

UC Berkeley

Replication/Extension Papers 2023 - 2024

Title

Mood Induction Techniques and Mind-body Practices on Mind-Wandering & Well-being: A Replication and Extension Study

Permalink

<https://escholarship.org/uc/item/6k67s0nk>

Authors

Chang, Fang Hsi

Ercingoz, Mira

Gonzalez, Daniel

et al.

Publication Date

2024-05-13

Supplemental Material

<https://escholarship.org/uc/item/6k67s0nk#supplemental>

Peer reviewed

**Mood Induction Techniques and Mind-body Practices on Mind-Wandering & Well-being:
A Replication and Extension Study**

Fang Hsi Chang, Daniel Gonzalez, Aman Jain, Daleen Sidhu, Christinie Spears

Cognitive Science and Psychology Laboratory at Berkeley

Undergraduate Mentor: Mira Ercingoz

University of California, Berkeley

Abstract

While mind-wandering is a relatively common and neutral affair in most, it can be maladaptive and affected by changes in mood. The original study examined changes in the frequency of mind-wandering and various attributes of mind-wandering, such as context, using various tools that include PANAS and the SART task-based assay. Our replication study examined positive and negative mood-induction techniques and their relationship to the susceptibility of negative affect (SNA) of participants. After conducting a literature review, we found issues with the procedures of the past study, notably on the mood induction techniques, and how certain groups of people, such as those with MDD, would need a will to initiate the will to do what they fantasize about. The methods involved a preliminary screening, DAS and PCI questionnaires, a lab session with PANAS and subsequent interventions, and SART. We discovered in our replication that mind-wandering off-task was more common after the stress task compared to positive fantasizing, especially when the intervention took place immediately after the first PANAS was positive fantasizing, with higher responses in participants with high SNA. Our extension consisted of investigating the role of mind-body practices in both content and frequency of mind-wandering, maladaptive thinking, and depression, through an extended literature review. Significant relationships between mindfulness practices and overall well-being were found, ranging from positive effects on attention on task, as well as reducing or shifting the context and frequency of mind-wandering and off-task thinking.

Introduction

Background

Mind-wandering is a ubiquitous human cognitive phenomenon that many individuals have been subjected to. mind-wandering does not have to follow any set of thought trajectories; specific thoughts can be about various topics that do not necessarily have to be linked to each other. Those with various mental health conditions, however, relatedly manifest variations in mind-wandering (Besten et al., 2023) that can oftentimes be negative in nature.

Maladaptive mind-wandering involves relentless irrational thoughts about the individual that interfere when the individual is carrying out activities. This mind-wandering is not something that the individual chooses to do consciously. Prior studies indicate that mind-wandering is impacted by mood, and various interventions can change the mood, either making it more positive or negative (Besten et al., 2023). This is known as mood induction. These interventions, which in the original study were “the public speaking task” (a negative stress task) and “a positive fantasizing challenge” (positive induction), can alter features of mind-wandering in tested individuals (Besten et al., 2023). Besten and his peers found that negative mood induction was seen to have more potent effects in individuals with a higher susceptibility to negative affect regardless of intervention type compared to individuals with low susceptibility to negative affect. Further, their team utilized mood induction techniques to determine if there were consequent changes in what the participants thought during mind-wandering as well as other aspects, such as whether or not the degree of those changes was related to the subjects’ greater likelihood to be neurotic and apprehensive (Besten et al., 2023).

Some methods that were used in the study included the SART (Sustained Attention To Response Task), which allows researchers to study present thoughts and features such as their

frequency, their valence and temporal orientation, and to what extent the thoughts are about the participants. The previously mentioned positive induction technique involved positive, self-related affirmations, and the negative induction gave rise to stress through a public speaking task where participants were asked to present in a job interview that is in a foreign language. (Besten et al., 2023) The study's results suggest that mood induction has an impact on mind-wandering, where interventions with varying orders of mood induction techniques impacted both the content and frequency of mind-wandering and off-task thinking. (Besten et al., 2023)

Current Literature

The primary exploration revolves around the divergent consequences of rumination, probing into both its maladaptive and adaptive facets, and scrutinizing the impact of self-focused attention on emotional processing. However, when considering mood inductions, it is crucial to acknowledge potential limitations in accurately measuring and manipulating individuals' emotional states. Interaction with the Cognitive Subsystems framework introduces a dichotomy between the conceptual-evaluative mode and the experiential mode. The former involves analytical, evaluative thinking about the self, while the latter entails non-evaluative, intuitive, direct experiential awareness of the present moment. This conceptualization demonstrates the varying effects of inducing conceptual-evaluative versus experiential modes on general autobiographical memory recall and social problem-solving in individuals with depression. The findings suggest that conceptual-evaluative self-focus tends to dominate over general memory, impairing problem-solving abilities, while experiential self-focus mitigates these cognitive impairments.

