The case for neuropsychoanalysis

Why a dialogue with neuroscience is necessary but not sufficient for psychoanalysis

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Abstract:

Recent advances in the cognitive, affective and social neurosciences have enabled these fields to study aspects of the mind that are central to psychoanalysis. These developments raise a number of possibilities for psychoanalysis. Can it engage the neurosciences in a productive and mutually enriching dialogue without compromising its own integrity and unique perspective? While many analysts welcome interdisciplinary exchanges with the neurosciences, termed neuropsychoanalysis, some have voiced concerns about their potentially deleterious effects on psychoanalytic theory and practice. In this paper we outline the development and aims of neuropsychoanalysis, and consider its reception in psychoanalysis and in the neurosciences. We then discuss some of the concerns raised within psychoanalysis, with particular emphasis on the epistemological foundations of neuropsychoanalysis. While this paper does not attempt to fully address the clinical applications of neuropsychoanalysis, we offer and discuss a brief case illustration in order to demonstrate that neuroscientific research findings can be used to enrich our models of the mind in ways that, in turn, may influence how analysts work with their patients. We will conclude that neuropsychoanalysis is grounded in the history of psychoanalysis, that it is part of the psychoanalytic worldview, and that it is necessary, albeit not sufficient, for the future viability of psychoanalysis.

Keywords: cognitive neuroscience, dual-aspect monism, Freud, interdisciplinary dialogue, meaning, mind-body problem, neuropsychoanalysis, subjectivity

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1. Introduction

Psychoanalysis and neuroscience have either ignored each other or were in a state of mutual hostility through most of the twentieth century. The few notable exceptions (e.g. Pribram and Gill, 1976) have steadily increased over the last twenty years (for a review see Fotopoulou, 2012b), as proponents of these divergent approaches to the human mind gradually realized that they might have something to gain from an interdisciplinary dialogue (Kandel, 1998; 1999). This evolving dialogue, despite (or perhaps because of) its inherent complexities, has aroused considerable interest. It was generally welcomed in both fields as a source of new insights and fresh perspectives (Crick and Koch, 2000; Fonagy, 2004; Kernberg, 2004; Mayes, 2003; Michels and Roose, 2005; Nagera, 2001; Northoff and Boeker, 2006; Panksepp, 1998; Ramachandran, 1994; Semenza, 2001; Shevrin, 2002; Shulman and Reiser, 2004; Watt, 2000). However, the rapprochement between psychoanalysis and the neurosciences also aroused deep concerns on both sides (Brothers, 2002; Hobson, 2004, 2005; Mechelli, 2010; Pulver, 2003).

In this paper, we initially sketch the development of neuropsychoanalysis and its impact and reception in both fields. We then focus on the concerns expressed in psychoanalysis regarding the theoretical foundations and scope of neuropsychoanalysis. In addressing these concerns we place special emphasis on the historical and philosophical (ontological and epistemological) issues at the heart of the relation between psychoanalysis and the neurosciences. To the best of our knowledge, Blass and Carmeli (2007) have put forward the most extensive critique of neuropsychoanalysis in the psychoanalytic literature to date. They have repeated many of their arguments in an expanded, more recent book review (Carmeli and Blass, 2013). Therefore, we refer to their concerns and conclusions repeatedly throughout this paper. While a full discussion of the clinical applications of neuropsychoanalysis is beyond the scope of this paper, we offer and discuss a brief case illustration in order to demonstrate our view that neuroscientific findings can – and should – be used to inform and enrich the ways in which analysts work with their patients. We then address two additional concerns of those opposed to neuropsychoanalysis: that it is not analytical, and that it is dangerous to psychoanalysis. We end with a brief discussion of the advantages of an interdisciplinary dialogue for psychoanalysis.

1.1. Brief Outline of the Development of Neuropsychoanalysis

Most historical considerations of the relation between psychoanalysis and neuroscience start from the fact that Freud was first a neuroscientist and neurologist, and only later turned to psychoanalysis. The

importance of this scientific origin of psychoanalysis has been addressed and debated several times, particularly since the publication and examination in the 1950s of the 'Project for a scientific psychology', Freud's abandoned neuropsychological model (Forrester, 1980; Greenberg, 1997; Guttmann and Scholz-Strasser, 1998; Kaplan-Solms and Solms, 2000; Pribram and Gill, 1976; Solms and Saling, 1986; Sulloway, 1979). These historical considerations have been the starting point of neuropsychoanalysis. They have also inspired a systematic examination of the scientific and epistemological foundations of psychoanalysis as revealed in Freud's early neurological texts (Solms and Saling, 1986; 1990). This examination suggested that the young Freud -- influenced by, among others, John Hughlings Jackson -- wanted to explain the operations of the brain as governed by hierarchically organized and dynamic neurophysiological functions. However, he had no means by which to investigate such systems in the brain, and his views contrasted with the rigid localizationism of the neuropsychology of his time. He instead opted for an independent new discipline, in which he would attempt to explain such dynamic organization from the purely functional standpoint, using purely psychological methods of investigation (Freud, 1900). Nevertheless, he remained faithful to the idea that his models of the mind, based on independent psychoanalytic study, would one day be correlated with models of brain function that are more dynamic and multilayered than was possible with the neurological methods of his time (Kaplan-Solms and Solms, 2000; Yovell, 2004; see also 3.4.1. below).

As neurology, psychiatry and neuroscience developed in the 20th century, however, several scholars in psychoanalysis and philosophy did not share Freud's positive view of the scientific origins and future of psychoanalysis (e.g. Grunbaum, 1984), while others deemphasized the scientific background of Freud and argued that he would not have embraced modern scientific methods of enquiry (e.g. Edelson, 1986). Yet in parallel several psychoanalysts and other scholars endeavoured to correlate aspects of psychoanalytic theory with empirical advances in neuroscience and related fields (e.g. Pribram and Gill, 1976; Shevrin, 1986; Weinstein and Kahn, 1995). Neuropsychoanalysis emerged in the 1990s as a formalized attempt to build bridges between psychoanalytic and neuroscientific methods, findings, and theories of the mind (Solms, 2006a). In 2000 one of us (Solms) founded the International Neuropsychoanalysis Society. It was a small group of psychoanalysts and scientists who joined forces to create a forum of interdisciplinary dialogue. Dialogue in the history of psychoanalysis, as well as in that of the neurosciences, was not always egalitarian, open-minded, mutually empowering, and based on the co-construction of knowledge. This is however the kind of interdisciplinary dialogue that neuropsychoanalysis has always aimed for (Kaplan-Solms and Solms, 2000; Solms and Turnbull, 2002; Fotopoulou, 2012a). Following Freud, Solms argued that 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' (Kaplan-Solms and Solms, 2000 , p. 25).

Solms instead argued that the natural first point of contact between the two disciplines should be dynamic neuropsychology, the version of the clinicoanatomical method and corresponding theory of dynamic localization that Alexander Luria pioneered shortly after Freud's death (Kaplan-Solms and Solms, 2000). Unfortunately, Luria's work and similar traditions in 'dynamic' neurology had been de-emphasized in the later decades of the twentieth century, due to the dominance of modular theories in cognitive neuropsychology and neuroscience, but this trend is now reversing (see Fotopoulou, 2012c; see also 1.3. below). In neuropsychoanalysis, Luria's neuropsychological insights were recruited in an effort to build the skeleton of a conceptual bridge that would allow psychoanalysis and neuroscience to communicate. It was further envisioned that once the foundations of a facilitating and also constraining conceptual bridge have been built, neuropsychoanalytic work could be performed between psychoanalysis and a wide range of neuroscientific disciplines with different methods and concepts. In the last two decades, a number of prominent psychologists and neuroscientists have taken a renewed interest in Freudian writings and psychoanalysis (e.g. in the fields of affective and social neuroscience: Antonio Damasio, Jaak Panksepp, Georg Northoff, Helen Mayberg, Vittorio Gallese; in cognitive psychology: Martin Conway, Marcel Kinsbourne, Mike Anderson, Carlo Semenza; see the journal *Neuropsychoanalysis* for their publications; see also the volumes *Psychoanalysis and Neuroscience*, edited by Mauro Mancia, and *From the Couch to the Lab*, co-edited by one of us - Fotopoulou). Similarly, several psychoanalysts have taken an interest in understanding the biological foundations of human psychology (e.g. Ansermet and Magistretti, 2007; Beutel et al., 2003; Fonagy, 2004; Maze, 2003; Olds, 2012; Scalzone, 2005; Schore, 2003; see also the long list of papers published in the *International Journal of Psychoanalysis* and the journal *Neuropsychoanalysis* over the past 10 years). This change, in both psychoanalysis and neuroscience, is reflected in a number of additional, influential publications in major scientific journals (e.g. Kinsbourne, 1998; McCrone, 2004; Turnbull and Solms, 2007; Carhart-Harris and Friston, 2010; Carhart-Harris et al., 2008; Panksepp and Solms, 2012; Rizzolatti et al., 2014) and in wider media journals (e.g. Solms, 2004). It is also evident in the organization of several interdisciplinary conferences (e.g. the 'Neuroscience and Psychoanalysis' symposia held during the annual conference of the International Psychoanalytical Association, American Psychoanalytic Association and the European Psychoanalytic Federation).

1.2. The Reception of Neuropsychoanalysis in Psychoanalysis

The range and wealth of the above-mentioned studies and theoretical syntheses attest to the interest and success of neuropsychoanalysis in both neuroscience and psychoanalysis. However, its advent has not been welcomed by all, and it has not been free of shortcomings. The rapprochement between psychoanalysis and the neurosciences has taken several forms in the past decades (for a recent review see Sauvagnat et al., 2010) and has always aroused deep concerns about its potential character and implications (e.g. Edelson, 1986). The more recent neuropsychoanalytic position has generated renewed objections on both sides (Blass and Carmeli, 2007; Hobson, 2005; Mechelli, 2010; Pulver, 2003). In psychoanalysis, the modular, reductionistic and materialistic epistemology of some neuroscientific research (see below), as well as the frequently 'simplistic' coverage of complex psychological concepts such as empathy, embodiment and conflict, in the relatively new and fast-developing fields of cognitive, affective and social neuroscience, may have led some analysts to refrain from engaging in interdisciplinary dialogue.

In addition to objections in principle, sound interdisciplinary efforts need to be based on disciplinary excellence, and highly specialized and successful psychoanalytic professionals may find it time-consuming and difficult to profess in a new and vastly different discipline. By contrast, superficial mergers are easier to generate, as they rely on quick, shallow studies of the new fields and they can be easily coupled with the oversimplification and popularization of neuroscientific research in the media. The explosion of neuroscientific methods and findings has resulted in an unprecedented potential for speculative syntheses. Despite the cautionary writings of several scholars in neuropsychoanalysis that have tried to base neuropsychoanalytic efforts on clear, psychoanalytically-constrained foundations (Kaplan-Solms and Solms, 2000), not all of the work at the borders between psychoanalysis and neuroscience has been built on the careful metapsychological foundations that Solms had hoped for.

Most importantly, despite the recent, promising trends in mainstream cognitive neuroscience (see 1.3. below), the 'personal mind' as we know it in psychoanalysis and philosophy is still largely inaccessible to neuroscientific methods. Moreover, several cognitive scientists and neuroscientists deny the importance of subjectivity and first-person accounts in both their research aims and their implicit or explicit neurophilosophical attitudes and beliefs. It is understandable therefore that some analysts may wish to oppose the ruthless, reductionistic biologization of the subjective and the personal in neuroscience. Nevertheless, as the proponents of neuropsychoanalysis have argued (see Fotopoulou, 2012b for review), and as we argue in the current paper, such opposition is not synonymous with opposing a biologically-constrained metapsychology and the possibility of

dialogue with *some* neuroscientists. 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 to cognitive neuroscience, as detailed in 1.3. below.

1.3. Recent Scientific Developments and their Impact on the Reception of Neuropsychoanalysis in the Neurosciences

The renewed interest in the possibility of a mutually beneficial dialogue between psychoanalysis and neuroscience was facilitated by parallel, dramatic developments in the neurosciences. Although a full description of the latter goes beyond the scope of this paper, we offer a brief outline here and direct the reader to relevant recent publications (e.g. Fotopoulou, 2012c). In the 20th century, neuroscience has made remarkable progress in studying the brain and also in understanding the neural correlates of mental processes. Whereas in previous decades such progress was dominated by behaviourism and cognitive science in psychology, functionalism and computationalism in neurophilosophy, and reductionism in neurobiology and genetics, these paradigms are fast losing their popularity within the neurosciences. In the last twenty years, neuroscience has not only accelerated in pace but also changed in character. Technological progress and some unexpected discoveries, for example mirror neurons in the macaque monkey (Di Pellegrino et al., 1992), allowed neuroscientists to expand their enquiries to topics that have traditionally been the preserve of psychoanalysis and other related fields within psychology and philosophy.

Specifically, the assumption that prevailed until the early 1990s, to the effect that the human mind can be understood by examining *exclusively* cognitive functions and their neural correlates (e.g. what goes on in the brain when one thinks, remembers, etc.), has undergone considerable criticism. A diverse and growing community of neuroscientific researchers have come to realize that mental abilities are *also* defined by emotions and motivations; that they are embedded in the acting, sensing and feeling body; and that they are subject to intricate couplings between organisms and their interpersonal, social and technological environments (e.g. Benedetti, 2010; Damasio, 1994; Decety and Ickes, 2009; Gallese, 2009; LeDoux, 1996; Panksepp, 1998). Thus, topics such as the neural correlates of emotions, mental conflict and attachment are now considered mainstream areas of neuroscientific enquiry, and new subfields such as affective and social neuroscience are now well-established. In addition, mainstream investigators in cognitive neuroscience have increasingly turned their attention to the neurobiological basis of dynamically unconscious processes and their cognitive control (see Berlin, 2011; Fotopoulou, 2012c for reviews). For example, certain dissociations between

explicit (conscious) and implicit (unconscious) processes in neuropsychology (e.g. Fotopoulou et al., 2010; Nardone et al., 2007) are increasingly understood as the neurodynamic equivalents of psychodynamic repression processes (see Fotopoulou, 2010 for discussion). More generally, the concept of unconscious 'will' (personal goals that operate outside of conscious awareness) has recently been included in the mainstream of scientific enquiry (Custers and Aarts, 2010; Dijksterhuis and Aarts, 2010). In general, the scope of cognitive neuroscience has been stretched well beyond the traditional topics of visual perception, reasoning, memory and language, and thus it provides a wider basis of dialogue with psychoanalysis.

