Verbal Repetition in the Reappraisal of Contamination-Related Thoughts

By

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I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

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Abstract

Acceptance and Commitment Therapy is a therapeutic approach that emphasizes the alteration of the relationship one has towards one's thoughts, rather than attempting to change the content of thoughts. It seeks to promote the awareness of thinking as an ongoing relational process through cognitive defusion techniques. The verbal repetition of thoughts is a technique that has recently been shown in a single-case alternating treatment designs study to significantly reduce the believability and distress associated with self-relevant negative thoughts (Masuda, Hayes, Sackett, & Twohig, 2004). The present study compared the effects of verbal repetition with brief imaginal exposure and no intervention in reducing the believability, distress, and meaningfulness associated with contamination-related thoughts. Individuals with high levels of obsessive-compulsive symptoms identified three distressing contamination-related thoughts and made ratings of belief, distress, and meaningfulness for each thought, using 100-mm visual analogue scales. They were then randomly assigned to receive verbal repetition, imaginal exposure, or no intervention, after which they completed ratings at post-intervention and one-week follow-up. Participants also completed a category membership decision task to determine whether verbal repetition and/or imaginal exposure produces *semantic satiation*, a temporary loss of the literal meaning of words. Significant reductions in belief, distress, and meaningfulness were observed following verbal repetition at post-intervention and there was some maintenance of these gains one week later. In contrast, no significant reductions were observed at post-intervention following either imaginal exposure or no intervention. However, significant reductions in ratings of belief and distress were observed one week later following imaginal exposure. A semantic satiation effect was

observed for only verbal repetition, and although there was no evidence that this effect was associated with reductions in appraisal ratings at post-intervention, there was some indication of a relationship with follow-up appraisal ratings. Implications of these findings are discussed in relation to cognitive-behavioural theories of obsessive-compulsive disorder.

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Table of Contents

List of Appendices

List of Figures

List of Tables

Introduction

We experience a stream of continuous thoughts during each and every waking day. Some thoughts appear to emerge spontaneously whereas others are more deliberate and consciously evoked and elaborated. We also have the ability to think about, and make interpretations and appraisals of these thoughts, a process termed *metacognition* (i.e., thinking about thinking, or cognition about cognition – e.g., Nelson, 1992). When individuals interpret their ongoing stream of thoughts, some thoughts are appraised as "neutral", some are appraised as "positive", whereas others are experienced as unwanted and appraised as "negative". The occurrence of, and belief in, the myriad "negative" thoughts we experience can be a source of suffering for people and lead to problems with anxiety. Cognitive models of anxiety propose that problems with anxiety result from erroneous beliefs about the dangerousness of certain thoughts, as well as erroneous beliefs about the dangerousness of certain feelings, physical sensations, and/or external situations (e.g., Barlow, 1988; Beck, Emery, & Greenberg, 1985).

Obsessive-compulsive disorder (OCD) is an anxiety disorder in which erroneous beliefs about thoughts are implicated as playing a central role in its development and persistence (e.g., Rachman, 1997, 1998). OCD is characterized by recurrent intrusive thoughts, images, or impulses, and/or compulsive behaviours or mental acts designed to reduce anxiety or distress (American Psychiatric Association, 1994). Obsessions are viewed as extreme forms of normal intrusive thoughts, which are defined as "repetitive, upsetting, unwanted thoughts, images or impulses of internal origin that suddenly appear in consciousness and are considered irrational, unrealistic, foreign to one's character, and difficult to control" (Purdon & Clark, 1993, p. 715). Between 80-99% of the general

population experience unwanted, intrusive thoughts whose content and nature is experienced as distressing (Purdon & Clark, 1993, Rachman & de Silva, 1978; Salkovskis & Harrison, 1984), and such intrusive thoughts have been found to be similar in content to the obsessions that characterize OCD (e.g., Purdon & Clark, 1993; Rachman & de Silva, 1978; Rachman & Hodgson, 1980).

Cognitive-behavioural models of OCD assert that intrusive thoughts become problematic and develop into clinically significant obsessions when they are erroneously appraised as meaningful, potentially harmful to self or others, and/or when they evoke a sense of responsibility for preventing the perceived harm portended by the thoughts (Rachman, 1997, 1998; Salkovskis, 1989). For example, a new mother with OCD may experience intrusive thoughts that she could sexually abuse her infant son. While changing his diaper or bathing him, she may wonder if she feels sexually aroused. This doubt may become so frequent and troubling that she avoids bathing or changing her son, and relies on her husband to do so. This appraisal of the intrusive thought as potentially being true is associated with worry about the meaning of thought recurrences and concomitant changes in mood (e.g., Purdon, 2001; Salkovskis & Campbell, 1994). This in turn is said to influence the individual's ability to control the obsessive thoughts, and evokes the use of compulsive rituals designed to neutralize the thought and/or ameliorate the distress it causes (Purdon, 2001; Sutherland, Newman, & Rachman, 1982). In the above example, the mother may unsuccessfully attempt to suppress any thoughts that she will abuse her son, and she may begin to excessively ask her husband for reassurance that she would not harm their child.

Cognitive-behavioural models of OCD consider the negative and erroneous appraisal of the meaning and significance of intrusive thoughts to be a key factor in the development and persistence of OCD (e.g., Rachman, 1997, 1998; Salkovskis, 1989). As such, interventions that seek to change the relationship one has towards his or her obsessive thoughts, and thinking in general (i.e., changes in metacognitive processes), should be effective in altering the belief in these thoughts, leading to successful treatment of OCD.

The most effective psychological treatment of OCD to date is exposure and response prevention (e.g., Foa, Franklin, & Kozak, 1998), in which people expose themselves to their obsessions while refraining from compulsive acts. Exposure and response prevention is thought to produce *habituation*, a natural decrease in anxiety, which allows for extinction of the aversive emotional response to the obsession, making the compulsive act unnecessary. Exposure and response prevention has been found to be at least as effective as, and in many cases superior to, pharmacological approaches to the treatment of OCD (Foa & Kozak, 1996). For example, findings from the National Institute of Mental Health-sponsored collaborative study of clomipramine and behaviour therapy found exposure and response prevention to be superior to pharmacotherapy at both posttreatment and 3-month follow-up (Kozak, Liebowitz, & Foa, 2000). A review of behaviour therapy and pharmacotherapy for OCD concluded that exposure and response prevention is associated with higher improvement rates at posttreatment, and that dropout and refusal rates are higher for medication than exposure and response prevention (Stanley & Turner, 1995).

Despite the reported efficacy rates for exposure and response prevention in the treatment of OCD, there is still between a 20-30% dropout and refusal rate reported for exposure and response prevention (Stanley & Turner, 1995). When these factors, as well as non-response rates, are taken into account, exposure and response prevention treatment may be an effective treatment for only about 50% of individuals with OCD (Salkovskis & Westbrook, 1989). In attempting to uncover the reasons for this high rate of dropout and treatment refusal, it has been suggested that a key predictor of exposure and response prevention treatment refusal is the fear of exposure and response prevention itself (Foa, Steketee, Grayson, & Doppelt, 1983; Maltby & Tolin, 2003). Exposure and response prevention requires individuals with OCD to directly face the situations and objects that elicit heightened anxiety and avoidance. It is argued that cognitive interventions may be helpful both in reappraising the erroneous beliefs associated with OCD symptoms and in reducing the meaning attached to obsessive thoughts (Purdon, in press; Salkovskis, 1985, Salkovskis & Kirk, 1997), thereby reducing the fear associated with exposure and response prevention.

Cognitive-behavioural therapy (CBT) for OCD involves the addition of cognitive restructuring techniques to the existing exposure and response prevention intervention, in order to help teach individuals to correct the maladaptive appraisals that maintain OCD. However, the addition of cognitive therapy to exposure-based treatment has, in general, not led to significantly improved treatment efficacy (Foa & Franklin, 2001). Vogel, Stiles, & Gotestam (2004) compared exposure and response prevention treatment with and without cognitive therapy interventions designed to increase motivation for the completion of exposure exercises. They found that the addition of cognitive therapy to

exposure and response prevention treatment resulted in fewer OCD patients discontinuing treatment at some point during the study than exposure and response prevention plus relaxation training [6% (n =1) versus 37% (n = 7), respectively]. However, treatment outcome was not significantly improved compared to exposure and response prevention without cognitive therapy, for both the "intention to treat" analyses and the "completer" analyses. In addition, other studies have not found a significantly lower dropout rate associated with cognitive therapy (Cottraux et al., 2001; van Oppen et al., 1995). It appears that cognitive therapy, either alone or combined with exposure and response prevention, is no more effective than exposure and response prevention alone (e.g., Abramowitz, Taylor, & McKay, 2005; McLean et al., 2001; for a review, see Foa & Franklin, 2001). As such, alternative or modified approaches are needed to more effectively treat those individuals with OCD who are not currently helped by existing treatments.

Over the past decade there has been a proliferation of acceptance-based and mindfulness-based therapeutic approaches, including Acceptance and Commitment Therapy (Hayes et al., 1999), Dialectical Behaviour Therapy (Linehan, 1993), Mindfulness-Based Stress Reduction (Kabat-Zinn, 1990), and Mindfulness-Based Cognitive Therapy (Segal, Williams, & Teasdale, 2002). In contrast to traditional CBT, these approaches all have as a therapeutic emphasis the alteration of the relationship that an individual has towards their thoughts (metacognitive beliefs), rather than directly attempting to change the form or content of thinking. Thoughts are not so much evaluated as "realistic" or "unrealistic," as is typical of traditional CBT; instead, the therapeutic

emphasis is on helping individuals to see all thoughts, including negative or unwanted thoughts, as *just* thoughts – no more, no less (Hayes et al., 1999).

There is recent preliminary evidence that the addition of a metacognitive rationale to exposure and response prevention results in greater reductions in anxiety and distress, metacognitive beliefs, and the urge to engage in compulsive rituals, than does exposure and response prevention with a habituation rationale (Fisher & Wells, 2005). This research finding lends support to the idea that interventions which address metacognitive processes (i.e., how obsessive thoughts are thought about) will be helpful in increasing OCD treatment efficacy.

In addition to the above evidence supporting a metacognitive approach to the treatment of OCD, a recent uncontrolled study (Twohig, Hayes, & Masuda, 2006) suggests that Acceptance and Commitment Therapy may be a potentially efficacious treatment for OCD. Using a multiple-baseline, across-participants design, four individuals with a primary diagnosis of OCD received eight sessions of Acceptance and Commitment Therapy. At the end of treatment, all participants reported clinically significant reductions in compulsive behaviour, and these gains were maintained at three-month follow-up. In addition, all participants rated the treatment as highly acceptable. However, controlled research needs to be conducted prior to the arrival of any firm conclusions. In addition, there has been no research comparing an Acceptance and Commitment Therapy intervention with CBT or exposure and response prevention in the treatment of OCD, so it is not known whether Acceptance and Commitment Therapy will be able to improve upon existing treatment efficacy rates.

Acceptance and Commitment Therapy is a therapeutic approach which takes the view that language processes are at the core of many psychological disorders. It uses acceptance and mindfulness processes, along with a commitment to behaving in ways which lead to the realization of valued goals, in order to promote greater psychological flexibility. Acceptance and Commitment Therapy is based on Relational Frame Theory (Hayes, Barnes-Holmes, & Roche, 2001), a line of basic behavioural research on human language and cognition which has emerged from a pragmatic philosophical tradition termed *functional contextualism*. Relational Frame Theory posits that thoughts acquire their literal meaning and much of their emotional and behavioural regulatory functions because the social/verbal community establishes a context in which verbal symbols relate mutually to other events and have functions based on these relations. *Cognitive fusion* is the term developed by Hayes and colleagues to describe how verbal symbols become "fused" together with the events they describe, and how the some of the functional properties of the event can become present with the emergence of the symbol without a full realization that the event has not actually taken place:

> Cognitive fusion refers to the human tendency to interact with events on the basis of their verbally ascribed functions rather than their direct functions, while being oblivious to the ongoing relational framing that establishes these functions. The event and one's thinking about it become so fused as to be inseparable and that creates the impression that verbal construal is not present at all (Hayes, Strosahl, Bunting, Twohig, & Wilson, 2004, p. 25).

In a real-life example of the effects of cognitive fusion, Luoma and Hayes (2003) describe what happens when an individual thinks about a lemon, when no lemon is actually present:

> When we think a thought, the functions of the current situations are usually altered by the content of that thought because symbols are mutually related to other events. For example, when one thinks of a lemon, some of the reactions produced by an actual lemon occur, at least in weakened form. For example, one may "visualize" a lemon and one's mouth may water…Because many contexts are of this kind, people can come to interact with the world as cognitively organized without noticing that they are constantly organizing it. Verbal or cognitive constructions come to substitute for direct contact with events (p. 73).

Cognitive fusion becomes problematic when it causes individuals to become excessively attached to the content of their thoughts, making psychological flexibility difficult or impossible. The verbally-conceptualized and evaluated world cannot be distinguished from the world of direct experience, meaning that anything imported into human experience by language will have its effects as if it is the product of nature itself (Strosahl, Hayes, Wilson, & Gifford, 2004).

Acceptance and Commitment Therapy incorporates various *cognitive defusion* techniques to help individuals to "defuse" from the meaning of their thoughts and instead become more aware of thinking as an ongoing relational process. These techniques attempt to alter the ordinary meanings of language in various ways so that the literal meanings of words become disrupted, allowing individuals to experience thoughts as thoughts, feelings as feelings, memories as memories, and physical sensations as physical

sensations, none of which are inherently harmful (Hayes et al., 1999). These techniques are comparable to mindfulness meditation practices, which emphasize nonjudgmental attention to one's present-moment experiencing. These techniques seek to change the *context* of thinking, in order to promote a metacognitive shift to the acceptance of all thoughts as being appraised as *just* thoughts that do not need to be believed or considered personally relevant to the individual (e.g., Bach & Hayes, 2002; Kabat-Zinn, 1990; Teasdale et al., 2002).

In the aforementioned example of the mother with OCD who experiences recurrent doubts that she may sexually abuse her infant son, an Acceptance and Commitment Therapy treatment approach may focus on helping the mother become more willing to accept these negative thoughts, while continuing to act in valued ways (e.g., bathing her son in a loving manner). To increase the willingness to experience these obsessive thoughts, the mother may be instructed to verbally repeat the word "molest" over and over again until she experiences the word as just a meaningless sound, or verbalize the thoughts in the voice of a cartoon character. The goal of these exercises is for the anxiety-provoking thought to be experienced in a more detached context so that it need not be feared and actively resisted.

Cognitive defusion techniques make up a core element of Acceptance and Commitment Therapy. They are frequently used throughout therapy to help clients caught up in the content of their own cognitive activity limit their negative interpretations of their thoughts. A goal of this process is for clients to become accepting of their thoughts being *just* thoughts and feelings being *just* feelings, as opposed to being valid indicators of reality. These techniques emphasize the awareness of the *process*, rather than the

content, of thinking and feeling (Hayes et al., 1999). The Acceptance and Commitment Therapy approach views an individual's interactions with their thoughts (i.e., metacognition), rather than the occurrence or non-occurrence of negative thoughts, as being of primary importance in whether dysfunction will occur. Mindfulness meditation, paradox, and metaphor are some examples of cognitive defusion techniques, in that they all promote a shift in language towards noticing the ongoing process of thinking rather than focusing on thought content. There are more than twenty-five different cognitive defusion techniques used in Acceptance and Commitment Therapy, with new techniques continuously being developed (Luoma & Hayes, 2003). However, to date there are few studies which have directly tested the theoretical assumptions of Acceptance and Commitment Therapy in regards to the effectiveness of cognitive defusion techniques in increasing the awareness of the process of thinking.

There is recent preliminary evidence to suggest that the effectiveness of Acceptance and Commitment Therapy interventions may be mediated by changes in metacognitive processes, specifically, how individuals come to appraise their thoughts as being less believable. Bach and Hayes (2002) examined the impact of a brief version of Acceptance and Commitment Therapy in preventing the rehospitalization of psychiatric inpatients experiencing auditory hallucinations or delusions. Patients were randomly assigned to either three hours of an Acceptance and Commitment Therapy intervention which included the implementation of cognitive defusion techniques, or treatment as usual. Results showed that patients receiving Acceptance and Commitment Therapy were half as likely as those receiving only treatment as usual to be rehospitalized during a four month follow-up period. Interestingly, those receiving Acceptance and Commitment

Therapy were *more* likely to report hallucinations and delusions at follow-up than patients receiving treatment as usual; however, following Acceptance and Commitment Therapy, patients were *less* likely to believe the content of their hallucinations and delusions when they occurred, indicating a change in their metacognitive beliefs. Bach and Hayes suggest that an acceptance of unpleasant thoughts and a decrease in the belief in the content of thoughts may be more important than reductions in the frequency of negative thoughts. These results have since been replicated (Gaudiano & Herbert, 2006a, 2006b), with the Acceptance and Commitment Therapy group again demonstrating significantly decreased belief in hallucinations compared to the control group at post-intervention.

Studies indicate that a decrease in the believability of negative thoughts has therapeutic benefit. In a comparison of Acceptance and Commitment Therapy versus cognitive therapy in the treatment of major depressive disorder, Zettle and Hayes (1986) assigned 18 depressed women to receive either 12 sessions of Acceptance and Commitment Therapy or 12 sessions of cognitive therapy. Both treatment groups were found to have significantly improved at 2-month follow-up. However, participants in the Acceptance and Commitment Therapy treatment group were rated by an independent evaluator, blind to treatment condition, as significantly less depressed than those receiving cognitive therapy. Interestingly, whereas both groups reported similar reductions in the frequency of depressive automatic thoughts (with a reduction in depressive thinking being a goal of CBT but not Acceptance and Commitment Therapy), individuals receiving Acceptance and Commitment Therapy reported significantly greater reductions in the belief in depressive automatic thoughts than did individuals receiving

cognitive therapy. In a recent re-analysis of these data (Hayes, Luoma, Bond, Masuda, & Lillis, 2006), patients' week 6 ratings of their belief in their depressive automatic thoughts differed significantly between treatment groups [F (1, 16) = 8.61, p = .01; Acceptance and Commitment Therapy M = 49.00, SD = 10.95, Cognitive Therapy M = 92.25, SD = 34.77, d = 1.68). These ratings were then assessed for their role as a mediator of outcomes on the post-treatment Beck Depression Inventory scores (Beck et al., 1961), which revealed a significant difference in treatment outcome [F (1, 16) = 4.61, $p < .05$; Acceptance and Commitment Therapy M = 4.83, SD = 5.19 versus Cognitive Therapy M = 19.42, SD = 16.01, d = 1.23).

In the Acceptance and Commitment Therapy treatment literature, empirical evidence suggests that reductions in the believability of negative thoughts and symptoms occur as a result of both brief and full interventions (Bach & Hayes, 2002; Gaudiano & Herbert, 2006a, 2006b; Zettle & Hayes, 1986). However, until recently there has not been any examination of specific cognitive defusion techniques administered independently of the Acceptance and Commitment Therapy treatment package. One cognitive defusion technique that is commonly used in Acceptance and Commitment Therapy is the verbal repetition of a word or thought (Hayes et al., 1999). This technique has a long psychological history, beginning with Tichener (1916), who first described how the rapid repetition of a word or phrase can temporarily prevent access to its meaning. He suggested that with repetition, "the word soon becomes meaningless; the direction of attention has given a sort of hypnotic narrowness to consciousness, the associative context of the word is cut off, and the bare perception remains" (p. 425).

The loss of meaning following the rapid repetition of a word has been studied in cognitive psychology under the label of *semantic satiation*. The semantic satiation hypothesis refers to the proposition that prolonged repetition of a word will lead to the subjective experience of loss of meaning of that word. Numerous investigations have been conducted to test the validity of this hypothesis using different methodologies. Although a number of studies have supported the semantic satiation hypothesis (Balota & Black, 1997; Kanungo & Lambert, 1963; Lewis & Ellis, 2000; Lindquist, Barrett, Bliss-Moreau, & Russell, 2006; Pilotti, Antrobus, & Duff, 1997; Pynte, 1991; Smith, 1984; Smith & Klein, 1990), other studies have failed to support it (Cohene, Smith, & Klein, 1978; Esposito & Pelton, 1969, 1971; Frenck-Mestre, Besson, & Pynte, 1997; Neely, 1977). However, it has been suggested that certain tasks used to detect semantic satiation may not be adequate to do so. For example, Balota and Chumbley (1984) argued that the lexical decision task used by Cohene et al. (1978) and Neely (1977) is inappropriate because the task can be completed without accessing the actual meaning of the word.

On the other hand, studies using the category membership decision task (CMDT) have reliably detected semantic satiation effects (Lewis & Ellis, 2000; Lindquist et al., 2006; Pilotti et al., 1997; Pynte, 1991; Smith, 1984; Smith & Klein, 1990; although see Frenck-Mestre et al., 1997). In this task, a category name (e.g., animal) is verbally repeated either a few or many times, after which the participant makes a rapid decision as to whether a target word (e.g., dog) is a member of the category. Semantic satiation is said to be evidenced by an increase in response time for member target words when preceded by verbal repetition of the category name many times, but no increase in response time for nonmember target words when preceded by verbal repetition of the

category. For example, in Smith's (1984) study of semantic satiation, participants repeated the name of a category (e.g., *fruit*) either 3 or 30 times, after which they had to decide whether a target word (e.g., *apple*) was a member of the category. Smith found that decision time increased with repetitions when the target word was a member of the repeated category (e.g., *fruit-apple*), whereas no increase was found for nonmember target words (e.g., *fruit-car*). This suggests that rapid verbal repetition of a word decreases the availability of semantic information related to that word, causing a temporary weakening of the links to the word's associative network of meaning.

In a similar methodology, participants make a rapid decision as to the relatedness of a word pair following the verbal repetition of a word (Balota & Black, 1997; Black, 2001). For example, verbal repetition of the word "dog" is followed by a decision as to whether "dog-cat" is a related or unrelated word pair. A reduction in the ability to make a rapid correct judgment on related word pair trials is considered evidence that semantic satiation has occurred.

Balota and Black (1997; Experiment 1 and 2) had younger and older participants (mean age, approximately 20 and 70 years, respectively) repeat a target word (e.g., *dog*) either 2, 12, or 22 times, after which they made rapid decisions about whether two visually presented words were semantically related (e.g., *dog-cat*) or unrelated (e.g., *dog-chair*). Semantic satiation was defined as a reduction of the difference in mean response latency and accuracy between responses to related and unrelated word pairs. Results found evidence of semantic satiation in younger, but not older, participants. The lack of satiation effects in the older adults is consistent with other work supporting age-related changes in satiation-type effects (e.g., McDowd & Filion, 1992; Warren & Warren,

1966). It is suggested that the age-difference results from a decreased activation of lexical and semantic representations from the orthographic pattern with age (Balota & Duchek, 1988), which would produce a decrease in semantic satiation effects (Balota & Black, 1997). Interestingly, Balota and Black also found that if a word is repeated that is *unrelated* to the word pair presented, no semantic satiation occurs, which suggests that a generalized fatigue or decreased attentional alertness is not responsible for the satiation effects found in younger adults (Experiment 4). Based on the results from the four experiments, Balota and Black concluded that semantic satiation is a semantic phenomenon arising from the decreased access to the meaning of the repeated word. Other investigations using the relatedness decision task have supported the semantic satiation hypothesis, at least in young adults (Black, 2001).

Recently, Lindquist et al. (2006) used a category membership decision paradigm to examine whether individuals would have more difficulty identifying emotion in others following the semantic satiation of relevant emotion words. Participants repeated an emotion category word (e.g., “fear”) out loud either 3 or 30 times, following which they were presented with a picture of a facial behaviour (e.g., a face depicting fear) and asked to judge whether or not the facial behaviour matched the word they had previously repeated. Lindquist et al. found that participants were slower to categorize faces depicting various emotions after the same emotion word was repeated 30 times. The authors interpreted these results as evidence that interfering with the accessibility of emotion category words results in slowed emotional perception, and provided initial support for their hypothesis that the perception of emotion is in part driven by language.

Masuda, Hayes, Sackett, and Twohig (2004) examined the impact of the rapid verbal repetition of a self-relevant negative thought in reducing the believability and discomfort associated with that thought. Using an alternating treatments design (Barlow & Hayes, 1979), 8 female undergraduate students generated two self-relevant negative thoughts (e.g., "I am too fat"), each of which they restated as one word (e.g., "fat"). Participants then rated the degree of discomfort as well as the believability of each thought, after which they received a rationale and instructions for the use of various interventions (verbal repetition, distraction, and thought control) and then completed 30 seconds of each intervention. Following each intervention, participants re-rated the degree of discomfort and belief in the thought. Masuda et al. found that the verbal repetition plus cognitive defusion rationale condition resulted in significantly greater reductions in both discomfort and believability than either of the comparison approaches.

