

Relationship between Belief in Determinism/Free Will and Mindfulness: Experiment I

William G. Collier
University of North Carolina at Pembroke

Xinyan Shi
University of North Carolina at Pembroke

This study examined possible interactions between mindfulness and induced beliefs in free will/determinism. Participants read either free will, determinism or neutral induction statements. Participants were also identified as having either high or low in mindfulness based on their MAAS scores. Then, participants answered a number of questionnaires. Those with higher mindfulness scores reported experiencing more positive affect and less negative affect than low mindful participants. There were several 2 (mindfulness) X 3 (type of induction) interactions for participants' reaction times to some questionnaires. Results are discussed in terms of improved attentional processing and in terms of high/low decision boundaries.

INTRODUCTION

In recent years there has been an increased research interest in studying mindfulness. Mindfulness is a psychological construct characterized as paying attention to the present moment without judging what is happening both internally and externally. By being present, it allows an individual to be aware of the context of his/her emotions, mental activities, and external environment, which may lead to more clarity and insight of current circumstances, more openness to new information, and more creative ways of solving a problem. The subjective “feel” of mindfulness is that of a heightened state of involvement and wakefulness or being in the present (Langer & Moldoveanu, 2000).

Earlier studies of mindfulness mainly focused on studying the characteristics of mindfulness (e.g., Chanowitz & Langer, 1981; Langer, Blank, & Chanowitz, 1978). Recently, mindfulness has been studied by researchers across different disciplines, such as health, business and education. One area of focus has been the relationship between mindfulness and attention. One model proposes that the phenomenon of attention is not a singular ability, but rather attention consists of three networks (Posner & Pertersen, 1990). Each network of attention carries out separate aspects of attention and different areas of the brain are activated in each of these networks of attention. The three networks consist of alerting, orienting and executive control (Fan, McCandliss, Sommer, Raz & Posner, 2002). First, *alerting* refers to a state of preparation in which a person is expecting a stimulus (i.e., a person is expecting a stimulus to appear). Second, *orienting* refers to directing one's attention to one specific location. Third, in the context of this

model of attention, *executive control* refers to one's ability to control one's response (i.e., control conflicting responses) (Petersen & Posner, 2012).

Previous researchers (Jha, Krompinger & Baime, 2007; van den Hurk, Giommi, Gielen, Speckens & Barendregt, 2010) have studied this model in connection with mindfulness meditators and mindfulness-based stress reduction (MBSR) training. Jha, et al. (2007) found that mindfulness meditators (with a mean of five years of experience in concentrative meditation) demonstrated better *executive control* than those that had no prior experience with mindfulness techniques. In addition, mindfulness meditators that had completed a one-month residential mindfulness meditation retreat demonstrated improved *alerting* as compared to participants in MBSR and those in a control condition with no meditation experience and no training. This improved alertness was particularly found in the no cue condition. Next, it was found that participants without any mindfulness experience that underwent MBSR (consisting of a weekly 3-hour long class on meditation and other mindfulness-based exercises for a total of 8 weeks) improved in their *orienting* as compared to both the control and mindfulness retreat conditions. Van den Hurk, et al. (2010) found that mindfulness meditators (with a mean of 14.5 years of experience in mindfulness meditation) had improved *orienting* attention and *executive* attention accuracy as compared to matched controls that had no experience with mindfulness meditation. These improvements in the three networks of attention were all indicated by shorter reaction times. Thus, it would seem that mindfulness improves all three of the proposed networks of attention.

In this study, we examine the relationship between mindfulness and reaction time when a belief is introduced. In particular, we are interested in the interplay between mindfulness and the belief. Furthermore, we discuss how well the executive control networks of attention can help explain the relationship between mindfulness and reaction time in the presence of a certain belief.

