancher & Rutherford, 2012, pp. 496-498).

Fancher and Rutherford argue that the attitude by influential figures led many in academic psychology to simply ignore psychoanalysis entirely during the 1920s, even omitting Freud from psychology textbooks (2012, p. 497). They add, however:

> This willful blindness ran against the tide of popular opinion and culture…Freud's works became widely known and his name a veritable household word in America. By the early 1920s his face appeared on the cover of *Time magazine*, and [in] the lyrics of a popular song...Indeed as Freud's popular fame increased, the words psychology and psychoanalysis became increasingly confounded in the public mind." (Fancher & Rutherford, 2012, p. 497)

In spite of the many criticisms, psychoanalysis became so popular that it "threatened to eclipse psychology" and it was this popularity that led psychologists to experimentally assess it (Hornstein, 1992, p. 256). The concepts of defense mechanisms (regression, reaction formation), infantile sexuality, castration anxiety, the Oedipal complex, unconscious sexual conflicts and fantasies, repression, and dream theory were all grist for the mill and by the 1940s and 1950s hundreds of empirical studies had been published in the key psychology journals of the day. Moreover, one psychologist of significant importance supported the collaboration of psychoanalysis and psychology.

In 1940, Gordon Allport (1897-1967), as editor of *Journal of Abnormal and Social Psychology,* published three volumes that focused on psychoanalytic theory, therapy, and the personal experiences of experimental psychologists who had been analyzed. In the editor's introduction, Allport (1940) stated, "…it is important to encourage a continuous free discussion and argument concerning the many issues involved [regarding Freud's theories]. For this reason the Journal would welcome any serious attempt to evaluate psychoanalysis as a branch of scientific psychology" (p. 3). Allport (1940) added, "Since it is of the utmost importance to encourage open discussion concerning the principles and practices of psychoanalysis among well-informed psychologists, it would, I think, be timely and profitable to publish a symposium written by psychologists who have completed a standard analysis with an authorized analyst" (p. 3).

Regarding Allport's decision to consider psychoanalytic theories, Shakow and Rapaport (1968) stated that "this series of papers show not only psychology's growing notice of, and tendency to deal directly with, psychoanalysis, but also the potential for reciprocity between psychology and psychoanalysis" (pg. 77). Thus, Allport "…always acknowledged the importance of psychoanalysis and other depth psychologies, and did much to promote their acceptance by academic psychologists" (Fancher & Rutherford, 2012, p. 511).

From a more personal standpoint, however, Allport's view on psychoanalysis may have been less enthusiastic. As a young man in 1919 Allport had written to Freud requesting they meet and he, perhaps thinking this was to be a collegial encounter, was shocked when Freud began analyzing him. For Allport, this meeting, "…suggested to him that depth psychology, for all its merits, may plunge too deep, and that psychologists would do well to give full recognition to manifest motives before probing the unconscious…[particularly when]…dealing with *normal* people, such approaches should always be preceded and complemented by an understanding of their more conscious assessments of themselves" (Fancher & Rutherford, 2012, p. 511).

Although Allport's professional and personal views of psychoanalysis diverged, the importing of psychoanalytic theories and concepts into an experimental publication provides evidence of an integrative moment between psychology and psychoanalysis.

Surveys of Empirical Studies on Psychoanalytic Concepts

In addition to the numerous journal publications that integrated and tested psychoanalytic theories, many books were also published that provided summaries and assessments of these empirical studies (Hornstein, 1992). Because so many studies on psychoanalytic concepts were being published, these books were the first attempts to systematically collect, review, and present evidence for and/or against the empirical soundness of Freud's theories. Although this episode in the history of psychology and psychoanalysis has been regarded as a moment in time that actually increased the popularity of psychoanalysis (Hornstein, 1992), this dissertation contends that these empirical publications also acted as an interdisciplinary tool that brought psychology and psychoanalysis together via knowledge exchange and knowledge borrowing.

Accordingly, this next part of the chapter will systematically analyze seven surveys of experimental studies on Freud's theories with the goal of quantitatively measuring the knowledge exchange between psychology and psychoanalysis. In so doing, this section will explore the psychoanalytic concepts of interest and follow the continuities and discontinuities in them as they are tested by psychology and as they change due to disciplinary and social forces. The goal is to gain an understanding of the strength of the relationship between psychoanalysis and psychology as psychoanalytic knowledge traversed the boundaries of an empirical field.

Measuring Borrowed Knowledge

Thus far, this dissertation has theorized about borrowed and transferred knowledge and viewed it as a form of interdisciplinarity. Exploring how and from whom Freud borrowed knowledge, by looking at the elements of his ideas and tracing them to the work of his mentors, for example, has been one way to look for moments of connection between disciplines. But is it actually possible to measure borrowed knowledge from a more quantitative standpoint between?

Bibliometrics

Today, bibliometric and scientometric tools can help to assess the interdisciplinary nature of fields in the past and present. Bibliometrics (sometimes called scientometrics or citation analysis) is the quantitative and statistical analysis of publications; this can be done with journal articles, books, dissertations, conference papers and proceedings, to name only a few. Although there are many forms of bibliometric analysis, my focus is on citation and content analysis.

Productivity in a field is often measured by counting the number of articles published by a discipline. This is a basic bibliometric measure and provides a quantitative picture of an area of study in comparison to others. Often, institutions, authors, and disciplines can be ranked by their paper counts as a way to assess the volume of their research endeavors. Today, some of the key bibliometric tools are citation indices. For example, the Science Citation Index and the Social Sciences Citation Index are commonly used to rank journals, authors, and citations

(Thompson Reuters, 2008). In 1972, Garfield, the creator of the first citation analysis index, argued that citation analysis was difficult due to the "practical difficulty of compiling and manipulating manually the enormous amount of necessary data" (p. 471). Now that more and more sources are published electronically, citation analysis can be computer-aided to create digital histories, where large-scale literature analysis can now be done.

Citation analysis has become a technique that is now widely accepted and allows researchers to assess how knowledge moves within and across disciplines, but it comes with limitations, primarily if it is being used to assess a journal or an article's influence. But, can one say that an article that is most often cited is the most influential? Garfield (1972) addressed this forty years ago and similar questions have been asked more recently (Haslam, Ban, Kaufmann, Loughnan, Peters, Whelan, Smith, 2008). According to Garfield (1972),

> Citation frequency is, of course, a function of many variables besides scientific merit. Some of them are known or can reasonably be assumed: an author's reputation, controversiality of subject matter, circulation, availability and extent of library holdings, reprint dissemination, coverage by secondary services, priority in allocation of research funds, and others. It is extremely difficult, even when possible, to clarify the relations among such variables and their relative impact on citation frequency. (p. 536)

In addition to citation analysis, content analysis is another bibliometric tool that is often used. This method can assess the level of interdisciplinarity between two or more fields and identifies patterns across qualitative data and provides frequency counts of citations within and between disciplines (Braun and Clarke, 2006). These frequency counts can measure objects of study, methodology, and changes in research emphasis over time, and this dissertation will utilize these methods.

When looking at either citations or content, bibliometric analysis in general can assess the level of communication within a field and between disciplines. Van den Besselaar and Heimeriks (2001) posit that there are a number of "indicators" for disciplinary and interdisciplinary activities. More specifically they argue that citations and co-citations are a form of communication within fields and between them, stating, "One may expect strong citation relations within and between journals belonging to a discipline, and (much) weaker relations with other journals. Additionally, one expects that journals belonging to the same discipline relate (through citation patterns) to existing knowledge in a different way than other journals" (p. 3). Using these methods, it is possible to ascertain just how much one discipline depends on information from outside its borders and how above and beyond a field may be working from its "normal science," to quote Kuhn (1962/1996). Moreover, in examining citation communication, we can assess, to use a psychoanalytic term, the "relational environment" between disciplines to explore their mutual influence on each other.

Previously, bibliometric tools have been used to examine paradigm shifts or trends in psychology by doing citation analyses on psychology textbooks (Anderson et al, 2003; Bartels, 2015; Cave, 2003; Grigs & Christopher 2016; Griggs & Jackson, 2013) or by analyzing psychology or psychiatry journals for publication trends (Alexander, Murphy, & Greene 2012; Arakawa, Flanders, Hatfield, & Heck, 2013; Burnham, 2011; Guidi & Fava 2014; Tracy, Robins, Gosling, & Samuel, 2004; Sum, 2015). There have also been many attempts to assess the scholarly activity of specific authors (Price, Floyd, Fagan, Smithson, 2011; Simonton, 1992), the status of a specialty area of psychology (Haslam, Ban, Kaufmann, Loughnan, Peters, Whelan, & Wilson, 2008; Neal, Janulis & Collins, 2013), and the impact specific articles, journals, and dissertations have on a discipline (Buela-Casal & Zch, 2010). In addition, studies have been done that explore just how paradigmatic and interdisciplinary a field is (Friman, Allen, Kerwin, & Larzeler, 1993; Porter & Chubin, 1985), and how knowledge is transferred between disciplines via scholarly publications (Rinia et al, 2002). In considering knowledge transfer, Porter and Chubin, (1985) argue that there are many "indicators" of cross-disciplinary research to be found by looking at Journal Citation Reports and Science Citation Indices to assess citations that fall within and outside a discipline.

Bordons, Morillo, & Gomez (2004) note "The most successful bibliometric indicator for the study of cross-disciplinary research is the citations outside category (COC), first introduced by Porter and Chubin (1985)…With this approach a citation is classified as COC when the subject matter of the cited journal is different from that of the citing journal" (p. 446). However, there are also concerns about citation analyses as a methodology. For example, Rinia et al., (2001) found that "Scientific methods, techniques and results published in scientific journals in other disciplines, in general appear to take more time to be incorporated in a discipline than results from within this discipline" (p. 308). Thus, there is a lag between time of publication and the transfer of this knowledge into a discipline, making it difficult to make definitive statements about the nature of the field at any one point in time, based on citation analysis.

In addition, Moed, & Schmoch (2004) state, "The lack of consensus about what should be considered as interdisciplinarity or the diversity of classification schemes used in the different studies, are some of the problems to be solved. Moreover, the importance of maintaining up to date thematic classifications, such as the classification of journals into categories [is imperative]" (p. 453). Furthermore, today, computer aided citation analysis has become an increasing trend and this comes with its own flaws, particularly when dealing with historical literature that has not yet been digitized and some of the inaccuracies noted by the authors above.

Thus, the idea of looking at changing paradigms or trends in psychology, via citation analysis, is not a new one. This study, however, attempts to use citation analysis to assess the amount of theory and conceptual borrowing done by psychologists as they attempted to understand and test the credibility of Freud's psychoanalytic theories. Analysis of these citations is useful because the publication of a journal article is a widely accepted technique for determining the flow of information within and across disciplines (Lievrouw, 1990). This technique is helpful because it allows me to condense, for example, Hornstein's (1992) broad statements about the interest in empiricising Freud's theories into a quantitative account.

Methodology

Knowledge borrowing can be "conscious" or "purposive," in that it is deliberate, or it can be "random, accidental, or opportunistic" (Murray and Evers, 1989, p. 647). The hypothesis of this section of the dissertation is that experimental psychologists borrowed knowledge from psychoanalysis when they 1) theorized about Freudian concepts, 2) compared psychoanalytic outcomes to those found in psychology, 3) identified mechanisms of change in psychoanalysis (techniques) and compared them to those found in psychology, 4) operationalized Freudian concepts and terms, 5) applied experimental methods to Freudian concepts, and 6) finally, published their findings and study results in psychology journals. From a bibliometric point of view, psychology's borrowing was purposive and opportunistic as it was most often a deliberate attempt to prove Freud wrong.

In order to assess the borrowing between these fields, based on the six criteria above, this analysis used seven published surveys of empirical studies that tested Freudian concepts, theories, techniques, and validity as a science. The surveys used were *Emotions and Memory* (Rapaport, 1942), *A Survey of Objective Studies of Psychoanalytic Concepts* (Sears, 1943), *Experimental Approaches to Psychoanalysis* in the book *Psychoanalysis as Science* (Hilgard, Kubie, & Pumpian-Mindlin, 1952), *Fact and Fantasy in Psychoanalysis* (Kline, 1972), *The Experimental Study of Freudian Theories* (Eysenck & Wilson, 1973), *The Scientific Credibility of Freud's Theories and Therapy* (Fisher and Greenberg, 1977/85), and finally, *Freud Scientifically Reappraised: Testing the Theories and Therapy* (Fisher and Greenberg, 1996).

The primary rationale for using these specific titles was based on the fact that a large number of empirical studies could be found in just seven distinct places, and they could be reviewed manually. Because databases have changed their journal and article categorization processes over the period of time that Freud's ideas have been empirically tested, using keyword and subject searches would have been less fruitful. In addition, because psychological concepts are socially constructed (Danziger, 2003), and this study crosses an almost 100 year time-span, the definitions of some concepts had changed. For example, studies testing Freud's concept of "neurosis" in the 1930s, were testing his theories of anxiety and depression in the 1980s. Consequently, doing a manual analysis was thought to be a more reliable and valid method.

Finally, because qualitative methods were used to categorize the empirical studies into the psychoanalytic concepts of interest over time, the authors of these surveys acted as the first raters of the studies; most often their books laid out each chapter by topic or Freudian concept studied, for example, one chapter summarized all the empirical studies dedicated to research on Freud's psychosexual stages, while another chapter focused on his dream theory. I then acted as the second rater and confirmed the category of the concept being studied. For this analysis I, "presumed the title of a book, article, or chapter reflects, to some tolerable degree of approximation, the contents of the work it announces" (Simonton, 1992, p. 6). Most often the title provided a clear idea of the concept being studied, but when this did not occur, the abstract or full content was read for clarification.

In examining these seven surveys, and attempting to categorize the psychoanalytic concepts being tested, it became clear that both Freudian concepts and therapeutic processes and efficacy were being evaluated. This made it necessary to separate the studies testing Freud's concepts and theories from studies assessing his therapy. In addition, large "global" categories materialized that subsumed many of the specific concepts tested. For example, the study of unconscious processes (U) became a "global category," that included studies on the "key concepts" of dreams, defence mechanisms, and hypnosis as an unconscious state (rather than a technique). Pathology (P) included the concepts of hysteria, homosexuality, conversion, somatization, neurosis, psychosis, and later, depression. Memory (M) was synonymous with repression, and Pleasure/Unpleasure (U/P) incorporated the oral, anal, and genital psychosexual stages. Categories that related to child parent attachments and relationships (PR) included, the Oedipal complex, and the defenses of introjection, identification, and idealization. Although these can be thought of as defense mechanisms, they were not included in the Defense Mechanisms (DM) category because defenses have various etiologies; introjection arises as part of the relational dynamic between parent and child, while sublimation for example is an outlet for anxiety, which may or may not be founded in the oedipal stage of development. This will be elaborated on further in this chapter. In addition, some defense mechanisms were not studied as often as others; thus, grouping them into a general defense mechanism category was a practical decision.

Survey 1 - *Emotions and Memory* (Rapaport, 1942)

In 1895, Freud explained neurologically how memories were laid down and stored via associative processes and the forward movement of energy *Q* through contact barriers.

Remembering or reproductive thought, on the other hand, was the backward flow of *Q* within the Psi/Omega feedback system along previously created associative paths. If, however, during this reversal process, unpleasure was felt, Freud suggested that "the passage of thought is interrupted" (p. 379), thus, the memory did not come to mind, repression occurred. Freud first used the term "repression" in *Studies on Hysteria* (1895) (Erdelyi, 1985), published the same year he was working on the *Project*.

From a psychological perspective, Freud viewed repression as a form of "amnesia" brought on by emotionally painful "intrusions," of "distressing affect (unpleasure)" into consciousness (Freud, 1895, p. 350). As a defense against conscious awareness, repression could also be brought on by "ideas from sexual life" (p. 350), and he argued that a special technique (psychoanalysis) was needed to make these unconscious memories conscious. Freud's view on repression is inconsistent early in his career; at times he describes it as a purposeful act or conscious decision to suppress emotionally painful ideas, while at other times he describes it as unconscious. It is not until the 1930s, with his structural model, that repression remains consistently an unconscious defence (Erdelyi, 1985). Thus, in 1942, when David Rapaport collected the scholarly research on this concept, in his book *Emotions and Memory*, it was being tested as an unconscious process.

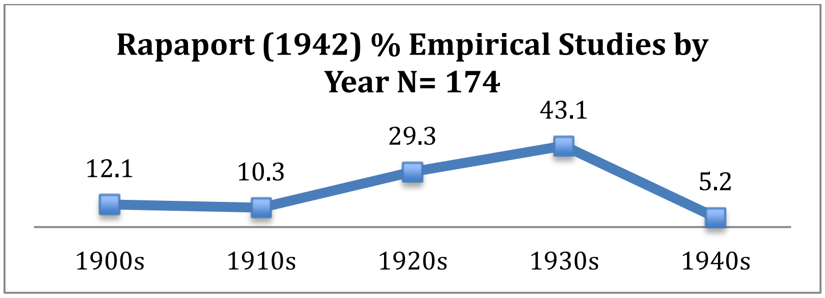
Rappaport's book marks one of the first published surveys of empirical studies on Freudian psychology that specifically focuses on empirical studies of repression. The first edition was published in 1942, and a second unaltered edition was published in 1950. In the preface of Rapaport stated, "Today the interest in the relationships between psychoanalytic and experimental findings, as well as in the experimental validation of psychoanalytic propositions, is greater than ever before. This monograph is a summary of the successes and failures of such endeavors" (1942, p. vi).

Rapaport cited 570 sources that dated from 1692 to 1942. He began by discussing the philosophical and psychological foundations of the various theories of emotion and also provided a historical account of empirical studies, taking the reader through the first forty years of the 20th century. He then delved into a discussion on current theories of emotion to provide a foundation for an analysis of empirical studies on emotion and memory.

Rapaport describes the historically changing notions of "emotions" and "memory." He notes that the words for "association" and the "passions" have been exchanged with "memory" and "emotion," respectively (p. 4), and that by 1942 emotion research was fixated on the physiology of fear (Cannon-Bard, James-Lang), while the empirical studies on memory were based on the 19th century studies of: 1) the capacity of memory (studies related to Ebbinghaus' work on learning/memory) and 2) the associative processes of memory (based on Galton and Wundt's association studies). It was within this scientific milieu of memory research that Freud emerged with a different perspective on memory. Danziger (2008) states, "Freud's concept of repression….and psychological dissociation shared the distinction of being members of a historically new class of concepts relating to human memory: they were essentially psychopathological concepts, derived from the aberrations, not the ordinary or the ideal manifestations, of memory. Unlike previous notions about memory, they were deeply rooted in pathology and the medical gaze that was required for identifying this pathology" (p. 116).

In assessing this new interest in Freud's theory of defence, the focus of my analysis was only the empirical studies, testing Freud's theory; any citations that were theoretical in nature were omitted. Thus, there were 174 empirical studies, dating from 1900 to 1942, to be analyzed

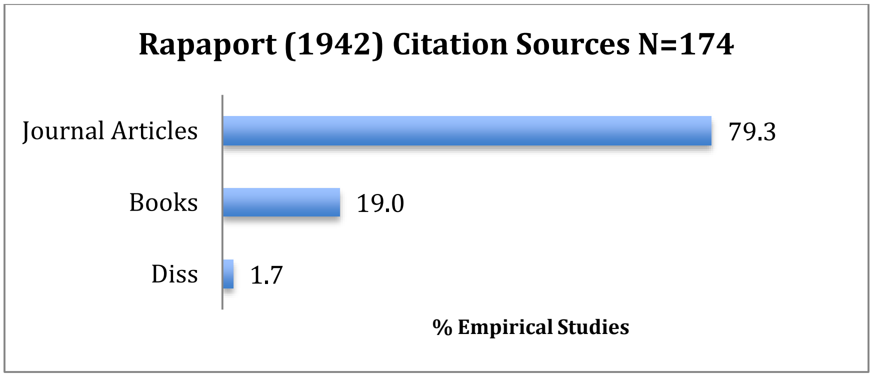
(Graph 1). The largest proportions of these studies were published in the 1930s (43.1%), at a time when "Emulation of the 'hard' sciences had become an accepted part of building a truly scientific psychology in the 1930s" (Danziger, 2008, p. 92).



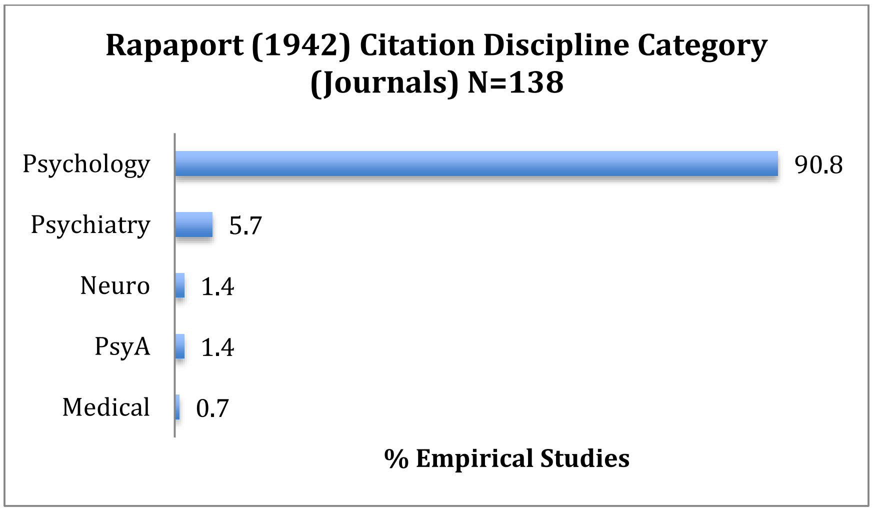
Graph 1. Rappaport Studies by Year.

This collection of studies focused specifically on the link between unpleasant words, thoughts, and emotions and how emotions could disrupt memory. One hundred percent of these fell within the global concept category of memory/repression and, although various methodologies were employed, word association tests were used the most. Often the speed of memory was tested when subjects read lists of either pleasant or unpleasant words. Further, many of these studies employed electric shocks, which were used as the unpleasant stimuli to prompt negative emotion. The shocks were followed by memory tests to see how fear or anxiety, for example, interfered with remembering lists of words. In addition, amnesia and hypnotic memory studies were also surveyed, and Rapaport concluded that, in most of these studies, Freud's theory of repression had been substantiated.

As the charts below indicate (Graph 2 and 3), almost 80% of the studies Rapaport surveyed came from peer-reviewed journals, and 90% of this research was published in psychology journals. With the remainder of the studies being published in psychiatry (5.7%), psychoanalytic (1.4%), neurology (1.4%), and medical journals (0.7%). Medical journals included the *Journal of the American Medical Association* and *Journal of Pediatrics*.



Graph 2. Rapaport Citation Sources.



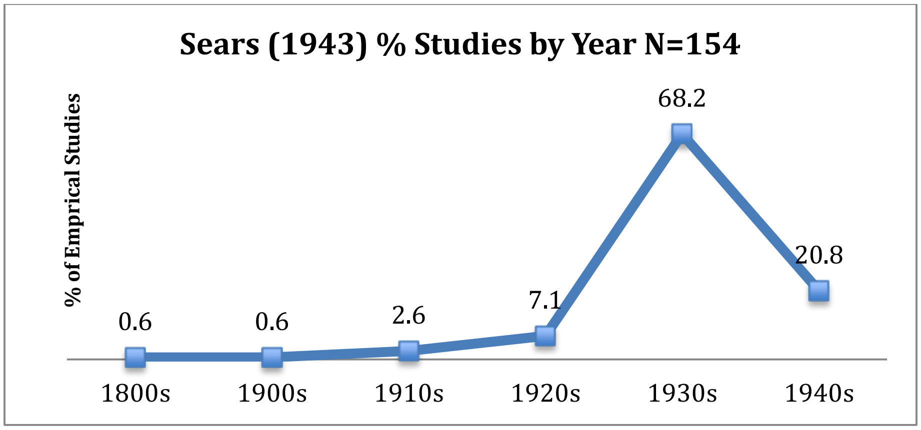
Graph 3. Rapaport Citation by Discipline.

The American Journal of Psychology (13.2%) published the most citations on this topic in Rapaport's book, followed by the *Journal of Experimental Psychology* (10.3%), *Psychological Review* (4%), and the *British Journal of Psychology* (4%). Evidently, Freud's concept of repression was of great interest to those in psychology during the first half of the 20th century.

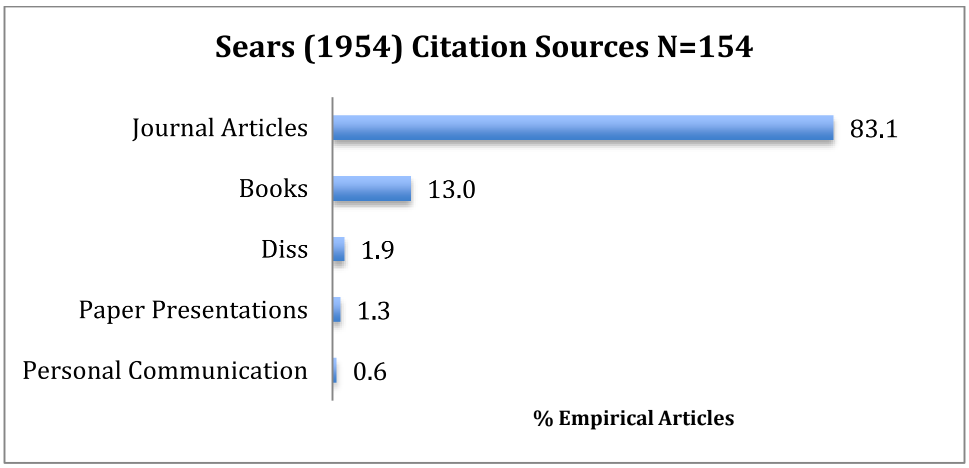
Survey 2 - A Survey of Objective Studies of Psychoanalytic Concepts: A Report Prepared for the Committee on Social Adjustment (Sears, 1943)

A year later, in 1943, Robert Sears published *A Survey of Objective Studies of Psychoanalytic Concepts*, which was funded by the Social Science Research Council and examined studies done between1893-1942 with the majority of the studies surveyed coming from the 1930s (68.2%) and 1940s (20.8%) – see graph 4. In the forward, Poffenberger, the chair of the Social Adjustment Committee, stated, “No one of the social sciences has escaped the impact of the concepts and technics that are included within the term Psychoanalysis…Freud made the greatest contributions of our times to the study of man in relation to himself and others, and would find in psychoanalytic doctrines the key to all social adjustment” (1943, p. vii). The goal of this project was to report on the scientific status of psychoanalysis; Sears’ directive was to first, discuss empirical studies psychoanalytic concepts and, thus, focus on concepts rather than technics and, second, to assess those concepts that are recognized as particularly Freudian, rather than “the many variants of these which have emanated from his successors and from competing schools of thought” (1943, p. vii-viii).

Sears noted that experimental psychology’s interest in personality had led to an increased interest in Freud’s views on the concept, he stated, “They [psychologists] have sought to resystematize psychoanalytic concepts and principles in terms of current academic psychologies, and have, in a good number of cases, tried to subject these notions to investigation by other than psychoanalytic methods…all the work, however, serves to emphasize the increasing significance attached to psychoanalysis, by non-analysts, as a guide to the planning of research on personality” (1943, p. ix-x). Sears reviewed studies on Freud’s theories of sexuality (libido) as a “source of energy for all positive affectional attachments” (p. 1); Freud’s psychosexual stages, distortions of sexuality, object choice, defense mechanisms, dreams, and repression were all grist for the mill.



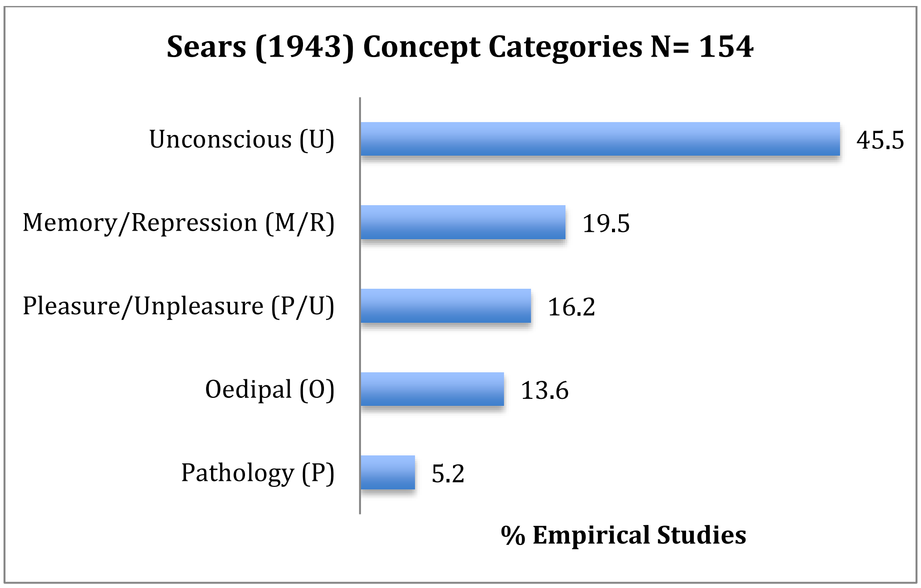
Graph 4. Sears Studies by Year.



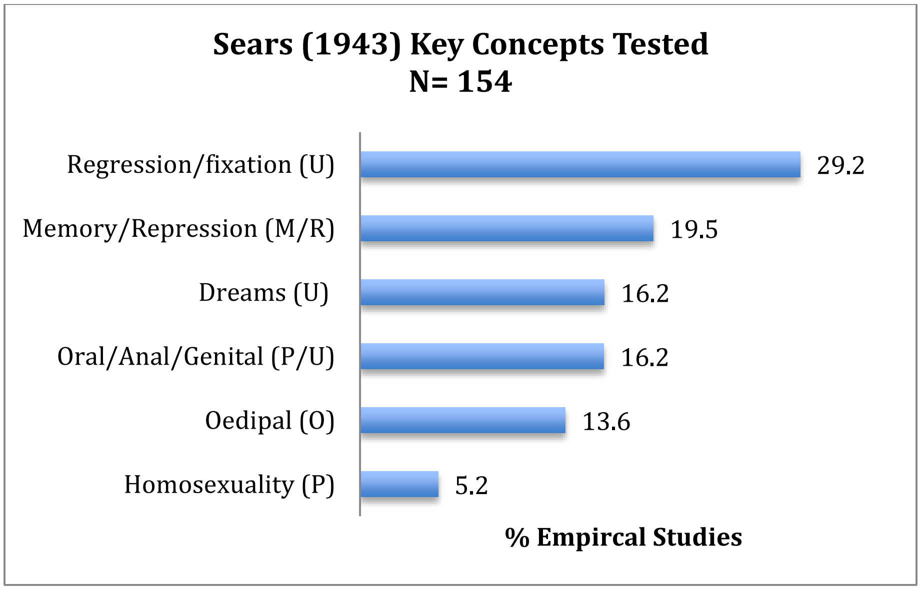
Graph 5. Sears Citation Sources.

Sears' studies (Graph 5) were drawn primarily from journals (83.1%) and consisted of experimental, observational, and questionnaire studies that tested Freud's theories of emotion, memory, pleasure, and unpleasure, and unconscious processes. The majority of the studies tested unconscious processes (45.5%), which included the concepts of dreams (16.2%, topics included, day residue, dream content, manifest/latent content, and wishes), and the unconscious defense mechanisms of regression and fixation (29.2%). The majority of the defence mechanism research presented used animal subjects, thus, these studies looked for object or food fixations and regressive behavior in, most often, rodents.

19.5 % of the studies tested Freud's theory of memory/repression, which included research on infantile amnesia, recall of pleasant/unpleasant memories, and studies that induced repression with shock or strong emotions. Studies on pleasure and unpleasure (16.2%) focused on erotogenesis and erotic behavior in children and Freud's oral, anal, and genital stages of development (thumb sucking, masturbation, nail biting, spontaneous erections in babies, constipation). These studies were subsumed under the category of pleasure and unpleasure, depending on the study findings, primarily because Freud's psychosexual theories were founded on the basic desire to move toward pleasure and avoid pain.

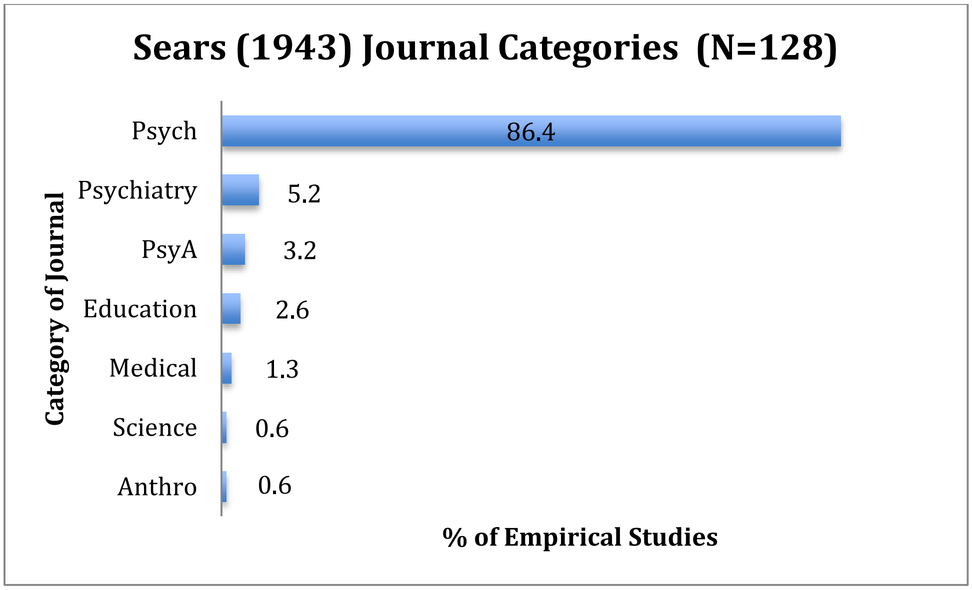


Graph 6. Sears Concept Categories.



Graph 7. Sears Key Concepts

Studies (Graph 5 and 6) on Freud's concept of object choice and emotional attachments to parents were grouped into studies testing Freud's Oedipal Complex (13.6%), and finally, Homosexuality (5.2%) was assigned to the pathology category, because, at the time, homosexuality was seen as a pathological defence founded on conflicted emotional feelings toward one's parents. The concept of homosexuality was discussed as a "disorder of sexuality" - a category that included hypo- and hypersexuality, and perversions such as fetishism, voyeurism, and sadomasochism. Sears' review concluded that there was evidence to support Freud's sexuality theories but that his more abstract theories, such as repression, fixation, regression, projection, and his theories of dreams, held less validity. Sears also advised the need for more longitudinal, cross cultural, and child development studies. In making an evaluation of Sears' work, Shakow and Rapaport (1968) noted, "Sears provided a focal point for the consideration of the experimental approach to psychoanalysis…He was one of the earlier and more prominent contributors to both the theoretical and experimental aspects of the attempt to bridge the gap between the two fields" (p. 171).



Graph 7. Sears Journal Categories.

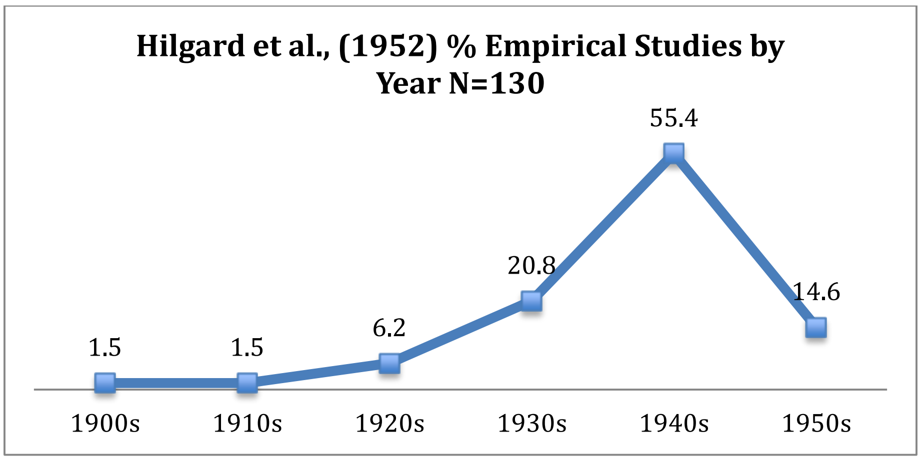
In examining where these studies were published, one can measure the connection between psychoanalysis and other fields to gain insight into just how much psychology "borrowed" from psychoanalysis. As the chart above (Graph 7) indicates, 86.4 % of these studies were published in psychology journals, with psychiatry coming next at 5.2%, and 3.2% were published in psychoanalytic journals.

The majority of these empirical studies were published in *The Journal of Abnormal and Social Psychology* (9.7%), followed by *The Journal of Experimental Psychology* (9.1%), *The Journal of Comparative Psychology* (8.4%), *The Journal of Social Psychology* (6.5%), and the *American Journal of Psychology* (5.6%). Sears' survey from 1943 clearly indicates psychologists keen interest in Freudian concepts.

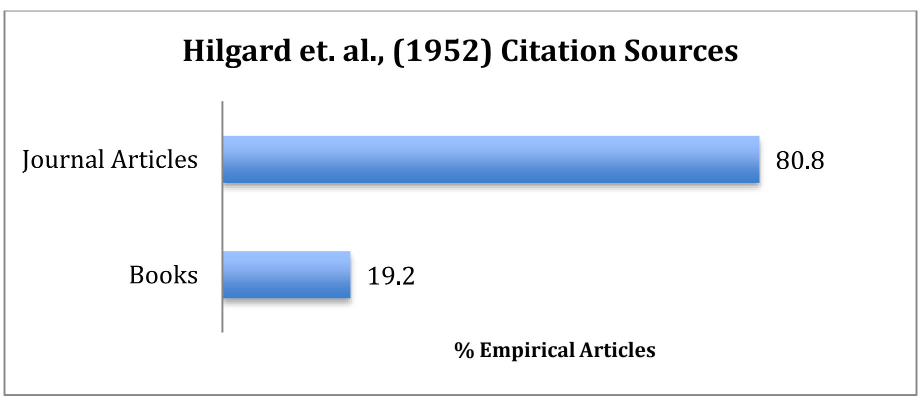
Survey 3 - Experimental Approaches to Psychoanalysis in Psychoanalysis as a Science (Hilgard, Kubie, & Pumpian-Mindlin, 1952)

Almost ten years after the Sears, Ernest Hilgard, Lawrence Kubie, and Eugene Pumpian-Mindlin published "Experimental Approaches to Psychoanalysis" in the book *Psychoanalysis as*

Science (1952), which was part of the *Hixon Lecture Series on the Scientific Status of Psychoanalysis*. This book included 157 citations and surveyed 130 empirical studies from 1908 to 1952, using both human and animal subjects. Concepts such as, infantile frustration, defense mechanisms, dream theory, psychosexual development, experimental psychodynamics (hypnosis and transference), neurosis in animals, and empirical research on psychotherapy. 55.4% of the studies in Hilgard et al's survey came from journals published in the 1940s, followed by studies published in the 1930s (20.8%), see graph 8 and 9.



Graph 8. Hilgard - Empirical Studies by Year.

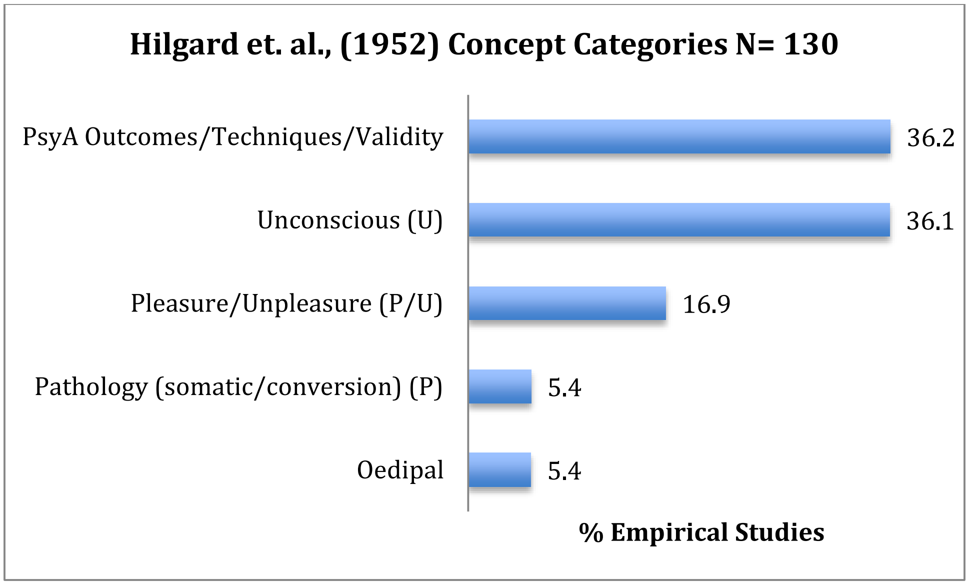


Graph 9. Hilgard Studies by Source.

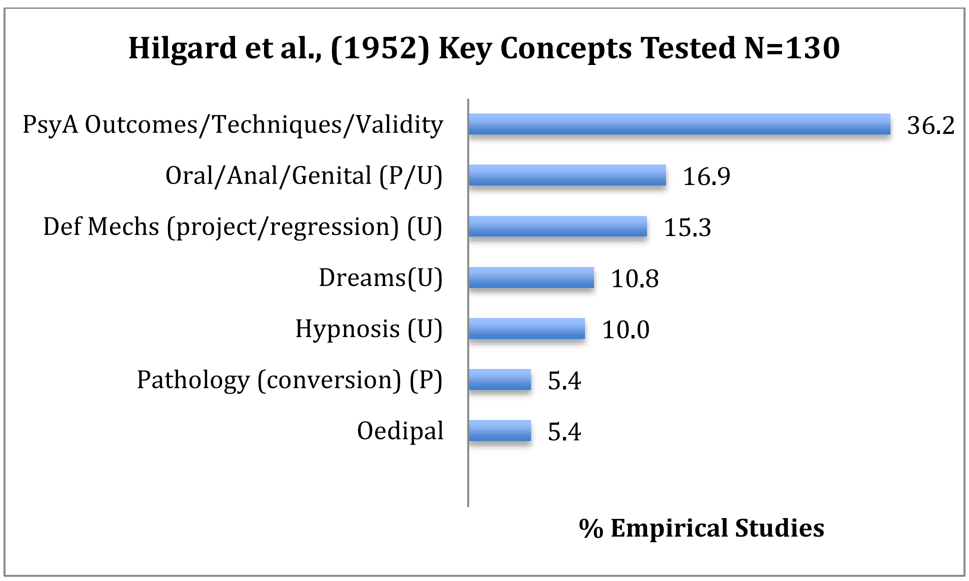
The data in this survey from the late 1940s shows evidence of the new interest in Freud's therapeutic process (types of clients, therapist factors such as personality, inconsistencies in therapeutic practices), the efficacy and outcomes of psychoanalysis compared to other therapies, and the mechanisms used in psychoanalysis (free association, the use of dreams, the couch, hypnosis, and transference). Thus, with Hilgard et al's survey, there is an added concept category, which covers 36.2% of the studies surveyed. This survey included a chapter by the psychologist Ernest Hilgard with research on empirical studies on Freudian concepts, but the two other chapters focused on research that was attempting to validate not only Freud's concepts, but also the discipline itself and psychoanalytic techniques. Lawrence Kubie wrote a chapter entitled "Problems and Techniques of Psychoanalytic Validation and Progress," and Pumpian-Mindlin's chapter was called "The Position of Psychoanalysis in Relation to the Biological and Social Sciences." Thus, this survey was an attempt to look very broadly at Freud, his concepts, his techniques, and the field's relationship with other disciplines.