Similarly, numerous studies have cemented a robust link between personality traits and affective states, highlighting extraversion and neuroticism as pivotal dimensions. Studies found a strong correlation between Extraversion and positive affect, and Neuroticism and negative affect (Costa and McCrae et al., 1980). The nature of positive and negative affect dimensions, as supported by research, allows for differential correlations with external variables, including personality, social activities, and physical symptoms (Larsen and Ketelaar et al., 1989). However, it is important to recognize potential challenges and limitations associated with the accurate measurement of mood inductions in experimental settings.

While the affect-relevant personality traits align with traditional measures of Extraversion and Neuroticism, the intricate nature of mood induction procedures presents potential pitfalls. Measuring and manipulating mood states can be inherently subjective and influenced by individual differences in emotional regulation. Additionally, contextual factors, such as the environment in which mood induction occurs, may introduce variability. Furthermore, the ethical considerations surrounding the induction of certain emotional states, especially negative ones, warrant careful attention. Researchers must navigate these limitations judiciously when designing and interpreting studies involving mood inductions.

To fully understand the impact of maladaptive mood induction on the vulnerability for depression, it would be best to get an in-depth understanding of each participant individually if possible. Another study does this by separating a group with diagnosed chronic depression (CD) from a healthy control group. They used individualized autobiographical scripts for each participant with CD and compared the affective and cognitive reactivity of the two groups (Guhn et al., 2018). By catering the mood induction used in the previous study to the individual participants like in the mentioned study, we may have seen an increase in cognitive reactivity

which could help us better understand the impact on individuals with depression or symptoms of depression.

Another study focused on positive fantasies of a desired future and whether that future was achieved. The results of the 4 studies conducted showed that positive fantasies of a desired future do not result in that desired outcome because the fantasy generates no energy to pursue the desired fantasy (Kappes et al., 2011). By recognizing the possible negative impact positive fantasy and mood induction can have on participants susceptible to major depressive disorder (MDD), we will be able to better understand the impact mood induction can have on them.

New information proposes that the content of mind-wandering we should focus on pertains to the time orientation of mind-wandering (Hoffmann et al., 2016). The time orientation of mind-wandering, (past, present, or future), dictates the emotion associated with it.

Future-oriented mind-wandering warrants a more positive result than past and present mind-wandering; this was found using SGTs (self-generated thoughts) which come more naturally to individuals and have less “considerable limitations” than the questionnaire and inductions used in Hoffman’s study (Hoffmann et al., 2016). Combining the methods from the previous study with the methods from Hoffmann et al. will allow us a more in-depth look at mood induction on maladaptive thinking and the factors that contribute to it.

Present Study

Our present study aims to identify any gaps in knowledge regarding the characteristics of mind-wandering using positive and negative mood induction. In the original study, participants’ susceptibility to negative affect and depression was assessed using the Sustained Attention to Response Task (SART), followed by either stress-inducing or positive fantasizing tasks. The task-based assay was used in a crossover experimental design to compare the participants who

scored high and those who scored low in neuroticism and worrying. This was intended to give insight into their susceptibility to maladaptive mind-wandering while possibly leading to ways of therapeutic interventions (Besten et al., 2023). To deepen our understanding of the effects of susceptibility of negative affect on task attentiveness, we will be replicating Figure 2 which shows the relationships between intervention type, SNA, and mean frequency of participant off-task thinking using original papers' SART data. Further literature review will also be conducted, allowing us to dive deeper into the therapeutic interventions that may prompt neutral or positive mind-wandering outcomes.

Methods

Participants

A total of 249 university students underwent screening, from whom 82 were selected for participation based on their combined scores on the Dutch adaptations of the Penn State Worry Questionnaire (PSWQ; Meyer, Miller, Metzger, & Borkovec, 1990) and the Neuroticism scale of the Dutch NEO Five-Factor Inventory (NEO-FFI; Costa & McCrae, 1995). Among these, 40 participants were classified as having "low susceptibility to negative affect" (low-SNA; total score ≤ 70), and 42 participants were categorized as having 'high susceptibility to negative affect' (high-SNA; total score ≥ 90). Of these, 40 and 39 participants respectively were included in the analysis.

Materials

Susceptibility to negative affect

Susceptibility to negative affect (SNA) is measured by the PSWQ questionnaire and NEO-FFI scale. The PSWQ questionnaire comprises 16 items designed to assess the degree of excessiveness and uncontrollability of worry, ranging from 1 (not at all typical of me) to 5 (very

typical of me). The NEO-FFI includes 36 statements pertaining to Neuroticism, Extraversion, and Conscientiousness traits. While all three scales were administered during the screening phase, only the Neuroticism scale was utilized for screening purposes. The Extraversion and Conscientiousness scales were employed for describing the sample, as previous research has linked these traits to the susceptibility of developing affective psychopathology (Karsten et al., 2012). Both the PSWQ and Neuroticism scale demonstrated a strong correlation in the present study ($r = 0.8$, $p < .001$) and in prior research (Servaas, Riese, Ormel, & Aleman, 2014).

