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Knock yourself out:

Brief mindfulness-based meditation eliminates self-prioritization

Marius Golubickis,[1] Lucy B. G. Tan,[2,3] Sara Saini,[1] Kallum Catterall,[1]
Aleksandra Morozovaite,[4] C. Neil Macrae[4]

[1]School of Psychology, University of Plymouth, Plymouth, England, UK
[2]School of Clinical Medicine, University of Queensland, Brisbane, Australia
[3]Child and Youth Mental Health Services, Children's Health Queensland, Brisbane, Australia
[4]School of Psychology, University of Aberdeen, Aberdeen, Scotland, UK

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Address Correspondence to:

Marius Golubickis
School of Psychology
University of Plymouth
Drake Circus
Plymouth PL4 8AA
England, UK

Email: marius.golubickis@plymouth.ac.uk

Abstract

Recent research has suggested that self-prioritization is an inescapable facet of mental life, but is this viewpoint correct? Acknowledging the flexibility of social-cognitive functioning, here we considered the extent to which mindfulness-based meditation — an intervention known to reduce egocentric responding — attenuates self-bias. Across two experiments (Expt. 1, $N = 160$; Expt. 2, $N = 160$), using an object-classification task, participants reported the ownership of previously assigned items (i.e., owned-by-self vs. owned-by-friend) following a 5-minute period of mindfulness-based meditation compared either to control meditation (Expt. 1) or no meditation (Expt. 2). The results revealed that mindfulness meditation abolished the emergence of the self-ownership effect during decision-making. An additional computational (i.e., Drift Diffusion Model) analysis indicated that mindfulness-based meditation eliminated a pre-stimulus bias toward self-relevant (vs. friend-relevant) responses and facilitated the rate at which evidence was accumulated from friend-related (vs. self-related) objects. Collectively, these findings elucidate the stimulus and response-related operations through which brief mindfulness-based meditation tempers self-prioritization.

Keywords: self-prioritization, ownership effect, mindfulness-based meditation, drift diffusion model.

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Decades of research have identified a purportedly basic feature of social cognition, information processing and decision-making are biased in decidedly self-serving and self-prioritizing ways (Conway, 2005; Mezulis et al., 2004; Sedikides & Alicke, 2012; Sui & Humphreys, 2015; Symons & Johnson, 1997). For example, whether comprising familiar (e.g., faces, names) or arbitrary (e.g., shapes, colours, sounds) stimuli, material related to the self is easier to detect, classify, and remember that comparable items pertaining to other people (Alexopoulos et al., 2012; Bargh & Pratto, 1986; Constable et al., 2019; Cunningham et al., 2008; Falbén et al., 2020; Golubickis et al., 2018; Gray et al., 2004 Rogers et al., 1977; Shapiro et al., 1997; Sui et al., 2012). Indeed, based on these findings, it has been argued that, underpinned by the enhanced processing of self-relevant inputs, self-prioritization is an inescapable facet of mental life (Sui & Humphreys, 2015, 2017). But, at least for stimuli with no prior self-association, is this in fact the case?

Using both shape-label matching and object-ownership tasks — the dominant paradigms in research in this area (Golubickis et al., 2018; Sui et al., 2012) — recent findings have suggested that self-prioritization is neither inevitable nor grounded in facilitated stimulus processing (e.g., Caughey et al., 2021; Constable et al., 2019; Falbén et al., 2019, 2020; Siebold et al., 2015; Stein et al., 2016; Svensson et al., in press; Wade & Vickery, 2018; Woźniak & Knoblich, in press). Take, for instance, the self-ownership effect whereby arbitrary objects assigned to the self are classified more rapidly and accurately than comparable items possessed by others (Constable et al., 2019; Golubickis et al., 2018, 2019; Lockwood et al., 2018). As it turns out, this effect only emerges when the self-relevance of the to-be-judged items is an explicit component of the prevailing task set. Judging stimuli along non-self-related dimensions eliminates self-prioritization (Caughey et al.,

2021; Constable et al., 2019; for related research, see also Falbén et al., 2019; Stein et al., 2016; Woźniak & Knoblich, in press).