A belief system is a cognitive mechanism that helps an individual comprehend the world with or without evidence that something is true. It can be classified as spiritual, philosophical, ideological, etc. Each individual forms a set of beliefs about the world based on his or her life experiences, upbringings, education, etc. However, the set of beliefs is constantly updated through learning new information and having new experiences. When new information or new experiences contradict one's existing beliefs, then the individual either accepts the new information and alters his or her current beliefs, or the individual rejects the new information as false or irrelevant and maintains his or her current beliefs. Many factors play a crucial role throughout the process. One of those factors is attention. Since the fundamental aspect of mindfulness training is the training of attention, in the present study we investigated how one's mindfulness level relates to one's processing of free will/determinism statements.

The free will/determinism induction statements used in our study were the same as the ones used by Vohs and Schooler (2008, Experiment 2). In experiment 2, Vohs & Schooler (2008) induced participants into three different conditions, including: free will, determinism and neutral. This induction technique consisted of participants reading and focusing for one minute on each of fifteen statements consistent with either a belief in free will, a belief in determinism or neutral factual statements. Vohs and Schooler (Experiment 2) found that those in the determinism induction group scored lowest on the free will scale and also scored highest on the scientific determinism scale. In addition, there were indications that participants in the determinism group cheated on a task to earn more money, whereas there was no indication of participants cheating in the free will and neutral induction groups. Other studies on social behavioral impacts of believing in free will or determinism include Stillman, Baumeister, Vohs, Lambert, Fincham and Brewer (2010) who found that possessing a belief in free will predicted better career attitudes and job performance. In addition, Baumeister, Masicampo & DeWall (2009) found that a disbelief in free will reduced helping and increased aggression. Although the current study did not attempt to replicate Vohs & Schooler's (2008) findings on cheating, this study did use the induction technique from their experiment 2.

There are also important differences between our study and previous studies on mindfulness. Previous studies have examined the effect of mindfulness training or meditation on attention, whereas this study examined differences on the executive control network of attention between inherently low and high mindful individuals. No attempt was made in this study to influence participants' mindfulness. In this

paper, Issues we will investigate three main issues. First, would one's mood relate to one's mindfulness level? To study that, we use the brief scales to measure the two primary dimensions of mood— Positive and Negative Affect (PANAS Scales), developed by Watson, Clark & Tellegen (1988). We predicted that participants with higher level of mindfulness experience more positive affect and less negative affect than participants with lower level of mindfulness. Second, we study the impact of induction technique on participants' belief in free will/determinism. We predicted that participants in the Free Will induction group score higher on the Free Will Scale subscale whereas participants in the Determinism induction group score higher on the Fatalistic Determinism Scale. Third, we hypothesized that participants with higher level of mindfulness may experience a faster response time than participants with lower level of mindfulness. The rationale behind this hypothesis is that a participant with a higher level of mindfulness may have a higher performance due to advanced executive control of attention, thus he/she process the information stimuli from the free will/determinism statement using a shorter time. Conversely, a participant with a lower level of mindfulness may have less advanced executive control of attention, which causes the response time to be longer. Furthermore, since neutral statement has no information with perceived stimulus, we predicted that the executive control of attention may or may not be different among participants with a higher mindfulness and the participant with a lower level of mindfulness.

EXPRIMENT

The current study uses the belief induction technique that Vohs and Schooler (2008) utilized in their second experiment. Using this induction method, participants will read and focus for one minute on each of fifteen statements that are consistent with either: free will, determinism or neutral statements. In the current study, mindfulness will also be assessed so that a possible interaction between mindfulness and belief in free will can be examined.

METHOD

Participants

One hundred eighty-three participants were recruited from a mid-sized state university in the Southeastern United States. Participants ranged in age from 18 to 54 ($M = 20.17$). One hundred thirteen participants were female and seventy were male. There are 68 African American, 54 Caucasian, 25 Native American, 14 Multi-Ethnic, 11 Latin American, 7 other, 3 Asian and 1 Polynesian.

Apparatus

Dell optiplex 3010 computers and MediaLab (v 2010.2.19) software.

