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Journal

Proceedings of the Annual Meeting of the Cognitive Science Society, 44(44)

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Publication Date

2022

Peer reviewed

The Relationship Between Individual Differences in Mental Imagery Vividness and Emotional Distress

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Abstract

Mental imagery is theorized to play a key role in mood and mood disorders due to the emotional impact of visualizations and biases in the processing of negative versus positive imagery. Although differences in emotional imagery have been linked to mental health outcomes, it is unclear if individuals experiencing emotional distress differ in their *baseline* ability to generate mental images (i.e., ‘imagery ability’). Recent research has highlighted linkages between imagery ability and facets of trait mindfulness, such as the tendency to observe and describe inner thoughts. Thus, we suspected that individual differences in trait mindfulness may help explain inconsistent findings regarding the relationship between imagery ability and emotional distress. A path analysis revealed that trait mindfulness significantly and fully mediated the relationship between imagery vividness and depression, indicating that mindfulness is a critical aspect of imagery phenomenology, as well as emphasizing the importance of mindfulness to mental health.

Keywords: mental imagery; vividness; mindfulness; depression; anxiety; mediation analysis; mood

Introduction

Mental imagery is described as a type of perceptual simulation (Ji et al., 2016; Kosslyn et al., 2001) that allows individuals to re-experience memories or imagine hypothetical scenarios such as those occurring in the future (Ji et al., 2016). Imagery is purported to play a role in a multitude of cognitive processes, ranging from perception and action (McAvinue & Robertson, 2008; Munzert & Lorey, 2013; Vogt, 1996) to mood regulation (Holmes & Mathews, 2005; O’Donnell et al., 2018). Although it is a ubiquitous inner experience, a substantial body of research highlights individual differences in the baseline ability to generate mental images, including some individuals who report a complete absence of imagery ability (i.e., ‘aphantasia;’ Zeman et al., 2015). Note that we use the term ‘imagery ability’ here to describe individual differences in general propensity to generate and manipulate imagery.

Mental imagery is particularly relevant to mental health because of the emotional impact of images compared to language-based representations (Holmes & Mathews, 2005). Thus, maladapted imagery could contribute to the

maintenance of mood disorders like anxiety and depression (Holmes & Mathews, 2010; Ji et al., 2016) by ‘amplifying’ negative affect in response to negative thoughts. Aligning with these theories, individuals diagnosed with depression and anxiety appear to have a propensity towards negative versus positive imagery during experimentally induced imagined scenarios (Holmes et al., 2016; Ji et al., 2016; Morina et al., 2011; Pearson et al., 2015).

Previous research has focused primarily on the effect of induced emotional imagery; therefore, it is unclear if individuals with anxiety and depression differ in their imagery ability, or baseline ability to generate mental images. It is assumed that imagery ability can amplify emotional distress, but there are inconsistent results regarding this effect (Fulford et al., 2018; Guarnera et al., 2019; Jelinek et al., 2015; Lambert et al., 2001; Moriya, 2018; Sindhu & Pande, 2019). One explanation for these inconsistent findings is that the current literature does not sufficiently model the complex relationship between imagery ability, mood, and relevant aspects of information processing.

A pathway by which imagery may influence mood is through mindfulness. The practice of mindfulness is believed to contribute to mental wellbeing (Siegling & Petrides, 2014), and emerging research indicates strong positive linkages between mindfulness and imagery ability (Frewen et al., 2010; Kharlas & Frewen, 2016). It is reasonable to assume that increased mindfulness of one’s inner experience may help explain why some participants experience heightened vividness of imagery, because imagery itself is an inner experience. However, the connection between imagery and mindfulness has received little attention.

The current paper attempts to address this gap by untangling the overlap between mental imagery ability, trait mindfulness, and emotional distress. Specifically, we investigate whether trait mindfulness mediates the relationship between the ability to generate vivid mental images and emotional distress. Unlike previous research focusing on biases toward emotionally positive or negative imagery, we examine individual differences in the baseline ability to generate neutral, non-emotional imagery. That is, we assess the baseline ability to generate imagery versus

assessing cognitive biases regarding negative thoughts. Additionally, we extend the literature by investigating how mindfulness intersects with the phenomenological experience of visual imagery, which may help to provide a more holistic view of how imagery is experienced.