Beyond alteration of the judgmental context, other factors likely moderate the emergence and magnitude of the self-ownership effect (and indeed other manifestations of self-bias). Moreover, it may be possible to weaken self-prioritization even under conditions in which personal relevance is the dimension along which the items must be judged (Caughey et al., 2021; Falbén et al., 2019; Woźniak & Knoblich, in press). As revealed by computational modeling analyses, the self-ownership effect reflects the operation of an egocentric decision-making strategy (Epley & Gilovich, 2004; Falbén et al., 2020 Epley et al., 2004; Golubickis et al., 2018, 2019; Lockwood et al., 2018). Specifically, through variation in the evidential requirements of response selection (i.e., less evidence is required to select self-relevant compared to other-relevant responses), even before a to-be-judged object appears on the screen, participants are biased toward a self-relevant (vs. other-relevant) outcome (i.e., self-relevance modulates response selection rather than stimulus processing). What, of course, this suggests is that anything that serves to reduce egocentrism, even temporarily, should also attenuate the response bias that underpins self-prioritization. Brief mindfulness-based meditation, we suspect, may exert just such an influence.

Emphasizing the non-judgmental appraisal of present-moment thinking (Bishop et al., 2004; Brown & Ryan, 2003; Kabat-Zinn, 2003), mindfulness-based meditation wields substantial impact on cognition and behaviour, even among individuals with no prior meditative experience (Hölzel et al., 2011). Of pertinence to the current inquiry, even brief (e.g., 5-10 min) experimentally induced periods of mindfulness have been shown to affect a range of psychological processes, including (but not limited to) emotional appraisal, action control, mindreading, and social perception (e.g., Erisman & Roemer, 2010; Golubickis et al., 2016; Papies et al., 2012, 2015; Tan et al., 2014). Crucially, one way or another, many of the benefits of mindfulness originate in changes to the character of self-construal, notably a detachment or decentering of the self that acts to diminish the potency of self-referential processing, hence minimize self-other differentiation (Carmody et al.,

2009; Hölzel et al., 2011; Farb et al., 2007; Shapiro et al., 2006; Vago & David, 2012). For example, Golubickis et al. (2016) reported that brief mindfulness-based meditation fostered the adoption of a third-person (vs. first-person) vantage point during visual imagery, thereby lessening people's self-centric estimates of personal salience in a potentially embarrassing situation (i.e., the spotlight effect; Gilovich et al., 2000; Macrae et al., 2016). Similarly, by reducing reliance on an egocentric decision-making strategy during an object-ownership task (Golubickis et al., 2018, 2019), we expected a transitory period of mindfulness-based meditation to diminish self-prioritization.

Despite burgeoning interest in the benefits of mindfulness both inside and outside the laboratory, quite how this practice impacts thinking and doing remains largely unspecified (Hölzel et al., 2011; Malinowski, 2013). To date, only a modest literature has explored the cognitive and neuropsychological processes through which mindfulness exerts influence, with emphasis falling primarily on the manner in which meditative experiences modulate attentional and motivational control (e.g., Lutz et al., 2008; Papies et al., 2015; Shapiro et al., 2006; Tang et al., 2007; Teper & Inzlicht, 2013). Given, therefore, continued uncertainty about the critical pathways through which meditative episodes impact cognition, here we adopted a computational modeling approach — specifically a Drift Diffusion Model (DDM) analysis (Ratcliff et al., 2016) — to explicate the mechanism (or mechanisms) through which mindfulness-based meditation modulates decisional processing (van Vugt & Jha, 2011; van Vugt et al., 2019; van Vugt & van den Hurk, 2017).

Computational accounts of decisional processing, such as the DDM, are valuable as they yield important mechanistic insights into the stimulus and response-related operations that underpin task performance across a range of psychological domains (Ratcliff et al., 2016; Wagenmakers, 2009). In binary decision-making tasks (e.g., is an object owned-by-self or owned-by-friend?), information is continually garnered from a stimulus until sufficient evidence has been acquired to select a response. In this way, performance can be facilitated through differences in the efficiency of stimulus processing (i.e., rate of information uptake; *stimulus* bias) and/or the evidential

requirements of response selection (i.e., *response* bias). Critically, a DDM analysis has the capacity

to isolate these independent sources of bias, thus inform understanding of the processes that

underpin decision-making (White & Poldrack, 2014). If, as expected, brief mindfulness-based

meditation attenuates (or eliminates) self-prioritization, then this should be realized through a

reduction (or abolishment) of the prior bias toward self-owned (vs. other-owned) responses that

underpins the self-ownership effect (Falbén et al., 2020; Golubickis et al., 2018, 2019, 2021).

