



Enhancing Inhibitory Learning: The Utility of Variability in Exposure

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Exposure therapy has strong empirical support as a treatment for anxiety and related disorders, yet not all participants see clinically meaningful reduction in symptoms, and some experience return of fear. In this review, we examine the theoretical models of exposure therapy, from early precursors to the contemporary inhibitory learning model. The inhibitory learning model is applied to examine one potential method of improving outcomes in exposure therapy: increasing variability in the progression of the exposure hierarchy. We explore mechanisms that support the use of variability in exposure, including the violation of expectancies to enhance learning. In addition, the role of intolerance of uncertainty in anxiety is examined; variable exposure therapy could target this transdiagnostic mechanism in anxiety and related disorders. Suggestions for future research are then offered.

EXPOSURE is a key component of effective treatment for anxiety and related disorders. A large body of evidence supports the efficacy of exposure in the treatment of obsessive-compulsive disorder (OCD; Abramowitz, 1996, 1997; Abramowitz, Franklin, & Foa, 2002; Foa & McLean, 2016; Gava et al., 2009; Rosa-Alcázar, Sánchez-Meca, Gómez-Conesa, & Marin-Martínez, 2008), posttraumatic stress disorder (PTSD; Foa & McLean, 2016; McLean & Foa, 2011; Powers, Halpern, Ferenschak, Gillihan, & Foa, 2010), specific phobias (Choy, Fyer, & Lipsitz, 2007; Grös & Antony, 2006), social anxiety disorder (Gould, Buckminster, Pollack, Otto, & Yap, 1997; Rodebaugh, Holaway, & Heimberg, 2004; Taylor, 1996), and panic disorder (Barlow, Craske, Cerny, & Klosko, 1989; Craske, Brown, & Barlow, 1991; Gould, Otto, & Pollack, 1995). Exposure therapy is based on principles of fear extinction, in which classically conditioned stimuli gradually lose their phobic quality through repeated exposure without the feared negative consequences (Myers & Davis, 2007). However, the theory behind exposure and the specific techniques used in therapy have evolved since the initial conceptualization of exposure therapy in the mid-20th century. Historical perspectives on exposure therapy are reviewed before turning to contemporary theoretical models and applications. Adult clients are the primary focus of this review; for a detailed review of historical approaches to exposure with an emphasis on children, see Davis and Ollendick (2005).

Keywords: exposure therapy; inhibitory learning; intolerance of uncertainty

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Theories of Exposure Therapy: A Historical Perspective

Systematic Desensitization and Flooding

The earliest approach to exposure therapy was systematic desensitization (Wolpe, 1958, 1961). Wolpe outlined three key components to systematic desensitization: relaxation training, the construction of a hierarchy of feared stimuli or situations, and progression through this hierarchy through alternating exposure and relaxation. The theoretical basis of systematic desensitization, Wolpe's reciprocal inhibition theory, is the counterconditioning of feared stimuli. Typically, exposure to these stimuli is paired with relaxation in order to evoke a response incompatible with fear or anxiety; however, other methods such as humor, pleasurable food, or sexual behavior could be paired with the stimulus as well (Davis & Ollendick, 2005; Wolpe, 1958). Wolpe suggests that the counterconditioning of feared stimuli with relaxation or another pleasurable experience eliminates avoidance and inhibits anxious responses. Early research on systematic desensitization, in the form of case studies and some experimental designs, demonstrated greater efficacy of systematic desensitization compared to fear extinction paradigms that did not use relaxation (Rachman, 1967).

An alternative approach to systematic desensitization used a technique termed "flooding," in which stimuli that evoke intense fear responses are presented to the client immediately, without progression up a hierarchy and without pairing an incompatible response (Marks, 1972; Morganstern, 1973). The literature on the effectiveness of flooding techniques is more mixed than that of systematic desensitization, partly due to the confounding of flooding with implosive therapy, which involves imaginal exposure to

extreme and unrealistic stimuli (Morganstern, 1973; Smith, Dickson, & Sheppard, 1973). Some studies have demonstrated the relative effectiveness of flooding over systematic desensitization (Boulougouris, Marks, & Maset, 1971; Marks, Boulougouris, & Maset, 1971; Marshall, Gauthier, Christie, Currie, & Gordon, 1977; see Smith et al., 1973 for a review), while others have reported mixed results and raised ethical concerns over the use of flooding in anxious clients (Morganstern, 1973). Concerns have also been raised about clients' acceptability of flooding. A crossover study comparing flooding and desensitization noted that clients were surprisingly accepting of flooding, and some clients even preferred flooding to desensitization because they felt it was more effective (Marks et al., 1971). Notably, these clients were highly motivated to pursue treatment, as the trial required a large number of sessions; clients who are less highly motivated might not find flooding to be as acceptable. Additionally, flooding is thought to be less acceptable for children (King & Gullone, 1990).