Importantly however, as these neuroscientific fields are in their infancy, their use of complex psychological concepts and their epistemological assumptions are frequently dominated by errors of oversimplification, reductionism, localizationsim, atheoretical use of terms, and other fallacies (see Bennett and Hacker, 2003; Gold and Stoljar, 1999; Fotopoulou, 2012c for critical reviews). The dialogue and interdisciplinary exchange with fields such as social psychology, philosophy and psychoanalysis, with their rich theoretical and epistemological traditions, and their emphasis on first-person levels of explanation, may have constraining effects over such neuroscientific errors (Fotopoulou, 2012c; Hopkins, 2012; Canestri, 2012; Gallese, 2009). In fact, the kind of dialogue initiated by neuropsychoanalysis is also actively pursued in other interdisciplinary efforts to bridge between the humanities and neuroscience, such as neurophenomenology, embodied cognitive neuroscience and second–person neuroscience (Freeman, 2003; Gallagher, 2003; Gallesse, 2009; Reddy, 2009; Varela, 1996).

Perhaps more important than the change that took place in 'what' neuroscientists study, are the dramatic developments in 'how' they study the brain, and thus what kind of knowledge about brain/mind relations they can arrive at. Recent developments in neuroscience echo the models of dynamic localization of mental function that Hughlings Jackson and Freud had anticipated — based solely on their inferences from mental dynamics and clinical observations (see Fotopoulou, 2012c, for a recent review). Technological and mathematical advances have progressively led to a shift of emphasis, from exclusive attention to functional segregation (the description of specialized neurons, grouped together in space to form neural modules) to parallel consideration of functional integration (or convergence). When applied to mental functions, the latter approach posits that complex mental functions are based on interactions among various interconnected and specialized brain regions which result in hierarchical and distributed systems (e.g. Friston, 2009; Raichle et al., 2001). As mentioned above, such dynamic, large-scale network operations in the brain have been long anticipated in theoretical neurology and physiology, including in the work of Luria that formed the initial

neuropsychological model upon which neuropsychoanalysis first attempted to build a dialogue between psychoanalysis and neuroscience (Solms and Saling, 1986). Nevertheless, the technology that would allow quantification of such large-scale network dynamics was not hitherto available. By tracking different aspects of dynamic brain behaviour, new approaches in functional neuroimaging design and analysis, as well as parallel efforts in the fields of neurodynamics, neurophysiology, dynamic neuropsychology and neuropharmacology, provide a way of looking at these functional networks at an appropriate scale (Coombes, 2010; Freeman, 2003; Friston, 2009).

These advances require that new epistemological criteria for cognitive theories are set; for example, modular, information-processing theories, genetic models and computer metaphors are constantly being re-evaluated and often abandoned (Friston and Dolan, 2010; Fuster, 2009; Hopkins, 2012; see also 3.2.1.1. below). Current neuroscientific approaches seem collectively to convey a picture of neurocognitive organization and function that transcends the classical modular and computationalistic view of the mind as portrayed in cognitive sciences and neurophilosophy (e.g. Fodor, 1974; 1975). Unlike cognitive theories of mental function, Freudian metapsychology was built on a commitment to the dynamics of mind. Thus, Freudian and other psychoanalytic models may be highly suitable for interdisciplinary exchanges with contemporary, dynamic neuroscientific models. Examples of such syntheses have already been put forward (e.g. Cathart-Harris and Friston, 2010; Fotopoulou, 2012c; Hopkins, 2012; Rizzolatti et al., 2014). Studies in new interdisciplinary fields such as psychodynamic neuroscience (Fotopoulou, 2012c) can counter the atheoretical and reductionistic approach of some contemporary studies and papers in cognitive neuroscience and can further increase the exposure to and familiarity with psychoanalytic ideas among mainstream neuroscientists (Mechelli, 2010). Without this influence, mindless reductionism stands a chance of prevailing for several more years until meaningful, psychoanalytically-inspired theories and systematic studies of subjective experience provide novel insights about brain function (Panksepp, 2007; Panksepp and Solms, 2012).

Indeed, for some neuroscientists, psychiatrists and psychologists, psychoanalytic theory and practice is considered misleading and archaic (e.g. Hobson, 2004, 2005). Freudian and other psychoanalytic ideas are frequently portrayed as irrelevant, if not actually dangerous in scientific textbooks, journals, and in university science and psychology departments, particularly in Anglo-American institutions. For the most part, these attitudes are based on misconceptions or ignorance about psychoanalytic theory, methods and language (Fotopoulou, 2012a). Thus, while an increasing number of neuroscientists would agree with the idea that unconscious cognition, rich and complex motivational systems, and social influences on development uniquely shape the human mind and behaviour, they do not necessarily see how these positions may relate to psychoanalysis. Few of these scientists see

how a renewed interest in the academically isolated and largely non-experimental field of psychoanalysis could enhance their understanding of the complex workings of the mind and brain. Dialogue with psychoanalysis, like the one put forward by neuropsychoanalysis, cannot guarantee full understanding between the fields, but it can help dispel some of the basic misconceptions between analysts and scientists, and constrain the scope of both disciplines.

2. Points of Agreement

Blass and Carmeli (2007) have presented an extensive, detailed review and discussion of the case against neuropsychoanalysis. Many of their arguments were repeated in an expanded, more recent book review (Carmeli and blass, 2013). In this paper we therefore examine their critique as a representative of the various objections to neuropsychoanalysis that were raised within psychoanalysis. However, before we clarify our disagreements, it might be useful to note where we are in agreement with them.

First, we agree that "underlying the debate over the relevance of neuroscience to psychoanalysis, there lies a struggle over the essential nature of psychoanalytic theory and practice" (Blass and Carmeli, 2007, p. 19). While we would prefer to use the term "discussion" rather than "struggle," we believe that their perspective is indeed part of an important current debate about the very nature of psychoanalysis, about its scope, about its future, and about its relationship with other disciplines.

Second, we agree that the name "neuropsychoanalysis" should not imply that the two disciplines of neuroscience and psychoanalysis have become one, or are going to become one in the future, or that they are in principle capable of becoming one.[1] Psychoanalysis and the neurosciences are and will continue to be two inherently different disciplines (more accurately, groups of disciplines). They employ different methodologies to investigate two complementary aspects of the human mind – the subjective and the objective, neither of which is reducible to the other or more real than the other (see Solms, 1997; see also 3.2.1.2., 3.2.1.3., 3.6.1. and 3.6.2. below). However, as a result of the neuroscience revolution of the last three decades, these two disciplines have come to investigate the same territory – namely the functional organization of the human mind – each from its own perspective. This momentous development has far-reaching implications for both fields.

[1] When it was first formally introduced (Nersessian and Solms, 1999) the term denoting this interdiscipline was "neuro-psychoanalysis." The hyphen was meant to emphasize the fact that psychoanalysis and the neurosciences are separate and cannot be merged. Over the last few years, however, as the phrase became more popular and widely used, the hyphen was dropped . Nevertheless, the reasons for its original usage remain pertinent.

Neuropsychoanalysis has therefore evolved with the aim of fostering a dialogue between the two groups of fields. Simply put, neuropsychoanalysis is a bridge between disciplines (see also Fotopoulou, 2012b).

Third, we note that Blass and Carmeli broadly agree with us when they "do not in any way question that all mental phenomena necessarily require a biological substrate" (2007, p. 21) – although we would prefer the non-reductionist term "correlate" to "substrate". They add that "indeed, neuroscientific findings can help demarcate the limits of psychoanalysis" (2007, p. 21). In a similar fashion they stress that "psychoanalytic models must not, of course, contradict the new cognitive findings" (2007, p. 32). This last statement, which implies that psychoanalytic models must always comply with cognitive-neuroscientific findings, is surprising given the claim that the two disciplines are irrelevant to each other. It is also surprising because cognitive-neuroscientific findings and models, like all findings and all models in all disciplines, are sometimes discovered to be overly general, inaccurate or simply mistaken later. Therefore, in our view, they should not automatically be held as the final court of appeal for psychoanalytic models. This issue is further discussed below (3.6.2.). Nevertheless, we agree with Blass and Carmeli that the new cognitive-scientific findings and models should have a profound impact on psychoanalytic models. As we will show, these basic agreements about the relationship between neuroscientific and psychoanalytic models are in opposition to – and ultimately refute – many of the current criticisms of neuropsychoanalysis.[2]

3. Objections to Neuropsychoanalysis

Blass and Carmeli (2007) make three unequivocal statements about neuropsychoanalysis, and thus about the emerging dialogue between psychoanalysis and the neurosciences. First, they claim that the neurosciences are essentially irrelevant to psychoanalysis. Second, they claim that neuropsychoanalysis in not analytical. Third, they claim that neuropsychoanalysis is dangerous to psychoanalysis. These categorical claims, which amount to a sweeping repudiation of neuropsychoanalysis, require careful consideration and examination. In examining them below, we will discuss the theoretical basis of neuropsychoanalysis, and illustrate one of its potential clinical applications.

3.1. Claim: The Neurosciences are Essentially Irrelevant to Psychoanalysis

[2] It can already be seen that the statements quoted in this paragraph are in opposition to the basic case against neuropsychoanalysis. Who is to determine what the "biological substrate" is, and what the "limits of psychoanalysis" are? It would have to be someone fully conversant with both disciplines, namely a neuropsychoanalyst.

According to Blass and Carmeli, the neurosciences have nothing to offer psychoanalytic theory and practice, because "psychoanalysis [is] a domain concerned with meanings, to which neuroscience cannot significantly contribute" (2007, p. 21). Likewise, "neuroscience can tell us of the biology of the mind while dreaming, while feeling motivated, while having affective experience, but not of the meaningfulness of that biological substrate or how it can be understood and characterized meaningfully" (2007, p. 34). Therefore, an interdisciplinary dialogue is without merit and futile, and neuropsychoanalysis, which believes otherwise, is based on a series of fallacies and mistaken intuitions. This point of view is expressed more broadly in papers that address the relationship between neuroscience and the psychological level of discourse (e.g. Bennett and Hacker, 2003; Gold and Stoljar, 1999). Similar concerns are raised by Mechelli (2010) and Pulver (2003), with special emphasis on the irrelevance of neuroscience to psychoanalytic practice. For example, even if Mechelli is among those who do believe that the psychoanalytic perspective can inform the quest of some neuroscientists for a deeper understanding of the neurobiological basis of mental phenomena, he doubts how neuroscience can contribute to psychoanalysis, given their different epistemologies (Mechelli, 2010).

3.2. Response and Discussion: Irrelevant or Essential?

This broad, vital question is addressed and discussed from the perspective of psychoanalytic theory (3.2.1.), and then from the perspective of psychoanalytic clinical practice (3.2.2.). The latter discussion is accompanied by a case illustration (3.2.2.1).

3.2.1. The Relevance of the Neurosciences to Psychoanalytic Theory

The claim that the neurosciences are essentially irrelevant to psychoanalysis lies at the heart of the categorical opposition of some authors (Blass and Carmeli, 2007; Edelson, 1986). Importantly, however, some other authors who similarly oppose the dialogue between psychoanalysis and the neurosciences do not oppose it categorically, but rather are interested in examining and clarifying the assumptions that are made during such a dialogue (Boesky, 1995; Smith, 1997). As discussed in section 1.2. above, we share these latter concerns, including the common and potentially problematic use of neurobiological models as if they were metaphors in psychoanalysis – as if they were just another figurative language (Fotopoulou, 2012c ; Solms and Turnbull, 2002; Yovell, 1997). Still other

authors (e.g. Pulver, 2003) acknowledge that the neurosciences might be relevant to psychoanalytic theory, but not to psychoanalytic clinical practice.

In contrast, Blass and Carmeli (2007) claim that the neurosciences can offer no contribution at all to anything that is truly psychoanalytic. This is not because neuropsychoanalysis has not yet developed the tools necessary to make such contributions, but rather because there can never be a productive exchange between psychoanalysis and the neurosciences. According to this view, the domain of psychoanalysis and the domain of the neurosciences are in effect mutually exclusive: Where there is meaning, the neurosciences can have no say; where biological influences on the mind are clear and inescapable (as in brain damage or disease), psychoanalysis can have no say, and the psychological effects of such brain lesions are inherently devoid of psychic meaning (2007, p. 35). This is a radical claim, which, if taken seriously, has far-reaching ramifications for psychoanalysis. For example, it implies that psychoanalysis can cast no light on the content and meanings of the ramblings of a drunkard – since the intoxicated state has an 'organic' chemical basis. Still, this is a central claim in the current debate, and it therefore deserves examination and discussion.

3.2.1.1. Functionalism and the Hardware-Software Fallacy

While Blass and Carmeli do not deny that "all psychological phenomena require a biological substrate" (2007, p. 21), and that "biology can set limits on psychological experience" (2007, p. 34), they stress that the domain of meanings can and should be approached without any understanding of the mechanisms that underpin them: "By rejecting the contribution of neuroscience to psychoanalysis per se, we do not in any way question that all mental phenomena require a biological substrate. We question only the relevance and value of the understanding of the biological substrate, the hardware of the mind, for the understanding of the mental" (2007, p. 21).