Experiment 1

Method

Participants and Design

One hundred and sixty undergraduates (132 females, 24 males, 4 others; $M_{age} = 21.63$, $SD =$

5.67), with normal or corrected-to-normal visual acuity, took part in the research. Informed consent

was obtained from participants prior to the commencement of the experiment and the protocol was

reviewed and approved by the Ethics Committee at the School of Psychology, University of

Plymouth. The experiment had a 2 (Meditation: mindfulness or control) X 2 (Owner: self or friend)

mixed design, with repeated measures on the second factor. To detect a significant interaction, a

sample of one hundred and sixty participants afforded 97% power for a medium effect size (i.e., *d*

= .50; PANGEA, v .0.2).

Stimulus Materials and Procedure

The experiment was conducted online using Inquisit software. Participants, upon accessing

the experiment through a web link, were randomly assigned to either the mindfulness or control

condition. Participants who underwent the mindfulness intervention were instructed to close their

eyes, relax, and listen via headphones to a pre-recorded audio for 5 minutes until a bell chimed to

signal the end of the activity. Based on an established protocol (Tan & Martin, 2013, 2015),

participants were instructed to pay particular attention to the sensation of their breathing during the

5-minute period (Golubickis et al., 2016; Tan et al., 2014). They were also told it is quite natural for the mind to wander. However, they were requested to observe these episodes as fleeting experiences and to return attention to their breathing each time a distracting thought, emotion, or memory occurred (Smith & Novak, 2003). Previous research has confirmed the efficacy of this brief intervention in increasing levels of mindful-attention and awareness (Tan et al., 2014). Participants in the control condition heard audio instructions that were identical in length and style. Contrasting the mindfulness treatment, however, these individuals were told to attend to each thought, emotion, and memory that occurred and to be totally immersed in the experience (Papies et al., 2012).

Following the 5-minute intervention, participants were informed they would next perform an object-classification task featuring two categories of items — pencils and pens (Golubickis et al., 2018). Prior to the start of the task, they were told the computer would randomly assign one category of objects to be owned by them (i.e., self-owned) and the other category to be owned by their best friend (i.e., friend-owned). At this point, participants were requested to bring to mind their best friend as s/he would be the owner of the items. They then pressed the spacebar on the keyboard and text appeared indicating who had been assigned the pencils and pens, respectively (e.g., you = pens; friend = pencils). Assignment of the objects to self and friend was counterbalanced across the sample. Participants were then told they would be presented with images of individual pencils and pens on the screen and their task was to report, via a relevant button press as quickly and accurately as possible, whether the item belonged to them or their friend. Responses were given using two keys on the keyboard (i.e., N and M). Key-response mappings were counterbalanced across participants.

Each trial began with the presentation of a central fixation cross for 1000 ms, followed by a picture of a pencil or a pen for 100 ms. Once the object was presented, the screen turned blank until participants decided about the ownership of the item (i.e., self-owned or friend-owned). Following each response, the fixation cross re-appeared and the next trial began. The stimuli comprised

images of 20 objects (10 pens and 10 pencils) 140 by 140 pixels in size, grayscale, and matched for luminance (Golubickis et al., 2018). Participants performed 10 practice trials, followed by two blocks of 100 trials in which all stimuli occurred equally often in a random order. There were 200 trials in total, 100 trials per condition (i.e., self-owned vs. friend owned trials). Upon completion of the task, participants were debriefed and thanked.

Results and Discussion

Sixteen (13 females, 3 males) participants failed to follow the experimental instructions (i.e., responded with random button presses, yielding chance performance), thus were excluded from the analysis. Responses faster than 200 ms and slower than 2000 ms were also excluded, which eliminated less than 1% of the total number of trials. Participants' response accuracies and mean correct reaction times (RTs) were submitted to a 2 (Meditation: mindfulness or control) X 2 (Owner: self or friend) mixed-model analysis of variance (ANOVA) with repeated measures on the second factor. Analysis of response accuracies revealed a main effect of Owner ($F(1, 142) = 5.31$, $p = .023$, $\eta_p^2 = .04$) and a significant Meditation X Owner interaction ($F(1, 142) = 8.39$, $p = .004$, $\eta_p^2 = .06$; see Figure 1). Follow-up analysis yielded a significant simple main effect of Owner in the control condition ($F(1, 142) = 10.75$, $p = .002$, $\eta_p^2 = .14$), indicating that responses were more accurate to self-owned compared to friend-owned items. No such significant difference was observed in the mindfulness condition ($F(1, 142) = 0.22$, $p = .639$). A mixed model ANOVA on error responses revealed no significant effects.

