Short Communication

Be open: Mindfulness predicts reduced motivated perception

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A B S T R A C T

Mindfulness is defined as non-judgmental present-moment attention and awareness, which varies across persons and moments. As a non-judgmental stance, mindfulness should allow for greater perceptual objectivity. Previous research suggests that self-interest can motivate people to "see what they want to see" (Balcetis & Dunning, 2006). We hypothesized that mindfulness would moderate this effect such that state and trait mindfulness would be associated with less motivated perception. We adapted the methods of Balcetis and Dunning (2006) in an online study ($N = 161$). Results show that state and trait mindfulness predicted less motivated perception. These effects were stronger after excluding participants who noticed the ambiguity of the image as well as controlling for mood. These findings suggest that mindfulness is a stance of greater objectivity.

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1. Introduction

Mindfulness has been defined as non-judgmental attention and awareness of the present moment, which varies across individuals, as well as within individuals, across time (Bishop et al., 2004). Buddhists liken this stance of non-judgment to having a "child's mind," or a "beginner's mind," such that experience is approached with openness and curiosity (Suzuki, 1973). Psychologists describe non-judgment as a stance of greater initial equanimity towards events (Brown, Ryan, & Creswell, 2007) and as being experientially open (Hayes, Strosahl, & Wilson, 1999). Accordingly, when mindful, a person takes in the world empirically, collecting experiential evidence to inform behavior and attitudes, rather than jumping to conclusions. Mindfulness is thus thought to foster more objective and unbiased processing of experience through a "bare registering of the facts observed" (Brown et al., 2007, p. 212), and conversely, lessen reliance on top-down mental processes fueled by expectations, desires, or schemas (Olendzki, 2005).

Previous research links mindfulness to reduced judgment, albeit mostly using self-report measures. Arch and Craske (2006), for instance, found that, compared to a control condition, participants randomly assigned to a brief mindfulness induction reported less emotional volatility in response to pleasant and unpleasant photos, and exhibited greater willingness to view highly unpleasant pictures, indicative of more openness and acceptance. Moving beyond self-report, Brown, Goodman, and Inzlicht (2013) used a neural

measure of emotional reactivity, the late positive potential (LPP), as participants viewed photographs of varying arousal and valance, and found those higher in dispositional mindfulness exhibited lower LPP responses to highly arousing unpleasant images, consistent with the view that mindfulness is related to reduced judgment. Using a behavioral measure of selective attention, Hodgins and Adair (2010) found individuals with formal meditation training, compared to matched controls, exhibited greater ability to overcome distracting visual cues, indicative of greater openness and flexibility. Although evidence supports the conceptualization of mindfulness as a stance of greater objectivity, research has not investigated behavioral evidence of non-judgment as it applies to implicit biases in perceptual processing.

To the extent that mindfulness fosters greater non-judgment and equanimity towards experience, it should predict a reduction in the use of top-down processes in which expectations or desires influence perception. Instead, mindfulness should predict increased use of bottom-up or experiential perception, reflecting openness to experience the world with greater objectivity. To test this, we examined mindfulness in relation to 'motivated perception', a top-down process in which people's visual perception is influenced by their desires. This phenomenon was showcased by Balcetis and Dunning (2006), who told participants that they would either consume a disgusting smoothie or orange juice, and that the computer would randomly assign their beverage by flashing either a letter or a number on the screen. Half were told that seeing a letter meant assignment to the smoothie, whereas a number meant assignment to the orange juice. The other half received the opposite pairing. In reality the figure shown to all participants could be perceived as either the letter B or the number 13. Results

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showed that most people saw the ambiguous image in the way that would lead to the desired outcome of receiving the orange juice, evidencing motivated perception.

In the current study we conducted a conceptual replication of this Balcetis and Dunning (2006) study to test the hypothesis that trait and state mindfulness would predict reduced motivated perception, indicative of lesser reliance on top-down perceptual processes.

