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A Parametric Study of Cognitive Defusion and the Believability and Discomfort of Negative  
Self-Relevant Thoughts

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## Abstract

A previous time series study showed that rapidly repeating a single word version of a negative self-referential thought reduced the discomfort and the believability associated with that thought. The present parametric study examined whether durations of word repetition were differentially effective in altering the discomfort and believability of negative self-referential thought. In two studies, both discomfort and believability varied systematically with the duration of word repetition. The effects of rapid repetition on emotional discomfort bottomed out after 3 to 10 seconds of rapid repetition, while the effects on believability did so after 20 to 30 seconds of repetition. This study lends support to the cognitive defusion interpretation of the effect of word repetition, suggesting that emotional discomfort and believability may be distinctive functional aspects of cognitive events.

**Key Words:** Cognitive defusion; deliteralization; acceptance; mindfulness; self-referential thoughts; emotional discomfort; believability of negative thoughts; Acceptance and Commitment Therapy

## A Parametric Study of Cognitive Defusion and the Believability and Discomfort of Negative Self-Relevant Thoughts

In recent years, acceptance and mindfulness-based interventions have received increased attention in the field of cognitive behavior therapy (CBT; see Hayes, Follette, & Linehan, 2004 for a book length review). In contrast to both traditional behavior therapy (BT) and traditional CBT, these procedures address the function of private events (e.g., thoughts, feelings, physiological sensations, & memories) while not necessarily affecting their form or frequency (Hayes, 2004; Segal, Teasdale, & Williams, 2004). A treatment with this focus is Acceptance and Commitment Therapy (ACT, said as a word, not as initials; Hayes, Strosahl, & Wilson, 1999).

ACT uses scores of acceptance and cognitive defusion techniques within the therapy. From an ACT perspective, acceptance is a process of being open to whatever one is experiencing without defense. Cognitive defusion, which is thought to facilitate acceptance, is construed as a process of reducing the literal and behavior-regulatory function of private events (see Blackledge, 2007 for detailed account of cognitive defusion). ACT assumes that cognitive defusion is particularly relevant in contexts where unworkable attempts to control private events, such as thought suppression, distraction, rumination, and avoidance, are occasioned and maintained by one's thinking. In ACT, change in the stimulus function of private events (i.e., cognitive defusion) is typically achieved without change in the form, frequency, or situational sensitivity of the event (Hayes, 2004).

Although ACT outcome studies with stringent empirical methodology are still limited (Ost, 2008), a series of preliminary treatment outcome studies have suggested the potential applicability of ACT to a wide range of behavioral problems (see Hayes, Luoma, Bond, Masuda, & Lillis, 2006 for a review). A number of correlational and clinical studies have also suggested that cognitive defusion processes play an important part in ACT outcomes (e.g., Bach & Hayes, 2002; Zettle & Hayes, 1986). Experimental tests of ACT specific therapeutic procedures (e.g., Eifert & Heffner, 2003; Gutiérrez, Luciano, Rodríguez, & Fink, 2004; Hayes, Bissett, Korn, Zettle, Rosenfarb, Cooper, et al., 1999; Levitt, Brown, Orsillo, & Barlow, 2004; Takahashi, Muto, Tada, & Sugiyama, 2002) have shown that the therapeutic techniques used in ACT influence behavioral processes, such as acceptance and cognitive defusion, as the model suggests.

Furthermore, a time-series experimental study previously showed the utility of a cognitive defusion technique (Masuda, Hayes, Sackett, & Twohig, 2004). Using a series of eight single-case alternating treatment designs (Barlow & Hayes, 1979), the study investigated the effects of the rapid repetition of single word, which was originally introduced by Titchener nearly a century ago (Titchener, 1910). Titchener (1910) argued that when a word is rapidly repeated out loud, the context required for the word to have its literal meaning is altered and removed.

In that study (Masuda et al., 2004), each participant was first asked to identify two one-word negative self-relevant thoughts (e.g., "ugly," "stupid," etc), and then discomfort and believability of each thought was assessed using a 100-mm Likert-style visual analogue scale, ranging from 0 (not at all uncomfortable) to 100 (very uncomfortable) for the discomfort scale, and from 0 (not at all believable) to 100 (very believable) for the believability scale. One of the thoughts was randomly assigned to the cognitive defusion condition (i.e., the combination of defusion rationale and 30-second rapid word repetition for one of the identified thoughts), and the other to a comparison condition. One comparison condition was a distraction task where

participants were asked to read an article about Japan. The other comparison condition involved the combination of thought control rationale and an actual thought control attempt on the assigned thought. Participants received each intervention three times quasi-randomly. Results revealed that the defusion condition reduced the believability and the discomfort associated with self-relevant thoughts more so than distraction and thought control conditions across all participants (Masuda et al., 2004).