Masuda et al. (unpublished manuscript) followed up their preliminary investigation of verbal repetition with two experiments designed to measure the amount of change in the believability and discomfort associated with self-relevant negative thoughts following various durations of the verbal repetition technique. In Experiment 1, 75 undergraduate students rated the degree of discomfort and belief in a self-relevant negative thought, after which they were randomly assigned to receive a cognitive defusion rationale only, a rationale plus 3 seconds of verbal repetition of their thought, or a rationale plus 20 seconds of verbal repetition. Results indicated that the rationale-only condition reduced distress significantly less than both the 3 second and the 20 second verbal repetition conditions, with no differences between the latter two conditions. For believability ratings, the rationale-only condition reduced believability significantly less

than both the 3 second and the 20 second verbal repetition conditions, and the 20 second condition reduced believability by a significantly greater amount than the 3 second condition. Experiment 2 repeated the design from Experiment 1, but included verbal repetition conditions of 1, 10, and 30 seconds. Experiment 2 results were such that the 10 second and 30 second conditions were associated with greater reductions in distress and believability than were the 1 second and rationale-only conditions, with no significant differences between the 10 and 30 second conditions.

Overall, the work of Masuda, Hayes, and colleagues suggests that the cognitive defusion technique of rapid verbal repetition of self-relevant negative thoughts, along with a cognitive defusion rationale, is an effective technique for reducing the believability and discomfort associated with these thoughts, at least in the immediate short-term. A question left unanswered, however, is what mechanism(s) is/are actually responsible for the observed reductions in discomfort and believability following verbal repetition. Hayes et al. (1999) suggest that the verbal repetition of thoughts cause these thoughts to temporarily lose their meaning and be viewed differently; in particular, the thoughts become seen as *just* thoughts or noise, and are experienced apart from their normal literal functions and meaning. However, Masuda et al. (2004; unpublished manuscript) did not explicitly test for a reduction in meaning in either of their studies, and it is not known whether changes in meaningfulness actually occurred or whether a loss of meaning mediated the decrease in believability and/or discomfort for the verbal repetition condition.

It is also not known whether the results obtained by Masuda et al. (2004; unpublished manuscript) following verbal repetition are different from what might occur

following imaginal exposure of the thought for an equivalent duration of time. Repeated exposure to any stimulus produces habituation, which is generally conceptualized as a reduction in the responsiveness of the neural structures involved in processing incoming information (e.g., Sokolov, 1991). Habituation allows for repetitive extraneous information to be filtered out in order to decrease the allocation of resources to redundant information (Cowan, 1988). Although there is some controversy over the mechanism(s) underlying why exposure is an effective treatment for anxiety-related problems, one view is that a requirement for successful exposure is that habituation to the anxious thoughts occurs during each exposure session. This is thought to promote an overall reduction in the exaggerated responses and disconfirmation of the expectancy of an aversive outcome, leading to the extinction of anxious responding (for a recent review of the processes that may be involved in exposure therapy, see Craske & Mystkowski, 2006). As such, it is possible that the results obtained by Masuda, Hayes, and colleagues are attributable to a habituation to the negative thoughts, rather than a reduction in the meaningfulness of the thoughts (i.e., semantic satiation). There is some research to suggest that, at least in individuals with OCD, habituation through exposure and response prevention can change unrealistic beliefs without any direct cognitive or metacognitive intervention (Ito, De Araujo, Hemsley, & Marks, 1995; Whittal, Thordarson, & McLean, 2005). However, in general, the impact of exposure therapy on changing beliefs is not well known.

Overview

The present study was a preliminary investigation of the effects of verbal repetition in reducing the believability, distress, and meaningfulness of contamination-related thoughts in an analogue sample of individuals reporting high levels of OCD

symptoms. This is an exploratory study that tested whether the verbal repetition technique that has been recently found to reduce the believability and discomfort associated with self-relevant negative thoughts is more effective than brief imaginal exposure in the reappraisal of contamination-related thoughts. Participants identified three contamination-related thoughts, after which they completed the CMDT as a test of whether semantic satiation occurs following verbal repetition and/or imaginal exposure. They then completed ratings of the believability, distress, and meaningfulness associated with each identified contamination-related thought. For each of the three identified thoughts, participants then completed a 30-second period of either verbal repetition, imaginal exposure, or no intervention, and re-rated the thought on the above dimensions. Finally, all participants returned to the laboratory one week later to assess for the temporal stability of any changes in the appraisals of their contamination-related thoughts.

Research Questions

The purpose of the present study is fourfold: (1) to investigate whether verbal repetition immediately reduces the believability, distress, and meaningfulness associated with contamination-related thoughts to a greater extent than does imaginal exposure or no intervention; (2) to determine if verbal repetition and/or imaginal exposure is associated with stable reductions in the believability, distress, and meaningfulness associated with the identified thoughts, as seen in the one-week follow-up; (3) to determine if verbal repetition and/or imaginal exposure produces semantic satiation effects, as assessed by the CMDT; and (4) to examine if any observed semantic satiation effects are associated

with the reduction of belief, distress, and meaningfulness appraisals of the contamination-related thoughts.

Changes in the believability, distress, and meaningfulness of contamination-related thoughts were assessed via 100-mm visual analogue scale ratings at four points: i) at baseline, prior to completing the CMDT (pre-CMDT); ii) immediately following the CMDT and prior to randomly receiving either verbal repetition, imaginal exposure, or no intervention (pre-intervention); iii) immediately following the intervention (post-intervention); and iv) at one-week follow-up (follow-up). Semantic satiation was assessed through a comparison of mean median response times (RTs) in the CMDT. Correlations between semantic satiation effects and visual analogue scale appraisal ratings of belief, distress, and meaningfulness at post-intervention and follow-up following verbal repetition and imaginal exposure were also assessed.

Hypotheses

It was hypothesized that verbal repetition would produce significantly greater reductions in the believability, distress, and meaningfulness associated with the identified contamination-related thoughts than would imaginal exposure and no intervention, and that this would be observed both at post-intervention and at one week follow-up. It was also hypothesized that semantic satiation effects would be found in the CMDT following verbal repetition, as has been found in previous semantic satiation experiments (e.g., Smith, 1984), but not following imaginal exposure. The magnitude of the semantic satiation effect was expected to correlate negatively with the appraisal ratings at both post-intervention and follow-up (i.e., higher semantic satiation scores would be associated with lower belief, distress, and meaningfulness ratings).

Method

Participants

The sample consisted of 93 undergraduate students (82 women, 11 men) with a mean age of 19.39 years (*SD* = 1.76). Participants were a subset of individuals from a large pool of individuals enrolled in an introductory psychology course at the University of Waterloo. All individuals had completed a large number of psychological measures as part of the course, including the *Padua Inventory-Washington State University Revision* (PI-WSUR; Burns, Keortge, Formea, & Sternberger, 1996) and the *Interpretations of Intrusions Inventory* [Obsessive-Compulsive Cognitions Working Group (OCCWG), 2001. For details of all measures, see below]. Participants received course credit in exchange for participation in this study.

Inclusion criteria for the present study was a PI-WSUR *contamination obsessions and washing compulsions* (PI-WSUR COWC) subscale score that was no less than the mean subscale score of a clinical sample of individuals diagnosed with OCD [M = 13.9, SD = 8.0 (possible range is 0-40); as reported in Burns et al., 1996]. This was to ensure that participants were individuals who report being disturbed by contamination-related thoughts at a clinically significant level.

Measures

PI-WSUR. The PI-WSUR is a 39-item self-report measure of obsessions and compulsions. It is a revised version of the *Padua Inventory* (PI; Sanavio, 1988); this revision was undertaken in order to reduce the original PI's overlap with worry. Each item is rated on a 5-point (0-4) scale, according to the degree of disturbance caused by the thought or the behaviour. The PI-WSUR consists of five subscales: (1) *contamination*

obsessions and washing compulsions (10 items, e.g., "*I find it difficult to touch garbage or dirty things*"); (2) *dressing/grooming compulsions* (3 items, e.g., "*I feel obliged to follow a particular order in dressing, undressing, and washing myself*"); (3) *checking compulsions* (10 items, e.g., "*I tend to keep on checking things more often than necessary*"); (4) *obsessional thoughts of harm to self/others* (7 items, e.g., "*When I hear about a disaster, I think it is somehow my fault*"); and (5) *obsessional impulses to harm self/others* (9 items, e.g., "*I sometimes have an impulse to hurt defenseless children or animals*"). The factor structure of the PI-WSUR has been supported, and the alpha coefficients of the different subscales have been found to be quite high (Burns et al., 1996).

Interpretations of Intrusions Inventory (See Footnote). The Interpretations of Intrusions Inventory is a 31-item self-report measure which assesses three categories of interpretations of intrusive thoughts (i.e., metacognitive beliefs), including the *importance* of thoughts (10 items, e.g., "*The more I think about these things, the greater the risk they will come true*"), the perceived *responsibility* for having these thoughts (10 items, e.g., "*If I ignore this thought, I could be responsible for serious harm*"), and *control* of the thoughts (11 items, e.g., "*I should be able to rid my mind of this thought*"). Respondents are first asked to identify two examples of intrusive thoughts that they have experienced, and interpretations of these intrusive thoughts are made by rating each of the 31 items on a scale of beliefs ranging from 0 (*I did not believe this idea at all*) to 100 (*I was completely convinced this idea was true*). The Interpretations of Intrusions Inventory has been shown to have good reliability and convergent validity and is able to distinguish

individuals with OCD from individuals with other anxiety disorders and controls (OCCWG, 2001).

Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988). The PANAS is a 20-item self-report measure of two broad mood states, termed positive affect (10 items) and negative affect (10 items). Positive affect reflects positive feelings and emotions such as interest, excitement, and determination. Negative affect reflects negative feelings and emotions such as fear, irritability, and shame. Items are rated on a 5-point scale, 1 (*very slightly or not at all*) to 5 (*extremely*). By changing the time frame of the questioning, the PANAS can be used as either a trait (i.e., how you feel generally) or state (i.e., how you feel at a particular moment) measure. Positive affect and negative affect have been shown to be distinctive dimensions which are not generally correlated (Watson et al., 1988). Good internal and test-retest reliability have been shown in nonclinical samples, and adequate construct validity has also been demonstrated (Watson et al., 1988).

Procedure

Upon arrival to the laboratory and after giving informed consent to participate in the study, participants were randomly assigned to one of three intervention groups: i) verbal repetition, ii) imaginal exposure, or iii) no intervention. Each participant began the study by completing the PANAS, with instructions to rate each item using the prompt "*to the extent you feel this way right now*", in order to assess their present mood state. Participants were then given a list of nine contamination-related words (e.g., *disease, germs, urine*, see Appendix A) and asked to rank, in order, the three words that are most distressing to them. They also were instructed to write down, in one brief sentence, a

distressing thought they experience involving the identified word, for each of their three identified words. Participants were then given a list of nine "automobile-related" words (e.g., *mazda, ford, dodge*, see Appendix B) and asked to rank, in order, the three words that are most familiar to them. All participants then completed three visual analogue scale appraisal ratings (pre-CMDT ratings) for each of their identified contamination-related thoughts: (1) *Belief*: "*How believable is the thought?*" (0 = not at all believable; 100 = very believable), (2) *Distress*: "*How distressed are you by the thought?"* (0 = not at all distressed; 100 = very distressed), and (3) *Meaningfulness*: "*How meaningful is the thought?*" (0 = not at all meaningful; 100 = very meaningful). They were also asked to complete appraisal ratings for a general thought they experience related to the word "contamination" (Appendix C). All visual analogue scale ratings were made via paper and pencil measures and they were hand-scored by the experimenter by measuring the exact point on the 100-mm scale where the line was drawn by the participant to indicate their rating.

At this time, participants were seated at the computer and given instructions for the CMDT. The CMDT used in the present study is similar to the procedures laid out by Smith (1984, Experiment 1). In Smith's study, participants were shown 40 different category names, with each name followed by a target word that was either a member or nonmember of that category. Participants were required to make rapid member/non-member decisions for each target word. The present task used 44 items, which included 38 items developed by Smith and 6 items we developed (Appendix D). Two category-target pairs from Smith's study were excluded because they contained words which could be considered aversive by participants (DISEASE and CANCER). In addition, the

present task included 36 trials of the same aversive category word ("CONTAMINATION") with different member targets (the three contamination-related words previously identified by the participant; e.g., *excrement*) and nonmember target words (the three automobile-related words previously identified by the participant; e.g., *toyota*). The task also included 36 trials of the same neutral category word ("AUTOMOBILE") with different member target words (the three automobile-related words previously identified by the participant; e.g., *toyota*) and nonmember target words (the three contamination-related words previously identified by the participant; e.g., *excrement*).

CMDT Design

For the present CMDT, category names were presented in uppercase letters, and target words were presented in lowercase letters at the center of a 17-inch VGA color monitor. Participants completed 116 experimental trials, including trials of each of six types of category-target word pairs, or trial types: (1) neutral category – member target (e.g., TOOL – hammer; $n = 22$), (2) neutral category – nonmember target (e.g., BIRD – doll; $n = 22$), (3) "contamination" category – member target (e.g., CONTAMINATION – virus; $n = 18$), (4) "contamination" category – nonmember target (e.g., CONTAMINATION – toyota; $n = 18$), (5) "automobile" category – member target (e.g., AUTOMOBILE – toyota; $n = 18$), and (6) "automobile" category – nonmember target (e.g., AUTOMOBILE – virus; $n = 18$). Trials were presented in two separate blocks. Participants completed a block of the 44 neutral category – member/nonmember targets, followed by a second block of 72 trials of "contamination" category –

member/nonmember targets and “automobile” category – member/nonmember targets, with the order of blocks of trials counterbalanced.

For the present task, participants assigned previously to the verbal repetition intervention engaged in verbal repetition of each category word, whereas participants assigned to the imaginal exposure intervention were asked to imagine a picture of each category word during each trial presentation. Participants in the no intervention condition were randomly assigned to complete the CMDT according to either verbal repetition instructions (n = 15) or imaginal exposure instructions (n = 15).

On half of the trials all participants completed a “long” trial (30 repetitions of the category word or an equivalent duration of imaginal exposure of the category word); on the other half of the trials, participants engaged in a “short” trial (3 repetitions of the category word or an equivalent duration of imaginal exposure). Prior to the administration of the experimental trials, 10 practice trials of similar neutral category – member/nonmember targets were provided to illustrate the task requirements and to familiarize the participant with the displays.

CMDT Procedure

The following sequence of events occurred for each trial: (1) a fixation point appeared in the center of the screen, signaling the participant to press the space bar to start the trial; (2) the category name first appeared in two locations at the centre of the screen for 1000 msec. After this time, the verbal repetition participants saw the word displayed either 3 or 30 times for 500 msec, with a 200-msec interval between exposures. Verbal repetition participants were instructed to say the word out loud each presentation. Imaginal exposure participants saw the word presented first for 1000 msec, after which

the word turned into a symbol of equivalent length (e.g., from "TOOL" to "%%%%")[1], which was displayed either 3 or 30 times for 500 msec, with a 200-msec interval between exposures, and served as a prompt to continue imagining the word; (3) an auditory signal alerted participants to the end of the interval; (4) a fixation point appeared for 1000 msec to serve as a warning signal for the target word; (5) a target word appeared in the middle of the screen; (6) participants signaled, as quickly and as accurately as possible, whether the target word was a member or nonmember of the category name. Half of the participants signaled "member" with their left index finger ("a" key) and "nonmember" with the right index finger ("l" key), whereas the other half used the reverse mapping. If no response was made within 3000 msec, the trial automatically ended; and (7) the fixation point returned, prompting participants to press the space bar in order to start the next trial.

During the CMDT, no feedback was given as to whether participants correctly responded on each trial. Participants were instructed to make each decision as quickly and as accurately as possible, and were told that the experimenter would be monitoring them behind the one-way mirror, in order to ensure compliance with the task.

Upon completion of the CMDT, each participant rated their perceived ability to carry out the intervention (verbal repetition or imaginal exposure) during the task, from 0 = not at all able, to 100 = very able (Appendix E), to check for any potential differences between the two CMDT groups in terms of their ability to use their intervention during the task. All participants again completed visual analogue scale Belief, Distress, and Meaningfulness appraisal ratings (pre-intervention ratings) for each of their three

[1] This change from the category word to the symbol was intended to prevent imaginal exposure participants from merely repeating the category word silently during the time period, and to prompt them to continue imagining a scene involving the word.

identified contamination-related thoughts and their general "contamination" thought. Participants then received their randomly assigned intervention of verbal repetition (n = 33), imaginal exposure (n = 30), or no intervention (n = 30), each of which are described below.

Verbal repetition. Participants viewed a 5-minute, 30 second videotaped cognitive defusion rationale, adapted from Masuda et al. (2004), prior to engaging in the verbal repetition technique. This rationale highlights the advantages of literal language and thought, as well as the problem of language and thought in creating anxious thinking. It also includes a demonstration of verbal repetition, whereby the actor is asked to repeat the word "milk" out loud as fast as possible for 30 seconds to demonstrate how its context changes and its meaning disappears with the repetition of the word (Appendix F).

Imaginal exposure. Participants viewed a 4-minute, 15 second videotaped habituation rationale, adapted from Baer (2000) and similar in format to the verbal repetition rationale, prior to engaging in the imaginal exposure technique. This rationale explains how imaginal exposure to anxious thoughts can help with the process of habituation, or getting used to anxious thoughts, so they do not seem so distressing. It includes a demonstration of imaginal exposure, whereby the actor is asked to imagine in detail an anxious event (a scary-looking dog barking at her) for 30 seconds, to demonstrate how the scene becomes less distressing as she continues to concentrate on it (Appendix G).

No intervention. The no intervention control group sat quietly for a period of three minutes, receiving no instructions.

Following the videotaped rationale, and immediately prior to the actual completion of the 30-second intervention, verbal repetition and imaginal exposure participants rated how credible they perceived their intervention rationale (0 = not at all credible; 100 = very credible, see Appendix H). Verbal repetition participants were then given instructions to repeat the first of their three identified words out loud, as fast as possible, for 30 seconds, following which they completed visual analogue scale Belief, Distress, and Meaningfulness ratings for the associated contamination-related thought (post-intervention ratings). They then completed verbal repetition for their remaining two words, completing visual analogue scale ratings after each use of the technique. Imaginal exposure participants were asked to imagine a scene involving the first of their three identified contamination-related thoughts and to concentrate on it in detail for a period of 30 seconds, following which they completed visual analogue scale Belief, Distress, and Meaningfulness ratings for that thought. They then completed 30 seconds of imaginal exposure for their remaining two thoughts, completing ratings after each period of imaginal exposure. The no intervention group completed visual analogue scale ratings for each of their three identified thoughts immediately following the three-minute relaxation period.

Finally, all participants completed the Interpretations of Intrusions Inventory, after which they were notified that the experiment was over for the day. Participants were asked to return to the laboratory one week later for a brief follow-up involving the completion of some questionnaires.

One-Week Follow-Up Procedure

Upon their return to the laboratory one week later, all participants completed the PANAS, with instructions to rate each item using the prompt "*to the extent you feel this way right now*", in order to assess their present mood state. Participants then completed visual analogue scale Belief, Distress, and Meaningfulness ratings for each of their three contamination-related thoughts and the general "contamination" thought (follow-up ratings), followed by completion of the Interpretations of Intrusions Inventory and PI-WSUR. Participants in the verbal repetition and imaginal exposure conditions were also asked to indicate whether or not they used their intervention at all during the week, and if so, they rated the extent to which they used it during the week, from 0 = not at all, to 100 = all the time (Appendix I). Participants were then instructed that the experiment was over and were debriefed and thanked for their participation.

Results

Participant Characteristics

Table 1 displays the gender distribution and the group means and standard deviations for age, PANAS scores, visual analogue scale ratings of the credibility of the assigned intervention, and amount of intervention practice. Ninety-three participants (verbal repetition $n = 33$; imaginal exposure $n = 30$; no intervention $n = 30$) attended the first session and 88 participants (verbal repetition $n = 30$; imaginal exposure $n = 30$; no intervention $n = 28$) returned to complete the questionnaire package at one-week follow-up.

There was an equal distribution of men and women in each experimental group, $\chi^2 (2) = 1.79$, $p = .41$. There was a trend towards a significant age difference between groups, $F (2, 90) = 2.78$, $p = .068$, $MSE = 2.97$, with verbal repetition participants being,

on average, one year younger than no intervention participants. There were no significant differences in positive or negative affect between groups at either the first session or the follow-up session (all $Fs < 1.19$, $ps > .31$).

Preliminary Analyses

The belief, distress, and meaningfulness appraisal ratings for each group at each time point were examined for outliers. An appraisal rating was labeled an outlier if it had a *z* score that was less than -3 or greater than 3, and was discontinuous from the rest of the distribution. No outliers were detected for the following analyses, unless specified.

The no intervention participants were randomly assigned to receive one of two sets of CMDT instructions: verbal repetition ($n = 15$) or imaginal exposure ($n = 15$) instructions. A 4 (time; Pre-CMDT, Pre-intervention, Post-intervention, Follow-up) x 2 (group; No Intervention – Verbal Repetition, No Intervention – Imaginal Exposure) repeated measures analysis of variance (ANOVA) was conducted to determine if the differing CMDT requirements had a significant impact on the subsequent visual analogue scale ratings. Two participants from the no intervention – imaginal exposure group did not attend the follow-up session, and their data were excluded from the analyses. There was a significant main effect of time for the meaningfulness ratings for identified contamination-related thought #1, F (3, 23) = 4.39, $p < .05$, $MSE = 133.72$, such that there was a significant increase in ratings from pre-CMDT to pre-intervention. There was, however, no significant group by time interaction, F (3, 23) = .37, $p = .78$, $MSE = 133.72$. There was also a trend towards a main effect of time for the distress ratings for contamination-related thought #1, F (3, 23) = 2.45, $p = .09$, $MSE = 101.52$, such that there was a slight decrease in ratings from pre-intervention to follow-up. There was,

however, no significant group by time interaction, F (3, 23) = 1.11, p = .36, MSE = 101.52. There were no other significant differences in ratings between no intervention – verbal repetition and no intervention – imaginal exposure groups, and no differences in change across time for either group (examination of all other main effects: Fs < 1.60, ps > .21; examination of interactions: all Fs < 1.55, ps > .22). As no significant differences were observed between the two groups, it suggests that the differing CMDT requirements did not differentially affect the participants, and they were collapsed into one group (no intervention n = 28) for the present analyses.

Tests of the Main Hypotheses

It was hypothesized that significantly greater reductions in the belief, distress, and meaningfulness associated with contamination-related thoughts would occur immediately following verbal repetition than immediately following imaginal exposure and no intervention. In addition, it was hypothesized that the significant differences in appraisal ratings between verbal repetition and both imaginal exposure and no intervention would also be observed at one-week follow-up.

Follow-up appraisal ratings were unavailable for the five participants who did not attend the follow-up session. As such, their data could not be entered into the repeated measures analyses and these participants were excluded from all subsequent analyses, unless otherwise specified.

The verbal repetition rationale was rated as significantly more credible (M = 72.43, SD = 15.43) than the imaginal exposure rationale [M = 56.97, SD = 25.05; t (58) = 2.88, p < .01]. Seven verbal repetition participants (23.3%) and 8 imaginal exposure participants (26.7%) reported using their intervention during the week. There were no

significant differences in the amount each intervention was used during the week by these participants [verbal repetition, M = 40.43, SD = 32.35 versus imaginal exposure, M = 30.63, SD = 20.96; t (13) = .71, p = .49].

Correlations between pre-CMDT (baseline) appraisal ratings of belief, distress, and meaningfulness for each of the three identified contamination-related thoughts were attained, to ensure that the three variables were sufficiently independent constructs to warrant separate analyses for each type of appraisal. The correlation matrices for each of the three identified contamination-related thoughts are displayed in Table 2. Overall, there were only low to moderate correlations between the three types of appraisals (range of *r*s: .23 to .57).

For each participant, the mean rating of belief, distress, and meaningfulness was created by averaging their appraisal ratings for their three contamination-related thoughts at each time point. A series of 4 (time; Pre-CMDT, Pre-intervention, Post-intervention, Follow-up) x 3 (group; Verbal Repetition, Imaginal Exposure, No Intervention) repeated measures ANOVAs were then conducted to examine the change in the appraisals of belief, distress, and meaningfulness associated with the mean ratings of belief, distress, and meaningfulness following verbal repetition, imaginal exposure, and no intervention. For the belief ratings, there was a main effect of time, F (3, 83) = 11.27, $p < .001$, MSE = 103.74, which was qualified by a significant time by group interaction, F (3, 83) = 3.01, $p < .01$, MSE = 103.74. For the distress ratings, there was a there was a main effect of time, F (3, 83) = 7.73, $p < .001$, MSE = 147.90, and a significant time by group interaction, F (3, 83) = 3.58, $p < .01$, MSE = 147.90. For the meaningfulness ratings, there was a there

was a main effect of time, F (3, 83) = 13.79, $p < .001$, MSE = 125.30, and a significant time by group interaction, F (3, 83) = 3.33, $p < .01$, MSE = 125.30.

As each of the above time by group interactions were statistically significant, a series of 4 (time; Pre-CMDT, Pre-intervention, Post-intervention, Follow-up) x 3 (group; Verbal Repetition, Imaginal Exposure, No Intervention) repeated measures ANOVAs were conducted to examine the change in the appraisals of belief, distress, and meaningfulness associated with *each* of the three identified contamination-related thoughts. Tables 3-5 display the visual analogue scale appraisal ratings of belief, distress, and meaningfulness for the three identified contamination-related thoughts. The results for contamination-related thought #1 are detailed below; as the pattern of results for contamination-related thoughts #2 and #3 were similar to those found for thought #1, they are detailed in Appendices J and K, respectively.

