

RELATIONAL EXPOSURE AND SEMANTIC PROCESSES AS MECHANISMS OF CHANGE IN PSYCHODYNAMIC PSYCHOTHERAPY: CONVERGENCES BETWEEN PSYCHOTHERAPY RESEARCH AND AFFECTIVE NEUROSCIENCE

IRENE MESSINA
MERCATORUM UNIVERSITY OF ROMA

ALESSANDRO GRECUCCI
UNIVERSITY OF TRENTO

CRISTINA MAROGNA
VINCENZO CALVO
UNIVERSITY OF PADOVA

Although the efficacy of psychodynamic psychotherapy has been largely demonstrated, the understanding of how therapeutic relationship produces a change in dynamic psychotherapy has been only partially achieved. In the present article, we discuss the hypothesis that the expression of previously avoided impulses inside a relational situation — relational exposure — and its cognitive correlates of change in the semantic representation of relationships may underpin therapeutic change. In discussing our hypothesis, we considered previous literature on: (a) common factors in psychotherapy; (b) relevance of exposure in relational situations in psychodynamic therapy; (c) recent advances in affective neuroscience concerning the neural correlates of psychotherapy and emotion regulation. Consistent evidence accounts for relational exposure as an important element of therapeutic change, especially (but not only) in the case of psychodynamic therapy. In line with this evidence, in-vivo relational dynamics as they emerge in the therapeutic relationship can be a powerful tool for psychotherapists.

Key words: Psychotherapy; Psychodynamic; Neuroscience; Affective neuroscience; Common factors; Exposure; Therapeutic relationship.

Correspondence concerning this article should be addressed to Irene Messina, Department of Psychology and Cognitive Science, Mercatorum University of Roma, Piazza Mattei 10, 00186 Roma (RM), Italy. Email: irene.messina@unimercatorum.it

Psychodynamic psychotherapy refers to a range of treatments based on psychoanalytic concepts and methods. It is aimed to the exploration of aspects of self as they are manifested and influenced in the therapy relationship (Shedler, 2010). The object of the present article is therapeutic change in dynamic therapy, considered as a set of processes of change occurring in the course of a psychodynamic treatment and obtained using specific psychotherapeutic procedures. These procedures are aimed to the emotional expression in patients (including emotion identification and expression, as well as working through avoidance of distressing thoughts and feelings) and are focalized on relationships (identification of recurring themes and patterns, discussion of experience, and focus on the therapeutic relationships) (Shedler, 2010). Psychotherapy research has largely demonstrated the efficacy of these procedures for the treatment of common mental disorders (e.g.,

meta-analyses on short-term dynamic psychotherapy: Abbass, Hancock, Henderson, & Kisely, 2006; Leichsenring, Rabung, & Leibing, 2004). In the last decade, the interest of researchers for dynamic therapy has been especially focused on providing evidence of its efficacy in the case of resistant disorders, such as personality disorders (Leichsenring & Leibing, 2003) and resistant depression (Fonagy et al., 2015), and on the evaluation of long-term outcomes (Leichsenring et al., 2004; Leichsenring & Rabung, 2008; De Maat, De Jonghe, Schoevers, & Dekker, 2009), opening new options for evidence-based treatments. Although the efficacy of psychodynamic psychotherapy has been largely demonstrated, the understanding of therapeutic change in psychodynamic psychotherapy has been only partially achieved.

Beyond the context of psychodynamic literature, the clarification of mechanisms of psychological change in psychotherapy may provide general explanations for understanding human psychological change regardless of the specific therapeutic approach. In addition, outside the context of psychotherapy, it would contribute to the improvement of other forms of interventions such as pharmacotherapy, social work, or education. Due to this general interest, therapeutic change has been taken as an object of investigation by different disciplines. Among others, psychotherapy research has provided evidence on factors that are predictive of psychotherapy outcome regardless of the specific psychotherapy approach — *common* factors or *non-specific* factors (for recent reviews, see Laska, Gurman, & Wampold, 2014; Marogna & Caccamo, 2014; Palpacuer et al., 2017) — suggesting the relevance of such factors (especially factors associated to the therapeutic relationship) as key elements for therapeutic change. General and experimental psychology have described basic psychological processes involved in psychotherapy change, including associative learning and change of internal representations of the self and the relationships. More recently, affective neuroscience has provided early models of mechanisms of change through the investigation of neural functional changes associated with psychotherapy and to symptomatic recovery after psychotherapy. In the present article, we propose a psychodynamic model of therapeutic change that takes into consideration and integrates these different perspectives.

PSYCHOTHERAPY RESEARCH: COMMON FACTORS AND THERAPEUTIC RELATIONSHIP

In formulating the hypotheses regarding possible mechanisms of psychotherapeutic action, two main considerations are suggested in psychotherapy research. First, despite the wide variety of existent psychotherapy approaches that have proposed relatively different models of psychotherapeutic actions as well as specific therapeutic techniques to reach therapeutic change, common factors shared by all psychotherapy approaches seem to be more predictive of psychotherapy outcomes than specific factors theorized by specific approaches. The importance of common factors was mentioned for the first time in 1936 by Rosenzweig, who hypothesized that psychotherapy outcome depends more on the existence of implicit factors, such as psychological interpretation, catharsis, and the therapist's personality, shared by different psychotherapy approaches, than on the specificity of single approaches. The identification of common factors was labeled as one of the most significant trends in psychotherapy research in the 1980s (Lambert, Shapiro, & Bergin, 1986; Luborsky, Singer, & Luborsky, 1975). More recently, additional confirmation to the importance of common factors was provided by Luborsky et al. (2002), examining the results of 17 meta-analyses of studies comparing patients' and control groups' outcomes.

Second, among common factors, the relationship between therapist and patient is frequently considered the most important instrument to produce therapeutic change. In 1957, Rogers mentioned several elements of the therapeutic relationship — unconditional positive regard, congruence, and empathy — as

necessary and sufficient conditions for therapeutic change. More recently, the Society for the Advancement of Psychotherapy (Division 29) of the American Psychological Association created a task force for the investigation of evidence-based psychotherapy relationship (EBR; Norcross & Lambert, 2011). This task force aimed to the identification of elements of effective therapeutic relationships through the evaluation of consistency of the research results, the magnitude of the positive relation between the elements and psychotherapy outcome, the directness of the link between the elements and the outcome, the experimental rigor of the studies, and the external validity of the research. Among others, therapeutic alliance (Friedlander, Escudero, Heatherington, & Diamond, 2011; Horvath, Del Re, Flückiger, & Symonds, 2011; Shirk & Karver, 2003), empathy (Elliott, Bohart, Watson, & Greenberg, 2011; Messina et al., 2012), positive regard (Farber & Doolin, 2011), congruence/genuineness (Kolden, Klein, Wang, & Austin, 2011), repairing alliance ruptures (Safran, Muran, & Eubanks-Carter, 2011), and managing countertransference (Hayes, Gelso, & Hummel, 2011) were listed by the EBR task force as the most important elements of the relationship when predicting psychotherapy outcome.