Background

Mental Imagery

Mental imagery is the occurrence of perceptual experiences that are driven by memories and thoughts instead of physical sensory input (Ji et al., 2016; Kosslyn et al., 2001). The exact qualities of these visualizations have been the subject of long-standing debate. Mainly, it is debated whether mental imagery is represented pictorially in the brain (Pearson & Kosslyn, 2015) or if imagery is the result of a more symbolic process (Pylyshyn, 2003). The conceptualization of mental imagery as a type of ‘weak perception’ follows from research showing that mental imagery elicits physiological responses and brain activity patterns similar to bottom-up perception (Dijkstra et al., 2017, 2019; Holmes & Mathews, 2005, 2010; Pearson & Kosslyn, 2015; Wicken et al., 2019). Thus, mental imagery is construed as an internal representation of the world allowing people to re-experience memories and simulate hypothetical scenarios (Ji et al., 2016).

Research on imagery, particularly experiments evoking imagined scenarios, often fail to account for differences in participants’ baseline ability to consciously experience mental images. While some participants report only vague representations, others report experiencing imagery as vivid as real-life (Andrade et al., 2014; Mckelvie, 1995). Consistent with the idea that imagery is a depictive experience, individuals who can generate more vivid mental images have stronger physiological reactions to imagined stimuli (Wicken et al., 2019) and are more prone to certain types of perceptual biases (Pearson et al., 2011). The strong emotional response to visual representations is believed to be a mechanism by which negative imagery contributes to mood in several psychological disorders.

Furthermore, the observation that mental imagery elicits physiological reactions (Kosslyn et al., 2001; Milton et al., 2020; Wicken et al., 2019)—and that imagery may be more emotionally impactful than language-based processing (Holmes & Mathews, 2005)—has relevance for mood disorders like anxiety and depression. In fact, imagery appears inherent in several common symptoms reported by individuals diagnosed with mental health disorders. For example, flashbacks (i.e., vivid memories of traumatic events) are a core symptom of posttraumatic stress disorder (PTSD; e.g., Jelinek et al., 2015), generalized and social anxiety are associated with anticipation of negative future events, and intrusive memories are associated with depression (Eysenck et al., 2006).

Common among these symptoms is a bias towards imagery with negative emotional valence. During experimentally

induced imagined scenarios, individuals with depression appear to more easily generate negative past imagery, while individuals with anxiety more readily generate negative prospective imagery (for review, see Holmes et al., 2016; Ji et al., 2016; Morina et al., 2011; Pearson et al., 2015). Although these findings suggest a connection between negatively valenced imagery and mental health disorders, there is inconsistent evidence for a connection between mood and neutral valenced imagery (i.e., imagery of faces or buildings; Fulford et al., 2018; Guarnera et al., 2019; Jelinek et al., 2015; Lambert et al., 2001; Moriya, 2018; Sindhu & Pande, 2019). Therefore, it is unclear if differences in the processing of negative imagery are due to differences in specific imagery ability or if they are simply the result of attentional bias to negative thoughts.

Mindfulness

Recent evidence indicates that individuals who are more mindful tend to report experiencing more vivid imagery (Frewen et al., 2010; Kharlas & Frewen, 2016); however, only limited work has explored this relationship. Mindfulness describes the ability to observe and attend to current inner thoughts and bodily sensations in a non-judgmental and non-reactive manner (Sauer et al., 2013; Siegling & Petrides, 2014). Therefore, it is logical to assume that the vividness of imagery is partially explained by an individual’s awareness of their inner experience in addition to their ability to generate those representations. These findings also suggest that imagery vividness can be influenced using mindfulness techniques, such as mindful meditation—an assumption that has some support in the literature (Keesman et al., 2020).