Appraisals of Identified Contamination-Related Thought #1 (Table 3)

Belief Ratings (Figure A): There were no differences between groups in their belief ratings at either pre-CMDT or pre-intervention (all $Fs < .12$, $ps > .73$). There was an overall main effect of time, F (3, 83) = 8.45, $p < .001$, MSE = 200.62, but no significant time by group interaction, F (3, 83) = 1.09, $p = .37$, MSE = 200.62. Despite no significant interaction present, planned comparisons were conducted to examine the change in ratings following verbal repetition and imaginal exposure, in order to determine if either intervention resulted in significant reductions in belief appraisals, at either post-intervention or follow-up (Keppel, 1991). For verbal repetition, planned comparisons revealed a trend towards a significant increase in belief ratings from pre-CMDT to pre-intervention, F (1, 85) = 3.32, $p = .07$, MSE = 102.69. There was also a

significant decrease in belief ratings from pre-intervention to post-intervention, F (1, 85) = 8.37, $p < .01$, MSE = 209.13; from pre-CMDT to follow-up, F (1, 85) = 5.51, $p < .05$, MSE = 171.35; and from pre-intervention to follow-up, F (1, 85) = 16.71, $p < .001$, MSE = 144.82. For imaginal exposure, there was a significant increase in belief ratings from pre-CMDT to pre-intervention, F (1, 85) = 5.03, $p < .05$, MSE = 102.69. There was also a significant decrease in belief ratings from pre-intervention to follow-up, F (1, 85) = 5.57, $p < .05$, MSE = 144.82, and a trend towards a decrease in belief ratings from post-intervention to follow-up, F (1, 85) = 3.67, $p = .06$, MSE = 248.54.

Distress Ratings (Figure B): There was a significant difference between groups in their distress ratings at pre-CMDT, such that baseline verbal repetition ratings were lower than both imaginal exposure, F (1, 85) = 4.27, $p < .05$, MSE = 554.52, and no intervention, F (1, 85) = 7.62, $p < .01$, MSE = 554.52. There was also a trend for a difference between groups at pre-intervention, such that verbal repetition ratings were somewhat lower than no intervention, F (1, 85) = 3.57, $p = .06$, MSE = 651.85. There was an overall main effect of time, F (3, 83) = 7.71, $p < .001$, MSE = 220.77, in the reduction of distress, which was qualified by a significant time by group interaction, F (3, 83) = 3.48, $p < .01$, MSE = 220.77. Planned comparisons for verbal repetition revealed a trend for an increase in distress ratings from pre-CMDT to pre-intervention, F (1, 85) = 3.59, $p = .06$, MSE = 164.30. There was a significant decrease in distress ratings from pre-CMDT to post-intervention, F (1, 85) = 5.63, $p < .05$, MSE = 233.62; from pre-intervention to post-intervention, F (1, 85) = 20.11, $p < .001$, MSE = 182.25; and from pre-intervention to follow-up, F (1, 85) = 8.77, $p < .01$, MSE = 231.60. For imaginal exposure, there was a significant decrease in ratings from pre-CMDT to follow-up, F (1,

85) = 12.90, p = .001, *MSE* = 276.90; from pre-intervention to follow-up, F (1, 85) = 12.10, p = .001, *MSE* = 231.60; and from post-intervention to follow-up, F (1, 85) = 19.17, p < .001, *MSE* = 235.98. For no intervention, there was a trend towards a decrease in ratings from pre-intervention to follow-up, F (1, 85) = 3.66, p = .06, *MSE* = 231.60.

Meaningfulness Ratings (Figure C): There were no differences between groups in their meaningfulness ratings at either pre-CMDT or pre-intervention (all *Fs* < 1.57, *ps* > .20). There was an overall main effect of time, F (3, 83) = 8.57, p < .001, *MSE* = 231.74, which was qualified by a significant time by group interaction, F (3, 83) = 2.27, p < .05, *MSE* = 231.74. Planned comparisons for verbal repetition revealed an increase in meaningfulness ratings from pre-CMDT to pre-intervention, F (1, 85) = 7.70, p < .01, *MSE* = 166.13. There was a significant decrease in meaningfulness ratings from pre-intervention to post-intervention, F (1, 85) = 16.75, p < .001, *MSE* = 215.14; and from pre-intervention to follow-up, F (1, 85) = 8.62, p < .01, *MSE* = 160.40. For imaginal exposure, there was a significant decrease from pre-intervention to follow-up, F (1, 85) = 4.20, p < .05, *MSE* = 160.40; and from post-intervention to follow-up, F (1, 85) = 4.20, p < .05, *MSE* = 226.57. For no intervention, there was a significant increase in meaningfulness ratings from pre-CMDT to pre-intervention, F (1, 85) = 8.13, p < .01, *MSE* = 166.13.

Overall, the above results (and the results detailed in Appendices J and K) revealed that significant reductions in belief, distress, and meaningfulness appraisals were observed at post-intervention for only the verbal repetition group. At one-week follow-up, the significant reductions following verbal repetition were, for the most part,

maintained. In addition, there were significant reductions in belief and distress ratings, from pre-CMDT to follow-up, for the imaginal exposure group.

Between-Group Comparisons

To determine if there were significant differences between intervention groups in their respective abilities to promote immediate change in appraisal ratings following the intervention, a series of 2 (time; Pre-intervention, Post-intervention) x 2 (group; Verbal Repetition, Imaginal Exposure) repeated measures ANOVAs were conducted for the belief, distress, and meaningfulness appraisal ratings for contamination-related thought #1. For the belief ratings, there was no main effect of time, F (1, 58) = 2.80, p = .10, MSE = 286.23. There was, however, a trend towards a significant time by group interaction, F (1, 58) = 3.33, p = .07, MSE = 286.23, suggesting that verbal repetition was more effective than imaginal exposure in immediately reducing the belief in the contamination-related thought. For the distress and meaningfulness ratings, the main effects of time (Fs > 4.62, ps < .05), as well as the time by group interactions (Fs > 8.00, ps < .01), were significant, indicating that verbal repetition was significantly more effective than imaginal exposure in reducing the distress and meaningfulness associated with the thought.

In addition, a series of 2 (time; Pre-CMDT, Follow-up) x 2 (group; Verbal Repetition, Imaginal Exposure) repeated measures ANOVAs were conducted for the appraisal ratings, to determine if there were significant differences in the change in ratings from baseline to one-week follow-up following verbal repetition and imaginal exposure. For the belief ratings, there was a trend towards a main effect of time, F (1, 58) = 3.50, p = .07, MSE = 190.20, but no time by group interaction, F (1, 58) = 1.65, p = .20,

MSE = 190.20, suggesting no differences between groups in their respective abilities to reduce the belief in the contamination-related thought. For the distress ratings, there was a main effect of time, F (1, 58) = 9.51, $p < .01$, *MSE* = 341.31, but no time by group interaction, F (1, 58) = 2.23, $p = .14$, *MSE* = 341.31, and for the meaningfulness ratings, neither the main effect of time nor the time by group interaction were significant (Fs < .42, ps > .51). Thus, the two intervention groups did not differ significantly in the reappraisal of contamination-related thoughts at follow-up.

To compare verbal repetition and no intervention, a series of 2 (time; Pre-intervention, Post-intervention) x 2 (group; Verbal Repetition, No Intervention) repeated measures ANOVAs were conducted for the belief, distress and meaningfulness ratings. Each of the main effects of time (Fs > 10.21, ps < .01), as well as each of the time by group interactions (Fs > 4.64, ps < .05) was significant. In addition, a series of 2 (time; Pre-CMDT, Follow-up) x 2 (group; Verbal Repetition, No Intervention) repeated measures ANOVAs were conducted for the appraisal ratings, to determine if there were significant differences in the change in ratings from baseline to one-week follow-up following verbal repetition and no intervention. For the belief ratings, there was a trend towards a main effect of time, F (1, 56) = 3.11, $p = .08$, *MSE* = 186.04, but no time by group interaction, F (1, 56) = 1.87, $p = .18$, *MSE* = 186.04, suggesting no differences between groups in their respective abilities to reduce the belief in the contamination-related thought. For the distress ratings, there was a main effect of time, F (1, 56) = 5.48, $p < .05$, *MSE* = 168.89, but no time by group interaction, F (1, 56) = 0.01, $p = .91$, *MSE* = 168.89. For the meaningfulness ratings, there was no main effect of time, F (1, 56) = .59, $p = .45$, *MSE* = 207.75, or time by group interaction, F (1, 56) = .81, $p = .37$, *MSE* =

207.75. Thus, verbal repetition was not significantly more effective than no intervention in the reduction of appraisal ratings at follow-up.

To compare imaginal exposure and no intervention, a series of 2 (time; Pre-intervention, Post-intervention) x 2 (group; Imaginal Exposure, No Intervention) repeated measures ANOVAs were conducted for the belief, distress, and meaningfulness ratings. None of the main effects of time (Fs < .49, ps > .48), or the time by group interactions (Fs < 2.33, ps > .12) were significant. In addition, a series of 2 (time; Pre-CMDT, Follow-up) x 2 (group; Imaginal Exposure, No Intervention) repeated measures ANOVAs were conducted for the appraisal ratings, to determine if there were significant differences in the change in ratings from baseline to one-week follow-up following imaginal exposure and no intervention. For the belief and meaningfulness ratings, none of the main effects of time (Fs < .33, ps > .56), or the time by group interactions (Fs < 1.94, ps > .16) were significant. For the distress ratings, there was a significant main effect of time, F (1, 56) = 10.38, p < .01, MSE = 318.39, but no time by group interaction, F (1, 56) = 2.06, p = .16, MSE = 318.39. Thus, imaginal exposure was not significantly more effective than no intervention in the reduction of appraisal ratings at follow-up.

Overall, these results indicate that verbal repetition was significantly more effective than both imaginal exposure and no intervention in the immediate reduction of appraisals of contamination-related thoughts. In contrast, imaginal exposure and no intervention were equally ineffective in the immediate reappraisal of the thought. A comparison of the change in appraisal ratings from baseline to follow-up after verbal repetition and imaginal exposure revealed no change between intervention groups in the reduction of belief, distress, and meaningfulness ratings. There were significant

differences found between verbal repetition and no intervention at follow-up only in the reduction of distress and meaningfulness in thought #2, and there was a trend towards a significant difference in the reduction of meaningfulness in thought #3 (see Appendices J and K). Examination of the change in appraisal ratings from baseline and follow-up revealed significant differences between imaginal exposure and no intervention in the reduction of belief in thought #3, and a trend towards a significant difference in the reduction of distress in thought #3 (see Appendix K).

Appraisals of "Contamination" Thought (Table 6)

In addition to completing visual analogue scale ratings of the belief, distress, and meaningfulness associated with the three identified contamination-related thoughts, all participants completed appraisal ratings for a general thought they experienced related to the word "contamination". Ratings were made at three time-points: immediately prior to completion of the CMDT, immediately following completion of the CMDT, and at one-week follow-up.

A series of 3 (time; Pre-CMDT, Pre-Intervention, Follow-up) x 3 (group; Verbal Repetition, Imaginal Exposure, No Intervention) repeated measures ANOVAs were conducted to examine the change in the appraisals of belief, distress, and meaningfulness associated with the "contamination" thought following the CMDT task (pre-intervention) and at one-week follow-up (follow-up). One no intervention participant failed to complete appraisal ratings at pre-CMDT and one imaginal exposure participant did not complete appraisal ratings at follow-up; as such, they were not included in the analyses.

Belief Ratings (Figure J): One no intervention case was observed to have recorded an extremely low rating of belief associated with the "contamination" thought at pre-CMDT. As such, she was eliminated from the analysis of belief ratings.

There was a significant difference between groups in their belief ratings at pre-CMDT, such that baseline verbal repetition ratings of belief were lower than imaginal exposure ratings, F (1, 82) = 6.01, $p < .05$, MSE = 372.30. There was an overall main effect of time, F (2, 81) = 9.70, $p < .001$, MSE = 113.21, but no time by group interaction, F (2, 81) = 1.43, $p = .23$, MSE = 113.21. Planned comparisons for verbal repetition revealed a significant increase in belief ratings from pre-CMDT to pre-intervention, F (1, 82) = 9.69, $p < .01$, MSE = 67.45; and a significant decrease in ratings from pre-intervention to follow-up, F (1, 82) = 8.22, $p < .01$, MSE = 136.06. For imaginal exposure, there was a significant decrease in ratings from pre-CMDT to follow-up, F (1, 82) = 7.79, $p < .01$, MSE = 136.12; and from pre-intervention to follow-up, F (1, 82) = 11.03, $p = .001$, MSE = 136.06.

Distress Ratings (Figure K): There was a significant difference between groups in their distress ratings at pre-CMDT, such that baseline verbal repetition ratings of distress were lower than imaginal exposure ratings, F (1, 83) = 4.81, $p < .05$, MSE = 582.60. There was an overall main effect of time, F (2, 82) = 7.55, $p = .001$, MSE = 228.32, in the reduction of distress, but no significant time by group interaction, F (2, 82) = 1.35, $p = .26$, MSE = 228.32. Planned comparisons for verbal repetition revealed a trend towards an increase in ratings from pre-CMDT to pre-intervention, F (1, 83) = 3.62, $p = .06$, MSE = 173.32, and a significant decrease in ratings from pre-intervention to follow-up, F (1, 83) = 9.94, $p < .01$, MSE = 208.95. For imaginal exposure, there was a significant

decrease in ratings from pre-CMDT to follow-up, F (1, 83) = 4.89, $p < .05$, MSE = 302.68; and from pre-intervention to follow-up, F (1, 83) = 9.26, $p < .01$, MSE = 208.95.

Meaningfulness Ratings (Figure L): There was a significant difference between groups in their meaningfulness ratings at pre-CMDT, such that baseline verbal repetition ratings were lower than imaginal exposure ratings, F (1, 83) = 4.26, $p < .05$, MSE = 609.46. There was an overall main effect of time, F (2, 82) = 5.78, $p < .01$, MSE = 200.21, in the reduction of meaningfulness, but no significant time by group interaction, F (2, 82) = 1.93, $p = .11$, MSE = 200.21. Planned comparisons for verbal repetition revealed a trend towards an increase in ratings from pre-CMDT to pre-intervention, F (1, 83) = 3.44, $p = .07$, MSE = 148.27. There was also a trend towards a decrease in ratings from pre-CMDT to follow-up, F (1, 83) = 3.50, $p = .07$, MSE = 249.53; and a significant decrease in ratings from pre-intervention to follow-up, F (1, 83) = 13.41, $p < .001$, MSE = 202.84. For imaginal exposure, there was a trend towards a decrease in ratings from pre-CMDT to follow-up, F (1, 83) = 3.16, $p = .08$, MSE = 249.53; and a significant decrease in ratings from pre-intervention to follow-up, F (1, 83) = 5.57, $p < .01$, MSE = 202.84.

Overall, an examination of the change in appraisal ratings of the general "contamination" thought revealed a trend for a slight increase in appraisals, from pre-CMDT to pre-intervention, for the verbal repetition group. There was also a significant reduction in appraisals, from pre-CMDT to follow-up, for only the imaginal exposure group, and there was a significant reduction in appraisals, from pre-intervention to follow-up, for both the verbal repetition and imaginal exposure groups.

Examination of Credibility Ratings

To determine if the reductions in belief, distress, and meaningfulness could be accounted for by the higher credibility ratings of the verbal repetition group, correlations between credibility ratings and change in visual analogue scale appraisal ratings of belief, meaningfulness and distress were examined. Five different changes in ratings were calculated: i) pre-CMDT to post-intervention, ii) pre-CMDT to follow-up, iii) pre-intervention to post-intervention, iv) pre-intervention to follow-up, and v) post-intervention to follow-up. There were no significant correlations between credibility ratings and change in appraisals for the verbal repetition group (n = 30; all $rs < .35$, $ps > .05$). For the imaginal exposure group (n = 30), only 8 out of 45 correlations were significant (Belief ratings for thought #1: imaginal exposure credibility ratings were significantly correlated with the reduction from pre-intervention to post-intervention, $r = .44$, $p < .05$; from pre-CMDT to follow-up, $r = .43$, $p < .05$; and from pre-intervention to follow-up, $r = .45$, $p < .05$. Distress ratings for thought #2: imaginal exposure credibility ratings were significantly correlated with the reduction from pre-CMDT to post-intervention, $r = .50$, $p < .01$; from pre-intervention to post-intervention, $r = .50$, $p < .01$; from pre-CMDT to follow-up, $r = .49$, $p < .01$; and from pre-intervention to follow-up, $r = .56$, $p = .001$. Meaningfulness ratings for thought #2: imaginal exposure credibility ratings were significantly correlated with the reduction from pre-intervention to post-intervention, $r = .38$, $p < .05$).

Examination of the above correlations revealed that the reductions in appraisals of belief, distress, and meaningfulness at post-intervention and one-week follow-up were not related to the verbal repetition participants' perceived credibility of the cognitive defusion rationale. In addition, the perceived credibility of the habituation rationale was

not consistently related to the changes in appraisals for the imaginal exposure participants.

As a further test of whether the immediate reductions in appraisal ratings were influenced by the differences in credibility ratings between verbal repetition and imaginal exposure groups, a series of 2 (time; Pre-intervention, Post-intervention) by 2 (group; Verbal Repetition, Imaginal Exposure) repeated measures ANOVAs were conducted, with participants' credibility ratings entered as a covariate. Seven of the nine time by group interactions remained statistically significant after controlling for participants' credibility ratings (Fs > 3.91, ps < .05). However, no significant time by group interactions were observed, after controlling for participants' credibility ratings, for the contamination-related thought #3 distress ratings, F (1, 57) = 1.01, p = .32, MSE = 256.73, or thought #3 meaningfulness ratings, F (1, 57) = 2.60, p = .11, MSE = 277.29.

Change in PI-WSUR scores

Change in PI-WSUR total score and subscale scores from initial selection to follow-up was also assessed, using a 2 (time; Initial selection, Follow-up) x 3 (group; Verbal Repetition, Imaginal Exposure, No Intervention) repeated measures ANOVA. Means and standard deviations are displayed in Table 7. There were no main effects or interactions for the Total Score or the DGC, CC, OTHS, and OIHS subscales (all Fs < .85, ps > .35). For the contamination subscale, there was no main effect of time, F (1, 85) = .14, p = .71, MSE = 21.97; however, there was a trend towards a significant time by group interaction, F (2, 85) = 2.78, p < .07, MSE = 21.97. Planned comparisons revealed no significant differences between groups at initial selection; however, there was a significant difference between verbal repetition and no intervention scores at follow-up, F

(1, 85) = 5.03, $p < .05$, $MSE = 57.21$, with verbal repetition scores being significantly lower than no intervention scores (Figure M).

Tests of CMDT Hypotheses

As stated above, in the CMDT paradigm, a semantic satiation effect is defined as a statistically significant increase in RT for member decisions following 30 repetitions, when compared with 3 repetitions, as well as no significant increase in RT for nonmember decisions following 30 repetitions, when compared with 3 repetitions. It was hypothesized that a statistically significant semantic satiation effect would be observed for each of the three verbal repetition conditions (verbal repetition – neutral items; verbal repetition – repeated "automobile" items; verbal repetition – repeated "contamination" items), but no semantic satiation effect would be observed for the three imaginal exposure conditions (imaginal exposure – neutral items; imaginal exposure – repeated "automobile" items; imaginal exposure – repeated "contamination" items).

Forty-eight participants completed the CMDT using verbal repetition instructions (verbal repetition $n = 33$; no intervention – verbal repetition $n = 15$) and 45 participants completed the task using imaginal exposure instructions (imaginal exposure $n = 30$; no intervention – imaginal exposure $n = 15$). Immediately following the task, participants rated their ability to carry out the verbal repetition or imaginal exposure technique during the CMDT. There were no differences in ability between those assigned to complete the task using verbal repetition ($M = 76.65$, $SD = 16.11$) and those assigned to complete the task using imaginal exposure [$M = 71.38$, $SD = 21.18$; t (91) = 1.36, $p = .18$].

To analyze the data obtained from the CMDT, the mean median RTs for the correct category membership decisions and the mean percentage of errors were obtained

for each of the following four trial types: i) 3 repetitions or "short" imagining/member target; ii) 3 repetitions or "short" imagining/nonmember target; iii) 30 repetitions or "long" imagining/member target; and iv) 30 repetitions or "long" imagining/nonmember target. Separate two-way ANOVAs were conducted on the mean median RT data and the mean percent error data. The factors of the ANOVA for the verbal repetition conditions were number of repetitions (3 or 30), and the decision type (i.e., whether the target word was a member or nonmember of the category word). The factors of the ANOVA for the imaginal exposure condition were the length of time spent imagining the category word (short or long), and the decision type (member or nonmember). Post hoc comparisons were made for the mean median RTs and the mean percent error data for each of the four trial types, using two-tailed *t* tests. These analyses were conducted for each of the six different CMDT conditions: i) imaginal exposure – neutral items; ii) imaginal exposure – repeated "automobile" items; iii) imaginal exposure – repeated "contamination" items; iv) verbal repetition – neutral items; v) verbal repetition – repeated "automobile" items; and vi) verbal repetition – repeated "contamination" items. The mean median RTs for the correct category membership decisions and the mean percentage of errors are displayed in Table 8. Trials with incorrect category membership decisions were excluded from the analyses. Following Smith and Klein (1990), a participant's data was excluded from a condition if they responded incorrectly on 50% or more of the trials in any one of the four trial types.

Imaginal Exposure – Neutral Items

Each participant completed four trial types (short imagining length/member target; short imagining length/nonmember target; long imagining length/member target;

long imagining length/nonmember target). Data from three participants contained errors on 50% or more trials in one or more of the trial types, and were excluded from the analysis.

There was a main effect of imagining length (short versus long), F (1, 41) = 5.40, $p < .05$, MSE = 73 644.40, and a trend towards a significant main effect for the decision type (member versus nonmember), F (1, 41) = 3.83, $p = .05$, MSE = 73 644.40. The interaction of decision type and imagining length did not approach significance, F (1, 41) = .01, $p = .91$, MSE = 73 644.40. However, as this task was designed to test for semantic satiation effects, relevant comparisons were made, even though the interaction was not significant (see Smith and Klein, p. 854, Footnote 1), following the data analytic strategy of previous experiments incorporating the category membership decision task (Lewis & Ellis, 2000; Lindquist et al., 2006; Smith, 1984; Smith & Klein, 1990). Two-tailed t tests showed that participants were significantly slower to make member decisions following a long imagining length (M = 868.18, SD = 261.45) than following a short imagining length [M = 766.02, SD = 241.78; t (41) = 5.12, $p < .001$]. They were also slower to make nonmember decisions following a long imagining length (M = 945.30, SD = 320.14) than following a short imagining length [M = 852.83, SD = 255.49; t (41) = 4.08, $p < .001$]. Examination of the two-way ANOVA for the mean percent error data revealed no main effect for type of decision, F (1, 41) = 1.12, $p = .29$, MSE = 99.21. There was also no reliable difference in error rates between decision times as a function of the length of imagining, F (1, 41) = 1.43, $p = .23$, MSE = 99.21. However, the interaction of decision type and imagining length did approach significance, F (1, 41) = 3.62, $p = .06$, MSE =

99.21. Post hoc comparisons revealed a significant difference in errors between only the long/member trials (10.0%) and short/member trials [5.2%; t (41) = 2.89, $p < .01$].

The above pattern of results (an increase in RTs for member and nonmember targets following long imagining) appears to represent a general slowing of response time following a long imagining length, rather than a semantic satiation effect (which is evidenced by a significant increase in RTs for member, but not nonmember, targets).

Imaginal Exposure – Repeated "Automobile" Items

Data from five participants contained errors on 50% or more trials in one or more of the trial types, and were excluded from the analysis. There was a main effect for decision type, F (1, 39) = 5.83, $p < .05$, MSE = 47 096.75, with participants responding to nonmember decisions slower than to member decisions. There was a significant main effect for length of imagining, F (1, 39) = 5.83, $p < .05$, MSE = 47 096.75, with participants responding slower following a long imagining length than following a short imagining length. The interaction of decision type and length of imagining did not approach significance, F (1, 39) = .56, $p = .46$, MSE = 47 096.75. Two-tailed t tests showed that participants were significantly slower to make member decisions following a long imagining length (M = 810.78, SD = 255.93) than following a short imagining length [M = 704.13, SD = 175.88; t (39) = 4.00, $p < .001$]. There was also a trend towards a significant difference between nonmember decisions following a long imagining length (M = 868.58, SD = 204.82) and following a short imagining length (M = 812.58, SD = 223.61; t (39) = 1.99, $p = .05$). Examination of the two-way ANOVA for the mean percent error data revealed no main effect for type of decision, F (1, 39) = .44, $p = .51$, MSE = 62.79. There was, however, a significant main effect for length of imagining, F

(1, 39) = 3.97, $p < .05$, *MSE* = 62.79. The interaction of decision type and imagining length did not approach significance, F (1, 39) = .44, $p = .51$, *MSE* = 62.79. Post hoc comparisons revealed a significant difference in the mean percent error rates when comparing nonmember trials with a short imagining length (3.3%) with member and nonmember trials with a long imagining length [both 6.7%; t (39) = 2.15, $p < .05$]. These results suggest the occurrence of a general slowing of response following long periods of imagining, and as hypothesized, no semantic satiation effect was observed.