Materials

The materials utilized in this experiment were the Mindfulness Attention Awareness Scale (MAAS; Brown & Ryan, 2003), the Free Will and Determinism Plus Scale (FAD-Plus; Paulhus & Carey, 2011) that includes subscales for Free Will Scale, Fatalistic Determinism, and Unpredictability, the Positive and Negative Affect Schedule (PANAS; Watson et al., 1988), the Neutral, Free Will and Determinism induction statements previously used by Vohs and Schooler (2008, Experiment 2), and a brief demographics questionnaire.

Procedure

There are one to six participants at each session of this experiment. Each participant first read and signed the consent form. Then, participants were assigned to one of the three induction conditions where they read either the neutral, determinism or free will induction statements during the experiment. After participants were assigned to an induction condition, the appropriate software program began. Once the

program began the order of the questionnaires and statements was the MAAS, followed by the induction statements, then the FAD-Plus, the PANAS and the demographics questionnaire. Once the participants completed the experiment they were given a debriefing statement and dismissed from the experiment.

RESULTS

Preliminary Analysis

The mindfulness score for all the participants ($N = 183$) has a mean of 3.73 ($SD = 0.8$). A median split for the mindfulness scores placed participants into low mindfulness ($N = 91$, $M = 3.09$, $SD = 0.5$) and high mindfulness ($N = 92$, $M = 4.37$, $SD = 0.47$) groups for further analyses.

Both the answers to the questionnaires themselves and participants' reaction times (RT) to the questionnaires were examined.

Questionnaire Answers Analyses

2 x 3 Analyses

A 2 (low/high mindfulness) x 3 (type of induction statement) Multivariate Analysis of Variance found no significant interactions for answers to the questionnaires.

Main Effects Analyses

A number of main effects, however, were found and they are reported below.

Positive Affect Scale of the PANAS. A significant main effect for mindfulness was found for participants' ratings of the positive affect words on the PANAS [$F(1, 183) = 9.66$, $p < .005$, $d = .05$]. High mindful participants ($M = 34.93$) reported experiencing more positive affect than low mindful participants ($M = 31.44$).

Negative Affect Scale of the PANAS. A significant main effect for mindfulness was also found for participants' ratings of the negative affect words on the PANAS [$F(1, 183) = 5.41$, $p < .05$, $d = .03$]. Low mindful participants ($M = 19.12$) reported experiencing more negative affect than high mindful participants ($M = 16.67$).

Free Will Scale of the FAD-Plus. A significant main effect for type of induction statement was found for participants' ratings for the Free Will subscale [$F(2, 183) = 5.87$, $p < .005$, $d = .06$]. Bonferroni corrected post hoc analyses found participants that had read the free will induction statements ($M = 4.11$) scored higher on the free will scale than participants that had read the determinism induction statements ($M = 3.74$).

Fatalistic Determinism Scale of the FAD-Plus. A significant main effect for type of induction statement was found for participants' ratings for the Fatalistic Determinism subscale [$F(2, 183) = 3.27$, $p < .05$, $d = .04$]. Bonferroni corrected post hoc analyses found participants that had read the neutral induction statements ($M = 2.96$) were more unsure on their answers (with 3 = Unsure) than participants that had read the free will induction statements ($M = 2.61$).

Unpredictability Scale of the FAD-Plus. A significant main effect for type of induction statement was found for participants' ratings for the Unpredictability subscale [$F(2, 183) = 3.54$, $p < .05$, $d = .04$]. Bonferroni corrected post hoc analyses found participants that had read the determinism induction statements ($M = 3.75$) scored higher on the unpredictability scale than participants that had read the free will induction statements ($M = 3.51$).

