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INTERDISCIPLINARY APPROACH TO PSYCHOTHERAPY THROUGH NEUROSCIENCE

INTERDISCIPLINARNI PRISTUP PSIHOTERAPIJI KROZ NEUROZNANOST

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ABSTRACT

This paper analyses the connection between psychotherapy and neuroscience, exploring existing literature and research findings on this topic. It focuses on the fundamental principles of researching psychotherapy within the framework of neuroscience, investigating the mental correlates of psychotherapy. Psychotherapy provides deep insight into patients' unconscious processes and the necessity of reconstructing latent memories within the therapeutic environment. The relationship between therapist and patient creates a new affective configuration that enables the reinterpretation of implicit memories, with neuronal changes reflecting psychic transformations. By integrating with neuroscientific research, it provides the opportunity to analyse the impact of other scientific disciplines on psychotherapeutic practice and ensures the integration of complex psychotherapeutic concepts with perspectives from other scientific fields. This interdisciplinary approach enriches the discipline of psychotherapy, successfully incorporating new insights from various areas of science. The connection of different scientific disciplines reflects the improvement of understanding complex dynamics of the mind and encourages further research and application in the field of psychotherapy and neuroscience.

Keywords: psychotherapy, neuroscience, interdisciplinarity

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SAŽETAK

Ovaj rad analizira povezanost između psihoterapije i neuroznanosti, istražujući postojeću literaturu i istraživačke nalaze o ovoj temi. Usredotočuje se na osnovne principe istraživanja psihoterapije unutar neuroznanstvenog okvira, istražujući mentalne korelate psihoterapije. Psihoterapija pruža duboko uvid u nesvjesne procese pacijenata te nužnost rekonstrukcije latentnih sjećanja unutar terapijskog okruženja. Odnos između terapeuta i pacijenta stvara novu afektivnu konfiguraciju koja omogućuje reinterpretaciju implicitnih sjećanja, s neuronskim promjenama koje odražavaju psihičke transformacije. Kroz spajanje sa neuroznanstvenim istraživanjima, pruža se mogućnost analize utjecaja drugih znanstvenih disciplina na psihoterapijsku praksu te osigurava integraciju složenih psihoterapijskih koncepata s perspektivama drugih znanstvenih polja. Ovaj interdisciplinarni pristup obogaćuje disciplinu psihoterapije, koja, prepoznavši važnost širine uvida, uspješno integrira nove spoznaje iz različitih područja znanosti. Povezivanje različitih znanstvenih disciplina odražava se na unapređenje razumijevanja kompleksnih dinamika uma te potiče na daljnje istraživanje i primjenu u području psihoterapije i neuroznanosti.

Ključne riječi*:* psihoterapija, neuroznanost, interdisciplinarnost

INTRODUCTION

In recent decades, we have witnessed astonishing advancements in the fields of neuroscience and psychotherapy, particularly in psychoanalysis, opening doors to a more comprehensive understanding of the human mind and behaviour. Psychoanalysis, traditionally focused on unconscious processes and emotions, now finds a common ground with neuroscience, the science that explores the biological foundations of these very processes. The integration of these two disciplines is crucial as it allows for a deeper understanding of how our thoughts, emotions, and behaviours stem from complex neural networks in the brain. By incorporating modern techniques such as neuroimaging and neurobiological research, scientists and therapists are better equipped to study the effects of psychotherapeutic methods on the brain, contributing to the development of more effective treatments for various mental and behavioural disorders. This interdisciplinary dialogue offers new perspectives and potential solutions for enhancing mental health.

The ongoing dialogue between psychoanalysis and neuroscience (Kandel, 2001; Northoff et al., 2006) has led to the formulation of several empirical hypotheses and investigations of psychodynamic concepts such as defence mechanisms (Northoff, 2007; Boeker et al., 2006), the concept of self (Milrod, 2002), memory (Gabbard, 2000; Mancia et al., 2008), dreams (Andrade, 2007), and empathy (Gallese et al., 2007). Although these originally psychodynamic concepts are currently being investigated in a neuroscientific context, the neural basis of one of the fundamental components of psychoanalysis and psychodynamic psychotherapy remains unclear (Boeker & Northoff, 2018).