Analysis of participants' mean correct RTs revealed only a significant Meditation X Owner interaction ($F(1, 142) = 5.34$, $p = .022$, $\eta_p^2 = .04$; see Figure 1). Follow-up analysis yielded a significant simple main effect of Owner in the control condition ($F(1, 142) = 7.77$, $p = .007$, $\eta_p^2 = .10$), such that responses were faster to self-owned compared to friend-owned items. No such significant difference emerged in the mindfulness condition ($F(1, 142) = 0.13$, $p = .723$).
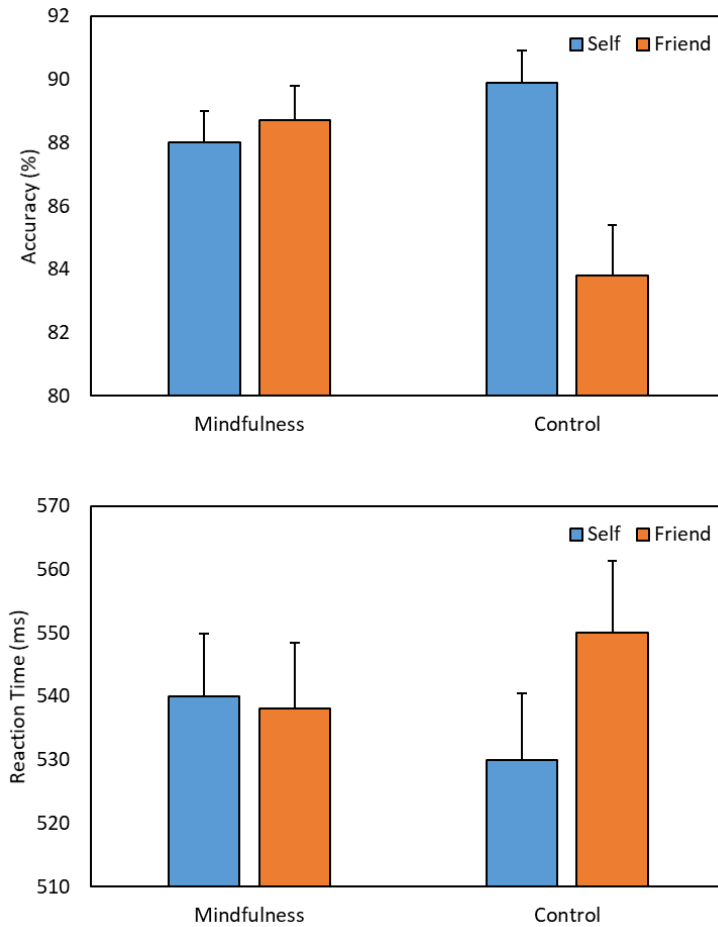
Figure 1. Mean correct response time (ms) and accuracy (%) as a function of Meditation and Owner. Error bars represent +1 SEM.

The results of Experiment 1 demonstrated that self-bias can be attenuated, indeed eliminated, following a brief period of mindfulness-based meditation. Specifically, whereas self-prioritization was evident among participants in the control condition, those who undertook mindfulness meditation failed to generate a self-ownership effect. A potential difficulty with the current experiment, however, was that participants in the control condition were instructed to focus on their ongoing thoughts, emotions, and memories. As such, rather than mindfulness-based meditation eliminating self-bias, it is possible that self-directed attention in the control condition amplified self-prioritization (Blagov & Singer, 2004; Kuhn & McPartland, 1954). To address this issue, we therefore conducted an additional preregistered experiment in which the effects of brief

mindfulness-based meditation were contrasted with a control activity in which attention was not directed toward the self. We expected to replicate the effects observed in Experiment 1.