The association between mental imagery and mindfulness appears highly relevant to mental health. Mindfulness—and mindfulness meditation—has long been linked to stress reduction and improved mood (for review, see Hofmann et al., 2010; Hofmann & Gómez, 2017). In fact, mindfulness-based interventions (MBIs) are commonly integrated into cognitive therapies with notable effectiveness for the treatment of anxiety (Hofmann et al., 2010). It is believed that mindfulness and MBIs contribute to well-being by shifting attention away from negative rumination and towards the present moment (Gu et al., 2015). Additionally, MBIs may help individuals notice their thoughts and memories less judgmentally and reactively (Gu et al., 2015). However, more work is needed to examine the underlying mechanisms of stress reduction observed in response to MBIs.

Study Overview

Expanding on prior connections drawn between mental imagery and mental health outcomes, we examined whether individual differences in the ability to generate vivid mental imagery were tied to feelings of anxiety and depression. In addition, we investigated whether such relationships were mediated by trait mindfulness. First, we used a correlation analysis to examine how the vividness of visual mental

imagery related to five facets of trait mindfulness, depression, and anxiety symptoms. Based on previous research, we predicted that mental imagery ability would positively correlate with the sensory components of trait mindfulness (i.e., observing and describing sub-dimensions; Kharlas & Frewen, 2016). We also predicted that both imagery ability and trait mindfulness would negatively correlate with emotional distress (Carpenter et al., 2019). Thus far, only limited research has examined the relationship between trait mindfulness and imagery ability; therefore, we attempted to replicate previous findings and examined which of the five mindfulness facets most strongly associated with imagery.

Next, using a path analysis, we investigated if the relationship between *neutral* imagery vividness and emotional distress was mediated by trait mindfulness. Several studies have reported diminished imagery vividness during experimentally induced imagery tasks among individuals with depressive and anxiety symptoms (Guarnera et al., 2019; Lambert et al., 2001; Sindhu & Pande, 2019). It was assumed that the ability to observe and describe one's inner thoughts would help explain these differences. Considering emerging evidence that mindful individuals report more vivid imagery (Kharlas & Frewen, 2016), we predicted that trait mindfulness would mediate the relationship between imagery ability and emotional distress. In other words, we suspected that individuals experiencing depression and anxiety would be less mindful of their inner experiences, and this lower attentiveness would correlate with a reduction in self-reported imagery vividness.

Method

Participants

A total of 207 undergraduate students enrolled in psychology courses were recruited using a university-based research recruitment system and were compensated course credit for successfully completing the survey. To be included in the study, participants had to be over the age of 18, live in the United States, and have normal or corrected-to-normal vision. Participants who provided overly uniform responses or completed the survey unreasonably fast were excluded from the survey.

Materials

The ability to generate vivid mental images was measured using the 16-item Vividness of Visual Imagery Questionnaire (VVIQ; Marks, 1973). The VVIQ presented the participant with several imagined stimuli and asked them to rate the visual vividness of the details that came to their mind on a scale of 1 (“*No image at all, you only know that you are thinking of the object*”) to 5 (“*Perfectly clear and vivid as real life*”). For example, after being instructed to visualize a

sunrise, participants were asked to rate the vividness of a “sun rising above the horizon into a hazy sky” as it appeared in their mind. Scores on the VVIQ were obtained by summing ratings on individual items for a minimum score of 16 and a maximum score of 80, with higher scores indicative of greater vividness.

Trait mindfulness was assessed using the 15-item version of the Five Facet Mindfulness Questionnaire (FFMQ; Baer et al., 2012). The FFMQ evaluated trait mindfulness along five sub-dimensions, including mindful “*observing*” (ability to observe thoughts and bodily sensations), “*describing*” (ability to describe inner experiences), “*awareness*” (ability to act with awareness), “*non-judgement*” (tendency not to judge inner experiences) and “*non-reactivity*” (tendency not to be disrupted by inner experiences). Participants were presented with hypotheticals, such as “I’m good at finding words to describe my feelings” and rated each item on a scale of 1 (“*Never or very rarely true*”) to 5 (“*Very often or always true*”). Responses were then totaled to calculate scores for overall mindfulness and each of the five facets.

