Low Dispositional Mindfulness as an Indicator of Poor Cognitive Control of Negative Memories

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LITERATURE REVIEW

Breakdowns in **cognitive control** (i.e., one's ability to increase or decrease thoughts at will) can lead to significant psychological problems addressed by cognitive interventions. For example, deficits in control of negative thoughts related to the past have been well linked to depression (Hertel & Mahan, 2008; Joorman, 2004; Matt et al., 1992), but extensive individual differences complicate rapid identification of those with a predisposition to poor cognitive control (Freeston et al., 1991). As a result, it would be helpful to identify attributes related to a reduced ability to manage negative thoughts.

When given enough time, cognitive resources, and opportunity, people are often able to suppress unwanted thoughts or memories, although individuals vary greatly in their ability to do so (Freeston et al., 1991; Levy & Anderson, 2008). Recently, a new experimental task has given cognitive psychologists an innovative method to explore a participant's ability to use cognitive control during retrieval from long-term memory (Anderson & Green, 2001). The Think/No-Think Task has also allowed new lines of clinical research into the relationship between cognitive control of memory processes and psychological disorders (Hertel & Gerstle, 2003; Hertel & Mahan, 2008), especially on the effect of emotionality on recall (Depue, Curran, & Banich, 2007). Evidence has also emerged to suggest that differences in self-regulating behaviors may be related to individual differences in cognitive performance (Donaldson, Lam, & Mathews, 2007; Joormann, Hertel, Brozovich, & Gotlib, 2005). Together, these studies indicate the presence of a cognitive control network that varies in efficiency between individuals and that is integral to the control of memory with emotional content. Furthermore, this control can fail due to overuse or individual differences, and when it does, those failures often lead to negative outcomes, such as increases in negative thoughts and low mood.

One particularly promising characteristic for accessing individual differences in cognitive control is **dispositional mindfulness (DM)**, a measure of one's ability to stay focused in day-to-day life. Recent research has begun to establish a link between DM and brain areas active in cognitive control processes (Modinos, Ormel, & Aleman, 2009). The current study seeks build on this literature to determine if DM can identify individual differences in performance on an emotionally valenced cognitive memory task.

METHOD

Participants were **28 students** at a large southeastern public university (50% male) with a mean age of 22.0 (SD = 6.57) recruited through a participant pool and rewarded with course credit. Three were excluded for poor performance.

DM was assessed using the **Mindful Attention Awareness Scale** (MAAS; Brown & Ryan, 2003). This 15-item, self-report measure produces scores on a single factor representing one's ability to stay mindful in daily life. The memory task featured Anderson and Green's (2001) **Think/No-Think Task** and **photo/picture stimuli** employed by Depue, Banich, and Curran (2006) from the International Affective Picture Series.

The **computer task** explored each participant's ability to use intentional cognitive control to remember or forget negative and neutral stimuli as prompted (See figure below). In Phase I, participants learned 80 face-photo cues (half male) displayed in blocks for 3.5 sec with matched pictures (half negative, half neutral) taken from the IAPS (all images 225 x 225 pixels). Training consisted of four presentation cycles followed by forced-choice testing using a response box. Of these, 16 were reserved for a baseline. In Phase II, cue photos were presented with a 30-mm color border that prompted them either to attempt to remember (green border) or to avoid remembering the matching images (red border). In Phase III, participants were tested on their recall of all 80 pairs. Baseline-corrected recall scores (BCRSs) were generated for four conditions, crossing the think/no-think conditions with the negative or neutral stimuli, and compared to performance on the MAAS.

Figure 1. Screenshots of the computer task at each stage of the experiment.

After the risks of participation were explained and informed consent was obtained, participants were provided with preliminary paper-and-pencil measures to complete. Then, they started Phase I, a training phase that consisted of two parts: a stimulus learning period and a testing period. Testing used a forced-choice method between a previously learned distractor and the correct target. Stimuli were presented using E-Prime (version 1.1-SP3) on a 17-inch, flat-screen monitor. Throughout the task, breaks were provided and participants were given an opportunity to rest their eyes. The entire experiment time was approximately 2 hours.

ABSTRACT

Unwanted negative thoughts can be problematic in people who have trouble controlling them. Recent research has identified a new paradigm, the Think/No-Think task, that can be used to investigate individual differences in cognitive control of emotional memories. These differences in memory recall may be related to other variables to investigate cognitive and clinical vulnerabilities. Relevant theories are discussed.

Method. Data was analyzed from 25 participants (56.0% women) with a mean age of 22.2 years. Demographic and psychometric data was collected on dispositional mindfulness, ruminative style, depressive symptoms, cognitive intrusions, and stress. These scores were related to memory performance on the Think/No-Think task using image stimuli with negative and neutral content.

Results. Planned analyses showed that participants remembered a greater percent of neutral stimuli and think stimuli. An extreme-groups analysis was generated using mindfulness scores. Baseline-corrected recall scores submitted to a 2 x 2 x 2 ANOVA analysis produced a significant 3-way interaction. Follow-up analyses attributed this effect to a reversed pattern of memory for negative stimuli in the low mindfulness group where participants showed worse recall in the think condition than the no-think condition. Additional relationships with clinical variables are reported.

Discussion. The ability to forget unwanted thoughts at will is a key skill for the efficient functioning of memory. These results suggest that participants who endorse low day-to-day mindfulness may show a striking failure in their ability to cognitively control memory for negative memories. Implications for clinical and cognitive psychology are discussed and recommendations are made for future research.