Although brain science and psychoanalysis historically evolved on divergent paths, scientific investigations have unveiled numerous discoveries that have facilitated a deeper comprehension of the brain among psychotherapists and neuroscientists, enabling a more

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extensive examination of mental functions (Cooper, 1985; as cited in Gabbard, Litowitz, & Williams, 2012). The 1990s were famously acknowledged as the "decade of the brain." This period witnessed notable advancements in neuroscience aimed at elucidating the biology of mental operations. The emergence of novel brain imaging technologies empowered scientists to directly investigate mental and biological processes in living individuals. Concurrently, neurobiological studies delved into the influence of genes and proteins on behaviour and biological functions (Swift, 2001; as cited in Postružin, 2015).

While Sigmund Freud, the Austrian neurologist and founding figure of psychoanalysis, notably spearheaded the integration of psychotherapy into the realm of conventional medicine, his early investigations dating back to 1895 delved into the impact of unconscious mental processes on behaviour. Freud ambitiously sought to embrace a neural model of behaviour as part of his quest to forge a scientific psychology—a pursuit eloquently articulated in his seminal work, "Project for a Scientific Psychology." Regrettably, spurred by the nascent state of neuroscience and biology during his era, Freud ultimately elected to veer away from this biological paradigm, with the formal publication of his explorations not materialising until 1954 (Postružin, 2015).

Through the lens of neuroscience, a more profound comprehension has emerged regarding how psychodynamic interventions intersect with the human brain. Ongoing examinations underscore specific neuronal transformations linked to therapeutic processes within the domain of psychoanalysis. Despite sporadic reports detailing neurobiological alterations in select cases undergoing psychodynamic psychotherapy (Lai et al., 2007; Lehto et al., 2008), a dearth of systematic and meticulously controlled brain imaging investigations scrutinising the neural repercussions of psychodynamic psychotherapy persists.

In contrast to its psychodynamic counterpart, the neurobiological ramifications of alternative modalities, such as cognitive-behavioral therapy (CBT) and interpersonal therapy (IPT), have garnered heightened scrutiny leveraging neuroimaging methodologies (Beauregard, 2007a, b; Frewen et al., 2008; Linden, 2006; Roffman et al., 2005). These endeavours have spotlighted neural modulation across a spectrum of brain regions encompassing subcortical, medial, and lateral cortical loci during predominantly cognitive-emotional regulatory tasks pre- and post-application of CBT or IPT techniques.

Yet, a nuanced interpretation of these findings is impeded by a panoply of methodological intricacies. The intricacies range from intricacies inclusive of the objective quantification of psychotherapeutic effects in behavioural and subjective realms, to the judicious selection of activation tasks within the realm of functional neuroimaging. Furthermore, conundrums concerning the discerning curation of apt control cohorts and the array of physiological, behavioural, and psychological parameters indicating task-specific neural perturbations further complicate the terrain of results explication. A paramount necessity materialises in demarcating between salient symptoms and conceivable psychodynamic processes that underpin them (Frewen et al., 2008).

Future scholarly inquiries are advocated to pivot towards pinpointing distinct cerebral territories susceptible to alterations during diverse therapeutic interventions while concurrently unraveling the nexus between these transformations and clinical ameliorations.

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Equally pivotal is the imperative to ascertain the sustainability of enduring cerebral shifts post-therapy denouement—an inquiry pregnant with the promise of engendering acute insights into the protracted impacts of psychodynamic methodologies, potentially heralding the genesis of novel therapeutic stratagems harmoniously tuned to the biological veracities of patients.

Ergo, these scholarly pursuits demand sustained synergies underpinned by ceaseless erudition and interdisciplinary synergism catalysed between clinicians and researchers. This concerted framework not only promises to yield optimal patient outcomes but also pledges to fortify the enduring salience of psychoanalysis within the contemporary echelons of mental health discourse.

Problematic Issues in Understanding the Psychoanalytic Process and Changes

The aim of this research work is to comprehensively describe and characterise key and specific aspects that elucidate the process and change undergone by patients during psychoanalysis or analytic psychotherapy. These insights may serve as a foundation for the development of significant research designs and paradigms in future studies.

The main research questions pertaining to these topics are as follows:

1. What is the process and what changes occur within psychoanalysis or analytic psychotherapy?

2. What are the mechanisms, techniques, and actions that facilitate the psychoanalytic process and change?

Patients typically seek psychotherapy due to various psychological distress, mental symptoms, dysfunctional behaviours, and/or disturbances in their psychosocial environment (e.g., interpersonal issues, relationship problems, workplace challenges, etc.) with the aim of alleviating and resolving these afflictions. Often, patients also aspire to achieve enhanced self-understanding. Other objectives include obtaining emotional and personal support or guidance and direction from therapists in addressing their issues.