2. Method

2.1. Participants

American adults (N = 161, 65% female) recruited from Amazon Mechanical Turk participated for a small financial reward. The study was described as evaluating the influence of pleasant and unpleasant tasks on behavior. Participants ranged in age from 18 to 65, (M = 37.7, SD = 12.4). Most indicated their race/ethnicity as White (82%), 8.0% as Asian, 7.5% as Black, and 2.4% as Native American, Pacific Islander, or "other." Most reported having had some college education, receiving a bachelor's or graduate degree (87.5%). Only 4.4% reported having a regular meditation practice for more than 6 months.[1]

2.2. Procedures and measures

2.2.1. Consent and cover story

All participants provided informed consent. Participants were told that they would be assigned at random by a computer program to engage in either a pleasant task, which was watching a funny video clip of a comedian, or an unpleasant task, which was to complete high-level logic and mathematic problems as well as crossing out the number "5" in a randomly-generated, 150,000-integer-long number string. We further told participants that the computer would convey their assignment by flashing a either a letter (A–Z) or a number (1–26) on the screen. We counterbalanced the meaning of the letter or number by informing half the participants that seeing a letter meant they would do the pleasant task, whereas a number signaled the unpleasant task. For the other half of participants, the pairing was reversed.

2.2.2. B/13 task

Each participant was then presented a fixation point (3 s) prior to a 400 ms flash of the same ambiguous image used by Balcetis and Dunning (2006), which can be interpreted as either the letter "B" or the number "13" (Fig. 1). Participants were asked to indicate whether they saw a letter or a number (forced choice) and to type the letter or number they saw. To ensure participants were not simply seeing the ambiguity in the image and reporting it in the way that would lead to their desired task, we next made a supposed correction, stating the opposite pairing of tasks to the letter or number from what we had originally stated (e.g., participants originally told that a letter meant assignment to the video and a number to the logic task, we now stated that a letter meant the task and a number the video; procedure similar to Balcetis & Dunning, 2006, Study 5). After stating the switched meanings of the letter or number, we asked again whether they saw a letter or number, as a check to make sure no one changed what they said they saw. Subsequently, we asked how pleasant of a mood participants were in (1 = very unpleasant to 7 = very pleasant), and which task they hoped to be assigned to.

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[1] The same pattern of results holds when these participants are excluded from the analyses.

Fig. 1. Ambiguous B-13 stimulus.

2.2.3. State mindfulness

Next participants completed the State Mindfulness Attention and Awareness Scale (Brown & Ryan, 2003), which assesses the frequency of mindful behavior during a specified time frame. We asked participants to report on "the last five minutes," so that ratings would reflect self-reported mindfulness at the time that the image was perceived. A sample item is, "During the last five minutes I found myself preoccupied with the future or the past" (reverse coded). This measure exhibited good reliability in the current sample (α = .88).

2.2.4. Trait mindfulness

We subsequently measured trait mindfulness with the "Mindful Attention and Awareness Scale" (Brown & Ryan, 2003). This self-report measure asks participants to rate frequency of mindful experiences and behavior, with higher scores indicating greater mindfulness. This scale also exhibited good reliability in the current sample (α = .89).

2.2.5. Suspicion probing and debriefing

Next participants completed demographics items and responded to two open-ended questions, "What was the purpose of the letter or number that flashed earlier?" and "What do you think was the purpose of the study?" Finally, participants learned that they would not engage in a pleasant or unpleasant task and received a debriefing form.

3. Results

Four participants began but did not complete the study, resulting in missing data for some variables. Participants with partial data were included in analyses for which they had complete data, but were omitted from analyses for which they had incomplete data.