Similar to both Rapaport and Sears, the majority of Hilgard et al's empirical studies came from journal articles (80.8%) and unconscious processes were a major interest to psychologists (36.1%). Unconscious processes tested included: defence mechanisms (15.3%), dreams (10.8%), and hypnosis (10%). It is in this survey that an interest in psychoanalytic outcomes, techniques, and the validity and/or efficacy of Freud's therapy are considered (36.1%).

Following these, pleasure/unpleasure (16.9%) was the next highest concept category of interest and included studies that tested Freud's psychosexual theories (oral/anal/genital). Finally, 5.4% of the studies examined pathology with an emphasis on psychosomatic or conversion symptoms and Oedipal theory was studied 5.4% of the time (Graph 10 and 11).



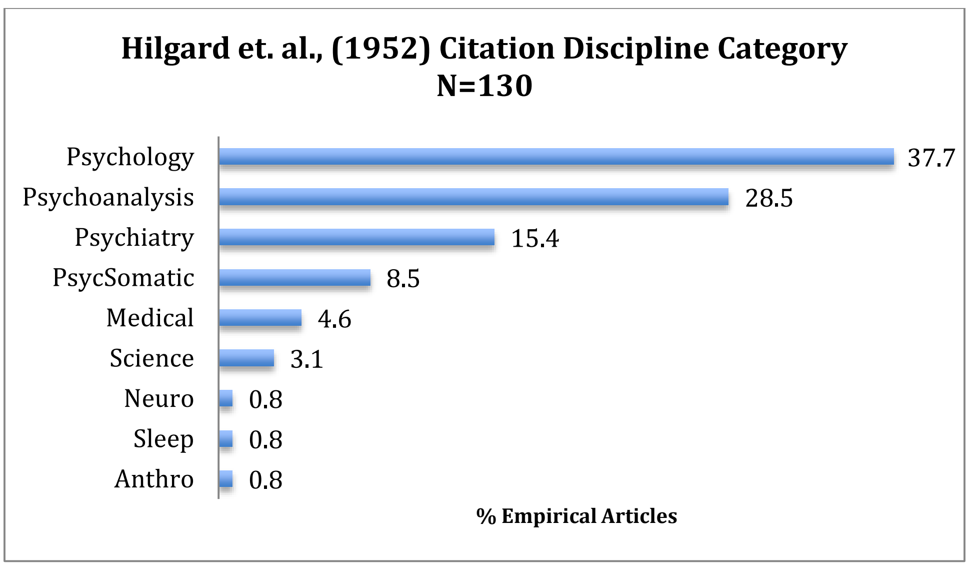
Graph 10. Hilgard Concepts.



Graph 11. Hilgard Key Concepts

As Hornstein (1992) noted, many psychologists during the first half of the 20th century were focused on creating empirical studies of psychoanalytic concepts in order to discredit Freud. Hilgard, however, seemed geared toward supporting interdisciplinarity when he stated, “If experiments supporting psychoanalytic interpretations are any good, they ought to advance our understanding, not merely confirm or deny the theories that someone has stated" (p. 43). Hilgard (1952) also argued that,

> If psychoanalysts are themselves to make a science of their knowledge, they must be prepared to follow some of the standard rules of science…whatever psychoanalysts do about research, the obligation is clearly upon experimental, physiological, and clinical psychologists to take seriously the field of psychodynamics, and to conduct investigations either independently or in collaboration with psychoanalysts. It is a tribute to Freud and his psychoanalytic followers that the problems faced by psychologists in their laboratories have been enormously enriched by the questions the analysts have taught us to ask. (p. 44-45)

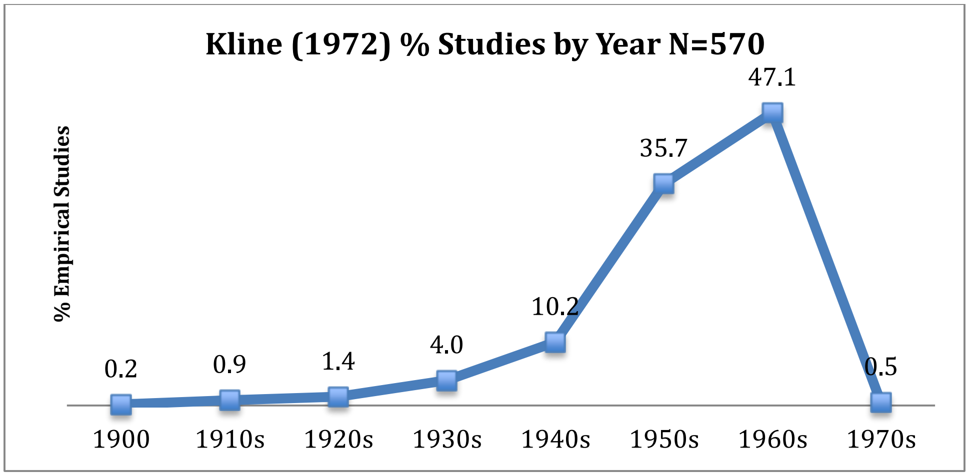


Graph 13. Hilgard – Disciplines.

37.7% of the studies reviewed in this survey came from psychology journals, followed by psychoanalysis (28.5%), and psychiatry at 15.4%. Compared to the studies thus far, this survey had a high number of citations from psychoanalytic journals (15.4% of the studies were in *The Psychoanalytic Quarterly*); Rapaport's survey included only 1.4% of studies from the field of psychoanalysis, and Sears' study had only 3.2% from this discipline (Graph 13). The increase in publications in psychoanalytic journals may be connected to the fact that psychosomatic medicine emerges as a new field with new journals during the period of time these studies were culled from. Moreover, Kubie was a psychoanalyst, and both he and Pumpian-Mindlin, a psychiatrist, worked in psychosomatic medicine at a time when this field and psychoanalysis were becoming more engaged with each other. Kubie also cited 27 of his own publications in this survey, many of which were published in psychoanalytic journals; thus driving the number of empirical studies in psychoanalytic journals upward.

Survey 4 - Fact and Fantasy in Psychoanalysis (Kline, 1972)

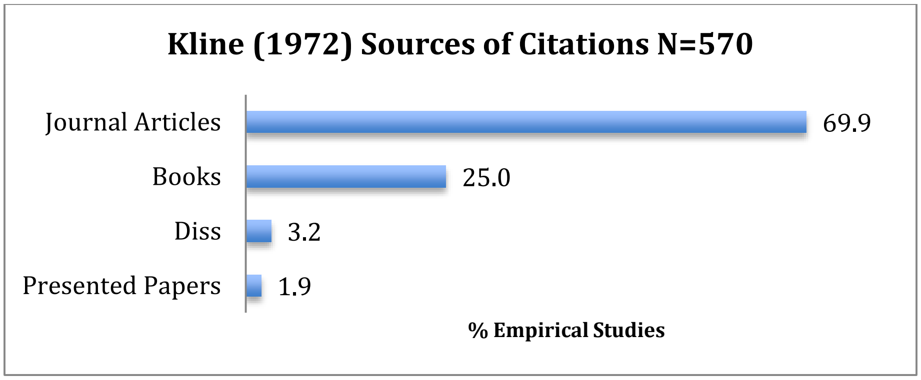
While Rappaport, Sears, and Hilgard et al provided surveys of the empirical research on psychoanalytic concepts up to about 1950, more than twenty years later, in 1972, Kline published *Fact and Fantasy in Psychoanalysis,* which included 724 citations which ranged from 1900 to 1970. Of these, 569 were empirical studies of Freudian concepts. The majority of these studies were written in the 1960s (47.1%) and 1950s (35.7%). In examining these studies (Graph 14), Kline's goal was "To establish which parts of Freudian theory have been confirmed or, at least, could be confirmed by objective, scientific psychological research [and] to establish psychoanalysis as a true science" (1972, p. ix).



Graph 14. Kline – Studies by Year.

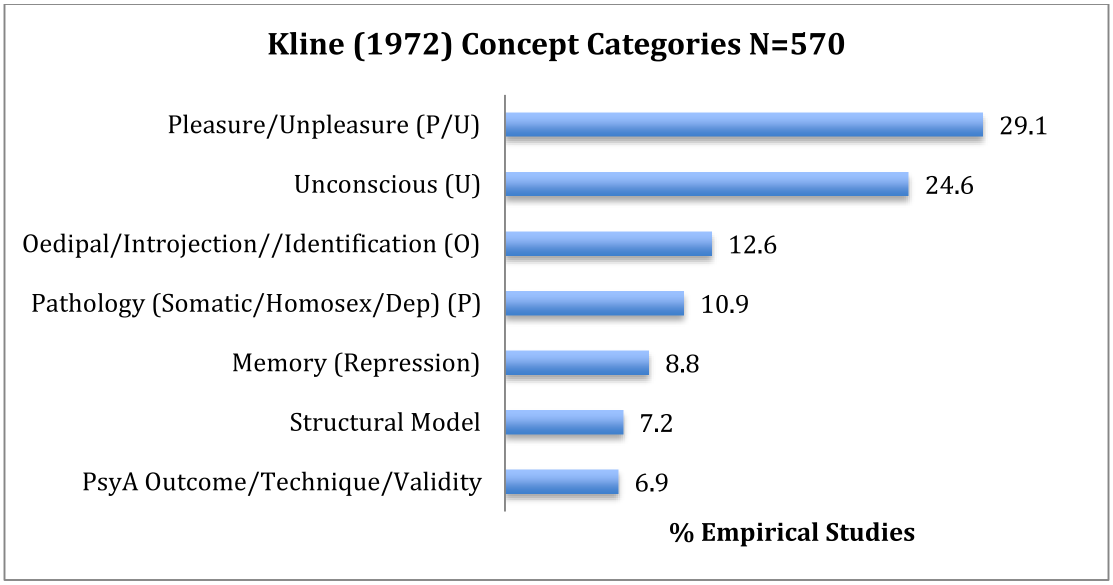
Prior to Kline, many authors had noted the difficulties in studying psychoanalysis from an empirical standpoint; for example, they often noted things like varying subjective experiences, methodological problems, and the difficulties of trying to objectively measure things that were subjective, unconscious, and uncomfortable, such as studying sexuality. Kline, as others had, noted all of these issues, but he also suggested that, "A serious difficulty in the study of psychoanalysis lies in the emotional attitudes it arouses both in its adherents and its opponents – feelings which are not conducive to a rational appraisal of its value" (1972, p. ix).

So, while scientific and methodological issues had previously been highlighted as the key problem psychologists had with psychoanalytic theory, Kline was among the first to openly question the personal biases and emotional motivations for putting psychoanalysis to the empirical test. Evidently, he kept this in mind when he assessed studies that tested psychosexual development and personality, the Oedipus and castration complexes, defense mechanisms, dream theory, theories of neurosis and psychosis, and psychoanalytic psychotherapy. Kline, unlike his predecessors, also considered studies on concepts that were put forth by some of the neo-Freudians and other analytic psychologists, such as, Melanie Klein, Carl Jung, Alfred Adler, and Karen Horney, but these were not included in this analysis.



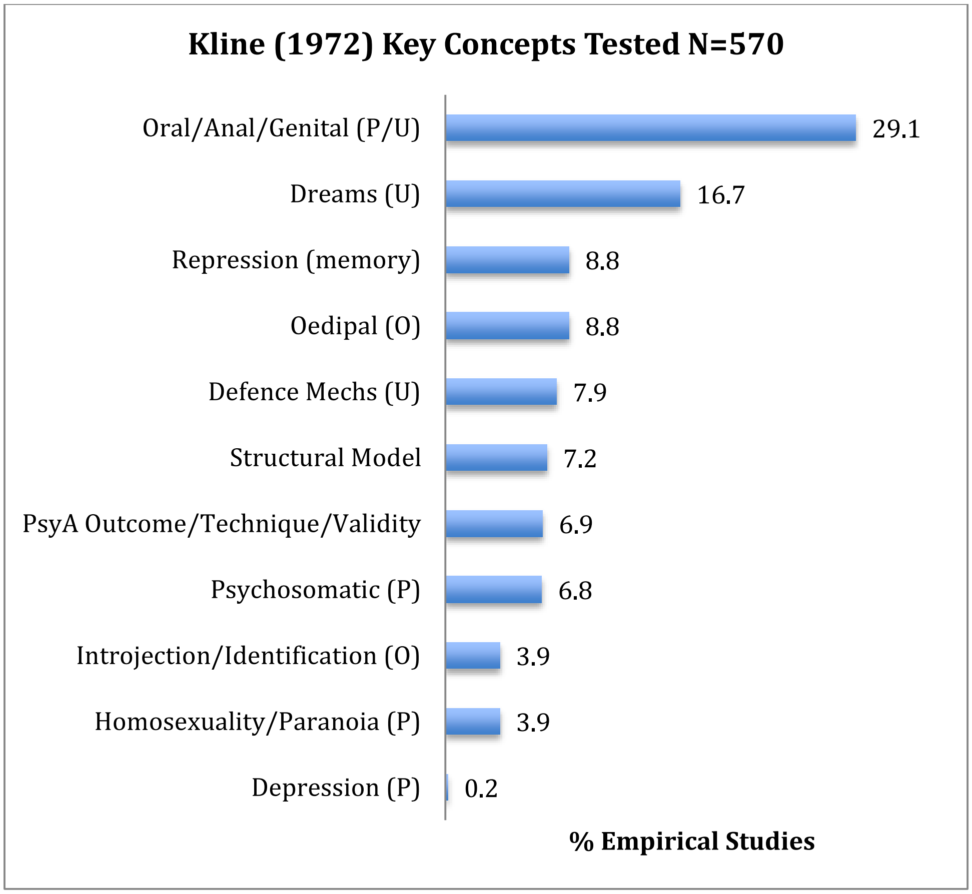
Graph 15. Kline – Sources of Citations.

The studies in Kline's survey (Graph 15) came primarily from journal articles (70%), books (25%), dissertations (3.2%), and paper presentations (1.9%). The primary concept category of interest was that of pleasure/unpleasure (29.1%), which included studies on Freud's oral/anal/genital psychosexual stages. The unconscious processes category (24.6%) consisted of studies on dreams (16.7%) and defence mechanisms (7.9%). The Oedipal complex (8.8%) and introjection/identification (3.9%) were grouped together as a category that dealt with parent-child relationships (12.6%), and somatic (6.8%), homosexual (3.9%), and depressive (.2%) disorders comprised the pathology category (10.9%), see Graph 16 and 17.



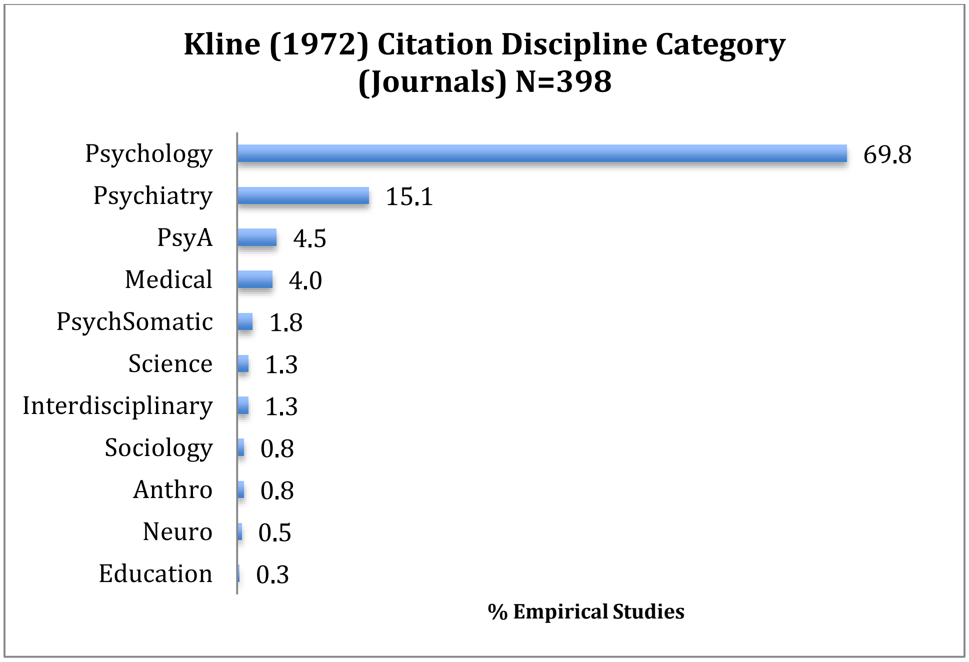
Graph 16. Kline Concept Categories.

The last three categories (Graph 16) of empirical studies tested were memory (Freud's theory of repression – 8.8%), his structural model (Ego/Id/Superego – 7.2%), and psychoanalytic outcomes/techniques/validity (6.9%). Kline's survey is the first to include studies Freud's structural model, making it unique from the earlier surveys discussed.



Graph 17. Kline – Key Concepts Tested.

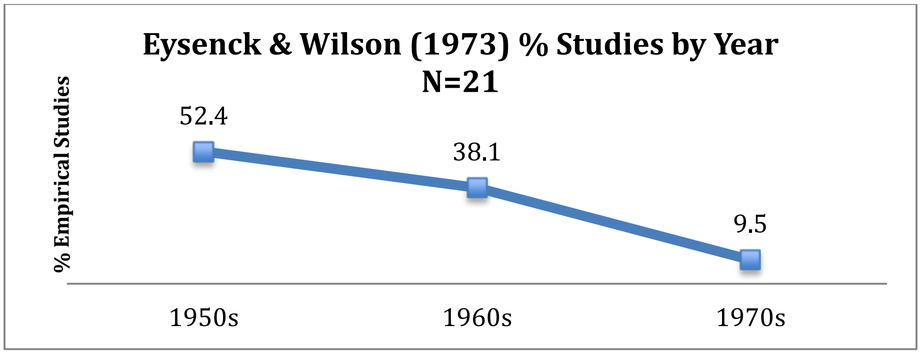
Most of the studies Kline cited had been published in psychology journals (70%), followed by psychiatry (15.1%), psychoanalysis (4.5%), and other fields (see graph below). The *Journal of Abnormal and Social Psychology* (6.7%), the *Journal of Consulting Psychology* (5.1%), and the *British Journal of Medical Psychology* (3.0%) were the top three journals cited in this survey (Graph 18).



Graph 18. Kline Discipline Categories.

Survey 5- The Experimental Study of Freudian Theories (Eysenck and Wilson, 1973)

About a year later, Eysenck and Wilson published *The Experimental Study of Freudian Theories* (1973), which assessed studies done between 1951 and 1972. This book differed from the earlier surveys in that it published the full papers of key empirical studies on psychoanalytic topics, rather than an interpretive review of the literature. Thus, only 21 studies were reviewed; the authors wanted readers to come to their own conclusions regarding the validity of psychoanalysis (Eysenck & Wilson, 1973, p. xiv). All of these studies came from peer-reviewed journals, there were no books, dissertations, or conference papers included, as in the other surveys presented thus far. The bulk of these studies had been published in the 1950s (52.4%) and 1960s (38.1%), and during the first two years of the 1970s (9.5%), see Graph 19.



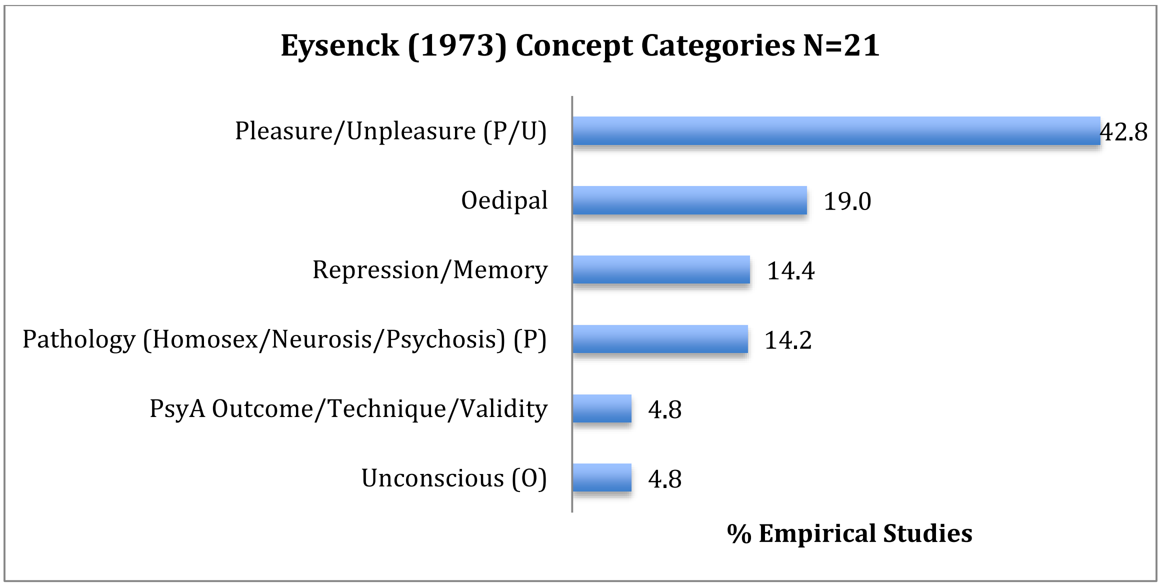
Graph 19. Eysenck and Wilson – Studies by Year.

In the introduction, Eysenck and Wilson (1973) stated, "We believe that we have chosen for inclusion in our book only articles which are widely believed to be the most convincing, the best designed, and the most conclusive among those which confirm Freudian theories" (p. xii). In general, Eysenck and Wilson were motivated to write this book based on two key frustrations: The first being psychology's fascination with Freudian concepts based on "faith" rather than science, and second, they noted that even in light of Freud's own disinterest in empiricising his theories, they were still popular.

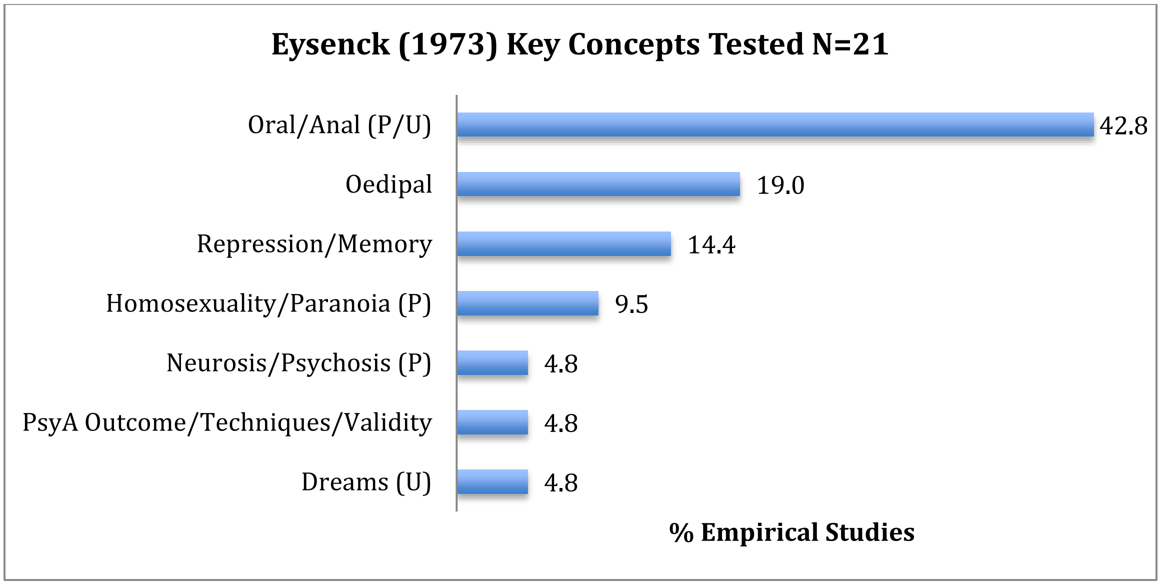
The most interesting fact, however, is that Eysenck and Wilson were not actually supporters of Freud, but they purposely chose research studies for this book that supported Freudian theory. They argued that it would be easy to choose "silly" or "erroneous studies" to make a case that Freud's work was invalid (p. 12). So they chose studies that were deemed to be the best in the field, in terms of methodology and persuasion, and they looked to researchers who had positive outcomes in their studies on Freudian concepts.

Not surprisingly, the book did include some studies that did not support Freudian concepts, the best known perhaps being the study done by Eysenck himself that suggested psychoanalysis had no better efficacy than any other form of psychotherapy, and moreover, that psychotherapies in general produced no better success than spontaneous recover from neurotic symptoms.

The studies presented by Eysenck and Wilson (Graph 20 and 21) included research on oral and anal character (pleasure/unpleasure - 42.8%), the Oedipus and Castration Complexes (19%), Repression/Memory (14.4%), Homosexuality/Neurosis/Psychosis (pathology – 14.2%), Outcome/Technique/Validity Category (4.8%), and Dreams (unconscious processes – 4.5%).

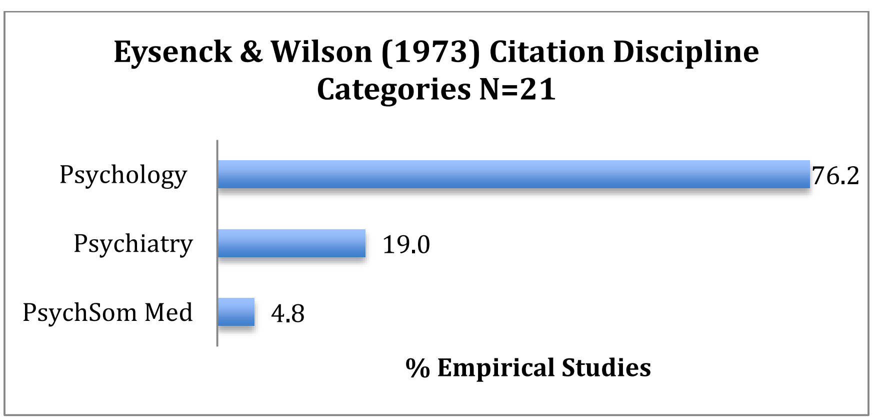


Graph 20. Eysenck Concept Categories.



Graph 21: Eysenck – Key Concepts

Similar to the earlier surveys, the majority of Eysenck & Wilson's studies were originally published in psychology journals, however, there were only two other discipline categories, psychiatry (19.0%) and psychosomatic medicine (4.8%) came second and third, respectively (Graph 22). More than one third of the studies were been published in the *Journal of Personality* (28.6%) and the *Journal of Personality and Social Psychology* (9.5%), thus, demonstrating the strong connection between psychology and psychoanalytic theory.



Graph 22. Eysenck and Wilson – Citation Disciplines

Survey 6 - The Scientific Credibility of Freud's Theories and Therapy (Fisher & Greenberg, 1977/85)

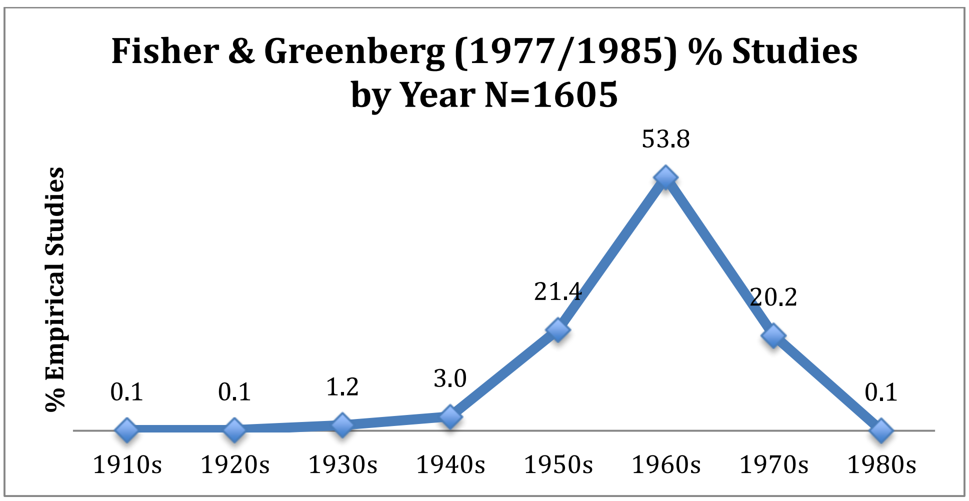
Fisher and Greenberg's (1977) *The Scientific Credibility of Freud's Theories and Therapy* was the next survey to be published. A second edition of this book was published in 1985 with only 1 new citation from 1985; this second edition was used for this analysis. In comparison to the other surveys, Fisher and Greenberg's exhaustive study examined the largest number of empirical studies and covered studies from the longest historical period. Fisher and Greenberg were keenly aware that as psychology had broadened, adding new research areas, psychoanalysis had remained somewhat resistant to empirical scrutiny and had not grown in light of the recent findings in the psychological sciences. In chapter one, Fisher and Greenberg (1977/85) questioned whether Freud's ideas could be sensibly tested and they stated in their introduction,

> The chief way in which psychoanalysts have hurt themselves in not pursuing the scientific testing of their ideas is that they have not been able to rid themselves of that which is defective and to replace it from the reservoir of new data accumulated by the work of the various behavioral science disciplines. What changes have managed to occur have reflected the power status or persuasive fluency of individuals pleading their special views. (pp. 6-7)

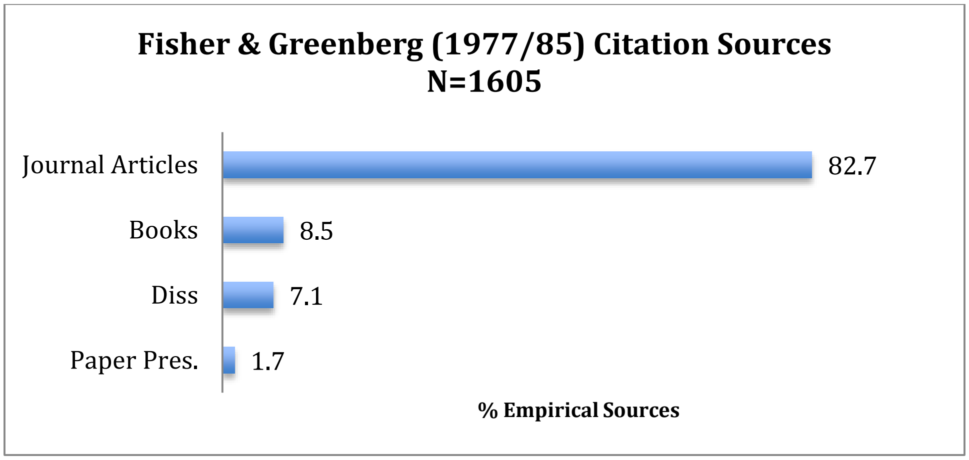
Fisher and Greenberg end the first chapter discussing the theoretical views of psychoanalysis and introducing their goals for the book, which were not to confirm whether Freud was right or wrong, but to assess Freud's theories in light of contemporary research and methodology. Each chapter ended with a summary of which aspects of the theories were confirmed and those that were not. In general, Fisher and Greenberg were surprised that many of Freud's theories were confirmed in the studies they surveyed.

More specifically, Fisher and Greenberg assessed the empirical studies on psychoanalytic concepts that existed between 1913 and 1985. The book included 1918 citations, which included theoretical and empirical studies, however, this analysis will focus on the 1605 empirical studies noted in this book.

As the data indicate, between the 1940s (3.0%) and 1950s (21.4%), there was a sharp increase in interest in psychoanalytic concepts. More than 50% of the research cited by Fisher and Greenberg were published in the 1960s (53.8%) and then there was a sharp decline into the 1970s (20.2%), See graph 23. Fisher and Greenberg do, however, write a follow up book that covers later decades, which is discussed in the next section.

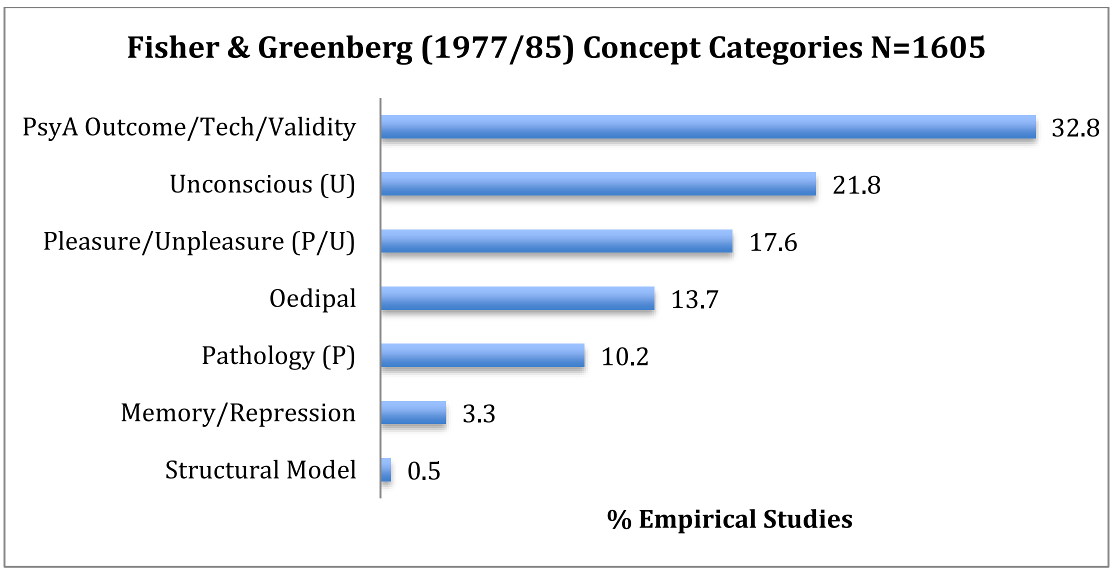


Graph 23. Fisher and Greenberg – Studies by Year.

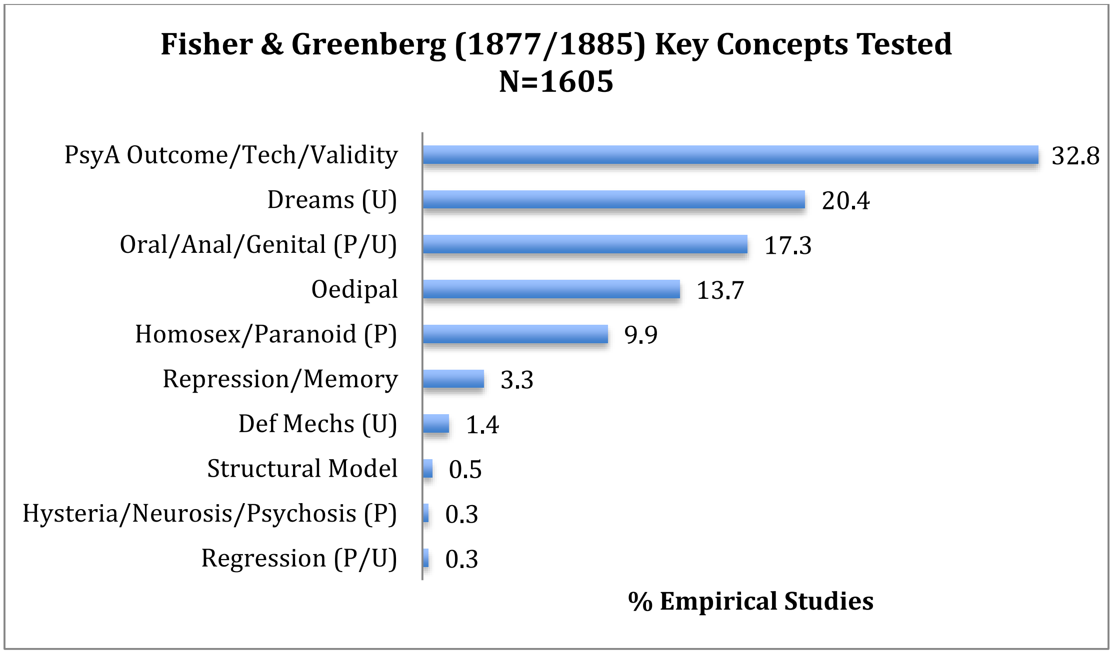


Graph 24. Fisher and Greenberg – Citation Sources

82.7% of the studies reviewed originated in journals, with the rest of the sources coming from books (8.5%), dissertations (7.1%), and paper presentations (1.7%), see Graph 24.

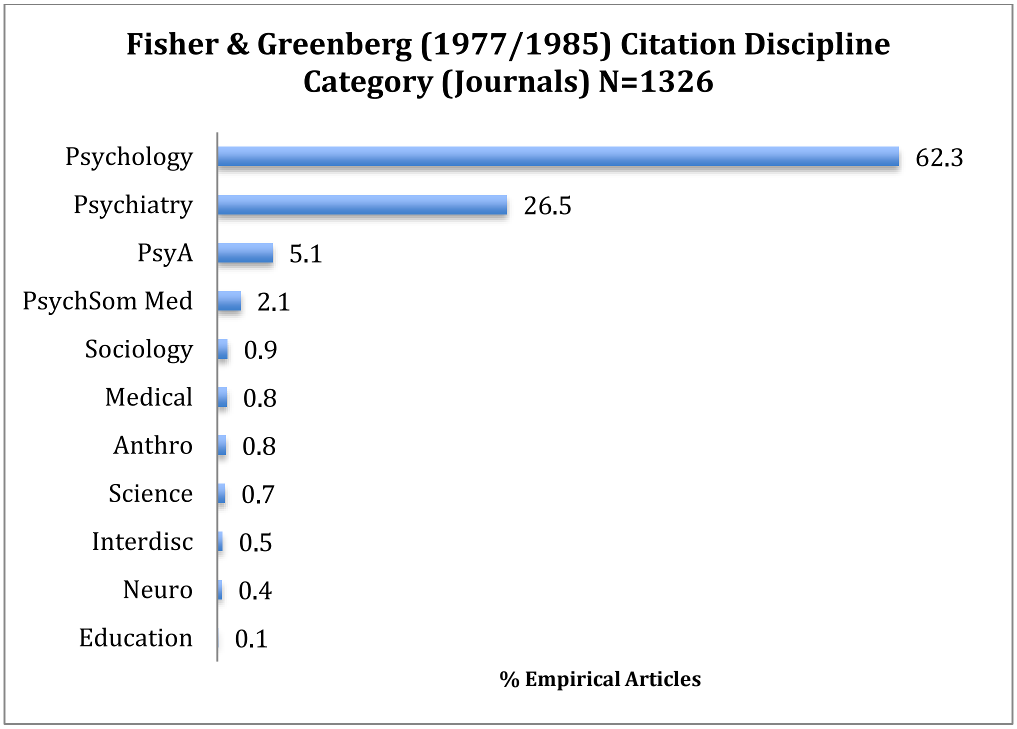


Graph 25. Fisher and Greenberg – Concept Categories



Graph 26. Fisher and Greenberg – Key Concepts**.**

The primary categories of empirical studies that Fisher and Greenberg reviewed were Psychoanalytic Outcome/Technique/Validity (32.8%). The Unconscious Processes category (21.8%) included Dreams (20.4%) and Defence Mechanisms (1.4%), while Pleasure/Unpleasure (17.6) incorporated the Oral/Anal/Genital (17.3%) and Regression (.3%) studies. 13.7% of the research was on the Oedipal complex, and studies on Hysteria/Neurosis/Psychosis (.3%) and Homosexuality (9.9%) fulfilled the Pathology category (10.2%). Memory (repression – 3.3%) was the second last category and Freud's structural model (.5%) was the least studied topic in Fisher and Greenberg's (1977/85) collection (Graphs 25 and 26).



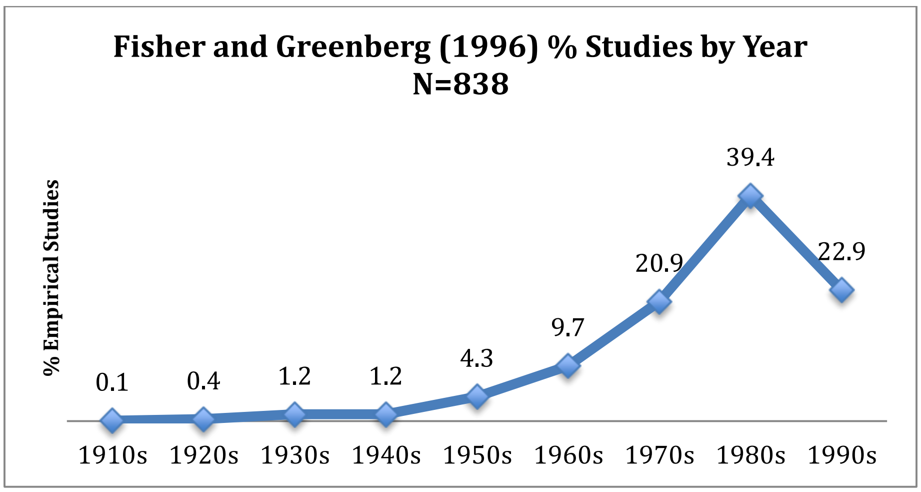
Graph 27. Fisher and Greenberg – Citation Discipline

The citations that came from journals primarily came from psychology journals (62.3%), followed by Psychiatry (26.5%) and Psychoanalysis (5.1%). *The Archives of General Psychiatry* (8.8%) was the single most highly cited journal, followed by the *Journal of Abnormal & Social Psychology* (7.5%), and *The American Journal of Psychiatry* (5.8%), see Graph 27.

Survey 7 – Freud Scientifically Reappraised: Testing the Theories and Therapy (Fisher & Greenberg, 1996)

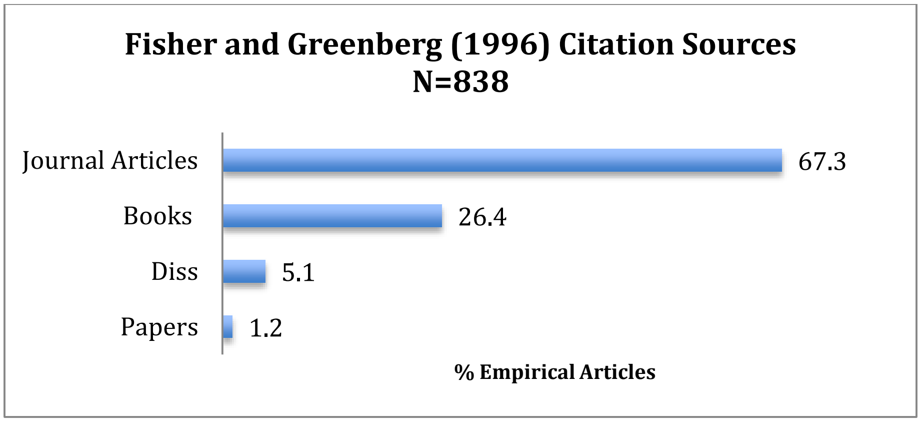
Almost twenty years after their 1977/1985 reviews, Fisher and Greenberg (1996), once again published a survey of empirical research on psychoanalytic concepts. *Freud Scientifically Reappraised: Testing the Theories and Therapy* examined Freudian constructs, either explicit or implicit, in the areas of social, clinical, cognitive, developmental, and physiological psychology. They also went outside psychology, looking at studies done in anthropology, sociology, psychiatry, and psychosomatic medicine. Their goal was to specifically "evaluate Freud's formulations rather than derivatives and elaborations produced by his followers" (Fisher and Greenberg, 1996, p. viii). Moreover, with this publication, they stated,

> We are more interested in reshaping Freud's formulations to reflect accumulated empirical research than in simplistically checking out whether they are right or wrong. On the basis of our 1977 book, it was already obvious to us that so much new empirical information had accumulated – beyond anything Freud could have imagined – that most of his paradigms probably stand in need of some degree of revision or more elaborate specification. (Fisher and Greenberg, 1996, p. viii-ix)



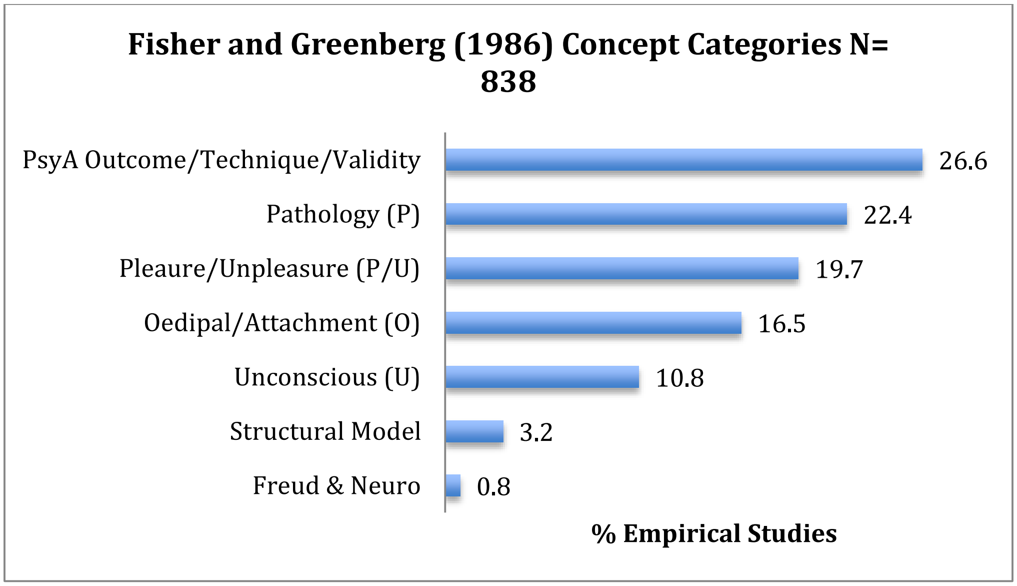
Graph 28. Fisher and Greenberg – Studies by Year.