Specific aspects of the therapeutic process and changes in psychoanalysis and analytic psychotherapy do not solely concern symptoms and dysfunctional behaviours. Another critical objective is to uncover what may lie beneath these symptoms and dysfunctional behaviours. This is interconnected with the fundamental psychoanalytic concept that conscious, so-called "manifest" symptoms, thoughts, and actions of the patient imply unconscious "latent" meanings and motivations. Within a psychoanalytic perspective, it is presumed that conscious symptoms and disorders are the product of defence mechanisms and compromise formations, addressing multiple preconscious or unconscious factors. Such dynamics profoundly influence how a person thinks, feels, and behaves.

Preconscious or unconscious factors may encompass intrapsychic conflicts or dilemmas, desires, expectations, fantasies, or structural psychic functions (super-ego, ego, and id, self and object representations, affect regulation abilities, impulses, self-esteem, interpersonal relations, etc.).

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Consequently, the fundamental psychoanalytic approach enabling the therapeutic process is the creation and stimulation of the patient's insight and understanding of these preconscious or unconscious aspects and parts of themselves. In light of all the aforementioned, this research holds the potential to heighten researchers' interest in the domain of mental health, offering novel perspectives and paving the way for further comprehension of intricate psychotherapeutic processes and mechanisms.

Analysis of Neurological and Psychoanalytic Interactions

As neuropsychoanalysis has evolved over the past 40 years, it embarked on two slightly different yet parallel and complementary paths. The original path initiated by Solms was an extension of Freud's early works, coupled with the contributions of European neurologists Broca, Charcot, and notably the eminent Russian neuropsychologist A. R. Luria (Solms, 2000, cited in Gabbard, Litowitz, & Williams, 2012). In its simplest form, the method followed by neurologists integrated a clinical-anatomical approach linked to neurological symptoms to dysfunction in specific brain areas, such as Broca's aphasia in the left prefrontal cortex causing an inability to produce language and speech, and Wernicke's aphasia in the posterior superior temporal cortex resulting in an inability to comprehend and receive language. Initially, localisation could only be achieved postmortem, a method that produced an increasingly accurate map of major brain regions and functions. Karen Kaplan-Solms and Mark Solms (2000, Cooper, 1985, cited in Gabbard, Litowitz, & Williams, 2012) penned a seminal work on neuropsychoanalysis describing cases with neurological lesions where the authors examined patients utilising a psychoanalytically oriented interviewing method. These patients demonstrated that their fully realised syndromes encompassed both their neurological deficits resulting from brain damage and the psychological response to that deficit, which could be explored and understood using a psychodynamic approach. By then, neuroimaging techniques had improved to the extent that brain damage involved in a syndrome could be visualised in living patients.

These research endeavours bridge psychoanalysis with neurology, as well as neurologists with psychoanalysts. This philosophy is embraced by analytically oriented therapists seeking general neuroscience insights into how the brain and mind function. They are particularly interested in understanding the workings of the healthy and neurotic mind and how psychoanalytic therapies impact the brain. This trend focuses more on advancing theory and is dedicated to educating analysts to help them uncover the neuroscientific foundations for psychoanalytic theory and practice. These analysts form a sizeable and expanding group, with numerous presentations at international congresses and local society meetings reflecting this trend. The valued research in this endeavour mainly stems from various fields outside the psychoanalytic sphere, including neuroscience, cognitive psychology, evolutionary psychology, primatology, and anthropology.

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Effects of Interdisciplinary Studies on Psychoanalytic Practice

Exploring interdisciplinary aspects within the context of psychoanalysis has deep roots, stretching back to the time of Freud who drew upon a wide array of disciplines such as classical mythology, literature, anthropology, and neurological areas like hypnosis and the theory of suggestion (Raz & Wolfson, 2010). Modern theoretical considerations within psychoanalysis integrate insights from recent disciplines like neuroscientific genetics, cognitive psychology, primatology, evolutionary psychology, as well as conceptual models such as connectionism and dynamic systems theories.

Some of the key initiatives that have significantly influenced psychoanalytic practice include psychopharmacology research, often applied as a complementary method to dynamic therapies such as psychoanalysis; advanced understanding of epigenetics and its role in gene expression regulation; neuroscientific explorations on fundamental conscious and unconscious processes; investigations into the neurobiology of cognitive variants like attention deficit disorders and autistic spectrum disorders; increasing awareness of the impact of trauma on brain development, personality, and pathology; and the potential implementation of dynamic systems models to better understand complex brain phenomena.