3.1. Perceptions of the stimulus

Across all participants (N = 161), 69.6% reported seeing the stimulus as the letter "B," and 30.4% reported seeing the stimulus as the number "13." Balcetis and Dunning (2006) found frequencies of responses in the same direction, but to a lesser degree; in their sample of 50 participants, 54% reported seeing the letter "B" and 46% of participants reported seeing the number "13." Of participants

who initially reported seeing a letter with our forced choice question, 94.6% typed as a free response that they saw the letter "B". Of participants who initially reported seeing a number, 98% typed in that they saw the number "13." After stating the swapped meaning of the letter/number assignments to tasks, 99.2% of participants maintained their original letter/number responses.

3.2. Coding motivated perception

Participants were coded as exhibiting motivated perception if they reported seeing the image in the way that would lead them to be assigned to the task they reported hoping to receive. Surprisingly, 23% of participants ($n = 37$) reported hoping to be assigned to the logic task. Thus, if these participants reported viewing the image in the manner in which they would receive the logic task, they were coded as having exhibited motivated perception. This coding resulted in 53.4% of participants exhibiting motivated perception. We have coded motivated perception in this way to retain as many data points as possible. In support that participants are "seeing what they want to see", motivated perception predicted being in a better mood after perceiving the ambiguous image ($r = .343$, $p < .001$). However, mood was not associated with state or trait mindfulness ($ps > .10$). Due to the association between mood and our dependent variable, we control for it when specified below. Given our directional hypothesis of mindfulness predicting reduced motivated perception, we ran 1-tailed regressions.

Because our paradigm rests on the stimulus being imperceptibly ambiguous, we first analyzed our data based on our suspicion probe. Specifically, we screened for participants who spontaneously mentioned the ambiguity of the image in the open-ended questions (13 participants did). Excluding these participants, we ran two separate hierarchical logistic regressions predicting motivated perception (1 = exhibited, 0 = did not exhibit) from either state or trait mindfulness, in the first step and the control variable, mood, was added in the second step.[2] The 2 × 2 classification accuracy matrices associated with each analysis can be found in the Supplemental Data. For each model we used a base rate of .50 to calculate the relative improvement over chance (RIOC), an index of improvement of prediction of our models over chance, relative to the base rate (Loeber & Dishion, 1983). RIOCs were calculated with Dichot3.2a (Barrett, 2014).

Both trait and state mindfulness predict less motivated perception in the first step of both regressions ($b = -.350$, $p = .045$, RIOC = 14.19%, Nagelkerke $R^2 = .026$, and $b = -.306$, $p = .049$, RIOC = 10.86%, Nagelkerke $R^2 = .026$, respectively); the effect of state mindfulness approaches marginal significance. In the second step, controlling for mood, both trait and state mindfulness continue to significantly predict less motivated perception ($b = -.496$, $p = .014$, RIOC = 27.19%, Nagelkerke $R^2 = .195$, and $b = -.400$, $p = .021$, RIOC = 32.39% Nagelkerke $R^2 = .190$, respectively; see Tables 1 and 2). If we do not exclude participants based on our suspicion probe we find the same basic pattern of results.[3]

4. Discussion

The current study offers initial evidence that state and trait mindfulness predict the reduced use of a top-down judgment,

Table 1
Logistic regression analyses predicting motivated perception (1-tailed).

Variable		b	S.E.	OR	Wald	RIOC	p
Suspicion probing sample ($n = 148$)							
Model 1	Step 1: trait mindfulness	−.350	.206	.705	2.884	14.19%	.045[*]
	Step 2: trait mindfulness	−.496	.226	.609	4.831	27.19%	.014[*]
	Mood	.598	.145	1.819	16.961		.000[**]
Model 2	Step 1: state mindfulness	−.306	.184	.737	2.749	10.86%	.049[*]
	Step 2: state mindfulness	−.400	.196	.670	4.175	32.39%	.021[*]
	Mood	.583	.142	1.791	16.751		.000[**]

[*] $p < .05$.
[**] $p < .001$.

Table 2
Correlations among variables (2-tailed).