Finally, the severity of depression and anxiety symptoms was measured using the thirteen-item Beck Depression Inventory (BDI; Beck et al., 1996) and the State Trait Anxiety Inventory – trait form (STAI; Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983) respectively. Both the BDI and STAI are widely distributed and standard methods for assessing anxiety and depression. The BDI short form contained thirteen statements related to negative mood and participants rated their level of agreement from 0 to 3, with higher scores representative of severity of depressed mood. Likewise, the STAI contained twenty-one statements related to trait anxiety (e.g., “I feel content”) and participants were asked to rate how they feel on a scale from 1 (“*Almost never*”) to 4 (“*Almost always*”). Higher scores indicated greater anxiety.

Procedure

The results presented here are preliminary findings from a larger study which collected information about imagery ability, mindfulness, mental health, and performance on several cognitive tasks. All procedures were approved by the university’s Institutional Review Board located in the southeast United States. After reviewing the eligibility requirements, participants were redirected to Qualtrics where they provided informed consent and verified their eligibility using a brief screening form. Participants then completed several online survey questionnaires, including the VVIQ, FFMQ, BDI, and STAI in randomized order. Finally, participants provided demographics including age, SES, employment, and gender identity.

Table 1: Descriptive statistics and correlation analysis

Variable	M	SD	1	2	3	4	5	6	7	8
1. VVIQ	58.15	12.11								
2. STAI - Trait	47.22	11.82	-.30**							
3. BDI	22.84	7.62	-.27**	.80**						
4. FFMQ Observe	10.43	2.22	.38**	-.17*	-.12					
5. FFMQ Describe	9.12	2.44	.21**	-.37**	-.30**	.19**				
6. FFMQ Aware	8.44	2.29	.04	-.21**	-.23**	-.05	.22**			
7. FFMQ Non-Judgement	9.46	2.60	.17*	-.59**	-.58**	.02	.26**	.31**		
8. FFMQ Non-Reactivity	9.36	2.04	.13	-.23**	-.16*	.24**	.11	-.02	.03	
9. FFMQ Total Score	46.82	6.44	.33**	-.58**	-.52**	.48**	.66**	.54**	.62**	.44**

** Correlation is significant at .01 level.

* Correlation is significant at .05 level.

Imagery Vividness Correlates to Multiple Facets of Trait Mindfulness

A Pearson correlation analysis was performed to explore the relationships between VVIQ, BDI, STAI Trait scores, and the five facets of trait mindfulness (Table 1). As expected, the vividness of visual imagery was positively correlated with FFMQ total scores, $r(205) = .33, p < .001$, as well as the “describe,” $r(205) = .21, p < .001$, “observe,” $r(205) = .38, p < .001$, and “non-judgement,” $r(205) = .17, p = .01$, mindfulness facets. Heightened imagery vividness was also associated with lower self-reported trait anxiety, $r(205) = -.30, p < .001$, as well as reduced severity of depressed mood, $r(205) = -.27, p < .001$.

In addition, consistent with previous research, participants scoring higher on trait mindfulness reported lower trait anxiety, $r(205) = -.58, p < .001$, and depression, $r(205) = -.52, p < .001$. Although the mindfulness facet associated with non-judging of inner experience was most closely related to BDI and STAI scores, these results suggest that lower emotional distress is associated with higher scores across all five facets of mindfulness.

Trait Mindfulness Mediates the Relationship Between Imagery Vividness and Emotional Distress

Next, we conducted a path analysis to investigate the role of mindfulness as a mediating variable (see Figure 1). Path analysis is related to structural equation modeling (SEM) and can model more complex relationships than possible with simple or multiple regression (Duncan, 1966). Importantly, this approach allowed us to incorporate both anxiety and depression scores simultaneously into our analysis. The model was fit using Lavaan, a package developed in R for SEM (Rosseel, 2012), and we utilized bootstrapping ($n = 5000$) to generate confidence intervals and test for indirect effects.