Hence, psychotherapy research suggests that models of therapeutic change should take into consideration processes that can be observed transversally across different psychotherapy approaches and that consider the role of the therapeutic relationship as a fundamental condition for therapeutic change. However, the therapeutic relationship is the *explanandum*, not the *explanans*, of therapeutic change. We need to understand how the therapeutic relationship produces therapeutic change. Moreover, there is an evident overlap among relational elements described in the literature (see, for example, the overlap between the concepts of empathy and therapeutic alliance), with no conceptual model knitting these elements into a more cohesive framework (Horvath, 2005). A more parsimonious description of the mechanisms underpinning the action of the therapeutic relationship would be required to provide a common framework to explain the effects of different relational elements documented in the literature. In this regard, we put forward the idea that the therapeutic relationship (*explanandum*) produces extinction of dysregulated emotions through the exposure to the experience of authentic emotional expression in the therapeutic relationship (*explanans*).

PSYCHOLOGICAL MECHANISMS OF CHANGE: FROM EXPERIMENTAL PSYCHOLOGY TO DYNAMIC THERAPY

Starting from the consideration of the therapeutic relationship as the core of psychotherapy action, the formulation of hypotheses on the therapeutic change in psychodynamic psychotherapy should consider how therapeutic relationships might work in producing change. Bearing in mind the importance of therapeutic relationships, we take into consideration two connected psychological mechanisms that allow a change in emotional responses: extinction of conditioned responses and change of semantic representations. The importance of these processes is confirmed by their key role in psychodynamic psychotherapy as well as in other psychotherapy approaches. Thus, they may be viewed as common factors, which characterize transversally several psychotherapy approaches.

Extinction of Conditioned Responses in Dynamic Therapy: Relational Exposure

The concepts of fear conditioning and extinction originally come from the associative learning literature. According to associative learning theories (Pavlov, 1927), animals and humans acquire fears of objects that were once potentially harmful or dangerous through the mechanism of conditioning, a process of

learning the association between two previously unrelated stimuli. According to such approach, emotional disorders (especially anxiety disorders) may be due to: (1) misguided conditioned fear that might render originally innocuous stimuli fear-inducing and threatening; (2) continuous attempts to avoid confrontation with the object of fears that do not allow the extinction of the conditioned response (Mowrer, 1960). Repeated exposure to the conditioned stimulus, without presenting the aversive response, gradually eliminates the reaction of fear (“extinction”). The extinction of conditioned responses is often considered the main therapeutic ingredient of exposure-based behavioral psychotherapies (Abramowitz, Deacon, & Whiteside, 2012).

Although less explicitly, the principle of exposure can also be applied to psychodynamic therapy. According to psychoanalytic approach (Freud, 1926/1959), neurotic symptoms are the effect of: (1) the replacement of spontaneous impulses with secondary affects (e.g., anger that covers sadness) or anxiety — in behavioral terms conditioned anxiety — and, (2) the attempts to avoid these impulses, together with associated conflicts, memories, and wishes — in behavioral terms avoidance of conditioned stimuli. However, compared to behavioral approaches, the psychodynamic approach is different in two key points that emphasize the role of relationships with the others: (1) the object of fear is not an external object but the expression of an emotion or an impulse which has been discouraged in early relationships; (2) the origin of the abnormal anxiety reaction (as well as of secondary affect) is considered the result of traumatic experiences that happens in early relationships. In the context of psychodynamic therapy, the relevance of the relational component has become gradually more relevant due to the contribution of infant research (Lichtenberg, 1991; Stern, 1985). Nowadays, anxiety reactions and secondary affects are mainly considered as the replacement of dissatisfied or neglected relational needs concerning attachment (Bowlby, 1969) or intersubjectivity (Stern, 2004).

Another peculiarity of the psychodynamic approach is the consideration of unconscious processes. In neurotic patients, as an effect of a vicious circle, the failure in recognizing and/or retrieving disturbing impulses, conflicts, memories, and wishes allows their avoidance, and the avoidance produces even less recognition of unconscious material. Thus, the absence of confrontation with impulses and other unconscious processes does not permit the exposure, and the subsequent extinction, of the conditioned anxiety/secondary affects. In the face of this situation, psychotherapy should provide a setting in which confrontation with unconscious material is promoted through the interpretation of patients’ dreams, free associations, and in-session behavior. In the specific case of brief or intensive dynamic approaches, this confrontation is actively searched by the therapist to accelerate the process of change (Davanloo, 1980). A mechanism corresponding to these processes was clearly described in the brief psychodynamic psychotherapy format proposed by Malan (1976). In this psychotherapeutic format, the therapist pursues the activation and cathartic expression of disturbing impulses or emotions inside the therapy session, and/or examines pathological relationships that cause disturbing emotions in the form of secondary affects (anxiety) and for this reason are avoided by the patient through different defense mechanisms (avoidance).

Despite the differences between behavioral and psychodynamic approaches, in both the extinction of fear responses through behavioral exposure to anxiety-laden stimuli can be viewed as a common mechanism of change. However, a more specific mechanism may come into play in psychodynamic therapies. If the origin of secondary affects (or conditioned anxiety) is a relational experience, to obtain therapeutic change, the exposure must likely be part of a relational experience. We hypothesize that the therapeutic change observed in dynamic therapies (and possibly not restricted to them), is facilitated by what we define “relational exposure” (RE). RE is the expression of problematic and disturbing relational-related emotions in the presence of a significant other (the psychotherapist), without receiving aversive relational responses. The expected aversive response, instead, is contrasted with an emphatic, acceptant response by the therapist.