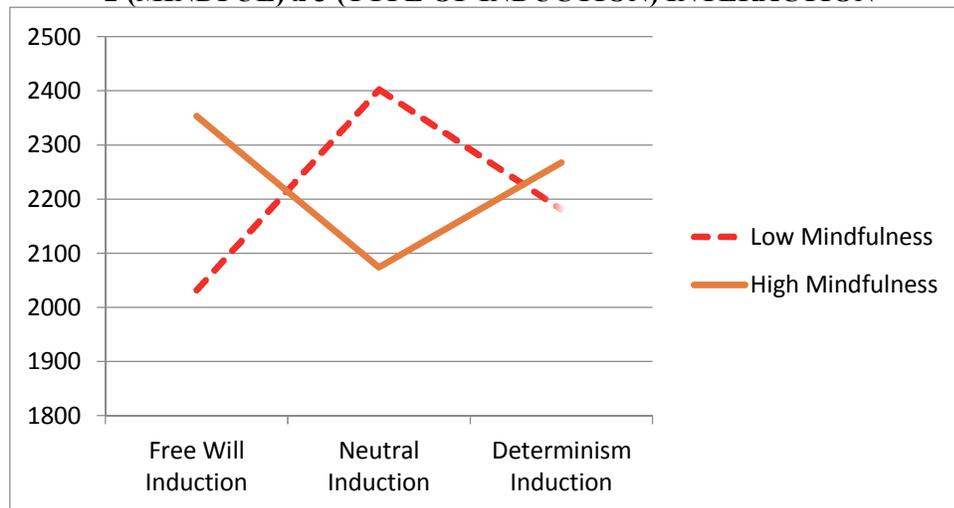
Questionnaire Reaction Time (RT) Analyses

2 x 3 Analyses

A 2 (low/high mindfulness) x 3 (type of induction statement) Multivariate Analysis of Variance found two significant interactions.

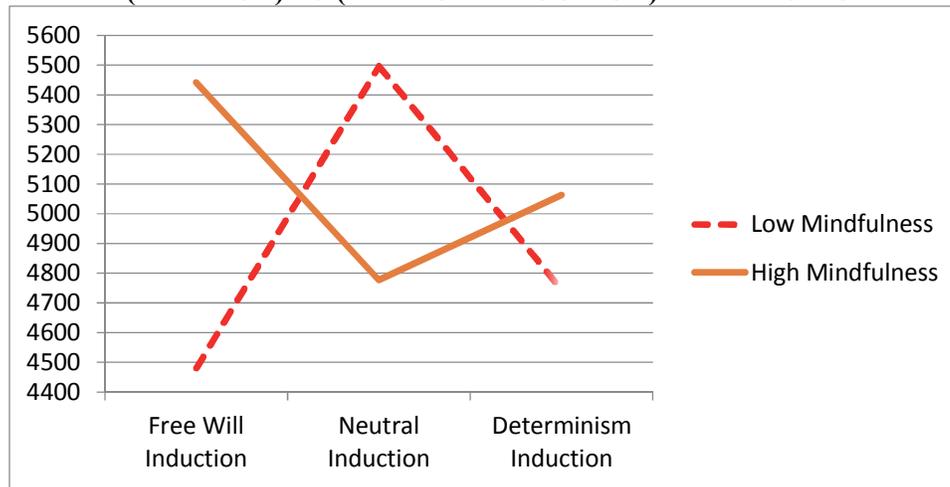
Reaction Time to the Negative Affect Scale of the PANAS. A significant 2 x 3 interaction was found (see Figure 1) for participants' RT to the negative affect words of the PANAS [$F(2, 183) = 4.675, p < .05, d = .05$]. Simple effects were used to further investigate this interaction. The simple effect for mindfulness within the neutral induction statements was significant [$F(1, 182) = 4.83, p < .05$] with high mindful participants ($M = 2073$ msec) in the neutral induction having faster RT to the negative affect words of the PANAS compared to the low mindful participants ($M = 2402$ msec) that read the neutral induction statements. The simple effect for mindfulness within the free will induction statements was also significant [$F(1, 182) = 4.26, p < .05$] with high mindful participants ($M = 2353$ msec) in the free will induction having longer RT to the negative affect words of the PANAS compared to the low mindful participants ($M = 2032$ msec) that read the free will induction statements. In addition, the simple main effect for type of induction statement within low mindfulness was significant [$F(2, 182) = 3.06, p < .05$]. Post hoc tests (Bonferroni corrected) found a significant difference in RT for negative affect words on the PANAS between low mindful participants that read the neutral induction statements ($M = 2402$ msec) and low mindful participants that read the free will induction statements ($M = 2032$ msec).