Imaginal Exposure – Repeated "Contamination" Items

Data from five participants contained errors on 50% or more trials in one or more of the trial types, and were excluded from the analysis. There was no main effect of imagining length, F (1, 39) = 2.22, $p = .14$, *MSE* = 74 042.77, or decision type, F (1, 39) = 2.47, $p = .12$, *MSE* = 74 042.77. The interaction of decision type and imagining length did not approach significance, F (1, 39) = .09, $p = .76$, *MSE* = 74 042.77. Two-tailed t tests showed that participants were significantly slower to make member decisions following a long imagining length (M = 864.38, SD = 249.47) than following a short imagining length [M = 813.49, SD = 248.65; t (39) = 2.15, $p < .05$]. They were also slower to make nonmember decisions following a long imagining length (M = 945.15, SD = 326.34) than following a short imagining length [M = 867.85, SD = 256.14; t (39) = 2.71, $p < .05$]. Examination of the two-way ANOVA for the mean percent error data revealed no significant main effects or interactions (all $Fs < 1.90$, $ps > .17$). As such, these results are suggestive of a general slowing of response following a long imagining length, and as hypothesized, no semantic satiation effect was observed.

Verbal Repetition – Neutral Items

There was a significant main effect for the type of decision (member versus nonmember), F (1, 47) = 4.87, $p < .05$, MSE = 35 385.85. There was no significant main effect for number of repetitions, F (1, 47) = 1.43, p =.23, MSE = 35 385.85, and the interaction of decision type and number of repetitions did not approach significance, F (1, 47) = .12, p = .73, MSE = 35 385.85. Two-tailed t tests showed that participants were significantly slower to make member decisions following 30 repetitions (M = 732.16, SD = 187.69) than following 3 repetitions [M = 690.38, SD = 162.93; t (47) = 3.27, $p < .01$]. In contrast, they were not significantly slower responding to nonmember targets following 30 repetitions (M = 782.79, SD = 190.06) than following 3 repetitions [M = 759.55, SD = 208.92; t (47) = 1.66, p = .10]. Examination of the two-way ANOVA for the mean percent error data revealed a significant main effect for type of decision, F (1, 47) = 13.82, $p < .001$, MSE = 34.00, with significantly more errors being made for nonmember than member trials. There was no reliable difference between decision times as a function of the number of repetitions, F (1, 47) = 1.54, p =.22, MSE = 34.00, and the interaction of decision type and number of repetitions did not approach significance, F (1, 47) = .32, p = .57, MSE = 34.00.

Keeping in mind that the interaction was not statistically significant, the above pattern of findings appears to support the semantic satiation hypothesis. Participants were slower to correctly decide that a target word is a member of a category following 30 repetitions than following 3 repetitions, but they were not significantly slower for nonmember decisions following 30 repetitions than following 3 repetitions.

Verbal Repetition – Repeated "Automobile" Items

Data from four participants contained errors on 50% or more trials in one or more of the trial types, and were excluded from the analysis. There was a trend towards a significant main effect for decision type, F (1, 43) = 3.60, p = .06, MSE = 31 392.65, with participants responding somewhat slower to nonmember decisions than to member decisions. There was a significant main effect for number of repetitions, F (1, 43) = 7.09, p < .01, MSE = 31 392.65, with participants responding slower following 30 repetitions than following 3 repetitions. The interaction of decision type and number of repetitions did not approach significance, F (1, 43) = .56, p = .46, MSE = 31 392.65. Two-tailed t tests showed that participants were not significantly slower to make member decisions following 30 repetitions (M = 712.59, SD = 171.42) than following 3 repetitions [M = 681.90, SD = 153.18; t (43) = 1.67, p = .10]. There was, however, a significant difference in RTs for nonmember targets following 3 repetitions (M = 733.03, SD = 161.16) and following 30 repetitions [M = 803.67, SD = 216.23; t (43) = 3.65, p = .001]. Examination of the two-way ANOVA for the mean percent error data revealed no main effects or interactions (all Fs < 2.26, ps > .12). As such, no semantic satiation effect was observed for this condition, contrary to hypotheses.

Verbal Repetition – Repeated "Contamination" Items

Data from four participants contained errors on 50% or more trials in one or more of the trial types, and were excluded from the analysis. There was no main effect for either decision type, F (1, 43) = .005, p = .94, MSE = 44 373.94, or number of repetitions, F (1, 43) = 1.58, p = .211, MSE = 44 373.94, and there was no interaction between decision type and number of repetitions, F (1, 43) < .001, p =.99, MSE = 44 373.94. Post hoc comparisons revealed that participants were significantly slower in responding to

member target words following 30 repetitions (M = 796.95, SD = 226.55) than following 3 repetitions [M = 757.38, SD = 217.39; t (43) = 2.05, $p < .05$]. Unexpectedly, participants were also slower to respond to nonmember target words following 30 repetitions (M = 794.89, SD = 203.23) than following 3 repetitions [M = 754.75, SD = 193.93; t (43) = 2.23, $p < .05$]. Examination of the two-way ANOVA for the mean percent error data revealed no significant main effects or interactions (all $Fs < .18$, $ps > .67$). As such, no semantic satiation effect was observed for this condition, contrary to hypotheses.

Unexpectedly, the above results revealed that no semantic satiation effect occurred during the conditions where one of two category words ("automobile" or "contamination") was verbally repeated 30 times on each trial. It is possible, however, that a semantic satiation effect was not found in these two verbal repetition conditions because of the way the task was designed. More specifically, in these two conditions, each of the different member and nonmember target words were presented on three separate trials. It is possible that participants responded differently to the target words on the repeated trials than to the target word on the first time it was presented, which might obscure any semantic satiation effects. In order to determine if this was the case, the above analyses were repeated for each of the four conditions that included repeated items (imaginal exposure – "automobile" items; imaginal exposure – "contamination" items; verbal repetition – "automobile" items; verbal repetition – "contamination" items). This time, however, only the trials in which a novel category-target word pair was introduced were included in the analyses, and any repeated trials were excluded from the analyses. As there were now only three trials of each trial type (instead of nine trials for each trial

type in the original analyses), the mean RTs for each trial type, as well as the mean percentage of errors, were calculated and subjected to separate two-way ANOVAs. Means and standard deviations are displayed in Table 9, and the results of the analyses are described below.

Imaginal Exposure "Automobile" Items without Repeated Trials

Data from five participants contained errors on 50% or more trials in one or more of the trial types, and were excluded from the analysis. In addition, one participant was observed to have an extremely long RT on at least one of the trial types, and was eliminated from the analysis. There was a significant main effect for length of imagining, F (1, 38) = 6.06, $p < .05$, MSE = 65 342.34, and a trend towards a significant main effect for decision type, F (1, 38) = 3.16, $p = .08$, MSE = 65 342.34. However, there was no significant interaction of decision type and length of imagining, F (1, 38) = .86, $p = .36$, MSE = 65 342.34. Two-tailed t tests showed that there was no significant difference between member decisions following a long imagining length (M = 890.99, SD = 273.91) and following a short imagining length [M = 828.11, SD = 237.76; t (38) = 1.33, $p = .19$]. However, participants were significantly slower to respond to nonmember decisions following a long imagining length (M = 1001.58, SD = 298.69) than following a short imagining length [M = 863.02, SD = 201.49; t (38) = 2.97, $p < .01$]. Examination of the two-way ANOVA for the mean percentage error data revealed a significant main effect for length of imagining, F (1, 38) = 5.12, $p < .05$, MSE = 229.21. There was no main effect for type of decision, F (1, 38) = .76, $p = .39$, MSE = 229.21, and no significant interaction between decision type and number of repetitions, F (1, 38) = .27, $p = .60$, MSE = 229.21. Post hoc comparisons revealed a significant difference in mean percent

error rates only between member trials with a short (M = 5.83, SD = 12.81) and a long imagining length [M = 12.49, SD = 17.99; t (38) = 2.24, $p < .05$]. As no significant increase was observed for member trials following a long imagining length versus a short imagining length, no semantic satiation effect was observed for this condition.

Imaginal Exposure "Contamination" Items without Repeated Trials

Data from five participants contained errors on 50% or more trials in one or more of the trial types, and were excluded from the analysis. There was a trend towards a significant main effect for length of imagining, F (1, 39) = 3.59, p = .06, MSE = 94 080.26. There was no main effect for decision type, F (1, 39) = .56, p = .46, MSE = 94 080.26, and the interaction of decision type and length of imagining did not approach significance, F (1, 39) = .05, p = .83, MSE = 94 080.26. Two-tailed t tests showed that participants were significantly slower to make member decisions following a long imagining length (M = 1004.84, SD = 327.73) than following a short imagining length (M = 902.55, SD = 304.75; t (39) = 2.45, $p < .05$). There was also a trend towards a significant difference between nonmember decisions following a long imagining length (M = 1030.80, SD = 294.69) and following a short imagining length [M = 949.20, SD = 298.66; t (39) = 1.78, p = .08]. Examination of the two-way ANOVA for the mean percent error data revealed a trend towards a significant main effect for type of decision, F (1, 39) = 3.05, p = .08, MSE = 275.63. There was no main effect for length of imagining, F (1, 39) = .03, p = .87, MSE = 275.63, and no significant interaction of decision type and number of repetitions, F (1, 39) = .03, p = .88, MSE = 275.63. Although the difference between nonmember decisions following short and long imagining lengths did not reach statistical significance, these results appear to better

reflect a general slowing following a long imagining length, rather than a semantic satiation effect.

Verbal Repetition "Automobile" Items without Repeated Trials

Data from four participants contained errors on 50% or more trials in one or more of the trial types, and were excluded from the analysis. In addition, one participant was observed to have extremely long RTs on at least one of the trial types. As such, they were eliminated from the analysis. There was a main effect for decision type, F (1, 42) = 4.64, $p < .05$, MSE = 49 708.08, and a main effect for number of repetitions, F (1, 42) = 9.57, $p < .01$, MSE = 49 708.08. However, the interaction between decision type and number of repetitions did not approach significance, F (1, 42) = .15, $p = .70$, MSE = 49 708.08. Two-tailed t tests showed that participants were significantly slower to make member decisions following 30 repetitions (M = 807.77, SD = 209.42) than following 3 repetitions [M = 721.52, SD = 167.83; t (42) = 2.86, $p < .001$]. In contrast, participants were not significantly slower to make nonmember decisions following 30 repetitions (M = 899.91, SD = 270.77) than following 3 repetitions [M = 839.72, SD = 231.29; t (42) = 1.45, $p = .15$]. Examination of the two-way ANOVA for the mean percent error data revealed no main effects or interactions (all $Fs < 1.23$, $ps > .26$). As such, this pattern of results is indicative of a statistically significant semantic satiation effect.

Verbal Repetition "Contamination" Items without Repeated Trials

Data from four participants contained errors on 50% or more trials in one or more of the trial types, and were excluded from the analysis. In addition, three participants were observed to have extremely long RTs on at least one of the trial types (i.e., z scores that were greater than 3 and discontinuous from the rest of the distribution). As such, they

were eliminated from the analysis. There was no main effect for either decision type, F (1, 40) = .06, p = .80, MSE = 62 479.45, or number of repetitions, F (1, 40) = .79, p = .38, MSE = 62 479.45, and there was no interaction between decision type and number of repetitions, F (1, 40) = .75, p = .39, MSE = 62 479.45. Two-tailed t tests showed that participants were somewhat slower to make member decisions following 30 repetitions (M = 886.71, SD = 258.76) than following 3 repetitions [M = 818.15, SD = 261.55; t (40) = 1.83, p = .07], although this difference was not statistically significant. There was no significant difference between mean RTs for nonmember trials following 3 (M = 861.82, SD = 243.42) and 30 repetitions [M = 862.69, SD = 235.17; t (40) = .03, p = .98]. Examination of the two-way ANOVA for the mean percent error data revealed no main effects or interactions (all Fs < .46, ps > .50). Whereas the above pattern of results is suggestive of a semantic satiation effect, it appears that there was too much variation in RTs for the mean difference between member decisions following 3 and 30 repetitions to reach statistical significance. As such, no statistically significant semantic satiation effect can be said to have occurred.

Overall, there was partial support for the CMDT hypotheses. As hypothesized, a statistically significant semantic satiation effect was observed for the verbal repetition – neutral items condition, but not the imaginal exposure – neutral items condition. There was also no semantic satiation effect observed for the two imaginal exposure – repeated items conditions. Contrary to hypotheses, however, no semantic satiation effect was observed for the two verbal repetition – repeated items conditions. When the repeated items data was re-analyzed with the repeated trials removed, a semantic satiation effect was observed for the verbal repetition – “automobile” items condition, as hypothesized,

but not the verbal repetition – "contamination" items, contrary to hypotheses. Finally, as hypothesized, no semantic satiation effect was observed for imaginal exposure – "automobile" items, or imaginal exposure – "contamination" items conditions when the repeated trials were removed.

Semantic Satiation and Appraisal Correlations

A semantic satiation score was derived for each participant, for each CMDT condition, by subtracting their mean median RT for the 3 repetitions (short imagining length)/member trial type from the 30 repetitions (long imagining length)/member trial type. The relation between semantic satiation scores and belief, distress, and meaningfulness appraisal ratings, at post-intervention and one-week follow-up, was then assessed via Pearson's correlation coefficient. Tables 10-17 display the correlation matrices for the verbal repetition, imaginal exposure, no intervention – verbal repetition, and no intervention – imaginal exposure groups. A negative correlation between the two variables (i.e., as semantic satiation increases, appraisal ratings decrease) would suggest that the propensity to produce semantic satiation through the verbal repetition or imaginal exposure of category words is associated with reductions in the negative appraisals towards contamination-related thoughts.

As reported above, a statistically significant semantic satiation effect was observed for only the verbal repetition – neutral items condition and the verbal repetition – "automobile" items condition with the repeated trials removed. Given that these two CMDT conditions were the only conditions for which a semantic satiation effect was observed, it was hypothesized that the semantic satiation scores for only these two

conditions would be significantly negatively correlated with post-intervention and follow-up appraisal ratings.

Semantic satiation scores were obtained for each verbal repetition participant, and were correlated with participants' post-intervention and follow-up appraisal ratings. Examination of the correlations revealed no significant correlations between semantic satiation scores and post-intervention appraisal ratings, with the exception of one correlation (Belief ratings for contamination-related thought #1, $r = .42$, $p < .05$), which was in the opposite direction (Table 10). Approximately half of the other post-intervention correlations for neutral items and "automobile" items, although not statistically significant, were in the hypothesized negative direction (with 8 of 18 correlations larger than -.20). However, the average correlation was only -.14.

Examination of the correlations between semantic satiation scores for neutral items and "automobile" items, and appraisal ratings for verbal repetition participants at follow-up revealed some evidence for a significant relation between these variables, with 7 out of 24 correlations reaching statistical significance. In addition, the majority of the correlations, while not statistically significant, were in the expected negative direction (with 19 of 24 correlations larger than -.20; see Table 11), and overall, the average correlation was -.28.

No statistically significant semantic satiation effect was observed following verbal repetition for "contamination" items condition (with the repeated trials removed). Not surprisingly, no significant relation was found between semantic satiation scores and appraisal ratings, at either post-intervention or follow-up, except for the Belief ratings for

the “contamination” thought at follow-up, which was in the opposite direction ($r = .41$, $p < .05$).

Overall, there was no significant relation between derived semantic satiation scores and appraisal ratings for the imaginal exposure group, either at post-intervention (Table 12) or at follow-up (Table 13; all $rs < .38$, $ps > .07$). This was not surprising, given that no semantic satiation effect was observed for any imaginal exposure condition.

Examination of the relation between semantic satiation scores and appraisal ratings for the no intervention – verbal repetition (Tables 14 and 15) and no intervention – imaginal exposure (Tables 16 and 17) groups revealed few statistically significant correlations (only 5 out of 63 correlations for the no intervention – verbal repetition group, and 6 out of 63 correlations for the no intervention – imaginal exposure group reached statistical significance). For both groups, however, the overall pattern of results was suggestive of a *positive* relation between the variables (i.e., higher semantic satiation scores were associated with higher appraisal ratings).

During the CMDT, the no intervention participants were randomly assigned to complete the task using verbal repetition or imaginal exposure. As there were no significant differences between these two groups (see above), their data were combined to form the present no intervention group. Separately, however, the data from these no intervention subgroups (no intervention – verbal repetition and no intervention – imaginal exposure) provide an opportunity to examine whether the mere repetition of the word “contamination”, or the repeated imaginal exposure of a thought involving contamination, without a cognitive defusion or habituation rationale, is effective in promoting a reappraisal of the “contamination” thought. A series of 3 (time; Pre-CMDT,

Pre-Intervention, Follow-up) x 2 (group; No Intervention – Verbal Repetition, No Intervention – Imaginal Exposure) repeated measures ANOVAs were conducted to examine the change in appraisal ratings for the "contamination" thought (Table 18)[2]. There were no significant main effects or interactions present (all *Fs* < 1.08, *ps* > .36). Planned comparisons revealed no significant differences between no intervention – verbal repetition and no intervention – imaginal exposure at either pre-CMDT, pre-intervention, or follow-up (all *ts* < 1.22, *ps* > .24), and there were no significant changes over time for either group (all *ts* < 1.50, *ps* > .16).

Discussion

In the present exploratory study, the use of the verbal repetition intervention was significantly more effective than either imaginal exposure or no intervention in the immediate reduction of appraisals of belief, distress, and meaningfulness associated with contamination-related thoughts. For participants receiving verbal repetition, there were significant reductions of each of the appraisal ratings, from pre-intervention to post-intervention. On average, there was an immediate 19% reduction in belief ratings, a 27% reduction in distress ratings, and a 28% reduction in meaningfulness ratings. In contrast, there were no significant reductions in appraisals, from pre-intervention to post-intervention, for either the imaginal exposure group (on average, a 2% reduction in belief ratings, a 2% reduction in distress ratings, and a 4% reduction in meaningfulness ratings) or the no intervention group (on average, a 2% reduction in belief ratings, a 4% reduction

[2] One no intervention – verbal repetition participant did not attend follow-up; as such, they were excluded from the analyses. One no intervention – verbal repetition participant recorded an extremely low rating of belief; as such, they were eliminated from the analysis of belief ratings. One no intervention – imaginal exposure participant did not attend follow-up, and one participant did not complete visual analogue scale ratings for the "contamination" thought at pre-CMDT; as such, they were excluded from the analyses.

in distress ratings, and a 5% reduction in meaningfulness ratings). These results suggest that this particular cognitive defusion technique, along with the appropriate rationale, may be a useful intervention for individuals to employ in order to promote an immediate reappraisal of distressing thoughts.

Although no immediate reductions in belief, distress, or meaningfulness appraisal ratings were observed following imaginal exposure, in comparison with the pre-intervention ratings, there was a significant reduction in these appraisals at one-week follow-up. This finding is consistent with a large literature supporting the use of exposure in the treatment of obsessional problems (Foa, Franklin, & Kozak, 1998), although the fact that it was a "sleeper" effect was unexpected. One explanation for these findings is that imaginal exposure is likely to be a distressing task for participants to complete. As such, it is possible that imaginal exposure participants were somewhat disturbed immediately after the experience, with the result being that the beneficial effect of imaginal exposure was not apparent at post-intervention. In other words, one explanation is that there was a delay before imaginal exposure participants were able to experience any reductions in their appraisals towards the contamination-related thoughts.

Overall, there was a differential pattern of change in appraisal ratings of contamination-related thoughts following verbal repetition and imaginal exposure. From pre-CMDT (baseline) to post-intervention, the verbal repetition intervention resulted in significant reductions in belief and meaningfulness ratings for two out of three contamination-related thoughts. There was also a significant decrease in distress ratings for all three thoughts. In contrast, there were no immediate reductions in appraisals following imaginal exposure, although from pre-CMDT to follow-up there were

significant reductions in the belief and distress ratings for two out of three contamination-related thoughts. Examination of the change in appraisal ratings from baseline (pre-CMDT) to follow-up revealed no significant differences between verbal repetition and imaginal exposure in terms of their respective abilities to reduce appraisals of belief, distress, and meaningfulness. Verbal repetition was significantly more effective than no intervention only in the reduction of distress and meaningfulness appraisals of contamination-related thought #2. Imaginal exposure was significantly more effective than no intervention only in the belief appraisals for contamination-related thought #1.

Interestingly, the largest reductions in appraisal ratings for verbal repetition occurred immediately following implementation of the intervention, whereas for imaginal exposure, there were no immediate reductions, but significant reductions were observed from post-intervention to follow-up for the distress and meaningfulness appraisals of one out of three contamination-related thoughts. One implication of these findings is that verbal repetition, with its explicit metacognitive emphasis, could potentially be used by individuals with OCD as an effective way to immediately view their obsessive thoughts in a different context. Verbal repetition may be one way that individuals with OCD to distance themselves from their obsessive thoughts, through the realization that their anxiety-provoking obsessive thoughts are also "just thoughts" that do not necessarily have any significance (Hayes et al., 1999). The verbal repetition intervention could also potentially be used by clinicians in the beginning stages of treatment for OCD, as a way to teach individuals with OCD to learn how to immediately reappraise their obsessive thoughts as less believable, less meaningful, and less distressing.

The immediate reduction in the appraisals of belief in contamination-related thoughts following verbal repetition supports the recent experimental findings of the effectiveness of verbal repetition in reducing the belief in negative thoughts and evaluations about the self (Masuda et al., 2004). In addition, these findings support the clinical research trials which have found significant reductions in the belief associated with negative thoughts following both brief (Bach & Hayes, 2002; Gaudiano & Herbert, 2006a, 2006b) and full Acceptance and Commitment Therapy interventions (Twohig et al., 2006; Zettle & Hayes, 1986)

The present study found that verbal repetition resulted in an immediate decrease in the distress associated with contamination-related thoughts. Future research should seek to determine if the addition of verbal repetition to exposure and response prevention-based treatment of OCD can significantly reduce the treatment refusal, treatment noncompliance, and drop-out rates commonly found in exposure and response prevention treatment outcome studies (e.g., Stanley & Turner, 1995).

Comparison of the credibility ratings given by verbal repetition and imaginal exposure participants suggest that individuals with high levels of contamination-related OCD symptoms are more likely to favor a cognitive defusion rationale than the habituation rationale typically given to individuals with OCD to explain the purpose for engaging in exposure and response prevention (e.g., Foa, 1991). In addition, the participants receiving verbal repetition plus a cognitive defusion rationale reported significant reductions in belief, distress, and meaningfulness immediately following the exercise; these immediate reductions were not evident in the imaginal exposure plus habituation rationale or no intervention groups. These results support the experimental

finding that, compared with brief exposure and response prevention with a habituation rationale, brief exposure and response prevention with a metacognitive rationale (similar to a cognitive defusion rationale) resulted in significantly greater reductions in anxiety/distress, belief in the obsessive thought and urge to neutralize in a subsequent behavioural assessment test (Fisher & Wells, 2005).

A central goal of the cognitive defusion techniques used in Acceptance and Commitment Therapy is to help individuals become more aware of the process of thinking, and to "defuse" from the cognitive content (Hayes et al., 1999). The present findings provide additional evidence to previous experimental research (Masuda et al., 2004; unpublished manuscript) that verbal repetition is an effective cognitive defusion technique for achieving this goal. The significant decrease in the meaningfulness of contamination-related thoughts following verbal repetition suggests that this particular cognitive defusion technique is effective in temporarily disrupting the literal meanings of contamination-related words so that they are reappraised as less meaningful, as was suggested over ninety years ago by Tichener (1916).

In a recent review of several prominent cognitive theories of OCD, Purdon (in press) summarized some suggestions originally proposed by Paul Salkovskis (e.g., Salkovskis, 1985), stating that "(t)reatment refusal and dropout may be decreased substantially if the obsession is 'detoxified' in advance through re-appraisal of the thought's meaning". Given that a large reduction in the meaningfulness appraisals of contamination-related thoughts was observed immediately following the use of verbal repetition, this intervention might be a helpful addition to existing CBT and exposure and response prevention treatments for OCD.

The imaginal exposure intervention caused a significant reduction in belief ratings, for two of the three contamination-related thoughts, when examining the change in ratings from pre-CMDT to follow-up. In addition, from pre-intervention to follow-up, there were significant reductions in the ratings of belief for all three thoughts. These unexpected findings support previous research demonstrating an improvement in unrealistic beliefs following exposure and response prevention without any direct cognitive intervention (Ito et al., 1995; Whittal et al., 2005). In addition, whereas no statistically significant reductions were observed for meaningfulness appraisals from pre-CMDT to follow-up in the imaginal exposure group, there were significant reductions in meaningfulness when examining the change in ratings from pre-intervention to follow-up.