Fisher and Greenberg (1996) evaluated 838 empirical studies from 1917 to 1993 (Graph 28). Almost 40% of them had been published in the 1980s and approximately 82% of the studies were published between the 1970s and 1990s. 67.3% of the studies were published in academic journals, 26.4% in books, 5.1% in dissertations, and 1.2% were conference papers (Graph 29).

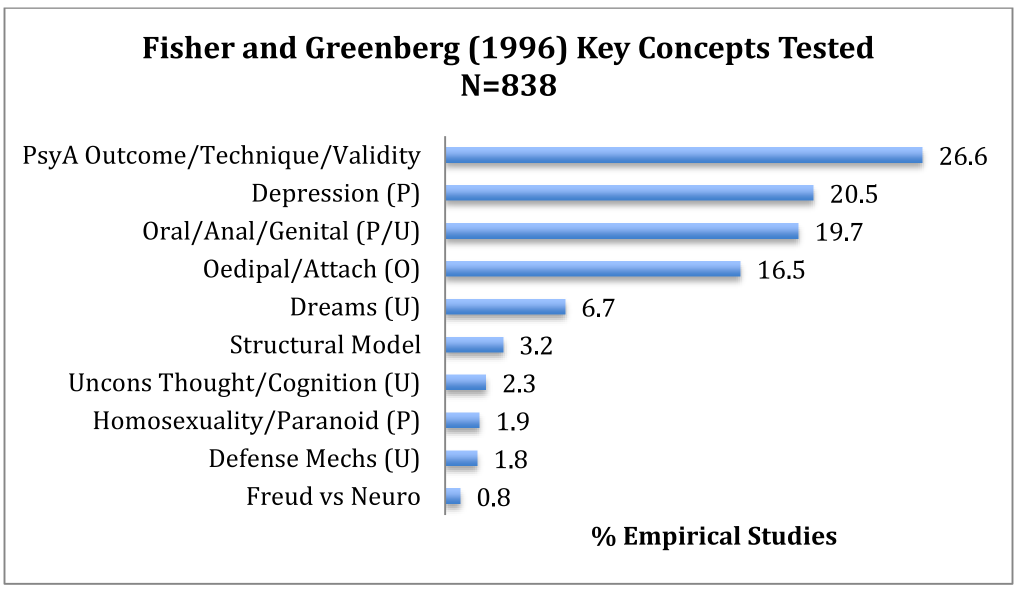


Graph 29. Fisher and Greenberg – Citation Sources

Conceptually, the majority of the studies in Fisher and Greenberg (Graphs 30 and 31) explored Psychoanalytic Outcome/Technique/Validity (26.6%) and Pathology (22.4%). In assessing the concept of pathology, this survey was a departure from earlier studies in that depression became a new concept of interest (20.5%) and homosexuality takes up only 1.9% of the pathology studies. Pleasure and Unpleasure (19.7%) is the third highest category of interest and included the oral/anal/genital psychosexual stages of development. The Oedipal category is changed to Oedipal/Attachment with this survey, primarily because of new research on attachment, birth order, and parenting relationships that emerges (16.5%). Unconscious Processes consisted of 6.7% of the studies on dreams, 1.8% of the studies on Defense Mechanisms, and 2.3% of the studies on Unconscious Thought/Cognition. The materialization of the category of Unconscious Thought/Cognition is another new arrival in Fisher and Greenberg's (1996) survey, compared to the earlier books, as is the category of Freud and Neuroscience (.8%). Although many of the studies on dreams, dating back to the 1950s, integrated the use of EEG methodology to study dreams, these studies, beginning in the 1970s, incorporated the advances made in the cognitive neurosciences. Finally, Freud's structural model was the focus in 3.2% of the studies.

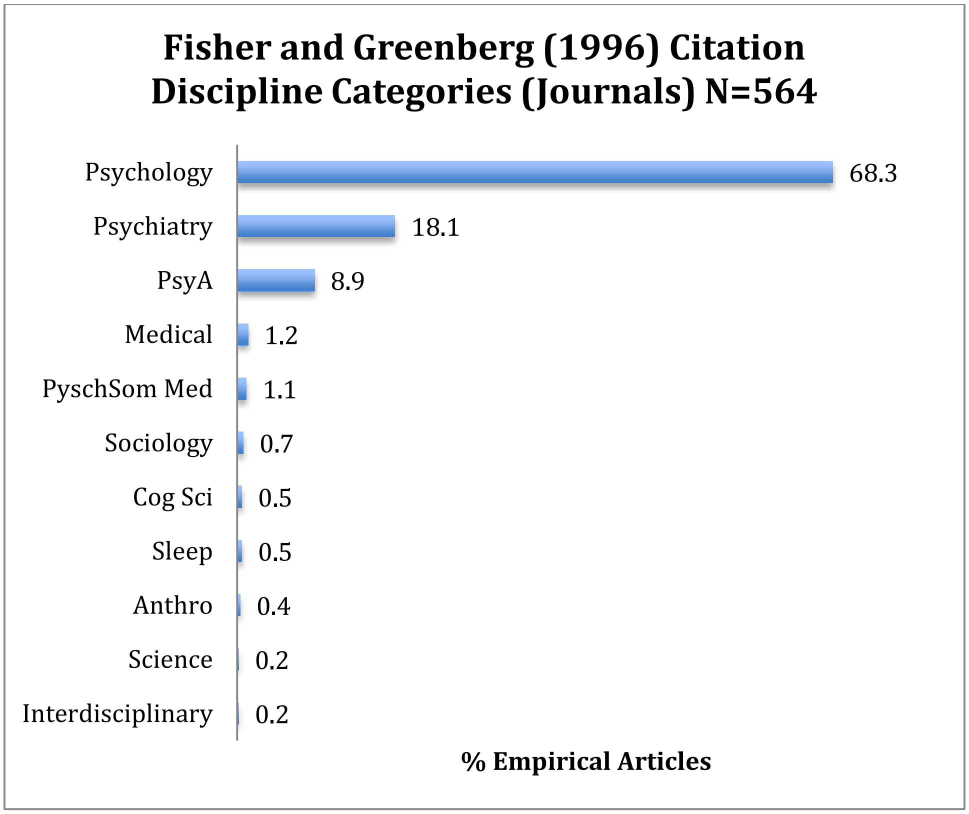


Graph 30. Fisher and Greenberg – Concept Categories



Graph 31. Fisher and Greenberg – Key Concepts

In sum, 68.3 % of the studies had been published in psychology journals, 18.1% were in psychiatry journals, and 8.9% were in psychoanalytic. Most of the articles had been published in the *Journal of Abnormal Psychology* (6.3%), *The Journal of Personality and Social Psychology* (3.9%), and the *Journal of Consulting and Clinical Psychology* (3.7%), see Graph 32.



Graph 32. Fisher and Greenberg – Citation Discipline

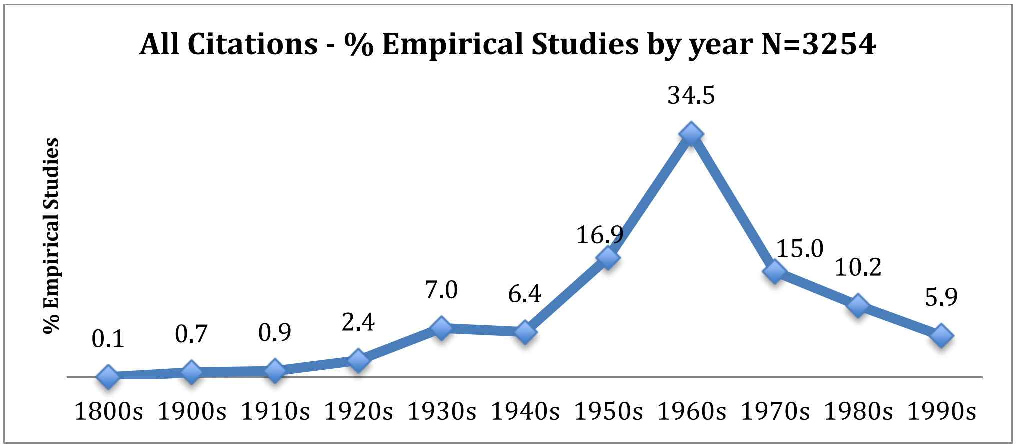
In general, Fisher and Greenberg found limited support for Freud's theory of dreams, in light of recent cognitive processing models, and that psychoanalysis produced no better outcomes than other forms of psychotherapy. However, they found it surprising that there was so much scientific support for Freud's theory of depression (dependency, self-criticism, and object ambivalence), his theory of paranoia, his personality theories (oral and anal), and the Oedipal complex (via subliminal studies).

In comparing their two surveys, Fisher and Greenberg (1977/85; 1996) found that Freud's theories of oral and anal personality types, his paranoia theory of homosexuality, and that some Oedipal concepts, were still generally supported over the twenty-year period. However, in looking at the details of the Oedipal factors, some correlations were supported, while others were not. For example, same-sex identification was linked to Oedipal factors, but psychopathology and sexual difficulties were not. In addition, there was little support for Freud's dream theory (wish fulfillment hypothesis) prior to 1977, and even less support for it by the 1996 review. The same results followed for Freud's psychoanalytic therapy. One area that was supported prior to 1977 was that closeness to one's mother contributed to homosexuality in males. By the 1996 review, research on the correlation of these variables had no empirical support. Fisher and Greenberg also noted that they did not assess some of Freud's most important concepts, for example, his theories of unconscious processing, repression, stage development, infant behavior, motivation, and defense mechanisms.

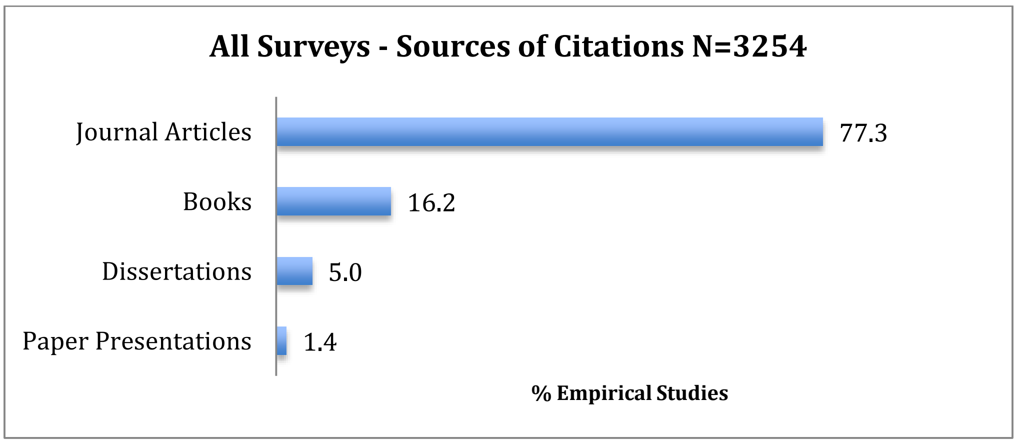
The numerous reviews that appeared between 1942 and 1996 had various goals; some were presented with the intention of proving Freud wrong, some aimed to support Freudian theory, and others had the goal of expanding psychological knowledge, whether or not the studies supported or refuted psychoanalytic theory. Whatever the author's intentions, these reviews were a form of knowledge sharing between psychology and psychoanalysis and, thus, are considered a form of interdisciplinarity.

The Collective: The Seven Surveys Combined

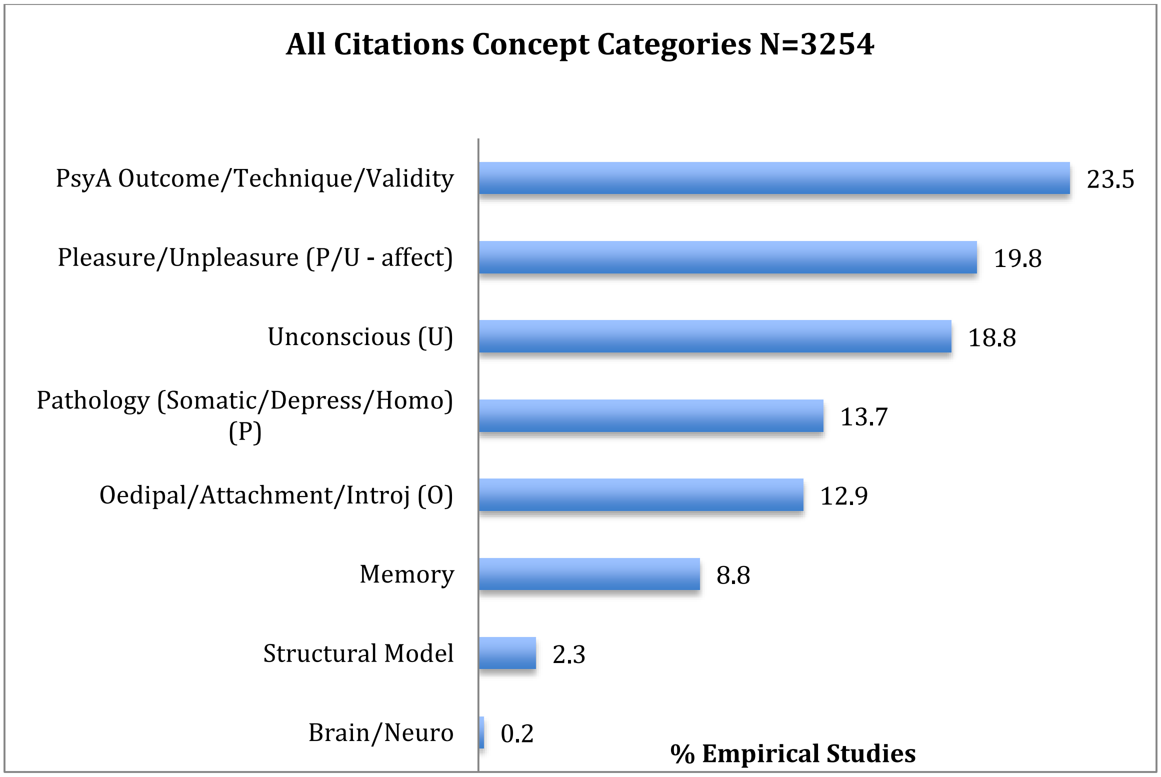
In total, these surveys contained 3254 empirical studies on Freudian concepts and psychoanalysis as a therapy, treatment, and process. The majority of the studies (34.5%) were published in the 1960s and two thirds of the studies were published between the 1960s and 1990s, see Graph 33. 77.3% of these studies were published in academic journals and the rest were in books (16.2%), or were dissertations (16.2%), and paper presentations (1.4%), see Graph 34.



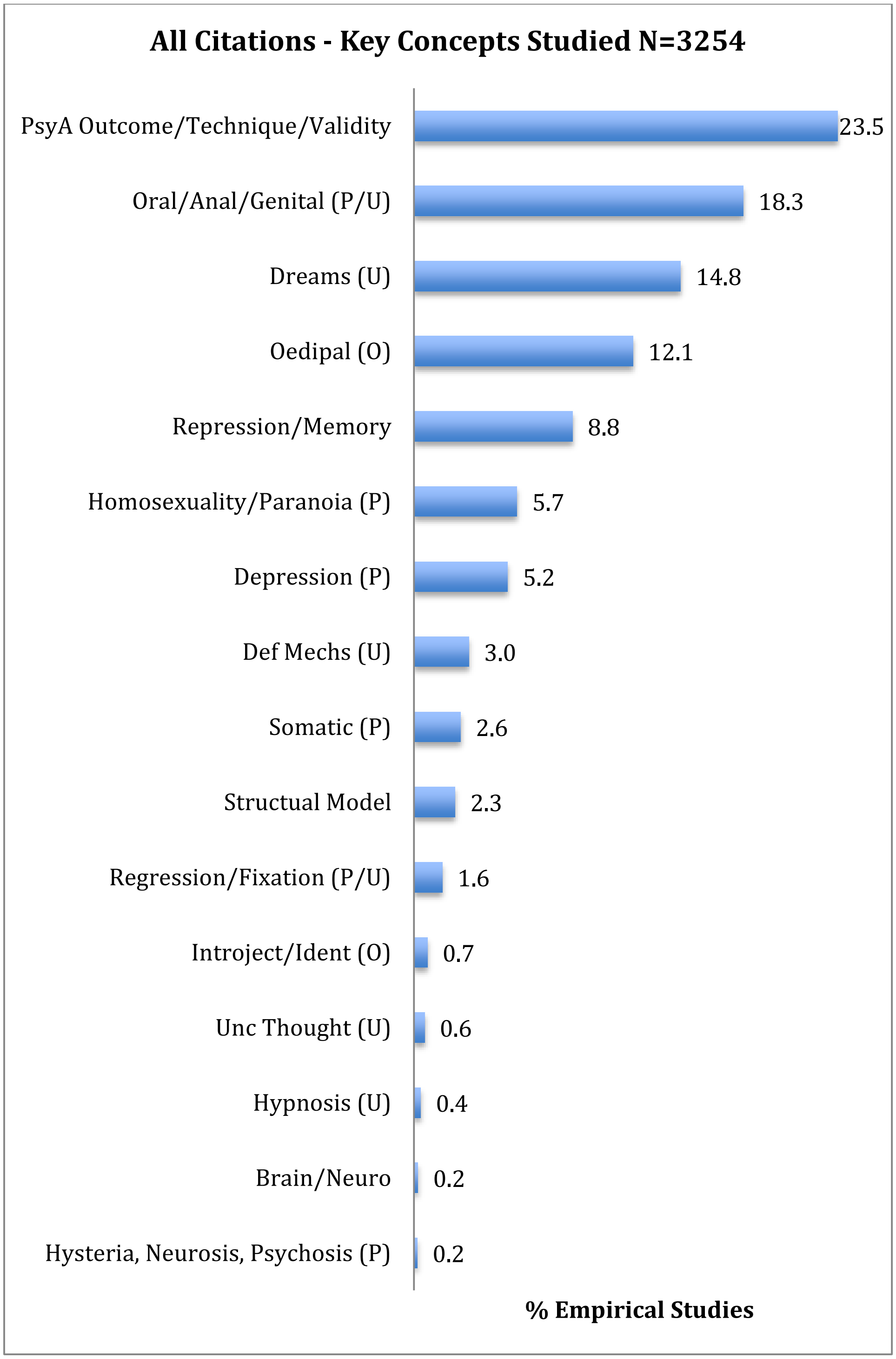
Graph 33. All Citations – Studies by Year.



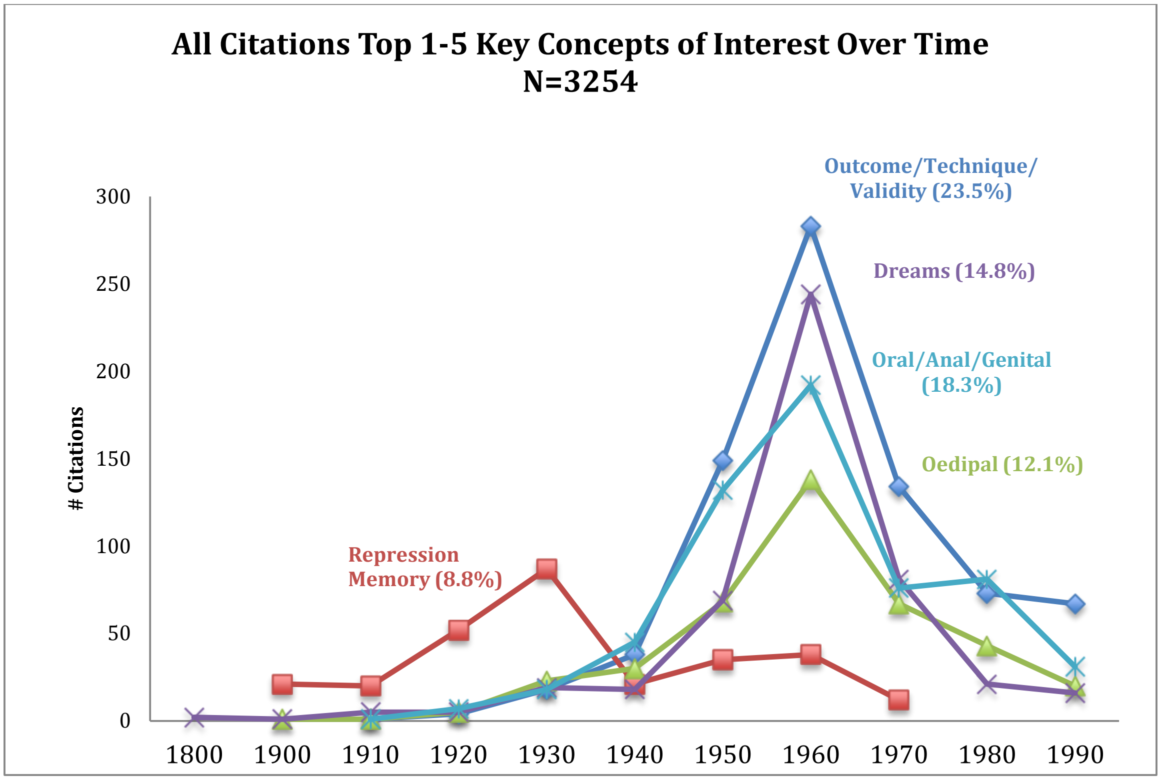
Graph 34. All Citations – Sources of Citations.



Graph 35. All Citations – Concept Categories



Graph 36. All Citations – Key Concepts.



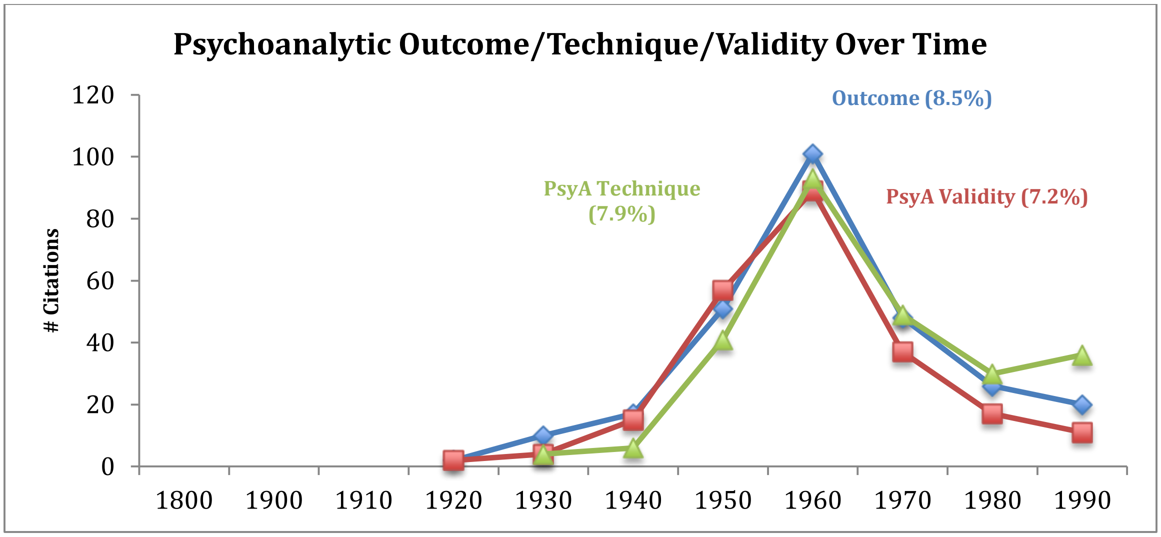
Graph 37. All Citations – Top 1-5 Categories of Interest.

PsyA Outcome/Technique/Validity

Overall the category with most interest within these 3253 citations over time was the Outcome/Technique/Validity of psychoanalysis category and, within this, the concern over efficacy, psychoanalytic technique, and the validity of psychoanalysis (23.5%), See Graphs 35-37. As with the other categories, this one peaked in the 1960s and interest waned following this decade. I borrowed from Fisher and Greenberg (1977/85) when creating this category; they had three chapters on this topic, "Freud's Psychoanalytic Therapy and the Realities of Current Analytic Practices," "The Outcome of Psychoanalytic Treatment," and "The Mechanisms of Psychoanalytic Therapy: The Search for Insight," which I then applied to all the other surveys.

Studies in "Freud's Therapy," as Fisher and Greenberg (1977/85) called them, were really about validity of the field, thus, I re-named this classification "Validity." This grouping (see Graph 38) focused on the day-to-day practice in psychoanalysis and some of the difficulties in defining psychoanalysis as one form of psychotherapy. Patients and analysts were interviewed and surveyed to gain insight into issues such as: the uniformity of analytic practice, the similarity in the types of patients accepted for this type of therapy, levels of agreement on theory, and the uniqueness of the analytic therapeutic relationship. In addition, individual differences in analysts were considered, for example, the years of experience of an analyst, the amount of personal analysis the analyst had undergone, and the type of training the analyst had.

Surveys and questionnaires of clients and therapists were the primary research methods. The outcome studies focused on comparing psychoanalysis to no treatment (spontaneous recovery), and to other types of therapy, particularly behavioral therapy. Surveys and questionnaires were used to assess relapse rates, and various mood and personality scales were also used to test the efficacy of psychoanalysis. Finally, the “Mechanisms” category, created by Fisher and Greenberg (1977/85), was renamed “Technique” for this study. Primarily because it tested the use of psychoanalytic techniques, particularly, free association, transference, the use of interpretations and the couch, and insight as a predictor of outcome. Breaking this category down, there were more studies on efficacy and psychoanalytic outcomes (8.5%) than techniques (7.9%) and validity (7.2%). After the peak of interest in the 1960s, interest in all three of these falls, except for technique, which falls until the 1990s, when there is a slight increase again.



Graph 38. Psychoanalytic Outcome, Technique and Validity over Time.

Pleasure/Unpleasure

The Pleasure/Unpleasure Category (19.8%) was the second highest area of notice and included the Oral/Anal/Genital stages (18.3%), as well as the topic of Regression/Fixation (1.6%). In all of the surveys reviewed (Eysenck & Wilson, 1973; Fisher and Greenberg, 1977/85; Fisher and Greenberg, 1996; Hilgard et al., 1952; Kline, 1972; Rapaport, 1942; Sears, 1943), almost 20% of them tested Freud's stages of psychosexual development, the oral, anal, phallic, and genital stages. For Freud these stages were correlated with psychological development as the child attempts to navigate the pleasures and frustrations that come from being dependent on another for survival (Freud, 1908). Thus, these stages were placed within the global category concept of Pleasure/Unpleasure (see Graphs 35-37).

Freud's assumption was that children needed to successfully pass through each psychosexual stage during their early development. If the stages were not moved through appropriately, a fixation could occur, whereby a child could become stuck in one particular stage, or regress readily back to a specific stage if coping skills were not developed. These coping skills developed as one gained the ability to differentiate fantasy (wishes) from reality, which was linked to one's ability to "master and integrate," for example, oral wishes (Fisher and Greenberg, 1978, p. 77). Moreover, movement through these phases was dependent on a balance of gratification and frustration and set the stage for later personality attributes. For example, a child that had been overly gratified or excessively frustrated during the first year of life, when orality and feeding was the dominant activity, could develop an oral personality or character, which could include excessive smoking, eating, talking, and could also result in specific personality traits. Traits such as jealousy, hostility, and entitlement were linked to being overly gratified at the oral stage, while clinginess, self-doubt, passivity, dependency, taking, getting, receiving, impatience, restlessness, and being close to others to have these dependency needs gratified (Fisher and Greenberg, 1977/85; 1978). These physiological and psychological attributes were seen as a compensatory behavior when oral needs were not met.

In light of Freud's theories, researchers set out to experimentally test orality by using three key methods, 1) they asked parents about their child's early feeding habits/behaviors and correlated this to personality scales, in so doing, they looked at early maternal influence, items such as motherly warmth and attitude toward dependence (breast vs. bottle feeding, rigid vs. demand feeding, gradualness of weaning, age taken off breast feeding), 2) they observed children and then later correlated their behaviors to early feeding disturbances, 3) they used anthropological studies to assess oral socialization and cultural impact on behavior. In addition, studies were done using specific subject pools, such as overeaters (obese subjects), alcoholics, and smokers. Methodologically, Rorschach, Blacky, Thematic Apperception tests, and sentence completion tasks were used to look for "oral" themes, which were then correlated to personality tests. Subjects came from all walks of life; healthy and disordered mothers, children, and college students were used. Large numbers of college students were often used, but case study and longitudinal studies were also done. The majority of these studies were correlational, using survey, scale, and projection tests. Some findings noted that early weaning could be correlated to pessimism, while late weaning was correlated with more optimistic personalities. Orality was often correlated with dependency, to name only a few of the results found in this research.

In addition to orality, anal character traits were also considered as researchers tested Freud's idea that there was an anal trait constellation. Freud argued that the process of toilet training was fodder for conflicts between parents and children; the process could pave the way for a child's personality development (Freud, 1908). With strong parental control over a child's bathroom activities, came a child resistant to the process of "letting go" of his/her bowel contents. The anal personality trait grouping included, obstinacy, criticalness, and aggressiveness (linked to a child's antagonism toward parents during this time), orderliness and cleanliness (linked to the avoidance of making a mess during bathroom times), hoarding tendencies and being parsimonious (connected to one's wish to "hold" on to things and have control) (Fisher and Greenberg, 1977/85). Similar to the orality tests, most of these studies used correlational methods that relied on projective and word association tests, lifestyle questionnaires, and personality inventories. Questions about early toilet training habits were given to parents and issues such as, orderliness, attitude toward money, being or getting dirty, obsessiveness/compulsiveness, bathroom habits, responses to fecal like substances, and anxiety related to anal themes were considered.

As with the other psychosexual stages, the genital and phallic stages are grounded on the desire for pleasure (Freud, 1905; 1908). Following the phallic stage (4 or 5 years of age), the genital stage during puberty is the next stage that focuses on the genitals. These stages were studied by giving questionnaires to college students asking them about their early sexuality, for example, when they first saw the genitals of the opposite sex, when their masturbation behaviors started and what they were like currently, and if they ever had "sex play" with their little friends. Some studies asked parents about their children in terms of voyeurism and exhibitionism, and married couples were also interviewed to discuss their early sexual development in comparison to their marital sex lives. These are only a few examples of the myriad of studies done on this topic. Finally, although small in comparison, the studies on regression and fixation, which assessed Freud's theory that reverting or regressing to pleasurable behaviors was a default defense mechanism in times of conflict or distress, were also considered in the pleasure/unpleasure category.

Dreams

Freud's theory of Dreams (14.8%) took up a considerable amount of research, alongside Somatic Reactions (2.6%), most often conversion or symptom substitution, Unconscious Thought (.6%), and Hypnosis (.4%) to make up the Unconscious Processes Category (18.8%), see Graphs 35-37. Almost 15% of the literature that emerged from these studies focused on the empirical testing Freud's theory of dreams. These studies attempted to explore the link between manifest and latent content in dreams to see if Freud's theories could be supported empirically. Freud argued that dreams had several purposes. First, he believed that the manifest content acted as a meaningless vehicle to disguise a latent unconscious wish that resided in it. In addition, manifest content was deeply connected to memory, either recent (day residue) or infantile. Freud stated, "In general terms, this would imply that every dream was linked in its manifest content with recent experiences and in its latent content with the most ancient experiences" (Freud, 1900, p. 218).

Second, Freud suggested that dreams helped to preserve one's sleep, thus, unconscious wishes had an indirect partial expression via the manifest content thereby preventing the dreamer from waking up. That said, if Freud was correct, why was the same manifest content often repeated over and over in the dreams of someone who had been traumatized? Freud argued that wish fulfilment and the preservation of sleep were not the only purposes for dreaming. He theorized that repetitive traumatic dreams might be one exception to the wish fulfilment hypothesis in that they were an opportunity for the dreamer to master the anxiety linked to the original incident. That is, replaying the trauma over and over was the "compulsion to repeat" and it gave the dreamer a chance to take control or problem solve the situation regarding their trauma; in their dreams they could change the outcome and master their anxiety, something that could not be done when the trauma occurred (Fisher and Greenberg, 1977/85).

However, in general, Freud argued that manifest content in and of itself was really only useful in getting to the latent unconscious infantile wishes; knowledge of the dreamer came from the latent unconscious material. Freud (1900) stated, "It is only necessary to take notice of the fact that my theory is not based on a consideration of the manifest content of dreams but refers to the thoughts which are shown by the work of interpretation to lie behind dreams. We must make a contrast between the manifest and the latent content of dreams " (p. 135). Thus, for Freud, manifest content was always a defensive tactic. In light of Freud's thesis, many psychology studies tested the relationship between the manifest and latent content and argued that the manifest content contained relevant information about the dreamer, it was linked to personality, and current coping skills in life, and was not just a link to the unconscious.

In addition, Freud argued that, from an energy perspective, dreams allowed for the discharge of unconscious wishes. He stated, "Thus there are two possible outcomes for any particular unconscious excitatory process. Either it may be left to itself, in which case it eventually forces its way through at some point and on this single occasion finds discharge for its excitation in movement; or it may come under the influence of the preconscious, and its excitation, instead of being discharged, may be bound by the preconscious. This second alternative is the one which occurs in the process of dreaming" (Freud, 1900, p. 578). Because the body was paralysed during the night there was no motor expression and energy was able to take a regressive pathway, which created a wish fulfilling hallucination. This second alternative is the one that occurs in the process of "venting" during dreaming.

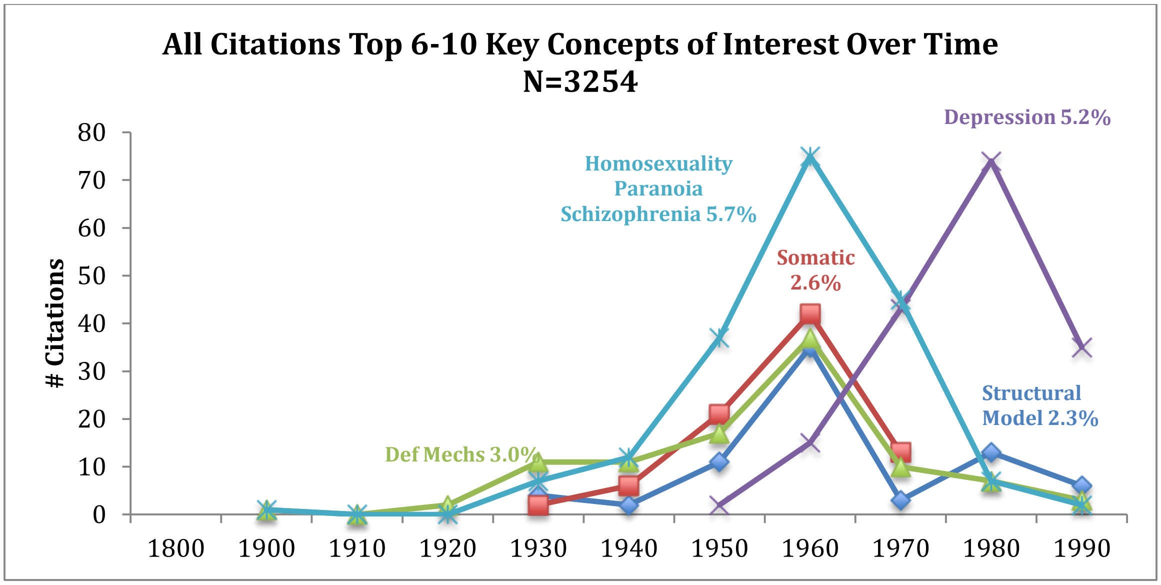
Psychologists were very creative to test this theory and dream research increased significantly between the 1950s and 1960s, after Aserinsky and Kleitman published their 1953 paper on REM sleep. Depriving subjects of REM sleep was a way to stop them from dreaming, thus, if Freud's theory was true, REM deprivation should cause psychopathology or at least mood and personality changes upon awakening. Many researchers found without dreams subjects awoke with anxiety, difficulties concentrating, agitation, increased appetite, confusion, withdrawal and hallucinations after 10 days without REM sleep. Often Rorschach, TAT, and word association test were often used to assess changes before and after REM reduction. This research suggested that Freud's theory might have been correct; when unconscious tensions have no outlet and are allowed to build up in the nervous system, pathology can be the result.

Oedipal Complex

The fourth highest category of interest was Freud's Oedipal stage of development (12.1%), see Graphs 35-37. Freud argued that during the fourth and fifth years of life, children become conflicted about their relationship with their parents. He believed that in the pre-Oedipal phases (ages 1-3) both male and female children were closer to their mother than their father.

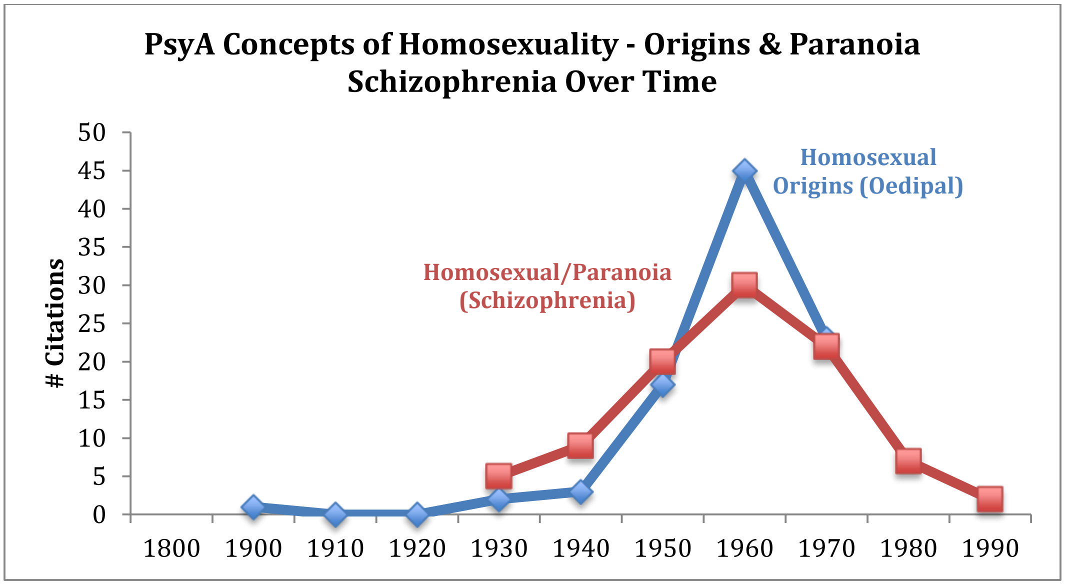
However, after this period there was a strong attraction toward the opposite sex parent and an antagonistic connection with the same-sex parent. Thus, leading to a castration complex and identification with the father in a male child, and a female child's later need for father substitute in her romantic relationships. But, how does one test these theories? Researchers looked at some specific issues to get at the Oedipal complex, for example, they assessed family conflict, sex-role identification, problems with intimacy, and object choice. Many of the studies on the Oedipal concept again used projective tests, questionnaires, and surveys, along with personality inventories. However, many of the studies with children of Oedipal age explored toy preference (boys or girls toys), as well as interviews with these children discussing their "favorite parent" (more positive toward opposite sex parent than same-sex parent). Masculine identification, father absence, and castration anxiety was explored via projective tests, and healthy and "abnormal" subjects (adults and children) were used for these studies. In light of the Oedipal stage being based so highly on parental attachments, this concept was classified under the global concept category of emotion/attachment.

The fifth highest category of attention was the concept of repression. Rapaport's (1942) entire survey focused on studies of repression (N= 172) but this was an important area of study in the other surveys as well, primarily because they attempted to test Freud's idea that emotions could play havoc with memory. Most of the studies attempted to induce negative feelings or thoughts within subjects, either with narratives or electric shock, and then used association tests and word lists to test their memory.



Graph 39. All Citations – Top 6-10 Key Concepts.

Pathology garnered 13.7% interest with Homosexuality (5.7%), Depression (5.2%), and Hysteria/Neurosis/Psychosis (.2%) making up that category. In addition to the general interest in specific concepts, the graph above demonstrates the rise and fall of interest in issues related to psychoanalytic views of psychopathology. Specifically, there is a decreased in the use of the words "neurosis and hysteria" and an increase in the use of "depression" as the 1950s begins. There is also some clarification needed regarding the concept of homosexuality throughout this study and it's link to schizophrenia. Many of the studies evaluated for this research differentiated the "origins of homosexuality" from homosexuality related to paranoia and schizophrenia. Thus, I created two categories (Graph 40) of pathology for homosexuality, "the origins of homosexuality" and homosexuality/paranoia."

