# Neural Network Applications in Psychotherapy

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Psychotherapy is a component of the therapeutic options accessible in mental health. Along with psychotherapy techniques and indications, there is a body of studies on what are known as psychotherapy's common factors. However, up to 40% of patients do not respond to therapy. Artificial intelligence approaches are hoped to enhance this and with the growing body of evidence of the use of neural networks (NNs) in other areas of medicine, this domain is lacking in the field of psychotherapy.

Keywords: psychotherapy ; neural networks ; artificial intelligence ; mental health

## 1. Psychotherapeutic Interventions

Psychotherapy is an important part of the array of treatments available to help patients suffering from a vast variety of mental illnesses. The evolution of systematized, evidence-based psychotherapeutic approaches in the field of mental illness can be traced back to the early 20th century [1]. Over the years, various psychotherapeutic methods have been developed and widely adopted. The American Psychological Association defines psychotherapy as a collaborative treatment based on the relationship between a person and a psychotherapist [2]. Over the 20th century, three major streams of psychotherapy have emerged. The first originates from Freud's pioneering work, which proposed a coherent approach emphasizing the major influence of the unconscious mind on our daily lives [3]. The second, rooted in scientific observation of human behavior, gave rise to the cognitive behavioral movement. The third revolves around humanistic approaches, prioritizing phenomenological perspectives and self-determination in treatment [4].

Numerous meta-analyses have consistently demonstrated the efficacy of psychotherapy in mental health disorders, in some cases showing comparable outcomes to pharmacological treatments [5]. Psychotherapeutic treatments can benefit individuals of all ages, educational levels, and ethnic and cultural backgrounds [6]. Given the wide range of efficacy of psychotherapy, the choice of psychotherapy type is generally guided by evidence-based validation for specific medical conditions [7]. For instance, cognitive-behavioral therapies, interpersonal therapy, and behavioral activation are considered first-line evidence-based acute and maintenance psychological treatments in depressive disorders [6]. Furthermore, meta-analyses suggest strong evidence for short- and long-term cognitive behavioral approaches to alleviate symptom distress in psychotic disorders [8].

The duration of psychotherapy can vary significantly [9][10][11]. Meta-analyses on different psychotherapeutic modalities indicate a significant improvement in symptoms in 53% of patients after eight weekly sessions, increasing to over 83% after 52 sessions [11]. There are no formal contraindications for psychotherapy [12]. However, therapeutic modalities must be carefully evaluated and adjusted to each patient's needs, as inappropriate psychotherapy, like other medical treatments, could have adverse effects [13].

## 2. Common Factors across Psychotherapeutic Approaches

Alongside the specific psychotherapy modalities and their indications, there exists an extended body of research on what are known as the common factors of psychotherapy. These are a set of characteristics present across all types of therapies that have been defined as early as 1936 and are considered fundamental to achieving positive psychotherapeutic outcomes. The factors that have been highlighted as most contributive to favorable outcomes are the therapeutic alliance, therapist empathy, goal consensus and collaboration, positive regard, mastery, genuineness, mentalization, emotional experience, and client expectations [14]. In a therapeutic dyad or a group setting, it has been found that relationship factors, some of them related to the common factors, are correlated with improved levels of functioning [15]. The outcomes of psychotherapy are conceptualized in a myriad of different ways but can be broadly described on a multidimensional level to include symptom reduction, improvement in functioning and quality of life, achievement of collaboratively articulated therapy goals, and a mature shift in defenses [14]. Moreover, it is important to understand that the common factors are not merely a set of elements that can be identified in all psychotherapies; rather,

they ‘collectively shape a theoretical model about the mechanisms of change in psychotherapy [16]. It is stipulated that benefits in psychotherapy are produced through three pathways, and these pathways have underlying mechanisms that stem from ‘evolved characteristics of humans as social species’ [16][17]. According to Wampold, the pathways are (1) the real relationship, (2) the creation of expectations through the explanation of disorder and treatment, and (3) the enactment of health-promoting actions [16].

The most extensively researched common factor is the therapeutic alliance, or the working relationship between patient and therapist. It is composed of the bond between patient and therapist as well as the agreement on therapeutic goals and the tasks of therapy. Its beneficial effect is therefore based on an increase in the mutuality and investment of the patient and the therapist in the therapy, as well as an increase in resilience and tolerance of distressing affects [14]. Another common factor shown to have a major curative effect on therapy is therapist empathy, which is both an inherent quality and learned skill. It is a complex phenomenon that can be subdivided into different factors that include mimicry, emotional and affective sharing, compassion, and sympathy. The therapist that achieves empathy is also able to distinguish the source of emotions in the therapeutic dyad, which refers to an awareness of the countertransference at play. This enables the therapist to adequately identify and reflect on the emotions expressed by the patient; this capacity, combined with the creation of a ‘holding environment’ in which emotions are validated and overwhelming affects are contained by the therapist, create beneficial outcomes by increasing ego strength. A focus on common factors can not only improve psychotherapy outcomes, but also facilitate an integration of common recommendations for effective psychotherapy training [14][18].

## 3. Artificial Intelligence in the Field of Psychotherapy

The literature on artificial intelligence supports that there are several applications of specialized tools and techniques that could be employed to enhance psychotherapy [19]. As an example, it has been stated that up to 40% of patients do not respond to therapy, and that artificial intelligence is hoped to enhance this number by using close or real-time recommendations [20]. Furthermore, a recent study suggested that artificial intelligence will have a beneficial impact, but that further empirical analysis through data-driven model development is needed [21]. It has therefore been hinted that artificial intelligence, especially the use of deep learning models, might help in personalizing patient treatments [22].

One such approach is known as neural networks (NNs). Algorithms relating to NNs are made up of node layers, each of which has an input layer, one or more hidden layers, and an output layer [23][24]. Each node, or artificial neuron, is linked to another and has its own weight and threshold. If the output of any node exceeds the given threshold value, that node is activated and begins transferring data to the network’s next tier [23]. Otherwise, no data are sent to the next network layer.

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