Variable	1	2	3	4
1. Trait mindfulness	–			
2. State mindfulness	.583[**]	–		
3. Mood	.090	.075	–	
4. Motivated perception	−.141[†]	−.138[†]	.343[**]	–

[†] $p < .10$.
[**] $p < .001$.

motivated perception. We hypothesized that state and trait mindfulness would predict reductions in this top-down process because mindfulness has been theorized as a stance of increased equanimity toward experience. In other words, being relatively more focused on the present moment should foster openness towards all experiences and perceptions – including learning that one has been assigned to a less desirable task. We found support for our hypothesis: both state mindfulness and trait mindfulness predicted attenuated motivated perception.[4] These effects were strengthened when controlling for mood and when excluding participants who spontaneously mentioned noticing the ambiguity of the stimulus. The RIOCs for our models of interest indicate that mindfulness is a good predictor of motivated perception, predicting improvements over chance between 10.86% and 32.39%. Still, these rates suggest that there are additional factors contributing to the likelihood of exhibiting motivated perception as well.

We were surprised that our rates of desiring assignment to the "unpleasant" logic task as well as reporting seeing a "B" vs. "13" in the stimulus differed from those reported by Balcetis and Dunning (2006). These differences may reflect procedural changes associated with the on-line administration of the current study. A few participants who hoped for the presumably "unpleasant" logic task noted that this was because they did not like popular comedians or they found the notion of crossing out numbers more intriguing than watching a video. Additionally, although we programmed the stimulus to appear exactly the same as in Balcetis and Dunning's study in terms of size and length of presentation, it is possible that browser settings or internet speed may have slightly varied among participants, which may have also contributed to the differences in reports of seeing a "B" vs. "13" that we observed.

It was not surprising to us that mindfulness, a stance of greater non-judgment, did not predict self-reported mood after seeing the stimulus. The mood rating was correlated with exhibiting moti-

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[2] State mindfulness exhibited negative skew in our sample (skewness = −1.237, SE of skewness = .191), thus we created a log 10 transformed variable (transformed skewness = .544). We found the same pattern of results for both transformed and non-transformed variables, therefore, for ease of interpretation, we report the effects for the non-transformed variable.

[3] When we include the 13 participants who reported noticing the ambiguity, both trait and state mindfulness predict reduced motivated perception (trait: $b = -.344$, $p = .041$, RIOC = 3.38%, Nagelkerke $R^2 = .026$; state: $b = -.221$, $p = .099$; when controlling for mood, trait: $b = -.468$, $p = .015$, and state: $b = -.337$, $p = .034$).

[4] State mindfulness predicted motivated perception with a p-value that approached marginal significance ($p = .049$). We believe that this effect would have achieved greater significance were it not that power is considerably reduced with binary outcomes.

vated perception; seeing what you hope for leads to a better mood. Highly mindful people exhibited less motivated perception, and therefore their moods were not influenced.

Although the use of a behavioral task is a strength of this study, the work is limited by our use of self-report measures for state and trait mindfulness and the correlational study design. It remains unknown whether mindfulness per se directly influences motivated perception, or whether processes related to mindfulness account for the findings. Additional research is needed to replicate and further elucidate these results. Our measure of mindfulness (MAAS) focuses exclusively on the attention and awareness facets of mindfulness. So even a measure that does not target non-judgment predicts non-judgmental perception. Future research may benefit from assessing both attentional and attitudinal features of mindfulness by including subscales that capture non-judgment or curiosity. Additionally, future research evaluating whether changes in mindfulness over time are related to reductions in various top-down processes would further substantiate the definitional aspect of "non-judgment" in mindfulness.

In sum, the current study offers initial behavioral evidence that state mindfulness predicts greater objectivity in visual perception. This result helps to confirm that mindfulness is a state of greater equanimity towards experience that reduces the use of top-down motivated processes.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.paid.2015.04.008.

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