The Relationships between Mindfulness, Distraction Control, and Working Memory
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Abstract
In recent years, there has been a growing interest in the topic of mindfulness in psychological science, particularly as it pertains to health, well-being, and cognition. Yet, to date, little is known about the relationships between mindfulness and common cognitive processes, such as working memory and distraction control. Using a sample of 54 young adults aged 18 to 34, correlations were examined between the three factors and the Reading with Distraction task (RWD), Operation Span for Working Memory Capacity (Ospan), Cognitive Failures Questionnaire (CFQ), and Five Facet Mindfulness Questionnaire (FFMQ). Pearson product-moment correlation analysis revealed a strong negative correlation between cognitive failure scores (CFQ) and mindfulness scores (FFMQ). In addition, our results also showed a strong negative correlation between the Observe facet of the FFMQ and distractibility scores (RWD). The results of the current study suggest that mindfulness is negatively associated with cognitive failures. This association may be of interest to individuals who experience frequent cognitive blunders and/or those interested in mindfulness practice.

People often experience cognitive lapses, such as forgetting to turn off the lights when a room is not in use. However, these cognitive failures, despite being common lapses in perception, memory, and motor functions, have garnered relatively little attention from researchers over time (Efklides & Sideridis, 2009); the existing literature has demonstrated that these slips may be composed of memory lapses, distractibility, and blunder (Wilkerson, Boals, & Taylor, 2012) but has not made clear a relationship between these slips and similar cognitive elements. Furthermore, research involving Broadbent, Cooper, FitzGerald, and Parkes' (1982) Cognitive Failures Questionnaire (CFQ)—a successful measure of one's susceptibility to mental error (e.g. Larson, Alderton, Neideffer, & Underhill, 1997)—has been used in the past to suggest that correlations between cognitive failures and other absent-minded traits, such as distractibility, may exist (Broadbent et al., 1982) but no clear evidence has directly corroborated such details.

Thus, in the present study we investigated the relationships between cognitive failures and other relevant factors, as to better understand this widespread phenomenon.

Distractibility, or the extent to which one is distracted by one's environment (Connelly, Hasher & Zacks, 1991), may be associated with cognitive failures, as both cognitive factors are closely associated with attention. In past studies, distractibility—as assessed by the Reading with Distraction (RWD) task, which measures distraction control by assessing one's ability to filter task-irrelevant information (Connelly, Hasher & Zacks, 1991)—was found to increase when attention is inhibited. Furthermore, constant vigilance, or continuous attention, appeared to be one factor required to reduce both cognitive failures and distractibility (Clark, Parakh, Smilek, & Roy, 2012). In addition, as one may become more vulnerable to both cognitive failures and distractibility as one ages (Carlson, Hasher, Connelly,
research has reported a positive correlation between cognitive failures and self-reported memory deficits (Broadbent et al., 1982). WM has also been found to be associated with attention control (Buttle, 2011), as well as fluid intelligence and intentional processing (Unsworth & Engle, 2005). However, its connection to cognitive failures is unclear due to the lack of consistent findings pertaining to the topic (Unsworth, Brewer, & Spillers, 2012; Wright & Osborne, 2005). Though, WM has been associated with mindfulness in the past: research found overlapping relationships between mindfulness, self-control, and WM (Black, Semple, Pokhel, & Grenard, 2011; Fisak & von Lehe, 2012) where a major finding among these being that mindful attention control can compensate for working memory capacity (WMC) depletion and even lead to an increase in WMC (Jha, Stanley, Kiyonaga, Wong, & Gelfand, 2010). This suggests that cognitive failure, or inattentive mindlessness, may be reduced by compensating for the lack of attention or WMC depletion through the means of developing mindfulness—and thus, mindfulness may be positively correlated with WM.

In the current study, we searched for potential associations between mindfulness, distraction control, and WM. In addition, we looked for associations between the five subscales of mindfulness, distraction control, and WM. More specifically, the following predictions were examined:

Hypothesis 1. The CFQ and RWD task scores will be significantly and positively correlated with one another, since both tasks are intended to measure distraction control (i.e. self-reports for cognitive failure and performance-based tests for distractibility, respectively).

Hypothesis 2. The degree to which one makes cognitive blunders, as measured by the CFQ, and one's level of mindfulness will be significantly and negatively correlated with one another.

Hypothesis 3. The FFMQ subscales measuring mindfulness (Observe, Describe, Act with awareness, Non-judge, and Non-react) will be significantly and
negatively correlated with distraction measure CFQ.

Hypothesis 4. Significant negative correlation between WM and cognitive blunders, and significant positive correlation between mindfulness and WM.

Method

Participants

A total of 56 young adults were recruited from the University of Toronto and the surrounding area. Most were recruited from a third-year psychology lab course; all were compensated with small treats and baked goods. Two participants were excluded from the analyses due to low math accuracy scores on the Operation Span Task (less than 85%). The final sample consisted of 54 young adults (28 males; 26 females), with ages ranging from 18 to 34 (M = 22.63, SD = 3.48). All participants reported normal to corrected-to-normal vision. Twenty-eight participants reported English as their second language.