The highly specific and very short term nature of this technique enables a kind of study rarely performed in empirical clinical psychology, other than in pharmacotherapy: a parametric analysis. There are practical reasons to conduct parametric studies, such as learning the level of a variable needed to produce optimal effects, but there are even more important theoretical reasons. Parametric studies increase the confidence in the importance of a specified component because it is possible to keep all aspects of a procedure identical except for a single quantitatively manipulated variable. If results vary systematically, alternative explanations (e.g., demand characteristics; allegiance effects; and so on) weaken, although the possibility of these factors is not completely eliminated. In the case of word repetition, if the amount of repetition (given a proper rationale) has orderly effects, it is likely that the procedure systematically manipulates defusion as is claimed.

Parametric studies may also allow functionally distinct dependent variables to be identified. For the present study, these variables were *emotional discomfort* and *believability of a thought*. The previous study of this cognitive defusion procedure revealed similar changes in the two related but theoretically distinct dependent variables (Masuda et al., 2004). A parametric study can extend the current understanding of cognitive defusion and provide an experimental way to see if these two measures are two different ways of looking at the same event. If a parametric study showed identical impact on these two measures across very different quantitative values, it suggests that they may be measuring the same functional process. If the impact varied between the two measures across quantitative values of the independent variable, it would suggest that they do measure theoretically distinct aspects of the psychological reaction to negative self-relevant thoughts.

The previous defusion study (Masuda et al., 2004) used a single subject design where multiple treatment interference or other competing factors could not be ruled out. The present project consisted of two experimental studies. The present parametric studies used a group design, thus augmenting the experimental control in the previous study. This also means that a larger number of participants were used. Given the theoretical focus of the study, the use of a normal population seemed justifiable.

## Experiment 1

### *Participants, Thought Selection, and Assessment*

Seventy-five undergraduate students were recruited from an introductory psychology course subject pool (20 males and 55 females, mean age = 20.8). All participants fulfilled course requirement and received extra credit for participation. The experiment was conducted in a research room (3m x 5m).

Each participant was given an assessment sheet and asked to generate one self-relevant negative thought that she or he found particularly disturbing and believable (e.g., "I am stupid."). Participants were then asked to restate the thought in one word (e.g., "stupid"). The degree of

emotional discomfort and the believability of the thought were assessed using a 100-mm Likert-style visual analog scale before and immediately after the intervention. On the sheet of paper, a prompt “how uncomfortable is the thought?” was written above the discomfort scale, and “how believable (true) is the thought?” was written above the believability scale. Responses ranged from 0 (not at all uncomfortable) to 100 (very uncomfortable) for the discomfort scale, and from 0 (not at all believable) to 100 (very believable) for the believability scale.

Participants who could not come up with initial thoughts that were above 50 on discomfort or 20 on believability scores (both values at the 10<sup>th</sup> percentile for their respective measures) were eliminated in order to work with participants who had thoughts that fit the purpose of the procedure. Eight participants were excluded on this basis. An additional six participants were excluded due to extraneous methodological factors (e.g., not being able to repeat the thought fast enough, room unavailability; session disruptions by other arriving participants), leaving 61 participants. The target thought generated an average amount of discomfort of 72.6 ( $SD = 11.9$ ) and believability of 65.8 ( $SD = 22$ ; over 80% scored 50 or greater on believability), indicating a relatively high degree of discomfort and believability.

### *Procedure*

Participants were randomly assigned to one of three conditions: (a) defusion rationale and training only, (b) defusion rationale and training plus 3-second repetition of the self-relevant negative thought, and (c) defusion rationale and training plus 20-second repetition of the self-relevant negative thought. These three conditions were administered by two undergraduate research assistants trained by the first author. Each condition was closely scripted and a weekly research meeting was held to ensure adherence to the scripted intervention.