In line with the hypothesis of RE as a mechanism of therapeutic change, most psychotherapy approaches contemplate the importance of disconfirming past pathological associations between emotional expression and expectancies concerning the reactions of the others. On the one hand, approaches that come from the humanistic and existential tradition emphasize the importance of empathy, nonjudgmental style, and unconditional positive regard as necessary and sufficient curative elements of psychotherapy (Hayes, 2004; Rogers, 1959). On the other hand, several approaches — among others, gestalt therapy (Perls, Hefferline, & Goodman, 1951), transactional analysis (Berne, 1961), and schema therapy (Dadomo et al., 2016; Young, Klosko, & Weishaar, 2003) — use experiential techniques to provide exposure experience to the patient by enacting early traumatic relational situations in the “here-and-now” of the session. The peculiarity of dynamic approaches, especially brief or intensive approaches (Davanloo, 1980; Frederickson, 2013; Sambin & Scottà, 2018), is that the therapist promotes the spontaneous emersion of transference and countertransference dynamics to work on maladaptive relational patterns as they are enacted in the therapeutic relationship. Thus, in psychodynamic therapy, such relational experiences experienced and elaborated during the therapeutic relationship are considered the core of psychotherapy.

Work on Semantic Representations in Dynamic Therapy

This process of in-vivo activations and disconfirmations of relational patterns that happens through RE implies a work on semantic representations of the self, the other, and the relationships with others. We refer to semantic representations as attributes of cognitive representations that are based on the generalization of experiences with the environment and are subsequently used to give meaning to the new experience (Tulving, 1972). In the context of psychotherapy, the semantic representation of relational experiences is particularly important due to their significance for understanding psychopathological symptoms. Transversally to several psychotherapy approaches, psychotherapists use techniques aimed to the awareness and revision of semantic representations of self and relationships. For example, cognitive approaches are based on the modification of automatic thoughts and schemas that individuals use to give sense to their life events (Beck, Rush, Shaw, & Emery, 1979), or on the modification of semantic representations corresponding to irrational beliefs (Ellis, 1989), or in the construction of semantic representations of emotions and cognitions (meta-cognitions) (Wells, 2011). Dynamic therapies, by working on relational themes with the therapist, allow the reenactment of maladaptive relational patterns inside the session. This implies a reactivation of past-introjected relational representations in the here-and-now of the therapeutic relationship and its associated affective responses. Therapeutic change is possible if a pathological internalized object relation is activated in the relationship with the therapist and overlapped or replaced with a good object relation. In the case of brief psychodynamic approaches, the peculiarity of the work on semantic representations consists in empathic interpretations and confrontations of the dynamics that emerge in the here-and-now of therapeutic relationship, to help the patient become more conscious of his/her repetitive relational patterns due to internal semantic representations of self and relationships (Fosha, 2002; Frederickson, 2013).

In sum, if the therapeutic relationship may be considered the *explanandum* of therapeutic change in dynamic therapy, RE and work on semantic representations of the self and the relationships can be considered the *explanans*. In our opinion, RE and work on semantic representations can be considered connected. From the behavioral perspective, some authors recognize that, in addition to formed associations, some aspects of the meaning of the associated events are involved in learning, thus therapeutic action may require not only stimulus-response associations but also the change of their meanings as they are represented in semantic

memories (Foa & Kozac, 1986; Hayes et al., 2007). Vice versa, it was hypothesized that change of semantic meaning (such as in reappraisal tasks) may influence conditioning processes (Hermann, Keck, & Stark, 2014). Moreover, we consider that both RE and semantic processes are necessary to produce change. Although extinction may represent an important mechanism underpinning therapeutic change, the mere exposure without a work on semantic representation might not be considered exhaustive (Foa & Kozac, 1986). On the other hand, the importance of a psychotherapy action that involves both cognitive-affective and experiential-somatic components associated with symptoms, instead of mere cognitive work on semantic representations, is strongly emphasized in psychotherapy literature (Erskine, 1980; Greenberg, 2002). Evidence coming from affective neuroscience confirms this view.

INSIGHTS FROM NEUROBIOLOGICAL MODELS OF EMOTION REGULATION

In the last few years, there has been a growing interest on the potential contribution of the science of emotion regulation (Gross, 1998) in the understanding of therapeutic change (for a review see: Etkin, Pittenger, Polan, & Kandel, 2005; Frewen, Dozois, & Lanius, 2008; Ressler & Mayberg, 2007). Early neurobiological models of psychotherapy focused on the concept of cognitive control to characterize the key process involved in regulating emotions when responding to emotional stimuli, following the model of emotion regulation proposed by Gross (1998, 2002, 2015). In line with this model, emotion regulation has been shown to increase the activation of the fronto-parietal attentional system and to decrease the activation of the amygdala, representing successful activation of executive functions during the experimental exposure to emotional stimuli (Buhle et al., 2014; Ochsner, Bunge, Gross, & Gabrieli, 2002). And, in emotion regulation tasks, patients affected by mood and anxiety disorders recruit the regulatory fronto-parietal network to a lesser extent in comparison to healthy controls, with a parallel hyperactivation of the amygdala (Picó-Pérez, Radua, Steward, Menchón, & Soriano-Mas, 2017). Based on this view of emotion regulation, the most popular model of psychotherapy action considers therapeutic change as the result of an increased effectiveness of control processes executive in nature reflecting the improvement in emotion regulation abilities (Beauregard, 2007; DeRubeis, Siegle, & Hollon, 2008; Frewen et al., 2008, Marogna, Nobile, & Giacomuzzi, 2018). This model has been adapted to explain some aspects of cognitive-behavioral therapies, however, the focalization on affect and expression of emotion that characterize psychodynamic approaches — and more in general “expressive therapies” — is not compatible with a model of therapeutic change based on cognitive control of emotions. In the following sections, we describe recent advances of affective neuroscience that are providing new insights for the understanding of emotion regulation and therapeutic processes that are more consistent with psychodynamic approaches.

Experiential-Dynamic Emotion Regulation Model

A basic assumption of the psychodynamic model is that primary emotions (spontaneous emotions or impulses) may be replaced by secondary affects (such as conditioned anxiety). The cognitive model of emotion regulation proposed by Gross (1998) provides a general explanation of emotion regulation that does not consider this important difference between primary and secondary affects. This limitation is overcome by the experiential-dynamic emotion regulation model (EDER) — inspired to psychodynamic models — that emphasizes the difference between the regulation of primary and secondary emotions (Frederickson,

Messina, & Grecucci, 2018; Grecucci, Chiffi, Di Marzio, Job, & Frederickson, 2016; Grecucci, Frederickson, & Job, 2017; Grecucci & Job, 2015). Physiological (or primary) emotions are generated implicitly by interpersonal relevant events and they activate, peak, and return to baseline as a physiologic process. Secondary affects, instead, are generated by unconscious dysregulatory mechanisms (such as conditioned anxiety and defense mechanisms) and they are not proportional to the stimulus itself. For this reason, they do not follow the physiological pattern (activation, peak, and return to baseline) but lead to dysregulated emotional states. Thus, emotional disorders are not explained with the lack of explicit regulatory strategies (or emotional control), but with the presence of dysregulatory mechanisms (Grecucci & Job, 2015). While the cognitive model of emotion regulation prescribes to “add” regulatory strategies based on cognitive control to help patients regulating their emotions, the most important innovation introduced by the EDER model is the prescription to “remove” dysregulatory mechanisms (conditioned anxiety and defense mechanisms; see Frederickson et al., 2018; Ghedin et al., 2017; Grecucci & Job, 2015; Grecucci et al., 2016; Grecucci et al., 2017).