PANAS, SART & Thought Probes

Mood Induction effects are measured by the Positive and Negative Affect Scale (PANAS; Watson, Clark, & Tellegen, 1988), which inquires about participants' current feelings and emotions. Responses were provided using a Likert scale spanning from 1 (very slightly or not at all) to 5 (extremely).

Sustained attention to Response Task (SART) was used to analyze the impact of interventions on mind-wandering behavior. Besten et al (2023) utilized an adapted version of the SART from McVay and Kane (2013), designed to induce mind-wandering through a lengthy and intentionally monotonous go/no-go task. Participants were required to press a button upon seeing a word in lowercase (e.g., "home") and refrain from responding when presented with a word in uppercase (e.g., "BOAT"), which occurred in approximately 10% of trials. A total of 192 English-to-Dutch translated words (van Vugt & Broers, 2016) were quasi-randomly selected from the Battig-Montague word pool (Battig & Montague, 1969). Each word was displayed for 0.3 seconds, followed by a 0.3-second mask. Participants had 3.6 seconds from stimulus onset to respond. To minimize predictability, the inter-stimulus interval (ISI) varied randomly between

1.5 and 2.1 seconds. Stimulus presentation and response tracking were managed using PsychoPy 1.8 (Peirce, 2007).

Incorporating words on participants' concerns (McVay & Kane, 2013) aimed to increase the likelihood of self-related ruminative thinking. These concern words were derived from the Dutch version of the Personal Concern Inventory (Cox & Klinger, 2004), focusing on participants' significant concerns or goals for the upcoming year. Besten et. al. (2023) selected the two most significant concerns and transformed them into sets of three words each, which were presented as triplets of word stimuli sequentially displayed as go-stimuli. As a control, concerns from other participants were used, selected to minimize overlap with the participants' concerns.

Furthermore, they employed thought probes to assess participants' subjective experiences during the task. These probes covered five dimensions: occurrence, stickiness (difficulty disengaging from the thought), temporal orientation, valence, and self-relatedness of off-task thoughts. Together, these questions provided a detailed understanding of thinking patterns, aiding in the identification of ruminative thinking characteristics (sticky, negative, past- and self-related mind-wandering).

Negative & Positive Mood Induction Interventions

The Public Speaking Task was employed to induce stress reliably. The task involved a preparation phase and a presentation phase, each lasting 5 minutes. Participants were instructed to prepare and deliver a 5-minute speech in English, not their native language, for a mock job interview. They were informed that their speech would be recorded on video and that they would be evaluated based on grammar and vocabulary. While notes were allowed during preparation, participants were told not to refer to them during the presentation. During the presentation,

participants faced a jury member with a neutral expression and a video camera. The jury member remained silent, only interjecting with a neutral prompt of “Please continue, you still have time” when participants paused. Upon completion of the 5-minute presentation, participants were asked to exit the interview room.

Positive fantasizing was adapted from the Preventive Cognitive Therapy protocol (Bockting et al., 2005), which aims to identify and challenge dysfunctional attitudes and beliefs. This technique, also known as the positive-challenging technique, focuses on fostering a positive mood through positive fantasizing.

Participants were also instructed to complete the Dysfunctional Attitude Scale (DAS-A; Weissman & Beck, 1978) between five and one day before the lab session. This scale presented participants with statements reflecting possible life rules they may hold. They rated their agreement with both positively and negatively formulated items on a Likert scale.

At the onset of the positive fantasizing intervention, participants were presented with the DAS questionnaire again. They were asked to select a positively formulated life rule from the DAS that appealed to them or to rephrase a negative life rule into a positive one. Alternatively, they could develop a new positive life rule themselves. For example, a positive life rule could be: “People still like me, even if I make many mistakes.” Participants then engaged in positive fantasizing for 10 minutes, envisioning living with this positive life rule in a “dream world.” They were encouraged to explore how it would feel and consider concrete actions they could take to align with this rule.

Procedure

The study included three sessions: an online screening, an online questionnaire, and a lab session. In the screening session, participants completed online questionnaires via anonymous

Google Forms, requiring approximately 20 minutes. Compensation for this part included 0.3 SONA study points or 2 Euros. Eligible participants progressed to subsequent sessions until 40 analyzable participants per group were attained. The online questionnaire session involved completing the Dysfunctional Attitude Scale (DAS) between five and one day before the lab session. In the lab session, participants began with the Positive and Negative Affect Schedule (PANAS) to establish baseline affective states, followed by the first intervention, either the public speaking test or positive fantasizing, with the order counterbalanced and pseudorandomized. After the intervention, PANAS was readministered to assess its effect on effect, followed by the Sustained Attention to Response Task (SART). If the first intervention was the public speaking task, a debriefing occurred to clarify its purpose and reassure participants. Following a brief break, the same sequence was repeated with the other intervention. The session concluded with a general debriefing, lasting approximately 100 minutes. Compensation for the lab session included 3.0 SONA credit points or 16 Euros.