Prior to Experiment 1, small pilot investigations were conducted in order to estimate the proper duration of thought repetition. In these investigations, the duration of thought repetition was manipulated across participants (e.g., 5-, 10-, 15-second, etc). These participants reported that the discomfort of self-relevant negative thoughts disappeared immediately after they rapidly repeated the one-word version of that thought several times. They also reported that they began to experience the thought just like a sound with no apparent psychological meanings after about five seconds of rapid repetition. Based on these observations, the 3-second repetition was selected for Experiment 1 because it appeared to significantly reduce the discomfort, but not the believability, of negative self-relevant thought. The 20-second repetition was selected because it appeared to reduce both the discomfort and believability of negative self-referential thought.

*Rationale.* At the beginning of the intervention, a 5-minute rationale and training were provided. The rationale and training were drawn from the original ACT book (Hayes et al., 1999; see Masuda et al., 2004). It identified the positive aspects of language and thinking, but also addressed the role of language and thinking in human suffering. It was presented that self-referential negative thoughts may be relatively automatic and that people often identify with the literal content of their thoughts, but that a thought may also simply be a thought. To exemplify this, the participant was asked to say the word "milk" once and to notice all of its perceptual functions (e.g., “white,” “cold,” “creamy”). The participant was then asked to repeat the word "milk" out loud as rapidly as possible for approximately 20 seconds and to notice what happened to the perceptual functions. Participants typically reported that the meaning of the word began to disappear and most noted that more direct functions appeared (e.g., "the word milk did not mean

anything.” “It became just a sound.”). The experimenter then suggested that the participant apply this experience to his or her self-relevant negative thought, indicating that negative thoughts are also simply sounds with conventional meanings.

*Rationale plus 3 second or 20 second repetition.* Participants in these conditions received the defusion rationale and training as in the condition above. The participant was then asked to repeatedly state the one-word self-relevant negative thought (e.g., “fat”) aloud as fast as possible. The experimenter said, “stop” after either 3 or 20 seconds, depending on the participant’s assigned condition. As in Masuda et al. (2004), to maintain engagement in this condition, the experimenter provided a verbal prompt (i.e., “faster” and “louder”) to the participant after 5, 10 and 15 seconds.

### *Results of Experiment 1*

The means and standard deviations of change scores on both measures in all conditions are shown in Table 1. The key measure was the degree to which measures of discomfort and believability changed from pre- to post-intervention. Both change scores (and their underlying raw scores) significantly violated normality (for the change scores, Kolmogorov-Smirnov and Shapiro-Wilk statistics were either at or below  $p = .01$ ). For this reason a non-parametric analysis was used. The three conditions were compared for each measure with a Kruskal-Wallis test, with pairwise comparisons following significant overall tests. Because the focus was on a systematic relation with a manipulated parameter, there was no attempt to control for experiment-wise alpha, which would incorrectly treat tests as severable and lower overall power.

*Emotional Discomfort.* The overall Kruskal-Wallis test revealed a significant effect for condition on emotional discomfort ( $\chi^2(2) = 25.02, p < .001$ ). Pairwise comparisons revealed that the rationale condition reduced discomfort significantly less than both the 3 second ( $\chi^2(1) = 21.17, p < .001, d = 2.02$ ) and the 20 second conditions ( $\chi^2(1) = 16.48, p < .001, d = 1.64$ ), but that the latter two conditions did not differ ( $\chi^2(1) = 0, p = .99$ ).

*Believability.* The overall Kruskal-Wallis test revealed a significant effect for condition on believability ( $\chi^2(2) = 29.61, p < .001$ ). Pairwise comparisons revealed that the rationale condition reduced believability significantly less than both the 3 second ( $\chi^2(1) = 13.93, p < .001, d = 1.41$ ) and the 20 second conditions ( $\chi^2(1) = 22.14, p < .001, d = 2.17$ ). Unlike the case with emotional discomfort, the believability of the 20 second condition was significantly less than the 3 second condition ( $\chi^2(1) = 9.91, p = .002, d = 1.06$ ).

### *Discussion of Experiment 1*

Experiment 1 suggests that the rapid repetition of self-relevant negative thoughts, when combined with a clinical rationale and brief training, reduces the believability and emotional discomfort associated with them as compared to the clinical rationale and training procedure. This systematically replicates our previous findings (Masuda et al., 2004) and increases confidence in them. The impact of word repetition on believability, but not discomfort, varied across the two values (i.e., 3 sec and 20 sec) selected. These findings may suggest that the two measures are not functionally synonymous. Additionally, the systematic manipulation of the

duration of word-repetition seems to be evidence that word repetition is a critical and a quantitatively specifiable aspect of this defusion procedure.