Materials

Reading with Distraction Task (RWD). The RWD stimuli were the same as those reported by Connelley et al. (1991), except that two out of the four control stories were omitted. The RWD task consisted of six narrative passages that measured how accurately one reads a story written in italics while avoiding all upright-font words that are scattered throughout the story. Each story was approximately 125 words long, with 60 distracting words in each passage. All text was presented in 12-point serif font (SG Times).

Operation Span (OSPAN). WMC was assessed using an adapted procedure detailed by Conway and Engle (1996). The current procedure was an automated, and computerized version of the OSPAN task from COGLAB, an online computer-based inventory of cognitive tests (Francis, Neath, MacKewn, & Goldthwaite, 2003). In each trial, the participant was presented with a simple math equation (e.g., Is 10/2 + 2 = 7), which they read aloud before deciding whether a given answer was correct or incorrect by pressing a button. Afterwards, the participants read aloud several words. They then recalled the words that they had seen at the end of each trial set, in chronological order, by clicking the appropriate buttons. The trial sets ranged from two to six equation-word pairs, for a total of 15 trial sets.

Cognitive Failures Questionnaire (CFQ). The CFQ was a self-report questionnaire consisting of 25 questions that assessed absent-mindedness, errors due to inattention, and failures in perception, memory, and motor function over the last six months (Broadbent et al., 1982). Some sample items include: “Do you find you forget people’s names?” and “Do you daydream when you ought to be listening to something?”. Items were rated using a 5-point Likert scale that indicated how often each item was true for the individual (e.g., 0 = never and 5 = Very often). Higher scores indicated more cognitive failures, while lower scores indicate less cognitive failures.

Five Facet Mindfulness Questionnaire (FFMQ). The FFMQ was a self-report questionnaire that measured trait mindfulness (Baer et al., 2006). This measure was based on five independently developed mindfulness questionnaires that yielded five factors representing different elements of mindfulness as it is currently conceptualized: observing one’s environment, describing one’s environment, acting with awareness, being non-judging of inner experience, and being non-reactive to inner experience. The FFMQ consisted of 39 statements, such as “I am easily distracted”; several were reverse-scored. Each item was rated on a 5-point Likert scale (e.g., 1 = never or very rarely true and 5 = very often true or always true) based on how much it applied for the individual. For a composite mindfulness score, the scores of all five subscales were summed and totalled, with higher scores indicating higher trait mindfulness.

Procedure

Informed consent was collected from all partici-
Correlational Analysis

Correlations among all of the variables are presented in Table 2. The significant correlations shown below reflect a fair effect size, despite the small overall sample size of the participants.

Cognitive Failures and Reading with Distraction

We hypothesized that the CFQ and RWD would be significantly correlated with one another since the CFQ is a self-report measure of distractibility and the RWD is a task that measures distraction control. Surprisingly, the data obtained from the current study does not support an association between the two constructs, \( r(54) = .115, p = .409 \). But this may have been because the RWD task has been validated for measuring distractibility in older adults (Connelly, Hasher, Zacks, 1991), and not younger adults.

Trait Mindfulness and Cognitive Failures

Mindfulness and Cognitive Failures were two constructs proposed to have a high likelihood of being related to each other, given that they both measure inattention (Baer et al., 2006). The data obtained in the current study suggests that the two constructs are indeed related: Total scores on the FFMQ correlated significantly and negatively with the total scores on the CFQ, \( r(52) = -.549, p < .001 \) (see Figure 1). Significant negative correlations were also found for three of the five FFMQ subscales and the CFQ: Describe, \( r(54) = -.425, p = .001 \), Act with Awareness, \( r(54) = -.576, p < .001 \), and Non-react, \( r(54) = -.484, p < .001 \). Non-significant negative correlations were found for the Observe and Non-judgment FFMQ subscales and the CFQ: Observe, \( r(54) = -.209, p = .130 \), and Non-judgment, \( r(54) = -.252, p (.067) \).

Reading with Distraction and Mindfulness Subscales

Although the mindfulness composite score did not significantly correlate with the RWD task, \( r(54) = -.212, p = .123 \), we found one small but significant negative correlation between the observe subscale and the
low on the observe facet of mindfulness took more time to read passages that included difficult distractions.

Interestingly, the OSPAN scores and all other measures showed no significant correlations, thereby contradicting our initial hypothesis that higher WMC will predict higher mindfulness, fewer reported cognitive failures, and better performance on the RWD task. This lack of significant results, however, may be due to a small sample size. For the correlation analysis to be sensitive enough to detect a large effect size difference between two populations at $\alpha=0.05$, approximately 66 participants were needed in each sample group (Cohen, 1992)—a number we did not have, though our number was extremely close anyway. Furthermore, it was possible that the general tendency of young adults to score well on the OSPAN task and demonstrate ceiling effects led to less variation in OSPAN results than there could have been with a sample with a larger age range.