Replication Procedure

We replicated Figures 2A and 2B from the original paper to reaffirm the validity of the data and gain a deeper understanding of the relationship between mood intervention techniques and mind-wandering. Figure 2 represents the impact of the implementation, or order, of fantasizing & stress interventions on the number of times participants were having off-task thoughts. Figure 2A shows the mean frequency of off-task thinking across all participants, and Figure 2B the mean frequency of off-task thinking across participants, separated by high and low susceptibility to negative affect. To replicate the data, we used files through the publicly accessible Open Science Framework. Specifically, the data file on the Sustained Attention Response Task (SART) was used for our replication purposes.

All of the data filtering and visualization was done through code on R-Studio. In addition to the standard R libraries, Dplyr, Ggplot2, and Magrittr were downloaded to aid the process of synthesis and visualization. After importing the data to R-studio, an initial filtration on the data set was performed to limit the data set to trials on thought probes (trial type '5') To make working with the data more efficient, we relevelled the "OnOffTask" variable to align with the coding scheme used in the original paper. After re-leveling, the "SessionCondition" variable was created that represents the interaction between 'Session' and 'condition.'

The frequency of observations across the aforementioned variables is computed by an initial grouping followed by a summarizing function that aids in the calculation of the count and frequency of occurrences for each combination. Standard errors are computed to assess the variability of the frequencies and to quantify the uncertainty associated with each frequency estimate. The final step preceding visualization involves creating a new subset of data called 'freq_condition' and a variable 'freq_offtask' to include only off-task thinking instances and only those observations where the modified 'OnOffTask' variable indicates off-task thinking. Lastly, the data was visualized by creating multiple bar graphs, where the bars represent the mean proportion of off-task thinking and the error bars the standard error of the mean. Bars are grouped by session, where sessions are represented in separate frames.

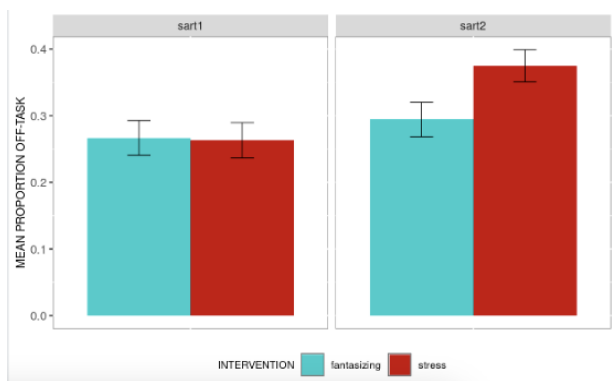
Replication Results

Fig. 2

After replicating according to the datasheet provided by the original authors, there were no differences in the computed data synthesis and visualization. Thus, the replication is consistent with the outcomes of the original paper. Similarly to the findings of the research paper, the replicated data observed that participants were more prone to off-task thinking after the stress

induction compared to after fantasizing, particularly when fantasizing was the first intervention (see Fig.2A). A significant interaction between intervention and group, along with a significant three-way interaction of session, condition, and group was also identified. Also similar to the research paper, Fig 2B demonstrates that individuals with high susceptibility to negative affect (SNA) reported more off-task thinking after stress compared to those with low SNA, specifically when fantasizing was the initial intervention. Notably, no intervention effect was detected on the frequency of off-task thinking; the frequency of on-task thinking remained relatively stable over time. In summary, the key findings of the paper were replicated successfully, highlighting the importance of intervention sequencing and individual differences in SNA in influencing off-task thinking.

A)



B)

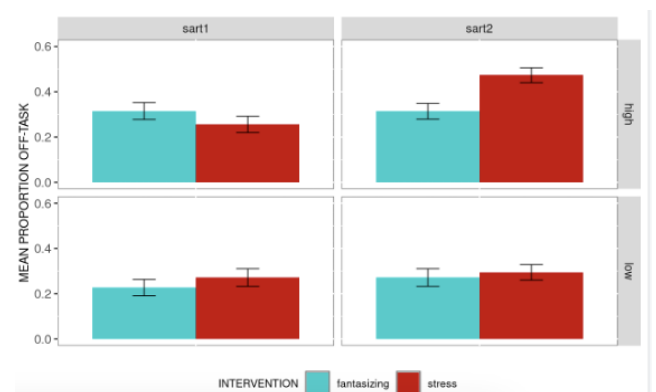


Fig 2. A) The bar plots illustrate the mean frequency of off-task thinking as well as the standard errors, following each intervention per session. B) The bar plots illustrate the mean frequency of off-task thinking across participants, with standard errors, for both interventions per session and group.