In 1975, Marks published an extensive literature review on systematic desensitization and determined that the active ingredient in this treatment was the exposure to feared stimuli, not relaxation (Marks, 1975; Tryon, 2005). After the publication of this review, behavioral modification research and theory focused on "exposure therapy" instead of systematic desensitization or flooding, although some recent studies suggest that flooding may still have utility (Moulds & Nixon, 2006).

Modeling

Albert Bandura's theory of social learning has also been applied to the extinction of fear. Bandura and colleagues suggested that individuals with phobias could learn approach behavior and experience reduced fear through modeling, or observing others approach a feared object or situation without negative consequences (Bandura, Blanchard, & Ritter, 1969; Bandura, Grusec, & Menlove, 1967; Ritter, 1968). For example, a person with a snake phobia would watch someone else interact confidently with a snake without displaying fear. When the model did not experience a negative outcome, the client would learn that behavioral approach of snakes was not as dangerous as feared and could change his/her behavior accordingly. After observing appropriately modeled approach behavior and practicing it, the client gains coping skills and self-efficacy, which is likely to increase future approach behavior and decrease fear (Bandura, 1977). Modeling has been shown to be more effective than systematic desensitization for the treatment of multiple phobias (Bandura et al., 1969; Shaw & Thoresen, 1974) and is especially effective when the model shares characteristics like age and gender with the client (Kazdin, 1974; Meichenbaum, 1971). Although modeling leads to beneficial outcomes, approaches in which the client attempts

the approach behavior him- or herself after modeling leads to greater reductions of fear and higher self-efficacy compared to vicarious experience alone (Bandura, Adams, & Beyer, 1977). A combination of modeling and exposure is commonly used in the treatment of phobias and other anxiety disorders, especially for children (Davis & Ollendick, 2005).

Emotional Processing Theory

A revised theory of exposure therapy, emotional processing, took hold in the 1980s (Foa & Kozak, 1986; Rachman, 1980). Emotional processing theory drew upon Lang's bioinformational model of fear (Lang, 1977, 1979), which notes the importance of changes in physiology (e.g., heart rate) in response to emotional stimuli as an indicator of improvement during systematic desensitization (Lang, Melamed, & Hart, 1970). These physiological changes occur in response to fear imagery and were hypothesized as the key to the emotional processing of fear (Lang, 1977). Noting that systematic desensitization, flooding, and modeling approaches could all successfully reduce fear, Rachman suggested that "the transformation or neutralization of emotion-provoking stimuli," which is "facilitated by repeated presentations, by stimuli presented for certain minimal durations, by piecemeal presentations, by minimizing distractions, (and) by inducing a low level of arousal" could be the common principle that explains their effectiveness (Rachman, 1980, p. 57). Thus, Rachman introduced a recipe for successful exposure therapy for fear.

Using Lang's bioinformational model, Foa and Kozak (1986) discuss the fear memory as the basic propositional representation that is represented in the brain and is targeted during exposure. This representation includes basic information about the feared situation or stimulus, information about potential responses to the situation or stimulus (verbal, physiological, or behavioral), and interpretations about the meaning of both the stimulus and the responses. Together, this structure can be modified in memory through exposure; the modification of memory is the mechanism through which emotional processing reduces fear (Foa & Kozak, 1986). To measure the degree of emotional processing that has taken place, three indicators can be used. First, initial reports of fear, often measured by physiological signs such as an increase in heart rate and/or electrodermal activity, indicate that the fear memory has been "activated." Second, clients undergoing successful emotional processing habituate within a given session of exposure, and therefore experience lower levels of arousal at the end of exposure than at the beginning. Finally, between-session habituation should also occur, such that feared stimuli are less fear-provoking at the beginning of the second session of exposure than at the

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