Experiment 2

Method

Participants and Design

One hundred and sixty undergraduates (132 females, 24 males, 4 others; M_{age} = 21.63, SD = 5.67), with normal or corrected-to-normal visual acuity, took part in the research. Informed consent was obtained from participants prior to the commencement of the experiment and the protocol was reviewed and approved by the Ethics Committee at the School of Psychology, University of Plymouth. The experiment had a 2 (Meditation: mindfulness or control) X 2 (Owner: self or friend) mixed design, with repeated measures on the second factor. Based on Experiment 1, to detect a significant interaction, a sample of 132 participants afforded 80% power for an effect size of d = .4 (PANGEA, v .0.2). Additional participants (~20%) were recruited to allow for potential online testing drop-out (i.e., total N = 160).

Stimulus Materials and Procedure

The study was conducted online using Inquisit software. Contrasting Experiment 1, on this occasion participants in the control condition spent 5-minutes performing a puzzle task in which they had to make shapes using polygons (i.e., Tangram). In all other respects the methodology was identical to Experiment 1.

Results and Discussion

Twenty (13 females, 3 males) participants failed to follow the experimental instructions (i.e., responded with random button presses), thus were excluded from the analysis. Responses faster than 200 ms and slower than 2000 ms were also excluded, which eliminated less than 1% of the total number of trials. Participants' response accuracies and mean reaction times (RTs) were

submitted to a 2 (Meditation: mindfulness or control) X 2 (Owner: self or friend) mixed-model

ANOVA with repeated measures on the second factor. Analysis of response accuracies revealed a

main effect of Owner ($F(1, 138) = 3.97$, $p = .048$, $\eta_p^2 = .03$) and a significant Meditation X Owner

interaction ($F(1, 138) = 4.42$, $p = .037$, $\eta_p^2 = .03$; see Figure 2). Follow-up analysis yielded a

significant simple main effect of Owner in the control condition ($F(1, 138) = 8.01$, $p = .006$, η_p^2

$= .10$), indicating that responses were more accurate to self-owned compared to friend-owned items.

No such significant difference was observed in the mindfulness condition ($F(1, 138) = 0.01$, p

$= .937$). A mixed model ANOVA on error responses revealed no significant effects.

Analysis of participants' mean correct RTs revealed a main effect of Owner ($F(1, 138) =$

7.17, $p = .008$, $\eta_p^2 = .05$) and a significant Meditation X Owner interaction ($F(1, 138) = 4.76$, p

$= .031$, $\eta_p^2 = .03$; see Figure 2). Follow-up analysis yielded a significant simple main effect of

Owner in the control condition ($F(1, 138) = 13.50$, $p < .001$, $\eta_p^2 = .16$), such that responses were

faster to self-owned compared to friend-owned items. No such significant difference emerged in the

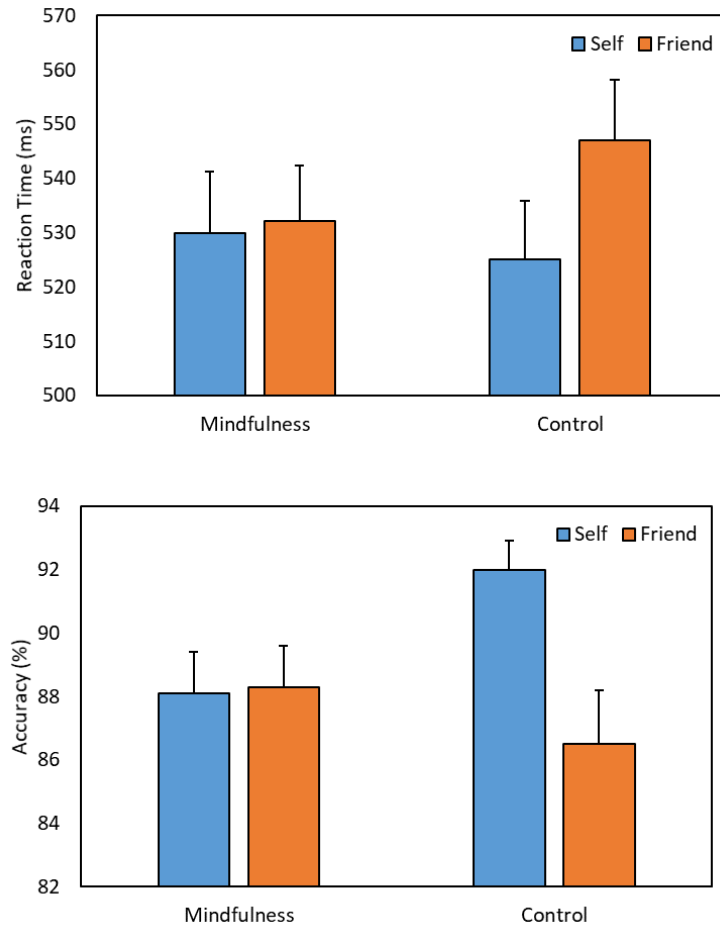mindfulness condition ($F(1, 138) = 0.11$, $p = .742$).