There were no significant differences for PI-WSUR contamination subscale scores for verbal repetition, imaginal exposure, and no intervention groups at the initial selection of the participants. At follow-up, however, there was a statistically significant difference in PI-WSUR contamination subscale scores between the verbal repetition and no intervention groups. Although the change in scores for each group was not statistically significant, an examination of the mean scores at initial selection and follow-up revealed that there was a slight increase for the no intervention group (from 21.29 to 23.36) at follow-up, and a slight decrease in scores for both the verbal repetition (from 19.93 to 18.90) and imaginal exposure (from 22.37 to 20.53) groups. The follow-up PI-WSUR was administered immediately following the exposure to the contamination-related thoughts and subsequent visual analogue scale appraisal ratings. Although speculative, it is possible that this exposure produced an aversive response in the no intervention group

which caused the slight increase in contamination subscale scores. In contrast, the verbal repetition and imaginal exposure interventions may have provided a psychological "buffer" against this increase, resulting in a slight decrease in contamination subscale scores for these two groups at follow-up.

All participants, as part of the CMDT, either verbally repeated the word "contamination" or imagined their identified "contamination" thought for a large number of CMDT trials. As such, the data from the no intervention – verbal repetition and no intervention – imaginal exposure subgroups provided a way to examine the effects of repeated verbal repetition and imaginal exposure practice, without an accompanying treatment rationale, on the reappraisal of a thought related to the word "contamination." Interestingly, there were no significant changes in appraisal ratings either immediately following the CMDT or at one-week follow-up, for the no intervention – verbal repetition and no intervention – imaginal exposure subgroups. In addition, an examination of the appraisal ratings made by the imaginal exposure group for their "contamination" thought revealed no significant changes immediately following imaginal exposure, and there was a tendency towards an increase in appraisal ratings for the verbal repetition group immediately following the CMDT.

The above findings suggest that the repeated practice of verbal repetition and imaginal exposure on its own, without a plausible treatment rationale has no beneficial effect on the reappraisal of contamination-related thoughts. Previous research has found that viewing a cognitive defusion rationale without the subsequent completion of the verbal repetition technique, was significantly less effective than the rationale plus 20 seconds of verbal repetition in reducing the belief and distress in self-relevant negative

thoughts (Masuda et al., unpublished manuscript). Taken together, these findings suggest that the combination of a cognitive defusion rationale plus the completion of the verbal repetition technique is necessary for beneficial effects to occur, and that each component in isolation is not enough to promote a significant reappraisal of negative thoughts. This is in accordance with a theoretical assumption of Relational Frame Theory that establishing behaviour by direct verbal rules (e.g., viewing the cognitive defusion rationale) is counterproductive if the problem is related to excessive verbal control. However, direct experiencing without a verbal framework (e.g., merely repeating a word over and over again) would also be expected to be less than optimal given that no framework has been established for interpreting the experience.

Discussion of CMDT Results

The semantic satiation effect demonstrated by Smith (1984) using a category membership decision task, and defined as a significant increase in RT for member, but not nonmember, targets following 30 repetitions, was replicated in the present study. As hypothesized, for neutral category and target words, verbally repeating a category word 30 times significantly slowed the participant's response to categorizing a target word as a member of the repeated category. This finding is taken as evidence of a decreased accessibility of semantic information related to the repeated word.

When the repeated target trials were excluded from the analysis, a statistically significant semantic satiation effect was also found for the verbal repetition – "automobile" items condition. The pattern of results for the verbal repetition – "contamination" items condition, though not reaching statistical significance, was consistent with the typical pattern of results suggestive of the presence of a semantic

satiation effect. It is possible that the inclusion of more trials may have led to a decrease in the variability of RT scores, resulting in the mean RT difference between 30 repetitions/member and 3 repetitions/member trial types becoming statistically significant. Overall, the present results are consistent with the large body of research which has reliably found a semantic satiation effect following verbal repetition, using a category membership decision paradigm (for a review, see Black, 2003).

In contrast with the above findings, imaginal exposure during the CMDT did not produce a semantic satiation effect. Instead, the prolonged imagining of a category word appears to have caused a more general slowing of response when categorizing both member and nonmember target words. This was the pattern which emerged for all imaginal exposure conditions, except for the imaginal exposure – "automobile" items condition with the repeated trials excluded. However, although a significant increase in RT for member targets following a long imagining length was not observed, there were significantly more errors committed on this trial type, suggesting a speed-accuracy trade-off. It is likely that had participants been more accurate in this trial type, the mean RT would have been significantly slower, thus replicating the pattern observed for the other imaginal exposure conditions. It is unknown why this specific pattern of errors emerged in this condition. In the present study, no consistent pattern of error rates emerged for either the various verbal repetition or imaginal exposure conditions; examination of the error rates reported in previous experiments (Lindquist et al., 2006; Pilotti et al., 1997; Smith, 1984; Smith & Klein, 1990) also reveals an inconsistent pattern for the percentage of errors on each trial type.

For verbal repetition participants, the correlations between semantic satiation scores and ratings of belief, distress, and meaningfulness were, overall, not statistically significant. For the two conditions where a statistically significant semantic satiation effect occurred, the correlations were largely in the predicted direction, with larger semantic satiation scores being somewhat associated with lower appraisal ratings at follow-up. However, as the majority of the correlations did not reach statistical significance, caution must be taken to not over-interpret these results. As mentioned previously, there were no significant correlations observed between verbal repetition participants' satiation scores for "contamination" items and appraisal ratings. This is not surprising, given that a statistically significant semantic satiation effect was not observed for this CMDT condition.

Examination of the correlations between the semantic satiation scores and appraisal ratings for the no intervention – verbal repetition and no intervention – imaginal exposure groups revealed an interesting pattern. Whereas the majority of the correlations were not statistically significant, for both groups the overall pattern was that of a positive relation between semantic satiation scores and belief, distress, and meaningfulness appraisals (i.e., higher semantic satiation scores were associated with higher appraisal ratings). An important caveat, however, is that due to the small sample sizes, interpretation of these correlations must be made with caution. One tentative explanation for these results is that the semantic satiation accompanying verbal repetition, and the absorption occurring following a long length of imaginal exposure, without any rationale to accompany it, had a negative impact on subsequent appraisal ratings. This is in accordance with the related finding of a significant increase in some appraisal ratings

immediately following the CMDT (pre-intervention) in the verbal repetition and imaginal exposure groups. As stated above, however, this is speculative and these results would need to be replicated in a larger sample in order to consider this a valid explanation.

Study Limitations

Participants receiving verbal repetition rated their cognitive defusion rationale as significantly more credible, in comparison with imaginal exposure participants who viewed a habituation rationale. It could be argued that had the habituation rationale been perceived more credibly, comparable reductions would have been observed immediately following imaginal exposure. However, even after controlling for participants' credibility ratings, verbal repetition remained significantly more effective than imaginal exposure in immediately reducing the belief, distress, and meaningfulness appraisals associated with contamination-related thoughts, with the exception of the ratings of distress and meaningfulness for contamination-related thought #3. In addition, the verbal repetition and imaginal exposure credibility ratings were not significantly correlated with reductions in belief, distress, or meaningfulness at either post-intervention or follow-up (average r = -.07), which suggests that the differences between verbal repetition and imaginal exposure were due to factors other than the differences in perceived credibility of the interventions.

It could also be argued that the intervention exercise shown in the cognitive defusion rationale (the *milk, milk, milk* exercise) and the exercise shown in the imaginal exposure rationale (imagining a scary dog barking) were not of an equivalent emotional valence. Specifically, the imagining of a scary dog may be more anxiety-provoking than the verbal repetition of the word "milk". However, as the purpose of showing each

exercise in the rationales was to give a demonstration of the actual technique and explain its purpose, it did not seem plausible to have the actor in the imaginal exposure rationale imagine a non-distressing scene. It is also likely that had a less aversive exercise been used, the imaginal exposure intervention rationale would have been rated by participants as even less credible. In an attempt to replicate the procedures used in Masuda et al.'s (2004) study of verbal repetition, the *milk*, *milk*, *milk* exercise was included in the present study as the example to demonstrate the technique, instead of replacing it with a potentially more aversive word.

The current sample consisted of undergraduate students selected based on clinical levels of contamination-related OCD symptoms. There is the potential for a lack of generalization of results to individuals with a diagnosis of OCD. However, participants' PI-WSUR contamination subscale scores at the initial selection were approximately one standard deviation greater than those observed in the sample of individuals diagnosed with OCD reported by Burns et al. (1996), evidence that they are reporting significant concern with contamination-related obsessive-compulsive symptoms. As such, the rapid verbal repetition of contamination-related thoughts, presented with a cognitive defusion rationale, may be an effective addition to existing psychological approaches for treating OCD. In addition, participants receiving verbal repetition rated the cognitive defusion rationale as more credible than participants receiving the imaginal exposure rationale. This suggests that individuals with OCD may be more readily accepting of a cognitive defusion rationale than a treatment rationale that requires people to mentally elaborate a stimulus they fear.

There was an overrepresentation of women in the current sample, which is not atypical of an undergraduate psychology class. Although a more balanced sample would have been desirable, there is no reason to expect that these findings would not generalize well to men.

Through an accident of random assignment, in comparison with the imaginal exposure group, the verbal repetition group reported significantly lower pre-CMDT (baseline) ratings of distress for the first identified contamination-related thought, as well as lower pre-CMDT ratings of belief, distress, and meaningfulness for the "contamination" thought. However, there were no other significant differences between groups in baseline ratings of belief, distress, or meaningfulness, which suggests that the reductions observed following verbal repetition were due to the intervention, rather than simply being due to a less negative initial appraisal of the contamination-related thoughts.

Caution must be taken when attempting to determine the therapeutic benefit of verbal repetition, based on the present results. An examination of the change in appraisal ratings, from the initial ratings at pre-CMDT to the final ratings at one-week follow-up, reveals a significant reduction following verbal repetition for only five of nine appraisal ratings. There was an 11% decrease in belief ratings for contamination-related thought #1; a 9% decrease in belief, a 24% decrease in distress, and an 18% decrease in meaningfulness ratings for thought #2; and a 15% decrease in meaningfulness ratings for thought #3. An examination of the change in appraisals following imaginal exposure reveals a significant reduction in appraisal ratings for four of nine ratings. For thought #1, there was a 23% decrease in ratings of distress; for thought #2, there was a 9% decrease in belief ratings; and for thought #3, there was an 11% decrease in belief and a 14%

decrease in distress ratings. As such, at one-week follow-up, the overall change in appraisal ratings following verbal repetition was fairly similar to the change following imaginal exposure.

An examination of the change in appraisal ratings for the "contamination" thought from pre-CMDT to follow-up, revealed no significant reductions in belief and distress, and a 15% reduction in meaningfulness ratings, following verbal repetition. One explanation for the lack of significant reductions in belief and distress ratings is that while the word "contamination" was repeated many times by the verbal repetition group during the CMDT, this practice was not explicitly linked with the cognitive defusion rationale, which participants did not view until after the CMDT was completed. This is further evidence to suggest that the cognitive defusion rationale and the verbal repetition exercise needs to be connected in order for benefits to occur. It also raises the possibility that extended practice of verbal repetition may not result in commensurate reductions in appraisal ratings. The extent to which extended practice and/or daily use of verbal repetition over a period of time leads to further reductions in appraisals of anxiety-provoking thoughts is an important area for future investigations.

Following the extended use of imaginal exposure for the "contamination" thought during the CMDT, significant reductions in the belief (10 %), distress (15 %), and meaningfulness (12%) ratings were observed at follow-up. These results are consistent with a substantial body of research demonstrating the benefits of extended exposure on reducing the distress associated with anxious thoughts (e.g., Foa et al., 1998). The significant reductions in belief and meaningfulness appraisals were unexpected, but are consistent with the previous finding that repeated exposure, in the absence of any direct

cognitive intervention, promotes a change in beliefs towards obsessive thoughts (Ito et al., 1995; Whittal et al., 2005).

It might be argued that the significant reductions in meaningfulness that were observed immediately following verbal repetition were simply due to demand characteristics, as the cognitive defusion rationale explicitly stated that through rapid repetition of a word, that word will temporarily lose its meaning. However, the imaginal exposure rationale explicitly stated that thoughts can become less distressing through thinking about them, yet participants did not report any significant decrease in distress immediately following imaginal exposure. In addition, for the verbal repetition group, similar reductions were observed for appraisals of belief and distress immediately following verbal repetition, and these dimensions of change were not discussed in the cognitive defusion rationale.

It is unknown how well the reductions in appraisals of contamination-related thoughts following the verbal repetition intervention would generalize to the cognitions associated with other types of emotional disorders (e.g., worrisome thinking associated with generalized anxiety disorder, catastrophic misinterpretations associated with panic disorder, intrusive thoughts associated with post-traumatic stress disorder, obsessive thoughts associated with other clinical subtypes of OCD, and depressive rumination associated with major depressive disorder). It is conceivable that certain thoughts (e.g., the vague worrying characteristic of generalized anxiety disorder) would be difficult to succinctly summarize in a short word or phrase that can be repeated out loud. An inability to accurately summarize negative cognitions in one or two short words or phrases could limit the potential clinical utility of this intervention for these individuals. However, for

problems associated with specific and identifiable thoughts (e.g., a major depression characterized by specific negative beliefs about the self, such as "I am ugly", or a specific phobia of the number "thirteen"), the verbal repetition intervention may be useful in promoting a reappraisal of these negative cognitions. In addition, the cognitive defusion rationale used in the present study, with its emphasis on shifting the context of thinking towards viewing anxiety-provoking thoughts as *just* thoughts that do not need to be eliminated or controlled, is consistent with recent acceptance-based approaches to the treatment of anxiety disorders (for a review, see Orsillo, Roemer, Lerner, & Tull, 2004).

Unfortunately, due to problems by participants in following the instructions during the completion of the Interpretations of Intrusions Inventory, there were no data available to examine the more general changes in metacognitive beliefs following verbal repetition and imaginal exposure. This will be an interesting and important area to study in future investigations of verbal repetition, as it is possible that verbal repetition, with its explicit metacognitive emphasis, may have a lasting beneficial impact on the way in which individuals view their negative thoughts.

Although there was a tendency for verbal repetition participants' semantic satiation scores and appraisal ratings to be associated in the hypothesized negative direction, the correlations were, for the most part, not statistically significant (at post-intervention, average r = -.14; at follow-up, average r = -.28). It is possible that an effect between variables does exist, but that either the sample size was not large enough to detect the effect, or that there were too few novel "contamination" and "automobile" items presented, resulting in too much variability for the mean differences in RTs to be statistically significant. It is expected that an increased sample size and the inclusion of

more CMDT stimuli would have been necessary to better ascertain the relation between semantic satiation and changes in appraisals of contamination-related thoughts following verbal repetition.

Directions for Future Research

Follow-up research should replicate and elaborate on the present findings by assessing factors such as the extent to which verbal repetition, compared to imaginal exposure, leads to changes in daily contamination-relevant routines and avoidance behaviours. In addition, it will be interesting to determine whether the daily practice of verbal repetition and/or imaginal exposure results in further reductions in the believability, distress, and meaningfulness associated with contamination-related thoughts. This will be an important comparison, given the extensive research supporting the positive effects of repeated exposure-based practice (for a review, see Foa, Franklin, & Kozak, 1998). It is expected that with repeated imaginal exposure practice, ratings of distress associated with contamination-related thoughts would show a linear decrease, whereas it is unknown if the repeated practice of verbal repetition would further reduce the associated distress. In addition, it is not known what effects, if any, repeated verbal repetition or imaginal exposure practice would have on the reappraisal of the belief and meaningfulness associated with contamination-related thoughts.

In the present study, participants who received verbal repetition experienced immediate reductions in the belief, distress, and meaningfulness associated with their contamination-related thoughts. Future studies should seek to determine if the addition of verbal repetition to the CBT and exposure and response prevention treatment of OCD will promote an increase in treatment outcomes, as well as an increase in compliance

rates in individuals who are resistant to complying with standard exposure and response prevention instructions. The use of the verbal repetition intervention could be a way for individuals to view their obsessive thoughts less meaningfully, and promote an experience of the thoughts as being "just thoughts" (Hayes et al., 1999). It has been suggested that interventions that promote a reappraisal of the beliefs held towards obsessive thoughts and that promote reductions in the meaningfulness of obsessive thoughts may improve treatment outcomes (Salkovskis, 1985; Salkovskis & Kirk, 1997), and decrease exposure and response prevention treatment refusal and dropout (Purdon, in press). As such, it would be interesting to study the effects of adding verbal repetition as an adjunct to existing exposure and response prevention and CBT treatments for OCD.

There has been a recent proliferation of "third wave" CBT interventions such as Acceptance and Commitment Therapy, all of which have an explicit emphasis on metacognition (e.g., Hayes et al., 1999; Linehan, 1993; Marlatt, 2002; Segal et al., 2002; Wells, 2000). Advancements in cognitive theories of OCD (e.g., Clark, 2004; Purdon and Clark, 1999), as well as the results of a recent uncontrolled clinical trial of Acceptance and Commitment Therapy for the treatment of OCD (Twohig et al., 2006), suggest that interventions which teach individuals with OCD to experience obsessive thoughts in a detached context (i.e., experiencing an obsessive thought as "just another thought" that does not need to be acted on) are promising modifications to existing habituation-focused exposure and response prevention and CBT treatments for OCD.

For the verbal repetition group, from post-intervention to follow-up there was a significant increase in the belief and distress ratings for one of the contamination-related thoughts. It would be interesting to know if a mid-week "booster session" of verbal

repetition would have prevented this small increase and maintained the significant reductions observed at post-intervention.

There were a number of significant decreases in appraisal ratings at follow-up for the imaginal exposure group. Although there were no immediate reductions following the imaginal exposure intervention, it is possible that immediate reductions in appraisal ratings would have been observed had the period of imaginal exposure practice been extended beyond 30 seconds, given the well-established benefits of extended exposure-based practices.

Another potential direction for future research is to examine *positive affectivity* following the use of verbal repetition. During the verbal repetition intervention, it was observed that a number of participants began to smile and/or laugh while completing the rapid verbal repetition of contamination-related words, as they noticed how the word is perceived differently (e.g., “urine” begins to sound like “you’re in” during rapid repetition of the word). Although no formal data was collected to support this observation, these displays of positive emotion were not observed in the imaginal exposure participants while they were engaged in imaginal exposure of their contamination-related thoughts. In the recent uncontrolled study of Acceptance and Commitment Therapy for the treatment of OCD (Twohig et al., 2006), all participants found it to be a highly acceptable therapeutic approach. It would be interesting to more formally examine whether Acceptance and Commitment Therapy-based interventions such as cognitive defusion techniques are more palatable, more likely to promote positive emotions, and more likely to be used by individuals with OCD than are exposure and response prevention interventions.

An intriguing finding was that whereas no immediate effect was observed following imaginal exposure, significant reductions were observed one week following the intervention. This finding highlights the importance of conducting follow-up assessments when studying the effects of exposure-based treatments. Otherwise, a lack of immediate treatment effects may be considered inaccurately as evidence of a lack of clinical utility, and potentially efficacious treatments may be wrongly dismissed as ineffective.

If the results of the present study are replicated and future studies find verbal repetition to be an effective adjunct to existing psychological treatment of OCD, it will be useful to determine the possible predictors of a positive response to the verbal repetition intervention. The present results suggest that the credibility ratings of the cognitive defusion rationale were overall, not predictive of outcome, although they were significant predictors for two of the nine between-group comparisons of reductions in appraisals. Noteworthy is the fact that the credibility ratings in the present study were made immediately after watching the video, but *prior* to the actual implementation of the verbal repetition technique. As such, it is possible that a significant relation between credibility ratings and outcome could exist between the two variables. It is a reasonable to hypothesize that participants who experience an immediate reduction in belief, distress, and meaningfulness appraisals will rate the rationale credibility higher than participants who experience no reduction; this is a question for future research to address.

Conclusion

The verbal repetition of thoughts is a cognitive defusion technique used in Acceptance and Commitment Therapy to help clients distance themselves from the literal

content of their thoughts, so they can be viewed in a detached context. In the present study, verbal repetition plus a cognitive defusion rationale was significantly more effective then either brief imaginal exposure plus a habituation rationale, or no intervention, in the immediate reductions of belief, distress, and meaningfulness associated with contamination-related thoughts. As such, the verbal repetition of thoughts might be an interesting adjunct to existing psychological treatments for obsessive-compulsive disorder, but more research is necessary to better determine its clinical utility.

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Footnote

Seventeen of the 93 participants (18.3%) did not complete the Interpretations of Intrusions Inventory at initial selection. Another participant (1.1%) completed the Interpretations of Intrusions Inventory at initial selection, but did not report any intrusive thoughts. Eight participants (8.6%) reported thoughts for which it was unclear if it was an intrusive thought or an actual event which they were identifying (e.g., “my grandmother’s funeral”). Six participants (6.5%) identified thoughts which were either worries about the future or negative thoughts about the past (e.g., “I will disappoint my parents”, “I failed a course”), instead of intrusive thoughts. The identified thoughts from four other participants (4.3%) were not considered interpretable (e.g., “dislike of sharing food”). In total, data from 36 participants (38.7%) had to be excluded. In addition to these reporting problems, following the completion of the Interpretations of Intrusions Inventory in the laboratory, six participants informed the experimenter that they were unsure if they completed the questionnaire properly, as they made different interpretations for each of the two thoughts they identified. Unfortunately, due to these myriad problems, the remaining data from this self-report measure was not considered to be suitable to address the questions of interest, and this data was not analyzed or reported.

Appendix A: Identification of Contamination-Related Thoughts

Please read over the list of "contamination" words and rank, in order, the three words that you find to be most distressing (e.g., germs #1, urine # 2, bacteria #3).

bacteria _____
blood _____
disease _____
excrement _____
germs _____
infection _____
saliva _____
urine _____
virus _____

For each of the three words you have identified, please write down, in one brief sentence, a distressing thought you experience that involves the word.

1. _____

2. _____

3._____

Appendix B: Identification of Automobile-Related Thoughts

Please read over the list of “automobile” words and rank, in order, the three automobiles that you find to be most familiar (e.g., mazda #1, chevrolet #2, toyota #3).

buick _____
chevrolet _____
chrysler _____
dodge _____
ford _____
honda _____
mazda _____
pontiac _____
toyota _____

For each of the three words you have identified, please write down, in one brief sentence, a thought you may experience that involves the word.

1. _____

2. _____

3._____

Appendix C: Appraisal Ratings of Identified Contamination-Related Thought

Identified thought:_____

How believable is the thought?

|----------|

Not at all believable Very believable

How distressed are you by the thought?

|----------|

Not at all distressed Very distressed

How meaningful is the thought?

|----------|

Not at all meaningful Very meaningful

Appendix D: CMDT Neutral Category Names and Target Words

Category	Member Target	Category	Nonmember Target
TIME	minute	GEM	horse
METAL	gold	ANIMAL	cotton
DOG	poodle	CLOTH	oil
CRIME	murder	FUEL	scotch
WEAPON	gun	LIQUOR	apple
SPORT	hockey	FRUIT	rain
MUSIC	jazz	WEATHER	robin
COLOUR	blue	BIRD	doll
DANCE	disco	TOY	spider
FLOWER	rose	FISH	halifax
TREE	maple	CITY	cactus
SNAKE	cobra	PLANT	russia
DRUG	heroin	COUNTRY	dollar
FOOD	bread	MONEY	candy
TOOL	hammer	SNACK	water
SPICE	pepper	DRINK	lobster
GAME	chess	SEAFOOD	love
MONTH	april	EMOTION	diamond
VEHICLE	truck	SPICE	sofa
APPLIANCE	stove	EXERCISE	rail
BOOK	novel	DESSERT	foot
MEDIA	radio	HOUSE	blanket

Appendix E: CMDT Ability Rating

How able were you to carry out the intervention during the interval?

|----------|

Not at all able Very able

Appendix F: Verbal Repetition Rationale and Intervention

Videotaped Dialogue

Scientist (S): As a species, language, including thoughts and words, gives us the blessings and the curse of knowledge. The power of language has pros and cons: there is a "light side" and a "dark side". On the positive side, we can influence the environment and create a comfortable life. Just look around in this room. Lights, chairs, central heating, and the clothes we are wearing… Without language and our thoughts, which we call logical thinking, these would not be here. On the dark side, however, we are the only species that worries. In the extreme case, we are the only species that commits suicide.

The dark side becomes dominant when we believe that our thoughts are literally what they say they are. And we tend to think of our thoughts, of what they say, as the reality or as the criteria of the reality. For example, you are what your thoughts say who you are, what you are, and how you are. However, are you really what your thoughts say you are?

What if I say that thoughts are simply what they are – thoughts are just thoughts – rather than what they say they are. It might be difficult to get this point, so let's do a sort of silly exercise.

As I say, this exercise sounds silly. I'm going to ask you to say a word. Then you tell me what comes to mind. I want you to say the word, "Milk".

Actor (A): Milk.

S: Good. Now tell me what comes to mind when you said it?

A: I have milk at home in the refrigerator.

S: O.K. what else? What shows up when we say "Milk"?

A: I picture it---white, a glass.

S: Good what else? Can you taste it?. Can you feel what it feels like to drink a glass of milk? Cold, creamy, coats your mouth…right?

S: O.K. let's see if this fits. What came across your mind was things about actual milk and your experience with it. All that happened is that we made a strange sound — Milk. say it slowly! --- and lots of those things show up. Notice that there isn't any milk in this room, not at all. But milk was in the room psychologically. You and I were seeing it, tasting it, and feeling it. And yet, only the word was actually here.