In other words, despite the fact that brain and mind are inextricably correlated, psychoanalysts should continue to focus on the mind as if the brain did not exist, as they did throughout most of the twentieth century. Why? Because the brain – "the biological substrate" – is no more than "the hardware of the mind" (2007, p. 21), and hence irrelevant. This view on the relationship between psychoanalysis and the neurosciences (i.e., no relationship) stems, as Blass and Carmeli implicitly acknowledge (2007, p. 21), from a particular approach to the mind/body problem: functionalism (Fodor, 1974; 1975). Blass and Carmeli's approach does indeed invoke the (functionalist) computer analogy, according to which the brain is the 'hardware' that supports the mind, which is itself a product of the brain's 'software'. Furthermore, if one accepts this view, then it can be seen how some people may come to

the conclusion that the neurosciences are irrelevant to psychoanalysis: Psychoanalysts are concerned with the software, while neuroscientists are concerned with the hardware. In order to work with a particular software program, one does not need to know anything about how a computer is physically built or how it is wired. It is enough that the software specialist (the psychoanalyst) is able to tell when there is a malfunction in the hardware, and then call a computer technician – someone from a different discipline.

At that point, nothing that is psychoanalytically meaningful can be done with the software, because the malfunction has no meaning: "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. But, while it is important to avoid such error, to do so does not require the analyst to enter a dialogue with neuroscience, but rather to be familiar with the clinical pictures that may suggest the influences of a non-psychical, non-meaningful kind are playing a major role" (Blass and Carmeli 2007, p. 35). In other words, the psychoanalyst should know when to call a computer technician (a neurologist? a psychiatrist? a neuropsychologist?), but need not enter into a conversation with him or her. The technician's job is to work on the hardware, and he or she is in no position to discuss the function of the software with the analyst. They are simply dealing with two different entities.

For over thirty years this 'functionalist' approach to the mind/body problem has raised strong objections from several philosophers (Chalmers, 1995a; 1995b; Leibowitz, 1974; Nagel, 1986; 1993; Searle, 1980; 1992). Not surprisingly, for similar reasons, very few neuroscientists endorse it, and as cognitive neuroscience progresses it even loses its appeal in neurophilosophical and neuropsychological circles (see above and Hopkins, 2012). This is because the computer analogy is a poor metaphor for the actual relationship between brain and mind. It is now almost universally accepted that *when it comes to the functions of the brain, it is impossible to separate hardware from software* (Eccles, 1994; Edelman and Tononi, 2000; Freeman, 2003; Yovell, 2004; see also 3.2.1.4. below).

3.2.1.2. Dual-Aspect Monism

At this point, a brief digression into the enduring problem of the relationship between mind and brain is inevitable. The mind-body problem, which was the domain of philosophers for millennia, has recently become the subject of an intense and productive exchange between philosophers, neuroscientists and psychologists (Hameroff, Chalmers and Kaszniak, 1999). A new generation of philosophers who are aware of recent advances in the neurosciences has taken a fresh look at this

ancient problem which is, of course, highly relevant to psychoanalysis (Chalmers, 1995a; 1995b; Nagel, 1986; 1993; Searle, 1980; 1992). A discussion of the different philosophical approaches to the mind-body problem and their relationship with psychoanalysis is beyond the scope of this paper but has been attempted elsewhere (Edelheit, 1976; Fotopoulou, 2012b; Gaddini, 1987; Solms, 1997; Solms and Turnbull, 2002; Yovell, 2004). Here we will only provide a quick outline of a position put forward by the early proponents of neuropsychoanalysis (Solms, 1995; Solms and Turnbull, 2002).

This approach, dual-aspect monism, posits that the mind and brain are one entity (ontological monism). The functions of the mind are real, as real as any biological function. Nevertheless, we cannot have direct third-person perspective access to them (indirect realism). Instead, to understand and systematically study them we need to draw inferences (create models) based on two different and irreducible sources: the study of *subjective experience* in individuals or groups (as in psychology and psychoanalysis) *and* the study of *brain states and functions* in individuals or groups (as in neuroscience). Thus, understanding the mind (first person subjectivity) and gaining knowledge of the brain (third-person objectivity) are scientifically independent practices (epistemological dualism). They concern different ways of arriving at the necessary insights, and hence they ultimately form different types of inferences of mental processes (e.g. psychoanalytic models of mental processes, and neuroscientific models of mental processes). Since, however, both observational methods study the same entity (the so-called 'mindbrain'), and since, inherently, neither is sufficient to fully explore and describe it, collaboration and dialogue between them may enhance both, without eliminating each other's unique perspective and practice.

Nowadays this and similar positions in neurophilosophy are understood as different monistic but non-reductionistic and non-materialistic approaches to the mind-body problem; i.e. the thesis that the mind and body are ontologically one entity, but we can never epistemologically reduce the mind to the body and vice versa (see Chalmers, 1995b; Nagel, 1993; Solms and Turnbull, 2002). The details of this position, its origins (e.g. Kant and Spinoza) and its role in philosophy and psychoanalysis go beyond the scope of this paper. It is important to also mention that there are several other influential positions in neurophilosophy that oppose some theses of dual-aspect monism but nevertheless support the thesis of autonomous first-person, subjective-experiential events (e.g. Davidson's anomalous monism, Davidson, 1970; Varela's neurophenomenology, Varela, 1996). We cannot cover these positions here (see Canestri, 2012, and Hopkins, 2012, for further insights), but below we address some of the implications for neuropsychoanalysis when any of these non-reductionistic approaches is adopted instead of the 'hardware/software' functionalist approach.

3.2.1.3. Cooperation, not Incorporation

If one accepts the above non-reductionistic positions, then cooperation between psychoanalysis and neuroscience can be seen as collaboration between two distinct fields on topics of mutual interest, and neuropsychoanalysis is a bridge-building exercise. Although dialogue between the fields is important, this is not synonymous with claiming that they can gain precedence over each other. Their relationship is one of cooperation and not incorporation, as Pugh (2006) has noted. As also agreed by several critics, such as Blass and Carmeli (2007, p. 32), psychoanalysis is ontologically constrained by the mind's biological underpinnings. The same applies to psychology as a whole, a discipline born out of philosophy and biology. Psychological perspectives seemed to have had a troubled childhood as these 'parental' disciplines grew epistemologically further and further apart. Nevertheless, it is this dual composition of the mind that defines its nature and uniqueness and calls for simultaneous biological and first-person modes of exploration.

This tension between the objective and the subjective realms, between analysis by science and consideration by fields such as psychoanalysis and philosophy, is not an artifact of insufficient scientific knowledge or professional developments, but rather a fundamental characteristic of the human condition. Hence, this tension has marked the history of most models of the mind, including Freud's, and it seems that this is a tension that is likely to stay (Chalmers, 1995b; Yovell, 2004). Any field or theory that endeavors to understand the subjective mind (i.e. to develop and apply a metapsychology) is *at some level* constrained by its biological basis. Even within neuroscience such issues are still debated without a clear solution: whether 'mind' concepts will eventually become redundant (according to reductionist approaches), or coexist with neural-based accounts (as in dual-aspect theories, endorsed by most neuropsychoanalysts), is yet unknown. These are two rather prominent positions debated within neuroscience itself. Psychoanalysis, in contrast, ought to be true to its original values and its historical, as well as contemporary reasons for existing as an independent discipline.

Freud's original clinical observations founded this new discipline. Yet, as is well known, Freud's theoretical influences were embedded in his wider, cultural and scientific education (see 3.4.1. below). Similarly, current psychoanalytic models can be influenced by clinical observation and developments in both culture and science. Psychoanalysis needs to be in a position to consider developments in science, even if it ends up dismissing some of them as irrelevant, due to the criteria and findings of its own epistemology (see also 3.6.2. below).

In summary, the inferences that both fields make can only go as far as the intrinsic characteristics of the facet of our beings (subjective and objective, respectively) that they study. Given that neither of the two facets is sufficient to fully describe the actual phenomenon (the so-called 'mindbrain'), collaboration and dialogue may *constrain and enhance each other's models*, without incorporating or eliminating each other's unique scope and practice. This is why our position, as stated in the title of this paper, is that a dialogue with neuroscience is *necessary but not sufficient* for psychoanalysis.

3.2.1.4. "Brain Illness" and "Meaning" – Mutually Exclusive?

In our view, the claim that "brain illness" and "meaning" are mutually exclusive (Blass and Carmeli, 2007, p. 35), and the suggested dichotomy between brain hardware and mind software (*Ibid*, p. 21), are both incorrect, and lead to absurd conclusions. Simply put, the sharp distinction that they propose between "biological" and "psychological" influences on the mind is fallacious – it does not really exist. There is overwhelming clinical and experimental evidence, which has accumulated during the last twenty years, that this allegedly sharp distinction is inherently and irreducibly fuzzy. People who have psychological difficulties and supposedly "intact" brains, people with whom psychoanalysts work every day, like Ms. A, whose case example will be discussed below, actually have measurable neuronal abnormalities that are intimately correlated with the way their minds function. This is true for people who suffer from panic attacks (Alexander et al., 2005), psychic trauma (Bremner, 2005), depressive syndromes (Liotti and Mayberg, 2001), shyness (Mathew and Ho, 2006), obsessions (Micallef and Blin, 2001) and compulsive, self-destructive urges (Potenza, 2001). Indeed, how could they not? If their minds are affected, so are their brains.

For example, it is highly likely that Ms. A (see below) suffers from focal, measurable neuronal shrinkage; people with histories of childhood sexual abuse that resembled hers were found, even with the crude non-invasive technologies that were available more than a decade ago, to suffer from measurable, clinically significant hippocampal atrophy (Bremner et al, 1997). Given this finding, should Ms. A be re-classified as a neurological patient? Has she now become un-analyzable (Blass and Carmeli 2007, p. 35)? In our opinion, the opposite is true. Psychoanalysis will change her brain, just as her traumatic experiences did. Understanding how the brain functions and malfunctions in patients who suffer from psychic trauma, shyness, anxiety, compulsive urges and the like may also enhance and improve both our psychoanalytic technique and our psychoanalytic theories, as will be described in the case of Ms. A. In the same vein, understanding how the brain develops and matures throughout childhood may help formulate better psychoanalytic models to account for the complexities of the adult human mind.

Any attempt to force the biological/psychoanalytic dichotomy on the mind will result in a severe diminution of both the clinical relevance and the theoretical scope of psychoanalysis. In fact, this is what Blass and Carmeli appear to welcome. They are aware that "neuroscientific findings can help demarcate the limits of psychoanalysis" (2007, p. 21). They also see no possibility for overlap between the areas covered by psychoanalysis ("meanings") and those covered by neuroscience ("non-psychical, non-meaningful") (2007, p. 35). Therefore, if it is found that a patient who is in psychoanalytic treatment suffers from a significant, measurable, and pathological brain abnormality, this should lead to her exclusion from the realm of meaning and psychoanalytic discourse. The mind will inevitably get smaller, on this view, as the understanding of the brain advances.

Even if one wishes to avoid at all costs a dialogue between psychoanalysis and the neurosciences, this can no longer be done: the dialogue is everywhere. What do you do when both disciplines are employed to treat the same patient for the same problem, as when a depressed patient who is in psychoanalysis also receives medication, an everyday reality for many psychoanalysts for many years (Donovan and Roose, 1995)? Where does the hardware end and the software begin in such treatments? Should this dually treated patient not do well, would he or she need more (or a different) analysis with different meanings, or more (or a different) medication with a different chemical structure? Could it be both? Or neither? There are no easy answers to these questions and to many others they raise, but they can no longer be avoided or circumvented by simply refusing a dialogue. Moreover, these questions are currently being discussed intensively, as part of mainstream psychoanalytic discourse (Cabaniss and Roose, 2005; for an extensive discussion see Busch and Sandberg, 2007; for a recent review see Sandberg and Busch, 2012).

The same considerations are also applicable to people who suffer from severe brain injury. As any psychoanalyst who has worked clinically with people who have sustained brain damage knows, they are as meaningful as anyone else (Solms, 1995, 2000, 2001). They are complex human beings, their minds have depth and dynamics and they seek and generate meanings. The meanings they create are as personal, as understandable, and as vital to them as the meanings created by individuals with "intact" brains. The discourse of people who suffer from gross brain lesions is however also meaningful in special and specific ways, that are influenced, among other things, by the site and the nature of their lesions. In other words, the meaning of their communications cannot be properly understood in isolation; their utterances need to be filtered through an understanding of the state of their brains. Psychoanalysts may, moreover, learn immensely valuable lessons about how meanings are created and processed in the intact mind by carefully studying and making psychoanalytic sense

of the ways in which these meaning-generating mechanisms are distorted in people with brain lesions (Solms, 2001; Kaplan-Solms and Solms, 2002). Meanings are of course deeply influenced by context and culture, but to disregard the subjective meanings generated by people with brain lesions because their minds have been disordered by "biological events" is to deny these patients, ourselves and our discipline a unique opportunity for growth and development. It also deprives us of an opportunity to demonstrate to our neuroscientific colleagues how the disorders they study are influenced and structured by the emotional dynamics, personal meanings and inner world of the individual patient (Turnbull et al., 2004; 2006). To neglect the subjective perspective of the neurological is to disregard a full half of what we can know about the effects of damage to specific parts of the mental apparatus.

It is an undeniable fact that brains shape meanings: Localized brain lesions alter the ways in which people experience and ascribe meanings to their environments and to their own actions and feelings (for a review see Kaplan-Solms and Solms, 2002). It is also an undeniable fact that meanings shape brains: For example, successful psychotherapy has been found to normalize the hyperactivity of the anterior cingulate gyrus in depressed patients (Brody et al., 2001; Martin et al., 2001); it decreases the activity of the caudate nucleus in patients with obsessive-compulsive disorder (Schwartz et al., 1996); and it decreases the abnormal activation of the dorsolateral prefrontal cortex and the parahippocampal gyrus in patients with spider phobia (Paquette et al., 2003; for a review see Etkin et al., 2005).