Before accounting for the effect of trait mindfulness, VVIQ scores were significantly and negatively related to both depression ($\beta = -.27, SE = .04, p < .001$) and anxiety

($\beta = -.30, SE = .06, p < .001$). However, after introducing trait mindfulness scores to the model, the direct effect of imagery on depression was no longer significant ($p = .08$), and the direct effect on anxiety was greatly diminished ($\beta = -.11, SE = .05, p = .04$). Furthermore, there was a significant indirect effect on both depression ($\beta = -.16, SE = .02, p < .001$) and anxiety ($\beta = -.18, SE = .04, p < .001$). Consistent with our initial predictions, this model indicated that mindfulness completely mediated the relationship between imagery ability and depression severity, and partially mediated the effect on anxiety.

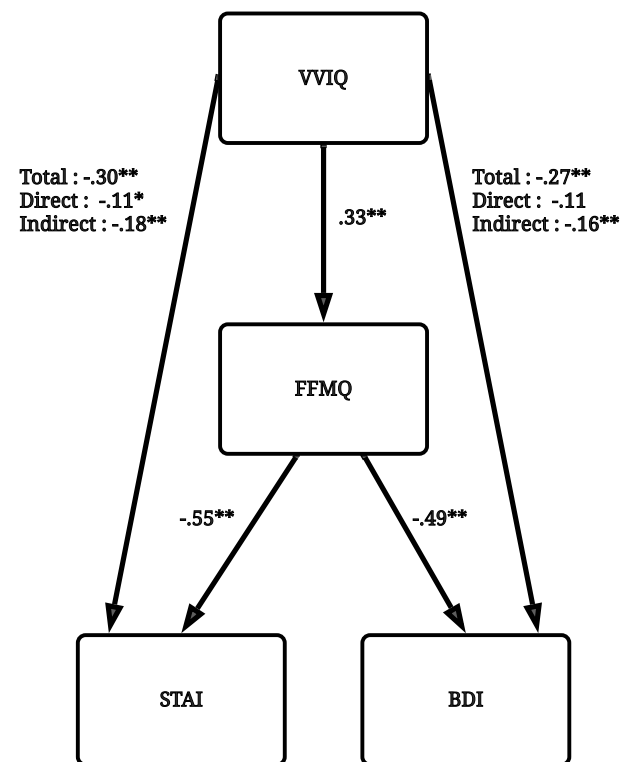


Figure 1: Mediation analysis depicting relationship between imagery ability, mindfulness, and emotional distress. Regression coefficients are standardized. Note: ** $p < .01$; * $p < .05$.

Discussion

Mental imagery and mindfulness have long been implicated in the experience of depression and anxiety (e.g., Carpenter et al., 2019; Holmes et al., 2016), but their influences on mood are typically investigated as independent processes. Recent work has highlighted significant overlap between trait mindfulness and imagery ability (Frewen et al., 2010; Kharlas & Frewen, 2016), such that people who are more mindful of their inner experiences tend to report experiencing more vivid mental imagery. However, this connection has not yet been explored in the context of mental health. For example, it is reasonable to assume that the reduced mindfulness reported by individuals experiencing emotional distress (e.g., Carpenter et al., 2019) would correspond to reduced self-reported imagery vividness. We begin to address this gap in the literature by investigating whether five facet trait mindfulness mediates the relationship between imagery ability and emotional distress.

The results of our path analysis revealed that trait mindfulness fully mediated the relationship between vividness and depression and partially mediated the relationship between vividness and anxiety. In other words, we found evidence that individuals experiencing emotional distress did not necessarily differ in their baseline ability to generate neutral imagery, but instead were less disposed to ‘observe’ or attend to those thoughts. This supports the idea that trait mindfulness plays a role in both the phenomenology of imagery and the experience of emotional distress.