FIGURE 1
ANALYSIS OF AVERAGE REACTION TIME (RT) TO NEGATIVE AFFECT SCALE OF PANAS
2 (MINDFUL) x 3 (TYPE OF INDUCTION) INTERACTION



Reaction Time to the Free Will Scale of the FAD-Plus. A significant 2 x 3 interaction was found (see Figure 2) for participants' RT to the Free Will Scale [$F(2, 183) = 3.435, p < .05, d = .037$]. Simple effects were used to further investigate this interaction. The simple effect for mindfulness within the free will induction statements was significant [$F(1, 182) = 4.22, p < .05$] with high mindful participants ($M = 5441$ msec) in the free will induction having longer RT to the free will scale compared to the low mindful participants ($M = 4480$ msec) that read the free will induction statements. Unlike the Negative Affect Scale, we did not find significant simple effect within the neutral induction statements or a significant difference in RT between low mindful participants that read the neutral induction statements and low mindful participants that read the free will induction statements.

FIGURE 2
ANALYSIS OF AVERAGE REACTION TIME (RT) TO FREE WILL SUBSCALE OF FAD-PLUS
2 (MINDFUL) x 3 (TYPE OF INDUCTION) INTERACTION



Main Effects Analyses

A significant main effect was found for participants’ reaction times to the Unpredictability scale [$F(2, 183) = 3.847, p < .05, d = .042$].

Reaction Time to the Unpredictability Scale of the FAD-Plus. No significant interaction was found, however, there was a significant main effect for the Type of Induction Statement read by participants. Post hoc tests (Bonferroni corrected) found a significant difference in average RT to questions on the Free Will Scale with those that read the determinism induction statements having a faster average RT ($M = 4296$ msec) than those that read the neutral induction statements ($M = 5048$ msec).

DISCUSSION

For participants’ *answers* to the questionnaires there were no significant interactions between mindfulness and type of induction statement, however, there were a number of significant main effects for mindfulness and type of induction condition. Mindfulness on its own influenced the number of positive and negative affects experienced by participants. High mindful participants reported experiencing more positive affect and less negative affect, as compared to low mindful participants. This is consistent with the notion that high mindfulness leads to more positive emotional experiences for individuals.

On its own type of induction condition had a number of significant effects on three of the subscales of the Free Will and Determinism Plus Scale (FAD-Plus). Consistent with Vohs and Schooler (2008, Experiment 2), participants that were in the free will induction condition scored higher on the free will subscale than participants that were in the determinism induction condition. This supports the hypothesis that the induction technique did indeed influence participants’ belief in free will. Participants in the determinism induction condition also scored higher on the unpredictability subscale than those in the free will induction group. This could indicate that those induced to believe in determinism have no confidence that we can currently accurately determine the causes of events. Lastly, the participants in this study were inclined to be neutral on the fatalistic determinism subscale, however, those in the free will induction group were more inclined to disagree with fatalistic determinism than those in the neutral induction group.

For participants’ *reaction times* to answering the questionnaires, there was one main effect for type of induction statement to answers on the unpredictability subscale of the FAD-Plus questionnaire.

Participants that read the determinism induction statements responded faster to the questions than those that read the neutral induction statements. This suggests the possibility of individuals with particular beliefs having faster reaction times to different types of information, perhaps indicating an improvement in attention. Future research should explore the possibility.