RESULTS

- DEPENDENT VARIABLE: Baseline-corrected recall scores (BCRS) were computed by subtracting the average recall (*M* = 53.5%) of the 16 baseline items (not included in the experimental phase) from the final recall scores.
- ANOVA: BCRS were entered into a 2 Strategy x 2 Valence repeated-measures ANOVA (see Figure 2 above right). Main effects for strategy and valence showed that think items were recalled more than no-think items and neutral items were recalled more than negative items. A significant interaction [$F(1,24) = 20.02$, $p < .001$, $\eta_p^2 = .46$] indicated a greater effect for strategy in the neutral condition than the negative condition.
- MINDFULNESS: MAAS total scores were correlated with BCRS scores in the think/negative condition (r = .56, p = .004) and a sizable but non-significantly with the think/neutral condition ($r = .40$, $p = .051$). Thus, MAAS scores for each participant ($M = 4.06$, $SD = 0.68$) were used for an extreme-groups analysis. A median split ($Mdn = 4.13$), rejecting five participants with the median value and for missing data, produced a high control group ($n = 9$, $M = 4.70$, $SD = 0.39$) and a low control group ($n = 10$, $M = 3.45$, $SD = 0.48$). A Cohen's d of 2.86 confirmed statistically different groups.

Comparing between these groups using a 2 Strategy x 2 Valence x 2 Group ANOVA on BCRS produced a significant 3-way interaction, $F(1, 17) = 5.39$, p = .033, $\eta_p^2 = .24$. Investigation of this result showed that the interactions of valence and strategy differed greatly between groups (see Figure 3 below). High controllers remembered more think items than no-think items for both negative and neutral stimuli. Low controllers showed a similar pattern for neutral stimuli. However, for negative stimuli, low controllers showed a deficit in cognitive control, i.e., recall in the think condition was not greater than the no-think condition.

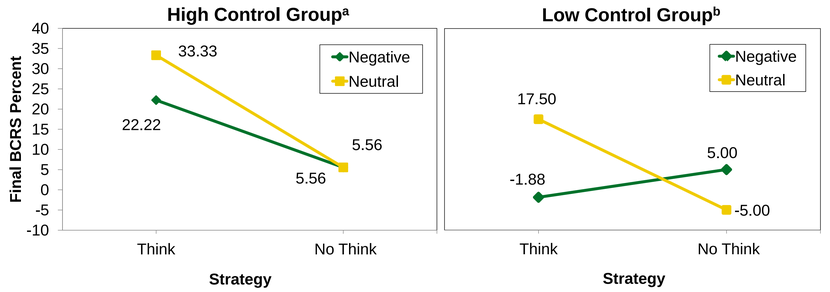

Figure 3. BCRS percents show the significant three-way strategy x valence x group interaction (means at endpoints). As shown in the left graph, the effect of strategy in the high controller group is similar across categories of valence. However, for the low controller group (right), there is a significant two-way interaction indicating the breakdown in cognitive control of memory exhibited by the lack of a strategy effect in the negative condition.

[a] Strategy x valence interaction for the high control group was not significant ($p = .095$).

[b] Strategy x valence interaction for the low control group was significant ($p < .001$).

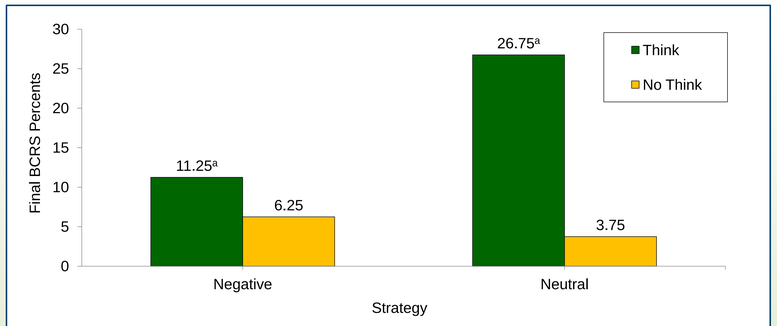

Figure 2. Results from a 2 Valence x 2 Strategy ANOVA on baseline-corrected recall percents. Means are displayed above bars. Main effects for strategy and valence and the interaction were significant (all p's ≤ .001). [a] Indicates the mean is significantly different from zero.

DISCUSSION

These results carry implications for the use of mindfulness in cognitive therapies. The ability to remember and forget cognitive events at will is an important skill for healthy, efficient cognitive functioning. In this study, participants' memory performance generally resulted in predicted patterns:

- *Forgetting occurred in all conditions.*
- *Participants were mostly able to remember or forget as instructed.*
- *Neutral items were recalled better than negative items (~6.5%).*
- *Think items were recalled better than baseline or no-think items.*

The chief finding, however, was that stimulus recall showed a surprising vulnerability to emotional content. Those reporting a good ability to maintain mental focus in day-to-day life (high DM) showed effective patterns of cognitive memory control for both negative and neutral stimuli whereas **those reporting less ability to maintain mental focus (low DM) exhibited poor cognitive control of memory for negative but not neutral stimuli.** In fact, think items were remembered nearly 7% less than no-think items. Simply, those low in DM showed no evidence of cognitive control on new memories having negative content.

Despite the limitations in this study—which include possible participant fatigue, modestly lower baseline recall than other studies, and insufficient power to identify small effects—-the current study is one of the first to identify the role of dispositional mindfulness as a clinical influence on successful cognitive control of emotional memory. If replicated, this finding could lead to a significant step forward in the theoretical understanding of individual differences in memory performance. Ultimately, these results support a call for future research to replicate and build on the role of DM as a simple, viable method of identifying those for whom mindfulness training may be particularly helpful and suggest directions for future research on clinical disorders that feature poor control of negative thoughts.

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