Figure 2. Mean response time (ms) and accuracy (%) as a function of Meditation and Owner. Error bars represent +1 SEM.

Modeling Analysis

To identify the processes underpinning task performance, data were submitted to a Hierarchical Drift Diffusion Model (HDDM) analysis (see Supplementary Material for a description of drift diffusion modeling and details of the current analysis). Models were response coded, such that the upper threshold corresponded to an owned-by-self response and the lower threshold to an owned-by-friend response (Golubickis et al., 2018). Inspection of the posterior distributions for the best fitting model indicated that task performance was underpinned by both response (z) and stimulus (v) biases as well as differences in response caution (a, see Figure 2). First, comparison of the observed starting point (z) values with no bias ($z = .50$) revealed extremely strong evidence of a

bias toward self-owned compared to friend-owned responses in the control condition ($M = .53$, p_{Bayes}[bias > 0.5] $< .001$, BF > 1000). That is, prior to stimulus presentation, responses were biased toward a self-relevant (vs. friend-relevant) outcome. In contrast, no evidence for such a bias was observed in the mindfulness condition ($M = .50$, p_{Bayes}[bias > 0.5] $= .527$, BF $= .90$).[1] There was also extremely strong evidence that the starting point of evidence accumulation was larger in the control compared to the mindfulness condition (p_{Bayes}[control $>$ mindfulness] $< .001$, BF > 1000), indicating that mindfulness increased the evidential requirements of self-relevant responses.

Second, there was extremely strong evidence that boundary separation (a) was larger in the mindfulness (vs. control) condition (Ms: 1.20 vs. 1.15, p_{Bayes}[control $<$ mindfulness] $< .001$, BF > 1000), revealing that mindfulness-based meditation increased response caution. Finally, evidence for a difference in drift rates (v) was also observed. Specifically, decisional evidence was accumulated more rapidly in the mindfulness compared to the control condition (Ms: 2.71 vs. 2.37, p_{Bayes}[control $<$ mindfulness] $< .001$, BF > 1000). In addition, there was extremely strong evidence that drift rate (v) was larger for self-owned (vs. friend-owned) objects in the control condition (Ms: 2.48 vs. 2.25, p_{Bayes}[self$_{control}$ $>$ friend$_{control}$] $= .001$, BF $= 999$), an effect that was reversed in the mindfulness condition (Ms: 2.66 vs. 2.75, p_{Bayes}[self$_{mindfulness}$ $<$ friend$_{mindfulness}$] $= .051$, BF $= 19$).