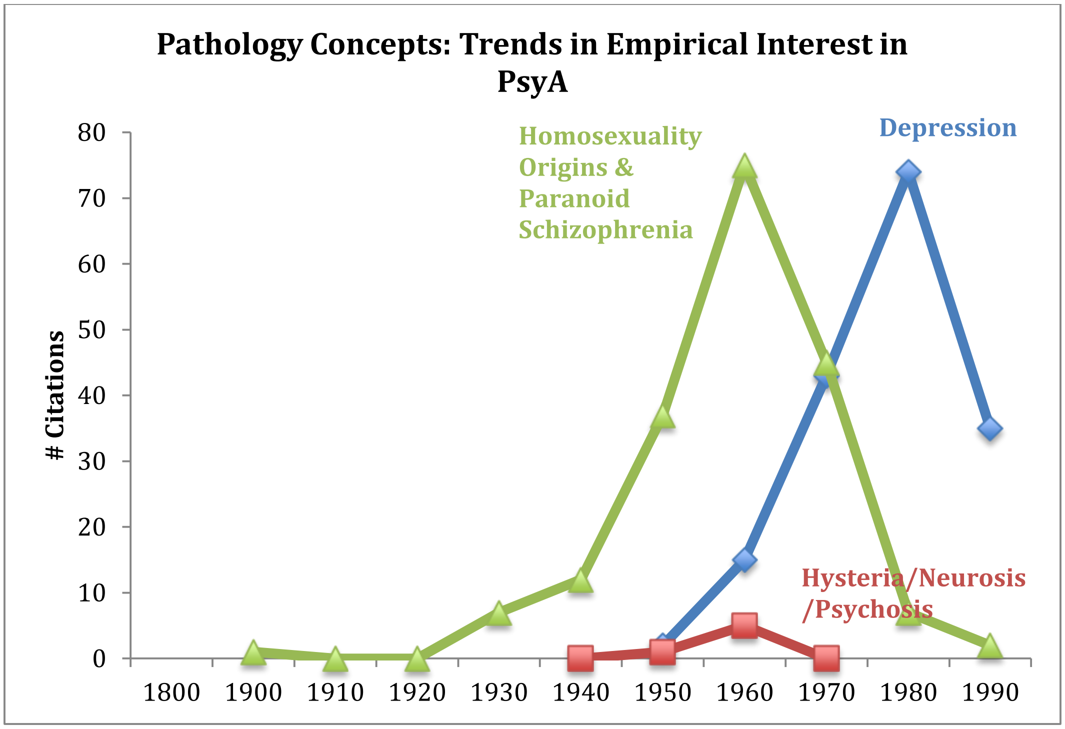


Graph 40. PsyA Concepts of Homosexuality

Freud suggested that homosexuality resulted from difficulties during the Oedipal developmental stage; a homosexual male could not take a female lover because the female genitalia provoked castration anxiety in him. On the other hand, female homosexuals were thought to develop out of a girl's frustration at never being able to take her father as a love object. Most of these studies considered family dynamics in order to study this phenomena and often homosexuals were compared to heterosexual subjects. Questionnaires about parent-child relationships were given (mother-son relationship scale, family triangle scale) as well as tests of castration anxiety. Mothers of homosexuals were often seen as seductive and controlling while fathers were distant, detached, hostile, and unfriendly. In addition, male homosexuals tended to over-identify with their mother and under-identify with their father. Although the origins of homosexuality were correlated with family dynamics, homosexuality was considered a disorder during the time when most of these studies were published. Thus, this concept was classified under the category of pathology, rather than the attachment/emotion category, as the Oedipal concept was studied most often as a form of "normal" development.

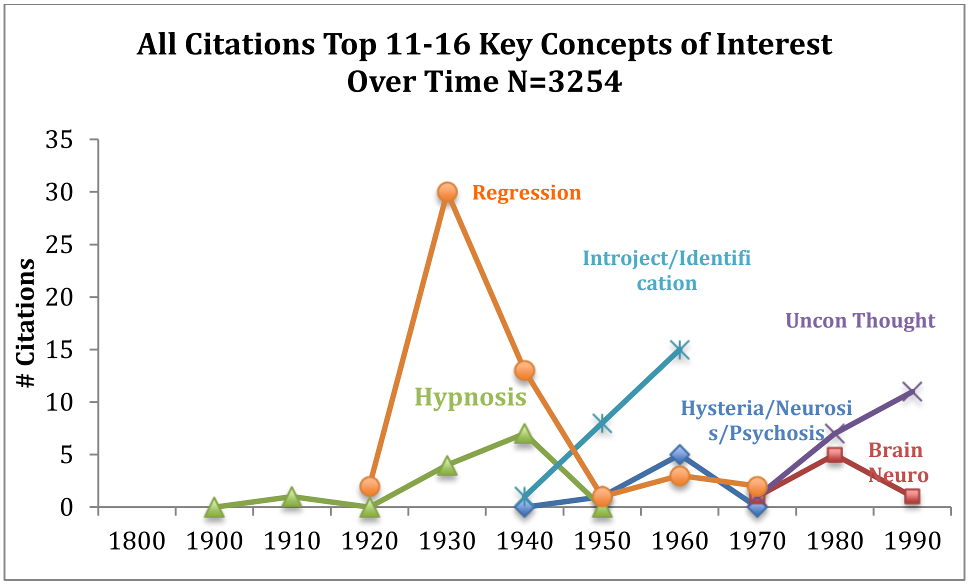
Freud also viewed psychosis as a disorder of the Oedipal phase of development. More often than not, Freud believed that the repression of homosexual wishes led to disorders such as paranoid schizophrenia. Most of the studies in these surveys compared healthy subjects with subjects who had schizophrenia, as well as paranoid schizophrenics with non-paranoid schizophrenics. Accordingly, some of the results are as follows: paranoid males showed more interest in male photographs than female ones, paranoids tended to be more pre-occupied with homosexuality, and paranoids tended to show a preference for more feminine imagery. Again, like the other studies, projective, association, and sentence completion tests were used in conjunction with questionnaires, personality tests, and interviews. This form of homosexuality was also classified within the category of pathology.

In general, from 1900 to 1990 there is a clear increase in interest in homosexuality, as a form of psychopathology, however, there is a definite drop in interest in this concept in the 1960s; the family dynamic etiology of homosexuality appear to lose interest more quickly than that of the paranoid schizophrenia theory. In addition, in the 1950s, the word "depression" appears as a new concept of interested in empirical studies and increases until the 1980s, as interest in homosexuality and hysteria/neurosis/psychosis falls (Graph 41).



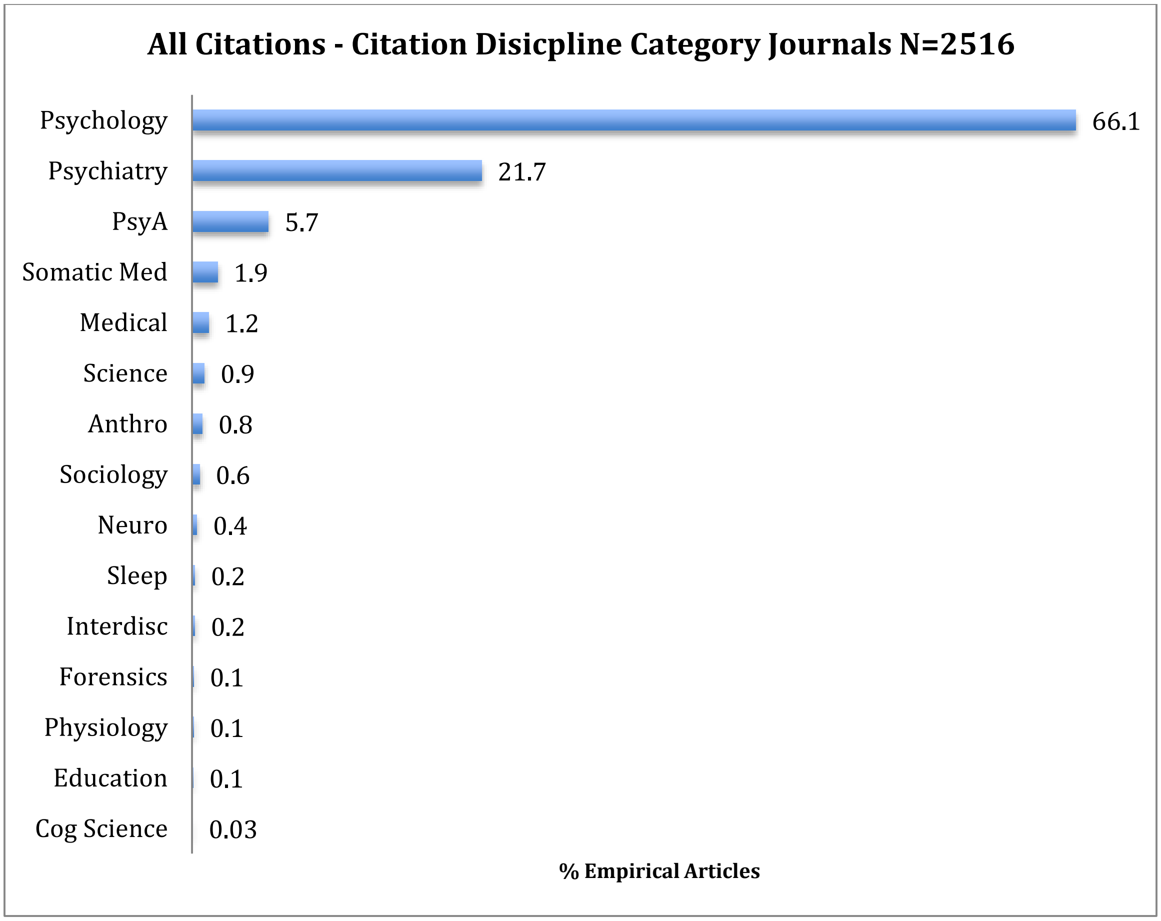
Graph 41. Pathology Concepts.

The concepts of more limited interest (<2%) are demonstrated in the graph below. Some interesting notes include the arrival of the concepts of unconscious thought and the comparisons of Freud's work to neuroscience brain 1970s and 1980s.

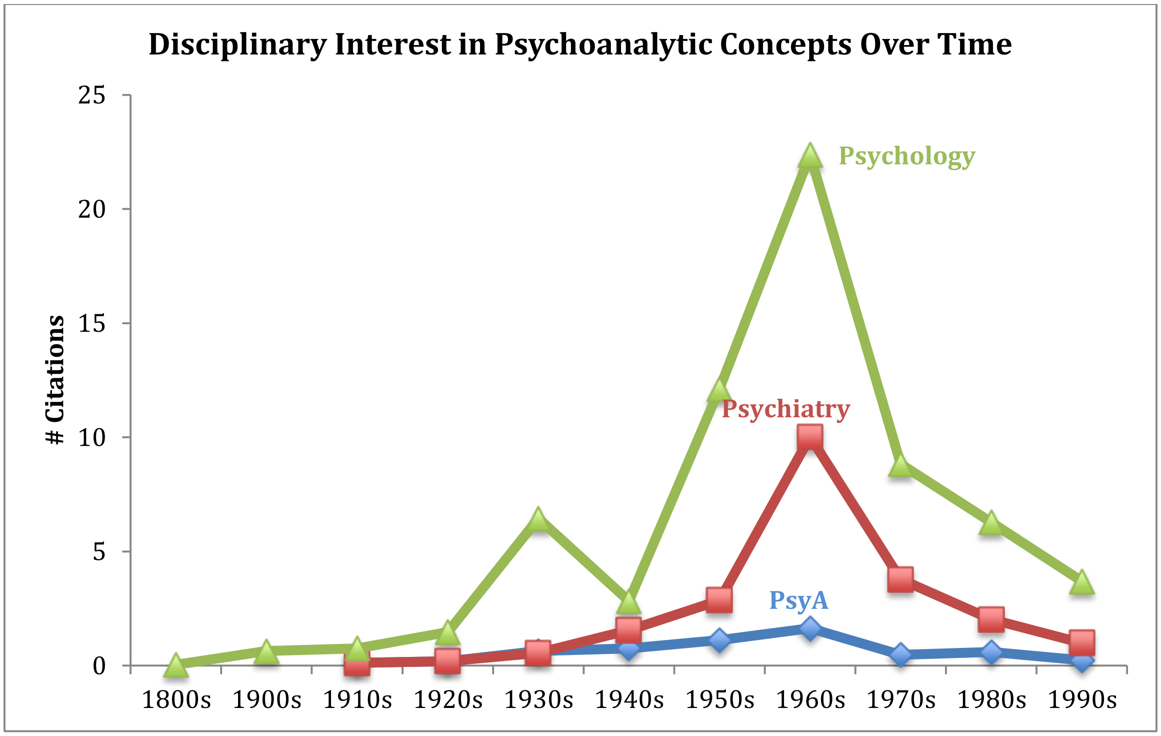


Graph 42. All Citations – Top 11-16 Concepts.

To analyze the disciplinary patterns, only the journal articles were used for this analysis because the books, dissertations, and conference talks were difficult to categorize by discipline. The majority of the studies within this pool of research were published in the discipline of Psychology (66.1%), followed by Psychiatry (21.7%), and Psychoanalysis (5.7%). The chart below shows the trends of interest that these disciplines had in testing psychoanalytic concepts. As extensive literature has noted, psychoanalysis has had little interest in testing its own theories and concepts empirically and the graphs below clearly demonstrates this (Graphs 43 and 44).



Graph 43. All Citations – Disciplines.



Graph 44. All Citations – Disciplinary Interest.

Paradigm Shifts and Borrowed Knowledge

> "Many psychiatrists and psychotherapists warm their pot of soup at our fire (incidentally without being very grateful for our hospitality" (Freud, 1933, p. 8)

In addition to assessing the concepts that psychologists borrowed from psychoanalysis, the analysis of these concepts over time allows us to see the transitional nature of research on these specific psychoanalytic concepts. In general, from 1900-1950 there was an emphasis on research that focused on psychoanalytic efficacy, techniques and validity, and interest in all psychoanalytic concepts climbed from 1900 to the 1960s. Not surprisingly all interest in studying psychoanalytic concepts dropped after the 1960s. That being said, after the 1950s, interest in depression begins and rises for the next 30 years. Further, in the 1970s we see the beginning of interest in Freud's theory of unconscious thought and the testing of his ideas in relation to neuroscience, most likely due to the interest in "implicit" unconscious processes in the areas of cognitive psychology and information processing. Moreover, with the advent of the discovery of neurotransmitters in the 1970s and the creation of new antidepressants, biological psychiatry emerged as a powerful area of interest and research into the neuroscience of unconscious processes and depression.

During the last quarter of the 20th century, however, the most important change was the decrease in the explicit use of psychoanalytic terminology, but an increase in the implicit use of Freudian concepts. In 1996, Fisher and Greenberg noted that there was a changing interest in psychoanalysis since the publication of their 1977 book. They stated, “There has been less research that formally announces it is testing this or that psychoanalytic proposition…for example, cognitive psychologists are increasingly interested in….unconscious decision making…in other words, a good deal of experimental work in progress does not bear a psychoanalytic stamp, but actually falls within the psychoanalytic domain” (p. viii).

Although there are debates regarding whether Kuhnian paradigm shifts have occurred in psychology, there is no debate that behaviorism emerged during the first half of the 20th century, sweeping concepts of the unconscious quickly under the rug. The behaviorism shift, however, did not just affect psychoanalysis; it impacted all areas of psychology, particularly the area of personality theory and research. In the 1920s and 1930s, Freud was expanding his psychoanalytic theory, Allport was defining and systemizing personality, Murray was building a psychoanalytically based theory of needs, and Cattell was looking at personality traits (Winter & Barenbaum, 1999). Theories of motivation for personality were often unconsciously based, however, behaviorism emerged, bringing with it an emphasis on conscious behavior. In addition, “The ‘cognitive revolution’ of the late 1950s and 1960s had major effects on personality [theory and methods]” (Winter and Barenbaum, 1999, p. 16.).

Historically, the relationship between psychology and psychoanalysis appears to have been strained because of their differing views of methodology, experimental and objective versus introspective and subjective, respectively. While psychoanalysis has had surges in popularity, particularly during the 1940s, the marginalization of psychoanalysis within psychology and psychiatry is as much a concern today as it was when Freud first presented his ideas. The gulf between psychology and psychoanalysis became larger as academic psychology became increasingly lab oriented with the rise of behaviorism and the so-called cognitive revolution. These methodological differences have also kept psychoanalysis in its place and left it with a historical reminder of its vulnerability to the objective sciences.

In 1933, in connection to his theory of dreams, Freud argued that "outsiders" had a habit of embracing his theory, but not admitting to it or giving him credit for it. Bornstein (2005) makes a similar argument with Freud's theory of the unconscious, suggesting that it has been revised and reinvented throughout all the revolutions, behaviorism, cognitive, and information processing. Bornstein (2005) has outlined, as Westen (2002) has, that the language of psychoanalytic discourse has impacted research on unconscious processes, as well as other psychoanalytic concepts, as outlined in the table below. Thus, different terminology has been invoked as the paradigms have changed during the last century. The result of a new linguistic discourse is that psychoanalytic concepts have been relabeled in order to be associated more with contemporary information processing or cognitive science terminology and to dissociate itself from the language of psychoanalysis, and thus, psychoanalysis as a discipline. In the table below, Bornstein (2005) argues this point using this chart,

Revisions and Reinventions of Psychoanalytic Concepts

Psychoanalytic concept	Revision or reinvention
Unconscious memory (1900/1953a)	Implicit memory (Schacter, 1987)
Primary process thought (1900/1953a)	Spreading activation (Collins & Loftus, 1975)
Object representation (1905/1953b)	Person schema (Neisser, 1976)
Repression (1910/1957a)	Cognitive avoidance (Beck, 1976)
Preconscious processing (1915/1957b)	Preattentive processing (Treisman, 1969)
Parapraxis (1916/1963)	Retrieval error (Tulving, 1983)
Abreaction (1916/1963)	Redintegration (Bower & Glass, 1976)
Repetition compulsion (1920/1955)	Nuclear script (Tomkins, 1979)
Ego (1923/1961)	Central executive (Baddeley, 1992)
Ego defense (1926/1959)	Defensive attribution (Lerner & Miller, 1978)

The question of paradigm shifts in psychoanalysis has also been considered. For example Schore argues that emotion research is the new paradigm for psychology, psychoanalysis, and the neurosciences (Schore, 2008, personal communication), and in the next chapter, with the analysis of the field of neuropsychoanalysis, this will be confirmed. What is clear, however, is that psychology and psychoanalysis had a strong interest in and connection to each other during the last century. In analyzing the empirical studies on psychoanalytic concepts, and examining the continuities and discontinuities in the psychoanalytic objects of interest in the 20th century, it is clear that the shifting interests in objects of study have been due to both internal disciplinary forces (i.e. lack of empirical support for Freud's theories, paradigm shifts within the field, more focus on clinical techniques and therapy outcomes, and attempts to make psychoanalysis more scientific with empirical methods) and external forces (i.e. knowledge integration of Freud's theories by other fields such as experimental psychology, increased interest and funding for research in cognitive psych and the brain sciences, and advances in the neuroimaging sciences). Nevertheless, this connection and exchange of knowledge between these two fields has been an interdisciplinary one.

Interdisciplinary Framework 4 – Some Bold Attempts to Integrate Psychosomatic Medicine, Neurophysiology, and Cybernetics with Psychoanalytic Theory (1930s-1960s)

Thus far, this chapter has focused on the evidence of knowledge exchange and knowledge borrowing between psychoanalysis and experimental psychology, with psychology doing most of the borrowing. Although we saw an initial acceptance of psychoanalysis by academic psychology in the 1930s, this was followed by a decline in interest later in the century most likely due to psychoanalysis' subjective methodology and refusal to put more emphasis on empirical studies. However, while academic psychologists attempted to discredit psychoanalysis, after the 1930s the medical professions latched on to it and interdisciplinary relationships began between psychoanalysis and neurology, psychiatry, and, psychosomatic medicine.

Psychosomatic Medicine

In the 1930s we see somatic medicine journals beginning to publish studies on psychoanalytic concepts, and this continues into the 1970s. In 1939, psychosomatic medicine became a formal psychiatric specialty, approved by the American Board of Medical Specialties. Historically, however, this line of investigation existed much less formally, dating back to the 17th century philosophers, for example. The 19th century, however, brought with it a strong growth in psychosomatic ideas emerging from America and Europe. For example, in America, Benjamin Rush's 1812 *Medical Inquiries and Observations upon the Diseases of the Mind* was published, making it the first American textbook of mental diseases (Blumenfield & Strain, 2006). In Europe, however, hysteria became one of the most contested diagnoses, with debates about the organic versus mental causes of such physical symptoms. For example, Franz Anton Mesmer (1734 –1815) proposed magnetism or Mesmerism as a cure for mental illness, and in France Jean-Martin Charcot (1825-1893), Pierre Janet (1859-1947), and Hippolyte Bernheim

(1840–1919) were popularizing hypnosis in relation to the hysteria. However, while Mesmer and Charcot were searching for the organic foundations of hysteria, Freud regarded hysteria as a psychological or psychosomatic phenomenon, and “conversion disorder” became his primary diagnosis for these cases. Freud would go on to make psychosomatic illness central to his psychoanalytic theories, which is perhaps why neurology and psychiatry adopted his point of view (Blumenfield & Strain, 2006). But, similar to the functionalist revolt against the structuralism, Woodworth (1931) argued that, “As a movement within psychiatry, psychoanalysis was a revolt against the dominant ‘somatic’ tendency of the nineteenth century, and a springing in to new life of the ‘psychic’ tendency. Just when psychology was becoming more somatic, psychiatry started in earnest to be psychic” (p. 126).

In terms of the relationship between psychoanalysis and other medical specialties, Hale (1971) argued that Freud came to America at a ‘psychological moment,’ at a time when there was a crisis in the treatment of mental disorders (p. 17). More specifically, “In the reception of psychoanalysis, neurology and psychiatry played the most important role. American neurologists and psychiatrists saw an apparent increase in the incidence of nervous and mental disease and a decline in recoveries. A few were increasingly disillusioned with the accepted somatic style of etiology and treatment” (Hale, 1971, p. 17). The medical model of nervous and mental disorders was a tradition that Freud and all neurologists in Europe and America had been educated in, however, when hysterics presented to neurologists with no organic etiology, somatic medicine emerged. The term “somatic style” was incorporated into psychiatry and neurology to account for the non-scientific treatments that were used on these patients. These treatments included hypnotism, hydrotherapy, dietary changes, massage, and rest, where self-control and insight into one’s moral failures could be examined. According to Hale (1971), by the time

Freud came to America, neurology has split into two camps, one that focused on the somatic style of treatment and another that began looking at psychotherapy as a cure. More importantly, five years after Freud's trip to America, WW I began taking a toll on American soldiers and this event catapulted Freud's talk therapy into dominance as a treatment for shell shock.

As noted by Hale (1995), Freud's influence on psychosomatic medicine and psychiatry was in part due to his 1909 trip to America and the "human laboratory of war" that emerged after WW I (p. 8). The World Wars brought to light many case examples of war neurosis, a disorder similar to hysteria and regular neurosis. Soldiers returned from war with nightmares, forcing psychiatrists to contemplate the importance of dreams and the conflicts soldiers felt in having killed other human begins. Alongside this, they also considered Freud's concepts of repressed memories, dissociation, defense mechanisms, the effects of trauma, and conversion (the idea that emotions could be converted into physical symptoms). Moreover, having no other medical treatments, they were obligated to consider the idea of catharsis and talk therapy, which brought relief to thousands of soldiers (Hale, 1995).

The war brought America and Europe a new form of psychiatry. Hale (1995) stated, "The war brought psychiatrists an exhilarating sense of hope and the promise of an expanded social role; the war had given psychiatry a "large body of exact knowledge" and placed a hopeful psychotherapy at the disposal of the physician (p. 22). More specifically geared toward the United states, Hale (1995) continued, "The new American psychiatry, an eclectic mix of Adolf Meyer's psychobiology and the various psychoanalytic schools, found a powerful auxiliary force among psychiatric social workers, for whom new important training institutions were established as a result of the war" (p. 23). The war called for the creation of more clinicians to be trained in psychoanalysis and, between 1917 and 1940, there was an increasing demand rising demand for psychiatric services. Consequently, this called for hospitals and clinics to establish training programs and, more significantly, psychoanalytic training became part of the medical school curriculum. The acceptance of psychoanalysis by the medical community was by far one of the largest turning points for broadening the use of Freud's theories and techniques (Hale, 1995). Thus, Freud brought to America, and somatic medicine, psychiatry, and neurology, a new tool with which to treat mental diseases, and he did so at a time when it seemed to be needed. However, this trend toward psychoanalysis was not limited to America. Makari (2008) stated, "As the need for training grew after WW I, Freud's papers on technique would become central pedagogical tools…The Great War created conditions for cultural realignment that helped the Freudians in Vienna grow" (p. 337).

In considering why psychoanalysis became so accepted after the war, Makari (2008) argued that the strength of Freudian theory was "its stunning interdisciplinary synthesis" (p. 296). This statement should be of no surprise; Freud's initial use of psychobiology and neuroscience to explain the mind in *Project for a Scientific Psychology* became the foundation of all his later psychoanalytic theories (Fancher, 1973). That said, Freud's attempt to integrate neuroscience and psychoanalysis was short-lived when, a few months after he wrote the *Project* he put it aside. From then on, Freud and the field of psychoanalysis would "…remain on psychological ground" (1900, p. 536).[27] In general, it is fair to say that for about fifty years following Freud's development of the field, psychoanalysis had not been keenly interested in neurological or physiological explanations of the mind. However, according to Kandel (2006), in the 1950s "the study of brain science was not an important discipline at many medical schools in the United States…" (p. 47). So it is not surprising that most psychoanalysts, who had trained in medicine, focused on the psychological. Kandel (2006) elaborated, "Although most psychoanalysts in the 1950s thought of the mind in nonbiological terms, a few had begun to discuss the biology of the brain and its potential importance to psychoanalysis" (p. 46). This trend however, appears to have begun in the1930s, when a small number of psychoanalysts in New York began exploring the important connection between psychoanalysis, psychosomatic medicine, and neuroscience.

New York Psychoanalytic Society

In 1911, Abraham Brill (1874-1948) founded the New York Psychoanalytic Society, and in 1931 The New York Psychoanalytic Training Institute, the first psychoanalytic training centre in the United States, was established. Brill, who had studied under Jung and translated many of Freud's works, had the aim of advancing psychoanalytic theory and practice on American soil. The New York Psychoanalytic Society became the home to many important psychoanalysts, such as, Kurt Eissler, Heinz Hartmann, Ernst Kris, Rudolph Loewenstein, Charles Brenner, Margaret Mahler, Mortimer Ostow, Sidney Margolin, Lawrence Kubie, Sándor Radó, and many others (NYPS website).

More directly relevant to the issue of interdisciplinarity, many at the New York Society were interested in making psychoanalysis more scientific, considered empirical research methods for the field, and were anxious to integrate psychoanalysis with other areas in the social and natural sciences. For example, Ernst Kris (1900-1957) promoted empirical research among psychoanalysts, particularly in the area of child psychology (Kandel, 2006). Abram Kardiner (1891-1981), who studied under Freud, integrated anthropology and psychoanalysis, while Sándor Radó (1890-1972) was interested in Walter Canon's (1871-1945) physiology of emotion and the relationship between fight or flight reactions and ego defences against anxiety. Finally, Lawrence Kubie (1896-1973) integrated Pavlov's work with psychoanalysis (Makari, 2008). Of these, Kubie and Radó were the most vocal about psychoanalysis becoming more of a natural science and as leaders in the New York Society and Institute this philosophy resonated throughout the curriculum and in members' publications. However, Kubie and Ostow emerged as the most prolific interdisciplinary theorists and empirical researchers.

Lawrence Kubie (1896-1973)

When one thinks of key figures in the history of psychoanalysis, Lawrence Kubie may not be a name that quickly comes to mind. Although he was president of the American Psychoanalytic Association for a number of years, his name does not reside on the "Noted Psychoanalyst's" biography page of the association's website. Those who are aware of him, however, know of his association with the New York Psychoanalytic Society and two of his key works, *Theoretical Aspects of Psychoanalysis* (1950) and *Neurotic Distortion of the Creative Process* (1958). He is also often remembered as Tennessee Williams's analyst. A lesser-known fact is that Kubie is that although he was a psychiatrist and psychoanalyst, he was also a neurophysiologist and studied under Sherrington for a short time. Because Kubie's foundations were very interdisciplinary, he published hundreds of articles that integrated psychoanalysis with neurophysiology, pharmacology, and psychosomatic medicine. Roazen stated (2000), "Kubie, although one of psychoanalysis's distinguished thinkers, has also fallen into a kind of limbo…however, Kubie was notable for having proposed the creation of a wholly new profession of medical psychology that would embrace the humanities as well as the sciences, so that the development of psychoanalysis would not be cut off from either its humanistic or scientific roots" (p. 162).

Kubie's publication list shows clearly that he had one foot in psychoanalysis and the other in neurophysiology; accordingly, he acted as a bridge that linked psychoanalysis, neuroscience, and cybernetics. From 1930 to the 1960s Kubie wrote extensively in the areas of neurophysiology, psychoanalysis, and pharmacology and was an advocate for research in psychiatry and psychoanalysis (1931, 1935, 1941a, 1941b, 1944, 1953, 1958, 1960). And in an important paper written in 1930, Kubie's research intersected with the field of cybernetics.

Kubie on reverberating circuits. In 1930 Lawrence Kubie wrote "A Theoretical Application to some Neurological Problems of the Properties of Excitation Waves which Move in Closed Circuits" (Kubie, 1930). Here, he posited that neural networks contained open and closed systems and had the ability to be self-organizing and thus, were nonlinear. Accordingly, he theorized that these networks were characteristically sensitive to initial conditions when he suggested that "spontaneous neurological phenomena" existed and that in the central nervous system, "under certain conditions and in certain areas, excitation waves move along pathways which ultimately return them to their starting points…a circular wave would constitute a source of energy, which…give little or no outward signs of its existence, but which, with a slight change in conditions might suddenly become manifest" (p. 167).

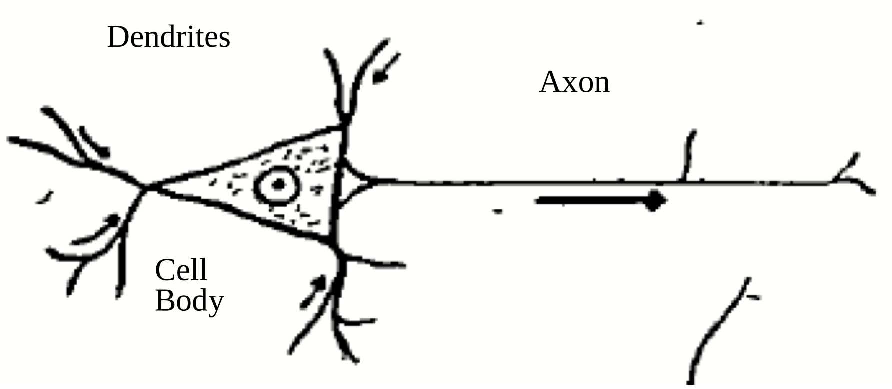


Figure 8. “Accepted picture of conduction of the nervous impulse through the dendrites cell body, and axone” (Kubie, 1930, p. 174).

To clarify, Kubie (1930, p. 174) included diagrams to elucidate his theories. In the figure above, he depicted the normal process of energy movement within the neuron, whereby incoming excitation enters the various dendrites before moving into the cell body and then exiting the neuron via the axon. In the two diagrams below, Kubie is demonstrating the behavior of a group of connected neurons - “normal” (Fig. 9) and “abnormal” circuits (Fig. 10). In the “normal” system there was a possibility that pathology could occur, but most often energy was contained within the circuit. A slight change in conditions could alter this system to begin to look more like the abnormal system portrayed in figure 10.

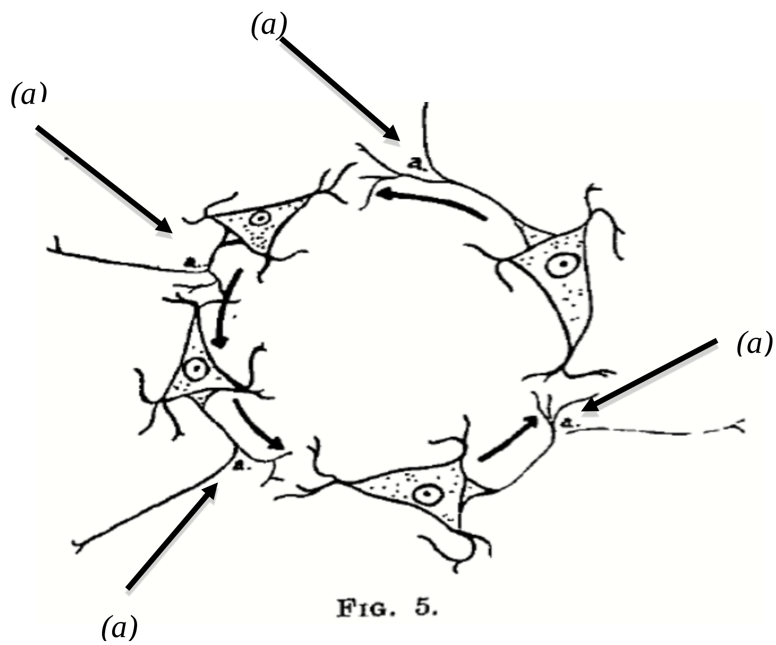


Figure 9. “Diagram of an excitation wave circling through a group of neurones, and following the accepted ideas of conduction through polarized neurones and synapses, i.e., from axone to dendrites or cell body (as in fig. 4). Such a system would affect other regions of the CNS only through the impulses which escaped from the closed circuit along the branching axones (a)” (Kubie, 1930, p. 174).

These “changes” to the system could be correlated with the velocity and initial intensity of the wave of energy, the conductivity of the tissues, and the number of cells within the circuit and/or the duration of the stimuli. In the “abnormal” circuit, the pathology was already present.

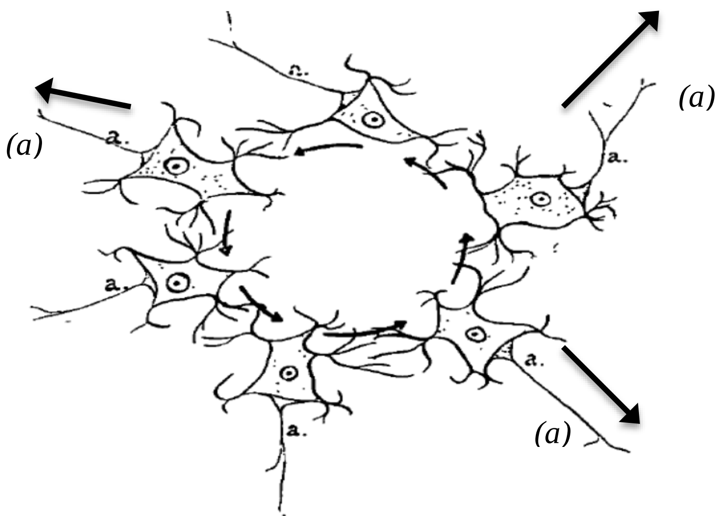


FIG. 6.

Figure 10. “An excitation wave circling though a group of neurones according to a less orthodox pattern of conduction than in fig. 5. Here the wave passes from neurone to neurone along their dendrites, while the axons (a) lead out of the circuit and respond to the circling wave of excitation when they are not in a refractory phase. It is less likely that this is a normal form of circuit than that pictured in Figure. 5” (Kubie, 1930, p. 174).

Kubie (1930) also theorized that these circular networks played a role in memory, memory disorders, and he believed these networks could explain Freud’s theory of repetition compulsion; Kubie referred to repetition compulsion as the “repetitive core of psychoneurosis” in two later works (1941, 1953). Moreover, Charles Sherrington, whom Kubie worked under while on a neuropathology fellowship in London from 1928-1930, supported his neural network theories and advised that his article on circular networks (1930) be published (McCulloch, 1969). In addition, Kubie’s theory of reverberating circuits of neurons was experimentally confirmed by neurobiologist Lorente de No (1902-1990) in 1933 (Boden, 2006; Dupuy, 2000; Heims, 1991).

This neural network theory by Kubie not only caught the eye of Sherrington, it also strongly influenced Warren McCulloch.

Warren McCulloch (1898-1969)

According to Heims (1991), in 1917 Warren McCulloch followed his family's aspirations when he entered the Haverford Quaker College thinking he would go into theology and the ministry, however, his interests turned to philosophy and mathematics and he transferred to Yale to earn a BA in psychology and philosophy (Abraham, 2002). McCulloch went on to Columbia to earn a Master's in psychology in 1923, and a medical degree in 1927, where he interned in neurology (Heims, 1991). In 1932, he began training in psychiatry and, although McCulloch's foundational training focused on psychoanalytic and behavioristic views of pathology, his primary concern was experimental research that focused on functional processes within the brain (Heims, 1991). During the 1930s, McCulloch began collaborating with neurophysiologist J. G. Dusser de Barenne at the Yale University laboratory, where they stimulated the cortices of cats and "broadly speaking, their work focused on the influence of one cortical area upon another, and the interaction between different areas of the cerebral cortex; that is, on cortico-cortical connections as was well as straightforward localization" (Abraham, 2002, p. 9).

However, it is McCulloch's later collaboration with the young mathematician Walter Pitts (1923-1969) that allowed him to make a name for himself as a neural network theorist and a key contributor to the creation of the cybernetic school; Pitts expanded on McCulloch's idea that the all or none firing of neurons could be explained via mathematics. Gefter (2015) argues that McCulloch "knew that each of the brain's nerve cells only fires after a minimum threshold has been reached: Enough of its neighboring nerve cells must send signals across the neuron's synapses before it will fire off its own electrical spike" (cited in Stewart and Folger, 2016, p. 55).

Based on the work of Claude Shannon, “it occurred to McCulloch that neurons were also set-up as interconnected binary systems of on or off switches—either the neuron fired or it did not. A neuron’s signal, he realized, is a proposition, and neurons seemed to work like logic gates, taking in multiple inputs and producing a single output. By varying a neuron’s firing threshold, it could be made to perform “and,” “or,” and “not” functions” (Gefter, 2015, para. 7). In 1941, at the time that Pitts and McCulloch began their collaboration, McCulloch had left Yale and moved to Chicago to become the head of research at the Illinois Neuropsychiatric Institute. Two years later Pitts and McCulloch published their seminal work “A Logical Calculus of the Ideas Immanent in Nervous Activity” (1943), which described one of the first hypothetical neural networks that applied “logical calculus to a living system” (Abraham, 2000, p. 41). “Historians and scientists alike often refer to the McCulloch–Pitts paper as a landmark event in the history of cybernetics, and fundamental to the development of cognitive science and artificial intelligence” (Abraham, 2002, p. 3). McCulloch’s strong desire to integrate two disparate fields to better understand psychological functioning led him to play a key role in the development of the Cybernetic School and found the Conferences on Cybernetics.

The Macy Conferences on Cybernetics

In 1930 Kate Macy Ladd created the Josiah Macy Jr. Foundation and “devoted it to the fundamental aspects of health, sickness, and of methods for the relief of suffering, with particular preferences to integrating functions in the medical sciences and medical education…[with the] mission of challenging, reforming, and renewing society” (Tudico, 2012, pp. 5-6). Until 1945, the Macy Foundation granted monies for research in the areas of mental illness due to war and trauma, human development, aging/geriatrics, and psychosomatic medicine, and “the Foundation’s extensive conference and publication program was also started during this period”

(Tudico, 2012, p. 9). For example, in the mid-1930s the foundation funded conferences on the "Problems of Neurotic Behavior" in New York City, and invitees included psychoanalysts, psychologists, as well as those from the medical profession who focused on internal medicine, physiology, and somatic medicine. This conference paved the way for the publication of the journal *Psychosomatic Medicine* in 1939, which included many articles written by psychologists. (Pickren and Rutherford, 2010, p.112).

In addition to the conferences on neurotic behavior, Macy also sponsored the "Conference on Feedback Mechanisms and Circular Causal Systems in Biology and the Social Sciences." In total, there were ten conferences, which ran every six months from 1946-1953 and had the goal of bringing together scientists from biology, psychology, psychiatry, anthropology, mathematics, engineering, and philosophy to share their ideas. Seen as an aftermath of the war effort that brought together the social, computer, and engineering sciences, the Macy Conferences allowed like-minded researchers, interested in understanding the human mind and body as a homeostatic biological system that functioned like a computer operating system, to come together. "The postwar meetings aimed to break down disciplinary barriers in the sciences. Mathematicians, engineers, biologists, social scientists, and humanists debated how the wartime theories of communications and control engineering applied to both humans and machines" (Kline, 2015, p. 1). These conferences, and the publications by some of its members, played a key role in creating the field of Cybernetics. For example, Norbert Wiener, an MIT mathematician, entitled his book on the subject, *Cybernetics: Or Control and Communication in the Animal and the Machine* (1948); Wiener coined the term *Cybernetics* with the publication of this book (Gefter, 2015). Wiener's contribution, along with Claude Shannon's, "A Mathematical Theory of Communication" (1948), Allen Turing's "Computer Machinery and Intelligence"

(1950), John von Neumann's work on self-reproducing automata, McCulloch and Pitt's (1943) "A Logical Calculus of the Ideas Immanent in Nervous Activity," and Lawrence Kubie's 1931 paper on reverberating circuits.

However, interdisciplinarity is never easy, there was often discord between those in the "hard sciences" questioning the social sciences use of their methods while the social scientists were concerned about reductionism and the ability of mathematics to reliably describe mental processes. Furthermore, the debate around the similarity between computers and the human brain often arose. Dupuy (2000) suggested that some people might have argued that the Macy conferences were "awash in ideology" and perhaps not as productive as the group had hoped for. "In fact, the main part of the discussions bore on specialized subjects involving neurophysiology and experimental psychology" (p. 88). Throughout the years, the Cybernetic group theorized about consciousness and discussions of unconscious processes came up effectively at every conference, primarily because of Kubie. Nonetheless, many from the hard sciences had a difficult time swallowing the idea that mental events could occur without registering in consciousness; Dupuy (2000) stated they believed, "…either a mental even occurs or it does not; either a train of nerve impulses is registered or it is not. To say that one has been registered, only "unconsciously," is nonsense" (p. 85). However, "In working through these difficulties of speaking across disciplines, by focusing on the communication rather than the research collaboration aspect of interdisciplinarity, the Macy conferences became a crucial site for the development and spread of cybernetics and information theory into the social sciences and biology. They provided an interdisciplinary space for prominent scholars from a range of disciplines to meet regularly over an extended period of time" (Kline, 2015, p. 38).

Moreover, while many doubted the idea of the Freudian unconscious, physicist, Norbert Wiener "liked to formulate psychology in terms of cybernetic concepts, but he was open to the evidence of gestalt psychology as well as to Freudian psychoanalysis" (Heims, 1991, p. 12). Lawrence Kubie was the lone psychoanalyst at these conferences; he was a core member of the group and presented regularly on psychoanalysis, reverberating neural networks, and other physiological aspects of psychoanalysis. Although Kubie was often seen as a square peg in a round hole within the group, in terms of his Freudian ideology, he was always respected for his attempts to marry psychoanalysis and cybernetics and he was highly influential for Warren McCulloch.

During his Macy years, McCulloch, in his paper on "Physiological Processes Underlying Neuroses" (1949), noted the influence the psychoanalyst Kubie had on him, stating, "In common with other psycho-analysts, Kubie makes a sharp distinction between [conscious and unconscious] processes…In the latter he puts the core of the neurosis…the memories and learned reactions sub-served by circuits connected with the regenerative circuit can no longer be evoked…because all the stimuli which once evoked them, [are now] feeding secondarily into the regenerative circuit which displaces all the others" (p. 75). Later, in 1969 McCulloch stated, "to me Kubie's article (1930) was the beginning of my attempt to handle information flowing in closed loops" (p. 55). McCulloch, however, also influenced Kubie; Kubie referenced McCulloch in "Some Implications for Psychoanalysis of Modern Concepts of the Organization of the Brain" (1953), theorizing that his version of reverberating feedback circuits might also be able to explain neurotic symptoms and pathological affect. Kubie argued that McCulloch's cybernetic network theories "…suggests the possibility that there may be a neurophysiological mechanism for both normal and pathological repetitive phenomena, and that this mechanism may consist in part of reverberating circuits along which nervous impulses not only can re-excite themselves, but in so doing may also isolate themselves in varying degrees from external influences" (1953, p. 22).

So in Kubie we see one of the earliest integrations of psychoanalysis and neuroscience and the first connections between psychoanalysis and the Cybernetic school. However, while Kubie and McCulloch shared knowledge between their disciplines, Kubie's cybernetic research was theoretical in nature. It was not until his work with Wilder Penfield (1891-1976) that he did a neuroscientific empirical study of unconscious processes.