Although Experiment 1 revealed interesting findings, there are several limitations. With respect to the purpose of the present investigation, one crucial limitation is that only two values of word repetition were used. That did not afford very detailed characterization of the parametric effect. Given this concern, a subsequent study (i.e., Experiment 2) was conducted with three distinct word repetition values: 1 second, 10 seconds, and 30 seconds. The 1-second repetition condition was selected due to the somewhat surprising results of the 3-second condition on discomfort. The 1-second condition was added to experiment 2 to investigate whether the very small number of repetitions (e.g., 3 repetitions of brief thoughts, such as “fat”) could significantly reduced the discomfort level of self-relevant negative thoughts.

A 10-second repetition, whose value was somewhat between 3- and 20- seconds, was added to experiment 2 in order to investigate where the condition reduced the believability of self-relevant negative thoughts greater than the 20-second condition did in Experiment 1. The 30-second condition was added to replicate the effect of the 30-second repetition condition used in the previous defusion study (Masuda et al., 2004). The 30-second condition was selected as the maximum duration in the present study because pilot investigations suggested that the effect of rapid word repetition satiated around 30 seconds.

## Experiment 2

### *Participants & Procedure*

Ninety-four undergraduate students were recruited from an introductory psychology course subject pool (27 males and 67 females, mean age = 20.2). The setting, procedure, exclusion criteria, and analytic strategy were identical to those in Experiment 1. Seventeen participants were excluded due to extraneous methodological factors or because the degrees of discomfort or believability for identified thoughts were below the previously presented cutoffs. Their target thoughts generated an average amount of discomfort of 72.5 ( $SD = 13$ ) and believability of 66.4 ( $SD = 17.7$ ; over 85% scored 50 or higher on believability), indicating a relatively high degree of discomfort and believability. Conditions were identical to the word repetition conditions in Experiment 1, except the duration of repetition was either 1, 10, or 30 seconds, depending on random assignment.

### *Results of Experiment 2*

The scores for both measures in all conditions are shown in Table 1.

*Emotional Discomfort.* The overall Kruskal-Wallis test revealed a significant effect for condition on emotional discomfort ( $\chi^2(2) = 14.94, p = .001$ ). Pairwise comparisons revealed that the 1 second condition reduced discomfort significantly less than the 10 second condition ( $\chi^2(1) = 6.15, p < .02, d = .73$ ) and the 30 second condition ( $\chi^2(1) = 13.59, p < .001, d = 1.26$ ), while the difference between the latter two conditions did not reach significance ( $\chi^2(1) = 3.23, p = .07, d = .50$ ).

*Believability.* The overall Kruskal-Wallis test revealed a significant effect for condition on believability ( $\chi^2(2) = 10.03, p < .007$ ). Pairwise comparisons revealed that the 1 second condition reduced believability significantly less than the 10 second condition ( $\chi^2(1) = 5.83, p < .02, d = .71$ ) and the 30 second condition ( $\chi^2(1) = 8.30, p = .004, d = .91$ ). The believability of the latter two conditions did not differ ( $\chi^2(1) = 1.31, p > .25, d = .32$ ).

### *Results of Experiment 1 & 2 Combined*

Because the results for Experiment 2 largely replicated those of Experiment 1 and a series of chi-square and *t*-tests revealed that the two experiments were not significantly different in the ratio of gender, age of participants, or pre-intervention levels of discomfort or believability of self-relevant negative thought ( $p > .05$ ), the data from both were combined in order to best characterize the parametric relationship between word repetition, discomfort, and believability. In order to determine which conditions were functionally equivalent, comparisons using the Kruskal-Wallis test were first sequentially calculated (rationale versus 1 second, 1 second versus 3 seconds, and so on). If comparisons were not significantly different, groups were combined. This process revealed three equivalent groupings: Rationale and 1 second; 3 seconds and 10 seconds; and 20 seconds and 30 seconds. These three groups were then compared in the same fashion as in Experiment 1 and 2. The overall parametric results are shown in Figure 1.

*Emotional Discomfort.* The overall Kruskal-Wallis test revealed a significant effect for condition on emotional discomfort ( $\chi^2(2) = 36.91, p < .001$ ). Pairwise comparisons revealed that the rationale/1 second combined group reduced discomfort significantly less than both the 3 second/10 second combination ( $\chi^2(1) = 25.23, p < .001, d = 1.21$ ) and the 20 second/30 second combination ( $\chi^2(1) = 29.18, p < .001, d = 1.43$ ), while the difference between the latter two combinations did not reach significance ( $\chi^2(1) = 2.25, p = .14, d = .31$ ).