Interestingly, also dysregulatory mechanisms involve the fronto-parietal network. For example, prefrontal hyperactivity was observed also in association with maladaptive forms of cognitive control in depression and anxiety (such as rumination) and a decreased activation of the fronto-parietal network was reported as effect of psychodynamic psychotherapy (Buchheim et al., 2012; Goldapple et al., 2004; Messina, Sambin, Beschoner, & Viviani, 2016). These results suggest that cognitive control per se does not explain therapeutic change, whereas in some cases removing dysregulatory mechanisms based on cognitive control may be an effective strategy to obtain therapeutic change.

Semantic Model of Emotion Regulation

As mentioned in the previous sections, psychodynamic psychotherapy works on the semantic representation of the self and the relationships; however, this element is neglected in the cognitive model described above. The semantic model of emotion regulation proposed by Messina and colleagues (Messina, Bianco, Sambin, & Viviani, 2015; Messina, Sambin et al., 2016) emphasizes the role of semantic representations (generalization of relational experiences in the interaction with the environment which are subsequently used to give meaning to the new relational experiences). According to this model, adaptive forms of emotion regulation do not depend only on cognitive control, but also on the flexibility and richness of semantic representations that the person may use to give sense to his/her relational experiences. The semantic model of emotion regulation considers scientific evidence coming from affective neuroscience, which has associated semantic processes to a network of brain areas known as “semantic system,” including the inferior parietal lobe, the temporo-parietal junction (TPJ), the anterior/middle temporal lobes (aTL), the ventromedial prefrontal cortex/anterior cingulate cortex (vmPFC/ACC), and the posterior cingulus (Binder, Desai, Graves, & Conant, 2009). In support of the semantic model, together with the activation of the fronto-parietal attentional system (associated to cognitive control), also the activation of semantic areas was found in voluntary emotion regulation studies (Buhle et al., 2014; Messina et al., 2015). Intriguingly, semantic areas, but not fronto-parietal attentional areas, are activated also in spontaneous emotion regulation, suggesting that semantic processes may be even more relevant than cognitive control in explaining emotion regulation mechanisms. An example of spontaneous emotion regulation is spontaneous avoidance of unwanted emotional stimuli. In a study by Benelli and colleagues (2012), participants were exposed to emotional and neutral narratives during a functional magnetic resonance imaging (fMRI) scan. After the fMRI session, participants were asked to write what they remembered from the material presented during the scan. The number of

emotional words spontaneously reported by the participants was used as indexing of spontaneous emotional avoidance, and it was predictive of the brain signal in the ventral areas of the default system (Benelli et al., 2012). In a fMRI perfusion study (Viviani et al., 2010), the spontaneous avoidance of negative content in a scrambled sentences task was shown to modulate the same ventral areas, whereas fronto-parietal attentional areas were unchanged under spontaneous avoidance. Moreover, important alterations of the semantic system were documented in common mental disorders characterized by dysfunctions in emotion regulation, accounting for a deficit in semantic functioning in such individuals (Broyd et al., 2009; Messina, Bianco, Cusinato, Calvo, & Sambin, 2016; Zhao et al., 2007).

Within the areas of the semantic system, lateral components such as the TPJ and aTL were associated to the semantic categorization of information which is relevant for social functioning, for example, their activation was reported in social cognition tasks and in the appraisal of expressive body posture (Amodio & Frith, 2006; Saxe, 2006). Moreover, studies on brain lesions in aTL showed impairments in retrieving representations of relationships that govern social interactions (Irish, Hodges, & Pigué, 2014; Zahn et al., 2007) and representations of the self (Lou et al., 2004; Sperduti et al., 2013). However, the affective relevance of semantic information relevant for social functioning may require the involvement of medial prefrontal areas, where experience on the affective value of encountered stimuli — based on associative learning of rewarding or aversive experiences — are stored (Noonan, Kolling, Walton, & Rushworth, 2012; Rudebeck, Saunders, Prescott, Chau, & Murray, 2013; Schoenbaum, Roesch, Stalnaker, & Takahashi, 2009). According to Viviani (2014), the medial areas of the semantic system may have a regulatory function specifically directed to emotional content. An important aspect of this form of control is that it is not static, but it is modulated by internal states reflecting here-and-now drives or needs of the individual and integrate complex information from affective memories of past states or experiences. This differentiation between medial and lateral areas of the semantic system may correspond to experiential (exposure) and cognitive (semantic representation) levels of therapeutic change. In this regard, these processes appear strictly connected, with a prevalence of the medial component due to its importance for emotional change.

According to the hypothesis of RE as mechanisms of dynamic psychotherapy action, laboratory animals and functional imaging in humans largely documented the involvement of medial areas of the semantic system in extinction of conditioned responses, describing its role of a key node in the “fear network,” together with other areas such as the amygdala and the insular cortex (Iordanova, Deroche, Esber, & Schoenbaum, 2016; Sehlmeier et al., 2009). However, the involvement of medial areas of the semantic system is present but less consistent in psychotherapy investigations, whereas functional changes were more consistently reported in temporal nodes of the semantic system (Messina, Sambin et al., 2016). Due to the prevalence of investigations about cognitive-behavioral therapy, the involvement of medial areas of the semantic system could characterize peculiarly all psychotherapies based on emotional activation instead of emotional control. At the same time, areas of the vmPFC and ACC were consistently reported as predictors of therapeutic change (Dickie, Brunet, Akerib, & Armony, 2013; Etkin et al., 2005; Lueken & Hahn, 2016). Thus, their activation seems to make the difference for symptomatic recovery.

In sum, although a more classical view of emotion regulation considered the increase of cognitive control as the main explication for therapeutic change, more recent models of emotion regulation suggest the implication of brain networks involved in extinction and semantic representations in psychotherapy, providing early evidence that is in line with the idea that such processes can be considered the *explanans* of the therapeutic change.