Extension

Background

Our mind and body work as a united front in our day-to-day life. To broaden our understanding of mind-wandering, we decided to investigate if mind-body practices impact the overall quality, and therefore, the outcomes of mind-wandering on well-being. To answer this question, we dove deeper into the literature surrounding the practice of mindfulness and its impact on both the frequency and content of mind-wandering and later its consequences, with emphasis on attention and overall health, bodily and mentally. We found that the practice of mindfulness studies has shown a potential reducing effect on mind-wandering and negative thoughts. While the original study uses mood induction to measure changes in participants during mind-wandering, our extension serves to seek any possible improvements mindfulness could contribute to both states of mind and body.

Varying Effects of Mind-wandering on Well-being

mind-wandering, characterized by attention drifting from the task at hand, is a common occurrence linked to negative affect and detrimental effects on cognitive function and performance. Past studies have found a relationship between mind-wandering and negative emotions as it leads us to allocate more importance to negative content (Bortolla 2021). This is especially problematic in maladaptive mind-wandering which is involved in several conditions such as anxiety (Besten et al., 2023). Research has generally shown a significant connection between mind-wandering which has the traits of apprehension and worry, and both anxiety (the formal subtypes of the psychological condition) and various manifestations of the feeling in different disorders such as depression which can make mind-wandering worse.

However, mind-wandering also has beneficial effects on ingenuity especially in the context of resolving a challenging question. (Bortolla 2021) Interestingly, mind-wandering also has an impact on organ systems beyond the CNS though this is understudied (Bortolla 2021). It appears that there exists a relationship between negative mind-wandering and decreased HRV which can lead to enhanced functioning in cognition and better control over feelings (Bortolla 2021). However, it is important to consider the content of mind-wandering from a larger perspective, since negative self-related thoughts may have unintended adverse effects (Besten et al. 2023). To manage the content and frequency of mind-wandering, intervention methods such as mind-body practices, especially mindfulness, can be explored.

Mindfulness as a Therapeutic Mind-Body Practice

Recent research has highlighted mindfulness as a potential strategy for addressing mind-wandering and enhancing attentional control. Mindfulness, on the other hand, is a mental state characterized by non-judgmental awareness and attention to the present moment. It involves intentionally focusing one's attention on bodily sensations, thoughts, and emotions, often through practices like meditation, deep breathing, and body scanning.

Mindfulness involves looking at the present without prejudice (Bortolla 2021). It's not something that one can produce easily naturally but individuals can practice to achieve it via mindfulness meditation (Bortolla 2021). This appears in multiple forms, the primary ones being focused attention meditation which involves focused attention, realization of the inevitable mind-wandering, return to focusing, and open monitoring meditation where thoughts are taken and allowed to dissolve but are not reacted to.

Mindfulness and Mind-Wandering

Numerous papers have established a positive relationship between mindfulness and mind-wandering. Studies have demonstrated that even brief periods of mindful breathing, as short as 8 minutes, can reduce mind-wandering during SART (Mrazek, Smallwood & Schooler, 2012). Additionally, a 2-week mindfulness training program focusing on meditation has been shown to decrease instances of mind-wandering and improve cognitive performance, including enhanced GRE reading comprehension scores and increased working memory capacity (Mrazek et al., 2013). Longitudinal research also indicates decreases in self-reported and performance-based metrics of mind-wandering following mindfulness-based attention training (Price et al., 2023). Moreover, meditation has been found to prevent the escalation of mind-wandering over time, acting as a protective factor for individuals with anxiety (Xu et al., 2017).

Neuroimaging studies have revealed that mind-wandering correlates with heightened activity in the default mode network (DMN), associated with self-referential and task-unrelated thoughts (Christoff et al., 2009, Fox et al., 2015, Mason et al., 2007). Research by Brewer and colleagues utilizing functional magnetic resonance imaging (fMRI) suggests that mindfulness may attenuate mind-wandering by modulating DMN activity and connectivity (Brewer et al., 2011). Specifically, meditators exhibit reduced DMN activation in medial prefrontal and posterior cingulate cortices and increased connectivity between posterior cingulate cortex (PCC), dorsal anterior cingulate cortex (dACC), and dorsolateral prefrontal cortex (DLPFC), which is related to self-monitoring and cognitive control, compared to non-meditators, correlating with fewer reports of mind-wandering.

Feruglio et. al. conducted a thorough study of the literature on the effect of mindfulness meditation on mind-wandering for their meta-analysis. In studies of sessions of mindfulness

meditation that last weeks, both subjects who just started meditation and those who have been doing so prior exhibit a decrease in thoughts that aren't concerned with the task at hand though it's greater for the latter. This observation is consistent with the results of cross-sectional studies. The second group also has decreased default mode network activity and more functional connections which may be the result of the lesser activity. When examining total hours of mindfulness meditation, no difference in mind-wandering is detected between the two subject groups - experts and novices by the subjects themselves.