*Believability.* The overall Kruskal-Wallis test revealed a significant effect for condition on believability ( $\chi^2(2) = 35.39, p < .001$ ). Pairwise comparisons revealed that the rationale/1 second combination reduced believability significantly less than both the 3 second/10 second combination ( $\chi^2(1) = 17.96, p < .001, d = .97$ ) and the 20 second/30 second combination ( $\chi^2(1) = 29.03, p < .001, d = 1.43$ ). The believability of the latter two combinations also differed ( $\chi^2(1) = 7.67, p = .006, d = .59$ ).

## General Discussion

Together the findings suggest that, in combination with an applied rationale and training, the rapid repetition of a self-relevant negative thought reduces the thought's believability and the emotional discomfort. Emotional discomfort goes down relatively quickly, and repetition in the 3- to 10-second range is effective. The reduction of believability takes more time, reaching its maximum in the 20 to 30 second range.

Conceptually, these data seem to suggest that, although related to each other, believability and emotional discomfort are not identical functional aspects of private events. Clinicians often rely solely on discomfort ratings (e.g., SUDS) to guide the application of exposure or similar techniques, for example. The recent acceptance and mindfulness-based CBT movement has suggested that, in addition to the degree of discomfort associated to private events,

how an individual sees and experiences them is crucial in understanding and treating human psychopathology. The believability of private events, which was measured in the present investigation, seems to capture the degree to which an individual is attached to or caught up by the event and is consistent with the assumption of this new movement in CBT.

Along with the current trend in CBT, the present study suggests that focusing exclusively on the emotional discomfort of cognition may be too narrow a view to treat the problems of cognition. This conceptual position may be worth exploring further because studies on acceptance and mindfulness-based interventions have shown that believability ratings often correlate with treatment outcome (e.g., Zettle & Hayes, 1986; Fisher & Wells, 2005). In practice, it makes sense to continue defusion exercises until believability ratings decline.

The rapid repetition of thoughts is only one of dozens of defusion techniques used in ACT and other mindfulness and acceptance-based methods. Researchers are beginning to examine other such techniques, such as stating a thought while doing the opposite behavior (Gutiérrez et al., 2004), physicalizing (Takahashi et al., 2002), and viewing thoughts and feelings as metaphorical passengers on a bus (Masedoa & Esteve, 2006). So far the results are positive. As a matter of research strategy it does not seem important to test each and every such technique. What needs to be determined is whether the overall process operates in accord with the underlying theory. The present study systematically replicates and strengthens our previous findings (Masuda et al., 2004) and provides support for cognitive defusion as a theoretically useful concept.

The present research has several conceptual and methodological weaknesses. It did not compare the rationale/training condition to a no-treatment condition, and the previous study compared it only to a thought control condition, so it is not yet known if the rationale is helpful compared to doing nothing at all. Additionally, none of the studies have examined the clinical impact of word repetition without a rationale. However, research on semantic satiation suggests that word repetition without a rationale is unlikely to be helpful (Esposito & Pelton, 1971).

It should also be noted that the impact of this defusion technique was examined only on one-word self-referential thought (e.g., "ugly") and was tested with a non-clinical population. In clinical use, it seems more important to fit the procedure to clinical needs, and to track emotional discomfort and believability.

Methodologically, while a parameter specific variable (e.g., duration of repetition) was systematically manipulated in each experiment, it was still unclear whether non-specific processes, such as demand characteristics or credibility, had influenced the present outcomes. A second limitation is that the sample is small. A third limitation is that the present research project exclusively relied on self-report measures. From an ACT perspective, discomfort and believability of private event are functional processes. Self-report type methods do not allow the investigators to measure these processes when they occur. It is difficult to directly assess these functional processes, but the presence of several studies on acceptance and mindfulness would seem to warrant the effort. Finally, although demographic and pre-intervention data suggested that it is justifiable to combine the two sets of experiments, it violated the premise of randomization and the interpretation of data is vulnerable to confounding factors. Therefore, additional replication studies are warranted and it is important to treat these findings as preliminary.

Despite these limitations, it seems very positive that the new behavior therapies are being exposed to relatively analytic examinations of their core processes early in their development as empirically supported procedures, rather than waiting for package dismantlement in the distant

future. As in the present study, so far the data suggest that these procedures are psychologically active even when tested in a minimal form and seem to work in theoretically coherent ways.

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