In all these instances, changes in the 'software' alter the 'hardware'. Indeed, in several areas of neuroscience (e.g. neuroimaging studies of placebo) neuroscientific findings have now further demonstrated that mental meaning can indeed directly and systematically influence brain processes. For example, placebo studies have found that mental expectation of analgesia causes alterations in opioid mechanisms and leads to reduced pain perception via mechanisms that are comparable to those responsible for drug-induced changes in pain perception (e.g. Zubieta et al., 2005). Comparable findings exist in other domains, such as studies of the role of suggestion (Raz and Wolfson; 2012; Oakley, 2012), psychogenic movement (Cojan et al., 2010) and memory disorders (Kopelman and Corno, 2012). These studies can offer support for non-reductionistic neurophilosophical positions (such as that of neuropsychoanalysis, outlined in 3.2.1.2. above), as well as the argument for psychogenesis; i.e. they suggest that mental meaning is not a mere epiphenomenon of neural activity but is as real as any chemical substance (e.g. an analgesic drug). Further, it can cause mental changes (both normal and pathological), correlates of which can be measured at the neural level and compared to those of pharmacological interventions. Thus, in at least some parts of the neuroscientific

community, it is now accepted that subjective mental meaning matters, and even more so, that it affects how the brain works.

In summary, the view that the brain is irrelevant where meanings exist, and that there are no psychoanalytic meanings where neuronal damage exists (Blass and Carmeli, 2007), quickly spirals into absurd, fallacious theoretical and clinical conclusions. By contrast, when one attempts to meaningfully understand the human psyche, arguably the most complex entity in the known universe, one should be humble enough to pursue and examine all the data one can get. Like the blind men studying the elephant, analysts and neuroscientists stand to learn a great deal from each other as they investigate the mind from their complementary perspectives – if they pool their information.

3.2.2. The Relevance of the Neurosciences to Psychoanalytic Practice

While above we outlined the many ways in which the neurosciences may be relevant to the analyst's theoretical thinking, below we describe and then discuss a case illustration. This paper is concerned mostly with theoretical aspects of the relationship between psychoanalysis and the neurosciences, and hence a full discussion of the clinical applications of a dialogue between them is beyond its scope. Nevertheless, we present this case illustration in order to demonstrate in principle our view that some neuroscientific findings may – and should – be used at times to inform and enrich the ways in which analysts work with their patients. The following case example (Yovell, 2000) was also cited by Blass and Carmeli (2007) and Pulver (2003) in their critiques, and we will address some of their concerns in the discussion that follows.

Before embarking on the case illustration, however, we wish to emphasize that our view does not tally with the position that neuropsychoanalysis may save the clinical fate of psychoanalytic therapy, nor with the fear that it may either distort or discredit it. We believe that neuroscience can influence the universal metapsychological models that are put forward, discussed and debated *within* psychoanalysis itself, and then applied to therapy. In this sense, neuroscience can *indirectly* influence psychoanalytic practice.

This emphasis is especially important, since there are authors who question the utility of neuroscience for everyday psychoanalytic practice (e.g., Pulver, 2003), but nevertheless acknowledge its importance for psychoanalytic theory (*ibid*., p. 755). Moreover, Pulver (2003, pp. 758-9), in referring to the case illustration that will follow (Yovell, 2000), acknowledges the impact of the neuroscientific findings described in it (and below) on his clinical choice of which psychoanalytic paradigm to apply

to his traumatized patients who are in analysis. This view is in agreement with our views on the role of neuroscientific findings and theory in psychoanalytic clinical practice.

3.2.2.1. A Case Illustration

Ms. A was a 29 year old lawyer who entered twice-a-week psychoanalytic psychotherapy in order to deal with her low self-esteem and bulimia, and to address her difficulties in forming intimate relationships with men. While she performed well in her job, she had no friends and seriously doubted whether she would ever be able to have a family. She was at most times convinced that she was "bad", and saw her typical pattern of reacting to any sexual contact with a man as further proof of her badness. Ms. A would react violently after all dates with men in which she was physically touched in any way, even when she was the one who initiated the contact. Following such encounters, which always occurred with men she was fond of, she would binge and purge, become depressed, stay home for several days, and sever all contacts with the man she dated. She had no idea why she reacted in this way, but could not stop herself from doing so. In addition, when she recalled the events of such a date in therapy, she turned out to have marked memory lapses for what had happened to her during the date. Likewise, in subsequent sessions she remembered very little of what had transpired between her and the analyst during that session.

During her first year in therapy she communicated isolated memory fragments of being repeatedly sexually abused by the adolescent son of friends of the family when she was four years old. At the time, she was staying with that family for the summer, while her parents were away on vacation. Ms. A had 'forgotten' about the abuse until she was in college. Even after she remembered, her recollections of the events remained fragmentary and were never coherent or complete. Moreover, the abuse was denied by both her own mother and the mother of the family with whom she had stayed. Her brother, however, who was three years her senior and had stayed with her during that summer, did remember that some abuse has taken place, but he was unsure about the details.

Ms. A typically doubted that she was ever abused, and at times blamed herself for coming up with the story – and the fragmented memories that gave rise to it – in order to excuse her difficulties in relating to men. She argued that if she had actually been abused, she would have been able to recall the events in detail. Indeed, after a few weeks in treatment she revealed that one of her main reasons for entering psychoanalytic therapy was her hope and expectation that more detailed and complete memories of the events would emerge, concomitant with the lifting of her repression in the course of the treatment. Should this not occur, she would be inclined to believe that the abuse never took place.

She felt that it was essential for her to know what had actually happened to her, and was not prepared to accept the view that how she remembered and understood her past, and what meanings she ascribed to it and to the vicissitudes of her relationship with the analyst, were just as important as finding out whether she had actually been abused. She stressed that a lot lay in the balance for her – on an interpersonal level, her relationship with her mother who flatly denied the abuse, and on an intrapsychic level, her extremely negative view of herself as someone who propagates false accusations in order to explain and justify her emotional difficulties. Ms. A expected psychotherapy to provide her with keys to her missing memories which, she believed, might still lie within her, waiting to emerge.

Ms. A's initial transference seemed to echo her complicated relationships with both her mother and the men she met on dates. She saw the analyst as someone who should provide protection and a sense of coherence and safety, but felt that he had continuously failed to do so. In addition, after sessions in which she recalled the events of her recent dates, she reacted in the same way as she did to the dates themselves – she became depressed, missed the following session, and contemplated leaving therapy altogether. Importantly, no new memories of her past emerged during her first two years in treatment, and Ms. A saw this as growing proof of the fallacy of her accusations of abuse, and as evidence of her inherent "badness".

3.2.2.2. A Clinical Dilemma

Ms. A's analyst, like all analysts who treat traumatized patients, faced many vexing clinical dilemmas. Of these, we will only consider one here: *how should the analyst understand and respond to her view that psychotherapy will enable her to re-discover her memories of the abuse, or establish that it never took place?* There are many psychoanalytic ways to approach Ms. A's memories and symptoms, and we do not wish to imply that ours are the only correct ones. However, we do wish to stress that in our opinion any clinical theory (and as a result, any clinical intervention) that ignores the consequences of the neuroscientific findings that we will describe below, is in danger of doing injustice to the pursuit of truth and reality that underlies all psychoanalytic encounters.

3.2.2.3. Independent Memory Systems

The most significant neuroscientific insight about the structure and function of human memory to emerge in recent decades is that *memory is not a unitary phenomenon*. Rather, human memory is mediated by several independent neural systems, only one of which is capable of encoding and

retrieving conscious memories that can be recalled as personal events and expressed in words (Schacter, 1996; 2001). This system is called the *declarative* or *explicit* memory system, to distinguish it from several other systems that are collectively called the *non-declarative* or *implicit* memory systems. Some implicit memory systems encode abilities and habits, like the ability to ride a bicycle and play the violin, others encode emotional responses to people and places, like the fear of driving that is experienced by many who have suffered automobile accidents, and the pleasant feelings generated by looking at a photograph of someone we love (Milner, Squire and Kandel, 1998).

This insight, which has dominated the neuroscientific study of memory ever since its discovery in 1953 (Scoville and Milner, 1957) has profound implications for psychoanalysis (Kandel, 1999; Solms and Turnbull, 2002; Yovell, 2000). Specifically, it means that when analysts consider how their patients remember their past (and how they do not), they should distinguish between different types of memory, and be aware of the possibility that one type of memory is compromised while others remain intact. Normally, all the different memory systems work in concert to produce the nuanced reminiscences that gradually build up our view of who we are and where we came from. However, under certain emotional conditions one memory system may falter, while the others may function well (LeDoux, 1996; Yovell, 2000; Yovell et al., 2003). As we will see, there are good reasons to consider the possibility that this may have happened to Ms. A.

During the last three decades it was discovered that fear conditioning, a powerful type of implicit emotional learning, may be formed, experienced and remembered in the absence of a corresponding explicit memory (LeDoux, 1996). What this means is that someone may have an intense fear of a person, place or situation without any explicit memory of why they fear it. It is important to note that the corresponding implicit memory here is not repressed; it never existed in the first place. It simply was not encoded in the brain. This applies not only to patients who suffer from neurological syndromes that have damaged parts of their memory systems, but also to "neurotic" patients, such as Ms. A. Indeed, it has long been observed that people who were exposed to events that produced extreme trepidation were often unable to recall coherent explicit memories of what had happened to them, or could only recall them with significant gaps (Yovell et al., 2003). At the same time, they appeared to have strong implicit memories that led them to fear the original situation (and situations that are associated with it, either consciously or unconsciously), without remembering the reasons for their intense fear (Jacobs et al., 1996; LeDoux, 1996).[3]

[3] Many analysts may be unaware of the fact that within the cognitive neurosciences there has been great skepticism about the very existence of the phenomenon of dynamic repression (Loftus, 1993; McHugh, 1992). One of the reasons for this is that attempts to produce traumatic amnesia in the lab have failed repeatedly. On the other hand, the psychoanalytic literature contains innumerable case studies that support the existence of dynamic repression (Blum, 2003). Blass and Carmeli (2007, p. 23) suggest that an empirical study that might address this apparent contradiction does not belong especially to the field of neuroscience. However, one of the only

3.2.2.4. Dynamic Repression or Absent Memories?

Psychoanalysis has been interested in reminiscences, and in their absence, from its very beginning. Indeed, Freud's theory of repression, and the many transformations it went through during the course of the last century, represents one of the most important and enduring contributions of psychoanalysis to the study of the mind (Blum, 2003). The feasibility of recovering repressed memories and the value of reconstruction in the therapeutic action of psychoanalysis have both been called into question, in part based on neuroscientific data (Fonagy, 1999). Still, many analysts would probably find merit in Freud's statement that "the theory of repression is the corner-stone on which the whole structure of psychoanalysis rests" (1914a, p. 16). Either way, it would seem reasonable that during the course of Ms. A's therapy, some previously-repressed memories of her putative abuse might come to light, as she herself and her analyst had expected.

But what if they don't? The classical psychoanalytic theory of repression maintains that a patient who experiences amnesia for a traumatic event is dynamically repressing the memory of that event, i.e., avoiding it because it is intolerable. There are several neuroscientific reasons to believe that such dynamic repression does occur (Blum, 2003; Carhart-Harris et al., 2008; Ramachandran, 1994; Yovell et al., 2003). But neuroscientific studies have also shown convincingly that during times of overwhelming fear, it is possible that declarative memories would not be *encoded* at all, or that only a degraded version of them would be encoded. This is because a key neural structure necessary for their formation, the hippocampus, can be partially or completely shut down by the high levels of adrenal steroids that are produced at times of intense stress. The shutdown and resultant amnesia are mediated by damage to the dendritic spines of hippocampal neurons (LeDoux, 1996; Kandel, 1999). But the neuronal damage may not stop there: people who suffer from repeated psychic trauma have ongoing deficits in their declarative memory, even for events that have nothing to do with the original trauma (Bremner et al., 1995; 1997). These deficits are the result of lasting damage to the hippocampus, due to synaptic loss caused by adrenal steroids; Such people are especially prone to further hippocampal damage caused by ongoing high levels of stress (reviewed in Kandel, 1999, and LeDoux, 1996). In line with these findings, people with histories of childhood sexual abuse were found to suffer from measurable hippocampal atrophy (Bremner et al., 1997).

empirical prospective studies to address it was done by researchers who were familiar with both the psychoanalytic and the neuroscientific aspects of this controversy (Yovell et al., 2003). The study found preliminary evidence for the existence of two different types of amnestic processes following trauma: one that resembles dynamic repression and another that resembles a form that we will consider below, in relation to Ms. A's symptoms.

3.2.2.5. Alternative Ways of Understanding an 'Absent' Memory

How may these neuroscientific findings affect our theories about the psychoanalytic treatment of patients with repeated psychic trauma? Ms. A wanted desperately to know whether she was abused or not. She felt that having clear memories of the abuse would serve as necessary and sufficient proof to her that it had occurred. Her desire to know what had happened to her, and her insistence on having clear memories in order to be convinced of it, are of course highly meaningful psychoanalytically. They should be (and were) explored and gradually clarified and understood during the course of her treatment. But given that such memories did not emerge after two years of therapy, one may arrive at one of several conclusions:

1. Ms. A's treatment is compromised by 'limited clinical technique, which in time could be improved' (Blass and Carmeli 2007, p. 21). In other words, the repression was not lifted because of the analyst's insufficient analytic work or poor analytic technique. As a corollary, the treatment has not yet helped Ms. A work through her defensive repression of the memories of her abuse, but it might do so in the future. More or better analytic work is needed in order to interpret – and thus work through – Ms. A's defenses. This will lead in due time to the return of her memories.