Importantly for this research paper, mindfulness meditation training is shown to have a positive effect on mind-wandering attributes for those with maladaptive mind-wandering. These findings suggest that the correct implementation of mindfulness offers the potential to experience a decrease in worrying and less rumination in those with depression. Further, the outcomes offer hope in the treatment of the symptoms of other psychopathologies, such as PTSD. The findings can be considered in the treatment of these individuals as they suggest symptom management, such as lessening the vividness and negative impact of trauma thoughts. These are all promising as they can be used in treatment, but further research is necessary to establish more firm conclusions.

Future Directions & Outlooks for Mindfulness on Mind-wandering

The intersection of behavioral and neurobiological evidence underscores the potential of mindfulness interventions to mitigate mind-wandering and enhance attentional stability, thereby improving cognitive function and performance. Future research should delve deeper into the mechanistic understanding of how mindfulness interventions modulate mind-wandering, utilizing advanced neuroimaging techniques to identify specific neural networks involved. Exploring individual differences in response to mindfulness interventions is crucial for tailoring

treatments. Additionally, further investigation into the feasibility and effectiveness of implementing mindfulness interventions across diverse settings and populations, along with the clinical applications for conditions characterized by heightened mind-wandering like anxiety and depression, will provide insights for their widespread adoption and integration into existing intervention and everyday life.

Discussion

Expanding upon the studies of Watkins (2004) and Watson, Clark, & Tellegen (1988), our paper furthers our understanding of mind-wandering, mood induction, and their interplay in healthy individuals and those with mental health conditions. Maladaptive mind-wandering and its association with mood parallels Watkins' investigation into adaptive and maladaptive rumination during emotional processing. As Watkins distinguishes between adaptive and maladaptive rumination, our synthesis could explore how different types of mind-wandering correlate with mood induction effects. Additionally, the essay discusses the use of mood induction techniques to alter mood states impacting mind-wandering, aligning with Watson et al. (1988), who developed the PANAS scales to measure changes in affect.

Our synthesis could investigate how variations of mood induction methods impact mind-wandering episodes. The essay explores the influence of personality traits on affective states, a theme also explored by Watson et al. (1988). Our synthesis could interpret how individual differences in trait affectivity moderate the effects of mood induction on mind-wandering. Lastly, new perspectives on mind-wandering content, focusing on its temporal orientation and relationship with emotions, complement existing research. Our synthesis could incorporate this temporal perspective into the analysis of mood induction and its effects,

investigating how different mood induction techniques influence the temporal orientation of mind-wandering episodes and their emotional outcomes.

Our extension synthesis works to incorporate insights from Watkins (2004) and Watson et al. (1988) into the study of mind-wandering and mood induction, intending to uncover nuanced relationships between cognitive processes, affective states, and mental health vulnerability. We aspire to advance our understanding of these phenomena and their implications on one's psychological well-being and clinical practice through interdisciplinary collaboration and methodological innovation.

Limitations and Future Directions

This study is subject to certain limitations, one of which relates to the nature of the study's sampling method. Since all the participants were volunteers, they may not be representative of the broader population, which could impact the generalizability of the findings. Those who volunteered may have different characteristics or experiences compared to those who did not volunteer, potentially influencing the results. Another aspect of the study that raises questions about the generalizability is the stressor that was used. The stressor was not as severe as real-life losses associated with depression, hence it questions the generalizability of the findings to more severe and major life events. Another major limitation of this study was the absence of a neutral control. Since there was no non-expressive neutral writing control, it made it difficult to determine the relative effectiveness of conceptual-evaluative expressive writing compared to no intervention or writing about an unrelated situation.

Future research directions could involve investigating the longitudinal effects of mood induction on mind-wandering and mental health outcomes. We aim to delve deeper into the role of individual differences and explore the efficacy of interventions in modifying maladaptive

mind-wandering. These findings hold promise for clinical implications, potentially informing targeted interventions for individuals with conditions like depression or high neuroticism. Additionally, our study's theoretical contributions could advance the understanding of mind-wandering mechanisms and their relationship to mood, ultimately aiding in the development of stronger cognition and emotion regulation theories. Methodologically, our study's design and the results we generated from replication could serve as a precedent for future research. By considering our findings within the context of the broader literature and their potential impact on personalized interventions based on susceptibility to maladaptive mind-wandering, we can further enrich the study's impact and relevance.