CONCLUSIONS

Starting from the primacy of the therapeutic relationship as *explanandum* of therapeutic change, in the present article we proposed the concepts of relational exposure and work on semantic representations as *explanans* of the therapeutic relationship as a key element for therapeutic change in psychodynamic therapy. An important contribution of the present article is that the explanans described are connected to psychodynamic therapeutic techniques. In such an approach, the therapeutic relationship is not uniquely a background condition for treatment, but it is also expressed in specific techniques that aim to explore internal relational models as they emerge in the here-and-now of psychotherapy sessions. In dynamic psychotherapy, RE is provided by promoting the emersion of transference and countertransference dynamics, to work on maladaptive relational representations as they are enacted in-vivo in the therapeutic relationship. Thus, therapy is a relational experience (*explanandum*) that produces emotional changes, through the activation of semantic representation during the sessions and the exposure of the patient to secondary affects associated to such representation (*explanans*). These characteristics ensure the usefulness of psychodynamic approaches for the treatment of emotional difficulties that have a relational origin, especially personality disorders or chronic mood difficulties.

These suggestions are not valid uniquely for psychodynamic approaches. Components concerning RE and work on semantic representation can be observed transversally in several psychotherapy approaches. They can be viewed as common factors across psychotherapy theoretical models and techniques. Thus, regardless of the specific approach, the therapist that would like to potentiate his/her interventions should consider the inclusion of works on in-vivo relational dynamics as they emerge in the therapeutic relationship as part of their approaches. In this regard, in the present paper, we provide a concrete model for the connection between psychotherapy approaches, providing a common background to proceed toward integration.

Affective neurosciences have a very strong potentiality in this process of integration. The possibility to observe similar neurobiological substrates for different processes facilitates the construction of theoretical bridges. In the present article, we considered the neurobiological correlates of *explanans* psychological processes described as active components of the therapeutic relationship. If early neurobiological models of psychotherapy were focused on cognitive control of emotion, new advances in affective neuroscience are emphasizing the importance of emotional expression, emotional experiences, and semantic representation of the self and the relationships providing theories which are more consistent with the importance of the therapeutic relationship endorsed in psychotherapy research.

Although the traditional distance of psychodynamic approaches from scientific research has not encouraged the contamination within these field in the past, early contamination between these sectors is very encouraging. Considering the current state of the art, the present work suggests important directions for future studies. First, psychodynamic concepts such as secondary affects, defenses, and internal representations should be integrated into neurobiological models of emotion regulation. Due to its relevance for the understanding of psychopathology and its treatment, this integration should consider the contribution of such concepts toward the distinction between adaptive and maladaptive forms of emotion regulation. Moreover, the phenomena of RE and semantic representations should be clearly explained through the introduction of relationship-related stimuli in experimental paradigms, together with the implementation of experimental paradigms for the investigation of relational factors as predictors of brain change in psychotherapy trials.

REFERENCES

- Abbass, A. A., Hancock, J. T., Henderson, J., & Kisely, S. R. (2006). Short-term psychodynamic psychotherapies for common mental disorders. *Cochrane Database of Systematic Reviews*, 7, CD004687. doi:10.1002/14651858.CD004687.pub4
- Abramowitz, J. S., Deacon, B. J., & Whiteside, S. P. (2012). *Exposure therapy for anxiety: Principles and practice*. New York, NY: Guilford Press.
- Amodio, D. M., & Frith, C. D. (2006). Meeting of minds: The medial frontal cortex and social cognition. *Nature Reviews Neuroscience*, 7(4), 268-277. doi:10.1038/nrn1884
- Beauregard, M. (2007). Mind does really matter: Evidence from neuroimaging studies of emotional self-regulation, psychotherapy, and placebo effect. *Progress in Neurobiology*, 81(4), 218-236. doi:10.1016/j.pneurobio.2007.01.005
- Beck, A. T., Rush, A. J., Shaw, B. F., & Emery G. (1979). *Cognitive therapy of depression*. New York, NY: Guilford Press.
- Benelli, E., Mergenthaler, E., Walter, S., Messina, I., Sambin, M., Buchheim, A., . . . Viviani, R. (2012). Emotional and cognitive processing of narratives and individual appraisal styles: Recruitment of cognitive control networks vs. modulation of deactivations. *Frontiers in Human Neuroscience*, 6, Article 239. doi:10.3389/fnhum.2012.00239
- Berne, E. (1961). *Transactional analysis in psychotherapy: A systematic individual and social psychiatry*. New York, NY: Grove Press.
- Binder, J. R., Desai, R. H., Graves, W. W., & Conant, L. L. (2009). Where is the semantic system? A critical review and meta-analysis of 120 functional neuroimaging studies. *Cerebral Cortex*, 19(12), 2767-2796. doi:10.1093/cercor/bhp055
- Bowlby, J. (1969). *Attachment and loss: Vol. 1. Attachment*. Reading, MA: Addison-Wesley.
- Broyd, S. J., Demanuele, C., Debener, S., Helps, S. K., James, C. J., & Sonuga-Barke, E. J. (2009). Default-mode brain dysfunction in mental disorders: A systematic review. *Neuroscience & Biobehavioral Reviews*, 33(3), 279-296. doi:10.1016/j.neubiorev.2008.09.002
- Buchheim, A., Viviani, R., Kessler, H., Kächele, H., Cierpka, M., Roth, G., . . . Taubner, S. (2012). Changes in prefrontal-limbic function in major depression after 15 months of long-term psychotherapy. *PLoS ONE*, 7(3), e33745. doi:10.1371/journal.pone.0033745
- Buhle, J. T., Silvers, J. A., Wager, T. D., Lopez, R., Onyemekwu, C., Kober, H., . . . Ochsner, K. N. (2014). Cognitive reappraisal of emotion: A meta-analysis of human neuroimaging studies. *Cerebral Cortex*, 24(11), 2981-2990. doi:10.1093/cercor/bht154
- Dadomo, H., Grecucci, A., Giardini, I., Ugolini, E., Carmelita, A., Panzeri, M. (2016). Schema therapy for emotional dysregulation: Theoretical implication and clinical application. *Frontiers in Psychology*, 7, Article 1987. doi:10.3389/fpsyg.2016.01987
- Davanloo, H. (1980). *Short-term dynamic psychotherapy*. New York, NY: Jason Aronson Press.
- De Maat, S., de Jonghe, F., Schoevers, R., & Dekker, J. (2009). The effectiveness of long-term psychoanalytic therapy: A systematic review of empirical studies. *Harvard Review of Psychiatry*, 17(1), 1-23. doi:10.1080/10673220902742476
- DeRubeis, R. J., Siegle, G. J., & Hollon, S. D. (2008). Cognitive therapy versus medication for depression: Treatment outcomes and neural mechanisms. *Nature Reviews Neuroscience*, 9(10), 788-796. doi:10.1038/nrn2345
- Dickie, E. W., Brunet, A., Akerib, V., & Armony, J. L. (2013). Anterior cingulate cortical thickness is a stable predictor of recovery from post-traumatic stress disorder. *Psychological Medicine*, 43(3), 645-653. doi:10.1017/S0033291712001328
- Elliott, R., Bohart, A. C., Watson, J. C., & Greenberg, L. S. (2011). Empathy. *Psychotherapy*, 48(1), 43-49. doi:10.1037/a0022187
- Ellis, A. (1989). *Rational-emotive therapy*. Itasca, IL: Peacock.
- Erskine, R. G. (1980). Script cure: Behavioral, intrapsychic and physiological. *Transactional Analysis Journal*, 10(2), 102-106. doi:10.1177/036215378001000205
- Etkin, A., Pittenger, C., Polan, H. J., & Kandel, E. R. (2005) Toward a neurobiology of psychotherapy: Basic science and clinical applications. *The Journal of Neuropsychiatry and Clinical Neurosciences*, 17(2), 145-158.
- Farber, B. A., & Doolin, E. M. (2011). Positive regard. *Psychotherapy*, 48(1), 58-64. doi:10.1037/a0022141