Lawrence Kubie and Wilder Penfield

After Kubie's Macy period, he continued to be a psychoanalyst and physiological researcher. Having written on reverberating circuits and memory (1930, 1941, 1953), Kubie became very interested in the work of Wilder Penfield (1891-1976), in particular, Penfield's research on memory; Kubie stated, "the work fascinated me for many reasons, but especially because of its implications for psychoanalysis" (Kubie, 1953, p. 21).

In the 1920s and 1930s, Penfield's epileptic seizure localization surgeries changed the face of neurosurgery, however after 1935 his focus moved to mapping the sensory and motor cortices. This mapping allowed Penfield to prove that the sensory-motor cortices were not as distinct as previously thought; he found that 25% of the sensory responses occurred in the motor cortex and the motor cortex could elicit 20% of the sensations (Guenther, 2015). Important in Penfield's methodology was the patient's ability to report the motor and sensory responses as the brain was stimulated. He found that motor movement accounts were more reliable if someone watching the patient observed the movement; conversely, the patient more accurately reported sensations.

One caveat, however, was that the patient had to have the ability to be introspective enough to report the sensations accurately, and Penfield noted that his relationship and rapport with the client before the surgery allowed them to be more open and able to report in depth descriptions of the felt sensations. During these surgeries Penfield noted that the subjects often reported sensations, as expected, but they also reported memories (Guenther, 2015). It is Penfield's interest in the patient-doctor relationship, the patient's self-awareness, their ability to provide in-depth insightful descriptions, and the reviving of long lost memories that caught Kubie's psychoanalytic interest.

After reading Penfield's research, Kubie travelled to Montreal to observe the neurosurgeon at work. Although Penfield was a brain surgeon, the concept of unconscious memory acted as a bridge that brought psychoanalysis and neuroscience together for a short time. Upon his arrival at the Montreal Neurological Institute, Kubie first observed Penfield's surgeries, but later was allowed directly into the operating room. With dictaphone in hand, Kubie recorded the memories of the patients on the table and Penfield also allowed him to do his own association experiments, recording the flow of patient thoughts as Penfield stimulated specific brain regions. Kubie's 1953 paper, "Some Implications for Psychoanalysis of Modern Concepts of the Organization of the Brain" was based on the research he did at Penfield's Montreal lab.

At a time when psychoanalysis was criticized for a lack of scientific credibility, a respected neurosurgeon had joined forces with a psychoanalyst to explore unconscious processes and together, they wrote "Memory Mechanisms" (1951), which was published in the *American Medical Association's Archives of Neurological Psychiatry*. In this paper Penfield explained his findings and Kubie contributed a discussion. Penfield (1951) found that "evoked memories," due to surgical stimulation, differed from memories recalled under nonsurgical circumstances. Evoked memories were more vivid and detailed and felt more real to the patient, as if it were really happening. Penfield (1951) stated, “It would appear that the memory record continues intact even after the subject’s ability to recall it disappears…when it is thus forced into the patient’s consciousness, it seems to him to be a present experience” (p. 184). “… It is tempting to believe that synaptic facilitation is established by the original experience which guides the succession of impulses, later employed to activate the pattern through one connection after another, thus producing recollection” (pp. 186).

In the discussion, Kubie (1951) agreed with Penfield’s findings and stated, “From all of this work we learn that at least in certain epileptic subjects the electrical stimulation of the temporal cortex can produce the equivalent of hypnotically induced regressions into the past, with a reliving of the past as though it were in the present…or a Freud put it, in the unconscious there is no such thing as time and space” (p. 192).

Kubie (1951) saw the potential of the research to play a role in psychotherapy; he stated, “Finally what is evoked is a specific reliving of a specific experience, and not a diffuse “memory” of nonspecific generalizations from many past experiences. In short, the electrical stimulation of these areas of temporal cortex can evoke in a few moments precisely that type of re-experiencing of the past which the analyst has to struggle for days and weeks and months and years to achieve” (p. 193). Kubie’s work with Penfield gave him hope for future research between psychoanalysis and neuroscience, Kubie (1951) noted, “I can sense the shades of Harvey Cushing[28] and Sigmund Freud shaking hands over this long-deferred meeting between psychoanalysis and modern neurology and neurosurgery through the experimental work Dr.

[28] Harvey Cushing (1869-1937) was an American neurosurgeon at Yale and is known as the Father of modern neurosurgery for creating instruments and surgical techniques.

Penfield has reported” (p. 191).

Further, Kubie suggested five directions for the future integration of the two fields. First, he thought that a detailed examination of patients’ free associations and dreams prior to surgery would be useful if they were later compared to utterances during surgery, and then again post-op. Kubie wondered if this could shed light on the patients’ emotional lives and, that in each case, normal base-line patterns, rhythms, and speed of spontaneous associations could be established and compared. Second, he argued that operative observations could be enriched with the use of psychological tests. Third, Kubie wondered whether experimentation with various drugs (narcotics) and hypnosis could take place during the operative phase so that dissociative states could be observed while free associations were recorded. Fourth, he considered ways that unconscious conflicts could be explored with both diffuse and focal stimulations. He also suggested that pre and post-operative comparisons of free associations would provide evidence of unconscious processes. Finally, Kubie believed that comparing pre and post-operative neurotic symptoms, dream material, free associations, and psychological tests would lead to a better understanding of unconscious processes; he wondered whether stimulation could alter neurotic symptoms, pre-existing associative patterns and emotional reactions (Kubie, 1951, p. 193).

Evidently, Kubie provided a unique take on psychoanalysis as he integrated it with somatic medicine, cybernetics, and neuroscience. In speaking of Kubie, Mortimer Ostow talked of the parallels between Freud and Kubie, he stated, “He [Kubie] was a psychoanalyst who flourished in the 1930s and ‘40s who wrote the first neuroscientific articles in [psychoanalytic] history after Freud's “Project” (1895), so far as I know (Turnbull, 2004, p. 210). However, Ostow also integrated psychoanalysis, neuroscience, and pharmacology to advance psychoanalysis as an interdisciplinary science.

Mortimer Ostow (1918-2006)

Mortimer Ostow, the neurologist, psychiatrist and psychoanalyst, was a student of Lawrence Kubie. Ostow's interest in the neural basis of psychodynamic processes began when he was a student at the New York Psychoanalytic Institute in the 1950s (Ostow and Turnbull, 2004). Some of his research included the use of EEG methods to better understand diseases of the temporal (1953, 1954) and frontal lobes (1954, 1955) and he was also very interested in psychopharmacology (1962) and psychodynamic processes in epilepsy. He was criticized for embracing the new pharmacology of the 1950s at a time when psychoanalytic puritans ruled the day. However, he believed that medication should be used in conjunction with psychoanalytic treatment for permanent change to occur. More recently, Ostow published in the journal *Neuropsychoanalysis* on mood regulation (2004) and he has also provided commentaries on recent neuropsychoanalytic research (2001) in the journal.

Although Kubie and Ostow made bold attempts to bridge the gap between psychoanalysis and neuroscience, their research, like Freud's went somewhat unnoticed. Kubie's research, for example, had great potential in terms of using direct observation of metapsychological concepts in the operating room alongside Penfield's empirically sound electrical stimulation technique. But, perhaps Kubie and Ostow ran into the same limitations that Freud did in terms of technological advances. For example, Freud was aware of such limitations in 1895 when he stated, "The future may teach us to exercise a direct influence, by means of particular chemical substances, on the amounts of energy and their distribution in the mental apparatus" (1938, p 182).

Additionally, Freud held the same view about the future of psychoanalysis when he stated, “Biology is truly a land of unlimited possibilities. We may expect it to give us the most surprising information and we cannot guess what answers it will return in a few dozen years to the questions we have put to it” (Freud, 1914, p. 60). One must keep in mind that the EEG did not appear until the 1930s and Penfield’s electrical stimulation techniques were quite new as well. After the war the surge in head injuries allowed for increased use of the lesion and clinico-anatomical methods, but MRI technology did not emerge until the 1970s and fMRI not until the 1990s. In terms of the field of neuropsychoanalysis perhaps Kubie and Ostow, like Freud, were ahead of the technology of their time.

Nevertheless, Kubie and Ostow made the first strides after Freud to formally integrate psychoanalysis with neurophysiology. Moreover, Kubie (1930, 1953) was among the first in any field, including neuroscience, cybernetics, and systems theory, to theorize that neural networks were sensitive to initial conditions, relied on internal and environmental feedback, and had emergent and self-regulating properties. His reverberating circuits model of the psyche influenced cybernetic theorists and pre-dated nonlinear theories, particularly chaos and complexity theory, as applied to psychic functioning and neural network modeling. Thus, Kubie’s work appears to be an original offshoot of his clinical work and neuroscience foundations; he did not have the benefit of being able to borrow nonlinear theory. Nevertheless, Kubie would not be the last psychoanalyst to consider nonlinearity and systems theory models.

Conclusion

This chapter focused on exploring four key frameworks for understanding the interdisciplinary relationship between psychoanalysis and a number of other fields that began with Freud’s *Project* as the first example of an interdisciplinary neuropsychoanalytic model of the mind. Jung’s borrowing of the psychology’s empirical methods to test the psychoanalytic theory of repression, followed by the Clark conference where Freud too supported empirical methods as applied to psychoanalytic thought, demonstrated that, early on, these two historical figures supported the integration of psychology and psychoanalysis to better understand psychic processes. Psychology's original acceptance of psychoanalysis was short-lived, as was Freud's early acceptance of empirical testing on his concepts, and was followed by psychology's attempts to undermine Freud's theories via thousands of empirical studies on Freudian concepts. Psychoanalysts went on to borrow knowledge from psychosomatic medicine, cybernetics, and neurophysiology with the hopes that these integrations could shine a brighter light on the mind-body relationship and psychological functioning. Thus, the examples presented in this chapter, of the sharing of information between the disciplines, provided not only evidence of the key concepts of shared interest among these fields, but also the explicit attempts by these fields to learn from each other, particularly in the cases of the Clark and Macy Conferences.

Nevertheless, thus far, most of the examples of knowledge sharing or borrowing have not been explicit attempts to integrate these disciplines. For example, when Jung used psychological methods to test Freud's theory of repression, it was not an explicit attempt to integrate these two fields; Jung's borrowing of the methodology was a means to an end to find support for the theory. And when psychology tested Freudian theories, the borrowing here was not a formal attempt at integration or collaboration; the borrowing was a means to an end. Today, however, there is an explicit attempt to integrate the neurosciences and psychoanalysis in the field of neuropsychoanalysis and the next chapter will analyze the development and status of this field.

Chapter Five

Freud's *Project* and Modern Neuropsychoanalysis

> No other document in the history of psychoanalysis
> has provoked such a large body of discussion with
> such a minimum of agreement as has Freud's *Project*
> Sulloway (1979, p. 118)

Sulloway's (1979) remark remains as true today as it did when he wrote it nearly forty years ago. The idea that Freud's early medical, clinical, and scientific education played a key role in his creation of the *Project*, thus laying the foundation for his later psychoanalytic theories has been debated (Amacher, 1965; Bilder & LeFever, 1998; Fancher, 1971, 1973, 1976; Guttmann & Scholtz-Strasser, 1998; Holt, 1963; Levin, 1978; Pribram, 1962; Pribram and Gill, 1976; Solms and Nersessian, 1999; Solms & Saling, 1986; Sulloway, 1979; Van DeVijver and Geerardyn, 2002). However, this chapter will provide support for the idea that Freud's *Project* was an interdisciplinary model that set the stage for the development of two new disciplines, psychoanalysis at the end of the 19th century and neuropsychoanalysis one hundred years later.

The lines of evidence for these two hypotheses come from the scholarly literature on the neurological origins of Freud's psychoanalytic theories and a scholarly and bibliometric citation analysis of the field of neuropsychoanalysis, respectively. Freud's pre-analytic work afforded him the tools to establish a new level of interdisciplinary discourse when he created the field of psychoanalysis, and one hundred years later, like Freud, those in the field of neuropsychoanalysis are attempting to create a modern version of Freud's "psychology for neurologists."

The field of neuropsychoanalysis is a prime example of Choi and Pak's (2006) view of interdisciplinarity, which theorizes that the borrowing and integration knowledge from disparate disciplines can create new fields. Mark Solms is the foundation of this discipline (1961-) and, although there are many contributors to the field and many social and political reasons for its development, I have chosen Solms as my primary subject because he coined the term "neuropsychoanalysis, and is the "creator" and the "guardian" of this new field (Schwartz, 2015). In addition to Solms, I also center on Jaak Panksepp (1943-) who collaborated with Solms from the beginning. The choice of Solms and Panksepp also makes sense in that they are the two researchers most often touted as the face of neuropsychoanalysis in academia and the popular press (Schwartz, 2015).

In exploring the field of neuropsychoanalysis, this chapter will highlight some of the research being done in this field to provide a portrait of the discipline. In so doing, it becomes evident that Solms, Panksepp, and their colleagues were privy to advances in neuroscience and technology that Freud was not. Thus, some of the key discoveries that emerged beginning in the 1950s are also discussed.

Founding Psychoanalysis

The *Project* was first published in German under the editorship of Marie Bonaparte, Anna Freud, and Ernest Kris. However, it was not published in English until 1954 when Strachey translated *The Origins of Psychoanalysis: Letters to Wilhelm Fliess, Drafts and Notes: 1887-1902* (1950/1954). Because the *Project* so strongly emphasized the neurological aspects of psychic functioning, its publication fifty-five years after it was written generated new questions about the foundations of psychoanalysis; until this time, Freud's theories were argued to be grounded in his few clinical cases. A primary question that arose after the publication of Freud's manuscript was, just how relevant it was to Freud's later, more psychological theories?

In the 1930s and 40s, before the *Project* was published, Jelliffe published three papers that looked at Freud's neurological discoveries (1937), his place in the history of psychiatry

(1937), and the impact that psychoanalysis had on neurology stating, “Psychoanalysis has liberated neurology from its invested and fixed patterns of thinking” (1940, p. 215). Essentially, Jelliffe focused on Freud’s neurological successes, but saw little continuity between Freud’s early neurology and psychoanalysis. However, Bernfeld came to a different conclusion. He assessed Freud’s Helmholtzian influences and the impact Brücke, Claus, Brentano, and Meynert on Freud’s development of psychoanalysis (1944; 1949). Interestingly, even before the publication of the *Project,* Bernfeld managed to give an accurate portrayal of Freud’s neurological influences, and the effect these had on his creation of *Studies on Hysteria* (1895) and *The Interpretation of Dreams* (1900).

Bernfeld’s effort is significant in that he is among the first to emphasize Freud’s history in the field of neurology and suggest that this played an important role in the development of his later psychoanalytic theories. In summary, before the publication of the *Project*, interest in Freud’s neurological beginnings was limited and there seemed to be just a few connections between his early work in the field of neurology and his later founding of psychoanalysis. PsycINFO™ and JSTOR™ searches from 1900 to 1949, before the publication of the *Project,* provided only a handful of publications that dealt with the neurological origins of psychoanalysis and Freud’s early career as a neurologist.

Following the publication of the *Project,* however, historians and biographers now had a new tool for analyzing and understanding Freud’s theories, and interest in the neurological origins of psychoanalysis increased. For example, Jones (1953) included an analysis of Freud’s neurological beginnings in his influential biography *The Life and Work of Sigmund Freud*. In 1962, Pribram published an appreciative account of *The Neuropsychology of Sigmund Freud* and in 1963, Holt looked at the influences of *Natürphilosophie* and the School of Helmholtz on

Freud’s scientific thought. In 1965, Amacher authored *Freud’s Neurological Education and its Influence on Psychoanalytic Theory*, now viewed as a classic investigation into the neurological origins of psychoanalysis.

When the *Standard Edition* version of the *Project* was published in 1966, James Strachey wrote: “The *Project*, or rather its invisible ghost haunts the whole series of Freud’s theoretical writings to the very end” (p. 209). Many works that followed Strachey’s were attempts to illustrate this fact. For example, in the 1970s Fancher published three works discussing the *Project* and its relevance to Freud’s later theories. In the “The Neurological Origin of Freud’s Dream Theory” (1971), Fancher examined the wish-fulfillment hypothesis of Freud’s dream theory, arguing that this hypothesis made its first appearance in the *Project* and thus was not completely derived from clinical observations. Fancher then guided the reader through some of the difficult aspects of the *Project* in his 1973 book *Psychoanalytic Psychology: The Development of Freud’s Thought.* Finally, in 1976, Fancher published “The Neurological Origins of Psychoanalysis” where he expanded on his 1971 paper, assessing the *Project* as the foundational underpinning for primary and secondary processes, the ego, and Freud’s concepts of cathexis and psychic energy. Pribram and Gill (1976) dedicated an entire book to reassessing Freud’s *Project* in light of contemporary cognitive theory and modern neuropsychology, and Sulloway (1979) explored Freud’s neurological beginnings in *Freud, Biologist of the Mind*, where he discussed the *Project* as well as the implications this manuscript had for psychoanalysis. Sulloway (1979) characterized Freud as a “crypto-biologist” thereby confirming Strachey’s argument that the origins of psychoanalysis were implicitly neurological (p. 15).

Although many scholars examined Freud's neurological career, particularly since the publication of the *Project,* they have disagreed about its importance for the development of his later psychoanalytic theory. Some scholars (e.g., Fancher, 1973; Pribram, 1962; Strachey, 1966; Sulloway, 1979) believe that the *Project* posthumously confirms a very strong neurological basis for the creation of psychoanalysis and illuminates many of Freud's later psychoanalytic theories. However, in some publications and letters to his friend Fliess, Freud appeared to give up his reliance on the neurological basis of psychology. This contradiction has only added to the speculation about Freud's intentions when he drafted and then abandoned the *Project.* Evidently, many scholars believe that Freud's early education and his *Project for a Scientific Psychology* provided enough of a foundation to create a discipline.

Scholars (Amacher, 1965; Holt, 1963; Sulloway, 1979) in support of this argument interpret Chapter seven of *The Interpretation of Dreams* as implicitly based upon many of the neurologically-based concepts Freud had established four years earlier in the *Project.* Pribram, (1962), Strachey, (1966), Fancher, (1971, 1976), and Sulloway, (1979) also suggest that the posthumous publication of the *Project* is of critical importance to historians of psychoanalysis and psychology in that it clarifies many of Freud's psychoanalytical theories. They argue that the *Project* confirms the neurological structure for the following concepts: wishful thinking; mechanisms of sleep and dreaming; pleasure, unpleasure, and pain; primary and secondary processes; thought, remembering, memory, perception, and consciousness; ego function; and the psychopathology of hysteria. However, Gill (in Pribram and Gill, 1976), took a middle position, seeing a major neurological influence on an ultimately sterile "metapsychology," with little such influence on Freud's "clinical theory."

More recently, another group of scholars expressed reservations about the neurological origins and the role of the *Project*, arguing that Freud's clinical experience was the foundation of the field (for example see Levin, 1978; Solms & Saling, 1986). Those that support this point of view recognize that Freud began his career as a neurologist but often assign a cutoff year that arbitrarily demarcates the place where Freud stopped thinking neurologically and began his psychological theorizing. This pivotal year of transition is 1900; the year *The Interpretation of Dreams* was published (Levin, 1978; Van DeVijver and Geerardyn, 2002). Evidence for Freud's transition from neurology to psychology is often based on the fact that Freud explicitly stated in this work that he would "…remain on psychological ground" (1900, p. 536).

Although the *Interpretation of Dreams* is considered by many to be evidence of Freud's transition to psychology, Solms and Saling (1986) believe that Freud's clinical work with aphasics contributed to his development of the *Project* and his transition out of neurology. They argue that Meynert was not the key influence for Freud, his *Project*, or his later psychoanalytic theories. Solms and Saling believe that Freud's 1891 publication *On Aphasia* strongly refutes and rejects Meynertian concepts and the disagreement between Meynert and Freud has been clearly documented by biographers (Jones, 1953; Sulloway, 1979). In addition, Solms and Saling argue that because *On Aphasia* is the precursor to the *Project*, the *Project* itself and Freud's later psychological writings, particularly the seventh chapter of *The Interpretation of Dreams*, cannot be credited as being strongly influenced by Meynert. They suggest that Meynert's influence has been overrated at the expense of a more important influence, Hughlings Jackson. Further evidence to support the notion that Freud left neurology behind comes from the fact that he never edited the *Project* and, after he sent it to Fliess, he never had the opportunity to see the document again. In addition, Freud also prevented his editors from including *On Aphasia*, his other neurological monograph, in the first version of his collected psychological works, thereby leaving some scholars to suggest that he truly had relinquished neurology (Van DeVijver and Geerardyn, 2002).

Indeed, the *Project* sparked much interest and numerous debates during the first three decades after its publication. Additionally, the 1990s saw a veritable surge of interest in Freud's neurology. In this decade, two edited books were published on the *Project, Neuroscience of the Mind on the Centennial of Freud's Project for a Scientific Psychology* (Bilder & LeFever, 1998) and *Freud and the Neurosciences: from Brain Research to the Unconscious* (Guttmann & Scholtz-Strasser, 1998). Solms and Nersessian (1999) analyzed the neurological origins of psychoanalysis and created *Neuropsychoanalysis*, a journal based on their belief that the neurological representations in the *Project* merit the addition of modern neuroscience to develop further Freud's theories. In addition to these edited books, and the development of a new journal, numerous articles and book chapters were published on Freud's *Project.* At first glance, this concentration of publications is prodigious and one might ask, why this surge in the l990s?

Interest in emphasis on brain function and neural networks began in many areas on the fringe of neuroscience, i.e. psychology, psychiatry, linguistics, and psychoanalysis, and cognitive psychology - which became highly prominent from the 1970s through the 1980s, causing scholars to question whether a Kuhnian paradigm shift had occurred in reaction to the behaviorism of the previous decades (Benjafield, 2005). In conjunction with the emerging cognitive revolution, came a push towards interdisciplinary research and cognitive psychology "…appealed to academic psychologists who regarded themselves as tough-minded scientists first and foremost" (Benjafield, 2005, p. 289). In addition, information theory, computer science, and Chomsky's linguistic theories provided an appealing scientific framework for cognitive psychologists (Benjafield, 2005).

This renewed emphasis on the brain and cognition brought with it new interdisciplinary research areas, such as neuro-psychology, neuro-psychiatry, neuro-linguistics, and neuropsychoanalysis (Kitcher, 1995, Pribram, 1998; Solms, 1999). By the 1990s, interest in the brain was firmly established and the United States Congress declared the1990s to be the *Decade of the Brain*. The Library of Congress, along with the National Institute of Mental Health, encouraged a public discussion of brain research topics during the last decade of the 20th century (Guttmann & Scholz-Strasser, 1998). In addition, the decade of the brain coincided with the centennial of Freud's *Project for a Scientific Psychology*, and this prompted conversation and numerous conferences; Solms (1998) also suggested that in 1895 Freud had similar goals to that of neuroscience in the 1990s: "to develop models of the mind constrained by known physiology and to consider what progress has been made towards that goal" (p. xi). Further, Pribram (1998) stated, "the time is ripe to realize what Freud was after: to build models based on neuroscience regarding conscious and unconscious processes" (p. 11).

Increased interest in the brain and cognition, and the common goals of Freud and modern neuroscience, definitely contributed to the renewed interest in Freud's *Project* in the 1990s. But this post hoc analysis of Freud's unpublished work does not answer questions about why his neurological theories, as published in chapter seven of *The Interpretation of Dreams*, *On Aphasia*, and *Studies on Hysteria* were not latched onto. For example, in his 1944 paper, Bernfeld stated that Freud's earliest works were strictly physicalistic and that they "…have an everyday sound, sometimes such obscure phrases occur as a 'quantity of excitation', 'discharge', 'detachment,' and the like, which appear to be relics of the neurology of 1890" (p. 34). Although these comments sound very much like they were referring to the *Project*, Bernfeld (1944) was talking about *Studies on Hysteria*.

Although *Studies on Hysteria* contained the theoretical chapter that established a neurological framework for the beginnings of psychoanalysis, many scholars have suggested that

Freud's clinical cases took precedence in the mind of readers. In this respect, the theoretical foundations were overlooked in *Studies*, but why did this also happen with the neurological aspect of *The Interpretation of Dreams*? It seems peculiar that the seventh chapter of *The Interpretation of Dreams* would be ignored, particularly because it presents an explicitly more neurological aspect of Freud's theory and this was available long before the publication of the *Project*. Hence, one might ask why it took the *Project* to draw so much attention to the neurological origins of psychoanalysis.

Gill (1977) also posits this question suggesting that, although some scholars have argued that Freud left neurophysiology behind in 1900, the seventh chapter of *The Interpretation of Dreams*, the metapsychological papers, and *Beyond the Pleasure Principle* do have some neurologically explicit sections, however, they are not as neurologically as explicit as the *Project*. However, Glymour (1991) suggests that Freud's pre-analytic works "…are unread by most academic psychologists…and psychologists, like almost everyone else, know Freud principally from a later period of his life" (p. 46). Moreover, Freud's lack of empirical research, the hypothetical nature of his neurological theories as put forth in some of his major works, and his choice to move toward more psychological explanations of the mind were also key reasons this aspect of his work went unnoticed. However, when the context or paradigm of psychology moved toward more neurological explanations, Freud's *Project* became more relevant.

Although some still question the importance of Freud's neurological thought on the development of psychoanalysis, the *Project* was where Freud's psychoanalytic thought began. The fact remains that Freud's psychoanalytic concepts of primary and secondary processes, conscious and unconscious processes, dreams, pleasure and unpleasure, language, the motor system, memory, emotion, thought, and hysteria all began in the *Project*. In the years following the *Project*, Freud could not get away from using biological terminology; he continued to use the phrases “discharge of energy” and “psychical energy,” and words such as “quotas,” “quantities,” and “cathexis” in his major works (e.g. 1900, 1905, 1914, 1915, 1917, 1920, and 1930, to name only a few) and in 1913, he stated, “In spite of all our efforts to prevent biological terminology and considerations from dominating psycho-analytic work, we cannot avoid using them even in our descriptions of the phenomena that we study. We cannot help regarding the term ‘instinct’ as a concept on the frontier between the spheres of psychology and biology” (p. 182). More importantly, he continued to support the idea that science would go on to shed more light on our understanding of psychological processes; in 1925, he stated, “It is left for the science of the future to bring together these isolated data into a new understanding. It is not psychology but biology that is responsible for this gap” (p. 70).

It would be 75 years later when “biology,” or rather neuroscience, would come together with psychoanalysis in an attempt to bridge the gap Freud spoke of. However, along the way, between Freud’s *Project* and the creation of the field of neuropsychoanalysis in 1999, advances in neuroscience played a key role in the increased interest in the brain, particularly in the 1990s as discussed, and provided researchers with new discoveries about the relationship between the brain and the mind, as well as new tools and technology. The connection between these discoveries, Freud, and the development of the field of neuropsychoanalysis will now be explored.

Founding Neuropsychoanalysis: Freud’s *Project* and Neuroscience

> I agree with Karl Pribram, who argued …in his book *Freud’s Project Re-Assessed*, **not** for a replacement of Freud’s science of subjectivity by an objective neuroscience of the mind, but rather for an integration of these two classical disciplines. Like Pribram, I see no reason why this integration should not be possible today, given the knowledge and the methods that are now available to us, 100 years after Freud first attempted this important - but at the time impossible - task. Solms (1998, p. 9, emphasis in original)

Today, Freud's *Project* is the foundation of the recently developed field of neuropsychoanalysis, an interdisciplinary field based on the idea that psychoanalysis and the neurosciences have similar goals and study similar "objects" and, as such, they should combine their research efforts. In addition, neuropsychoanalysts believe that Freud's 1895 model may be one that can bridge the gap between these two disciplines if empirical methods are applied to it, thus, providing an empirical foundation for psychoanalysis. Scholars and researchers in this area also want to follow in Freud's interdisciplinary and scientific footsteps, as they attempt to create a reciprocal relationship between psychoanalysis and neuroscience. In 2011, Solms and Turnbull stated:

> Our own vision is one of collaborative investigation of phenomena of common interest, approached using the rigor that is associated with all good scientific enquiry but also respects the methodological tools (with all the advantages and disadvantages) associated with each distinct field. An ideal outcome would be for neuropsychoanalysis to avoid any suggestion of being an armchair activity, or a field that is based on speculation rather than empirical work. Moreover, we envisage an interdiscipline in which the acquisition of knowledge is bidirectional (psychoanalysis informing neuroscience, and vice versa), and a discipline that retains the deep respect for subjective experience that is the hallmark of psychoanalysis. (p. 142)

Because this new field emphasizes interdisciplinarity, and is based on the idea of extending Freud's interdisciplinary work as outlined in the *Project,* this section of the chapter will analyze the field of neuropsychoanalysis by considering the concepts it studies, the methods it uses, and the researchers supporting and maintaining this discipline.

A Recent History of Neuropsychoanalysis

In 1911, Abraham Brill (1874-1948) founded the New York Psychoanalytic Society, which was the first psychoanalytic training centre in the United States. Brill, who had studied under Jung and translated many of Freud's works, had the aim of advancing psychoanalytic theory and practice on American soil, and it was at the New York Psychoanalytic where major advances in psychoanalytic theory and practice were made. In light of its long history of "firsts" in psychoanalysis, it is not surprising that the New York Psychoanalytic is the place where the field of neuropsychoanalysis came to fruition when the members of the society formed a Psychoanalysis-Neuroscience Study group in 1990.

Arnold Pfeffer, a neuropsychiatrist and psychoanalyst, initiated this group hosting monthly lectures on basic neuroscience. By 1998, the study group had become a diverse centre that consisted of monthly lectures by leading neuroscientists who were working on topics that were interdisciplinary in nature. The centre was then named "The Arnold Pfeffer Centre for Neuropsychoanalysis" and was linked to a number of satellite research and study groups. Furthermore, a seminar course on psychoanalysis and neuroscience was added to the institute's training curriculum. This informal study group continued to grow until the neuropsychoanalysis society was formed in 1999.

At this time, the Neuropsychoanalysis Society was established with regional affiliates and study groups in Boston, Stockholm, Vienna, Washington, New Haven (Yale), Chicago, Sweden, Buenos Aires, Cleveland, Denver, Frankfurt-Cologne, Houston-Galveston, Los Angeles, New England, New York, St. Louis, Seattle, and Toronto. In addition, The Anna Freud Centre in London formally initiated a "Neuropsychoanalysis Project" in September of 1999 with the aim of integrating psychoanalysis and neuroscience. The Neuropsychoanalysis Project had four components that focused on clinical neuropsychoanalysis, research, internal teaching, and external lectures, workshops, and conferences. The external lectures were convened and organized by Dr. Mark Solms[29] and Dr. Oliver Turnbull[30], who both went on to edit the society journal. In July 2000, the first neuropsychoanalytic congress was held in London and congresses have been held around the world annually since then. During the past 18 years, the Neuropsychoanalysis Society has grown considerably with a worldwide membership of 600 and more than 25 regional and specialist groups, primarily in North America, South America, and Europe.

In 1999, neuropsychoanalysis became an institutionalized field of study when the periodical *Neuropsychoanalysis: An Interdisciplinary Journal for Psychoanalysis and the Neurosciences* was launched. In the editor's introduction to the inaugural issue of the journal, Mark Solms and Edward Nersessian[31] (1999) stated,

> The goal of this new journal is to create an ongoing dialogue with the aim of reconciling psychoanalytic and neuroscientific perspectives on the mind…Notwithstanding the fact that psychoanalysis and neuroscience have approached this important scientific task from radically different perspectives, the underlying unity of purpose has become increasingly evident in recent years as neuroscientists have begun to investigate those "complications of mental functioning" that were traditionally the preserve of psychoanalysts. This has produced an explosion of new insights into problems of vital interest to psychoanalysis, but these insights have not been reconciled with existing psychoanalytic theories and models.

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[29] Solms, PhD, is a psychoanalyst and neuropsychologist at St. Bartholomew's and Royal London School of Medicine.
[30] Turnbull is a clinical psychologist and neuropsychologist from Bangor University, Wales, UK.
[31] Nersessian, MD, is a clinical professor of psychiatry at Weill-Cornell Medical College and training & supervising psychoanalyst at the New York Psychoanalytic Institute.

> Likewise, neuroscientists tackling these complex problems of human subjectivity for the first time have much to learn from a century of psychoanalytic inquiry. This journal intends to meet that need in a practical way. (p. 3)

The journal's specific aims are "to facilitate scientific dialogue and debate between neuroscientists and psychoanalysts; (2) to educate psychoanalysts and neuroscientists about matters of common interest; and (3) to provide a vehicle for communicating the results of interdisciplinary research in neuroscience and psychoanalysis" (Solms and Nersessian, 1999, p. 3). Solms and Nersessian have ambitious goals as they focus on the benefits of integrating psychoanalysis and neuroscience, however, there is also a direct link between the development of neuropsychoanalysis and Freud's *Project*. On the Neuropsychoanalysis Society home page, Arnold Pfeffer, president of the Neuropsychoanalysis Society stated,

> Freud, in his 1895 'Project for a Scientific Psychology', attempted to join the emerging discipline of psychoanalysis with the neuroscience of his time. But that was a hundred years ago, when the neuron had only just been described, and Freud was forced – through lack of pertinent knowledge - to abandon his project. We have had to wait many decades before the sort of data, which Freud needed, finally became available. Now, these many years later, contemporary neuroscience allows for the resumption of the search for correlations between these two disciplines. (Pfeffer, 1999)

Thus far, I have outlined the objectives of the journal and the field of neuropsychoanalysis, the next section of this chapter will provide a more detailed breakdown of this interdisciplinary field by first providing a bibliometric citation analysis of the scholarly articles and authors published in this journal, followed by a study of two of the key researchers in and founders of the field, Mark Solms and Jaak Panksepp.

Neuropsychoanalysis: Portrait of a Discipline

Methodology

One way to evaluate the interdisciplinarity of a field is to examine the publications in its journal. From 1999-2016 *Neuropsychoanalysis* published 18 volumes with 35 issues. The format of the journal is in many ways similar to most psychology or neuroscience journals in that each issue provides the reader with peer-reviewed scholarly research articles as well as society news and a book review section. The journal also boasts a "research digest," which provides readers with annotated bibliographies or brief summaries of selected research reports that have a bearing on psychoanalysis and neuroscience. The digest often contains reviews of research that is related to the theme of the specific journal issue so that readers can seek out more information on the recent developments in a specific area of interest.

This interdisciplinary journal is unusual, however, in that each issue has a "target" article followed by two or three "original" articles; since the journal's inception, there have been 28 target articles and 98 original articles published, for a total of 126 peer-reviewed papers. The "original" articles are just what you would expect from any journal – original scholarly peer-reviewed research on a variety of neuropsychoanalytic topics. The target articles are similar, but they are always followed by three to eight commentaries in order to provide a balanced view of opinions from various fields; the commentaries often come from neuropsychologists, neuroscientists, psychoanalysts, and cognitive psychologist, to name a few examples. In total the journal has published 189 commentaries. In addition to the commentaries, each issue often has an "ongoing discussion" section, where discussions on previously published articles are continued and commentaries on past commentaries are made, thus, the journal endeavors to keep the dialogue and discussion continuing from one issue to the next.

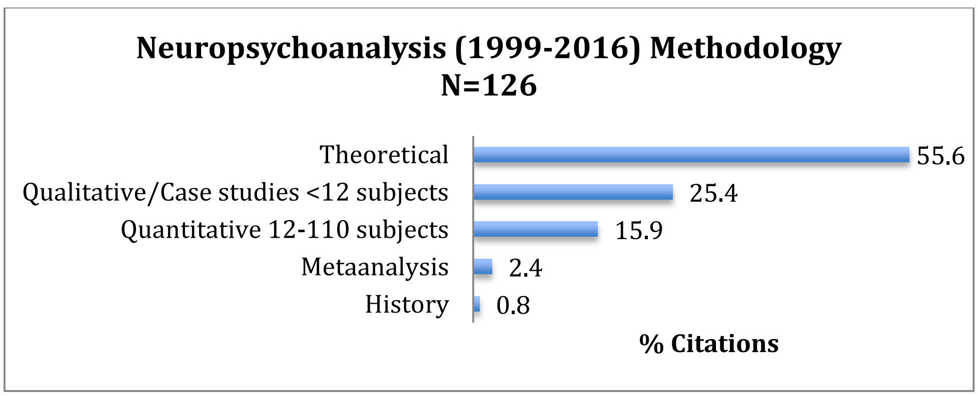
While most issues of this publication have only one target article, a few issues have had two, in order to show both the psychoanalytic and neuroscientific perspectives. For example, in the first issue of the journal Solms and Nersessian (1999) presented a detailed explanation of Freud's psychoanalytic theory of affect and Panksepp (1999) followed this with a neuroscientific view of emotion based on his own empirical studies. Six commentaries, three from neuroscientists and three from psychoanalysts, then followed. In general, the commentaries are always followed up with a response from the "target" article author. For this journal the commentaries and discussions are important primarily because of the interdisciplinary nature of the field and this follows in line with the discipline's goal of facilitating a continuing dialogue between psychoanalysis and neuroscience.

In assessing the primary topics of interest to this field, and to assess the disciplines involved, I restricted my analysis to the 126 "target" and "original" articles. Similar to the earlier bibliometric analysis with the surveys of research on Freud's theories done in chapter five, for this analysis I "presumed the title of a book, article, or chapter reflects, to some tolerable degree of approximation, the contents of the work it announces" (Simonton, 1992, p. 6). Most often the title provided a clear idea of the concept being studied, however, when this did not occur, the abstract or full content was read for clarification. Following Simonton's (1992) method, I attempted to use a "novel strategy, namely to execute an objective content analysis of the full titles" of the studies published in this journal (p. 6).

First, the research methods used in neuropsychoanalysis and the author credentials will be summarized so that the interdisciplinary nature of this field can be demonstrated. Second, Freud attempted to solve specific aspects of the mind-body problem by suggesting that the electrochemical processes in the brain contributed to psychopathology, consciousness and unconsciousness, defense mechanisms, memory, and primary and secondary processes. Because neuropsychoanalysis is founded on Freud's *Project*, particular attention will be paid to the contemporary research on these topics/concepts in the field, in light of some select advances that have been made since Freud's time.

Research Methods in the Journal *Neuropsychoanalysis*

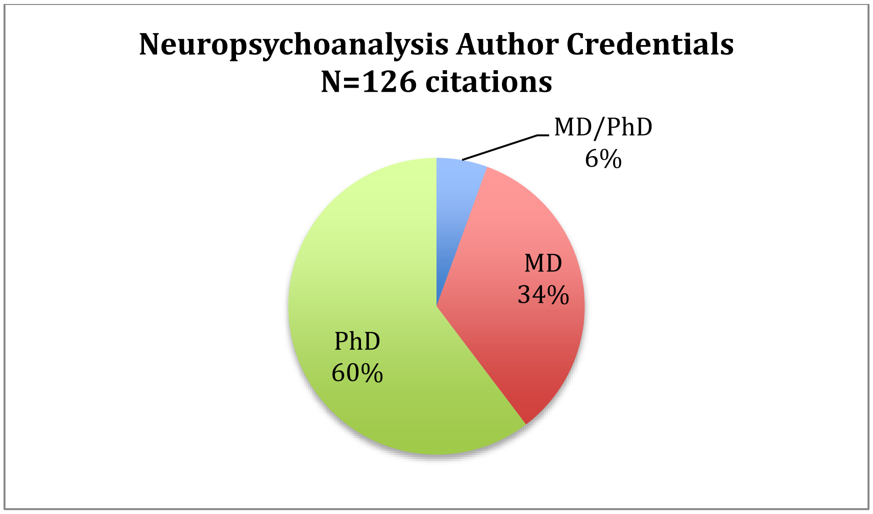
An analysis of the studies in the journal found that 55.6% of the papers were theoretical, 43.7% were empirical studies (qualitative and quantitative), and .8% were historical in nature. In addition, almost of all these papers (90%) cite heavily from neuroscience findings and imaging research (Graph 45).



Graph 45. Neuropsychoanalysis – Methodology.

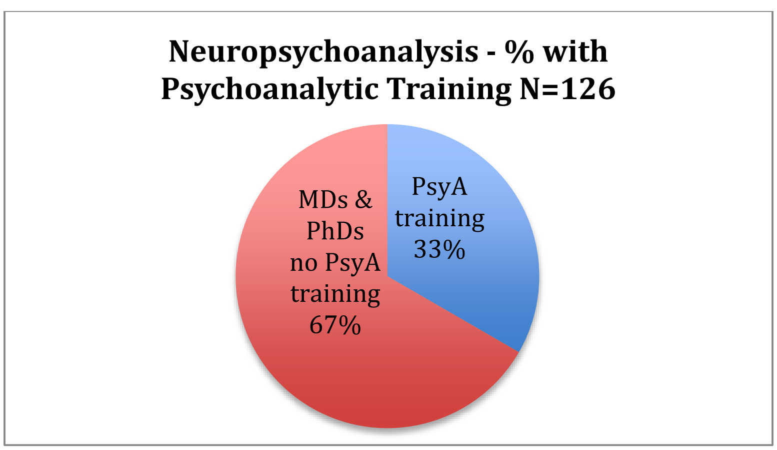
Who are Neuropsychoanalysts?

In assessing the field of neuropsychoanalysis as interdisciplinary, an examination of the authors' credentials was complied and found that 60% of the authors had PhDs, 34% had MDs, and 6% had MD/PhDs.

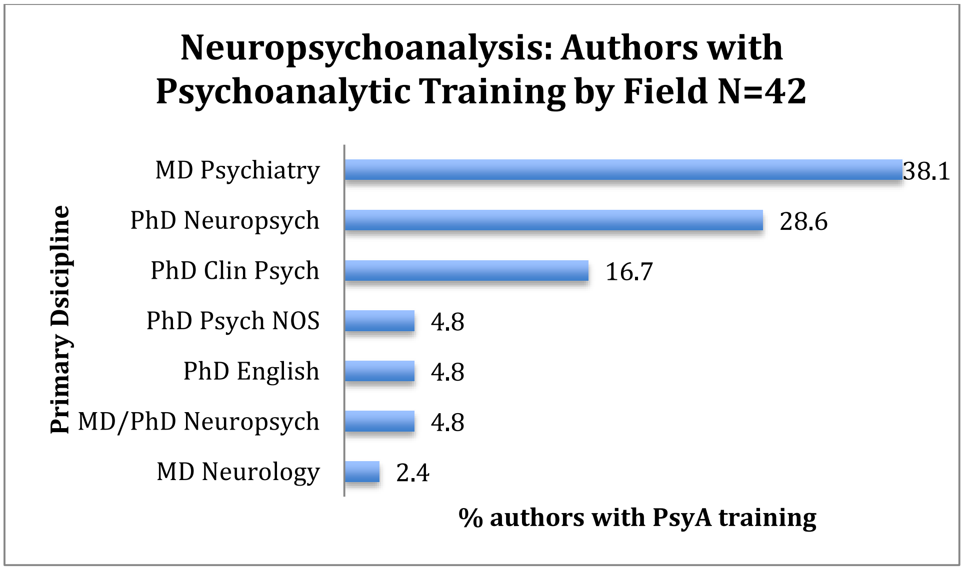


Graph 46. Neuropsychoanalysis – Author Credentials.

In breaking these statistics down further, 33% of the researchers had formal training in Psychoanalysis, while, 67% did not. Of these with psychoanalytic training many also had education in another discipline. 38.1% also had MDs in psychiatry, 28.6% had PhDs in neuropsychology, 16% had PhDs in clinical psychology, while the rest had PhDs in an area of experimental/research psychology (4.8%), and English (4.8%). Finally, 4.8% of the authors had MD/PhDs in neuropsychology and 2.4% had MDs in neurology (Graph 46).