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[1] Bayesian p values quantify the degree to which the difference in the posterior distribution is consistent with the hypothesis. For example, a Bayesian p of .05 indicates that 95% of the posterior distribution supports the hypothesis.
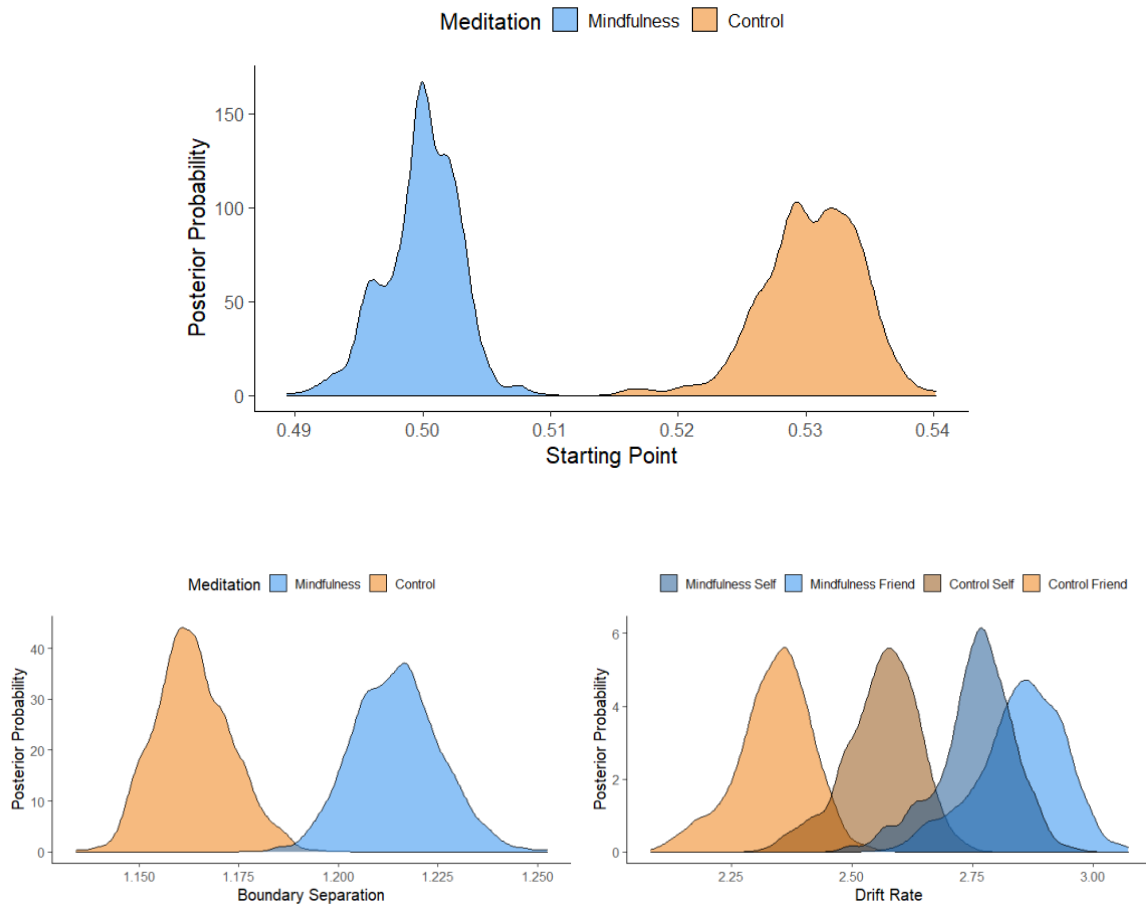
Figure 2. Mean posterior distributions of starting point (*z*), and boundary separation (*a*) as a function of Meditation and drift rate (*v*) as a function of Mindfulness and Owner.

Discussion

The current results confirmed that self-bias can be attenuated, indeed eliminated, following a brief period of mindfulness-based meditation. Specifically, whereas self-prioritization was evident among participants that focused on their thoughts for five minutes, those who undertook mindfulness meditation failed to generate a self-ownership effect. Furthermore, computational modeling (i.e., DDM analysis) identified the stimulus- and response-related operations through which mindfulness meditation moderated task performance.

Of theoretical significance, contrasting participants in the control condition, brief mindfulness-based meditation eliminated the prior (i.e., pre-stimulus) bias toward self-owned (vs.

friend-owned) responses that underpins the emergence of the self-ownership effect (Golubickis et al., 2018, 2019). Put simply, mindfulness meditation abolished the adoption of an egocentric response-related strategy during the object-classification task, thereby eradicating self-bias (Golubickis et al., 2016). Interestingly, the DDM analysis yielded further insights into the cognitive pathways through which mindfulness influenced task performance. Replicating previous research, mindfulness meditation increased boundary separation (i.e., a), such that additional evidence was required before a response was selected (van Vugt & van den Hurk, 2017). This indicates that mindfulness-based (vs. control) meditation increased response caution during decisional processing. Differences in the efficiency of stimulus processing (i.e., drift rate, v) were also observed. Specifically, whereas the rate of information uptake was faster for self-owned compared to friend-owned objects among participants in the control condition (i.e., self > friend), this effect was reversed (i.e., self < friend) for those that performed mindfulness meditation. Thus, following a brief period of mindfulness-based meditation, a combination of response and stimulus-related effects contributed to the elimination of the self-ownership effect. These findings affirm the value of computational modeling in explicating the pathways through which mindfulness-based meditation impacts cognition (van Vugt & Jha, 2011; van Vugt et al., 2019).