- Foa, E. B., & Kozak, M. J. (1986). Emotional processing of fear: Exposure to corrective information. *Psychological Bulletin*, 99(1), 20-35.
doi:10.1037/0033-2909.99.1.20
- Fonagy, P., Rost, F., Carlyle, J. A., McPherson, S., Thomas, R., Pasco Fearon, R. M., . . . Taylor, D. (2015). Pragmatic randomized controlled trial of long-term psychoanalytic psychotherapy for treatment-resistant depression: The Tavistock Adult Depression Study (TADS). *World Psychiatry*, 14(3), 312-321.
doi:10.1002/wps.20267
- Fosha, D. (2002). The activation of affective change processes in accelerated experiential-dynamic psychotherapy (AEDP). In F. W. Kaslow & J. J. Magnavita (Eds.), *Comprehensive handbook of psychotherapy: Psychodynamic/object relations* (Vol. 1, pp. 309-343). Hoboken, NJ: John Wiley & Sons Inc.
- Frederickson, J. (2013). *Psychodynamic psychotherapy: Learning to listen from multiple perspectives*. New York, NY: Routledge.
- Frederickson, J. J., Messina, I., & Grecucci, A. (2018). Dysregulated anxiety and dysregulating defenses: Toward an emotion regulation informed dynamic psychotherapy. *Frontiers in Psychology*, 9, Article 2054.
doi:10.3389/fpsyg.2018.02054
- Freud, S. (1959). Inhibitions, symptoms and anxiety. In J. Strachey (Ed. & Trans.), *The Standard Edition of the Complete Psychological Works of Sigmund Freud* (Vol. 20, pp. 75-176). London, UK: Hogarth Press. (Original work published 1926)
- Frewen, P. A., Dozois, D. J., & Lanius, R. A. (2008) Neuroimaging studies of psychological interventions for mood and anxiety disorders: Empirical and methodological review. *Clinical Psychology Review*, 28, 228-246.
doi:10.1016/j.cpr.2007.05.002
- Friedlander, M. L., Escudero, V., Heatherington, L., & Diamond, G. M. (2011). Alliance in couple and family therapy. *Psychotherapy*, 48(1), 25-33.
doi:10.1037/a0022060
- Ghedin, S., Semi, A., Caccamo, F., Caldironi, L., Marogna, C., Piccione F., Stabile, . . . Vidotto, G. (2017). Emotionally focused couple therapy: A pilot study in a structure for neurodegenerative diseases. *The American Journal of Family Therapy*, 45, 15-26.
doi:10.1080/01926187.2016.1223562
- Goldapple, K., Segal, Z., Garson, C., Lau, M., Bieling, P., Kennedy, S., & Mayberg, H. (2004). Modulation of cortical-limbic pathways in major depression: Treatment-specific effects of cognitive behavior therapy. *Archives of General Psychiatry*, 61(1), 34-41.
doi:10.1001/archpsyc.61.1.34
- Grecucci, A., Chiffi, D., Di Marzio, F., Job, R., & Frederickson, J. (2016). Anxiety and its regulation: Neural mechanisms and regulation techniques according to the experiential-dynamic approach. In F. Durbano & B. Marchesi (Eds.), *New Developments in Anxiety Disorders* (pp. 1-22). IntechOpen.
doi:10.5772/65374
- Grecucci, A., Frederickson, J., & Job, R. (2017). Advances in emotion regulation: From neuroscience to psychotherapy. *Frontiers in Psychology*, 8, Article 985.
doi:10.3389/fpsyg.2017.00985
- Grecucci, A., & Job, R. (2015). Rethinking reappraisal: Insights from affective neuroscience. *Behavioral and Brain Sciences*, 38, e102.
doi:10.1017/S0140525X14001538
- Greenberg, L. S. (2002). Integrating an emotion-focused approach to treatment into psychotherapy integration. *Journal of Psychotherapy Integration*, 12(2), 154-189.
doi:10.1037/1053-0479.12.2.154
- Gross, J. J. (1998). The emerging field of emotion regulation: An integrative review. *Review of General Psychology*, 2(3), 271-299.
doi:10.1037/1089-2680.2.3.271
- Gross, J. J. (2002). Emotion regulation: Affective, cognitive, and social consequences. *Psychophysiology*, 39(3), 281-291.
doi:10.1017/S0048577201393198
- Gross, J. J. (Ed.). (2015). *Handbook of Emotion Regulation*. New York, NY: Guilford Publications.
- Hayes, S. C. (2004). Acceptance and commitment therapy, relational frame theory, and the third wave of behavioral and cognitive therapies. *Behavior Therapy*, 35(4), 639-665.
doi:10.1016/S0005-7894(04)80013-3
- Hayes, A. M., Feldman, G. C., Beevers, C. G., Laurenceau, J. P., Cardaciotto, L., & Lewis-Smith, J. (2007). Discontinuities and cognitive changes in an exposure-based cognitive therapy for depression. *Journal of Consulting and Clinical Psychology*, 75(3), 409-421.
doi:10.1037/0022-006X.75.3.409
- Hayes, J. A., Gelso, C. J., & Hummel, A. M. (2011). Managing countertransference. *Psychotherapy*, 48(1), 88-97.
doi:10.1037/a0022182