These findings have several implications. First, studies examining how emotional distress is related to imagery ability (i.e., the generation of *neutral* imagery) have reported inconsistent findings ranging from weak positive to negative relationships (Fulford et al., 2018; Guarnera et al., 2019; Jelinek et al., 2015; Lambert et al., 2001; Moriya, 2018; Sindhu & Pande, 2019). These conflicting results may be explained by the fact that these previous studies did not consider individual differences in trait mindfulness or attention to imagery.

Furthermore, most of the research examining the role of imagery in mood disorders has focused on the generation of positive versus negative imagery during imagined scenarios (for review, see Holmes et al., 2016; Ji et al., 2016; Pearson et al., 2015). For example, it is commonly observed that patients with depression have difficulty generating vivid positive imagery (Holmes et al., 2016). Our results indicate that these differences in phenomenology are driven by attentional biases in information processing, as opposed to reductions in the ability to generate specific types of mental images—as previously suggested. Thus, it may be important to target maladapted imagery during interventions, like cognitive restructuring, which attempt to restructure negative thinking patterns.

Finally, the current project extends the literature by validating the link between imagery ability and trait mindfulness. Although it was previously unclear which of the five facets of mindfulness most closely related to imagery ability (Kharlas & Frewen, 2016), we found that imagery was primarily associated with the describe and observe facets. It should not be surprising that the tendency to observe and describe inner thoughts would be more closely related to imagery vividness than acting with awareness. However, we also found that participants with more vivid imagery were less judgemental of their inner experiences, suggesting that imagery is related to trait mindfulness more broadly. Taken together, we provide strong evidence that inner awareness is an important aspect of mindfulness contributing to the experience of imagery.

Several areas remain for future research. First, the observation that imagery vividness correlates with trait mindfulness has implications for training paradigms that aim to modulate imagery vividness. That is, it is possible that exercises invoking mindfulness, such as mindfulness meditation, may work to enhance the phenomenological experience of imagery and increase state mindfulness. Next, recent reports indicate a portion of the population lacks the ability to generate imagery altogether (i.e., Aphantasia; Zeman et al., 2015). These individuals experience substantial differences in their cognition, including a possible impairment in autobiographical memories (Brons, 2019). If these individuals do not experience imagery, research on Aphantasia could shed further light on the relationship between imagery, attention, and mindfulness. Finally, more research is needed to explore the connection between mindfulness and imagery specifically. For example, it is unknown how mindfulness may be related to aspects of imagery like valence, frequency, or intrusiveness.

Limitations

As previously mentioned, the results presented here are preliminary findings that have been collected as part of a larger project. Future analyses on these data will involve several additional metrics which may help to explain some of the residual error in the path model presented. Additionally, the current project focused on the ability to generate vivid *visual* mental imagery. However, imagery is often conceptualized as having multiple different dimensions (e.g., motor, perceptual, emotional; Andrade et al., 2014). Given that we found significant relationships between visual imagery vividness and sensory facets of trait mindfulness (i.e., the tendency to observe bodily sensations), it is possible that other dimensions of imagery, such as emotional imagery, may be uniquely associated with mindfulness. For instance, it seems plausible that emotional imagery may be more associated with non-reactivity and non-judgement of inner thoughts than with acting with awareness or observation of bodily sensations.

Finally, we focus specifically on the vividness of *neutral* imagery as a way of assessing general imagery ability, but we did not collect data on other components of imagery ability such as the ability to manipulate mental images.

Conclusions

The current paper examines how mindfulness and imagery ability intersect to influence mental wellbeing. In addition to confirming the link between imagery ability and the describe and observe facets of mindfulness, we provide evidence that trait mindfulness mediates the relationship between imagery ability and emotional distress. Individuals who were more mindful of their inner experiences tended to have greater imagery ability as well as lower depression and anxiety scores. Our results emphasize the importance of mindfulness for mental wellbeing and highlight a need for research investigating the relationship between imagery and mindfulness.

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