S: Now, here is another exercise. The exercise is a little silly, and you might feel embarrassed doing it, but I am going to do it with you so we can all be silly together. What I am going to ask you to do is to say the word, "milk," out loud, over-and-over again, and as rapidly as possible, and then notice what happens. Are you ready?

S: O.K., Let's do it. Say "milk" over and over again.

S: (after 30 seconds) O.K. now stop. Tell me what came to mind while you kept repeating it?

A: Gone, it sounds funny, it was just a sound.

S: Did you notice what happened to the psychological aspects of milk that were here a few minutes ago?

A: It seems to just go away.

S: Right. When you said it the first time, it was as if milk was actually here, in the room. But all that really happened was that you just said that word. The first time you said it, it was more than just a word, and it was almost solid. But when you said it again and again and again, you began to lose that meaning and the words became just a sound.

What I am suggesting is that, as you repeat scary or anxiety-provoking thoughts, your mind begins to see the thoughts as noise. What happens in this exercise may be applied to our negative thoughts. When you think about things, in addition to any meaning behind those words, isn't it also true that these thoughts are just thoughts. The thoughts are just smoke, there isn't anything solid in them.

Verbal Repetition Intervention

Experimenter (E): Now, your task here is to say the word "XXX", out loud, over and over again, as rapidly as possible until I say "stop". Do you have any questions?

Participant: (the participant may or may not ask questions about the procedure)

E:O. K., are you ready? Now, begin (Experimenter may repeat the thought with the participant initially to prompt him or her to follow the protocol).

(wait 30 seconds)

E: Stop! Please answer the following questions (the experimenter gives the participant a rating sheet).

Appendix G: Imaginal Exposure Rationale and Intervention

Videotaped Dialogue

Scientist (S): Have you ever visited friends who live on a really busy street or near an airport? You've probably wondered how in the world they can stand the noise. But your friends seem hardly to notice it. Or have you ever squeezed into a tight pair of shoes or jeans in the morning, only to find that a little later you've forgotten you have them on? If you've had either of these experiences, you've witnessed your body's process of "habituation" firsthand. Habituation, which comes from the Latin word *habitus*, for "habit", means "to accustom; to make familiar by frequent use or practice". In other words, after a familiarity with something that at first produces a strong physical or emotional reaction, we learn to get used to it and can ignore it.

Imagining in detail a scary thought may help you to think about uncomfortable, fear-provoking things so that they become less disturbing and meaningful. What if I say that thoughts can become less fearful and distressing if you just continue to experience them? In time, anxiety-provoking thoughts are likely to lessen in intensity as you concentrate on them, because you can get used to the initially fearful thoughts and become used to it so the "volume gets turned down".

S: Let's practice imaginal exposure. I would like you to think of a scary situation, in particular, a mean-looking dog that is barking at you, and think about it in vivid detail. Think of the scariest type of dog you know of, and imagine it with its teeth showing, barking really loudly at you. Imagine it as vividly as if you were watching yourself and the dog in a scene from a movie, frame by frame.

S: (After 30 seconds) O.K. now stop. Tell me what happened as you imagined the scene?

Actor (A): It seemed somewhat scary at first, but then it didn't bother me as much by the end.

S: Right. When you started to think about it, it was as if the barking dog was actually here, in the room. But all that really happened was that you just thought about that scene. But the more you think about it, the more your mind gets used to the image.

S: What I am suggesting is that, as you imagine a scary or anxiety-provoking scene, your mind gets used to the image and it becomes less distressing. It is like when you first put on those tight shoes, they hurt for a bit, but then you begin not to notice them. What happens in this exercise may be applied to our negative thoughts. When you think about distressing things, by concentrating on them for long enough, you become used to the thought and is doesn't seem as distressing or scary.

Imaginal Exposure Intervention

Experimenter (E): Now, your task here is to imagine a detailed scene involving the thought "XXX", and concentrate on it until I say stop. Do you have any questions?

Participant: (the participant may or may not ask questions about the procedure)

E:O. K., are you ready? Now, begin.

(wait 30 seconds)

E: Stop! Please answer the following questions (the experimenter gives the participant a rating sheet).

Appendix H: Intervention Rationale Credibility Rating

How credible is the rationale for this intervention?

|----------|

Not at all credible Very credible

Appendix I: Amount of Intervention Use

Did you use your intervention during the week?

Yes _____

No _____

If Yes:

How often did you use your intervention during the week?

|----------|

Not at all All the Time

Appendix J: Results for Contamination-Related Thought #2

Appraisals of Identified Contamination-Related Thought #2 (Table 4)

Belief Ratings (Figure D): There were no differences between groups in their belief ratings at either pre-CMDT or pre-intervention (all $Fs < 2.35$, $ps > .12$). There was a main effect of time, F (3, 83) = 7.46, $p < .001$, MSE = 138.77, which was qualified by a significant time by group interaction, F (3, 83) = 2.17, $p < .05$, MSE = 138.77. Planned comparisons for verbal repetition revealed a significant decrease in belief ratings from pre-CMDT to post-intervention, F (1, 85) = 12.34, $p = .001$, MSE = 166.42; from pre-intervention to post-intervention, F (1, 85) = 23.76, $p < .001$, MSE = 135.78; from pre-CMDT to follow-up, F (1, 85) = 4.14, $p < .05$, MSE = 169.18; and from pre-intervention to follow-up, F (1, 85) = 11.24, $p = .001$, MSE = 128.17. Planned comparisons for imaginal exposure revealed a significant decrease in ratings from pre-CMDT to follow-up, F (1, 85) = 5.26, $p < .05$, MSE = 169.18; and from pre-intervention to follow-up, F (1, 85) = 8.19, $p < .01$, MSE = 128.17. There was also a trend towards a decrease in ratings from post-intervention to follow-up, F (1, 85) = 2.96, $p = .09$, MSE = 166.84.

Distress Ratings (Figure E): There were no differences between groups in their distress ratings at either pre-CMDT or pre-intervention (all Fs < 1.91, ps > .16). There was an overall main effect of time, F (3, 83) = 6.85, $p < .001$, MSE = 236.44, in the reduction of distress, which was qualified by a significant time by group interaction, F (3, 83) = 3.00, $p = .01$, MSE = 236.44. Planned comparisons for verbal repetition revealed a significant decrease in distress ratings from pre-CMDT to post-intervention, F (1, 85) = 21.33, $p < .001$, MSE = 271.04; from pre-intervention to post-intervention, F (1, 85) = 28.04, $p < .001$, MSE = 183.75; from pre-CMDT to follow-up, F (1, 85) = 10.04, $p < .01$, MSE = 369.97; and from pre-intervention to follow-up, F (1, 85) = 13.41, $p < .001$, MSE = 239.58. For imaginal exposure, there was a trend towards an increase in distress ratings from pre-CMDT to pre-intervention, F (1, 85) = 3.34, $p = .07$, MSE = 152.73; and a significant decrease in ratings from pre-intervention to follow-up, F (1, 85) = 4.81, $p < .05$, MSE = 239.58.

Meaningfulness Ratings (Figure F): There were no differences between groups in their meaningfulness ratings at either pre-CMDT or pre-intervention (all $Fs < 1.21$, $ps > .26$). There was an overall main effect of time, F (3, 83) = 8.51, $p < .001$, MSE = 155.04, which was qualified by a significant time by group interaction, F (3, 83) = 4.08, $p = .001$, MSE = 155.04. Planned comparisons for verbal repetition revealed a significant increase in meaningfulness ratings from pre-CMDT to pre-intervention, F (1, 85) = 5.85, $p < .05$, MSE = 83.36. There was a significant decrease in ratings from pre-CMDT to post-intervention, F (1, 85) = 10.87, $p = .001$, MSE = 167.94; from pre-intervention to post-intervention, F (1, 85) = 34.96, $p < .001$, MSE = 120.14; from pre-CMDT to follow-up, F (1, 85) = 6.75, $p < .05$, MSE = 206.31; and from pre-intervention to follow-up, F (1, 85) = 21.32, $p < .001$, MSE = 165.42. For imaginal exposure, there was a significant increase in ratings from pre-CMDT to pre-intervention, F (1, 85) = 5.05, $p < .05$, MSE = 83.36; and a significant decrease in ratings from pre-intervention to follow-up, F (1, 85) = 5.52, $p < .05$, MSE = 165.42.

Between-Group Comparisons

To determine if there were significant differences between intervention groups in terms of the immediate change in appraisal ratings for contamination-related thought #2 following intervention, a series of 2 (time; Pre-intervention, Post-intervention) x 2 (group; Verbal Repetition, Imaginal Exposure) repeated measures ANOVAs were conducted for the belief, distress, and meaningfulness appraisal ratings. Each of the main effects of time (Fs > 13.56, ps < .01), as well as the time by group interactions (Fs > 6.55, ps < .05) were significant, indicating that verbal repetition was significantly more effective than imaginal exposure in the immediate reappraisal of the thought. In addition, a series of 2 (time; Pre-CMDT, Follow-up) x 2 (group; Verbal Repetition, Imaginal Exposure) repeated measures ANOVAs were conducted for the appraisal ratings for contamination-related thought #2, to determine if there were significant differences in the change in ratings from baseline to follow-up following verbal repetition and imaginal exposure. For the belief, distress, and meaningfulness ratings, there were significant main effects of time, (Fs > 4.16, ps < .05), but the time by group interactions (Fs < 2.90, ps > .09) were not significant, suggesting no differences between the intervention groups in their respective abilities to reduce the appraisals of contamination-related thought #2.

To determine if there were differences between verbal repetition and no intervention, a series of 2 (time; Pre-intervention, Post-intervention) x 2 (group; Verbal Repetition, No Intervention) repeated measures ANOVAs were conducted for the belief, distress, and meaningfulness ratings. Each of the main effects of time (Fs > 11.39, ps < .01), as well as each of the time by group interactions (Fs > 8.33, ps < .01) were significant. In addition, a series of 2 (time; Pre-CMDT, Follow-up) x 2 (group; Verbal Repetition, No Intervention) repeated measures ANOVAs were conducted for the appraisal ratings, to determine if there were significant differences in the change in ratings from baseline to follow-up following verbal repetition and no intervention. For the belief ratings, there was a trend towards a main effect of time, F (1, 56) = 3.42, p = .07, MSE = 145.74, but no time by group interaction, F (1, 56) = 1.43, p = .24, MSE = 145.74, suggesting no differences between groups in their respective abilities to reduce the belief in the contamination-related thought. However, for the distress and meaningfulness ratings, there were significant main effects of time (Fs > 4.92, ps < .05), as well as significant time by group interactions (Fs < 5.63, ps < .05), indicating that verbal repetition was more effective than no intervention in the reduction of these appraisals.

To determine if there were differences between imaginal exposure and no intervention, a series of 2 (time; Pre-intervention, Post-intervention) x 2 (group; Imaginal Exposure, No Intervention) repeated measures ANOVAs were also conducted for the belief, distress and meaningfulness ratings. None of the main effects of time (Fs < 2.61, ps > .11), or the time by group interactions (Fs < 1.11, ps > .30) were significant, indicating that imaginal exposure and no intervention were equally ineffective in the immediate reappraisal of the thought. In addition, a series of 2 (time; Pre-CMDT, Follow-up) x 2 (group; Imaginal Exposure, No Intervention) repeated measures ANOVAs were conducted for the appraisal ratings, to determine if there to determine if there were

significant differences in the change in ratings from baseline to one-week follow-up following imaginal exposure and no intervention. None of the main effects of time (Fs < 3.10, ps > .09), or the time by group interactions (Fs < 1.41, ps > .23) were significant.

Appendix K: Results for Contamination-Related Thought #3

Appraisals of Identified Contamination-Related Thought #3 (Table 5)

Belief Ratings (Figure G): Five cases (verbal repetition $n = 2$; imaginal exposure $n = 2$; no intervention $n = 1$) were observed to have recorded an extremely low rating of belief associated with their third identified contamination-related thought at pre-intervention. As such, they were eliminated from the analysis of belief ratings.

There was a significant difference between groups in their belief ratings at pre-CMDT, such that baseline no intervention ratings were lower than both verbal repetition, F (1, 80) = 3.97, $p = .05$, $MSE = 319.60$, and imaginal exposure, F (1, 80) = 8.69, $p < .01$, $MSE = 319.60$. There was also a significant difference between groups at pre-intervention, such that no intervention ratings were lower than verbal repetition, F (1, 80) = 5.24, $p < .05$, $MSE = 182.81$, and imaginal exposure, F (1, 80) = 7.89, $p < .01$, $MSE = 182.81$. There was an overall main effect of time, F (3, 78) = 11.00, $p < .001$, $MSE = 164.30$, which was qualified by a significant time by group interaction, F (3, 78) = 3.93, $p = .001$, $MSE = 164.30$. Planned comparisons for verbal repetition revealed a significant decrease in belief ratings from pre-CMDT to post-intervention, F (1, 80) = 16.58, $p < .001$, $MSE = 222.04$; from pre-intervention to post-intervention, F (1, 80) = 41.69, $p < .001$, $MSE = 122.60$; and from pre-intervention to follow-up, F (1, 80) = 7.83, $p < .01$, $MSE = 141.32$. In addition, there was a significant increase in belief ratings from post-intervention to follow-up, F (1, 80) = 7.75, $p < .01$, $MSE = 188.53$. For imaginal exposure, there was a significant decrease in ratings from pre-CMDT to follow-up, F (1, 80) = 6.16, $p < .05$, $MSE = 225.62$; from pre-intervention to follow-up, F (1, 80) = 10.19, $p < .01$, $MSE = 141.32$; and there was a trend towards a decrease in ratings from post-intervention to follow-up, F (1, 80) = 3.35, $p = .07$, $MSE = 188.53$.

Distress Ratings (Figure H): There were no differences between groups in their distress ratings at either pre-CMDT or pre-intervention (all $Fs < 1.23$, $ps > .26$). There was an overall main effect of time, F (3, 83) = 3.66, $p < .05$, $MSE = 255.19$, in the reduction of distress, which was qualified by a significant time by group interaction, F (3, 83) = 2.59, $p < .05$, $MSE = 255.19$. Planned comparisons for verbal repetition revealed a significant decrease in distress ratings from pre-CMDT to post-intervention, F (1, 85) = 14.46, $p < .001$, $MSE = 251.39$; and from pre-intervention to post-intervention, F (1, 85) = 20.27, $p < .001$, $MSE = 223.17$. There was also a significant increase in distress ratings from post-intervention to follow-up, F (1, 85) = 5.61, $p < .05$, $MSE = 312.12$. For imaginal exposure, there was a significant decrease in ratings from pre-CMDT to follow-up, F (1, 85) = 4.55, $p < .05$, $MSE = 301.80$; and from pre-intervention to follow-up, F (1, 85) = 6.40, $p < .05$, $MSE = 311.84$.

Meaningfulness Ratings (Figure I): There were no differences between groups in their meaningfulness ratings at either pre-CMDT or pre-intervention (all $Fs < 1.91$, $ps > .16$). There was a main effect of time, F (3, 83) = 6.13, $p = .001$, $MSE = 268.52$, which was qualified by a significant time by group interaction, F (3, 83) = 2.34, $p < .05$, $MSE = 268.52$. Planned comparisons for verbal repetition revealed a significant decrease in meaningfulness ratings from pre-CMDT to post-intervention, F (1, 85) = 12.32, $p = .001$,

MSE = 309.20, and from pre-intervention to post-intervention, *F* (1, 85) = 22.37, *p* < .001, *MSE* = 206.96. There was also a trend towards a decrease from pre-CMDT to follow-up, *F* (1, 85) = 2.97, *p* = .09, *MSE* = 394.69; and a significant decrease in meaningfulness ratings from pre-intervention to follow-up, *F* (1, 85) = 6.64, *p* < .05, *MSE* = 247.38. For imaginal exposure, there was a significant decrease in ratings from pre-intervention to follow-up, *F* (1, 85) = 6.90, *p* < .05, *MSE* = 247.38.

Between-Group Comparisons

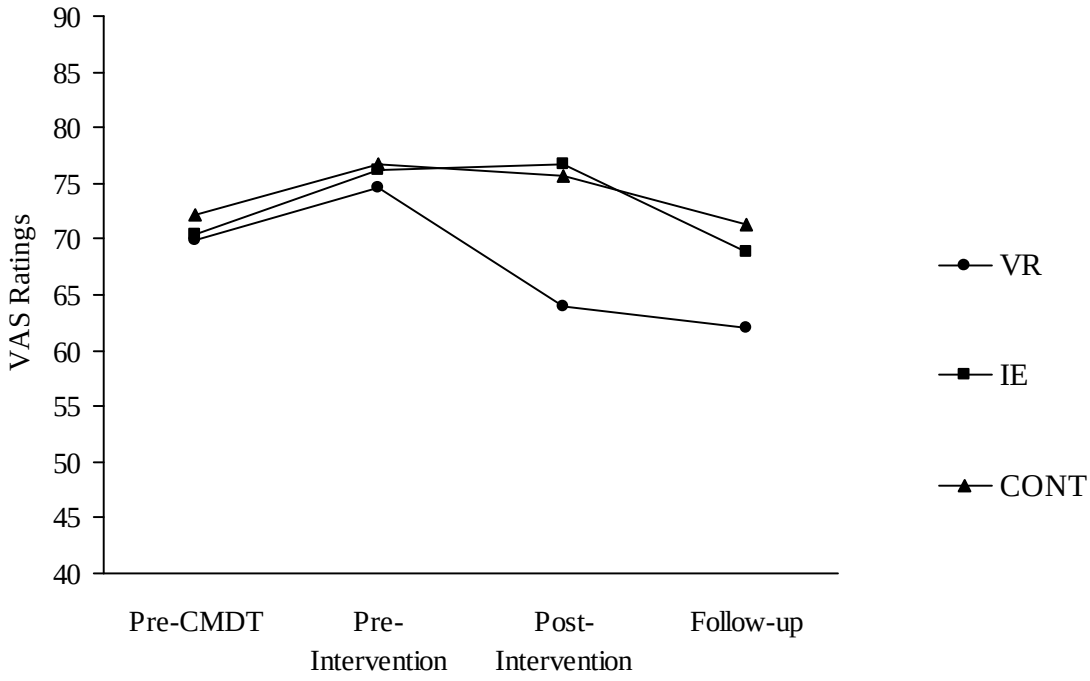
To determine if there were significant differences between intervention groups in terms of the immediate change in appraisal ratings for contamination-related thought #3 following intervention, a series of 2 (time; Pre-intervention, Post-intervention) x 2 (group; Verbal Repetition, Imaginal Exposure) repeated measures ANOVAs were conducted for the belief, distress, and meaningfulness appraisal ratings. Each of the main effects of time (*F*s > 12.13, *p*s < .01), as well as the time by group interactions (*F*s > 4.30, *p*s < .05), were significant, indicating that verbal repetition was significantly more effective than imaginal exposure in the immediate reappraisal of the thought.

In addition, a series of 2 (time; Pre-CMDT, Follow-up) x 2 (group; Verbal Repetition, Imaginal Exposure) repeated measures ANOVAs were conducted for the appraisal ratings for contamination-related thought #3, to determine if there to determine if there were significant differences in the change in ratings from baseline to one-week follow-up following verbal repetition and imaginal exposure. For the belief ratings, there was a significant main effect of time, *F* (1, 54) = 8.82, *p* < .01, *MSE* = 265.54, but no time by group interaction, *F* (1, 54) = 1.06, *p* = .31, *MSE* = 190.20, suggesting no differences between groups in their respective abilities to reduce the belief in contamination-related thought #3. For the distress ratings, there was a trend towards a significant main effect of time, *F* (1, 58) = 3.87, *p* = .05, *MSE* = 398.16, but no time by group interaction, *F* (1, 58) = 0.43, *p* = .51, *MSE* = 398.16. For the meaningfulness ratings, there was also a trend towards a significant main effect of time, *F* (1, 58) = 3.20, *p* = .08, *MSE* = 475.31, but no time by group interaction, *F* (1, 58) = 0.19, *p* = .67, *MSE* = 475.31.

To determine if there were differences between verbal repetition and no intervention, a series of 2 (time; Pre-intervention, Post-intervention) x 2 (group; Verbal Repetition, No Intervention) repeated measures ANOVAs were conducted for the belief, distress and meaningfulness ratings. Each of the main effects of time (*F*s > 12.50, *p*s < .01), as well as each of the time by group interactions (*F*s > 8.21, *p*s < .01) were significant. In addition, a series of 2 (time; Pre-CMDT, Follow-up) x 2 (group; Verbal Repetition, No Intervention) repeated measures ANOVAs were conducted for the appraisal ratings, to determine if there to determine if there were significant differences in the change in ratings from baseline to one-week follow-up following verbal repetition and no intervention. For the belief and distress ratings, there were no significant main effects of time (*F*s < .58, *p*s > .44), or significant time by group interactions (*F*s < 2.14, *p*s > .14). For the meaningfulness ratings, while there was no main effect for time, *F* (1, 56) = .56, *p* = .46, *MSE* = 308.93, there was a trend towards a significant time by group interaction, *F* (1, 56) = 3.82, *p* = .06, *MSE* = 308.93.

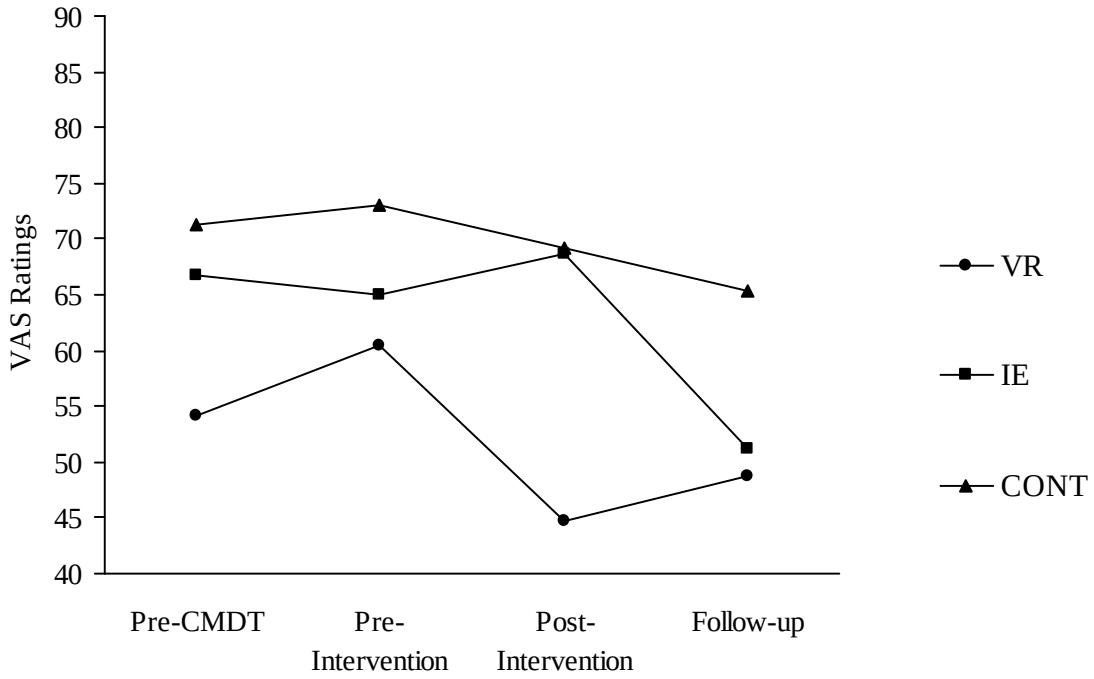
To determine if there were differences between imaginal exposure and no intervention, a series of 2 (time; Pre-intervention, Post-intervention) x 2 (group; Imaginal Exposure, No Intervention) repeated measures ANOVAs were also conducted for the belief, distress and meaningfulness ratings. None of the main effects of time (Fs < 3.01, ps > .08), or the time by group interactions (Fs < .68, ps > .41) were significant, indicating that imaginal exposure and no intervention were equally ineffective in the immediate reappraisal of the thought. In addition, a series of 2 (time; Pre-CMDT, Follow-up) x 2 (group; Imaginal Exposure, No Intervention) repeated measures ANOVAs were conducted for the appraisal ratings, to determine if there to determine if there were significant differences in the change in ratings from baseline to one-week follow-up following imaginal exposure and no intervention. For the belief ratings, there was a trend towards a significant main effect of time, F (1, 56) = 3.36, p = .07, MSE = 219.17, and a significant time by group interaction, F (1, 56) = 6.22, p < .05, MSE = 219.17. For the distress ratings, there was no main effect of time, F (1, 56) = 1.15, p = .29, MSE = 309.56, but there was a trend towards a significant time by group interaction, F (1, 56) = 3.45, p = .07, MSE = 309.56. For the meaningfulness ratings, neither the main effect of time, F = .04, ps = .84, MSE = 396.96, nor the time by group interaction, F = 1.59, ps = .21, MSE = 396.96, were significant.