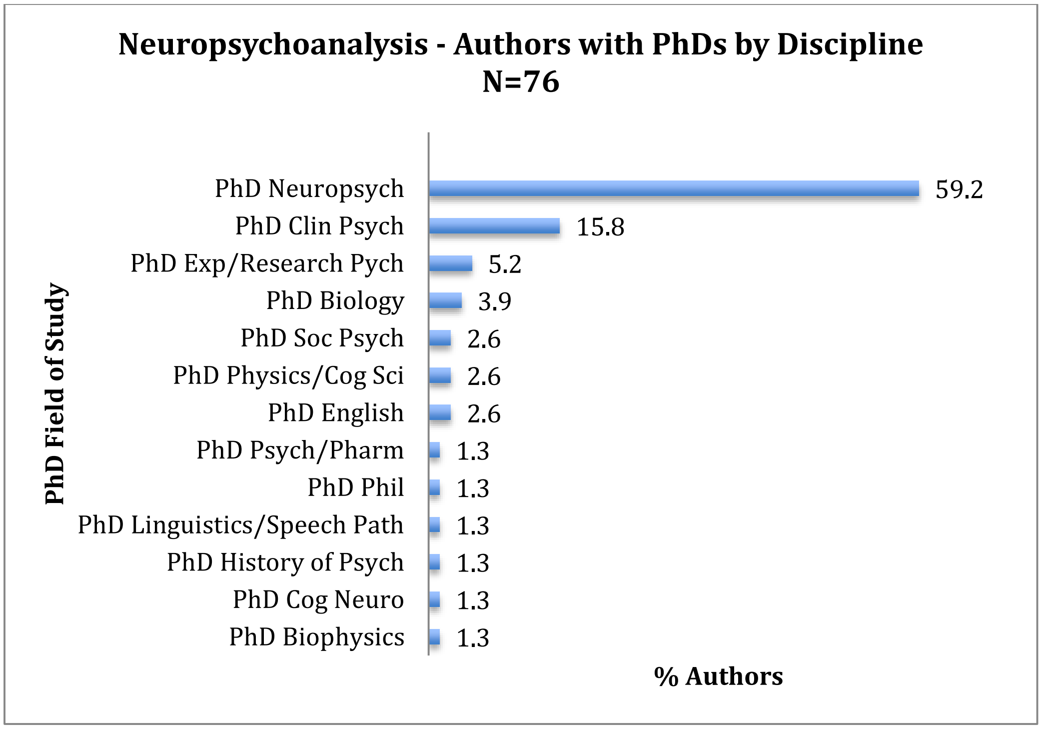


Graph 47. Percentage with PsyA Training.



Graph 48. Neuropsychoanalysis – Authors with PsyA Training by Field.

Authorship, as correlated to field of research, found that almost 60% of the researchers had PhDs in neuropsychology, while 15.8% had clinical psychology degrees (Graph 47). Authors from the areas of Experimental Psychology (5.2%), Biology (3.9%), Social Psychology (2.6%), Physics (2.6%), English (2.6%), Pharmacology (1.3%), Philosophy (1.3%), Linguistics (1.3%), History of Psychology (1.3%), Cognitive Neuroscience (1.3%), and Biophysics (1.3%) wrote the remainder of the 25% of the papers published (Graph 48).

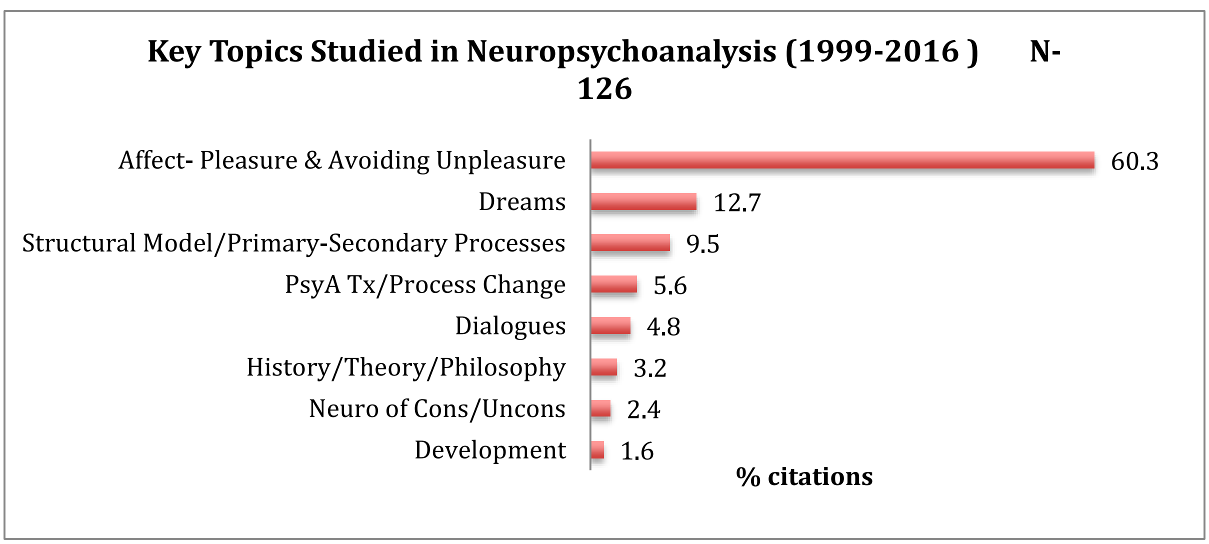


Graph 49. Neuropsychoanalysis – Authors with PhDs by Discipline.

In the case of neuropsychoanalysis, the interest in integrating psychoanalysis and neuroscience is based on the idea that many of the questions in the mental sciences cannot be sufficiently addressed by one discipline. The idea that advances can occur, and perhaps occur more quickly, when people from significantly different backgrounds, and with varying credentials, come together to share and integrate their expertise. "Interdisciplinary research relies on the strength of established disciplines to provide sound theory and methodology. It pushes the traditional boundaries of disciplines, helps ensure their growth and vitality as new and emerging lines of inquiry are pursued, and may lead to the development of new disciplines" (NSERC, 2016, para 2-3). The coming together of psychoanalysis and neuroscience definitely created a new discipline and its goals correspond to the recent trend or paradigm shift toward interdisciplinary in both academic and public sectors. Moreover, historically, psychoanalysis has had a subjective methodology. Thus, applying a neuroscientifically sound methodology to some of Freud's key concepts may provide the needed support psychoanalysis needs to continue its life as a discipline at all.

Neuropsychoanalysis: The Concepts

In total, eight key topic/concepts emerged from the bibliometric analysis of the journal *Neuropsychoanalysis*. These topics were dominated by three areas of core conceptual research on 1) Affect, 2) Dreams, and 3) Structural Model/Primary and Secondary Processes; these accounted for about 83% of the studies. Category 3 collapses Freud's structural model (Id and Ego primarily) and primary and secondary processes together because, most often, the researchers correlate Id processes with primary processing and Ego processes with secondary processing. In addition to researching specific concepts, the journal also presented papers on the psychoanalytic process of change, dialogues regarding the pros and cons of integrating psychoanalysis and neuroscience (dialogues), history/theory/philosophy, conscious and unconscious processes, and human development (Graph 50).



Graph 50. Key Topic Studied in Neuropsychoanalysis.

The focus of the next part of this chapter will be on the three key conceptual areas of primary interest to the field, Affect, Dreams and Freud's dynamic systems. However, as Danziger (1993) prescribed, and Blackman (1994) affirmed, these concepts have moved through history as social historical constructs and philosophy is considered as the analysis of this field continues.

The field of neuropsychoanalysis borrows significantly from cognitive, social, and affective neuroscience; all provide important foundations for this discipline. Cognitive functions such as memory and attention are studied alongside the social-emotional-relational concepts of attachment, object relations, and defence, to name only a few. Often, there are no clear-cut boundaries within the field; research on affect, for example, may include the cognitive and social elements of the concept, while research on cognition, may explore the emotional elements of our thoughts. Nevertheless, the concept of affect (pleasure and unpleasure) tends to dominate and is an area of research deeply embedded within the field; so much so that the largest single research topic in the journal is the neuroscience of emotion. This makes sense when one considers that psychoanalysis as a group of theories and form of therapy has focused on the etiology and treatment of affective disorders since Freud developed the discipline, and neuroscience has moved toward a better understanding of brain connectivity in specific brain areas and between groups of neurons and neurochemical pathways (Cozolino, 2010; Kandel, 1998, 1999, 2006, 2008; Schore, 2007, 2009). But how did we get here?

From a broad historical context, LeDoux (1997) argues that affect was a concept of interest in the mental sciences from Freud's time until the mid-20th century, with the work of Sherrington, Cannon, and Hebb. However, when the cognitive revolution began, LeDoux suggests that interest in emotion research waned. As previously noted, the 1990s "Decade of the Brain," and the creation of MRI and fMRI technology during this time, brought a revival of interest in the brain sciences in general, but also in the neurological foundations of emotion. LeDoux states,

> Neuroscientists have, in modern times, been especially concerned with the neural basis of such cognitive processes as perception and memory. They have for the most part ignored the brain's role in emotion. Yet in recent years, interest in this mysterious mental terrain has surged. Catalyzed by breakthroughs in understanding the neural basis of cognition and by an increasingly sophisticated knowledge of the anatomical organization and physiology of the brain, investigators have begun to tackle the problem of emotion. (1997, p. 62)

Many working in neuropsychoanalysis are aligned with LeDoux's point of view on emotion and many of the studies on this concept in *Neuropsychoanalysis* draw parallels to Freud's theories.

Pleasure, Unpleasure, Chemicals, and Drives

> The future may teach us how to exercise a direct influence, by means of particular *chemical substances*, upon the amounts of energy and their distribution in the apparatus of the mind. It may be that there are other undreamt-of possibilities of therapy. But for the moment we have nothing better at our disposal than the technique of Psycho-Analysis, and for that reason, in spite of its limitations, it is not to be despised. (Freud, 1938, p. 182, emphasis mine)

Keeping Freud's quote in mind, as I look at the field of neuropsychoanalysis I would say that the future is now. Although I cannot say that we have *solved* the problems that Freud presented us with in 1895, definite progress has been made since he wrote the *Project,* particularly in terms of the "chemical substances" he spoke of.

Before the 1950s, discussions about brain chemistry were nonexistent (Shepherd, 1991, p. 39), chiefly because it was assumed that neuronal communication in the brain and CNS was primarily electrical; chemical theories were directed toward the peripheral nervous system (Carlsson, 2001). From the 1920s to the 1950s many endocrine "chemicals" were discovered, but alongside these discoveries the idea of similar molecules in the brain had not widely entered academic, medical, or cultural conversations. Biologists, anatomists, and researchers in the neurological and medical sciences made key advances in brain chemistry research during the first half of the 20th century, but it was the 1950s, when the electron microscope was created, that confirmed the existence of "brain chemicals," researchers called neurotransmitters.

Freud, however, had hypothesized about the "instinctual chemicals" and psychological functioning as early as 1895 in the *Project,* when he suggested that there were numerous "sexual chemicals." From a contemporary point of view, his "chemical" theory at times reflects the idea of "hormones," but at other times his wording sounds similar to our view of neurotransmitters today. Correspondingly, he talked of "endogenous stimuli… which have their origin in the cells of the body and give rise to the major needs: hunger, respiration, sexuality" (p. 296), and he stated, "At the same time a suspicion forces itself on us that in both instances the endogenous stimuli consist of chemical products, of which there may be a considerable number" (p. 321).

Freud continued his thinking on neurochemical processes even after he finished the *Project*. For example, on April 26, 1896, Freud wrote to Fliess stating, "Furthermore, I have become downright obsessed with the problem of neuronic motion. Stimulated by your chemical theories, and after the most unbelievable trials, I have likewise arrived at a chemical conception that instills confidence in me…"(p. 183), and, "I am working on psychology, vigorously and in solitude…I believe more and more firmly in the chemical neurone theory…"(p.185). Freud went on to discuss "chemicals" in many of his later works (e.g. 1900, 1915, 1920) and this continued until the year before his death.

About fifty years after Freud's initial hypothesis, neurotransmitters were discovered; GABA, the primary inhibitory neurotransmitter in the brain, along with the excitatory transmitters, serotonin, dopamine, glutamate, and acetylcholine were found to play key roles in psychological processes. The ability to regulate emotion and mood with drugs allowed asylums to begin closing (Schutt, 2016) and today the increasing cases of mood, anxiety, stress, addiction, and spectrum disorders, particularly in children and adolescents, is contributing to affective neuroscience and psychopharmacology becoming an increasingly dominant field (Brooker and Dunsmore, 2016).

The neurological foundations of affect (pleasure and unpleasure) have journeyed through this dissertation from varying perspectives, from Bain, to Freud, to psychoanalysis' interaction with the other psy-disciplines. This, however, has not been a linear path. Along the way, discoveries in brain science, brain chemistry, and technology in the medical and mental sciences have played an important role in the changing perspective of Freudian concepts and the ability of neuropsychoanalysis to study them today.

For example, when one compares the research on Freudian concepts, as discussed in chapter four, to the contemporary work of neuropsychoanalysts in this chapter, the concept of emotion and how we study it has changed. In the 1950s, Freud's oral, anal, and genital psychosexual stages, as well as the concept of regression and fixation, fit into the categories of pleasure, unpleasure, and gratification, or lack thereof, in the development of psychological processes and the later adult personality. Today, Freud's psychosexual stages are of lesser interest to neuropsychoanalysts, and instead, the concepts of pleasure and reward are researched in relation to addictive processes and exploring how people avoid unpleasure. However, many of the historical Freudian studies on the psychosexual stages explored addictive pleasure processes, in association with Freud's oral stage of development, where alcoholics and obese subjects were studied to test Freud's theory of "orality." Back then, correlational methods and projection tests were used to understand the oral personality while today neurobiological and imaging methods are used to study addiction, not as an "oral" type of personality, but in terms of "pleasure" and "reward" pathways in the brain; today we hear of "addictive personalities." Also, addiction is correlated to genetics, brain chemistry, and a variety of environmental factors that influence the epigenome. Thus, in studying pleasure and unpleasure today "Blacky" tests have been replaced with brain scans and biochemical analyses.

Although Freud never wrote a distinct work that specifically focused on affect, the concepts of pleasure and unpleasure resides throughout his entire body of work (Andrade, 2003; Solms, 1999). In the *Project*, for example, he explored these concepts specifically under the headings of, "The Experience of Pain," "The Experience of Satisfaction," and "Affects and Wishful States." For Freud, affect included pleasure (satisfaction) and unpleasure, which was the qualitative perception of a quantitative level of energy *Q*. The feeling of pleasure or satisfaction occurred when cells filled with large quantities of *Q* discharged; high quantities of *Q* caused unpleasure. Freud also explored the "unpleasure" of pain, in which painful past experiences could come to life again in the present alongside affect-laden memories. Memory traces (reminiscences) occurred as qualia or strong quotas of affect that were discharged, causing psychopathology (e.g. hallucinations, hysterical symptoms).

Freud viewed affects and wishful states in terms of primary processes that drove us toward pleasure (satisfaction) and away from pain. Although he spoke of the "Instincts" and the "Ego" in the *Project*, Freud did not use the words "Drive" or the "Id;" Instincts and primary processes in the *Project* were an early description of Freud's later "drives" and the Id, respectively.[32] Freud described these concepts as somatic and biological, and he argued that they played a significant role in our motivations, thought processes, and behavior. Today, in neuropsychoanalysis, the research subsumed under the key category of affect and emotion, include the concepts of "pleasure," "primary processes," "gratification," "reward," and the "Id," and studies in this area emphasize the pleasure, addiction, and reward pathways in the brain and the neurotransmitter Dopamine.

Drives, Dopamine, and Rewards in the Journal *Neuropsychoanalysis*

Dopamine is one of the primary neurotransmitters associated with the pleasure and reward centers within the brain and "as a broadly acting neurotransmitter, is one of the most studied and theorized biological entities in personality neuroscience" (DeYoung, 2013, para. 1). The pleasure pathway/dopamine theory suggests that there are areas in the brain that contain higher densities of dopaminergic neuronal groups and those working in neuropsychoanalysis are attempting to connect the dots between Freud's theories of pleasure, "instinctual chemicals," and these contemporary research findings. One of the founding researchers of the field of

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[32] This dissertation is based on Strachey's translation of the *Project*. However, Solms (2013), and in the forthcoming revised translation of Freud's *Project*, argues that Strachey mistranslated Freud's term *Trieb* as "Instinct," when it should have been "Drive." The importance in this distinction lies in the fact that if Freud meant, "drive," it was the drives that were the internal biological homeostatic processes, not the instincts. See Solms (2013) for more on the differentiation between drives and instincts.

neuropsychoanalysis is Jaak Panksepp (1943-), a psychobiologist who studies emotional and chemical pathways in the brain.

Jaak Panksepp (1943-)

Panksepp, although born in Estonia, grew up in the United States and attended the University of Massachusetts where he graduated with a PhD in physiological psychology in 1967. He spent most of his career as a psychobiologist at Bowling State University in Ohio, and now holds an emeritus position at Washington State's College of Veterinary Medicine. His life's work has been spent investigating the emotional life of primarily rats. Throughout most of his early education, Panksepp was surrounded by research on rats and influenced by the school of behaviorism but he was privileged enough to be able to work outside that paradigm. He felt a strong "sadness" about psychology and its strong behaviorist paradigm throughout most of his career, and in 1987, he even wrote to B.F. Skinner, asking him to "throw his considerable intelligence and reputation behind the development of a hybrid science of psychology [with neuroscience] which has a true integral integrity" (1994, p. 12). About a month later, Skinner replied to Panksepp stating, "A third discipline may very well wish to deal with how the two can be brought together, but that is not my field" (p. 12).

From a popular culture perspective, Panksepp is known as the scientist who "tickles rats" (e.g. Bates, 2013, Bering, 2012, and Panksepp, 2014) because in the 1990s he discovered that rats laughed, they made chirping noises that could not be heard at the level of human audition when he tickled them with his hand. Moreover, the rats "craved" this tickling activity; when he stopped stimulating them, the rats chased Panksepp's hand as they were "self-seeking" this pleasurable stimulation (Panksepp, 2004). Panksepp's research led him to coin the term "Affective Neuroscience" in 1992 and, so, five years after the correspondence, Panksepp created the new "discipline" Skinner had suggested.

Affective neuroscience is the term Panksepp uses to describe his research as one that investigates theories of emotion via neurobiology and imaging methods (Panksepp, 2004). More directly relevant to the field of neuropsychoanalysis, is the fact that Mark Solms invited Panksepp, who was not directly influenced by psychoanalytic theory, to become an editorial board advisor for the discipline's journal in 1999. In light of a general lack of interest in the concept of emotion in the psy-disciplines at the time, because of the cognitive science paradigm, Panksepp remarked that Solms' was one of the first clinicians to recognize his research on emotion circuits in the brain (Ellis and Zachar, 2012, p. 5).

In 1965, Panksepp began his doctoral work under the supervision of Jay Trowill (1939-1983) who had just finished his PhD with Neal Miller of Dollard & Miller (1950), the two researchers who correlated learning theories with psychoanalysis. Working with Trowill provided Panksepp with the opportunity to research outside of the Skinnerian paradigm, and he was able to follow his own research interests, which included "incentives" and "brain reward" systems (Ellis and Zachar, 2012, p. 3). This was critical for Panksepp because he had been highly influenced by the work of Walter Hess (1881-1973), James Olds (1922-1976), and Peter Milner (1919-).

Hess was a Swiss physiologist who won the Nobel Prize in Physiology in 1949, along with Egas Moniz, for mapping parts of the diencephalon (thalamus/hypothalamus) and demonstrating that stimulation of these areas could cause defensive and aggressive behaviors. For example, using electrodes in the brain, they could induce a cat to hiss and hunch its back up ready to attack or make it curl up in a ball and go to sleep, depending on which part of the brain was stimulated. Focusing on Hess's induced rage theory, Panksepp wondered whether it was due to the subcortical stimulation of the primitive brain, or due to a loss of inhibition in the frontal cortex, or a combination of both; he has studied this question his entire career.

In addition to being influenced by Hess, Panksepp was highly attracted to the work of James Olds and Peter Milner who, at McGill University during the booming era of sleep research in the 1950s, accidently discovered that if an electrode was placed in a specific area in the brain of a rat, it would press a lever to continually self-stimulate for pleasure, even at the expense of food and water (Johnston and Olsen, 2012); they had discovered a major reward and reinforcement center in the lateral hypothalamus of the brain.

Drive and Affect Taxonomies in the Journal *Neuropsychoanalysis*

Panksepp merged the findings of Hess's aggression research with Olds and Milner's (1954) reward and self-stimulation theories, and extended them by providing evidence for seven emotional neurochemical systems in the brain, which incidentally correlate with many of Freud's theories on instincts, pleasure, the Id, and gratification (reward). Panksepp has 26 publications in the journal *Neuropsychoanalysis*, which include target and original articles, book reviews, and numerous commentaries, most of which discuss the neurobiology of emotion, his seven emotion systems, and Freud. Accordingly, Panksepp (1999, 2001) refers to his studies on emotion as research on "instinctual Id energies," or the more neuroscientifically palatable, "emotional command systems." and he argues that today the basic Id functions are biological, motivational, evolutionary, and consist of the SEEKING, RAGE, FEAR, PANIC, LUST, CARE, AND PLAY systems. Panksepp uses capital letters to distinguish his theory from other emotion theories, and to make clear that his all caps taxonomy represents the "genetically ingrained brain emotional operating systems," rather than the everyday vernacular (Panksepp, 2004, p. 51). Solms and Nersessian (1999) and van der Westhuizen & Solms (2015) all refer to Panksepp's theories in their own research, which is published in *Neuropsychoanalysis.*

In addition to Panksepp's taxonomy, Ostow (1994) also presented a classification of emotions, suggesting the following categories: 1) feeling (instincts, drives), 2) relief (satiation, gratification), 3) Emotion (motivates one to seek instinctual gratification), 4) threat (a special survival form of affect), and 5) mood (pleasure versus unpleasure linked to attachment and detachment). Ostow correlates these types of affect with Freud's views, particularly his theories of pleasure, unpleasure, and gratification. By following the most recent research on the various functional and chemical pathways in the brain, researchers in *Neuropsychoanalysis* are attempting to expand on Freudian drive (instinct) theory by breaking them down into their more constituent parts than Freud was able to.

Psychological disorders based on drive taxonomies. In addition to creating basic categories of neurological drive processes, Panksepp (2001) suggests that these drive systems can also be correlated with mental illnesses based on stress and social-emotional impoverishment that may occur during infant brain development. Accordingly, his taxonomy can be correlated with various mental health disorders; SEEKING (OCD, Paranoia, Schizophrenia, Addictions), RAGE (aggression, psychopathy, personality disorders), FEAR (generalized anxiety disorders, phobias, worry, PTSD), PANIC (separation distress, depression, pathological grief), LUST (fetishes, sexual addictions), CARE (dependency disorders, attachment disorders, autistic aloofness), AND PLAY (mania, ADHD) systems. Furthermore, Watt & Panksepp (2009) state, "Although depression as a syndrome may eventually be unpacked into several distinct subtypes, all subtypes presumably operate through a fundamental inhibition of the major social emotional systems of the brain—namely, within the PANIC/Separation distress, maternal CARE/Nurturance, LUST/Sexuality, PLAY/Social Joy, and SEEKING/appetitive systems" (p.

29). Moreover, alongside these anatomical systems, norepinephrine, serotonin, and dopamine, when inhibited, are discussed as three of the primary neurotransmitters associated with depression.

Panksepp has theorized that the PANIC/ANXIETY system is based on object loss, separation, and/or grief, which would correlate with Freud's theory of depression and the neurotic symptoms found in hysterics. In *Neuropsychoanalysis*, Blechner (2007) explores three clinical cases of panic/anxiety attacks and argues that these clients are often dissociating fear-inducing thoughts or situations, which then cause physiological symptoms of panic. He questions the current neuroscience of LeDoux (2002) in particular who states that fear and panic often have no connection to any real threat; Blechner suggests that there actually may be a real threat or conflict that fits with Freudian thought (fear of loss of love of the object, castration anxiety, or fear of the superego). When he asks a client about any life difficulties that may be causing the panic, they often say "no," however, over the course of a number of sessions, Blechner often finds something the client has dissociated. For example, a client was hiding an affair from his/her partner and the guilt, worry, shame, and fear of losing his partner was avoided. Once the analyst addressed these feelings through interpretation, these feelings became conscious and the panic attacks and the affair stopped. Blechner's concern is that primary researchers in neuroscience are saying there is no "real" threat and this may cause clinicians to proceed in therapy with this epistemological understanding.

In 1895, Freud stated, "Every observer of hysteria is struck in the first place by the fact that hysterical patients are subject to a compulsion which is exercised by excessively intense ideas…hysterical compulsion is (1) unintelligible, (2) incapable of being resolved by the activity of thought, (3) incongruous in its structure" (p. 348). Freud also suggested that, "excessively intense ideas, which force their way into consciousness too often, and each time gives rise to weeping. The subject does not know why he weeps…he regards it as absurd but cannot prevent it" (p. 348). In studying clients with excessively intense emotions in *Neuropsychoanalysis*, Alexander, Feigelson, and Gorman (2005) gave human subjects, who had post traumatic stress disorder, a list that contained "traumatic" words linked to their personal trauma and used fMRI methodology to find that it was possible to experimentally induce fear and anxiety.

From a contemporary neurological perspective, excessive emotions such as panic and anxiety are the most frequently studied and it has been found that anxiety can be due to an overly sensitive danger-fear response system in the amygdala, brainstem, and thalamic pathways (LeDoux, 2000), and/or from a sudden arousal of the separation-distress system which is correlated to the connections between the amygdala and the periaqueductal gray of the midbrain; all of these are primitive fear areas in the brain (Panksepp, 2001). The FEAR system is an anxiety system correlated with cortisol and stimulation of specific brain areas can lead to flight or freezing in animals and anxiety in humans. Research on the amygdala, which is primarily responsible for flight/fight/freeze behaviors, has established that damage to various parts of the amygdala can inhibit or enhance these behaviors which are directly linked with adrenal gland processes that release stress hormones and neurotransmitters that control these behaviors. The etiology of these brain systems being heightened in panic or anxiety patients is not directly clear, but genetic and environmental interactions (stress and trauma, to name only a few) are being researched as key causes to these systems being in overdrive in the field of neuropsychoanalysis.

In terms of relevance to psychoanalytic treatment, Alexander et al (2005) argue that essentially, psychoanalysis is a process by which the client can control anxious reactions; the reactive emotional responses created by memory traces between the unconditioned stimulus and the conditioned stimulus can be disrupted with talk therapy in a new contextual environment, which can lead to the client having higher threshold of amygdala activation and synaptic remodeling. However, psychotherapy is not just the removal of inappropriate cognitive-affective neuronal connections, it also involves the creation of new connections between dissociated affects and cognitive thought. Thus, the neurological foundations of panic/anxiety in contemporary neuroscience led Alexander et al (2005) to be encouraged about psychoanalysis as a process of change in terms of neuronal plasticity, something Freud had no knowledge of. But in 1895 Freud did argue that talk therapy could assist with healing associative traumas. He stated, "For instance, a man may have run into danger by falling out of a carriage, and driving in a carriage may after that be impossible for him…since the association with danger justifies the link between driving in a carriage and fear. It too [the fear], however, is not capable of being resolved by the activity of thought…Now our analyses show that a hysterical compulsion [fear of driving] is resolved immediately if it is explained (made intelligible)" (p. 348). Those working in the field of neuropsychotherapy suggest that neurological changes that come during the process of psychotherapy are beginning to advance our knowledge of the therapeutic process (Cozolino, 2010).

In a somewhat different vein, the neuropsychoanalysts Davis, Panksepp, and Normansell (2003), created an Affective Neuroscience Personality Scale (ANPS) based on six basic emotional tendencies (three positive and three negative) based on Panksepp's work (1998; 2004). The three positive emotions are PLAYFULNESS (having fun, physical contact, humour, laughter, happiness and joy), SEEKING (curiosity, solving problems/puzzles, engaging in new experiences, feeling able to accomplish anything), and CARING (nurturing, drawn to children and pets and those in need, feeling affection and liking to care for others, and being needed by others). The three negative ones are FEAR (anxiety, tense, worrying, struggling with decisions, ruminating about the past, losing sleep, and not being courageous), ANGER (hotheaded, easily irritated or frustrated that leads to anger, expressing anger verbally or physically, remaining angry for long periods), and SADNESS (feeling lonely, crying frequently, thinking about loved ones or past relationships, and feeling distressed when not with loved ones. The scales for the six emotions studied above were testing the "primitive" emotions, "the ancient mind/brain processes that may serve as a foundation for many "higher" mental attributes and abilities" (Davis, Panksepp, & Normansell, 2003, p. 59). Thus, there is an attempt here to empirically assess some of the drive processes Freud spoke of.

Similar to Panksepp, other researchers have reported parallels between Freud's drive system and the findings emerging from contemporary neuroscience. For example, Andrade (2003) parallels Freud's drive theory with Damasio's neurological theory, which views emotions and feelings as key indicators of drives and instincts. Damasio (1999) differentiates feeling and emotion and argues that affects "are a perception of body states along a number of biological dimensions, chemical as well as macrostructural…this is what causes feelings to be felt but not what causes feelings to be known" (p. 39). More specifically, emotions are associated with biological regulation, "specific behaviors such as freezing or flight-or-fight," and "homeostatic reactions that maintain metabolism: pain signaling; and drives such as hunger and thirst" (Damasio, 2001, p. 781). Furthermore, emotions are objectively observable either behaviorally, or with physiological measures; they are correlated to structures in the hypothalamus, amygdala, and the basal forebrain. Feelings, on the other hand, "are the mental representation of the physiological changes that characterize emotions," and are more subjective than emotions, however, with the appropriate methods, Damasio argues that these too can be studied (Damasio, 2001, p. 781).

Pleasure: The SEEKING, CARE, LUST AND PLAY Systems in *Neuropsychoanalysis*

SEEKING. The pleasure drive systems are a dominant topic in the journal *Neuropsychoanalysis*, and are described as a general appetitive, pleasure seeking, motivational, "drive" system, determined by dopamine (DA) and correlated with biological needs. Seeking behaviors would include, the search for food, water, and warmth, and reward. Panksepp expanded on the work of Olds and Milner (1954) by positing that it is the dopaminergic pathways in the mesolimbic and mesocortical areas of the VTA of hypothalamus that drive this SEEKING system and our need for pleasure. Direct electrical stimulation of this brain area also engages this system, as can drugs, such as cocaine, in both animal and human studies. Furthermore, The RAGE system may often be activated when frustration emerges from a SEEKING system that is not gratified. Glutamate, an excitatory neurotransmitter can activate this system, while opioids can inhibit it.

In line with Freud's work in the *Project*, the biological and adaptive nature of the SEEKING system sounds very similar to Freud's "endogenous needs." Freud stated, "This state [endogenous neurons filling with Q] has a prototype in the experience of satisfaction, which is so important for the whole course of development, and in its repetitions, states of craving which have developed into states of wishing and states of expecting" (1895, p. 361). This corresponds with Wright and Panksepp's (2012) view in *Neuropsychoanalysis* that the SEEKING system is not about the actual gratification of a desire, but the pleasure that comes from the idea that the gratification will come, the point is that the "SEEKING system is chemically or electrically aroused, and the psychological urge evoked is one of positive euphoria accompanied by increased engagement with all of the life-supporting "affordances of the world" (p. 8).

CARE and PANIC. Panksepp (1999) describes the CARE system as an innate brain system that allows mothers to nurture and care for their infants. The PANIC system is activated when this CARE system is not in place or is dysfunctional and is specifically related to separation distress or grief processes, particularly when young animals are separated from their mothers. In animal studies, separation distress is measured by observing the length (time) and strength of distress calls. In the work of Freud there are parallels to this contemporary work, particularly, to Freud's views on depression as object loss. Researchers studying these CARE/PANIC systems explore recent research on the psychophysiology of attachment, which includes neurotransmitter and neuroendocrine processes.

Today, oxytocin is the primary hormone linked to the CARE system in both animals and humans and its role is to promote maternal care and motivation. In short, this system allows for mother-infant attachment. Freud never used the word attachment in the *Project*, but he did discuss the mother-infant relationship in terms of its importance for the survival of the infant and its relevance for the development of associative memory. In terms of attachment theory today, Freud's name may not be the first one to come to mind. Bowlby and the object relation theorists who came after Freud are more widely recognized in contemporary research on attachment, particularly in the studies on the neurobiology of attachment. Nevertheless, Freud can be seen as one of the first attachment theorists.

For example, in reference to the mother-infant bond as a mechanism for survival, Freud notes how important it is for the mother to be able to gratify the child's survival needs via maternal care. Freud stated,

> At first, the human organism is incapable of bringing about the specific action [to gratify hunger by feeding for example]. It takes place by extraneous help, when the attention of

> an experienced person is drawn to the child's state by discharge along the path of internal change [infant cries]. In this way this path of discharge acquires a secondary function of the highest importance, that of communication, and the initial helplessness of human beings is the primal source of all moral motives… The total event then constitutes an experience of satisfaction, which has the most radical results on the development of the individual's functions. (1895, p. 318)

Freud then explains that an association between the mother and the feeling of satisfaction becomes set in the child's memory. The mother then becomes an "object" of satisfaction, and an object that can be "wished" for when endogenous needs arise and need to be gratified. Freud explains that, during infancy the child is incapable of satisfying its own biological needs and, as such, crying becomes a mechanism that alerts the mother to feed and attend to the child. The calls of the crying child are similar to the distress calls Panksepp speaks of; they too are designed to alert the caregiver to some kind of distress. The associations between the child's gratification after being fed and the mother are created quickly, causing make the mother to become the primary wished for object during early development.

In Freud's later works, particularly his Oedipal theory, there is a focus on parent child relationships as he suggested that children have a variety of emotions linked to their same and opposite sex parents. These relationships were explored via the concepts of internalization, introjection, and object choice, to name only a few, discussed earlier in this dissertation. Moreover, Freud's structural model established the idea that conflicts could arise within children as they navigate the three psychic agencies (Id, Ego, Superego) and as they develop within a dynamic system of parental forces. The contemporary research on the neurobiology of attachment looks very different from that of Bowlby and Freud, primarily because of some neurological advances and our current ability to study both normal and brain damaged subjects.

In *Neuropsychoanalysis*, research on attachment has explored the neurobiology of projective identification, and object relations, for example, and investigates attachment disruptions that occur after brain injury or disease (Clarici & Giuliani, 2008; Edlow, 2014; Greatrex, 2002; Hofer, 2014; Milrod, 2002; Roeckerath, 2002; Salas, 2012; Thibierge & Morin, 2010; Yeates, Henwood, Gracey, & Evans, 2006, and Yovell, 2008). In addition, Njiokiktjien, Verschoor, and de Sonneville (2012) investigated Freud's theory of the mother as an "object" of satisfaction for the infant and found parallels between the SEEKING system and Freud's drive theory of object seeking.

In surveying the neuroscience of object relations, the "self" can be seen as a mechanism related to introjection and attachment in terms of cognitive and affective neurological pathways. One of the biggest advances in neuroscience that has assisted neuropsychoanalytic research occurred in the 1990s when Gallese and Rizzolatti discovered mirror neurons. These neurons are in the frontal lobes and fire not only when we execute a specific action, but also when we observe this action in others. These neurons are hypothesized to be key for social and relational attachment (Gaensbauer, 2011). In many of these attachment studies presented in *Neuropsychoanalysis* the patients are said to have "disorders of the self," and include borderline personality (Brockman, 2002), PTSD (Yeats, 2009), autism (Singletary, 2015), or disordered object relations because patients misidentify people they know (reduplicative amnesia) due to focal point lesions or, in the case of schizophrenia, a lack of inter-hemispheric communication. In addition, brain injuries leaving clients with anosognosia, delusions, and confabulation, often alter the self in relation to others, to one's own body, to one's own life narrative, that is, these inter- and intra- personal relational attachments often become distorted and difficult for both the client and those they interact with (Feinberg, 2010). Finally, mother-infant dyad studies assessed the ability of mothers to regulate their baby's emotions (salivary cortisol measured for stress levels) based on their attachment abilities (M. Mello, Serafim, Moraes, Miranda, Soussumi, and F. Mello, 2011).

LUST. The LUST system includes the search for sex and companionship and oxytocin, as well as the male and female hormones, have been found to be primary neuromodulators. Panksepp (2004) believes that the nurturing CARE system probably arose from circuits that originally mediated sexuality. In *Neuropsychoanalysis*, Pfaff, Martin & Kow (2007) explore the brain mechanisms associated with Freud's theory of libido. Based primarily on meta-analyses of animal studies, Pfaff et al suggest that there is a general arousal system in the central nervous system which plays a primary role in sexual behavior, fear, hunger, motivation, thirst, pain, essentially, Freud's drive system. They argue that because sexual behavior, along with these other specific drives, are part of a generalized arousal system in the CNS, it makes sense that general arousal in one drive, could lead to activation of another drive. Moreover, there is now neuroscientific support for the idea that fear can induce sexual feelings (Dutton and Aaron, 1974)[33] because of the neuroanatomical, biophysical, and molecular connections in the brain. In addition, these neuroscientific findings would also support the findings that SSRI antidepressants, the medication that work on serotonergic pathways to assist in enhancing mood, can also cause sexual inhibition and lack of sexual desire as a side-effect (deBoer et al., 2014).

PLAY. The PLAY system is viewed as a vital social engagement system and Panksepp's "laughing rat" studies would fall into this category. In the *Project*, Freud's only discussion of

[33] Dutton and Aaron (1974)'s classic study "Some Evidence for Heightened Sexual Attraction under Conditions of High Anxiety" found that males on a fear-arousing suspension bridge were more attracted to their female interviewer than males on a non-fear inducing bridge.

laughter was in relation to one of his client's, Emma, who entered a shop when she was twelve years old. Upon her arrival, she saw two shopkeepers laughing, at her clothes she assumed, and since that time she has been unable to enter shops alone. Freud hypothesized that the laughter actually triggered a painful memory that Emma had repressed, that of an earlier sexual assault by one of the shopkeepers. Thus, laughter at this time was not a formal theory for Freud, but an example of how unconscious painful memories could be triggered. Much later, in 1905 in "Jokes and their Relation to the Unconscious," Freud's discussions of humour and laughter related more directly to defence mechanisms. Freud differentiated three types of cognitive humour, that like the theories in neuroscience, also involve comparisons; jokes (involves three people- two laughing and the third, who is the butt of the joke, becomes the victim of the teller's unconscious aggressive or sexual drives – Id comparison), the comic (involves two people and tend to be conscious expressions of aggression i.e. two people making racial comments in a humorous manner – Ego comparison), and humour (directed at oneself – Superego comparison). In addition, the use of humour as a defence to threats to one's identity is also confirmed in the neurological research.

In *Neuropsychoanalysis*, Gordon, Panksepp, Dennis, McSweeny (2005), using fMRI methodology, exposed subjects to crying and laughter imagery and asked them to imagine the corresponding bodily and emotional feelings. They found that, "The brain areas activated during laughter-happiness and during crying-sadness (e.g., left basal ganglia, right insula, bilateral caudate) were different from the control condition, walking-neutral (e.g., right parahippocampal, left inferior frontal). These data are consistent with the idea that arousal of the instinctual emotional action systems can facilitate the expected types of affective change and that they result in a similar overall pattern of neural responses" (p. 217). Moreover, this study confirms the activation of subcortical areas of the brain for instinctual emotion activation, which may support Panksepp's PLAY system hypothesis.

Holland (2007), like Panksepp argues that laughter is a universal innate emotion, however, in its different forms, different parts of the brain are activated. For example, most often the motor system is activated during the physical movements of laughter, thus, the brainstem is stimulated as facial expressions, respiration, and autonomic reactions occur. Areas of the motor cortex become excited alongside the release of dopamine during bouts of laughter, which correlates to Freud's belief that laughter was a tension release, a way to expend excess built up energy within the psychic system, thus providing the feeling of pleasure. Neuroscientists speak of the "three stages of laughter," that all involve surprise (novelty, incongruity between lead in and punch line), coherence (comprehending the joke), and finally, exhilaration or a feeling of mirth (the disinhibition that comes with laughing, smiling – the physical responses).

Avoiding Unpleasure

Mark Solms (1961-)

While Jaak Panksepp and many others working in the field of neuropsychoanalysis, research the seven emotional systems, where there is an emphasis on the seeking of pleasure and rewards, Mark Solms' research focuses on those who are strongly motivated to avoid unpleasure; his work resonates with Freud's theories of repression, wishful thinking, and defence. In addition, much of Solms' neuropsychology research is directed toward dreams.

Mark Solms and his brother, two years his senior, were born in Namibia on the Skeleton Coast. His father worked for a diamond mine owned by De Beers, and his childhood was spent at yacht clubs and boarding schools. Solms' interest in becoming a neuropsychologist began when his older brother fell off the roof of the yacht club and cracked his skull, leaving him with permanent brain damage (Schwartz, 2016). Following the incident, newspaper headlines questioned why a four-year old and a six-year old had been left alone while their parents went sailing. Moreover, Solms' family's continued denial of their eldest son's mental deficits left Solms feeling like there was "a family code of silence" on the issue of what happened to his brother, and Solms' mother often made denial-like statements like "He's just like me-he's not an intellectual" (Schwartz, 2015, p. 90). Solms has gone on to spend his life, to date, studying psychological deficits in clients with brain damage. Interestingly, much of his research focuses on issues that he learned about first hand within his own family dynamic after his brother's accident; memory, emotion, and defence mechanisms such as repression and denial.

In 1979, Solms was accepted into the psychology program at the University of Witwatersrand in Johannesburg. When he arrived at university he, like Panksepp, was very disappointed to find that he would not be learning about people and the human experience; the emphasis was on behaviorism, rats, mazes, and learning theories (Schwartz, 2015). Consequently, Solms transferred from psychology to neuropsychology, the area in which he earned a BA (1985), MA (1987), and PhD (1992). But, unlike Panksepp, Solms was highly influenced by Freud and psychoanalysis.

Solms first read Freud's *Project for a Scientific Psychology* (1895) in 1983 after attending an undergraduate philosophy seminar on it. He lost himself in Freud's *Project* over a three-day long weekend while housesitting for friends (Schwatz, 2015). The *Project* prompted Solms to go on to read anything and everything Freud wrote. As he was reading the *Project* and Freud's other works in his spare time, Solms' academic work would likely have focused on the classic works in neuropsychology, including Broca's and Wernicke's localization studies, among many others. Immersing himself in the world of psychoanalysis and neuropsychology simultaneously, Solms gained a clear understanding of the historical clinico-anatomical method used by these historical figures. But because Freud, rather than Broca and Wernicke, went on to focus on psychological processes, Solms became much more interested in Freud's method and his ability to make such accurate diagnoses. In a number of Solms' (Solms, 2000; Gamwell and Solms, 2006) publications, he writes admiringly about Freud's 1925 "Autobiographical Study," where Freud stated,

> I published a number of clinical observations on organic diseases of the nervous system… I was able to localize the site of a lesion the medulla oblongata so accurately that the pathological anatomist had no further information to add…The fame of my diagnoses and of their post-mortem confirmation brought me an influx of American physicians, to whom I lectured upon the patients in my department in a sort of pidgin-English. (p. 12)

But by the time Solms was in university, during the 1980s and 1990s, advances in neuropsychology had come a long way; the ability to explore brain functioning in living patients had arrived.