2. It does not matter much whether the abuse happened or not, and whether Ms. A remembers it or not. On the contrary, the attempt to reconstruct her past is largely irrelevant. What matters most is how Ms. A's relationship with her analyst unfolds, and how they come to meaningfully understand and work through her need to recollect and behave in a certain way in the transference and in her current life. In other words, what matters is 'the experience and understanding in the present (in the transference) of past events or meanings that need not ever be recollected per se' (Blass and Carmeli 2007, p. 23).

3. Ms. A only has fragments of memories of her abuse because it occurred under circumstances that did not allow for coherent declarative memories to be laid down (Kandel, 1999; LeDoux, 1996; Yovell, 2000; Yovell et al., 2003). In other words, her amnesia may not be primarily due to dynamic repression. The memories she seeks (and dreads) may have never existed in an explicit form. Instead, she may remember the abuse mainly through fear conditioning and other implicit types of memory. Therefore, her inability to recall the details of the abuse may not mean that it never happened, or that she is currently dynamically repressing its memory. Because of the multiplicity of human memory systems, she may be deeply, painfully and

lastingly affected by the consequences of a trauma that she might never be able to remember explicitly.

These alternative ways of understanding Ms. A's amnesia are not exhaustive. For example, Shevrin (2002) proposed a less rigid distinction between implicit and explicit memory systems, such that episodic memories might be formed without conscious awareness, accounting for some of Ms. A's symptoms. However, it can already be seen that the possibilities outlined above point the analyst in different therapeutic directions: If the continuing amnesia is the result of limited or poor analytic technique, then it should be improved and the treatment continued (perhaps with a different analyst), focusing on attempts to understand, interpret and work through her defensive forgetting of the trauma. But until when? How many years need to pass, and how many analysts must Ms. A consult, until the possibility is considered that the pursuit of her missing memories might be futile, and that their absence does not necessarily mean that she repressed them, or that they never happened?

On the other hand, if it is irrelevant whether the abuse occurred or not and whether Ms. A remembers it or not, then therapy should continue, focusing on clarifying the transferential interactions and their meanings. Indeed, this exclusive focus on meaning may save the analyst from the need to address Ms. A's question directly. But traumatized, sexually abused patients are highly sensitive to their therapists' lack of conviction and concrete support of the veracity of their history of abuse (Herman and Schatzow, 1987). Ms. A made it clear that such an approach would amount to an evasive betrayal of her and her suffering by the analyst, which would be akin to her mother's painful and ongoing denial. This too may, of course, be interpreted meaningfully. And so on, ad infinitum. (See Rosenfeld, 1987.)

But what if Ms. A really is unable to remember the abuse in detail because it was never coherently encoded in a declarative form? Importantly, this possibility did not emerge out of a purely psychoanalytical approach. It is mainly the result of the neuroscientific study of human memory processes, which her analyst was aware of. Nevertheless, the possibility (not the certainty) that Ms. A's memories were not encoded in a declarative form in the first place is significant and meaningful analytically. More importantly, failure to appreciate this possibility may lead the analyst to interpret a defense that might not be there – hardly a desirable analytic outcome.

At present[4], we are not in a position to know with certainty which of these alternative approaches to Ms. A's missing memories is correct. It is theoretically possible (although unlikely) that she is still repressing the memories of her abuse. It is also theoretically possible (although Ms. A did not believe so) that the best that psychoanalytic therapy has to offer her is a nuanced understanding of the meanings of her transferential interactions, and that her analyst need not concern himself with the existence and veracity of her memories.

However, if the analyst considers the possibility that, after two years in therapy and given the circumstances of her life, Ms. A did not remember her abuse because the memories were not there in a coherent, declarative form in the first place, then a new avenue opens up in therapy. Telling her that she *might* never be able to remember her abuse although she is still affected by it, and explaining to her why this might be the case, as Ms. A's analyst ultimately did, relieved her anxiety and her sense of shame and guilt to a significant degree. More importantly, it freed her and the analyst to pursue the complicated task of coming to terms with her damaged internal past so that she could stop repeating it. But her analyst might not have considered the possibility that her declarative memories of the abuse were simply absent had he not been aware of the neuroscientific work that explored the effects of stress-induced increases in adrenal steroids on the functioning of the hippocampal memory system in patients who suffered from repeated psychic trauma.

3.2.2.6. How Neuropsychoanalysis May Expand the Analyst's Clinical Repertoire

We would now like to discuss how neuropsychoanalysis affected the analyst's thinking about Ms. A. Essentially, it opened up additional ways of understanding her inner world. The analyst's listening is always informed by the theoretical models he or she is familiar with. Had we not known about repression, the Oedipus complex, projective identification and the like, our chances of identifying them in our patients' narratives and transferential interactions would have been greatly reduced. But being aware of a concept or a psychic mechanism is not synonymous with applying it to understand any particular patient at a particular time. As we listen to our patients and attempt to understand them, analysts are always – and appropriately – in a state of uncertainty. Our evenly-suspended attention is informed and defined, even without our conscious awareness, by the different theoretical models we are familiar with. These models may serve as alternative theoretical templates for different clinical possibilities to understand a patient's narrative and interactions. In the case of Ms. A's absent

[4] There are reasons to believe that in the not-too-distant future, advanced imaging techniques might help distinguish between true and false memories even when the patient who experiences them is unable to do so (Cabeza et al., 2001). In our opinion, analysts should not fear, deny or avoid the consequences of this development. It may enhance psychoanalytic technique and help us better understand the subjective experience of remembering something that never took place, a psychoanalytically meaningful mental phenomenon.

memories, very broadly speaking, there are two psychoanalytic models (the older model, which implies that her repression has not lifted yet, and the newer model, which suggests that her memories are less important than her internalized object relationships and how they are played out and meaningfully understood in the transference/countertransference interactions). However, Ms. A's analyst was aware of a third model. This model suggested that Ms. A might not remember because her memories had not been recorded as coherent declarative memories. In our opinion, being aware of this possibility enriched the psychoanalytic process and helped the analyst explore with Ms. A the different possible meanings of her absent memories.

3.3. Claim: Neuropsychoanalysis is Not Psychoanalytical

The claim that neuropsychoanalysis is not analytical appears to represent the ideological core of the case against it. According to this view, neuropsychoanalysis is not Freudian; metaphorically, it is to psychoanalysis what the Golden Calf was to the belief in one God. Blass and Carmeli cite Freud's *Moses and Monotheism* and state that neuropsychoanalysis "has been leading psychoanalysis towards an appreciation of the sensory, the physical, the visual, at the expense of psychological meaning, truth [*sic*], and ideas that cannot be captured in the images of a PET scan" (2007, p. 37). In other words, neuropsychoanalysts may say and even believe that they are doing psychoanalytic work and continuing the legacy of Sigmund Freud, but in reality they are no better than idolaters. They have failed to transcend the physical, and therefore have nothing to contribute at the level of discourse, meaning, abstract ideas and 'truth'. In the sections that follow we will examine this claim and show that neuropsychoanalysis is well grounded in Freudian (as well as other psychoanalytic) models of the mind, as these have developed in psychoanalysis.

3.4. Response and Discussion: The Psychoanalytic Basis of Neuropsychoanalysis

There is no generally accepted definition of what does and does not qualify to be called 'psychoanalytical'. However, one body of clinical, scientific and scholarly work that is surely beyond doubt in this respect is the work of Sigmund Freud. While clinical technique has evolved considerably since Freud, and many other, often competing psychoanalytic models of the mind have been offered since he formulated his original ideas, he is universally regarded as the founder of the field by both supporters and opponents of psychoanalysis. It is instructive, therefore, to compare the assertion that neuropsychoanalysis "ascribes to biology a kind of significance that does away with the value of meaning and psychic truth which is at the foundation of psychoanalysis" (Blass and Carmeli 2007, p. 36) with the following statement by Freud:

> The deficiencies in our description [of the mind] would probably vanish if we were already in a position to replace the psychological terms by physiological and chemical ones … 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. They may be of a kind that will blow away the whole of our artificial structure of hypotheses. (Freud, 1920, p. 60)

Freud said similar things, in different ways, on many different occasions, throughout his working life (see Solms, 2000). What should we make of such statements? Is it possible that Freud, like us neuropsychoanalysts, did not understand the true, unique mission of psychoanalysis, or the inherent irrelevance of the neurosciences to it?

3.4.1. Freud's Ideas and Expectations about the Relationship between Psychoanalysis and the Neurosciences

Freud would surely not agree with the claim that psychoanalysis is "a domain concerned with meanings, to which neuroscience cannot significantly contribute" (Blass and Carmeli, 2007, p. 21). He was acutely aware that his clinical efforts to understand the meanings of his patients' experiences were necessarily embedded in a theoretical model of how the mind works. This model had to be derived from somewhere. It is only natural that Freud (1900) – who had for over 20 years before he published *The Interpretation of Dreams* been a highly respected neuroscientist and neurologist – did not allow his earliest models of the 'mental apparatus' to contradict the best neuroscientific knowledge of his time (see Solms and Saling, 1986). Even Blass and Carmeli suggest that such constraints are necessary: "psychoanalytic models must not, of course, contradict the new cognitive findings" (2007, p. 32).

But this last statement causes insurmountable problems for the view that the new findings cannot contribute significantly to psychoanalysis. Surely, to the extent that our psychoanalytic models may be wrong (to the extent that they do not correspond to the facts), to that extent they will distort our meaning-making efforts, which in turn will compromise our therapeutic efforts. The case illustration of Ms. A provided an example of how this might happen. For this reason, throughout Freud's working life, he revised his models in the light of the unfolding scientific facts. (The same, of course, applies to all competent analysts; but we are using the precedent set by Freud because his work was

unequivocally 'psychoanalytic'.) In other words, *analytic, clinical meaning-making is guided by analytic, theoretical models.*[5]

Freud eventually developed a highly elaborate model of the instinctual life of children (and adults), which was informed not only by his patients' stories but also, again of necessity, constrained by the biological knowledge of his time. By Freud's own admission, biological knowledge concerning the nature and number of instincts that are active in human beings (the very foundation of the infantile sexual life that informed all his later clinical meaning-making) was extremely limited in the early decades of the 20th century. Nevertheless, he had to formulate some hypotheses, because his listening (like ours today) had to be informed by *some* basic assumptions about the fundamental forces that shape the minds (the 'meaning-making') of his patients. That is precisely why he so eagerly awaited the answers that the biology of the future would give "to the questions we have put to it" (Freud, 1920, p. 60).

That future has now arrived. There have been enormous advances in our understanding and classification of the instinctual foundations of all motivated behavior, not only in humans, but in all other mammals too; and a new general theoretical model has emerged (see Panksepp, 1998; Panksepp and Biven, 2012). These findings confirm some aspects of Freud's instinct theory and contradict other aspects (Panksepp, 1999; Solms, 2006a; Solms, 2013). This is not surprising; the subjective experiences and life stories of analytic patients are not a very direct source of information about the fundamental biological forces that drive the mammalian brain. (Likewise: the biochemical study of hormonal influences on the mammalian brain is not a very direct source of information about, say, adolescent phantasies; and yet the two things are clearly related.)

3.4.2. Libido, Attachment, or Both?

In order to illustrate this point, we would like to discuss the change in our understanding of human instinctual life as a consequence of recent neuroscientific findings. There is now abundant evidence that an all-purpose *appetitive* drive similar to Freud's 'libido' does exist in the human brain. In fact, we know a great deal about it, and it is strikingly compatible with Freud's findings (see Wright and Panksepp, 2012). However, we also know from this same body of research that a specific drive to *attachment* exists in the human brain, which from the outset functions almost independently of the

[5] This conclusion contradicts Pulver's suggestion that the neurosciences, while being relevant to psychoanalytic theory, are irrelevant to psychoanalytic technique. Even if neuroscientific findings only helped him decide which of two preexisting psychoanalytic theories to apply in order to understand a particular clinical situation, as he himself described (Pulver 2003, p. 759), they have thereby influenced his clinical meaning-making.

appetitive drive. The attachment drive follows different anatomical pathways, is activated by and activates different neurochemistries, is controlled by different genes, and facilitates different behaviors (Panksepp, 1998; 1999; Panksepp and Biven, 2012). This means that the forces (both constitutional and environmental) that shape our social bonds and responses to separations can and do, from the outset, follow many different and unrelated vicissitudes to those of our libidinal appetites and purposes. This conclusion strongly contradicts some important aspects of the Freudian theory of infantile sexuality. While classical Freudian drive theory held that a baby's initial attachment to his mother is the libidinal result of her provision of his basic bodily needs, Bowlby argued that the baby's attachment to his mother is the result of a primary, inborn need to attach, which is common to all young mammals and birds, and does not depend on drive reduction (reviewed in Diamond et al., 2007)

Knowing this, an analyst would be likely to listen to his or her patients differently, and be open to attributing different meanings to some central aspects of their life stories and experiences, compared to those that he or she would have been inclined to attribute under the old theory. Many analysts came to this conclusion after studying Bowlby's attachment theory and the related empirical findings of developmental psychology and more recently of social neuroscience (see Yovell, 2008, and Fonagy and Luyten, 2012, for recent reviews). At the very least, the analyst would want to listen to the analytical material with the new theoretical *possibilities* in mind. Either way, whether the new biological views are then ultimately accepted and integrated into the analytic instinct theory or not, the point remains the same: *in principle* biological knowledge can and does influence the implicit and explicit models of the mind that we form, and hence the ways in which we listen to and understand what our patients tell us.