Figure A: *Belief Ratings for Identified Contamination-Related Thought #1*



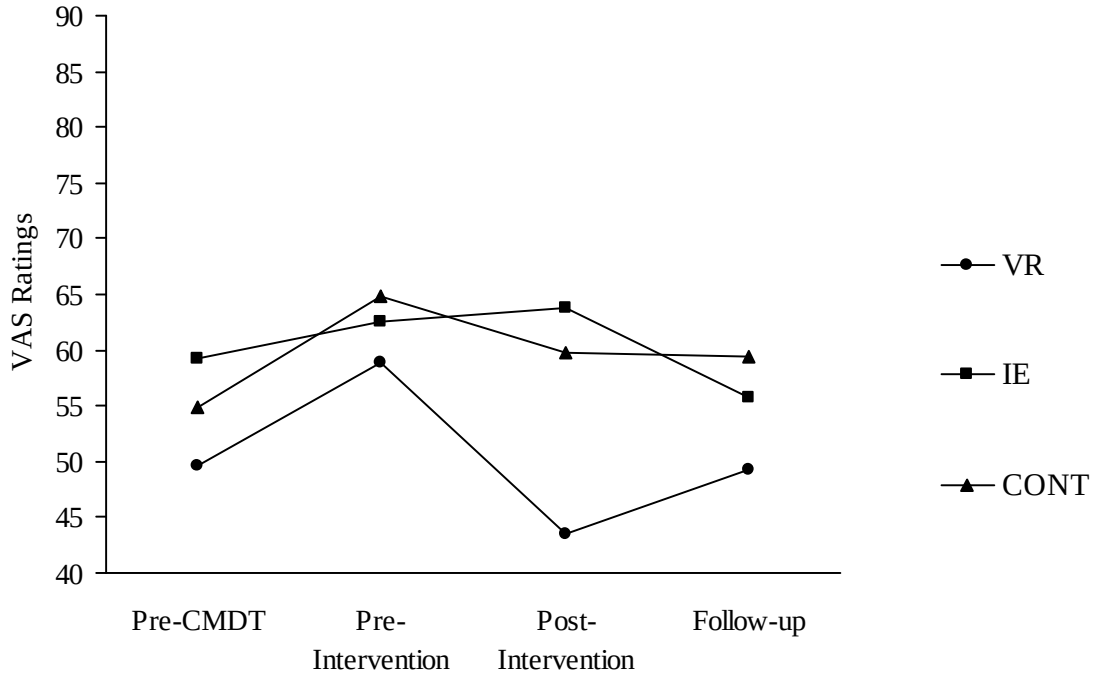
Note. VAS = Visual Analogue Scale; VR = Verbal Repetition; IE = Imaginal Exposure; CONT = No Intervention.

Figure B: *Distress Ratings for Identified Contamination-Related Thought #1*



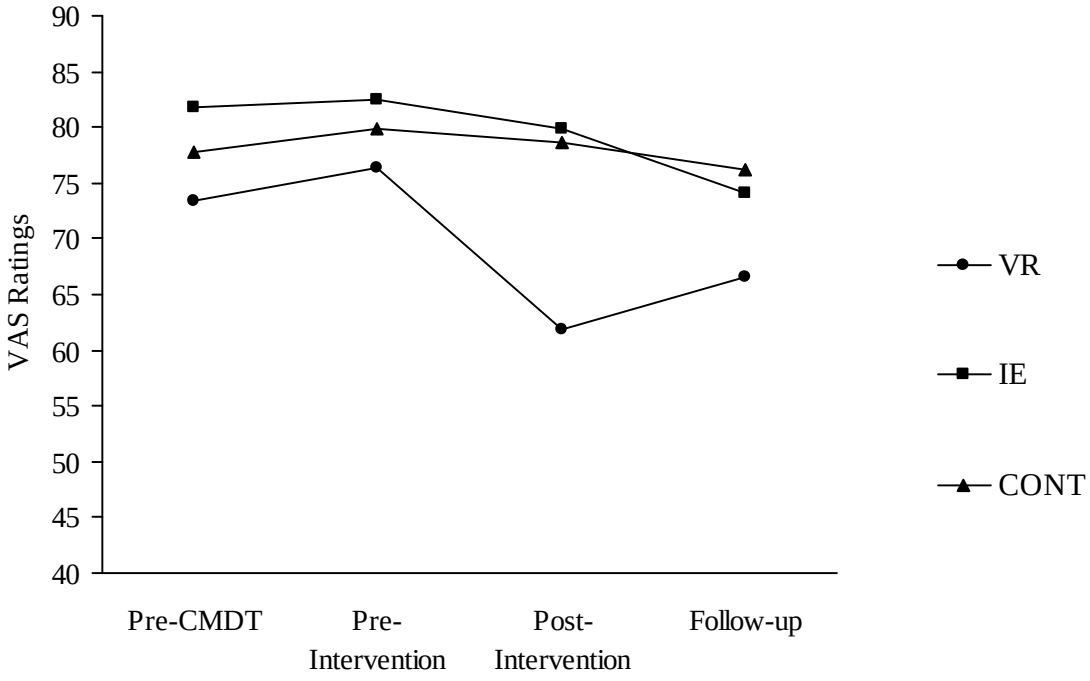
Note. VAS = Visual Analogue Scale; VR = Verbal Repetition; IE = Imaginal Exposure; CONT = No Intervention.

Figure C: *Meaningfulness Ratings for Identified Contamination-Related Thought #1*



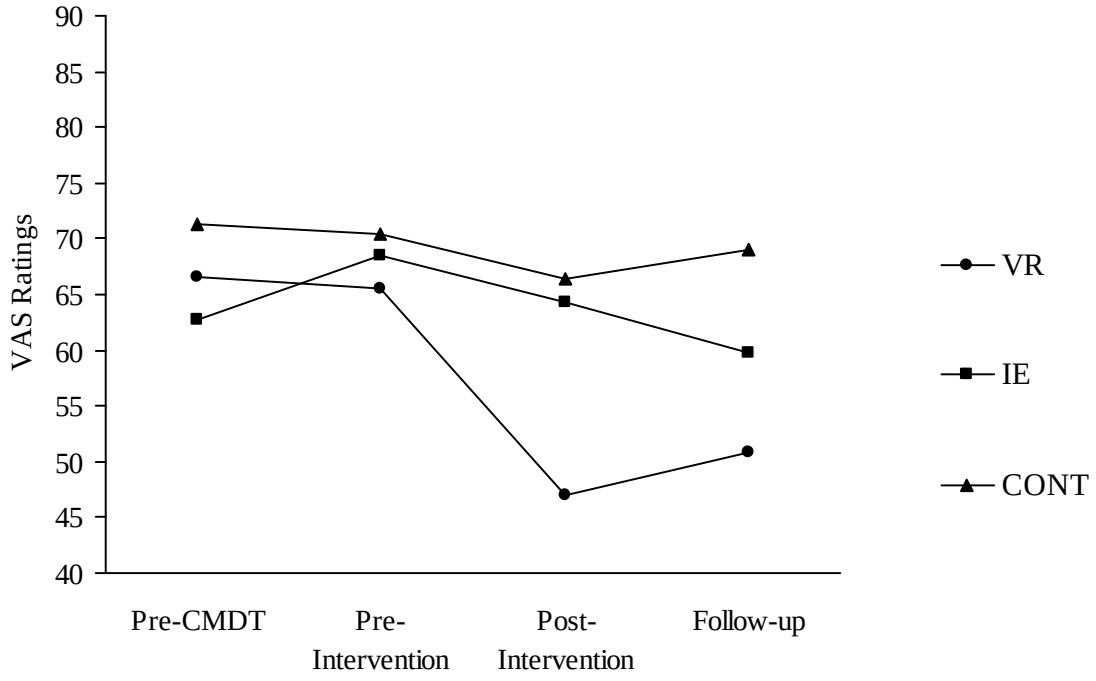
Note. VAS = Visual Analogue Scale; VR = Verbal Repetition; IE = Imaginal Exposure; CONT = No Intervention.

Figure D: *Belief Ratings for Identified Contamination-Related Thought #2*



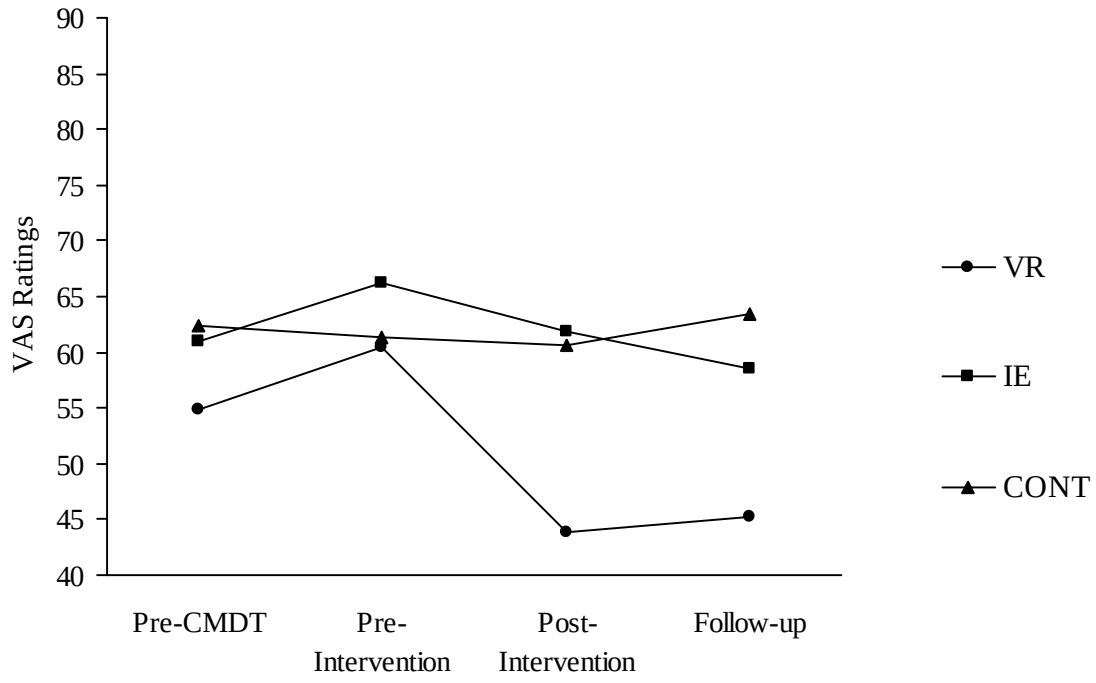
Note. VAS = Visual Analogue Scale; VR = Verbal Repetition; IE = Imaginal Exposure; CONT = No Intervention.

Figure E: *Distress Ratings for Identified Contamination-Related Thought #2*



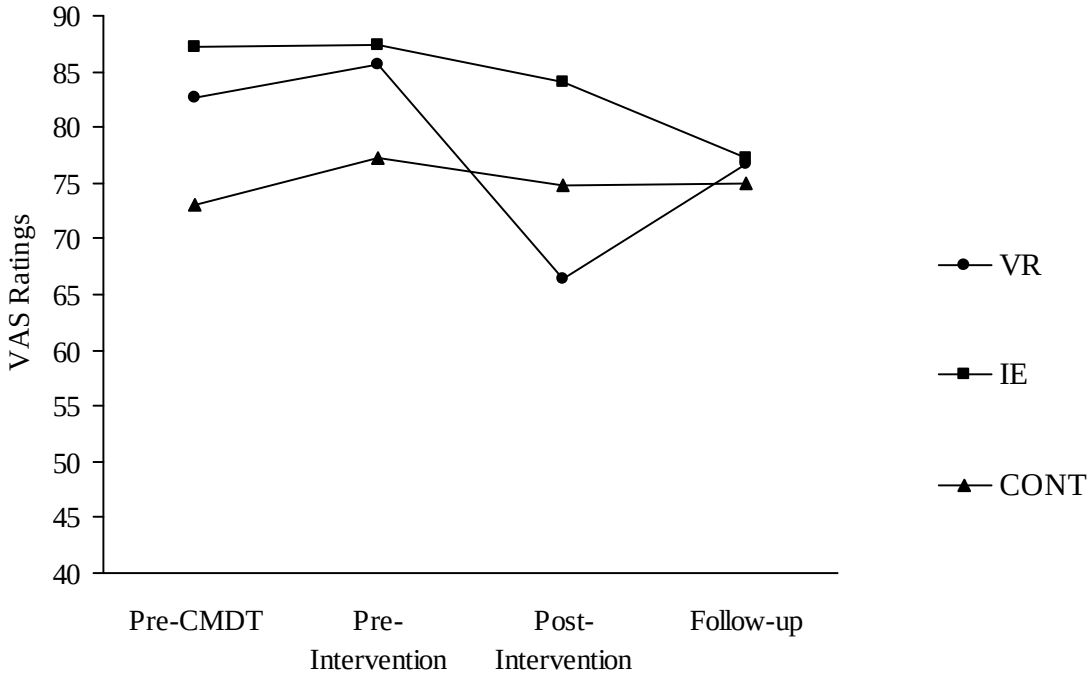
Note. VAS = Visual Analogue Scale; VR = Verbal Repetition; IE = Imaginal Exposure; CONT = No Intervention.

Figure F: *Meaningfulness Ratings for Identified Contamination-Related Thought #2*



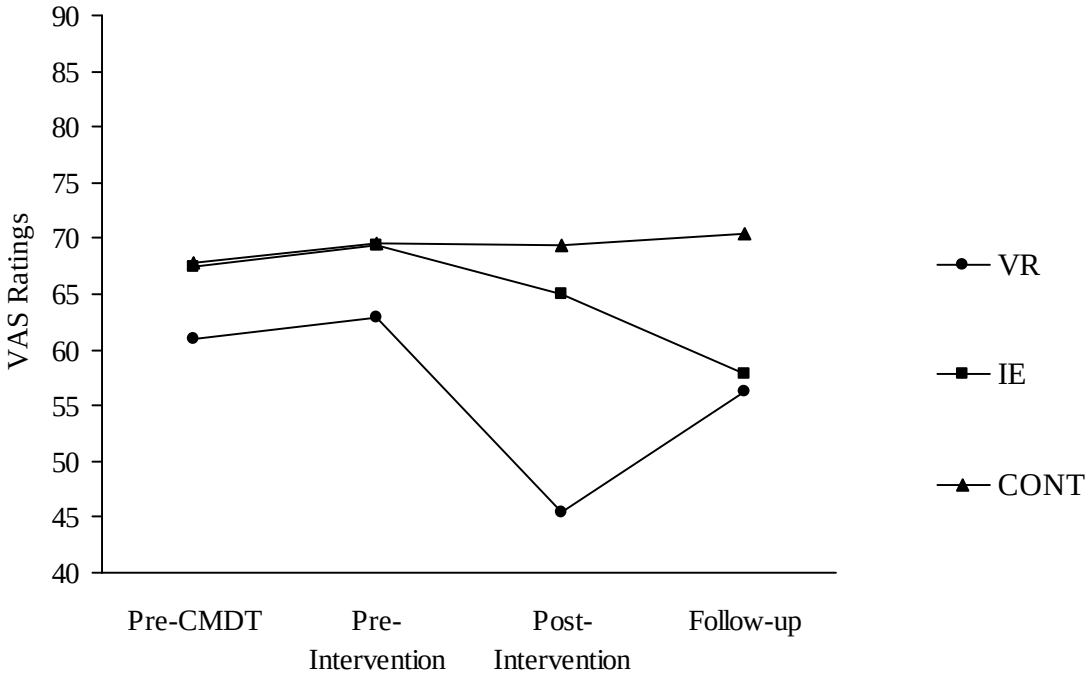
Note. VAS = Visual Analogue Scale; VR = Verbal Repetition; IE = Imaginal Exposure; CONT = No Intervention.

Figure G: *Belief Ratings for Identified Contamination-Related Thought #3*



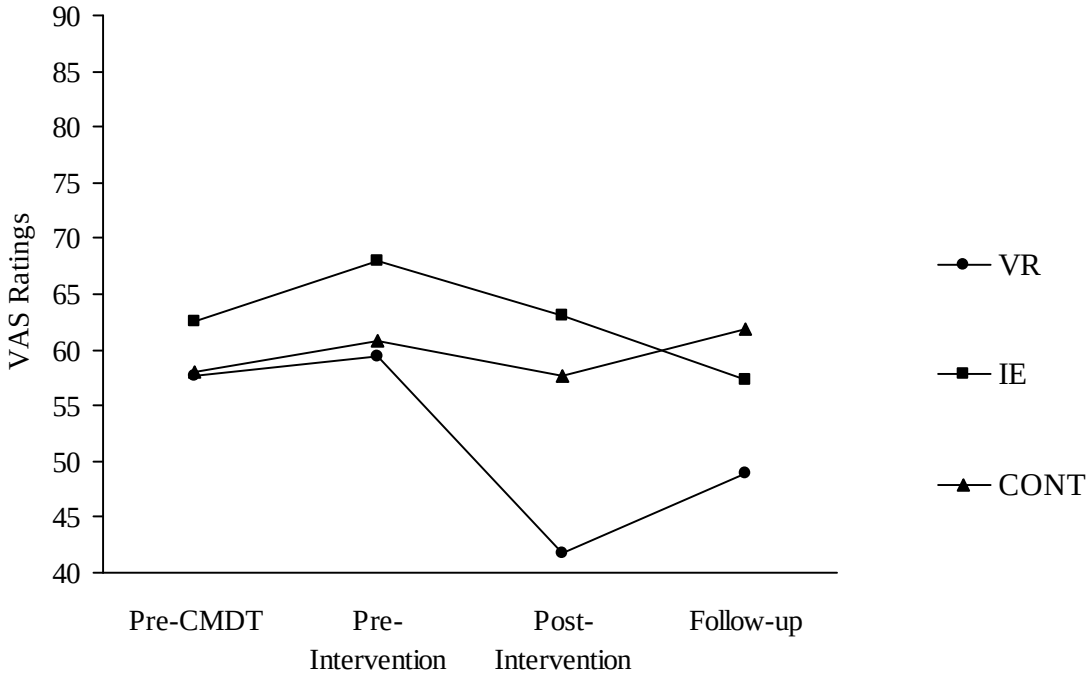
Note. VAS = Visual Analogue Scale; VR = Verbal Repetition; IE = Imaginal Exposure; CONT = No Intervention.

Figure H: *Distress Ratings for Identified Contamination-Related Thought #3*



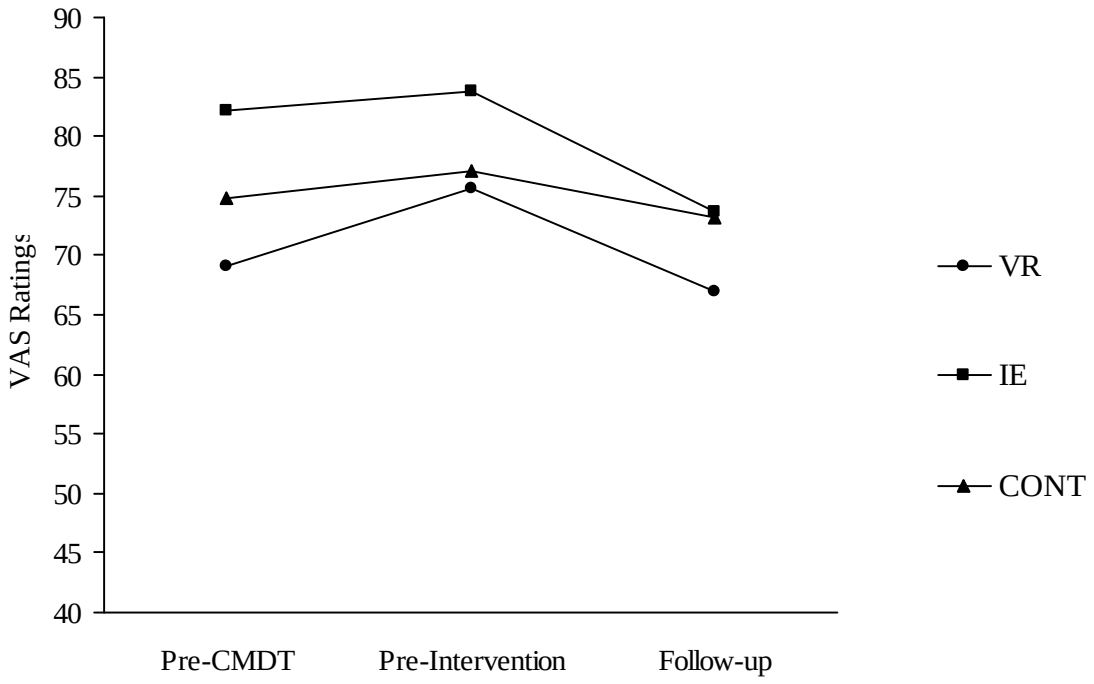
Note. VAS = Visual Analogue Scale; VR = Verbal Repetition; IE = Imaginal Exposure; CONT = No Intervention.

Figure I: *Meaningfulness Ratings for Identified Contamination-Related Thought #3*



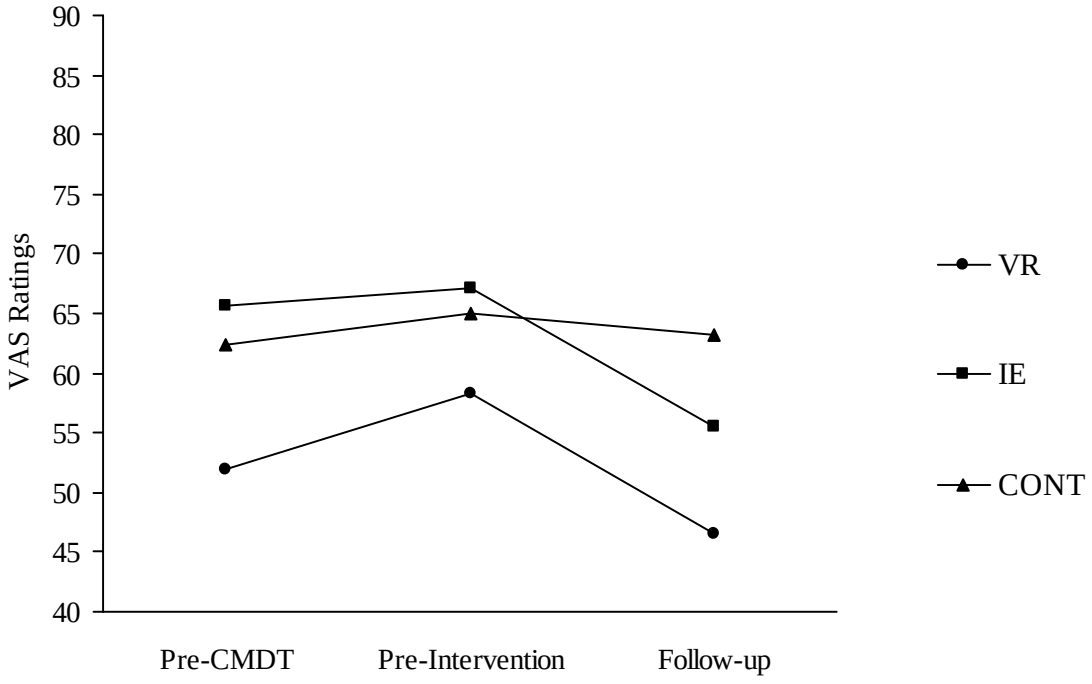
Note. VAS = Visual Analogue Scale; VR = Verbal Repetition; IE = Imaginal Exposure; CONT = No Intervention.

Figure J: *Belief Ratings for "Contamination" Thought*



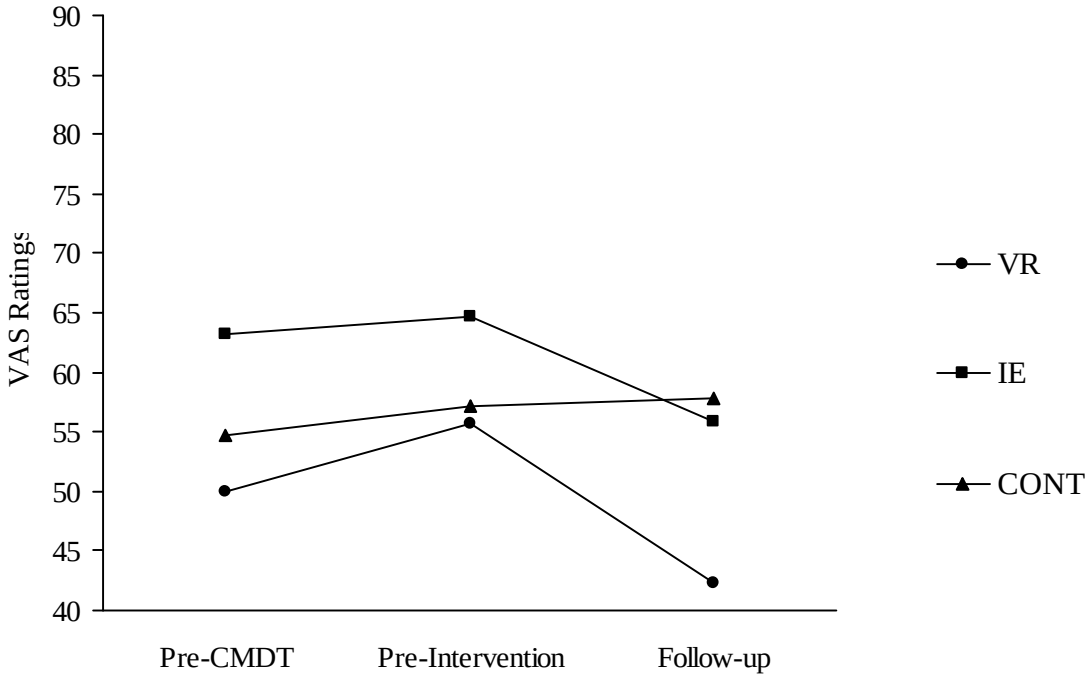
Note. VAS = Visual Analogue Scale; VR = Verbal Repetition; IE = Imaginal Exposure; CONT = No Intervention.