Conclusion

The original study's focus revolved around how mood induction impacts maladaptive thinking. It served to measure the subject's susceptibility to negative affect and depression through mood induction. The intention behind said study was to gain insight into maladaptive mind-wandering and find possible interventions (Besten et al., 2023). This study paved the foregrounds for our replication which expanded on different ways the original could have grown. Our replication served as a broadened scope of how mood induction practices could be improved. The literature review suggests that the mood induction conducted in the original study could have benefitted from considering more limitations such as the dichotomy between the conceptual evaluate mode and experiential mode (Watkins et al., 2004), individual relevance (Guhn et al., 2018), the negative impact of positive fantasizing on patients with diagnosed depression (Kappes et al., 2011), and self-generated thoughts (SGTs) (Hoffmann et al., 2016). Without acknowledging the possible gaps in the study, like the ones we found, it is impossible to get an accurate reading of how susceptible individuals are to negative effects.

Our extension sought to go one step further by finding how mind-wandering could be impacted, in our case, by mindfulness. In our investigation of this mind-body practice, we learned that mindfulness does have a positive impact on our minds, which in turn leads to a positive impact on our bodies. The improved mental state comes in the form of mental clarity and while its efficiency is still being measured, its overall impacts are the same. mind-wandering on its own can often lead to a negative mental state; by practicing mindfulness, participants were able to lessen the occurrence of mind-wandering and increase their mental clarity. Of course, there is still research ongoing surrounding the soundness of this theory but by practicing mindfulness consistently, we have seen positive results in the overall state of being.

References

- Battig, W. F., & Montague, W. E. (1969). Category norms of verbal items in 56 categories A replication and extension of the Connecticut category norms. *Journal of Experimental Psychology*, 80(3, Pt.2), 1–46. <https://doi.org/10.1037/h0027577>
- Bockting, C., Schene, A. H., Spinhoven, P., Koeter, M. W. J., Wouters, L., Huyser, J., & Kamphuis, J. H. (2005). Preventing Relapse/Recurrence in Recurrent Depression With Cognitive Therapy: A Randomized Controlled Trial. *Journal of Consulting and Clinical Psychology*, 73(4), 647–657. <https://doi.org/10.1037/0022-006x.73.4.647>
- Bortolla, R., Galli, M., Spada, G. E., & Maffei, C. (2021). Mindfulness effects on mind wandering and autonomic balance. *Applied Psychophysiology and Biofeedback*, 47(1), 53–64. <https://doi.org/10.1007/s10484-021-09527-x>
- Christoff K, Gordon AM, Smallwood J, Smith R, Schooler JW. Experience sampling during fMRI reveals default network and executive system contributions to mind wandering. *Proc Natl Acad Sci U S A*. 2009;106:8719–8724. doi: 10.1073/pnas.0900234106
- Costa, P. T., & McCrae, R. R. (1995). Domains and Facets: Hierarchical Personality Assessment Using the Revised NEO Personality Inventory. *Journal of Personality Assessment*, 64(1), 21–50. https://doi.org/10.1207/s15327752jpa6401_2
- Costa, P., & McCrae, R. R. (1980, April). Costa Jr pt, McCrae RR. influence of extraversion neuroticism on subjective well-being: happy unhappy people. ResearchGate. https://www.researchgate.net/publication/15816781_Costa_Jr_PT_McCrae_RR_Influence_of_extraversion_neuroticism_on_subjective_well-being_happy_unhappy_people_J_Pers_Soc_Psychol_38_668-678

Cox, E., Call, S. B., Williams, N., & Reeves, P. M. (2004). Shedding the Layers: Exploring the Impact of the Burn Camp Experience on Adolescent Campers' Body Image. *Journal of Burn Care & Rehabilitation*, 25(1), 141–147.

<https://doi.org/10.1097/01.bcr.0000105051.08323.8b>

Fox KC, Spreng RN, Ellamil M, Andrews-Hanna JR, Christoff K. The wandering brain: meta-analysis of functional neuroimaging studies of mind-wandering and related spontaneous thought processes. *Neuroimage*. 2015;111:611–621. doi: 10.1016/j.neuroimage.2015.02.039.

Guhn, A., Sterzer, P., Haack, F. H., & Köhler, S. (2018). Affective and cognitive reactivity to mood induction in chronic depression. *Journal of Affective Disorders*, 229, 275–281.

<https://doi.org/10.1016/j.jad.2017.12.090>

Hoffmann, F., Banzhaf, C., Kanske, P., Bermpohl, F., & Singer, T. (2016). Where the depressed mind wanders: Self-generated thought patterns as assessed through experience sampling as a state marker of depression. *Journal of Affective Disorders*, 198, 127–134.

<https://doi.org/10.1016/j.jad.2016.03.005>

Kappes, H. B., & Oettingen, G. (2011). Positive fantasies about idealized futures sap energy.

Journal of Experimental Social Psychology, 47(4), 719–729.

<https://doi.org/10.1016/j.jesp.2011.02.003>

Karsten, J., Penninx, B. W. J. H., Riese, H., Ormel, J., Nolen, W. A., & Hartman, C. A. (2012).