3.4.3. Meanings and Mechanisms

The two domains (neurobiology and psychoanalysis), as Freud always realized, are inextricable, for the simple reason that *the analytical model of the mental apparatus is embodied*. Freud's only caution in this regard was due to the relative ignorance of the neurobiologists of his day, especially in relation to the biological processes that were most relevant to psychoanalytical listening. This did not entail a radical division in principle between the two domains, but rather a strategic separation *for the moment*, until biology was better equipped to provide answers to the pertinent analytical questions:

> The psychoanalytical theory does not by any means fail to point out that neuroses have an organic basis – though it is true that it does not look for that basis in any pathological

> anatomical changes, and *provisionally* substitutes the conception of organic functions for the chemical changes that we should expect to find but are *at present* unable to apprehend. (Freud 1905, p. 113, emphasis added)
>
> We must recollect that all our provisional ideas in psychology will presumably *some day* be based on an organic substructure (Freud 1914b, p. 78, emphasis added)
>
> The theoretical structure of psychoanalysis is in truth a superstructure, which will *one day* be set upon its organic foundation. But we are still ignorant of this. (Freud 1916-17, p. 388)

These quotes suggest that the view that neuropsychoanalysis is 'un-analytic' is unsustainable. The assertion that psychoanalysis is "a domain concerned with meanings, to which neuroscience cannot significantly contribute" (Blass and Carmeli 2007, p. 21) is both factually and formally refuted by the admission that "psychoanalytic models must not, of course, contradict the new cognitive findings" (p. 32). In addition, as we have discussed above (2.) and below (3.6.2.), we see this statement as overly deferential to cognitive-neuroscientific findings, which are sometimes discovered later to be wrong or misinterpreted. However, if cognitive neuroscience can have an impact on our psychoanalytic models (even if only in the negative sense that Blass and Carmeli do acknowledge), then it can indeed contribute significantly to a domain concerned with meanings. In fact, as we have shown, it has always done so, since the very beginnings of psychoanalysis. All that has changed today is that the potential contribution is far greater, in proportion to the explosion in relevant neuroscientific findings that have the capacity to inform our psychoanalytic models. This is the very *raison d'être* for the advent of neuropsychoanalysis.

We have shown that the neurosciences are relevant to psychoanalysis even if one defines the latter solely as "a domain concerned with meanings". This, however, should not be taken to imply that we accept this restricted definition of psychoanalysis. Actually, we agree with Roose and Glick, who see psychoanalysis as "a hybrid discipline that shares questions with the neurosciences about causes and mechanisms and with the humanities about meanings. To continue to be both a relevant theory of the mind and a clinically effective treatment, psychoanalysis must enjoy free access to knowledge from both of these disciplines" (1995, p. ix).

3.5. Claim: Neuropsychoanalysis is Dangerous to Psychoanalysis

In addition to suggesting that the neurosciences are irrelevant for psychoanalysis (3.1.), and that neuropsychoanalysis is not analytical (3.3.), our critics are also concerned that neuropsychoanalysis might actually be harmful to psychoanalysis. This is because "neuropsychoanalysis, in effect, ascribes to biology a kind of significance that does away with the value of meaning and psychic truth which is at the foundation of psychoanalysis" (2007, p. 36). Thus, "relying on a biologistic 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" (2007, p. 19). In other words, if neuropsychoanalysis is allowed to survive and spread, it might rob psychoanalysis of its essence, of all that makes it worthwhile and special.

3.6. Response and Discussion: Hope and Dread in Neuropsychoanalysis

We agree with Blass and Carmeli, as well as with other authors (Mechelli, 2010; Pulver, 2003), about the tendencies of reductionism and materialism that are common in the neurosciences (see 1.2. and 2. above), which may lead to "wild", neuropsychoanalytic-sounding proposals. However, we believe that a dialogue with the neurosciences does not have to be based on such materialistic and reductionistic principles. In fact, psychoanalysis can help counter the existing tendency within the neurosciences to reduce complex neurophilosophical positions. To our reading, the view that neuropsychoanalysis is inherently and categorically dangerous to psychoanalysis is based on two interrelated premises:

1. Neuropsychoanalysis is bad for psychoanalysis because it is based (perhaps covertly) on the assumption that only what is biological is real.

2. Neuropsychoanalysis is bad for psychoanalysis because it believes that psychological explanations are always subordinate to biological ones.

We will now briefly discuss these two premises.

3.6.1. Thoughts, Feelings and Phantasies are as Real as Brains

According to some of its critics, neuropsychoanalysis maintains that "only the biological level of explanation can describe what is real in the mind" (Blass and Carmeli, 2007, p. 34). We reject this statement. It is an unfortunate and deep misunderstanding of what neuropsychoanalysis is and what

it says: We have consistently argued the opposite (see in particular Solms, 1995; 1997; 2003). While neuropsychoanalysis is not anyone's personal property, and different authors have expressed different views about many issues relevant to the current debate, one of us (Solms) introduced the term "neuropsychoanalysis," and two of us (Solms, Yovell) have served as editors of *Neuropsychoanalysis*, the journal of the International Neuropsychoanalysis Society. Therefore, we believe that we speak not only for ourselves but for many of our neuropsychoanalytic colleagues when we say, as we have said repeatedly, that *(a) the mind is every bit as real as the brain,* and that *(b) subjective experience is every bit as real as any objective phenomenon.*

It is our opinion, stated also above (1.3.; 3.2.1.4), that the subjective experience of what it is like to be a person – the lived reality of individual people, which is the traditional domain of psychoanalysis – cannot be eliminated by any biological model or theory. Simply stated, meanings and intentionality are *not reducible* to neurons. Likewise, we believe that the systematic study of subjective experience through introspective discourse and through the search for personal meanings yields essential and indispensable data about the structure and functions of the human mind that is impossible to arrive at in any other way. This, indeed, is the main contribution that psychoanalysis offers the neurosciences (Solms, 2006b). The source of the opposition to our views, it seems, is that we also believe that the same applies the other way round.

In summary, we disown the statement attributed to us, to the effect that only what is biological is real. As a consequence, we reject the solution that has been suggested in order to alleviate the danger posed by this supposed threat – to oppose a dialogue between psychoanalysis and the neurosciences. We are of the opinion that it is inherently wrong to discourage psychoanalysts from engaging with what neuroscientists have recently discovered about the mind, and vice-versa. There can be no excuse for deliberate, self-imposed ignorance; it is not a virtue.

3.6.2. When Neuroscientific and Psychoanalytic Models and Theories Contradict Each Other

One of the main concerns of opponents of neuropsychoanalysis is that a dialogue with the neurosciences may force psychoanalysis to give up or modify some of its theories. A discussion of the scientific foundations of psychoanalysis and the many controversies that surround it is beyond the scope of this paper, and has been attempted elsewhere (e.g., Edelson, 1986; Grunbaum, 1984). For our purposes it is enough to say that this concern is justified: indeed, we do believe that as a result of a dialogue with the neurosciences, psychoanalysts might well be moved to give up, modify, or at least

reconsider some of their theories and clinical hypotheses, as we have seen in the case example of Ms. A (3.2.2.), and in the discussion of libidinal drive theory and attachment theory (3.4.2.).

There are two reasons for this. First, a dialogue with the neurosciences can, as Blass and Carmeli appropriately acknowledge, "demarcate the limits of psychoanalysis" (2007, p. 21). As we discussed above (1.3.), this interdisciplinary dialogue may also demarcate the limits of neuroscience. Second, neuropsychoanalysis may help psychoanalysts to begin to resolve some of their many internal disagreements. As Solms and Turnbull (2002, p. 6) observed, "psychoanalysis today is associated with bitter rivalry between opposing camps that apparently have no valid means of deciding between their conflicting standpoints on various theoretical matters. One solution might be to find links between the disputed theoretical concepts of psychoanalysis and those of the neurosciences."

Neuropsychoanalysis is concerned with finding these links, but doing so is no simple matter. As several authors have noted (Boesky, 1995; Fotopoulou, 2012a; Pulver, 2003; Smith, 1997; Solms, 2000; see also 3.2.1.2.), the two disciplines are methodologically and conceptually distinct. Although they deal with the same entity – the human mental apparatus ('mindbrain') – they address it from two different points of view. Correlating their concepts, theories and findings requires careful consideration. It is fraught with potential pitfalls and oversimplifications, and is at this stage only in its early infancy. Whether this development is good or bad for psychoanalysis is more than a matter of opinion. Some authors (Edelson, 1986; Blass and Carmeli, 2007) fear that it will lead to the biologization of psychoanalysis and to the destruction of its essence. We believe that this fearful, avoidant view is unfounded, for the reasons already articulated. In contrast to it, many other psychoanalysts, like Fonagy (2004), Kernberg (2004), Mayes (2003), Michels and Roose (2005), and indeed Freud himself (1920, p. 60) believe that a dialogue with the neurosciences has the potential to enrich and expand psychoanalytic theory. It will do so not only by suggesting which psychoanalytic hypotheses should be modified or rejected, but also by offering new ways to understand, classify and link the different complex mental phenomena that we deal with as analysts.

What, then, is the desired relationship between neuroscientific and psychoanalytic hypotheses, especially when they stand in apparent contradiction? Neuroscientific findings are not necessarily the final court of appeal for analytic theories, for two reasons: First, many research findings and scientific theories are eventually discovered to be wrong, and are amended and sometimes completely overturned by subsequent research. Indeed, this is how science always progresses (Popper, 1963). Second, while neurobiological findings may pose novel questions and problems for analytic theories,

the theoretical solutions that they suggest should always in turn be tested against the analytic data in the analytic situation.

Nevertheless, we do believe that, in regard to some theoretical problems, the biological level of investigation enjoys several advantages over the psychoanalytic one. Critics of neuropsychoanalysis are mistaken when they state that "no reasons have been offered for [the] preferred status awarded to the biological level of explanation" (Blass and Carmeli, 2007, p. 34). Many such reasons have been offered; among them is the potential to validate or reject theories experimentally, with the understanding that future research may change the picture again. Another advantage is the ability of different investigators to agree that they are all studying the same phenomenon (Solms and Turnbull, 2002).

However, neuropsychoanalysis believes that neuroscientific theories will *never* be a substitute or a replacement for psychoanalytic theories, because they deal with the two irreducibly different (but equally real) phenomenal realizations of the mental apparatus: the objective brain and the subjective mind (Solms, 1997). Further, and importantly, the psychoanalytic level of investigating the mental apparatus also enjoys its own unique advantages over the biological level: not least, it is by its nature 'mental', based directly on a firsthand account of what it is like to be a person and to live a life. As a consequence, the psychoanalytic level of observation and explanation may prevent neuroscientific theories from arriving at wrong conclusions when they attempt to explain complex human mental phenomena from a purely external, behavioral, objective point of view. The mental apparatus has a subjective aspect, and we will do a grave disservice to science if we exclude the unique insights that this observational perspective provides. Feelings and phantasies, as such, can never be observed objectively – but still they have causal efficacy and explanatory power. Subjective experiences have objective effects (consider the example of suicide). To exclude such data from neuroscience is no less absurd than to exclude objective neuroscientific findings from psychoanalysis.

4. Advantages of a Dialogue with the Neurosciences

In addition to all that was already discussed above (1.2., 3.2.1., 3.2.2., 3.4.3., 3.6.2.), another way of looking at the advantages of a dialogue with the neurosciences for psychoanalysis is to look at what might happen if we recoil from it, as critics of neuropsychoanalysis suggest. First, we would lose a unique opportunity to reconnect psychoanalysis with its neighboring disciplines, as an equal partner and without compromising its essence. This is exactly what neuropsychoanalysis stands for. Second,

we would become increasingly irrelevant to the main body of scientific thinking about the mind. In our opinion, encouraging this tendency would be a mistake with far-reaching consequences.[6]

As we have discussed throughout this paper, the point of view of neuropsychoanalysis is not that "mental reality [is] a given biological substrate", as Blass and Carmeli wrongly claim (2007, p. 36). All we are saying is that the unique psychoanalytic perspective on the mind has both strengths and weaknesses, and therefore it will benefit from being assessed in conjunction with other perspectives, which have different (and in many respects complementary) strengths and weaknesses.

Last but not least, we believe that another important reason why analysts should welcome a dialogue with the neurosciences is deeply rooted in the psychoanalytic worldview. Psychoanalysis understands, as it did for over a century, that despite their apparent transparency, our consciousness and self-awareness are highly complex phenomena that stem from multiple unconscious processes and motivations. Psychoanalytic theories are, among other things, attempts to sort out, classify and meaningfully understand these complex mental phenomena and their vicissitudes. The methodologies employed by the neurosciences have recently enabled them to ask how such complex mental functions are constructed in the brain. In other words, contemporary neuroscience is now in a position to begin to "carve mental functions at their joints" (Solms and Turnbull, 2002, p. 65), something that psychoanalysts are also trying to do. By building bridges between psychoanalysis and the neurosciences, neuropsychoanalysis may help us in our efforts to elucidate the building blocks and the mental processes that organize our subjectivity, shape the meanings we find in our lives, and contribute to our sense of who we are. In doing so, it may help us know ourselves better – one of the ultimate goals of psychoanalysis.