Other limitations in the current study include the failure to control for the presence of psychiatric or neurological disorders in the participants, as this could have influenced the results. Furthermore, we did not control for the time of day when the participants were tested. This was particularly problematic because an individual’s circadian rhythm determines when their cognitive abilities function most optimally, as shown in previous research studies examining cognitive performance (e.g., distraction control) in older and younger adults during their non-optimal versus optimal time of day (May, Hasher, & Stoltzfus, 1993). Thus, it was possible that testing young adults during their optimal versus non-optimal time of day could result in alternative findings, especially in our experiment, because they were all tested randomly throughout the day, due to time constraints and limited resources we had to control the time tested. Participants for the current study were also not selected at random, but rather, many participants were classmates, colleagues, and personal acquaintances of the researchers. Finally, we did not find any significant associations between other factors and RWD task scores, perhaps because the RWD task scores were also not selected at random, but rather, many participants were classmates, colleagues, and personal acquaintances of the researchers.
has been validated as a sensitive measure for assessing distraction control in older adults (Connelly, Hasher, Zacks, 1991)—but not in younger adults. Thus, it is possible that the Reading with Distraction task was not a sensitive enough tool to capture distraction control in younger adults.

Overall, the results of our study contribute to the growing body of research that suggests that mindfulness can reduce the cognitive blunders, and improve attention and concentration (Grossman et al., 2004; Zylowska, et al., 2008). In the future, more controlled investigation in a larger sample should be conducted in future studies in order to better understand the relationship between mindfulness, cognitive failures, WMC, and the ability to ignore distractions.

Acknowledgements

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References


Wilkerson, A., Boals, A., & Taylor, D. J. (2012). Sharpening our understanding of the


**Appendix A**

Table 1. Means and Standard Deviations for all Scales, Subscales, and Scores (N = 54)

<table>
<thead>
<tr>
<th>Variable</th>
<th>M</th>
<th>SD</th>
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<tbody>
<tr>
<td>FFMQ</td>
<td>122.65</td>
<td>19.48</td>
<td>.91</td>
</tr>
<tr>
<td>FFMQ_Obs</td>
<td>24.30</td>
<td>6.15</td>
<td>.83</td>
</tr>
<tr>
<td>FFMQ_Des</td>
<td>26.94</td>
<td>5.26</td>
<td>.82</td>
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<tr>
<td>FFMQ_AWA</td>
<td>25.22</td>
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<td>.83</td>
</tr>
<tr>
<td>FFMQ_NJ</td>
<td>25.56</td>
<td>7.64</td>
<td>.92</td>
</tr>
<tr>
<td>FFMQ_NR</td>
<td>20.72</td>
<td>4.76</td>
<td>.81</td>
</tr>
<tr>
<td>CFQ</td>
<td>39.96</td>
<td>12.58</td>
<td>.89</td>
</tr>
<tr>
<td>RWD</td>
<td>50.65</td>
<td>22.77</td>
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<tr>
<td>OSPAN</td>
<td>39.88</td>
<td>12.59</td>
<td>-</td>
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</table>

Table 2. Summary of Intercorrelations for Scores on the FFMQ, FFMQ Subscales, CFQ, OSPAN, and RWD task (N = 54)

<table>
<thead>
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<th>Measure</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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<tr>
<td>1. FFMQ</td>
<td>-</td>
<td>-.549**</td>
<td>-.212</td>
<td>.187</td>
</tr>
<tr>
<td>2. CFQ</td>
<td>-.549**</td>
<td>.</td>
<td>.115</td>
<td>-.054</td>
</tr>
<tr>
<td>3. RWD</td>
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<td>.115</td>
<td>-</td>
<td>-.129</td>
</tr>
<tr>
<td>4. OSPAN</td>
<td>.187</td>
<td>-.054</td>
<td>-.129</td>
<td>-</td>
</tr>
<tr>
<td>5. OBS</td>
<td>.639*</td>
<td>-.209</td>
<td>-.335*</td>
<td>.282*</td>
</tr>
<tr>
<td>6. DES</td>
<td>.710**</td>
<td>-.425**</td>
<td>-.118</td>
<td>.120</td>
</tr>
<tr>
<td>7. AWA</td>
<td>.676**</td>
<td>-.252</td>
<td>-.194</td>
<td>-.029</td>
</tr>
<tr>
<td>8. NJ</td>
<td>.676**</td>
<td>-.252</td>
<td>-.020</td>
<td>.126</td>
</tr>
<tr>
<td>9. NR</td>
<td>.763**</td>
<td>-.484**</td>
<td>-.066</td>
<td>.206</td>
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</table>

Note. *p < .05, two-tailed; **p < .01, two-tailed