Additionally, there is a significant new approach derived from developmental models, especially inspired by Bowlby's work and research by his followers in the area of attachment systems study. This multidisciplinary integration provides deeper insights into the interaction between mental health, biological processes, and environmental factors, paving the way for advancements in understanding the complexity of the human mind and behaviour.

Impact of Psychopharmacology on Regulating Affective Disorders

One of the most significant and profound impacts on clinical practice has emerged from the study of affective systems and their links to affective disorders. Affective experiences are viewed as biologically structured phenomena with a key role in motivation and drives. They provide guidance to organisms, whether fish, birds, or mammals, about what is beneficial, what is to be avoided, with whom to establish closeness, or against whom to defend.

These studies have paralleled research on therapies aimed at addressing painful or pathological affects and affect patterns. The field of mental health, along with diagnostic manuals, is dedicated to the approach of affect disorders, including depressive and anxiety disorders. One of the most visible interactions with therapies has been with the field of psychopharmacology. Pharmacological approaches have become an integral part of psychiatric practice, using medications as a key form of therapeutic interventions. Similarly, therapists practicing psychodynamic, cognitive-behavioural, or interpersonal approaches have learned to integrate their work with psychiatrists prescribing pharmacotherapy. This collaboration has enabled many patients to achieve stability and symptom relief, which can be a useful preparation for psychotherapy, including psychoanalysis.

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Interaction of Genetics and Environment in Shaping Behaviour and Mental Health

A long-standing challenge for researchers has been the extent to which individual behavior and cognition are determined by genetic inheritance versus environmental influences. This dilemma has been at the core of Freud's interest as he recognised the importance of childhood experiences in shaping one's life but also acknowledged that genetic predisposition could determine a propensity towards pathology.

The development and organisation of the brain reflect a complex interplay of genetic foundations and environmental factors. Neurons during ontogenesis must find their defined pathways, establish specific connections with other neurons or executive cells. Processes such as neurogenesis, proliferation, migration, morphological and functional shaping, as well as differentiation, are under strong genetic control (Fanghanel et al., 2009, cited in Postružin, 2015).

Genes act as templates regulating brain organisation, defining structures and functions inherited through DNA that are shared among all healthy individuals of our species. Yet, environmental interventions also play a crucial role. Experiences can trigger gene transcription, promoting the synthesis of proteins shaping neural structures. Genes, through their transcriptional activity, enable neural plasticity throughout life, adapting to changes and enrichments of experiences like psychotherapy, which benefits both the young and adult brain (Cozolino, 2002).

Collaborative research addressing similar questions is becoming more common, enabling a multidisciplinary approach and achieving results that no single discipline could achieve on its own. For example, the prominent study by Caspi and Moffitt (2006) combined genetics and epigenetics with epidemiology and neuroscience. The evolution of genetics from statistical predictions to detailed genetic reading opens new avenues for better understanding the complex interactions between genes and the environment. The results of studies like Caspi's and Moffitt's suggest that genes may have a lesser impact on our destiny than previously thought. Through these interdisciplinary approaches, new perspectives are emerging for understanding mechanisms of behaviour and mental health and the effectiveness of therapeutic interventions.

Studying Conscious and Unconscious Processes through Neuroscientific Perspectives

Interdisciplinary approaches rooted in neuropsychoanalysis, such as the research by Solms (1995) and Pally and Olds (1998), have enriched the understanding of conscious and unconscious processes by integrating insights from various disciplines. In the context of consciousness, scientists have relied on insights from neuroscience on "neural correlates of consciousness" (Koch, 2004; Tononi, 2008); observations by neuropsychologists and philosophers on the nature of phenomena (Damasio, 2010; Dennett, 1991); neuroanatomical research on the locations and interactions of relevant brain regions (Horstman et al., 2010); and evolutionary psychology on the historical development of consciousness in species (Barkow et al., 1992; Evans & Zarate, 1999; Ornstein, 1991).

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Of invaluable interest for research are unconscious processes, which have intrigued scientists from Freud's time to modern representatives of science. In recent decades, cognitive neuroscience has dedicated significant attention to studying unconscious mental processes and subliminal perception, yielding abundant information on these domains (Bargh & Chartrand, 1999).