5. Conclusion

The revolution in the cognitive, social and affective neurosciences has led to a situation in which scientists are asking questions about aspects of the mind that were previously investigated almost

[6] Those who believe that the neurosciences are irrelevant to psychoanalysis often see no difficulty with a future in which psychoanalysis is irrelevant to the neurosciences, as it has been throughout most of the twentieth century. The marginalization of psychoanalysis in the academic world, the loss of its influence and representation in undergraduate and graduate psychology programs as well as in medical schools and psychiatry residency programs, and the unwillingness of third-party health care providers to cover the costs of psychoanalytic treatment, are in our opinion unwelcome consequences of such isolationist attitudes. Likewise, the fact that public and private funding for mental health research heavily favors neuroscience approaches, to the near exclusion of purely clinical ones, is in part another consequence of the absence of psychoanalytic voices in the neuroscientific discourse. In an effort to reverse these trends, all three of us (YY, MS, KF), as well as many other practicing neuropsychoanalysts, have obtained research funding for studies that are based on psychoanalytic theories and that employ psychoanalytic methods. In doing so, the growing neuropsychoanalytic community is strengthening the psychoanalytic voice in the current psychological, psychiatric, and neuroscientific discourse and research activity.

exclusively by psychoanalysts. In facing this development, psychoanalysis finds itself at a crossroad. Is it possible for us to engage the neurosciences in a mutually respectful dialogue? Is such a dialogue relevant and advisable? Can it be conducted without compromising the unique psychoanalytic perspective? In our opinion, the answer to all three questions is yes. A dialogue with other scientific disciplines, and predominately the neurosciences, is *necessary* for psychoanalysis. We have tried to show that those who claim otherwise base their arguments on misunderstandings, misconceptions, and at times even frank mistakes. Of course, as with any other attempt to correlate mind and brain concepts, neuropsychoanalysis calls for interdisciplinary caution and tolerance of unknown intersections. Beginning a cross-disciplinary dialogue between fields whose main body of knowledge remains tentative in many respects, and whose development has been so far largely independent for good historical and epistemological reasons, further calls for modesty, mutual respect, and avoidance of premature closure. Furthermore, a dialogue with the neurosciences is not *sufficient* for ensuring progress in psychoanalysis. Developments from within psychoanalysis are and will remain essential for the progress of psychoanalysis. Nevertheless, despite the challenges that lie ahead, we believe that neuropsychoanalysis is grounded in the analytic worldview and that it is good for the future of psychoanalysis. We base this view not only on our own arguments, set out above, but also on the statements of (among others) Sigmund Freud, the founder of psychoanalysis, who always anticipated this development and looked forward to it (3.4.1.).

The value of the unique perspective that Freud introduced to the study of mental life remains as vital as ever. In our opinion, it is well placed to make a meaningful contribution to the neurosciences, so long as it positively engages with them, which necessarily requires a non-defensive attitude. We also believe that psychoanalysis will change and grow as a result of its rendezvous with the neurosciences. It may have to modify or reconsider some of its theories, and it may develop new ones, that would be of even greater use to psychoanalysts, and of interest to the scientific community at large. This too should be positively welcomed. By doing so psychoanalysis will ensure that its particular perspective on the mind, on human subjectivity and on the human condition will not be lost to science. Subjective, first-person mental reality does exist after all; it is just another part of Nature. What else could it possibly be?

6. References

Alexander B, Feigelson S, Gorman JM (2005). Integrating the psychoanalytic and neurobiological views of panic disorder. *Neuro-Psychoanalysis* **7**:129-70.

Ansermet F, Magistretti P. (2007). Biology of Freedom: Neural Plasticity, Experience, and the Unconscious. The Journal of Nervous and Mental Disease, 197, 143-144.

Benedetti F (2010). *The Patient's Brain: The Neuroscience Behind the Doctor–Patient Relationship*. Oxford, UK: Oxford University Press.

Bennett MR, Hacker PMS (2003). Philosophical Foundations of Neuroscience. Oxford: Blackwell

Berlin H (2011). The neural basis of the dynamic unconscious. *Neuro-Psychoanalysis,* **13**(1): 5-31.

Beutel ME, Stern E, Silberstein, DA (2003). The emerging dialogue between psychoanalysis and neuroscience: Neuroimaging perspectives. *Journal of the American Psychoanalytic Association*, 51:773-801

Blass RB, Carmeli Z (2007). The case against neuropsychoanalysis: On fallacies underlying psychoanalysis' latest scientific trend and its negative impact on psychoanalytic discourse. *Int J Psycho-Anal* **88**:19-40.

Blum, HP (2003). Repression, transference and reconstruction. *Int J Psycho-Anal* **84**:497-503.

Boesky D (1995). Commentaries. *J Am Psychoanal Assoc* **43**:356–60.

Bremner JD, Randall P, Scott TM, Bronen RA, Seibyl JP, Southwick SM, Delaney RC, McCarthy G, Charney DS, Innis RB (1995). MRI-based measurement of hippocampal volume in patients with combat-related posttraumatic stress disorder. *Am J Psychiatry* **152**:973–981.

Bremner JD, Randall P, Vermetten E, Staib L, Bronen RA, Mazuro C, Capelli S, McCarthy G, Innis RB, Charney DS (1997). Magnetic resonance imaging-based measurement of hippocampal volume in posttraumatic stress disorder related to childhood physical and sexual abuse—a preliminary report. *Biol Psychiatry* **41**:23–32.

Bremner JD (2005). Effects of traumatic stress on brain structure and function: relevance to early responses to trauma. *J Trauma Dissociation* **6**:51-68.

Brody AL, Saxena S, Stoessel P, Gillies LA, Fairbanks LA, Alborzian S et al. (2001). Regional brain metabolic changes in patients with major depression treated with either paroxetine or interpersonal therapy: Preliminary findings. *Arch Gen Psychiatry* **58**:631–40.

Brothers L (2002). The trouble with neurobiological explanations of mind. *Psychoanalytic Inquiry*, **22**:857-870.

Busch FN, Sandberg LS (2007). *Psychotherapy and medication: the challenge of integration*. New York, NY: The Analytic Press.

Cabaniss DL, Roose SP (2005). Psychoanalysis and psychopharmacology: new research, new paradigms. *Clin Neurosci Research* **4**:399-403

Cabeza R, Rao SM, Wagner AD, Mayer AR, Schacter DL (2001). Can medial temporal lobe regions distinguish true from false? An event-related functional MRI study of veridical and illusory recognition memory. *Proc Natl Acad Sci USA* **98**:4805-4810.

Canestri J (2012). Emotion in the Psychoanalytic Theory. In A. Fotopoulou, M. Conway, D. Pfaff. *From the Couch to the Lab: Trends in Psychodynamic Neuroscience*. Oxford, UK: Oxford University Press.

Carhart-Harris RL, Friston KJ (2010) The default-mode, ego-functions and free energy: a neurobiological account of Freudian ideas. *Brain* ; **133**(Pt 4):1265-83.

Carhart-Harris R, Mayberg H, Malizia A, Nutt D (2008). Mourning and melancholia revisited: Correspondences between principles of Freudian metapsychology and empirical findings in neuropsychiatry. *Annals of General Psychiatry*, ***7***: 9.

Carmeli Z, Blass, R (2013) The case against neuroplastic analysis: A further illustration of the irrelevance of neuroscience to psychoanalysis through a critique of Doidge's The Brain that Changes Itself. *Int J Psycho-Anal* **94**:391-410.

Chalmers DJ (1995a). Facing up to consciousness. *J Consciousness Studies* **2**:200-19.

Chalmers DJ (1995b). *The conscious mind: In search of a fundamental theory.* New York: Oxford University Press.

Coombes S (2010). Large-scale neural dynamics: Simple and complex. *NeuroImage*, ***52***, 731–739.

Cojan Y, Waber L, Carruzzo A, Vuilleumier P (2009). Motor inhibition in hysterical conversion paralysis. *NeuroImage, **47***, 1026–1037.

Craig AD (2002) How do you feel? Interoception: the sense of the physiological condition of the body. *Nature Review Neuroscience*; **3**: 655–66.

Crick F, Koch C (2000). The unconscious homunculus. *Neuro-Psychoanalysis* **2**:3-59.

Custers R, Aarts H (2010). The unconscious will: how the pursuit of goals operates outside of conscious awareness. *Science, **329***, 47-50.

Damasio A (1994). *Descartes' Error: Emotion, Reason, and the Human Brain*. New York: G.P. Putnam's Sons.

Davidson DH (1970) Mental Events, in *Experience and Theory*, Foster and Swanson (eds.). London: Duckworth. 1970.

Decety J, Ickes WJ (2009). *The social neuroscience of empathy*. Massachusetts: Institute of Technology.

Diamond D, Blatt S, Lichtenberg JD (2007). *Attachment and sexuality*. New York, NY: Analytic Press.

Dijksterhuis A, Aarts H (2010). Goals, attention and (un)consciousness. *Annual Review of Psychology, **61***, 467-490.

Di Pellegrino, G., Fadiga, L., Fogassi, L., Gallese, V., Rizzolatti, G. (1992). Understanding motor events: a neurophysiological study. *Experimental Brain Research*, ***91,*** 176-180.

Donovan SJ, Roose SP (1995). Medication use during psychoanalysis: a survey. *J Clin Psychiatry* **56**:177-8.

Eccles JC (1994). *How the self controls its brain.* Berlin-New York: Springer.

Edelheit, H. (1976) Complementarity as a Rule in Psychological Research—Jackson, Freud and the Mind/body Problem. *Int J Psycho-Anal* **57**:23-29.

Edelman GM, Tononi GA (2000). *Universe of consciousness.* New York: Basic Books.

Edelson M (1986). The convergence of psychoanalysis and neuroscience—Illusion and reality. *Contemp Psychoanal* **22**:479–519.

Etkin A, Pittenger C, Polan HJ, Kandel ER (2005). Toward a neurobiology of psychotherapy: Basic science and clinical applications. *J Neuropsychiatry Clin Neurosci* **17**:145-58.

Fodor JA (1974). Special sciences: On the disunity of science as a working hypothesis. *Synthese* **28**:77–115.

Fodor JA (1975). *The language of thought.* Cambridge, MA: Harvard University Press.

Fonagy P (1999). Memory and therapeutic action. *Int J Psycho-Anal* **80**: 215-23.

Fonagy P (2004) Psychotherapy meets neuroscience. *Psychiatr Bull* **28**: 357–9.

Fonagy P, Luyten P (2012). The Multidimensional Construct of Mentalization and its Relevance to Understanding Borderline Personality Disorder. In A. Fotopoulou, M. Conway, D. Pfaff. *From the Couch to the Lab: Trends in Psychodynamic Neuroscience*. Oxford, UK: Oxford University Press.

Forrester J (1980). Language and the origins of psychoanalysis. New York: Columbia University Press.

Fotopoulou A. (2010). The affective neuropsychology of confabulation and delusion. *Cognitive Neuropsychiatry*, **15**, 1/2/3, 1-13.

Fotopoulou A. (2012a). Background, ethos, and content. In A. Fotopoulou, M. Conway, D. Pfaff. *From the Couch to the Lab: Trends in Psychodynamic Neuroscience*. Oxford, UK: Oxford University Press.

Fotopoulou A. (2012b). The History and Progress of Neuropsychoanalysis. In A. Fotopoulou, M. Conway, D. Pfaff. *From the Couch to the Lab: Trends in Psychodynamic Neuroscience.* Oxford, UK: Oxford University Press.

Fotopoulou A. (2012c). Towards Psychodynamic Neuroscience. In A. Fotopoulou, M. Conway, D. Pfaff. *From the Couch to the Lab: Trends in Psychodynamic Neuroscience*. Oxford, UK: Oxford University Press.

Fotopoulou A., Conway, M., Pfaff, D. (Eds) (2012) *From the Couch to the Lab: Trends in Psychodynamic Neuroscience*. Oxford, UK: Oxford University Press.

Fotopoulou A. Pergino, S. Maeda, R. Rudd, A. Kopelman, M. (2010a). Implicit Awareness in Anosognosia: Unconscious Interference without Conscious Re-representation. *Brain* **133**: 3564-77.

Freeman WJ (2003). Neurodynamic Models of Brain in Psychiatry. *Neuropsychopharmacology* **28**, S54–S63.

Freud S (1900). The interpretation of dreams. SE **4** & **5**.

Freud S (1905). Fragment of an analysis of a case of hysteria. SE **7**, p. 1-122.

Freud, S. (1914a). On the history of the psycho-analytic movement. SE **14**, p. 1-66.

Freud S (1914b). On narcissism: An introduction. SE **14**, p. 67-102.

Freud S (1916-17). Introductory lectures on psycho-analysis. SE **15** & **16**.

Freud S (1920). Beyond the pleasure principle. SE **18**, p. 1-64.

Friston KJ (2009). Modalities Modes, and Models in Functional Neuroimaging. *Science, **326**,* 399-403.

Friston KJ, Dolan RJ (2010). Computational and dynamic models in neuroimaging. *NeuroImage, **52**,* 752–765.

Fuster JM (2009). Cortex and memory: emergence of a new paradigm . *Journal of Cognitive Neuroscience* , **21** (11), 2047 – 2072 .

Gaddini E (1987). Notes on the mind-body question. *Int J Psycho-Anal* **68**:315-329.

Gallagher S (2005). *How the Body Shapes the Mind*. Oxford: Oxford University Press.

Gallese V (2009). The Two Sides of Mimesis Girard's Mimetic Theory, Embodied Simulation and Social Identification. *Journal of Consciousness Studies*, **16**, No. 4, 2009.

Gold I, Stoljar D (1999). A Neuron Doctrine in the Philosophy of Neuroscience. *Behavioral And Brain Sciences* **22** (5):809-830.

Greenberg VD (1997). *Freud and His Aphasia Book: Language and the Sources of Psychoanalysis*. Ithaca, New York: Cornell University Press.

Grunbaum A (1984). *The foundations of psychoanalysis: A philosophical critique.* Berkeley, CA: University of California Press.

Guttman G, Scholz-Strasser I (1998). *Freud and the neurosciences: From brain research to the unconscious*. Vienna, Austria: Verlag der Österreichischen Akademie der Wissenschaften.

Hameroff SR, Chalmers DJ, Kaszniak AW, Editors (1999). *Toward a science of consciousness III: the third Tucson discussions and debates.* Cambridge, MA: MIT Press.

Herman JL, Schatzow E (1987). Recovery and verification of memories of childhood sexual trauma. *Psychoanal Psychol* **4**:1-14.

Hobson JA (2004). Freud returns? Like a bad dream. *Scientific American* **290**:89.