- Hermann, A., Keck, T., & Stark, R. (2014). Dispositional cognitive reappraisal modulates the neural correlates of fear acquisition and extinction. *Neurobiology of Learning and Memory*, *113*, 115-124.
doi:10.1016/j.nlm.2014.03.008
- Horvath, A. O. (2005). The therapeutic relationship: Research and theory: An introduction to the special issue. *Psychotherapy Research*, *15*(1-2), 3-7.
doi:10.1080/10503300512331339143
- Horvath, A. O., Del Re, A. C., Flückiger, C., & Symonds, D. (2011). Alliance in individual psychotherapy. *Psychotherapy*, *48*(1), 9-16.
doi:10.1037/a0022186
- Iordanova, M. D., Deroche, M. L., Esber, G. R., & Schoenbaum, G. (2016). Neural correlates of two different types of extinction learning in the amygdala central nucleus. *Nature Communications*, *7*, 12330.
doi:10.1038/ncomms12330
- Irish, M., Hodges, J. R., & Piguët, O. (2014). Right anterior temporal lobe dysfunction underlies theory of mind impairments in semantic dementia. *Brain*, *137*(4), 1241-1253.
doi:10.1093/brain/awu003
- Kolden, G. G., Klein, M. H., Wang, C.-C., & Austin, S. B. (2011). Congruence/genuineness. *Psychotherapy*, *48*(1), 65-71.
doi:10.1037/a0022064
- Lambert, M. J., Shapiro, D. A., Bergin, A. E. (1986). Process and out-come in psychotherapy. In S. L. Garfield & A. E. Bergin (Eds.), *Handbook of psychotherapy and behavior change* (3rd ed., pp. 157-211). New York, NY: Wiley.
- Laska, K. M., Gurman, A. S., & Wampold, B. E. (2014). Expanding the lens of evidence-based practice in psychotherapy: A common factors perspective. *Psychotherapy*, *51*(4), 467-481.
doi:10.1037/a0034332
- Leichsenring, F., & Leibing, E. (2003). The effectiveness of psychodynamic therapy and cognitive behavior therapy in the treatment of personality disorders: A meta-analysis. *American Journal of Psychiatry*, *160*(7), 1223-1232.
doi:10.1176/appi.ajp.160.7.1223
- Leichsenring, F., & Rabung, S. (2008). Effectiveness of long-term psychodynamic psychotherapy: A meta-analysis. *JAMA*, *300*(13), 1551-1565.
doi:10.1001/jama.300.13.1551
- Leichsenring, F., Rabung, S., & Leibing, E. (2004). The efficacy of short-term psychodynamic psychotherapy in specific psychiatric disorders: A meta-analysis. *Archives of General Psychiatry*, *61*(12), 1208-1216.
doi:10.1001/archpsyc.61.12.1208
- Lichtenberg, J. D. (1991). *Psychoanalysis and infant research*. New York, NY: Routledge.
- Lou, H. C., Luber, B., Crupain, M., Keenan, J. P., Nowak, M., Kjaer, T. W., . . . Lisanby, S. H. (2004). Parietal cortex and representation of the mental self. *Proceedings of the National Academy of Sciences of the United States of America*, *101*(17), 6827-6832.
doi:10.1073/pnas.0400049101
- Luborsky, L., Rosenthal, R., Diguier, L., Andrusyna, T. P., Berman, J. S., Levitt, J. T., . . . Krause, E. D. (2002). The dodo bird verdict is alive and well—mostly. *Clinical Psychology: Science and Practice*, *9*(1), 2-12.
doi:10.1093/clipsy.9.1.2
- Luborsky, L., Singer, B., & Luborsky, L. (1975). Comparative studies of psychotherapies: Is it true that everyone has won and all must have prizes?. *Archives of General Psychiatry*, *32*(8), 995-1008.
doi:10.1001/archpsyc.1975.01760260059004
- Lueken, U., & Hahn, T. (2016). Functional neuroimaging of psychotherapeutic processes in anxiety and depression: From mechanisms to predictions. *Current Opinion in Psychiatry*, *29*(1), 25-31.
doi:10.1097/YCO.0000000000000218
- Malan, D. (1976). *The frontier of brief psychotherapy*. New York, NY: Plenum Medical Book Company.
- Marogna, C., & Caccamo, F. (2014) Analysis of the process in brief psychotherapy group: The role of therapeutic factors. *Research in Psychotherapy, Psychopathology, Process and Outcome*, *17*, 43-51.
doi:10.7411/RP.2014.019
- Marogna, C., Nobile, F., & Giacomuzzi, F. (2018) Body distress in eating disorders: A comprehensive review of treatment techniques. *TPM – Testing, Psychometrics, Methodology in Applied Psychology*, *25*, 589-605.
doi:10.4473/TPM25.4.8
- Messina, I., Bianco, F., Cusinato, M., Calvo, V., & Sambin, M. (2016). Abnormal default system functioning in depression: Implications for emotion regulation. *Frontiers in Psychology*, *7*, Article 858.
doi:10.3389/fpsyg.2016.00858
- Messina, I., Bianco, S., Sambin, M., & Viviani, R. (2015). Executive and semantic processes in reappraisal of negative stimuli: Insights from a meta-analysis of neuroimaging studies. *Frontiers in Psychology*, *6*, Article 956.
doi:10.3389/fpsyg.2015.00956