Regarding reaction times, there were also two significant mindfulness by type of induction statement interactions. First, there was a significant mindfulness by type of induction interaction for participants' reaction times to their answers on the negative affect scale of the PANAS. As shown in Figure 1, the low mindful participants in the neutral induction condition have longer reaction times to negative affect questions than high mindful participants in the neutral induction condition. However, this pattern is reversed for the participants in the free will induction group where low mindful participants had a faster reaction time to negative affect words than high mindful participants. Second, there was a significant mindfulness by type of induction interaction for participants' reaction times to their answers on the free will subscale of the FAD-Plus questionnaire. These findings reflect the same pattern found on reaction times for the negative affect scale. As shown in Figure 2, the low mindful participants in the neutral induction condition have longer reaction times to the free will scale questions than high mindful participants in the neutral induction condition. This pattern, however, is reversed for the participants in the free will induction group where low mindful participants had faster reaction times to free will scale questions than high mindful participants.

Assuming that faster reaction time is an indication of improved attention. These results would suggest the high mindful participants in the neutral induction condition tend to have more focused attention in regards to negative affect words and free will questions than the low mindful participants in the neutral condition. Perhaps, the neutral induction can be considered a type of "control" condition that portrays the "normal" differences between high and low mindful participants without free will or determinism induction statements. Thus, high mindful people may have an improved attentional capability for certain types of information (in this case negative affect words and free will induction statements) as compared to low mindful people. The possibility that high mindful people may not have improved attentional capability in everything should be further explored in future research. The assumption that faster reaction time is an indication of improved attention fails to explain why the results are reversed when participants are in the free will induction group. Therefore, we present an alternative explanation that proposes that faster reaction could also indicate the behavior of rushing through the study and paying less attention to each question. To elaborate on that, a participant with a higher level of mindfulness in the free will induction condition may favor accuracy, thus he/she processes the information (negative affect words and free will questions) for a longer time before deciding, which corresponds to a high decision boundary. Conversely, a participant with a lower level of mindfulness in the free will induction condition may favor speed of response instead of accuracy, which causes the response time to be faster. This corresponds to a lower decision boundary.

By adopting the first explanation, we can support our hypothesis which states that participants with higher level of mindfulness may experience a faster response time than participants with lower level of mindfulness, when being introduced to the neutral statement. However, the reverse pattern in free will induction group remains to be unanswered. By adopting the alternative explanation, we can explain the pattern in the free will induction group, but we cannot explain the pattern in the neutral induction group. The essential question to ask here is why the different induction statements have opposite impact on how high and low mindful participants react.

To reconcile this situation, we present the following explanation. Mindfulness may be associated with both improved attention and accuracy, which can have opposite impacts on reaction time. When the high mindful participants were in the neutral induction condition, the statements may not have engaged their interest sufficiently, so the improved attention may have been a dominant factor leading to their faster reaction times. However, when the high mindful participants were in the free will induction condition, the statements were engaging to the participants leading to accuracy (and a high decision boundary) being dominant and a longer reaction time. Having suggested this possibility, we must also acknowledge that

the low mindful participants in the free will induction condition may have improved attentional capability. Further research should more thoroughly examine and compare these competing explanations.

In conclusion, we found that high mindful participants reported experiencing more positive affect and less negative affect than low mindful participants, that participants in the free will induction condition scored higher on the free will subscale of the FAD-Plus and lower on the fatalistic determinism subscale of the FAD-Plus. In addition, participants in the determinism induction condition scored higher on the unpredictability subscale of the FAD-Plus. Concerning reaction time measures, participants in the determinism induction condition had faster reaction times to the questions on the unpredictability subscale of the FAD-Plus. There were also several 2 (mindfulness) by 3 (type of induction) interactions for reaction times to the negative affect scale of the PANAS and to the free will subscale of the FAD-Plus. Further research is needed to further explore the implications of these findings. Research is already examining the impact of meditation and how it may interplay with mindfulness and free will/determinism inductions.

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