In the 1930s, the EEG (electroencephalography) was introduced, allowing researchers and doctors to observe dynamical processes in the brain via electrical signals. Its use became especially widespread after the Second World War to assess traumatic brain injuries (Solms and Turnbull, 2011). In addition, the EEG became the primary method of research on Freud's dream theories in the 1950s and 1960s, after the discovery of REM sleep and the sleep cycle by Aserinsky and Kleitman (1953). In 1968, Cohen fashioned the MEG (magnetoencephalography), an imaging technique that allowed for arrays of superconducting quantum interference devices (SQUIDS) to pick up the magnetic fields produced bye the electrical currents in the brain. Up to this time, magneteco-electrical currents were the only option to understand the functionality of the brain during various activities. In 1979, just as Solms was entering his undergraduate program, Godfrey Hounsfield (1919-2004) and Allan Cormack (1924-1998) received the Nobel Prize for Physiology or Medicine for creating a machine that could take x-rays of the brain in three dimensions, it was called Computed Axial Tomography (CAT scan). This method was the first to allow diagnosticians to see soft tissue masses/tumors in the body. In the 1990s, MRI (magnetic resonance imaging), and particularly fMRI (functional magnetic imaging), techniques emerged allowing clinicians to "directly observe neurodynamic processes under changing psychological conditions" (Solms and Turnbull, 2011, p. 3).

However, even during his years training in neuropsychology, with the latest research and technology, Solms was feeling very disappointed that neuropsychology was more about the use of standardized tests, for example "can you draw a clock?" or "can you identify these three animals?" than it was on exploring clients' personality, emotions, and motivational systems, particularly after brain injury (Solms, 2015). So in the 1980s Solms moved to London while he was finishing his PhD to teach at University College London and work clinically at the Royal London Hospital in the Neurosurgery department. Because Solms' PhD was clinical, this move to London afforded the ability to work directly with neurologically impaired clients, but Solms' true motivation for the move to the UK was to pursue psychoanalytic training at the London Institute for Psychoanalysis (Schwartz, 2015).

Today, Solms is recognized as the founder of the field of neuropsychoanalysis, and his method integrates contemporary neuroscience and psychoanalysis and is very reminiscent of the clinico-anatomical method used by Broca and advocated by both Charcot and Freud during his early days as a neurologist. Solms' however has at his fingertips the technology these historical figures did not, and he is able to work psychoanalytically with clients who have brain damage while also having access to their brain imaging records. In addition to his own clinical work and research, Solms commutes between South Africa, London and New York on a monthly basis to learn from and with other neuropsychoanalysts. In so doing, he presides over numerous case conferences, presents research, and attends a variety of case study groups.

In one of these groups, in an apartment in Manhattan, a group of neuropsychoanalysts meets every four weeks to discuss cases (Schwartz, 2015). The conversations revolve around the most difficult cases for these professionals, who use talk therapy as their preferred method of treatment. The clients discussed in this circle are not the most neurotic, the most manic, or those with schizophrenia; these clients have brain damage. The patients have a variety of symptoms: depending on which part of their brain is damaged, they could have traumatic brain injury, seizure disorders, stroke, tumor, or progressive neurocognitive disorder, such as Korsakoff's syndrome, or Alzheimer's disease. Solms and the group have worked with them all. Many of these clients often have what Solms (2015) calls "core syndromes," that often include various paralyses, aphasias, amnesias and confabulatory memories.

Although Solms started these monthly group case sessions in New York in 2001, two years prior he formally created the field of neuropsychoanalysis. In so doing, Solms and Turnbull (2011) argue that, "We expect our psychodynamic experts to be knowledgeable about the brain, and we expect our brain experts to be knowledgeable about the psychology of the patient" (NPSA website). This quote relates primarily to the methodology used by this field, a methodology that makes it not only unique, but also reminiscent of Freud's early clinical work. Solms (2011) also argues that neurological patients, with focal brain lesions, "enable us to correlate our psychoanalytic inferences with definite neuroscientific ones. Structural neurological lesions provide infinitely more precision than do psychopharmacological manipulations, considering all the interactive vagaries of neurotransmitter dynamics" (p. 7). Because there is definitive anatomical damage, there is a more accurate correlation between the subjective thoughts, feelings, and behaviors of a client and the ability to make "clinic-anatomical" correlations (Solms, 2011, p. 8). Thus, Solms (2011) has developed "a method that offers a respectable degree of experimental control, a reasonable degree of neuroanatomical localization, excellent construct validity, and a direct observational window into the subjective life of the brain in a reasonably naturalistic setting" (p. 11). But how can one work analytically with these types of clients? This was a question asked by a neuroscientist and science writer for *Scientific American* who was invited to sit in on one of the group case meetings (Shwartz, 2016). Solms' answer was "We have an aversion to being with people who look funny and talk funny and act funny and are paralyzed. So to take those patients seriously, to really try to understand: What are they going through? How do they feel? And what is it like to know what they don't know. That's the thing we must do" (Schwartz, 2015, p. 136).

Consequently, Solms' and the clinical neuropsychoanalysts' case studies read like Broca's patient "Tan," or Penfield's 21-year old epileptic client "J.S," or Milner's long-suffering, "H.M." For example, once case discussed in the group focused on a client who had had a stroke at the age of 38, leaving him with Broca's aphasia and a partial paralysis of his right side. He could only say one word, "Laminada," and he repeated this word over and over as his only form of verbal communication. In the 1890s, John Hughlings Jackson called these "Recurring Utterances" (Schwartz, 2015, p. 139), and Freud's 1891 book *On Aphasia* he correlated these utterances with the "self" when he argued that hearing one's own vocalizations allows one to understand themselves from an external “object” perspective. The external is then internalized, which allows for self-reflective thought.

Consequently Freud, like Jackson, agreed that the brain was not a collection of isolated functions, as Broca and Wernicke had hypothesized. Later in the *Project*, Freud elaborated on this by suggesting that speech could play a role in making the unconscious conscious, he stated, “Thus, if the mnemic [memory] images are of such a kind that a part-current can go from them to the sound-images and motor word-images, then the cathexis of the mnemic images is accompanied by information of discharge, which is an indication of quality and also accordingly an indication of the consciousness of the memory…This is conscious, observing thought” (1895, p. 365).

Those working in neuropsychoanalysis would not agree that repetitive utterances are random neurological artifacts, they encourage clients to vocalize and/or write their words and thoughts down on paper so they can communicate with the analyst. While speech therapists help these client’s recover their words, neuropsychoanalysts help them recover their sense of self. Along with various forms of aphasia, most often occurring after left hemisphere brain damage, Solms and those working in the field of neuropsychoanalysis also work with clients who have memory disorders similar to that of H.M.

Avoiding Unpleasure with Defensive Processes: Confabulation, Anosognosia, & Addiction

In the 1950s, using Penfield’s “Montreal Method,” which allowed patients to be awake during brain surgery, Dr. William Beecher Scoville (1906-1984) completed a bilateral temporal lobectomy on Henry Gustav Molaison (HM), to cure him of his intractable epilepsy. Although successful in significantly reducing HM’s seizures, the surgery removed both his left and right hippocampi, leaving him with profound episodic memory loss. Although he still had memories of his life before the surgery, and could learn new things via procedural memory, H.M. could not consciously remember current day-to-day events, and he would often confabulate his memories to fill in any missing gaps. Brenda Milner documented HM's memory loss over many years and demonstrated that there were various types of memory, and, thus, many types of memory loss. Researchers in neuropsychoanalysis have clearly benefited from the work of Broca, Penfield and Milner, thus allowing those in the field to study and work with clients who have aphasias, amnesiac confabulations, and anosognosia, and addictions.

Avoiding Unpleasure: Confabulation Studies in *Neuropsychoanalysis*

Confabulation is a symptom found in clients with particular types of brain damage or neurological deficits affecting the ventromesial portion of the frontal lobes. These patients often have memory losses and, as such, will "fill in the gaps" of their lost memories with untruths, false beliefs, and/or inaccurate information (Kaplan-Solms and Solms, 2000). Studies on the causes of confabulation are numerous, however, in one example Turnbull, Jenkins, and Rowley (2004) explored the content of confabulations to seek out patterns. In so doing, they used the psychoanalytic case data from three neurological patients and found that these clients' confabulations were biased emotionally toward the positive (80%), which according to Turnbull et al, fell in line with other studies of this nature (e.g. see DeLuca, 2000). Moreover, along with a strong element of pleasantness, the client's confabulations also had hints of wish fulfillment. For example, one client believed that the hospital ward was a cruise ship and that he was in the Caribbean, while numerous times a day, another client believed that it was 5 pm, the time his wife visited. Similarly, Tallberg (2007) provided an analysis of four clients with dementia to explore confabulation of memory as an unconscious process with a bias toward positive self-image.

In neuropsychoanalysis, patients who confabulate significantly more often with positive wishes or falsely positive realities, versus more negative, may be important in light of Freud's idea that we seek pleasure but also avoid unpleasure. In the *Project*, Freud posited that the human beings were pleasure seekers, but he also noted that we avoid unpleasure, he stated, "Since we have certain knowledge of a trend in psychical life towards avoiding unpleasure…In that case unpleasure would have to be regarded as coinciding with a raising of the level of Qή or an increasing quantitative pressure… Pleasure would be the sensation of discharge" (p. 312). For Freud, both emotion and wishful thinking produced high levels of *Q* within neurons, which lead to unpleasure, he stated,

> The residues of the two kinds of experiences [of pain and of satisfaction], which we have been discussing, are affects and wishful states wishful states. These have in common the fact that they both involve a raising of Qή tension in ψ-brought about in the case of an affect by sudden release and in that of a wish by summation. Both states are of the greatest importance for the passage [of quantity] in ψ, for they leave behind them motives for it, which are of a compulsive kind. The wishful state results in a positive attraction towards the object wished-for, or, more precisely, towards its mnemic image; the experience of pain leads to a repulsion, a disinclination to keeping the hostile mnemic image cathected. (1895, p. 321)

The findings that clients who confabulate their memories, making their lives seem more positive than they are in reality, may lend support to Freud's theories of defence and wishful thinking, both mechanisms that can help one avoid the unpleasure of difficult life circumstances. A similar hypothesis occurs as one reviews the research on anosognosia.

Avoiding Unpleasure: Anosognosia Studies in *Neuropsychoanalysis*

From the Greek words "without-disease-knowledge," Anosognosia often results from damage to the right hemisphere, more specifically, the parietal lobe or the right fronto-temporal-parietal lobe. These patients may also have some form of motor paralysis (hemiplegia), blindness on one side of the visual field (hemianopia), unilateral neglect (loss of awareness of left or right field), memory loss, or aphasia. Alongside many physical difficulties, one of the primary psychological symptoms of this disorder is the denial of the physiological deficits, even in the face of a catastrophic hemiplegic paralysis.

In some ways, while hysteria became *the* disorder of psychoanalysis, anosognosia has become *the* disorder of neuropsychoanalysis with many studies investigating this syndrome as it relates to psychoanalytic defense mechanisms such as denial, wishful thinking, rationalization, projection, and reaction formation (Fotopoulou, Pfaff, & Conway, 2012; Fotopoulou, Solms, & Turnbull, 2004; Ownsworth, 2005; Solms & Turnbull, 2002; Turnbull, Berry, & Evans, 2004; Turnbull, Jones, Reed-Screen, 2002). According to Turnbull,

> These defensive explanations for the patient's inability to move the paretic limb are classified by Ramachandran (pp. 153-155) in direct accordance with Anna Freud's (1936) classic scheme: "I can move my left arm" (denial); "I have arthritis in my shoulder and it hurts" (rationalization); "this paralyzed arm belongs to my brother" (projection); and finally, the claim that a table could be lifted higher with the paretic left arm than with the normal right arm (reaction formation). (1999, p. 270)

Similarly, Yeates, Hamill, Sutton, Psaila, Gracey, Mohamed & O'Dell (2008) interviewed six clients with anosognosia, theorizing that their lack of awareness of their disability after brain injury was a form of repression. Although many of these clients deny that they have a disability, Morin, Thibierge, Bruguiere, Pradat-Diehl, and Mazevet (2005) studied clients who's limbs became "their husband's hand" or "their daughter's leg," thus the disorder in memory is more than just a denial of their disability, but a connection to or defence of an important relational object, which would be an important part of the psychoanalytic discussion.

Interestingly, even the caregivers are prone to denying their loved ones deficits. Segal (2013) found that caregivers for clients with dementia commonly deny their partner's deficits in a way to "defend against recognizing emotionally painful deficits" (p. 87), and Silberfeld (2003) discussed a case of duplicative paramnesia (loss of awareness of other people being who they say they are) in a client due to brain tumor. This was seen as a defence against a loss, a form of denial or grief, similar to those who deny their own physical disabilities.

Finally, in a study with clients, who in Freud's day would have been classified as hysterics, Northoff, Bogets, Leschinger, von Schmeling, Lenz, Heinzel, Scheich, & Boker (2002) studied 18 catatonic patients, who were in post-acute states, but had underlying disorders such as unipolar depression, bipolar depression, and schizoaffective psychosis. Catatonia is considered to be a form of "sensori-motor regression reflecting a basic somatic defense mechanism…an immobilization by the anxieties" (p. 149). Using fMRI imaging and affective scales, it was found that catatonic clients had a lack of social contact, lower self-esteem, and lowered emotional arousal, than non-catatonic psychiatric controls, and healthy controls. More directly, they found that clients with catatonia syndromes had more right orbitofrontal alterations or dysfunctions. Their overall goal was to correlate subjective symptoms with activation of specific brain areas to better understand this form of somatic defence mechanism.

In connection with these studies that tend to support Freud's theory of primary defence, hemispheric differences have also been explored. Depending on which side of the brain and injury occurs, a client's post-injury personality, demeanor, and mood may be either more positive or more negative. In general, since the 1950s, it has been documented that clients with left or right hemisphere damage have different emotional responses. These findings suggest that the hemispheres work together to process sensory information that leads to emotional comprehension and reactions.

Commonly the right hemisphere is dominant for negative emotional reactions and, when this hemisphere is damaged, responses may less negative and more manic or indifferent. Clients with this type of damage may minimize their disability or deny motor paralyses because of their inability to have negative emotions anymore. In addition when the right hemisphere is damaged, it is difficult for these clients to understand emotional verbal or facial expressions and non-verbal communication. Alongside the decrease in emotion or negative affect, these clients have corresponding weakened autonomic nervous system activation after the presentation of emotional stimuli. The right hemisphere is correlated with unconscious processing, automatic fight or flight responses, and "Emotionally relevant stimuli can be detected, processed, and learned without conscious awareness by a right-hemisphere subcortical pathway, mediating unconscious emotional learning" (Gainotti, 2005, p. 78).

On the other hand, the left hemisphere is dominant for conscious control and analysis of emotional processes and conscious learning. Damage to this side of the brain results in an inability to feel pleasure (Gainotti, 2005) and may also be responsible for higher levels of emotional negativity than control groups (Tondowski, Kovacs, Morin, and Turnbull (2007) and neuropsychologist and psychoanalyst, Allen Schore (2009), is even more specific stating, "I suggest that the ongoing paradigm shift across all sciences is from conscious, explicit, analytical, verbal, and rational left brain to unconscious, integrative, nonverbal, bodily-based emotional processes of the right brain" (p. 21).

Avoiding Unpleasure: Addiction Studies in *Neuropsychoanalysis*

Freud believed that as we grow and develop, we learn how to gratify our own needs, to differentiate wishes from reality, and to control our emotions using cognitive secondary processes. But, what happens when this developmental process goes awry or when brain damage occurs? And what happens when we have painful memories, fantastical wishes, or strong emotions that cannot be diminished through cognitive secondary processes?

Freud argued that this resulted in hysterical symptoms and/or a desire to avoid the painful thought, ideas, and/or emotions, he stated, "Here we have primary wishful attraction and primary defence [fending off]…It is harder to explain primary defence or repression-the fact that a hostile mnemic image is regularly abandoned by its cathexis as soon as possible. Nevertheless, the explanation should lie in the fact that the primary experiences of pain were brought to an end by reflex defence" (1895, p. 322). It is the fending off of these intense ideas and/or emotions that Freud speaks of that may correlate with the neuropsychoanalytic studies on confabulation and anosognosia, particularly his statement, "The emergence of another object in place of the hostile one was the signal for the fact that the experience of pain was at an end, and the ψ system, taught biologically, seeks to reproduce the state in ψ which marked the cessation of the pain" (1895, p. 322).

Neuropsychoanalysts have explored the relationship between the drive systems, wishes, and addictions, and they are also interested in finding out whether drugs or alcohol can act as a replacement object for hostile memories so that painful emotions can be avoided. For example, Khantzian (2003), integrated a clinical vignette with addiction science and stressed that substance use disorders are not just broken dopamine/limbic systems or drive systems out of control, they are correlated with suffering. In light of this he considers the empirical and clinical data on the self-medication hypothesis, the idea that clients self-medicate to avoid unpleasant emotions. Similarly, research by Johnson (2008, 2009, and 2010) in the journal found support for this idea by studying psychoanalytic clients with addictions, and thus, taking "a neuropsychoanalytic approach, which means that the neurobiology of the patient is taken into account in the interpretations made" (Johnson, 2008, p. 181). In the case of working clients using drugs or alcohol, understanding the culture of substance abuse and addiction is just as important as understanding the neurobiology of addiction.

Johnson (2008, 2009, and 2010) has studied addiction as both a coping mechanism for clients to unpleasant emotions, but also as a wishful process in his research on "drug dreams." He argued that the mesolimbic-mesocortical dopaminergic system is activated during dreaming, and this becomes upregulated by the use of drugs, thus these clients have an abnormally strong wish or desire for their substance of choice. In addition, Colace (2004) and Colace, Claps, Antognoli, Sperandio, Sardi, & Benedetti (2010) also examined the "drug dreams" of more than 70 subjects in three studies and hypothesized that these types of dreams emerged from a "drive-type" process in the limbic system. Colace (2004) found that clients in psychotherapy who were abstaining actually had an increase in "drug dreams," based on a "drug-craving frustration" or wish (p. 167).

Overall, the goal of these specific studies on addiction is to explore the idea of substance use as mechanisms to avoid unpleasure, and to understand what happens psychologically when the drive system in these clients is put to the test during abstinence. In addition, these researchers integrate qualitative and quantitative methods to make clear the neurological affective-motivational systems alongside the psychological processes occurring both inside and outside the clients' dreams. In so doing, the case studies/reports were included to provide a clinical picture alongside the neuroscientific findings that suggest that a SEEKING system, similar to Freud's drive theory, does exist and that "drug dreams" may be correlated with Freud's theory of wishful thinking. Moreover, the idea that drugs and alcohol can be used to temporarily repress unpleasant thoughts and memories emerges as a theme in *Neuropsychoanalysis*. However, researchers are also trying to understand which parts of the brain are involved in repression in clients who are not substance users but have a history of trauma.

Avoiding Unpleasure: Trauma Research in *Neuropsychoanalysis*

In 1895, Freud considered the correlation between unpleasurable affect and repression, he stated,

> It may already be suspected that it is this unpleasurable affect, which puts repression into operation. We have already, indeed, assumed the existence of a primary defence which consists in the current of thought being reversed as soon as it comes up against a neurone the cathecting of which releases unpleasure. The justification for this [hypothesis] arose from two experiences: (1) that the cathexis of this neurone was certainly not the one that was being sought for, when the thought-process aimed originally at establishing a situation of ψ satisfaction; (2) that when an experience of pain was brought to an end by a reflex, the hostile perception was replaced by another. (p. 350)

Research on repression in *Neuropsychoanalysis* was presented by Tolchinsky (2014), who explored post-traumatic stress disorder and correlated clinical subjective observations with neurophysiological research on the hippocampi's inability to encode the memories, thus causing a form of repression, and Yovell (2000) explored traumatic memories as a form of PTSD in Freud's theory of hysteria and discussed this in relation to research found in neuroscience today.

Furthermore, Caine (2009) discussed two clients who had lost their mirror self-recognition due to a brain injury as she theorizes that specific parts of the brain may be responsible for the subjective experiences that emerge from primary process systems and defensive repression behaviors.

Also, dissociation and splitting, as forms of repression were studied by Wolk, Savoy and Blaise (2012), and Saporta (2003) discussed four clinical psychoanalytic cases of clients who had encountered sexual abuse and trauma in their early lives. He argued that the frontal lobes could inhibit emotion and the recall of traumatic memories. These research findings, on the ability of the frontal lobes to inhibit emotion, are reminiscent of Freud's primary and secondary process systems, in which the secondary system could regulate primary system emotions. Moreover, this research is also recalls Freud's notion that painful emotions could block memory and also cause cognitive failures.

Primary and Secondary Processes in *Neuropsychoanalysis:* The Prefrontal Cortex (EGO and the Limbic System (ID), respectively

These seven emotional systems are "primitive systems" and strongly affiliated with the limbic system, primarily the amygdala, cingulate, frontal and insular areas, and have been identified via brain stimulation studies on animals. There is also confirmation that there is a constant dialogue between these emotional subcortical Id systems and the higher cortical brain processing systems that may assist in activating or inhibiting our many emotions. As part of his emotion taxonomy, Panksepp (1999) also differentiates primary, secondary, and tertiary Processes; similar to Freud, Panksepp's primary process emotions arise from biological needs arising from the "ancient" subcortical limbic system, while secondary processes are correlated with neocortical brain areas and include emotional learning, both classical and operant. Tertiary cortical processes are linked to cognitive-affective processes that include memory, rumination, and emotionally charged thought processes.

LeDoux (1996) argues that from an evolutionary perspective, the neuronal pathways from the amygdala to the prefrontal cortex are like super speed highways, sending emotional information outward into the frontal cortex from the amygdala. However, the pathways from the prefrontal cortex back to the amygdala are very small and slow, thus, making our ability to modulate our emotions difficult. Similar to Freud and Panksepp, LeDoux theorizes that the brain is comprised of a two-tiered system that includes a high road and a low road. The low road stems from the limbic system, particularly the amygdala, and is responsible for unconscious and fear processing systems. The high road, in the prefrontal cortex, allows for conscious processing, current attention, and memory.

In the *Project*, Freud argued that a bound system occurred when a neural network was highly cathected, that is, it had a high amount of total energy *Q*, but most of the energy was bound or stored within individual neurons; many neurons were partially cathected and energy was relatively evenly distributed throughout the network, thus allowing for cognitive secondary processing. In contrast, an unbound system occurred when *Q* moved quickly in and out of the system, discharging along paths containing few neurons. In this case, individual cells hypercathect often and the overall network is a low energy system because *Q* discharges out of the system before being able to be distributed widely throughout the network.

Freud suggested that it was the undeveloped primary process system that was responsible for excessive emotion and hysterical symptoms. In describing the relationship between primary (unbound) and secondary (bound) processes, Freud argued that as we developed we moved from being primary processes beings, who needed our parents to gratify our endogenous needs, to secondary processors, able to learn to gratify our own needs, cognitively process information, and control our emotions. For Freud, secondary processes represented the ego and were inhibitory, that is, they were able to inhibit primary processes, which may have consisted of painful thoughts, emotions, and memories by creating a side-cathexis as neuronal energy flowed within a network of connected neurons.

Moreover, Freud also hypothesized that "chemicals" played a role in hysteria when he stated, "We try to account for it [hysteria] by assuming the presence in them of a general abnormal sensitivity to stimuli... as if in such patients certain organs of the brain which serve to transmit stimuli were in a peculiar chemical state…or as if these cerebral organs had withdrawn from the influence of higher inhibiting centres…"(1986b, p. 216). Today, Freud's primary and secondary inhibitory processing systems fall in line with the current research on the relationship between the limbic system and the prefrontal cortex, respectively.

Recent research on the prefrontal cortex demonstrates that this part of the brain can inhibit or suppress these emotional memories, thus supporting subjective reports of fragmented and lost memories related to past traumas (Saporta, 2003). Additionally, the anterior cingulate cortex (ACC), which lies between the limbic system and the prefrontal cortex, has been found enhance conscious awareness but also to inhibit emotive processes (Stevens, 2016). Furthermore, Zuniga (2015) described a client with Klüver-Bucy syndrome (a form of brain damage that can include memory loss), who presented with strong primary process behaviours, such as asking sexually inappropriate questions, suggesting that damage to her frontal lobes had inhibited her ability to control her impulses. Solms' (2000) own research explored the ventromesial prefrontal cortex (VMPC) as the part of the brain that inhibits impulsivity and the limbic system and allows for decision making and other executive functions, and parallels this to Freud's idea of "binding," where energy was bound (spread out among many neurons) thus, allowing for secondary processes (cognitive thought) to prevail over primary process actions. Clients with damage to the VMPC demonstrate a lack of inhibition of the limbic system and they confabulate with biases toward the positive and towards wishful thinking.

Similar to Freud's view that the symptoms of schizophrenia were correlated with primary processes, that is, the "ego fails to repress the unconscious," Özkarar, Göktepe, and Canbeyli (2008) found that there was a "failure of the inhibitory functions of the left frontal lobe," partially due to the memory impairments and the loose associations that emerged from the word association tests (p. 197). Wilner and Aube (2014) reviewed the case of a client with encephalitis from a psychoanalytic perspective, arguing that this disorder caused the client to present with a loss of memory and cognitive processes (Ego functions) and an increase in the regressive infantile behavior of the Id (kicking, spitting, biting). Finally, Kovac, Stock, and Bernert (2011) presented a qualitative case study of a child with a brain injury where regression, projection, and introjection were prominent behaviors; secondary cognitive processing had diminished.

Further, in *Neuropsychoanalysis*, Busch, Oquendo, Sullivan, and Sandberg (2010) explore the recent research in neuroscience on panic and present an integrated model of panic disorder which suggests that both genetics and early life trauma may leave one with an and argue that both biology and environmental factors can cause serotonin and norepinephrine neurotransmitters to malfunction. This deficit comes with genetic and neurochemical foundations, which can cause overly sensitive fear (amygdala, prefrontal cortex, hippocampus) and/or separation-distress systems, or a hypervigilant suffocation alarm system (for example, an intrusive parent/person, being controlled by someone, the feeling of being trapped), all of which can cause the physical symptoms of panic. They cite fMRI studies that suggest that the prefrontal cortex may be inhibited and therefore unable to tame emotional signals coming from limbic system pathways.

Psychologically, increased aggression and perceived danger are also associated with a weakened Ego and a strong Id. In light of this, Busch et al (2010) suggest that medication can be used to calm the limbic system (decrease irritability and decrease the feeling of danger from separation or suffocation, thus allowing for attachment to therapist), while psychotherapy can assist strengthening the ability of the prefrontal cortex to better modulate the emotional systems (decreasing catastrophic fears of anger, abandonment, and abandonment (p. 75). Busch (2010) et al also noted that the separation and suffocation systems align with Freud's theories of object loss and fearful dependency, respectively.

Mathiesen, Forster & Svendsen (2004) and Ostow (2004) both examine affect regulation. In an example of a case study done in this field, Mathiesen et al discuss the case of one client with a frontal lobe injury, who manages to pass all the standard neurological and intelligence tests, yet has had changes in personality and behavior, in terms of being unable to control his emotions, similar to Phineas Gage. Psychoanalytically, they correlate these behaviors as an inhibition of the primary processing system (impulsivity, emotional lability, problem solving and decision making difficulties, childish behavior, and poor judgment, to name only a few). Because damage to the prefrontal portion of the brain tends to affect emotional, versus physical or cognitive responses, the client tended to tell the narrative stories of his life without any emotional connotations during his psychoanalysis. However, in this case, the brain injury enhanced his lack of emotion; he had had some difficulties expressing emotion prior to his accident. Moreover, Mathiesen et al found that unconscious defences increased during the three months of this psychoanalytic study; the client increased the use of immature defences, such as, projection, acting out, devaluation, displacement, and denial, all measured by a defence mechanism scale.

Recent research in *Neuropsychoanalysis* is finding support for the hypothesis that the Id, Ego, and Superego can be represented within the neuroanatomy of the brain. For example, Talvitie and Ihanus (2006) provided a theoretical discussion on this topic, while Wiest, Lurger, and Baumgartner (2012) used conscious brain stimulation methods to explore the correlation between the Freud's ego and the pre-frontal cortex, the place in the brain that is most activated when a subject exercises control over actions, decisions, or choices (p. 135).

In a recent finding, Solms (2013), using the most recent neuroscience, theorizes that, contrary to Freud, the Id is actually conscious. This dramatic shift in psychoanalytic theorizing has turned one of Freud's key theories on its head. According to Solms, consciousness is a bottom up process that begins with the brainstem, via the limbic system (periaqueductal grey, the PAG), and is a form of affective consciousness; essentially, the Id is a brainstem process that controls our feelings of pleasure and unpleasure and we are very conscious of these processes. Solms states, "My major conclusion can now be restated: the internal self, synonymous with Freud's "id," is the foundation of all consciousness; the external self, synonymous with Freud's "ego," is a learnt representation that is unconscious in itself, but can be consciously "thought with" when cathected by the id (p. 16).

Solms, Hobson, and Freud on Dreams

In addition to Freud's dynamic models of psychological functioning, neuropsychoanalysts are also interested in dreams, and this is one topic that Solms has focused on in his research with brain-damaged clients. Freud's personal interest in dreams began in his childhood, where he would observe and record his own dreams in a notebook. But Freud's professional interest in dreams began in his *Project for a Scientific Psychology* (1895), a manuscript that established the groundwork for many of Freud's later psychoanalytic theories, including his theory of dreams. He went on to expand on his theory of dreams in 1900 when he wrote *The Interpretation of Dreams*. Since the turn of the 20th century, Freud's dream hypothesis, that dreams were really the fulfillment of wishes, has been one of the most empirically tested theories, particularly since the advent of Aserinsky and Kleitman's discovery of the correlation between REM sleep and dreams.

Following this discovery, REM sleep, dreams, and sleep cycles became a primary focus of research in psychology, neuropsychology and the neurosciences, which was demonstrated in chapter five of this dissertation, where interest in dream research increased during the 1950s and 1960s. In the 1960s, Michel Jouvet built on the work of Aserinsky and Kleitman and discovered that the pons, a primitive area of the brainstem, was highly activated during REM sleep while, paradoxically, muscle paralysis occurred**.** Thus, Jouvet coined the term paradoxical sleep to more appropriately label the REM stage of sleep.

In 1999, the journal *Neuropsychoanalysis* published a paper by Allan Hobson on Freud's dream theory, in relation to Hobson's life-long research on dreams. Hobson stated, "In his 1895 *Project for a Scientific Psychology*, Sigmund Freud clearly stated his goal: to integrate the workings of the mind with the workings of the brain…A century later, Freud's brilliant but entirely speculative dream theory is in need of radical revision, if not complete overhaul, because dreams…can finally be approached from the solid foundation of neuroscience" (p. 157).

In the 1970s, Allan Hobson and Robert McCarley (1977) presented two new hypotheses about REM sleep. First their reciprocal-interaction theory suggested that REM sleep and dreams are turned on and off according to mechanisms and chemicals in the pons. Hobson and

McCarley determined that Acetylcholine was the neurotransmitter that turned on dreaming, thus, triggering arousal, and affected areas of the pons, cortex and the limbic center of the brain, while norepinephrine turned off the dreams, thereby inhibiting these centers. In addition to this theory, Hobson and McCarley proposed the two-state activation-synthesis model, whereby, the pons, cortex, and limbic centers act as dream generators by randomly activating neurons in the first "activation" state.

Thus, Hobson and McCarley believe that it is not wishes that direct the production of dreams, but internally generated fragments of sensory, emotional, and cognitive systems. They suggest that dreams are the brain's attempt to create sense out of the senseless images that arise from impulses that are generated by the connection between the pons, the frontal cortex, and the emotion laden limbic system, they state, "…the forebrain may be making the best of a bad job in producing even partially coherent dream imagery from the relatively noisy signals sent up to it from the brain stem" (1977, p. 1346). In addition, memory and past experiences may also be used to create a narrative that fits the stimuli that emerges from these brain centers. Furthermore, Hobson and McCarley suggest that it is not repression that plays a role in the forgetting of dreams, but a physiological mechanism based on the balance of neurotransmitters in their reciprocal-interaction theory, thus, certain chemicals that inhibit information storage may be more or less active during the shift from sleeping to waking states.

Hobson has gone on to maintain his Activation-Synthesis hypothesis in the journal *Neuropsychoanalysis* (1999) and has been a harsh critic of Mark Solms' dream theories and research. Because Hobson believes that more primitive areas of the brain are responsible for REM states, and thus dreaming, he has focused anatomically on the brainstem and the primary chemical pathways that exist there, primarily Acetylcholine. Thus, he has continued to support the thesis that REM states are the physiological equivalent to dreaming. Moreover, Hobson has downplayed the importance of non-REM state dreams and ignored other areas of the brain and brain chemical pathways that might also generate dreams. Solms (1999) has found that the forebrain and the chemical dopamine play a much larger role in the creation of dreams, thus, allowing for the possibility of a neurological correlate to Freud's libidinal wish theory of dreaming.

In *Neuropsychoanalysis*, Solms states that Hobson is the "leading authority on the neurophysiology of REM sleep dreaming, and his work has dominated this field for more than twenty years" (1999, p. 183). However, he disagrees with Hobson's hypotheses, arguing that wishes do play a key role in dream processes. Solms (1999) reminds readers that, "…the research program that Hobson has followed for the past thirty years was conducted not with human subjects but rather with lower mammals, principally the domestic cat" (p. 188). Solms (1999) debates whether or not cats actually dream and states, "In this way, Hobson and his animal-research colleagues have had to carry over a large unknown factor into all their theoretical formulations about dreams, and their inferences about the neuropsychological mechanisms of dreaming in humans could not be directly tested" (p. 188). Solms uses this argument to suggest that his work with naturally brain injured human subjects is a more valid methodology. While the argument between Solms and Hobson is interesting, it leads to larger questions regarding the developing field of neuropsychoanalysis.

Solms states, "…dreaming proper is the intervention of disinhibited appetitive drives during sleep" (1999, p. 184) and he believes that dopamine systems, also known as the "curiosity-interest-expectancy circuits," the "seeking system", or the "wanting" system, also plays a crucial role in the development of dreaming. Many drugs, such as L-dopa, cocaine, and amphetamines, act on dopaminergic pathways, causing psychotic symptoms, excessively vivid nightmares and hallucinations. In addition, Solms argues that lesions along dopaminergic pathways cause a cessation of dreaming and drugs that affect this pathway can block dreaming. Because activation of the dopamine pathways can induce dreams and hallucinations outside of REM states, Solms believes that dreaming and REM sleep are controlled by different mechanisms. For Solms, REM states are initiated in the primitive brain centers, the pons as Hobson suggests, but that dreaming is controlled by forebrain mechanisms with dopaminergic pathways that reside there acting as a mediator. For Solms, dreams are generated by the forebrain's instinctual-motivational circuitry. Consequently, Solms' dopamine theory allows him to correlate the brain's neurological craving center, and the neurotransmitter dopamine, with Freud's libidinal and instinctual drives. Thus, Solms concludes that Freud's dream theory is supported by the current neuroscience.

In *Neuropsychoanalysis*, others have used Solms' method to study dreams in clients with brain damage. Tarnow (2003) explored Freud's idea of day residue as an unconscious process that is encoded in long-term memory, but can transfer to working memory during the process of articulating/recalling the dream. Yu (2006) worked with eight brain damaged clients to compare neurological memory failure and poor dream recall, and he also studied 21 patients with neurological conditions (ventromesial frontal lobe) to better understand the cessation of dreaming after brain injury (2007a); both of these studies utilized fMRI methods alongside subjective interviews. Blechner (2005) explored reality testing in dreams, and Freud's views of dream censorship and dream bizarreness were discussed via the contemporary "activation-synthesis" hypothesis, the idea that dreams are random neural firings, versus the idea that dreams are motivated and have important subconscious content (Boag, 2008; Colace, 2012).

Hallucinations during waking hours and in dreams were explored in a psychoanalytic client with a brain injury, to better understand Freud's theory of dream work (Feve & Hart, 2006) and, the neural basis of dreaming as an unconscious process was discussed (Carhart-Harris, 2007), as was the role of the pons (Yu, 2005). Many of these dream studies used fMRI, PET, and CT data that explored the role of the frontal and temporal lobes and the supramarginal gyrus in dreaming (Yu, 2001a, 2001b, 2003) and others integrated psychoanalytic sessions with clients' recent MRI or fMRI scans. Overall, this research utilized qualitative, quantitative, and imagining methods providing an interdisciplinary methodology to better understand dream processes and Freud's theories.

Epilogue

On January 13, 2011, at the Waldorf Astoria in New York City, Nobel Laureate Eric Kandel stepped up to the podium at the winter meeting of the American Psychoanalytic Association and stated, "If psychoanalysis is going to survive, it must incorporate neuroscience" (Arehart-Treichel, 2011, para. 4). Kandel's (1999) message, however, is not novel to those working in the field of neuropsychoanalysis. As noted in this chapter, those working in the field have the same goal as Kandel, to create a dialogue between psychoanalysis and neuroscience and provide a forum to integrate these perspectives. Moreover, neuropsychoanalysts believe that Freud's dream of creating a scientific psychology is still alive and that the integration of psychoanalysis and neuroscience can benefit both of these fields; there are strong supporters of this movement, those who believe that psychoanalysis can have a neurological scientific foundation if it empiricises its theories (Kandel, 1999; Panksepp, 1999a, 1999b, 2000; Pribram & Gill, 1976; Reiser, 1984; Schore, 2003; Solms & Nersessian, 1999).

In addition, many of the studies surveyed in the journal *Neuropsychoanalysis*, utilized subjective questionnaires, qualitative interviews, and fMRI data, thus, these investigations into the mind-brain relationship used various methods to collect "multiple, converging lines of evidence" (Solms, 2005, p. 536). That said, not everyone is enthusiastic about painting psychoanalysis with a neuroscientific brush, primarily because of the use of imaging methods. Those who are skeptical about this integration fear reductionism, and suggest that the "biologizing" of Freud, or the "analyzing" of neuroscience can serve no benefit to either of these respective fields or the patients seeking care within their domains (Blass & Carmeli, 2007; Kitcher, 1995; Pulver, 2001).

Measuring Subjectivity: Imaging Studies

The debate about whether psychoanalysis and neuroscience should or should not be integrated often includes another discussion raised by neuro-philosophers, particularly because neuropsychoanalysis often relies on brain imaging technology. For example, many of the publications in *Neuropsychoanalysis* used either MRI, fMRI, EEG, or PET scans as part of their methodology, or referred to studies that did use them, which raises the question, does brain equal mind? And how much weight should we be putting on research that attempts to explain mental processes from the results of apparently objective brain scans?

The use of imaging studies has been on the rise since the 1990s, when the "Decade of the Brain" was announced by George Bush, and more recently in 2013, when Barak Obama created "The White House Brain Initiative: Brain Research Through Advancing Innovative Neurotechnologies." Since this time, it seems "neuro" can do no wrong, if we can see something on and fMRI machine, it must be true. Vidal referred to the emphasis on imaging results as "hype" (2009, p. 5), and Quart (2012) states, "The problem isn't solely that self-appointed scientists often jump to faulty conclusions about neuroscience. It's also that they are part of a larger cultural tendency, in which neuroscientific explanations eclipse historical, political, economic, literary and journalistic interpretations of experience" (para. 3). Thus, the word “neuro” has not only permeated academia, but also popular culture and Quart refers to it as “pop neuroscience…[something] coarsened for mass audiences,” (para. 3-10) while others call it neuroculture, where “neuroscience knowledge partakes in our daily lives, social practices, and intellectual discourses” (Franzetto and Anker, 2009, p. 815).

Although PET scans, fMRIs, and EEGs can measure brain activity, via glucose, oxygen, and electrical impulses, respectively, having the ability to measure observable physical actions, wakefulness, and brain activity over time does not mean that this technology is providing a direct correlation between neuronal activity and the mental steps that occurred to cause the anatomical change. Vidal (2009) suggests that there are concerns put forth by the “neuro-doubters” and the “neuro-critics” that question the clinical relevance of imaging studies, or lack thereof, and the use of fMRI research in understanding real life experiences. Bösel (2012) argues that just because an area of the brain becomes active during happiness, does not mean that happiness is localized to this area. In addition, he notes, “Some scientists warn against pseudo-empirical-findings-that is, the false interpretation of empirical results determined by a priori assumptions about the object being measured” (p. 279).

In addition, one must be cautious in using these methods because various types of radioactive tracers (those that attach to glucose molecules, some attach to oxygen, all with varying half-life characteristics) are used with this technology that vary from study to study, and there are also individual differences between different scanners at different institutions. Furthermore, the variation in statistical methods used (subtraction method versus averaging), and the comparisons to apparent “normal” data sets, has raised questions about the validity and reliability of brain scan data (Dumit, 2004). Moreover, when a researcher is deciding which images to publish with their study, they often choose the most extreme cases that support their findings. That is, they may publish the image with the most activation compared to that with the least activation (rather than averages) or they may publish the brain of a 27 year old compared to that of an 80 year old, without stating that there is an age difference (Dumit, 2004).

In addition, when data are presented in picture format, the conversion of numeric data into voxels (volumetric pixels), three-dimensional images representing millions of cells in a cube of brain tissue, is subjective due to the arbitrary coloration process (pixilation). Therefore, "new areas appear as discrete and sharply bound, rather than diffuse," and it can look like new brain areas are being created during the pixilation process" (Dumit, p. 90). For example, Vul, Harris, Winkielman and Pashler (2009) evaluated more than 50 fMRI studies and found inaccurate correlations, greater than .8, between measures of brain activity and measures of individual differences in the areas of emotion, personality, and social cognition. The inaccurate correlations that emerged were based on whether researchers used "voxel averages" or "peak voxel" measurements. Thus, there was subjective choice regarding which voxels to measure, and most researchers arbitrarily created thresholds for their voxel data. Consequently, coloured brain scans have the ability to draw experts and non-experts into research that may not be accurate.

Finally, of particular importance to neuropsychoanalysis, whose clientele often have various aphasias, "stimulation studies suggest that there are large individual differences found when attempting to map the cortical language centers; Often the location of the language areas falls outside Broca and Wernicke's areas, for example" (Dumit, 2004, p. 89). If this is true for language centers, what does this mean for other brain areas that are of interest to Neuropsychoanalysts such as the emotion centers (limbic/Id /primary processes), the frontal lobes (cognition/ego/secondary processes), and the idea that the motor system as activated during "talk therapy" is damaged? Again, a critical neuroscientific perspective must be maintained as these types of studies continue into the future.

Today, writers, particularly the neuro-philosophers interested in the mind-body problem, focus primarily on the mind-brain relationship (Gopnik, 2013, para. 2). Churchland (1989) argues that mind and brain are synonymous and that concepts such as consciousness, emotions, beliefs, should be eliminated and exchanged for neuronal rather than psychological explanations. Churchland asks "are mental states irreducible to neurobiological states?" and in considering her detractors, she defines two types of researchers, the "Boggled Skeptics" and the "Principled Skeptics" (p. 316). The boggled skeptics take a Kantian view arguing that "mental phenomena, in contrast to the physical objects investigated by physical scientist, (1) have no spatial dimension, (2) are too transient to pin down for sustained observation, (3) cannot be experimentally manipulated, and (4) perhaps most important of all, cannot be mathematically described or analyzed" (Fancher and Rutherford, 2012, p. 142). The principled skeptics are similar to the boggled skeptics, but they also consider the idea that the brain may contain a nonphysical soul (Churchland, 1989).

Gopnick, however, has a more light-hearted take on the matter and divides neuro writers into "the Spocks and Kirks, either embracing the idea that consciousness can be located in a web of brain tissue or debunking it" (2013, para 2). The Spocks are the rational and analytical sect that believes that the mind is a machine that can be studied via contemporary neuroscience, while the Kirks are the more emotional group that believes that soul and human spirit cannot be measured in a scanner (Gopnik, 2013, para. 2). A full examination of the philosophical debate regarding neuroimaging is outside the scope of this thesis, however, along these same lines, there are some psychoanalysts who are concerned over the use of imaging technology and believe that integrating neuroscience with psychoanalysis is not only clinically irrelevant, but also damaging to the field (Blass & Carmeli, 2007; Kitcher, 1995; Pulver, 2001).