Research in this segment is divided into two main corpi. Initial research focused on the extensive brain activity that occurs outside of consciousness, described as the cognitive unconscious concept. This area is interested in subliminal stimuli and other forms of implicit learning and memory, emphasizing aspects of implicit cognitive processes. On the other hand, the emphasis is on the emotional aspect of learning and unconscious defence mechanisms, which Freud and later psychoanalytic researchers define as dynamic unconscious. This terminology emphasises the conceptual idea that many functions segregated from conscious mind through defence processes aim to help individuals avoid conscious conflict.

Early research on unconscious cognitive processes by cognitive scientists mainly focused on brain aspects not related to emotions. However, in recent years, affective neuroscience oriented towards a psychoanalytic approach has redirected the focus toward the influence of emotions on content usually banned from the conscious mind, enriching the understanding of the dynamic unconscious concerning previous research focused on the cognitive unconscious. Numerous cognitive mechanisms shape our decisions motivated by unconsciousness, but equally important are defensive mechanisms whose purpose is to remain unnoticed. For example, repression is a defensive mechanism that operates unconsciously by removing painful thoughts and memories that cause anxiety or anger from the conscious mind. Such defense mechanisms act by maintaining unawareness of painful content, thus preserving psychic homeostasis.

For Freud and his followers, the dynamic or motivated unconscious was the essential basis of psychoanalysis, standing out as a distinctive aspect of this discipline that sets it apart from other psychotherapeutic approaches. Motivated forgetting through defence mechanisms is a central part of behaviour, symptomatology, fantasy world, and personality structure. As research delves into the mechanisms of the dynamic unconscious to further explain and point to aspects contributing to unconscious brain processes, their impact on psychotherapy becomes indispensable. Science shedding light on unconscious processes can be pivotal in identifying patients who might derive better benefit from psychodynamic therapeutic approaches than alternatives with a pronounced cognitive or behavioural orientation.

Integration of Psychoanalytic Principles with Findings from Neuroscience

Implementing a multidisciplinary approach in studying identification, mirror neurons, and transfer allows for a deeper understanding of the complex mechanisms of conscious and unconscious mind processes. Integrating knowledge from these areas, along with the approach to neuroscience and psychoanalysis on transfer, provides profound insights into the complexity of conscious and unconscious mind operations.

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In particular, insights from cognitive psychology, neurobiology, and psychological theories on identification in collaboration with neuroscientific discoveries of mirror neurons emphasise the deep interconnectedness between behaviour, empathy, and transfer.

Identification

Identity, as a complex psychological phenomenon that captivates psychoanalysts, is influenced by various scientific disciplines. Cognitive psychology, memory studies, animal behaviour research, the phenomenon of imitation, and mirror neuron neurobiology provide crucial insights into processes of identification with others. Psychoanalysts have traditionally been researchers in the field of identification, but the integration with scientific achievements of other disciplines adds additional value to understanding this phenomenon.

In the context of identification, significant aspects include behaviour, imitation, and the complex set of conscious and unconscious self-views and fantasies about oneself. The process of identification encompasses diverse behaviours, including aspects of procedural learning where characteristics of a model, such as parents, are unconsciously adopted. Various techniques like conditioning, teaching, and practice, as well as recent research in neurobiology, particularly in the area of mirror neurons, emphasise the importance and complexity of the identification process.

Research on mirror neurons, as demonstrated by Rizzolatti and colleagues, showcases a fascinating aspect of identification and empathy through the activation of specific neurons in monkeys. The discovery of premotor cortex activation while observing others' actions implies a virtual reaction in the observer, supporting the idea of mirror mechanisms in neurobiology. It is essential to note that accepting others' emotional states affects brain function similarly to one's emotional responses, and the mentioned authors (Carr et al., 2003; Decety & Chaminade, 2003; Gallese et al., 2004; Leslie et al., 2004) contribute to the understanding of the complexity of perception, identification, and empathy.

Lastly, research on mirror neurons, as the foundation for understanding identification and empathy, challenges the perception as a simple iconic representation but emphasises the active role of individuals in interaction with the environment. These entities are interpreted as part of larger systems in the brain that involve premotor neurons and parietal and temporal cortical elements, opening new avenues for studying the complexity of mental processes (Gallese & Goldman, 1998; Rizzolatti et al., 1996).