The state effect of depressive and anxiety disorders on big five personality traits. *Journal of Psychiatric Research*, 46(5), 644–650. <https://doi.org/10.1016/j.jpsychires.2012.01.024>

Larsen, R. J., & Ketelaar, T. (1989, January 23). Extraversion, neuroticism and susceptibility to positive and negative mood induction procedures. UC Berkeley Library proxy login.

<https://www-sciencedirect-com.libproxy.berkeley.edu/science/article/pii/019188698990233X?via%3Dihub>

Mason MF, Norton MI, Van Horn JD, Wegner DM, Grafton ST, Macrae CN. Wandering minds: the default network and stimulus-independent thought. *Science*. 2007;315:393–395. doi: 10.1126/science.1131295.

McVay, J. C., & Kane, M. J. (2013). Dispatching the wandering mind? Toward a laboratory method for cuing “spontaneous” off-task thought. *Frontiers in Psychology*, 4.

<https://doi.org/10.3389/fpsyg.2013.00570>

Meyer, T., Miller, M. L., Metzger, R., & Borkovec, T. D. (1990). Development and validation of the penn state worry questionnaire. *Behaviour Research and Therapy*, 28(6), 487–495.

[https://doi.org/10.1016/0005-7967\(90\)90135-6](https://doi.org/10.1016/0005-7967(90)90135-6)

Mrazek, M. D., Smallwood, J., & Schooler, J. W. (2012). Mindfulness and mind-wandering: Finding convergence through opposing constructs. *Emotion*, 12(3), 442–448.

<https://doi.org/10.1037/a0026678>

Mrazek, M. D., Franklin, M. S., Phillips, D. T., Baird, B., & Schooler, J. W. (2013). Mindfulness training improves working memory capacity and GRE performance while reducing mind wandering. *Psychological Science (Print)*, 24(5), 776–781.

<https://doi.org/10.1177/0956797612459659>

Peirce, J. W. (2007). PsychoPy—Psychophysics software in Python. *Journal of Neuroscience Methods*, 162(1–2), 8–13. <https://doi.org/10.1016/j.jneumeth.2006.11.017>

Price, M. M., Zanesco, A. P., Denkova, E., Barry, J. M., Rogers, S. L., & Jha, A. P. (2023).

Investigating the protective effects of mindfulness-based attention training on mind wandering in applied settings. *Frontiers in Psychology*, 14.

<https://doi.org/10.3389/fpsyg.2023.1232598>

Servaas, M. N., Riese, H., Ormel, J., & Alemán, A. (2014). The neural correlates of worry in

Association with individual differences in neuroticism. *Human Brain Mapping*, 35(9), 4303–4315. <https://doi.org/10.1002/hbm.22476>

Van Vugt, M. K., & Broers, N. (2016). Self-Reported Stickiness of Mind-Wandering Affects

Task Performance. *Frontiers in Psychology*, 7. <https://doi.org/10.3389/fpsyg.2016.00732>

Watkins, E. (2004, September). Adaptive and maladaptive ruminative self-focus during

emotional processing. UC Berkeley Library proxy login.

<https://www-sciencedirect-com.libproxy.berkeley.edu/science/article/pii/S0005796704001172?via%3Dihub>

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures

of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology*, 54(6), 1063–1070. <https://doi.org/10.1037/0022-3514.54.6.1063>

Weinstein, Y. (2017). Mind-wandering, how do I measure thee with probes? Let me count the

ways. *Behavior Research Methods*, 50(2), 642–661.

<https://doi.org/10.3758/s13428-017-0891-9>

Weissman, A. N., & Beck, A. T. (n.d.). Development and Validation of the Dysfunctional

Attitude Scale: A Preliminary Investigation. <https://eric.ed.gov/?id=ED167619>

World Medical Association Declaration of Helsinki. (2013). *JAMA*, 310(20), 2191.

<https://doi.org/10.1001/jama.2013.281053>

Xu, M., Purdon, C., Seli, P., & Smilek, D. (2017). Mindfulness and mind wandering: The protective effects of brief meditation in anxious individuals. *Consciousness and Cognition (Print)*, 51, 157–165. <https://doi.org/10.1016/j.concog.2017.03.009>

Feruglio, S., Matiz, A., Pagnoni, G., Fabbro, F., & Crescentini, C. (2021). The Impact of Mindfulness Meditation on the Wandering Mind: a Systematic Review. *Neuroscience & Biobehavioral Reviews/Neuroscience and Biobehavioral Reviews*, 131, 313–330. <https://doi.org/10.1016/j.neubiorev.2021.09.032>

Fell, J., Chaieb, L., & Hoppe, C. (2023). Mind wandering in anxiety disorders: A status report. *Neuroscience & Biobehavioral Reviews/Neuroscience and Biobehavioral Reviews*, 155, 105432. <https://doi.org/10.1016/j.neubiorev.2023.105432>