Hobson JA (2005). In bed with Mark Solms? What a nightmare! A reply to Domhoff. *Dreaming* **15**:21-9.

Hopkins J (2012). Psychoanalysis, Representation, and Neuroscience: the Freudian Unconscious and the Bayesian Brain. In A. Fotopoulou, M. Conway, D. Pfaff. *From the Couch to the Lab: Trends in Psychodynamic Neuroscience.* Oxford, UK: Oxford University Press.

Jacobs WJ, Laurance HE, Thomas KGF, Luczak SE, Nadel L (1996). On the veracity and variability of traumatic memory. *Traumatology* **2**:1-5.

Kandel ER (1998). A new intellectual framework for psychiatry. *American Journal of Psychiatry* **155**:457-69.

Kandel ER (1999). Biology and the future of psychoanalysis: A new intellectual framework for psychiatry revisited. *American Journal of Psychiatry* **156**:505-24.

Kaplan-Solms K, Solms M (2000). *Clinical studies in neuro-psychoanalysis: Introduction to a depth neuropsychology. 2 ed.* London: Karnac.

Kernberg OF (2004). Psychoanalytic affect theory in the light of contemporary neurobiology. Paper presented at 6th International Psychoanalytic Symposium, Delphi, October.

Kinsbourne M (1998) Taking the Project seriously. The unconscious in neuroscience perspective. *Annals of New York Academy of Sciences, 843*, 111-115.

Kopelman MK, Corno F (2012). Great escapes: Psychological forms of amnesia. In A. Fotopoulou, M. Conway, D. Pfaff. *From the Couch to the Lab: Trends in Psychodynamic Neuroscience*. Oxford, UK: Oxford University Press.

LeDoux J (1996). *The emotional brain.* New York: Simon and Schuster.

Leibowitz Y (1974). *Fundamentals of the psycho-physical problem.* Jerusalem: Van Leer.

Liotti M, Mayberg HS (2001). The role of functional neuroimaging in the neuropsychology of depression. *J Clin Exp Neuropsychol* **23**:121-36.

Loftus EF (1993). The reality of repressed memories. *American Psychologist* **48**:518-537.

Mancia M (2006). *Psychoanalysis and neuroscience.* Milan: Springer.

Martin SD, Martin E, Rai SS, Richardson MA, Royall R (2001). Blood blood flow changes in depressed patients treated with interpersonal psychotherapy or venlafaxine hydrochloride: Preliminary findings. *Arch Gen Psychiatry* **58**:641–8.

Mathew SJ, Ho S (2006). Etiology and neurobiology of social anxiety disorder. *J Clin Psychiatry* **67 Suppl 12**:9-13.

Mayes LC (2003). Partnering with the neurosciences. *J Am Psychoanal Assoc* **51**:745–53.

McCrone J (2004). Freud's neurology. *Lancet Neurology*, ***3,*** 320.

McHugh PR (1992). Psychiatric misadventures. *Am Scholar* **61**:487-510.

Mechelli A (2010). Psychoanalysis on the couch: can neuroscience provide the answers? Med Hypotheses, ***75***, 594-599.

Micallef J, Blin O (2001). Neurobiology and clinical pharmacology of obsessive-compulsive disorder. *Clin Neuropharmacol* **24**:191-207.

Michels R, Roose SP (2005). Editorial. *Clinical Neuroscience Research* **4**:289–90.

Milner B, Squire LR, Kandel ER (1998). Cognitive neuroscience and the study of memory. *Neuron Rev* **20**:445-468.

Nagel T (1986). *The view from nowhere.* New York: Oxford University Press.

Nagel T (1993). What is the mind-body problem? In: *Experimental and Theoretical Studies of Consciousness* **174**:1-13. New York: Wiley Interscience.

Nagera H (2001). Reflections on psychoanalysis and neuroscience: Normality and pathology in development, brain stimulation, programming, and maturation. *Neuro-Psychoanalysis* **3**:179-91.

Nardone IB, Ward R, Fotopoulou A, Turnbull, OE (2007). Attention and emotion in anosognosia: Evidence of implicit awareness. Neurocase, 13: 438 - 445.

Nersessian E, Solms M (1999). Editors' Introduction. *Neuro-Psychoanalysis* **1**: 3-4.

Northoff G, Boeker H (2006). Principles of neuronal integration and defense mechanisms: Neuropsychoanalytic hypothesis. *Neuro-Psychoanalysis* **8**:69-84.

Oakley DA (2012) From Freud to neuroimaging: Hypnosis as a common thread. In A. Fotopoulou, M. Conway, D. Pfaff. *From the Couch to the Lab: Trends in Psychodynamic Neuroscience*. Oxford, UK: Oxford University Press.

Olds D. (2012) Identification: The concept and the phenomenon. In A. Fotopoulou, M. Conway, D. Pfaff. *From the Couch to the Lab: Trends in Psychodynamic Neuroscience*. Oxford, UK: Oxford University Press.

Panksepp J (1998). *Affective neuroscience: The foundations of human and animal emotions.* Oxford: Oxford University Press.

Panksepp J (1999). Emotions as viewed by psychoanalysis and neuroscience: An exercise in consilience. *Neuro-Psychoanalysis* **1**:15-38.

Panksepp J (2007). Neuro-psychoanalysis may enliven the mindbrain sciences. *Cortex, **43**,* 1106-1107.

Panksepp, J. and Biven, L. (2012). *The Archaeology of Mind*. New York: Norton.

Panksepp, J. and Solms, M. (2012). What is neuropsychoanalysis? Clinically relevant studies of the minded brain. *Trends in Cognitive Sciences,* **16**: 6-8.

Paquette V, Levesque J, Mensour B, Leroux JM, Beaudoin G, Bourgouin P et al. (2003). 'Change the mind and you change the brain': Effects of cognitive-behavioral therapy on the neural correlates of spider phobia. *Neuroimage* **18**:401–9.

Popper K (1963). *Conjectures and refutations: The growth of scientific knowledge.* London: Routledge.

Potenza MN (2001). The neurobiology of pathological gambling. *Semin Clin Neuropsychiatry* **6**:217-26.

Pribram KH and Gill M (1976). Freud's Project Reassessed. New York: Basic Books.

Pugh G (2006). Cooperation not incorporation: psychoanalysis and neuroscience. In M. Mancia (Ed.), *Psychoanalysis and neuroscience.* Milan: Springer.

Pulver SE (2003). On the astonishing clinical irrelevance of neuroscience. *J Am Psychoanal Assoc* **51**:755–72.

Raichle M, MacLeod A, Snyder A, Powers W, Gusnard D, Shulman G. (2001). A default mode of brain function. *PNAS, **68***, 676-682.

Ramachandran, V. (1994). Phantom limbs, neglect syndromes, repressed memories, and Freudian psychology. *International Review of Neurobiology*, **37**: 291-333.

Raz A, Wolfson JB (2012). From Dynamic to Behavioral Lesions: The Relative Merits and Caveats of Elucidating Psychoanalysis with Brain Imaging. In A. Fotopoulou, M. Conway, D. Pfaff. *From the Couch to the Lab: Trends in Psychodynamic Neuroscience*. Oxford, UK: Oxford University Press.

Reddy V (2008). How infants know minds. Harvard University Press, Cambridge, Massachusetts.

Rizzolatti, G., Semi, A., Fabbri-Destro, M. (2014) Linking psychoanalysis with neuroscience: the concept of the ego. *Neuropsychologia*, **55**: 143-148.

Roose SP, Glick RA (1995). *Anxiety as symptom and signal.* Hillsdale, NJ: Analytic Press.

Rosenfeld, H (1987) *Impasse and Interpretation. Therapeutic and Anti-Therapeutic Factors in the Psychoanalytic Treatment of Psychtic, Borderline and Neurotic Patients*. London: Tavistock.

Sandberg LS, Busch FN (2012) Psychotherapy and pharmacotherapy: a contemporary perspective. *Psychodyn Psychiatry*, **40**:505-32.

Sauvagnat F, Wiss M, Clément S (2010). A historical perspective on the collaboration between psychoanalysis and neuroscience. *Journal of Physiology*, ***104***, 288–295.

Scalzone F (2005). Notes for a dialogue between psychoanalysis and neuroscience. *The International Journal of Psychoanalysis*, **86**;5, 1405–1423.

Schacter DL (1996). *Searching for memory.* New York: Basic Books.

Schacter DL (2001). *The seven sins of memory: how the mind forgets and remembers.* Boston, MA: Houghton Mifflin.

Schore A (2003). *Affect dysregulation and disorders of the self*. The Norton Series on Interpersonal Neurobiology. New York: WW Norton & Company.

Schwartz JM, Stoessel PW, Baxter LR, Jr., et al (1996). Systematic changes in cerebral glucose metabolic rate after successful behavior modification treatment of obsessive-compulsive disorder. *Arch Gen Psychiatry* **53**:109–13.

Searle JR (1980). Minds, brains, and programs. *Behavioral and Brain Sciences* **3**:417-57.

Searle JR (1992). *The rediscovery of the mind.* Cambridge, MA: MIT Press.

Semenza C (2001). Psychoanalysis and cognitive neuropsychology: theoretical and methodological affinities. *Neuro-Psychoanalysis* **3**:3-45.

Shevrin H (2002). A psychoanalytic view of memory in the light of recent cognitive and neuroscience research. *Neuro-Psychoanalysis* **2**:131-47.

Shevrin H. (1986). An argument for the evidential standing of psychoanalytic data. *Behavioral and Brain Sciences*, **9**: 257-259.

Shulman RG, Reiser MF (2004). Freud's theory of mind and functional imaging experiments. *Neuro-Psychoanalysis* **6**:133-64.

Smith HF (1997). Creative misreading: Why we talk past each other. *J Am Psychoanal Assoc* **45**:335–7.

Solms M (1995). Is the brain more real than the mind? *Psychoanal Psychother* **9**:107-120.

Solms M (1997). What is consciousness? (with 10 peer commentaries and author's response)*J Amer Psychoanal Assn* **45**: 681-778.

Solms M (2000). Freud, Luria and the clinical method. *Psychoanal Hist* **2**:76-109.

Solms, M. (2001) An example of neuro-psychoanalytic research: Korsakoff's syndrome. *Bull. Brit. Psycho-Anal. Soc.*, **37** (5): 24-32

Solms M (2003). Do unconscious phantasies really exist? In R. Steiner (ed.), *Unconscious Phantasy.* London: Karnac, pp. 89-10.

Solms M (2006a). Sigmund Freud heute: Eine neurowissenschaftliche perspektive auf die psychoanalyse. *Psyche* **60**:829-59.

Solms M (2006b). Putting the psyche into neuropsychology. *The Psychologist* **19**: 538-9.

Solms, M (2013). The conscious id. *Neuropsychoanalysis*, **15**: 5-85 (with 15 peer commentaries and author's response).

Solms M, Saling M (1986). On psychoanalysis and neuroscience: Freud's attitude to the localizationist tradition. *Int J Psycho-Anal* **67**:397-416.

Solms M, Saling M (Ed.). (1990). *A moment of transition: two neuroscientific articles by Sigmund Freud*. Mark Solms and Michael Saling (Trans.). London: The Institute of Psychoanalysis & Karnac Books.

Solms M, Turnbull O (2002). *The brain and the inner world.* London: Karnac.

Sulloway FS (1979). *Freud, Biologist of the Mind: Beyond the Psychoanalytic Legend* . New York, NY: Basic Books.

Turnbull OH, Solms M (2007). Awareness, desire, and false beliefs: Freud in the light of modern neuropsychology. *Cortex*, ***43***, 1083-1090.

Turnbull OH, Jenkins S, Rowley ML (2004). The pleasantness of false beliefs: An emotion-based account of confabulation. *Neuro-Psychoanalysis* **6**:5-45.

Turnbull OH, Zois E, Kaplan-Solms K, Solms M (2006). The developing transference in amnesia: Changes in interpersonal relationship, despite profound episodic-memory loss. *Neuro-Psychoanalysis* **8**:199-204.

Varela FJ (1996). Neurophenomenology: a methodological remedy to the hard problem. *Journal of Consciousness Studies* 3, 330-350.

Waelder R (1962). Psychoanalysis, scientific method, and philosophy. *J Amer Psychoanal Assn* **10**:617-637.

Watt D (2000). The dialogue between psychoanalysis and neuroscience: Alienation and reparation. *Neuro-Psychoanalysis* **2**:183-92.

Weinstein EA, Kahn RL (1995). Denial of illness: Symbolic and physiological aspects. Illinois: Charles C Thomas.

Wright, J., Panksepp, J. (2012). An evolutionary biological framework to understand foraging, wanting and desire: the neuropsychology of the SEEKING system. *Neuropsychoanalysis*, **14**: 5-39.

Yovell Y (1997). From mechanism to metaphor: On Freud's struggle with the biology of the mind. *J American Acad Psychoanalysis* **25**:513-24.

Yovell Y (2000). From hysteria to posttraumatic stress disorder: Psychoanalysis and the neurobiology of traumatic memories. *Neuropsychoanalysis* **2**:171–81.

Yovell Y, Bannett Y, Shalev AY (2003). Amnesia for traumatic events among recent survivors: a pilot study. *CNS Spectrums* **8**: 676-685.

Yovell Y (2004). The mind-body problem and psychotherapy: between neuroscience and the talking cure. *Sihot – Israel Journal of Psychotherapy* **19**:16-34.

Yovell Y (2008). Is there a drive to love? *Neuropsychoanalysis* **10**:117-188.

Zubieta J, Bueller J, Jackson L, Scott D, Xu Y, Koeppe R, Nichols T, Stohler C (2005). Placebo Effects Mediated by Endogenous Opioid Activity on μ-Opioid Receptors. *The Journal of Neuroscience*, **25**, 7754-7762.