Transfer

The concept of transfer is defined as the activation of implicit, sensory, and emotional memories from the past, particularly related to key individuals, which are reactivated in present situations and relationships (Mancia, 2006). Within psychoanalysis, transfer is considered a pivotal concept, confirmed by authorities like Gabard (2006) and Cooper (1987). The evolution of the transfer concept is closely linked to the advancement of neuroscience, especially the theory of neural networks that highlights the formation, strengthening, and breaking of connections between neurons as the basis of creating

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representations in the brain. Multiple transfers operate at different levels of analysis, each reflecting specific representations and activations of neural networks.

Cognitive neuroscience supports the idea that there are multiple transfers, each closely tied to specific contexts and activations of neural associations. The signals emitted by analysts trigger different networks of associations in patients, confirming the complexity of transfer. Through a constructivist approach, the understanding of transfer in analytical treatment is enriched with the theory of neural networks.

Cognitive neuroscience highlights the dominant role of transfer in unconscious mental life, also emphasising the significance of transfer in the therapeutic process of psychoanalysis. The goal of analytic treatment is to integrate the unconscious with the patient's awareness, particularly through the area of transfer. Through this process, early experiences become conscious thoughts, enabling the reintegration of dissociative neural networks and the integration of different aspects of mental life (Cozolino, 2012).

Neurobiological Influence of Psychotherapy on the Brain

Psychotherapy has a significant impact on the brain, especially in terms of stress, dissociation, and integration of neural networks. A critical factor in successful psychotherapy, as well as learning processes in general, lies in the natural ability of moderate stress to promote neural plasticity. Traumatic experiences and high levels of stress often result in dissociation as a defence mechanism characterised by the separation of thoughts, behaviours, sensations, and emotions. The integration and coordination of these functions are crucial for optimal mental health, although this importance can easily be overlooked as these functions are usually subtly and unconsciously related during normal states of consciousness.

Contrary to traumatic experiences, controlled stress exposure during therapy has a positive effect on new learning and encourages neuron integration (Cozolino, 2002). Through repeated experiential encounters, controlled stress exposure in a therapeutic environment results in an improved capacity to tolerate elevated levels of arousal. Since the prefrontal cortex, shaped by experience, supervises subcortical activity and regulates emotional responses, it is logical to conclude that psychotherapy contributes to the construction and integration of cortical circuits and enhances their regulatory function over subcortical activation.

Experiences from interpersonal relationships are stored within the nervous system to become an emotional foundation for future experiences. Inadequate affect regulation and the lack of meaningful emotional interpretation lead to defence mechanisms in the brain that distort reality to reduce anxiety. Neural connections supporting defence are established in circles of unconscious memory focused on anxiety control and fear. By activating multiple cognitive and emotional networks, disassociated functions gradually integrate and become subject to executive function control of the cortex, contributing to experience integration and improved emotional response regulation within the therapeutic environment.

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Conclusion

The dialogue between neuroscience and psychotherapy represents a significant topic that has laid the groundwork for progress in the academic field of psychoanalysis, even at a time when neurobiological techniques had not reached their peak. The decade of neuroscience has been marked by continual advancements in understanding the biological underpinnings of mental functioning, or the psychological aspects of the internal world. Understanding the neurobiological and neuropsychological aspects of brain development, memory, and consciousness points to the inseparable connection between brain structure and mental processes.

The brain, as the primary bodily organ of adaptation, constantly ensures our psychological, social, and physical survival, both at the individual and species' collective level. Translated into the language of biology, survival means the ability to adapt and change (Swift, 2001).

The brain's plasticity throughout life, or the foundation for enriched experiences, is provided by gene transcription function. For humans, enriched environments encompass educational and experiential opportunities that encourage learning new skills and expanding knowledge. With this in mind, psychotherapy can be seen as a specific form of an enriched environment that fosters social and emotional development, neural integration, and complex processing. The way the brain changes during therapy will depend on the neural networks involved in the treatment focus. Since the brain is not a static organ, it continuously changes in response to environmental challenges. As such, the brain's neural architecture embodies the environment that shapes it.

In the future, we can expect to learn more about how the brain and mental system function. By integrating this knowledge with research outcomes in psychotherapy, which are currently ongoing, we will gain a comprehensive view of the mind and how specific therapies work. Over the next few decades, there will be a continuous co-evolution between brain science and psychotherapy. Disciplines that will be called psychoanalytic will continue to delve into the depths of the mind to reveal unconscious desires, conflicts, and repetition schemas. In dialogue with science, we can hope to understand these mind and brain phenomena.

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