The Case Against Neuropsychoanalysis

In general I agree that if psychoanalysis is to survive as a science, it needs to, as Kandel (1998, 1999) noted, be connected with the neurosciences. Increased interest in the brain and the neurosciences in general have played a role in bringing attention to this very new form of psychoanalysis called neuropsychoanalysis. Questions arise, however, as to whether this is just a political move to keep psychoanalysis alive and if it is leading to a reductionist view of psychoanalysis.

The Politics of Neurologizing Freud

These are not new questions. For example, in 1984 Knight argued that some of the scholarship surrounding the importance of Freud's *Project* was written by, "the new neurologizers who see in the *Project* both the flaws of psychoanalysis and its potential redemption through updating its neurological base" (p. 340). Further, Knight argued that accentuating Freud's neurological background, one hundred years later, might induce renewed interest or redemption for the discipline of psychoanalysis, a discipline that had been struggling for survival during the 1980s (the decade of the neurotransmitter) and the decade of the brain (1990s).

In 1979, Sulloway had suggested that there was a "…quasi-political cast to the debate over the *Project*" (p. 121), with a division between the "soft-science" believers and the "hard-science" supporters. Much of the debate within the scholarship focused on many different interpretations of the text; it could be used to support or refute psychoanalysis as a science (Sulloway, 1979). Knight (1984) concurred stating: "Positions taken on these questions [about the *Project*] tend to reflect the kind of investment the disputant has in the intellectual viability of psychoanalysis as an autonomous, scientifically credible, and or humanistically fruitful field" (p. 340).

Thus, Freud's psychoanalytic theory has long been the subject of scholarly debate. His theorizing was broad, dynamic, and far-reaching as he extrapolated his ideas across many disciplines. While Freud's diversity as a thinker is often commended, this multiplicity has also left him open to opposition, not only from within many areas of psychology but also from other disciplines, such as philosophy, science, and medicine, to name only a few. While each discipline questions Freud and his theories from their own frame of reference, psychology, psychiatry, and neuroscience have been particularly uneasy with psychoanalysis, primarily because of its inability to objectively prove itself as a scientific discipline, in accordance with the standard scientific doctrine.

From a historical perspective, psychology has also had to face similar questions regarding its validity (Hornstein, 1992), and in this respect, psychoanalysis is not alone. Nevertheless, while psychology's empirical movement has tried to appease these concerns, psychoanalysis has often ignored the questions of experimental validity, making no attempt to empiricise its theories or clinical practices. The refusal, or inability, of psychoanalysis to make the subjective more objective has left it in a precarious position; often separate and at odds with disciplines both inside and outside of psychology and, as a result, psychoanalysis has had a history of problematic relationships with both psychology and psychiatry (Hornstein, 1992).

Because psychoanalysis has done little to empiricise its theories, one might suggest that it has had to resort to other tactics in order to sustain its scientific status. One tactic was to become more interdisciplinary, thus, aligning itself with other disciplines, such as neuroscience. In this instance, the discipline of psychoanalysis could attain a more credible or more scientific status by 'neurologizing' itself as Knight (1984) suggests. Emphasizing the neurological origins of psychoanalysis and accentuating Freud's neurologically oriented pre-analytical monographs would achieve this goal by providing evidence that psychoanalytic theory is grounded in science, thereby, making it and Freud, more scientific, more credible, more palatable.

Thus, Sulloway (1979) and Knight (1984) both suggested that there might be political reasons to 'neurologize' Freud or to emphasize the interdisciplinary nature of his theories. However, Solms himself agrees that the collaboration between psychoanalysis and neuroscience is "primarily politically" motivated (Solms, 2012). As Solms explains it, it sounds a little bit like an "if you can't beat them, then join them" sort of philosophy. But in reality, he notes that, as Kuhn (1962/1969) suggested, "scientists are people, scientists form groups…they compete for resources, in science that is funding, and for personal power." Solms and Panksepp decided not to "rail against" the scientific paradigm and so they "acknowledged that this is how it is and we engaged with it."

But along with Solms and Panksepp's engagement with the science for practical reasons, their interdisciplinary field also aligns with Kitcher (1995) view, who using cognitive science as an example, suggests that because the cognitive sciences include "…neural, developmental, computational, linguistic, psychological, and social factors…" (p. 3) there is a belief that these disciplines need to learn from each other and co-evolve. Consequently, interdisciplinary approaches are viewed as highly positive and are increasingly being supported in academic settings (Kitcher, 1995). From Kitcher's perspective neuropsychoanalysis makes sense, but why is a marriage between psychoanalysis and neuroscience so much more contentious and emotionally charged than any of the other neuro integrations with the psy-disciplines? Moreover, why is most of the pushback coming from psychoanalysts themselves?

Psychoanalysts Against Neuropsychoanalysis

Ramus (2013), in an article entitled, "What's the point of neuropsychoanalysis?" rages against the integration of psychoanalysis and neuroscience. The abstract states, "Neuropsychoanalysis is a new school of thought attempting to bridge neuroscience and psychoanalysis. Yet few neuroscientists and psychiatrists would have heard of it if it had not recently received public support from notable neuroscientists" (p. 170). The paper goes on to condemn neuropsychoanalysis but Ramus does not realize that he has answered his own question in the first two sentences of his article when he stated that "notable neuroscientists" working in the field and spreading the word of their interest in psychoanalysis.

Ramus continues,

> It may be that some scientists in molecular and cellular neuroscience need to be reminded of the limitations of a purely reductionist biological approach, and of the essential contribution of cognitive science to the understanding of the brain. But psychoanalysis is the last thing they need. The science of the mind already exists, and that is psychology. For most contemporary psychologists, psychoanalysis is only one school of psychology: an outdated one, whose hypotheses were either trivial or untestable, or proved wrong. And the new science of the mind/brain…already exists: it is to be found at the thriving interface between psychology and neuroscience. Thus, all the ideas that Panksepp & Solms attribute to neuropsychoanalysis are fine, but are already mainstream within cognitive, social, and affective psychology and neuroscience. So, what is the point of renaming these successful scientific endeavours 'neuropsychoanalysis'? Is this not just an attempt to rehabilitate psychoanalysis by giving it a fashionable prefix and

by attributing it the merits of other disciplines? (p. 170)

I would disagree with all of Ramus' arguments, primarily because his paper misses the key reasons for the creation of neuropsychoanalysis in the first place, which is to provide an *integration* of the subjective (psychoanalytic) and the objective (neuroscientific). The argument that what neuropsychoanalysis is, is already present in other areas of psychology is erroneous, based on the bibliometric analysis presented in this chapter. Cognitive neuroscience focuses on the cognitive, not the affective, which is the focus of neuropsychoanalysis (60%). Most often Ramus is referring to objective research in experimental, not the clinical subjective aspects psychology.

Moreover, Ramus compares neuropsychoanalysis to the work of psychoanalysts in France, who reject the DSM/ICD diagnosis of autism, "in favour of their own idiosyncratic one; [they] delay the diagnosis of autism or substitute it with psychoanalytic diagnoses such as 'infantile psychosis.' In addition, he calls for the Oedipal complex and Freud's psychosexual stages to be empirically supported by neuropsychoanalysis if it is to be a truly scientific endeavor. However, neuropsychoanalysis is not about proving Freud right or wrong, it is about using a new interdisciplinary methodology to solve some of the problems that Freud (and Bain) could not. In both of the above examples, Ramus is confusing the contemporary field of neuropsychoanalysis with an antiquated and distorted view of Freudian therapy and theory, and he also seems to be suggesting that neuropsychoanalysis return to 1950s and 60s, when experimental psychologists were preoccupied with testing the validity of Freud's theories of sexuality.

Another inaccuracy emerges in a letter to the editor in response to Ramus' article in the *British Journal of Psychiatry*. Gentili, Cristea, and Pietrini (2013) state, "Consequently, the great majority, if not all, of the neuropsychoanalysis papers are theoretical reviews loosely based on results from neurobiological research rather than original studies designed to verify specific hypotheses. Indeed, neuropsychoanalytic statements appear to be based merely on surface analogies." This argument is based on imagining neuropsychoanalysis as a field similar to the strictly empirical psy-disciplines that follow the prescribed scientific method. While this does happen in neuropsychoanalysis, it more often integrates the objective and the subjective. Gentili et al are correct, the bibliometric analysis in this chapter found that, although there are many theoretical papers (55.6%), there are also many empirical studies (44%), of which 15% were quantitative studies, having between 12 and 110 subjects testing specific hypotheses, thus meeting Gentili et al's criteria. 25.4% of the studies were qualitative and/or phenomenological in nature and often included case studies.

Nevertheless, there are many who find neuropsychoanalysis to be not empirical enough and so I refer them to Holmes (2013), who states, "We are still 'Darwinians', despite the fact that Darwin had no model of DNA to help him explain how acquired characteristics were transmitted across the generations. Modern genetics, through technical and conceptual innovation, reveals the mechanisms by which evolutionary change comes about. Similarly, contemporary neuroscience helps unravel the brain patterns, which underlie some of Freud's pioneering insights" (para. 2).

In *Neuropsychoanalysis* in 1999, Paul Whittle sharply distinguished the domains of psychoanalysis, experimental psychology, and neuroscience, and he doubted that there was a mutual relevance among these fields. Pulver (2003) questioned the relevance of neuroscience for clinical psychoanalysis, and Edelson (1986) and Brothers (2002) warned against the risk of confusing the psychological and the neurological. There are also those who believe that only the data produced in the clinical situation are of relevance to the discipline's theorizing (Brenner, 1980). However, I want to focus in on Pulver's article because it paid particular attention to the clinical relevance of neuroscience in psychoanalysis.

In 2003, Pulver was among the first to question the clinical relevance of neuroscience for psychoanalysis in his paper, "On the Astonishing Clinical Irrelevance of Neuroscience." Although this paper was controversial within the psychoanalytic community, particularly due to the high volume of neuropsychoanalytic papers showing up in the journals, it was actually a "pro-neuroscience" piece of work. Pulver's (2003) key objection to the integration of psychoanalysis and neuroscience was that often research on this topic did not distinguish between "clinically relevant" and "theoretically relevant" research, and he argued that psychoanalysts were overly enthusiastic about the connection between psychoanalysis and neuroscience (p. 759). Pulver argued that neuroscience certainly was relevant to theory, in allowing the analyst to better understand the client, however, new neuroscience discoveries in his mind did not help psychoanalysts with the bread and butter of their daily work with clients; their ability to listen, their interpretations, the skill of their timing, their aptitude to see patterns where a client might not, and the ability to assist the client in finding meaning.

Along these same lines I would argue that the primary factor in the process of change, the therapeutic relationship (Duncan, Miller, Wampold, and Hubble, 2010), is something that Pulver feels would not be affected by new insights from neuroscience. Thus, Pulver differentiated "technique" from "theory" in his arguments and provided a balanced view of the role neuroscience can play in psychoanalysis, particularly theoretically. In this respect, neuroscience may assist the analyst in understanding the anatomy and physiology of motivational circuits, for example, the "seeking" or "reward" system, but Pulver (2003) suggests that this would not help either the client or the therapist understand the "meaning" such motivations may have for the client, and he compared this struggle to one from the recent past; the comparison of the mind to a computer.

Nevertheless, Pulver suggested that the relevance to psychoanalytic theory comes from the current neuroscientific research on motivation, such as 1) "sexuality, aggression, social attachment, maternal devotion, hunger, and thirst" (p. 764), essentially similar to Freud's drives. 2) Affect as motivation, rather than an outlet for instinctual drives that includes "interest-excitement, enjoyment-joy, surprise-startle, fear-terror, distress-anguish, anger-rage, disgust, shame-humiliation" (p. 764), and 3) the structural system, with the ego paralleling the role prefrontal cortex where "perception, representation, planning, reasoning, memory, learning, consciousness, self-awareness, empathy, emotional modulation, decision, and the organization of conceptual knowledge" (p. 765), and 4) the topographical model, where conscious, preconscious, and unconscious processes exist.

In summary, Pulver suggested that psychoanalytic curriculums should include more "relevant" neuroscientific education, and that a clear distinction should be made between clinicians' use of neuroscience and academics' use of it; neuroscientific reductionism in the consulting room should be contained as the "overenthusiasm" for neuroscience continues to be on the rise. In Pulver I see someone who is cautiously optimistic about the theory integration of psychoanalysis and neuroscience, but I would disagree with him on the clinical relevance of neuroscience, particularly in light of the recent research on memory systems, and in working psychoanalytically with brain damaged clients.

The concept of repression was a foundational theory for Freud and is still foundational in many forms of psychoanalysis; the recovery of memories or connecting the dots between fragmented memories is often a part of psychoanalytic and psychodynamic therapy. Thus, allowing the client to create a meaningful cohesive life narrative. With this theoretical underpinning, a therapist watches for the emergence of these forgotten memories, thoughts, and ideas as the client works through the transferential relationship with the therapist. Some clients, particularly those with traumatic life events, even come to therapy with the idea that they have disconnected memories and that therapy should help them to discover the missing links of their life history so they can remember the "truth." However, recent research on memory and trauma suggests that early life trauma, particularly chronic trauma, causes cortisol levels to be consistently and continuously circulating at high levels, thus, affecting the body and the brain.

In his 2004 book, *Why Zebras Don't Get Ulcers,* Sapolsky argues that in the animal kingdom fight/flight/fear stress responses are acute and short-lived. The human animal, however, lives under chronic psychological stress, which differs from the physiological stress of living in the wild. Psychological stress, or anticipatory stress, leaves the nervous system in a constant state of fight/flight/fear with an unregulated flow of adrenal hormones. Trauma linked to chronically high levels of cortisol lead to the diseases of adaptation (heart disease, cancer, high blood pressure), a lowered immune system, and even a loss of neural network connections in the hippocampus (Sapolsky, 2015).

The key point here is that under chronic stress, the hippocampus may not be capable of encoding traumatic memories, so they may not actually be repressed, they may never have existed (Yovell, Solms, and Fotopoulou, 2015). Thus, recent neuroscience can inform our clinical practice if we are able to step back as analysts and stop pushing for the recovery of memories that may not be there. We can also share this knowledge with our clients who may feel humiliated, frustrated, and "lesser-than" for not being able to remember the totality of their abuse, for example. At this point, both the client and the therapist can become less frustrated and can focus on finding meaning in what is remembered, in what can be pulled together, and in the therapeutic relationship and the process of personal change that occurs during psychotherapy.

Not long after Pulver (2003), Blass and Carmeli (2007) published "The Case Against Neuropsychoanalysis: On Fallacies Underlying Psychoanalysis' Latest Scientific Trend and its negative Impact on Psychoanalytic Discourse." Here, the authors define psychoanalysis as a discipline strictly concerned with the "psychic dimension of human existence" (p. 37), and they, unlike Pulver, argue that neuroscience has nothing to offer psychoanalytic theory or clinical practice. Accordingly, they take a much less balanced and more polarized view than Pulver.

Blass and Carmeli argue that neuropsychoanalysis rests on false assumptions and carries the risk of, "biologizing" psychoanalysis and, in what is perhaps a dramatic and erroneous assumption that, "Relying on a biological perspective, whereby only what is biological is real, this new trend in effect offers a vision of psychoanalysis that limits the significance of the unique psychoanalytic concern with the understanding of meanings and the role of discourse in discerning and justifying these meanings" (p. 19). There can be some agreement with their point, particularly if one looks at, "the seductive allure of the neuroscientific explanations" (Weisberg, 2008, p. 470), and the concerns regarding the true explanatory capabilities of neuroimaging studies; this topic is of key concern to the neurophilosophers as well.

Nonetheless, after considering the portrait of neuropsychoanalysis earlier in this chapter, the quote above does not explain the reality of the work going on in the field of neuropsychoanalysis; here Blass and Carmeli (2007) appear to be describing neuroscience rather than neuropsychoanalysis, where brain imaging is used alongside the subjective reports of clients who may be in long-term psychoanalysis. Their paper is written as if psychoanalysts are giving up the key elements of their clinical work, for example, the importance analysts place on meaning, transference, the therapeutic relationship, latent meanings, and the process of change, in light of new neurological findings, when this is not the case. Moreover, the authors consistently describe the future of psychoanalysis, if neuroscience is integrated with it, as in "danger" and not without "significant negative impact" on the field.

If one analyzes the arguments of Blass and Carmeli, there is a clear effort to keep psychoanalysis pure, separate, and "unique" or special, and there is an air of superiority in their tone, primarily because they look at neuropsychoanalytic research on trauma/memory, motivation/emotion, dream theory, and theories of mind (cognition, learning, language, perception), and say that "neuroscience has nothing to say" (p. 33) clinically or theoretically on most of these scientific areas of study. This polarizing, catastrophizing, isolationist view may do more damage to psychoanalysis than the integration of neuroscience, particularly, when psychoanalysis may have insights to offer the field of neuroscience in terms of the examining the clinical psychological findings that emerge in clients who have brain damage.

However, Blass and Carmeli might have legitimate concerns if psychoanalysis was still being practiced in its most "classical" sense, i.e. from a one-person perspective, where the analyst is the authority. Contemporary psychoanalysis, however, differs from the classical in that it is first and foremost concerned with a co-created relational dyad between the client and therapist, and the ability of the therapist to facilitate the process of change as clients find meaning through the transferences, emotions, life events, dreams, wishes, trauma, relational patterns, attachments, joys, sorrows, and losses. Does understanding the biology of some of these processes weaken psychoanalysis as a discipline that takes ownership over meaning making? I would suggest, no, and believe that if psychoanalysis omits these subjective experiences, then Blass and Carmeli have a right to be concerned.

Conversely, at present the founders of neuropsychoanalysis, and those who are following in their footsteps state, “Any method that attempts to reduce mental phenomena to neural phenomena, or that tries to establish a strict localization of mental functions to discrete brain areas, is not suitable for neuropsychoanalytic enquiry, as it may be doing violence to the basic pillars upon which psychoanalysis was built” (Yovell, Solms, and Fotopoulou, 2015, p. 3). Neuropsychoanalysts believe that their job is to create inferences based on the study of two “irreducible sources,” the subjective experiences and the objective brain states of individuals and/or groups of individuals (p. 12). Further, they note, “On the contrary, the position of neuropsychoanalysis is that for as long as the ‘subjective’ and the ‘personal’ are less present in neuroscientific theories than they are in psychoanalytic theories, the latter have a great deal to offer cognitive neuroscience” (p. 5). Thus, in neuropsychoanalysis, there is a deliberate and systematic methodology in place to avoid the mindless reductionism that Blass and Carmeli are concerned about.

Blass and Carmeli’s view is dominated by a clear separation between brain and the meaning-making mind, but this philosophy seems very reminiscent of psychology’s attempt to separate the mind (feelings, emotions, unconscious processes) from observable behavior, when the objective took precedence over the subjective. Blass and Carmeli are arguing that any objective findings from neuroscience have no role to play in the subjective experience of the meaning-making human being; the study of brain states has no impact on the study of psychological states. Their point of view becomes particularly important for neuropsychoanalysis primarily because neuropsychoanalysts often work with clients who have brain damage, something that Blass and Carmeli speak to, "Obviously it would be wrong to ignore the effects of brain damage or illness and to interpret meaningless biological events as though they had psychic meaning" (2007, p. 35).

But who decides what a "meaningless biological event" is? As outsiders to the client or patient's experience, it is not we that provide the meaning, but them. I suggest that historically, and even today, the use of brain scans has the potential to create interpretations of knowledge that "construct the other as problematic, inferior, even when empirical results allow for meaningful, equally compelling, alternative interpretations. These interpretations are presented as 'knowledge' when, in fact, harm is inflicted through them" (Teo, 2008, p. 47). Deciding what an infarct on a CT or MRI means for the client, without asking the client what it means for them, in my mind, is an example of what Teo calls, epistemological violence. Determining a treatment plan for these clients, without factoring in a strategy for them to make meaning out of their severely altered lives, is detrimental and even harmful, if the interpretation of the data from a brain scan, determines they are not "suitable candidates" for an existential conversation about their lives.

For example, a brain scan that reveals an infarction of the left inferior frontal and anterior temporal lobes of the brain, with underlying white matter involvement, can tell the neuropsychologist a lot about the patient; the physician assumes that the client will likely have right-sided paralysis affecting the face, arm and/or leg with a high likelihood of Broca and/or Wernicke's aphasia. Understandably, a prime focus on patients with post stroke paralysis and aphasia will be speech pathology, occupational therapy, and physiotherapy; at the same time, however, their altered sense of self, their relational selves, their "personhood" (Dumit, 2004), their identity, may too often be subordinated because they are viewed not as people anymore, but as “disabled” people. Similarly we hear of the “schizophrenics,” the “depressives,” or the “bipolars” referred to by their disorders and classified as people who need to be fixed and made “normal” again. Moreover, it is often inferred about these clients or patients that they have a life-long disability and will never be “normal” again, but whose version of “normal” do they mean?[34]

As Oliver sacks stated, “neuropsychology is admirable, but it excludes the psyche, it excludes the experiencing, active, living, ‘I’” (1998, p. 177). Psychotherapy that is designed to deal with these “I” issues is not often offered, because how does one do “talk therapy” with someone whose speech is muddled and difficult to understand. An brain scan, and charted diagnosis reading “Broca’s aphasia,” provides knowledge that often leads to “interpretive speculation” (Teo, 2008, p. 57) about the patient’s capabilities, and clients with brain damage may not be offered the same access to psychological services as those with other types of disorders or diseases. Along with the limited access to services, those diagnosed with aphasias often stop being talked to.

For example, a neuropsychoanalyst who visited her client in the hospital arrived to find that he was missing from the ward. She and the nursing staff all went looking for him and found him sitting in a bathroom in his wheelchair just staring and doing nothing in particular. “It was difficult to communicate with him, so nobody even asked what had happened and what he was doing in the bathroom” (Kaplan-Solms and Solms, 2000, p. 121-122). In this case, the imaging data may play a role in the client being seen as, “problematic” or “inferior,” and therefore “marginalized” (Teo, 2008, p. 57). In the case scenario above, the client was not viewed as a disabled body; the client was actually invisible.

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[34] See Frances (2014), *Saving Normal*, for more on diagnostic inflation and the “medicalization of normal life” (p. 3).

Prior to neuropsychoanalysis, clients with memory deficits (Anosognosia) and/or aphasia, due to parietal lobe or the right fronto-temporal-parietal lobe damage, presented neurologists with symptoms that appeared to be the meaningless biological events that Blass and Carmeli (2007) spoke of. Examples of these meaningless events would include the repeating of a word(s) over and over again or denying they have any physical deficits. Although these symptoms are often ignored, Solms' work has demonstrated that brain-damaged patients are not all alike. That is, "despite the fact that they have sustained substantial damage to their brains, which has seriously impaired their motor, perceptual, and even cognitive functions, nevertheless, they retain essentially normal ego and superego functions" (Kaplan-Solms and Solms, 2000, p. 74). Other patients, with similar damage but in different parts of the brain, may have drastic changes in personality, motivation, and emotionality. Thus, Solms' (2000) suggests that his research, and that of neuropsychoanalysts, focuses on understanding the "different parts of the brain that are associated with different mental functions. This simple fact provides the essential scientific rationale for this study. Our task is to discover and describe - in psychoanalytic terms - the functional contribution that each of the areas that we study makes to the overall functional operation of the human mental apparatus as a whole" (p. 74).

Most often, clients who participate in neuropsychoanalytic studies are hospitalized; some have been released from hospital, but continue with post-damage physical therapies and, thus, they have a regular connection to hospital and rehabilitation services. These subjects volunteer for these studies in connection with the other rehabilitation services under the premise that "psychoanalytic investigation of patients with focal neurological lesions" can enhance our knowledge of mental processes (Kaplan-Solms and Solms, 2000, p. 64). In light of this, these clients undergo psychoanalytic psychotherapy and/or psychoanalysis. The modifications to standard psychoanalytic treatment include a reduced frequency (1-2 days per week rather than 5), a treatment time frame of months rather than years, and an analyst who is comfortable expanding their form of talk therapy to include drawing, note writing, body movements (pointing and gestures), non-speech sounds with varied intonation, and perhaps even computer aided communication. Nevertheless, free association, transference, and meaning making remain the same.

Paralleling Sacks (1989) view that neuropsychology has omitted the psyche from its field, Solms suggests that psychoanalysis or psychodynamic psychotherapy, albeit altered for these clients, "is the best available method when it comes to those deeper aspects of mental life which neuropsychology has left unstudied" (Kaplan-Solms and Solms, 2000, p. 62). In general, I see neuropsychoanalysis as a field with two parallel goals that focus on the co-creation of experience and research. Clients in these studies gain access to psychotherapy, which they most likely would never have been offered, and, in so doing they are able to not only have this treatment play a role in their overall rehabilitation, but they also have the opportunity to contribute their subjective experiences to the research process. The inclusion of the subjective "self," or the "I," within this science, allows clients to not only co-create their own meaning making with the therapist, but to also play a role in co-creating the research.

Nevertheless, it is wise to be cautious that neuropsychoanalysis not become overly focused on finding support for Freud. The idea that parallels can be found between Freud's theories and the neuro data emerging from the science is certainly interesting. For example, the idea that the functions of the frontal lobes may resemble those of Freud's ego, and that the limbic system shows similarities to the primitive id can be alluring for those who have spent their lives working in psychoanalysis with little or no support from the scientific community or the public in general. However, if neuropsychoanalysts focus on enhancing the lives of neurologically vulnerable clients, while also using imaging technology as "exploratory and hypothesis generating," rather than "hypothesis confirming," (Dumit, 2004, p. 157), they will strike a balance between the clinical and research processes.

In some respects, the question regarding this research is perhaps not why are we placing such weight on brain imaging when it is likely providing inaccurate data? The question is really, why would we not be putting such importance on brain scans? Why would we not want them to hold the answers? The interest in neuroscience by popular culture, led by the finding of brain differences in patients with depression, schizophrenia or bipolar disorder, can provide a degree of hope to those stigmatized by these illnesses as well as their families. Imaging data, even inaccurate data, provides mental health patients a real life confirmation that their disorder is real, that it is as legitimate as the diagnosis that a cancer patient gets. Everyone knows that you can't just think your cancer away or pick it up by its bootstraps, but mental health clients are all too often expected to do so. Thus, the expectations placed on the mentally ill far surpass that of any other diagnosis. Accordingly, the relief that comes with a realistic new answer to their problems may be immense. This high expectation may also be placed on mental health providers and researchers.

Thus, researchers and clinicians may be in denial about the lack of validity and reliability because of their wish to find answers for these patients. Moreover, is this blindness based on the increasing frustrations that come with the trial and error methodology that surround the prescribing of psychotropic medications? Whatever the reason, when teaching my psychotherapy students, I always tell them that a clear understanding of the DSM is certainly required to work in the profession, but when we are sitting with a client's hopes, dreads, trauma, pain, and sorrows, this culturally created book sits quietly in the background as we focus on co-creating a therapeutic relationship that facilitates change in their lives. I would recommend this same philosophy toward the current neuroculture and brain scan data in particular. The interpretations we make based on these two tools must be continuously critiqued and be largely suspended during the therapeutic hour. Thus, I would agree that the impact of neuroscience within the consulting room is less explicit and has a different impact on clients in comparison to research and theory development in the field. Integrating a subjective understanding of a client alongside their imaging findings important way to demonstrate that there is a real person connected to the picture of their brain, however, is not enough. Particularly if it is kept in mind that the brain and body cannot be separated from the culture they exist in.

The Future of Psychoanalysis

Freud gave up his "psychology for neurologists" but he never abandoned the idea of one day seeing an alliance with neurology and biology (Freud, 1938, p. 182). Neuropsychoanalysis is providing a way for Freud's dream to come true. Although this chapter focused on research within *Neuropsychoanalysis*, neuropsychoanalytic research is showing up in mainstream neuroscience journals, such as *Science* (Anderson, Ochsner, Kuhl, Cooper, Robertson, Gabrieli, Glover, and Gabrieli, 2004) *Brain* (Carhart-Harris and Friston, 2010; Fotopoulou, Pernigo, Maeda, Rudd, & Kopelman, 2010), *Cortex* (Besharati, Forkel, Kopelman, Solms, Jenkinson, and Fotopoulou, 2014; Fotopoulou, Conway, Tyrer, Birchall, Griffiths, & Solms, 2008; Turnbull and Solms, 2007), *Frontiers in the Human Neurosciences* (Boeker, Richter, Himmighoffen, Ernst, Bohleber, Hofmann, Vetter, and Northoff, 2013; Buchheim, Labek, Walter, and Viviani, 2013), *Reviews in the Neurosciences* (Marini, Di Tizio, Dezi, Armuzzi, Pelaccia, Valchera, … and Di Giannantonio, 2016), *PloS One* (Buchheim, Viviani, Kessler, Kachele, Cierpka, Roth, George, Kernberg, bruns, and Taubner, 2012)*, and Social Neuroscience* (Kim, Fonagy, Allen, and Strathearn, 2014).

Moreover, this research is being accepted into these journals with titles such as, ‘‘The Default-Mode, Ego-Functions and Free-energy: A Neurobiological Account of Freudian ideas,” which was published in *Brain* in 2010. Is this an example of the end of the re-packaging of Freudian terms into behavioral or cognitive science terminology in mainstream psychology and neuroscience? It is probably too early to tell, but if there truly has been a paradigm shift toward affective neuroscientific research, then neuropsychoanalysis is a field that can not only run in the same circles as the other brain science fields, but can also be an example of how to start conducting neurological research that incorporates a subjective perspective.

As this chapter has demonstrated, the majority of research in neuropsychoanalysis focuses on clients with brain damage; however, I am also interested in maintaining a neuropsychoanalytic perspective in the consulting room with neuro-typical clients. Because mind, brain, and body cannot be separated from the relational world they exist in, a relational neurodynamic perspective, as I call it, might be helpful, particularly in light of Panksepp’s seven emotional systems and some aspects of nonlinear dynamics.

Relational Neurodynamics: On the Couch and in the Lab

A relational neurodynamic framework is first based on one aspect of Davis and Morris’s *Biocultures Manifesto* (2007) which states, that “You can’t fully understand the results of a given data set without knowing the historical, social, cultural, discursive fields surrounding the data” (p. 418), Currently, I believe that neuropsychoanalysis is already following this path. By working with clients 1-2 times per week for extended periods of time neuropsychoanalysts are able to consider the historical, social, and cultural data brought into the consulting room by the client. The idea that meaningful subjective data can be used to elucidate neurological findings, or vice verse, ensures that the research is co-constructed and the "psyche" returns to studies within a "neuro" field. Moreover, keeping this philosophy in mind assists with the co-construction of the therapeutic relationship.

Secondly, this framework places an importance on how the relational world creates and modifies brain structure and function and psychological function. One relational example that comes to mind is the work of Patricia Kuhl, who found that babies who were exposed to a foreign language could only learn that language if they listened to the voice of a real person, face-face; no learning occurred when the babies were exposed to the new language by watching a person on television. Kuhl argues that the social brain is necessary to learn language, essentially "speech learning is 'gated' by the social brain" (2007, p. 110). This research suggests that the brain changes because of the social world and, therefore, one must be cautious of interpreting imaging research that is conducted with the subject isolated from the social world in an imaging machine.

This idea that the brain is hard-wired (Kuhl, 2007) to connect relationally and is biologically affectively primed (Panksepp, 2004) for social relationships led me to consider the idea that these theories are both in play as we co-construct our identities through others in our social world in a nonlinear relational fashion, and that any transformation or change that takes place in both the client and the therapist, for example, are based on, first, the idea that each person in the therapeutic dyad is working within a novel relational situation that compels them both to adapt, adjust, and change as they interact with each other. Gerald Edelman's (1992, 2000) theory of neuronal group selection and Stuart Kauffman's (1995) regulatory gene theory, both consider novelty as a mechanism that increases the complexity of a system, which triggered my thoughts on the idea that transference, interpretations, and working in a positive reparative therapeutic relationship could be elements of novelty that increase the complexity and diversity of the client's thought and emotional processes, particularly when the therapist acts as an emotion regulator for the client.

Second, Bi-directionality (see Kauffman, 1992, on iteration, bifurcation, and sensitivity to initial conditions), the notion that each person in a dyad resides within an iterative feedback system, where information is repetitively sent back and forth and forces each person to constantly adjust their thoughts, emotions, or behaviors, according to the most recent information they receive, and therefore the overall the dyadic system is constantly changing. In addition, because of this constant adaptation, input into the system does not result in a proportional output. When one person in the dyad encounters novelty (something new that must be adjusted or adapted to), there is no way to predict how either party (the system) will react because the conditions of the system are constantly in flux.

This nonlinear relational system allows both the client and the analyst to push and be pushed by the other to think and feel differently. Essentially, this becomes new learning for both, where new emotional, behavioral, and cognitive processing occurs via relational attunement and adaptation. The ability of an attuned therapist to regulate a client's emotions has been paralleled to parent-infant dyads, where there is a 'coregulation' occurring between parent and infant. "All behavior is unfolding in the individual while simultaneously modifying and being modified by the changing behavior of the partner" (Fogel, 1992, cited in Beebe, 2000, p. 442). Relational psychoanalysis focuses on the co-creation of the therapeutic relationship and the intersubjective change that occurs for both the client and therapist, based on social processes such as attachment, enactments, and transference, to name only a few.

Continuing to study these processes via subjective reports alongside neurological data may prove fruitful. However, the idea of brain-to-brain coupling has also been studied as a concept of research on how we create and share our social worlds (Hasson, Ghazanfar, Gallantucci, Garrod, and Keysers, (2011). Hasson et al argue, "in many cases the neural processes in one brain are coupled to the neural processes in another brain via the transmission of a signal through the environment," and in many cases research is conducted from a "stimulus-brain" methodology, rather than a "brain-brain" procedure (p. 114). Consequently, in the future, I believe that research into the social brain is imperative to understand how our social-relational world changes both our subjective narrative as well as our neural connections. Researching psychotherapeutic relationships and brain-to-brain interactions from a neurodynamic perspective will allow us to better understand the plastic nature of the brain. And while Norman Doidge (2007), in his bestselling book on brain plasticity, argues, "the brain changes itself," however, I would suggest that it actually does not change itself; the brain changes in relation to our external world which is primarily social. Because psychoanalysis is a long-term intense form of psychotherapy, it is well suited to be studied from a brain plasticity perspective.

Furthermore, in light of the neurocultural trend that does not seem to be slowing down, a neuro-dynamic relational perspective places an emphasis on psychotherapists becoming neurologically informed, particularly because if they are not, their clients certainly will be. Discussions of brain function in relation to psychotherapy often focus on the therapists understanding and application to the clinical setting (Corrigall and Wilkinson, 2004; Cozolino, 2010, 2014; Rustin, 2013; Schore, 2011; Simpkins and Simpkins, 2012; Tryon, 2014), however, discourse around the sharing neurological research with clients is limited.

For example, an understanding of the autonomic nervous system's role in anxiety, panic attacks, and depression, to name only a few disorders, will undoubtedly assist the therapist in, first, helping the client to understand and to track their own psychophysiological arousal, and second, to understand that in times of affective dysregulation, the client is actually appropriating the therapist's nervous system. The therapist provides a holding environment for the client. Further, knowledge of brain-based explanations can assist some clients in understanding their disorder as separate from their identity and perhaps reduce shame. Neurological explanations can also assist clients in understanding the rationale for taking psychotropic medications and encourage them through a long process of change in psychotherapy. Explaining some aspects of brain plasticity and these brain-based processes can also empower clients.

Conclusion

This dissertation explored three conceptually linked but historically distinct integrative projects. The first explored the integration of neurology and psychology in the late 19th century with specific reference Bain's *Mind and Body* and Freud's *Project for a Scientific Psychology*, the second considered psychoanalysis' relationships with some of the other psy-disciplines, and it ends with and analysis of the recently created interdisciplinary field of neuropsychoanalysis.

Chapter one presented a description of *Mind and Body* and highlighted the scientific context that this book emerged from. This section offered the first extensive explanation of Bain's neural network model – its foundations, concepts, and theories – and demonstrated his creativity in borrowing and integrating knowledge. In 1997, in the journal *Brain and Cognition*, Alan Wilkes and Nicholas Wade of Dundee Scotland wrote an article entitled "Bain on Neural Networks," where they outlined Bain's theory of memory and made some connections to Hebb. I hold their article, as well as Malcolm MacMillian's work in high esteem, and I hope that I have extended their work in a positive way by explaining the entirety of Bain's theories as presented in *Mind and Body*.

In examining Bain's and Freud's models, it became clear that there were many similarities between them, and a qualitative comparative quotation analysis documented these similarities and hypothesized that Bain may have indirectly influenced Freud. In so doing, some key differences between Bain's and Freud's models were also highlighted and accounted for in relation to some of the key historical discoveries that occurred between 1872 and 1895; the neuron doctrine and Freud's more clinically oriented background were found to be the key reasons for the discontinuities in their models. Additionally, the discovery of the neuron doctrine played a key role in Freud providing a more advanced neurological model of psychic functioning than Bain was able to.

Chapter three presented the first qualitative quotation comparison of Bain's *Mind and Body* and Freud's *Project for a Scientific Psychology*. The comparison of these two models was an explicit attempt to acknowledge the existence of Bain's little known neural network and recognize it, along with Freud's, as one of the first attempts to integrate physiology and association psychology. Although many similarities were found between Bain and Freud, this thesis found no conclusive evidence that Bain directly influenced Freud. The similarities were likely due the common scientific milieu they both drew from.

In part two of this thesis (chapters four and five) there was a move away from Bain and an emphasis placed on the fields of psychoanalysis and neuropsychoanalysis. A key idea that led me in this direction was the idea that Freud's *Project* was interdisciplinary and that it led to the creation of psychoanalysis, an interdisciplinary field. Alongside this, there were the connections between the *Project* and the new field of neuropsychoanalysis.

But in reading the scholarship on the “new field” there was an assumption that this was the first time psychoanalysis attempted integration with the neuro-fields since the *Project*. However, in my research this “new” connection between psychoanalysis and neuroscience was not new at all, particularly after learning about the work Lawrence Kubie, a psychoanalyst, and Wilder Penfield, a neurosurgeon, who collaborated on some interdisciplinary studies. I realize one cannot compare a brief one-time collaboration with the creation of an entire field, but this interdisciplinary collaboration made me question whether any earlier more implicit relationships or integrations had occurred between psychoanalysis and other psy-fields.

Consequently, chapter four presented four key points of connection between psychoanalysis and the psy-fields beginning with Jung’s empirical testing of Freud’s concept of repression, which also demonstrated Freud’s early support for empirical testing of his theories. Freud’s use of empirical evidence by others to support his psychoanalytic theories at the Clark conference in 1908, demonstrated his openness to interdisciplinarity, even though his thoughts on this changed throughout the course of his life.

Psychoanalysis’ relationship with some of the psy-disciplines, particularly psychology, were also described and a bibliometric analysis, which drew on the work of Hornstein (1992), provided the first detailed quantitative analysis of this period in history when psychology co-opted Freudian concepts. In addition, some interdisciplinary connections between psychoanalysis and somatic medicine were also identified, as were some connections between psychoanalysis and cybernetics. The journey between the *Project* and neuropsychoanalysis was not direct or linear, and this study demonstrated this in chapter four.

Finally, psychoanalysis and Freud’s *Project* were evaluated from a contemporary interdisciplinary perspective by presenting a portrait of the field of neuropsychoanalysis, which provides a new perspective on the field neuropsychoanalysis. Here, a bibliometric analysis presented the concepts studied and evaluated the credentials of those publishing in the journal *Neuropsychoanalysis*. In total, eight key concepts emerged from the field; however, only the top three, affect, dreams, and Freud's dynamic model, were emphasized in the discussion. In explaining the key concepts of interest to the field of neuropsychoanalysis, the work of Mark Solms and Jaak Panksepp was highlighted because their research has played such an important role in founding the field and continues to influence those following in their footsteps. In addition, some specific neurological and technical advances that occurred between the time Freud wrote the *Project* and the creation of the field in 1999 were discussed, as were the cases for and against neuropsychoanalysis as an interdisciplinary field.

My primary goal in chapter five was to understand the field by creating a portrait of it, with the hope that, in so doing, others would see the field more clearly and accurately. Moreover, I wanted to understand the opposition to it. Was the hostility today toward neuropsychoanalysis any different than it was 50 years ago when psychologists were testing its theories trying to prove him wrong? I found that psychoanalysts have more concerns regarding the integration of psychoanalysis and neuroscience, than neuroscientists do.

Neuropsychoanalysis is the new baby in the family of psychoanalysis and the psy-disciplines. Like any new baby in the family, it will take time for the psy-siblings to adjust to this new arrival; there will be sleepless nights, sibling rivalry, envy, complexes, and competition – but I am hopeful that it is possible that out of the chaos of its early development, a mature and confident field can emerge –a field that can provide a different methodology, one that explores both the objective and the subjective - a new way to seek answers to the same questions Bain and Freud grappled with more than 100 years ago. Moreover, beyond theory development, I hope that this field can contribute to reducing the suffering that so many clients bring to the consulting room.

But, it is perhaps somewhat early to judge the effects of interdisciplinary integration on psychoanalysis in general and on the discipline of neuropsychoanalysis itself. Neuropsychoanalysis is a contemporary field that integrates psychology and neuroscience and may be the field that both Bain and Freud imagined when they created their neurological models of the mind. Since then, theories, technology, and methods have changed allowing researchers the opportunity to use imaging technology to enhance our knowledge of the mind-brain relationship. The fact that neuropsychoanalysis is emphasizing subjective experience in neurological research opens up the possibility of keeping the meaning-making process at the forefront of brain-based studies. Nevertheless, the question about whether the mind equals brain is still open to complex philosophical debates, as are discussions regarding the influence of "neuroculture," both inside and outside of academia.

A critical neuroscientific perspective needs to be sustained as the field of neuropsychoanalysis continues to develop and in moving forward it is imperative for the field to follow Dumit's (2004) suggestion, and use an "exploratory and hypothesis generating," rather than "hypothesis confirming perspective (p. 157). I would argue that it is this philosophy that will assist neuropsychoanalysts as they continue to seek answers to the mind-body questions that also troubled Freud. Moreover, it may be this hypothesis-generating viewpoint that led Solms (2013) to revise Freud's structural model, based on recent neuroscientific findings.

Neuropsychoanalysis, however, is not without its flaws; there are concerns over the wide-spread use of imaging studies, the possible reductionism, and the loss of psychoanalysis as a primarily hermeneutic meaning making profession, to name only a few. These questions and these critiques will and should continue to be asked by those both inside and outside neuropsychoanalysis as the field continues on its journey.

But along this journey, keep some of Freud's last thoughts in mind. On Jan 10, 1937, about a year and a half before he died, Freud wrote to Marie Bonaparte, asking for an update on the status of her procurement of the Freud-Fliess correspondence, which contained, among other works, his *Project for a Scientific Psychology*. When Freud heard that she had not yet retrieved them, he stated,

> "It is disappointing that my letters to Fliess are not yet in your hands, but are still in Berlin…However, I tell myself that in eighty or a hundred years interest in the content of this correspondence will be notably less than it is today" (Freud, 1937, cited in Masson, 1986, p. 8).

Freud's reaction indicates that he, more than Bonaparte, was skeptical about the importance or interest his correspondence would provide in the future century; Solms, Panksepp, and those working in neuropsychoanalysis would likely agree - Freud could not have been more mistaken.

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