Figure K: *Distress Ratings for "Contamination" Thought*



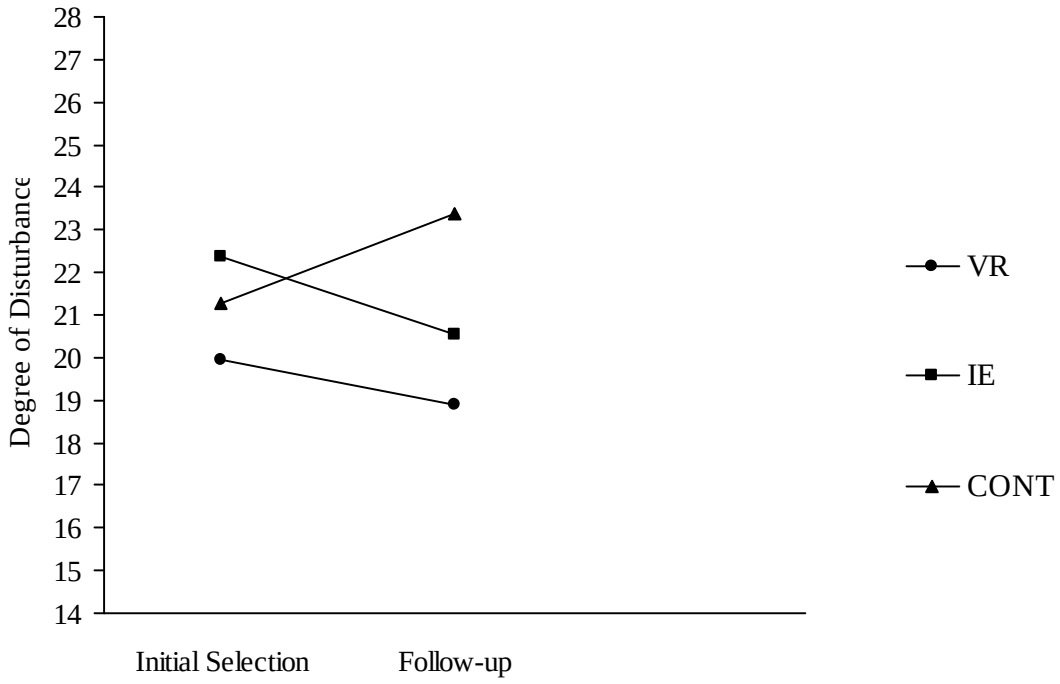
Note. VAS = Visual Analogue Scale; VR = Verbal Repetition; IE = Imaginal Exposure; CONT = No Intervention.

Figure L: *Meaningfulness Ratings for "Contamination" Thought*



Note. VAS = Visual Analogue Scale; VR = Verbal Repetition; IE = Imaginal Exposure; CONT = No Intervention.

Figure M: *PI-WSUR COWC Subscale Scores*



Note. PI-WSUR COWC = Padua Inventory – Washington State University Revision Contamination Obsessions and Washing Compulsions; VR = Verbal Repetition; IE = Imaginal Exposure; CONT = No Intervention.

Table 1

Gender Distribution, Means and Standard Deviations of Age, PANAS scores, Credibility Ratings, and Amount of Intervention Practice

Dependent measure	VR (n = 33)	IE (n = 30)	CONT (n = 30)
Gender	31 (2)	25 (5)	26 (4)
Age	18.91 (1.33)	19.37 (1.16)	19.93 (2.43)
PANAS Negative Affect			
Pre-intervention	14.73 (4.59)	13.93 (5.02)	15.67 (5.70)
Follow-up[a]	15.10 (5.23)	13.63 (3.97)	15.61 (6.01)
PANAS Positive Affect			
Pre-intervention	26.39 (6.01)	26.90 (5.35)	27.90 (6.25)
Follow-up[a]	23.70 (6.59)	26.37 (7.74)	24.64 (6.88)
Credibility of rationale[b]	72.43 (15.43)	56.97 (25.05)	
Amount of practice[c]	40.43 (32.35)	30.63 (20.96)	

Note. a. VR n = 30; CONT n = 28. b. VR n = 30. c. VR n = 7, IE n = 8. *PANAS = Positive and Negative Affect Schedule; VR = Verbal Repetition; IE = Imaginal Exposure; CONT = No Intervention.* Standard deviations and male gender are in parentheses.

Table 2

Relation between Pre-CMDT (Baseline) Ratings of Belief, Distress, and Meaningfulness for Identified Contamination-Related Thought #1, #2, and #3

VAS Rating	Belief	Distress
Thought #1		
Distress	.250*	
Meaningfulness	.546**	.416**
Thought #2		
Distress	.486**	
Meaningfulness	.537**	.463**
Thought #3		
Distress	.234*	
Meaningfulness	.247**	.574**

Note. $n = 88$. *$p < .05$; **$p < .01$. *VAS = Visual Analogue Scale.*

Table 3

Appraisal Ratings for Identified Contamination-Related Thought #1

Dependent measure	VR (n = 30)	IE (n = 30)	CONT (n = 28)
VAS Belief rating			
Pre-CMDT	69.93 (24.37)	70.40 (29.64)	72.25 (24.64)
Pre-intervention	74.70 (22.89)	76.27 (25.34)	76.68 (22.86)
Post-intervention	63.90 (20.67)	76.73 (19.77)	75.75 (22.85)
Follow-up	62.00 (29.00)	68.93 (27.71)	71.25 (26.26)
VAS Distress rating			
Pre-CMDT	54.13 (26.86)	66.70 (20.06)	71.21 (23.21)
Pre-intervention	60.40 (26.25)	64.93 (26.86)	73.07 (23.18)
Post-intervention	44.77 (26.28)	68.63 (19.29)	69.14 (27.10)
Follow-up	48.77 (26.83)	51.27 (31.42)	65.29 (26.44)
VAS Meaningfulness rating			
Pre-CMDT	49.70 (30.65)	59.30 (31.65)	54.93 (26.60)
Pre-intervention	58.93 (30.21)	62.47 (26.58)	64.75 (23.37)
Post-intervention	43.43 (24.48)	63.73 (22.03)	59.75 (27.39)
Follow-up	49.33 (27.10)	55.77 (30.09)	59.39 (28.91)

Note. VAS = Visual Analogue Scale; *VR = Verbal Repetition; IE = Imaginal Exposure; CONT = No Intervention.* Standard deviations are in parentheses.

Table 4

Appraisal Ratings for Identified Contamination-Related Thought #2

Dependent measure	VR (n = 30)	IE (n = 30)	CONT (n = 28)
VAS Belief rating			
Pre-CMDT	73.47 (26.74)	81.77 (13.64)	77.68 (20.58)
Pre-intervention	76.43 (26.32)	82.43 (12.73)	79.86 (19.72)
Post-intervention	61.77 (27.03)	79.80 (18.34)	78.71 (18.35)
Follow-up	66.63 (29.53)	74.07 (25.36)	76.21 (22.36)
VAS Distress rating			
Pre-CMDT	66.57 (26.26)	62.73 (22.23)	71.36 (22.65)
Pre-intervention	65.47 (27.86)	68.57 (21.73)	70.39 (22.78)
Post-intervention	46.93 (27.64)	64.33 (22.74)	66.46 (25.18)
Follow-up	50.83 (29.37)	59.80 (29.89)	69.07 (24.97)
VAS Meaningfulness rating			
Pre-CMDT	54.80 (30.62)	60.97 (24.00)	62.36 (23.14)
Pre-intervention	60.50 (30.25)	66.27 (21.81)	61.29 (25.04)
Post-intervention	43.77 (25.77)	61.83 (24.93)	60.64 (24.88)
Follow-up	45.17 (28.34)	58.47 (27.01)	63.39 (25.53)

Note. VAS = Visual Analogue Scale; *VR = Verbal Repetition; IE = Imaginal Exposure; CONT = No Intervention.* Standard deviations are in parentheses.

Table 5

Appraisal Ratings for Identified Contamination-Related Thought #3

Dependent measure	VR (n = 30)	IE (n = 30)	CONT (n = 28)
VAS Belief rating[a]			
Pre-CMDT	82.68 (17.62)	87.29 (12.71)	73.07 (22.21)
Pre-intervention	85.57 (13.19)	87.46 (10.00)	77.22 (16.70)
Post-intervention	66.46 (24.08)	84.04 (11.58)	74.74 (18.32)
Follow-up	76.68 (21.29)	77.32 (21.52)	74.96 (19.43)
VAS Distress rating			
Pre-CMDT	61.03 (26.79)	67.37 (22.66)	67.82 (19.85)
Pre-intervention	62.83 (27.72)	69.33 (24.39)	69.50 (22.84)
Post-intervention	45.47 (26.98)	64.93 (23.48)	69.39 (23.71)
Follow-up	56.27 (30.77)	57.80 (28.90)	70.39 (21.31)
VAS Meaningfulness rating			
Pre-CMDT	57.70 (30.48)	62.63 (29.11)	57.96 (22.02)
Pre-intervention	59.33 (28.24)	67.90 (19.62)	60.86 (23.47)
Post-intervention	41.77 (23.51)	63.03 (26.25)	57.64 (22.51)
Follow-up	48.87 (30.05)	57.23 (27.25)	61.89 (25.28)

Note. a. VR n = 28, IE n = 28, CONT n = 27. *VAS = Visual Analogue Scale*; *VR = Verbal Repetition; IE = Imaginal Exposure; CONT = No Intervention.* Standard deviations are in parentheses.

Table 6

Appraisal Ratings for "Contamination" Thought

Dependent measure	VR (n = 30)	IE (n = 29)	CONT (n = 27)
VAS Belief rating[a]			
Pre-CMDT	69.03 (23.66)	82.14 (16.29)	74.81 (16.57)
Pre-intervention	75.63 (19.85)	83.76 (12.45)	77.08 (17.58)
Follow-up	67.00 (25.03)	73.59 (24.37)	73.23 (17.40)
VAS Distress rating			
Pre-CMDT	51.87 (27.73)	65.66 (20.58)	62.33 (23.37)
Pre-intervention	58.33 (27.17)	67.10 (21.89)	64.93 (27.53)
Follow-up	46.57 (29.64)	55.55 (25.95)	63.19 (26.64)
VAS Meaningfulness rating			
Pre-CMDT	49.90 (27.16)	63.17 (22.41)	54.67 (24.12)
Pre-intervention	55.73 (27.00)	64.62 (19.79)	57.15 (26.43)
Follow-up	42.27 (28.55)	55.79 (24.86)	57.78 (26.48)

Note. a. CONT *n* = 26. *VAS = Visual Analogue Scale*; *VR = Verbal Repetition; IE = Imaginal Exposure; CONT = No Intervention.* Standard deviations are in parentheses.

Table 7

PI-WSUR Total Score and Subscale Scores at Initial Selection and Follow-Up

Dependent measure	VR (n = 30)	IE (n = 30)	CONT (n = 28)
Total score			
Initial selection	49.17 (18.16)	54.13 (22.62)	57.46 (19.97)
Follow-up	48.90 (19.70)	54.93 (23.97)	60.18 (24.69)
COWC score			
Initial selection	19.93 (3.77)	22.37 (5.64)	21.29 (5.62)
Follow-up	18.90 (6.72)	20.53 (8.40)	23.36 (7.47)
DGC score			
Initial selection	2.80 (2.83)	3.33 (3.32)	4.00 (3.50)
Follow-up	2.43 (2.40)	3.93 (3.82)	4.14 (3.81)
CC score			
Initial selection	15.07 (9.43)	16.37 (9.17)	17.50 (7.86)
Follow-up	15.00 (8.84)	17.37 (10.77)	18.00 (9.67)
OTHS score			
Initial selection	7.20 (4.83)	7.17 (5.36)	10.36 (6.14)
Follow-up	7.63 (4.21)	7.50 (4.62)	10.36 (6.01)
OIHS score			
Initial selection	4.17 (5.07)	4.90 (6.38)	4.32 (5.61)
Follow-up	4.93 (6.38)	5.60 (5.36)	4.32 (5.36)

Note. COWC = Contamination Obsessions and Washing Compulsions; DGS = Dressing/Grooming Compulsions; CC = Checking Compulsions; OTHS = Obsessional Thoughts of Harm to Self/others; OIHS = Obsessional Impulses to Harm Self/others; VR = Verbal Repetition; IE = Imaginal Exposure; CONT = No Intervention. Standard deviations are in parentheses.

Table 8

CMDT Mean Median Response Times (RTs) and Mean Percentage of Errors

Condition	3 repetitions/Short Imagining		30 repetitions/Long Imagining	
	RT	% error	RT	% error
IE – neutral[a]				
Member	766.02 (241.78)	5.2	868.18 (261.45)	10.0
Nonmember	852.83 (255.49)	6.5	945.30 (320.14)	5.4
IE – "automobile"[b]				
Member	704.13 (175.88)	5.0	810.78 (255.93)	6.7
Nonmember	812.58 (204.82)	3.3	868.01 (223.61)	6.7
IE – "contamination"[b]				
Member	813.49 (248.65)	6.9	864.38 (249.47)	6.9
Nonmember	867.85 (256.14)	4.2	945.15 (326.34)	5.8
VR – neutral[c]				
Member	690.38 (162.93)	1.9	732.16 (187.69)	1.3
Nonmember	759.55 (208.92)	5.5	782.79 (190.06)	4.0
VR – "automobile"[d]				
Member	681.90 (153.18)	4.0	712.57 (171.39)	2.0
Nonmember	733.02 (161.17)	2.5	803.67 (216.23)	1.8
VR – "contamination"[d]				
Member	757.38 (217.39)	4.3	796.95 (226.55)	5.1
Nonmember	754.75 (193.93)	4.3	794.89 (203.23)	4.5

Note. a. $n = 42$; b. $n = 40$; c. $n = 48$; d. $n = 44$. RT values are in milliseconds. *VR = Verbal Repetition; IE = Imaginal Exposure*. Standard deviations are in parentheses.

Table 9

CMDT Mean Response Times (RTs) and Mean Percentage of Errors for "Contamination" and "Automobile" Conditions (No Repeated Items)

Condition	3 repetitions/Short Imagining		30 repetitions/Long Imagining	
	RT	% error	RT	% error
IE – "automobile"[a]				
Member	828.11 (237.76)	5.8	890.99 (255.93)	12.5
Nonmember	863.02 (201.49)	5.0	1001.58 (298.69)	9.2
IE – "contamination"[b]				
Member	902.55 (304.75)	10.0	1004.84 (327.73)	10.8
Nonmember	949.20 (294.69)	5.8	1030.80 (298.66)	5.8
VR – "automobile"[c]				
Member	721.52 (167.83)	6.8	807.77 (209.42)	3.0
Nonmember	839.72 (231.29)	3.0	899.91 (270.77)	3.0
VR – "contamination"[d]				
Member	818.15 (261.55)	6.8	886.72 (258.76)	8.3
Nonmember	861.83 (243.42)	6.1	862.69 (235.17)	6.1

Note. a. $n = 39$; b. $n = 40$; c. $n = 43$; d. $n = 41$. RT values are in milliseconds. *VR = Verbal Repetition; IE = Imaginal Exposure*. Standard deviations are in parentheses.

Table 10

Relation between Verbal Repetition Semantic Satiation Scores for Neutral Items, "Contamination" Items, "Automobile" Items, and Post-Intervention Appraisal Ratings

VAS Rating	SS Score "neutral" (*n* = 30)	SS Score "automobile" (*n* = 26)	SS Score "contamination" (*n* = 25)
Post-Intervention:			
Belief Rating Thought #1	-.147	-.231	.023
Distress Rating Thought #1	-.202	-.374*	.035
Meaningfulness Rating Thought #1	-.207	-.294	-.033
Belief Rating Thought #2	.117	-.196	.042
Distress Rating Thought #2	-.041	-.310	.069
Meaningfulness Rating Thought #2	-.117	-.078	-.006
Belief Rating Thought #3	.415**	-.050	.008
Distress Rating Thought #3	-.152	-.273	.006
Meaningfulness Rating Thought #3	-.209	-.184	-.143

Note. *$p < .10$; **$p < .05$. *VAS = Visual Analogue Scale.*

Table 11

Relation between Verbal Repetition Semantic Satiation Scores for Neutral Items, "Contamination" Items, "Automobile" Items, and Follow-Up Appraisal Ratings

VAS Rating	SS Score "neutral" (n = 30)	SS Score "automobile" (n = 26)	SS Score "contamination" (n = 25)
Follow-Up:			
Belief Rating Thought #1	-.120	-.195	.207
Distress Rating Thought #1	-.360	-.391**	.259
Meaningfulness Rating Thought #1	-.362**	-.361*	.256
Belief Rating Thought #2	.103	-.335*	.231
Distress Rating Thought #2	-.400**	-.426**	.210
Meaningfulness Rating Thought #2	-.319*	-.276	.181
Belief Rating Thought #3	.231	-.311	.199
Distress Rating Thought #3	-.357*	-.528***	.325
Meaningfulness Rating Thought #3	-.380**	-.276	.137
Belief Rating "Contamination" Thought	-.086	-.395**	.409**
Distress Rating "Contamination" Thought	-.304	-.299	.295
Meaningfulness Rating "Contamination" Thought	-.301	-.236	.293

Note. *p < .10; **p < .05; ***p < .01. *VAS = Visual Analogue Scale.*

Table 12

Relation between Imaginal Exposure Semantic Satiation Scores for Neutral Items, "Contamination" Items, "Automobile" Items, and Post-Intervention Appraisal Ratings

VAS Rating	SS Score "neutral" (*n* = 27)	SS Score "automobile" (*n* = 24)	SS Score "contamination" (*n* = 24)
Post-Intervention:			
Belief Rating Thought #1	-.165	.063	.090
Distress Rating Thought #1	-.060	.020	.350*
Meaningfulness Rating Thought #1	-.287	.083	.212
Belief Rating Thought #2	.011	-.064	.202
Distress Rating Thought #2	.027	.186	.170
Meaningfulness Rating Thought #2	-.167	.219	.111
Belief Rating Thought #3	-.104	-.247	.209
Distress Rating Thought #3	.103	-.065	.370*
Meaningfulness Rating Thought #3	-.022	-.034	.292

Note. *$p < .10$. *VAS = Visual Analogue Scale.*

Table 13

Relation between Imaginal Exposure Semantic Satiation Scores for Neutral Items, "Contamination" Items, "Automobile" Items, and Follow-Up Appraisal Ratings

VAS Rating	SS Score "neutral" (n = 27)	SS Score "automobile" (n = 24)	SS Score "contamination" (n = 24)
Follow-Up:			
Belief Rating Thought #1	.024	-.278	.090
Distress Rating Thought #1	-.031	.042	.211
Meaningfulness Rating Thought #1	.027	-.046	.380
Belief Rating Thought #2	.266	.090	.098
Distress Rating Thought #2	.230	.310	-.008
Meaningfulness Rating Thought #2	.133	.320	.024
Belief Rating Thought #3	.128	-.083	.196
Distress Rating Thought #3	.074	.079	.118
Meaningfulness Rating Thought #3	-.003	-.203	.235
Belief Rating "Contamination" Thought	-.089	-.302	.079
Distress Rating "Contamination" Thought	-.046	-.138	.106
Meaningfulness Rating "Contamination" Thought	-.115	-.062	.149

Note. VAS = Visual Analogue Scale.

Table 14

Relation between No Intervention – Verbal Repetition Semantic Satiation Scores for Neutral Items, "Contamination" Items, "Automobile" Items, and Post-Intervention Appraisal Ratings

VAS Rating	SS Score "neutral" (*n* = 14)	SS Score "automobile" (*n* = 13)	SS Score "contamination" (*n* = 13)
Post-Intervention:			
Belief Rating Thought #1	.151	.162	.060
Distress Rating Thought #1	.427	.248	.150
Meaningfulness Rating Thought #1	.332	.247	.040
Belief Rating Thought #2	.103	.426	.188
Distress Rating Thought #2	.218	.082	.435
Meaningfulness Rating Thought #2	.270	.113	.069
Belief Rating Thought #3	.105	.361	-.016
Distress Rating Thought #3	-.142	.645**	.067
Meaningfulness Rating Thought #3	-.320	.723***	-.419

Note. *$p < .10$; **$p < .05$; ***$p < .01$. *VAS = Visual Analogue Scale.*

Table 15

Relation between No Intervention – Verbal Repetition Semantic Satiation Scores for Neutral Items, "Contamination" Items, "Automobile" Items, and Follow-Up Appraisal Ratings

VAS Rating	SS Score "neutral" (*n* = 14)	SS Score "automobile" (*n* = 13)	SS Score "contamination" (*n* = 13)
Follow-Up:			
Belief Rating Thought #1	.352	.241	.014
Distress Rating Thought #1	.439	.152	.156
Meaningfulness Rating Thought #1	.381	.287	.081
Belief Rating Thought #2	.358	.427	.185
Distress Rating Thought #2	.125	.234	.354
Meaningfulness Rating Thought #2	.270	.370	.294
Belief Rating Thought #3	.088	.237	.030
Distress Rating Thought #3	.076	.562**	.300
Meaningfulness Rating Thought #3	.057	.603**	.040
Belief Rating "Contamination" Thought	.282	.651**	-.132
Distress Rating "Contamination" Thought	.283	.374	-.060
Meaningfulness Rating "Contamination" Thought	.115	.439	-.258

Note. *$p < .10$; **$p < .05$. *VAS = Visual Analogue Scale.*

Table 16

Relation between No Intervention – Imaginal Exposure Semantic Satiation Scores for Neutral Items, "Contamination" Items, "Automobile" Items, and Post-Intervention Appraisal Ratings

VAS Rating	SS Score "neutral" (n = 13)	SS Score "automobile" (n = 13)	SS Score "contamination" (n = 13)
Post-Intervention:			
Belief Rating Thought #1	.569**	-.211	.552**
Distress Rating Thought #1	.008	.332	.246
Meaningfulness Rating Thought #1	.091	.186	.305
Belief Rating Thought #2	.397	.113	.469
Distress Rating Thought #2	.010	.344	.279
Meaningfulness Rating Thought #2	-.057	.327	.228
Belief Rating Thought #3	.438	-.296	.600**
Distress Rating Thought #3	-.054	.219	.388
Meaningfulness Rating Thought #3	.264	-.101	.520*

Note. *p < .10; **p < .05. *VAS = Visual Analogue Scale.*

Table 17

Relation between No Intervention – Imaginal Exposure Semantic Satiation Scores for Neutral Items, "Contamination" Items, "Automobile" Items, and Follow-Up Appraisal Ratings

VAS Rating	SS Score "neutral" (*n* = 13)	SS Score "automobile" (*n* = 13)	SS Score "contamination" (*n* = 13)
Follow-Up:			
Belief Rating Thought #1	.253	.095	. 511*
Distress Rating Thought #1	-.214	.433	. 231
Meaningfulness Rating Thought #1	.011	.130	. 292
Belief Rating Thought #2	.088	.254	. 571**
Distress Rating Thought #2	-.090	.613**	.257
Meaningfulness Rating Thought #2	.014	.502*	.137
Belief Rating Thought #3	.253	-.012	.497*
Distress Rating Thought #3	-.166	.769***	.019
Meaningfulness Rating Thought #3	.002	.070	.439
Belief Rating "Contamination" Thought	.423	.199	.356
Distress Rating "Contamination" Thought	-.010	.273	.219
Meaningfulness Rating "Contamination" Thought	-.183	.210	.072

Note. *$p < .10$; **$p < .05$; ***$p < .01$. *VAS = Visual Analogue Scale.*

Table 18

No Intervention – Verbal Repetition and No Intervention – Imaginal Exposure Appraisal Ratings for "Contamination" Thought

Dependent measure	CONT-VR (n = 14)	CONT-IE (n = 13)
VAS Belief rating[a]		
Pre-CMDT	72.69 (14.07)	76.92 (19.09)
Pre-intervention	74.54 (19.15)	79.62 (16.23)
Follow-up	71.62 (18.25)	74.85 (17.09)
VAS Distress rating		
Pre-CMDT	57.14 (25.51)	67.92 (20.32)
Pre-intervention	59.79 (28.89)	70.46 (25.96)
Follow-up	58.36 (28.07)	68.38 (25.04)
VAS Meaningfulness rating		
Pre-CMDT	50.64 (24.00)	59.00 (24.44)
Pre-intervention	52.07 (28.47)	62.62 (23.93)
Follow-up	54.57 (28.80)	61.23 (24.41)

Note. a. CONT-VR n = 13. *VAS = Visual Analogue Scale; CONT-VR = Control subgroup receiving verbal repetition instructions; CONT-IE = Control subgroup receiving imaginal exposure instructions.* Standard deviations are in parentheses.