- Messina, I., Palmieri, A., Sambin, M., Kleinbub, J. R., Voci, A., & Calvo, V. (2012). Somatic underpinnings of perceived empathy: The importance of psychotherapy training. *Psychotherapy Research, 23*(2), 169-177. doi:10.1080/10503307.2012.748940
- Messina, I., Sambin, M., Beschner, P., & Viviani, R. (2016). Changing views of emotion regulation and neurobiological models of the mechanism of action of psychotherapy. *Cognitive, Affective, & Behavioral Neuroscience, 16*(4), 571-587. doi:10.3758/s13415-016-0440-5
- Mowrer, O. (1960). *Learning theory and behavior*. Hoboken, NJ: John Wiley & Sons Inc.
- Noonan, M., Kolling, N., Walton, M., & Rushworth, M. (2012). Reevaluating the role of the orbitofrontal cortex in reward and reinforcement. *European Journal of Neuroscience, 35*(7), 997-1010. doi:10.1111/j.1460-9568.2012.08023.x
- Norcross, J. C., & Lambert, M. J. (2011). *Psychotherapy relationships that work II*. *Psychotherapy, 48*(1), 4-8. doi:10.1037/a0022180
- Ochsner, K. N., Bunge, S. A., Gross, J. J., & Gabrieli, J. D. (2002). Rethinking feelings: An fMRI study of the cognitive regulation of emotion. *Journal of Cognitive Neuroscience, 14*(8), 1215-1229. doi:10.1162/089892902760807212
- Palpacuer, C., Gallet, L., Drapier, D., Reymann, J. M., Falissard, B., & Naudet, F. (2017). Specific and non-specific effects of psychotherapeutic interventions for depression: Results from a meta-analysis of 84 studies. *Journal of Psychiatric Research, 87*, 95-104. doi:10.1016/j.jpsychires.2016.12.015
- Pavlov, I. P. (1927). *Conditioned reflexes*. Oxford, UK: Oxford University Press.
- Perls, F., Hefferline, G., & Goodman, P. (1951). *Gestalt therapy*. Oxford, UK: Dell.
- Picó-Pérez, M., Radua, J., Steward, T., Menchón, J. M., & Soriano-Mas, C. (2017). Emotion regulation in mood and anxiety disorders: A meta-analysis of fMRI cognitive reappraisal studies. *Progress in Neuro-Psychopharmacology and Biological Psychiatry, 79*, 96-104. doi:10.1016/j.pnpbp.2017.06.001
- Ressler, K. J., & Mayberg, H. S. (2007) Targeting abnormal neural circuits in mood and anxiety disorders: From the laboratory to the clinic. *Nature Neuroscience, 10*, 1116-1124. doi:10.1038/nn1944
- Rogers, C. R. (1957). The necessary and sufficient conditions of therapeutic personality change. *Journal of Consulting Psychology, 21*(2), 95-103. doi:10.1037/h0045357
- Rogers, C. R. (1959). *Client-centered therapy: Its current practice, implications, and theory*. Boston, MA: Houghton Mifflin.
- Rosenzweig, S. (1936). Some implicit common factors in diverse methods of psychotherapy. *American Journal of Orthopsychiatry, 6*(3), 412-415. doi:10.1111/j.1939-0025.1936.tb05248.x
- Rudebeck, P. H., Saunders, R. C., Prescott, A. T., Chau, L. S., & Murray, E. A. (2013). Prefrontal mechanisms of behavioral flexibility, emotion regulation and value updating. *Nature Neuroscience, 16*(8), 1140-1145. doi:10.1038/nn.3440
- Safran, J. D., Muran, J. C., & Eubanks-Carter, C. (2011). Repairing alliance ruptures. *Psychotherapy, 48*(1), 80-87. doi:10.1037/a0022140
- Sambin, M., & Scottà, F. (2018). *Intensive Transactional Analysis Psychotherapy*. New York, NY: Routledge.
- Saxe, R. (2006). Uniquely human social cognition. *Current Opinion in Neurobiology, 16*(2), 235-239. doi:10.1016/j.conb.2006.03.001
- Schoenbaum, G., Roesch, M. R., Stalnaker, T. A., & Takahashi, Y. K. (2009). A new perspective on the role of the orbitofrontal cortex in adaptive behaviour. *Nature Reviews Neuroscience, 10*(12), 885-892. doi:10.1038/nrn2753
- Sehlmeyer, C., Schöning, S., Zwitserlood, P., Pfleiderer, B., Kircher, T., Arolt, V., & Konrad, C. (2009). Human fear conditioning and extinction in neuroimaging: A systematic review. *PloS one, 4*(6), e5865. doi:10.1371/journal.pone.0005865
- Shedler, J. (2010). The efficacy of psychodynamic psychotherapy. *American Psychologist, 65*(2), 98-109. doi:10.1037/a0018378
- Shirk, S., & Karver, M. (2003). Prediction of treatment outcome from relationship variables in child and adolescent therapy: A meta-analytic review. *Journal of Consulting and Clinical Psychology, 71*, 462-471. doi:10.1037/0022-006X.71.3.452
- Sperduti, M., Martinelli, P., Kalenzaga, S., Devauchelle, A. D., Lion, S., Malherbe, C., . . . Piolino, P. (2013). Don't be too strict with yourself! Rigid negative self-representation in healthy subjects mimics the neurocognitive profile of depression for autobiographical memory. *Frontiers in Behavioral Neuroscience, 7*, Article 41. doi:10.3389/fnbeh.2013.00041
- Stern, D. N. (1985). *The interpersonal world of the infant: A view from psychoanalysis and developmental psychology*. New York, NY: Karnac Books.

- Stern, D. N. (2004). *The present moment in psychotherapy and everyday life*. New York, NY: W W Norton & Company.
- Tulving, E. (1972). Episodic and semantic memory. In E. Tulving & W. Donaldson (Eds.), *Organization of memory* (pp. 381-403). New York, NY: Academic Press.
- Viviani, R. (2014). Neural correlates of emotion regulation in the ventral prefrontal cortex and the encoding of subjective value and economic utility. *Frontiers in Psychiatry*, 5, Article 123.
doi:10.3389/fpsy.2014.00123
- Viviani, R., Lo, H., Sim, E., Beschoner, P., Stingl, J. C., & Horn, A. B. (2010). The neural substrate of positive bias in spontaneous emotional processing. *PloS One*, 5(11), e15454.
doi:10.1371/journal.pone.0015454
- Wells, A. (2011). *Metacognitive therapy for anxiety and depression*. New York, NY: Guilford Press.
- Young, J. E., Klosko, J. S., & Weishaar, M. E. (2003). *Schema therapy: A practitioner's guide*. New York, NY: Guilford Press.
- Zahn, R., Moll, J., Krueger, F., Huey, E. D., Garrido, G., & Grafman, J. (2007). Social concepts are represented in the superior anterior temporal cortex. *Proceedings of the National Academy of Sciences*, 104(15), 6430-6435.
doi:10.1073/pnas.0607061104
- Zhao, X. H., Wang, P. J., Li, C. B., Hu, Z. H., Xi, Q., Wu, W. Y., & Tang, X. W. (2007). Altered default mode network activity in patient with anxiety disorders: An fMRI Study. *European Journal of Radiology*, 63(3), 373-378.
doi:10.1016/j.ejrad.2007.02.006