In considering how exactly mindfulness meditation works, attention is posited to play a central role (Bishop et al., 2004; Brown & Ryan, 2003; Carmody, 2009; Hölzel et al., 2011; Malinowski, 2013; Sumantry & Stewart, 2021). For example, recent meta-analytic work has revealed that core components of attention (Miyake et al., 2000; Posner & Petersen, 1990), notably alerting, inhibition, and updating, are enhanced as a result of mindfulness meditation (Sumantry & Stewart, 2021). One intriguing possibility is that, through attentional training grounded in the non-judgmental appraisal of moment-to-moment mental contents (Bishop et al., 2004; Brown & Ryan, 2003; Kabat-Zinn, 2003), mindfulness cultivates a level of meta-awareness in which identification with the self is reduced (i.e., non-self) and all experiences are treated equally (Bernstein et al., 2019; Dunne et al., 2019; Schooler, 2002). In other words, sensations, thoughts, and feelings are handled

as if one was a dispassionate (i.e., non-evaluative) external observer (Golubickis et al., 2016; Kerr et al., 2011; Shapiro et al., 2006), a state of mind that would naturally lessen egocentrism and the emergence of self-bias. Importantly, not only do the current results provide a mechanistic account of how mindfulness meditation influenced decision-making, they also highlight the flexibility of self-other processing and the pliability of self-prioritization (Caughey et al., 2021; Constable et al., 2019; Falbén et al., 2019, 2020; Woźniak & Knoblich, in press).

The malleability of self-prioritization is unsurprising given the inherent fluidity of the self-concept. A common feature of models asserting the obligatory nature of self-bias is that they characterize the self as a monolithic psychological construct through which sensory inputs are assessed (i.e., the 'ubiquitous' self – Humphreys & Sui, 2016; Sui & Gu, 2017; Sui & Humphreys, 2015, 2017). This viewpoint is out-dated, however. Rather than comprising an immutable construct, the self-concept is dynamic, multifaceted and shaped by the continuous interplay of autobiographical knowledge, situational factors, and immediate processing goals (Conway, 2005; Conway & Pleydell-Pearce, 2000; McConnell, 2011; Oyserman, 2007). Indeed, when operationalized in this way, the emergence and magnitude of self-prioritization is highly dependent both on how the self is construed and which sub-components of the self-concept have been activated (Golubickis et al., 2017, 2020; Kim & Florack, 2021; Kim et al., 2019). Interestingly, the Buddhist traditions (e.g., Theravada) from which mindfulness meditation originated similarly view the self as a changeable construct, with obvious implications for self-referential mentation. By developing a neutral (i.e., non-judgmental) attitude toward the contents of one's experiences, a process of self-detachment takes place whereby mental life is no longer dominated by self-centric concerns, desires, and impulses (Hölzel et al., 2011). Simply put, reduced self-identification lessens self-bias. To fully understand the vagaries of self-referential processing, future research will benefit from nuanced treatments of self-representation that emphasize the plasticity of self-function Conway & Pleydell-Pearce, 2000; McConnell, 2011; Oyserman, 2007).

To expand the scope of the current inquiry, consideration should also be given to the longevity of the de-biasing effect that brief mindfulness-based meditation exerts on self-prioritization. The observed elimination of self-bias is unquestionably temporary, just how transitory however remains to be seen. In exploring this issue further, attention should be directed both to the dosage of mindfulness meditation (i.e., time spent meditating) that is experienced and the temporal interval before self-prioritization is probed, as these factors in tandem likely influence the eradication and re-emergence of self-bias (Papies et al., 2012, 2015). Additionally, individual differences in meditative expertise warrant empirical consideration. Compared to novice practitioners, experienced meditators display improved attentional functioning, reduced emotional reactivity, and heightened cognitive flexibility (Goleman & Davidson, 2017; Jha et al., 2007; Lutz et al., 2004; Moore & Malinowski, 2009). As such, extensive meditative practice may have notable implications for the generation of egocentric decisional biases. For example, it is possible that, via self-detachment, experienced meditators may fail to generate self-prioritization effects, an outcome that would challenge dominant theoretical accounts of self-function (Humphreys & Sui, 2016; Sui & Humphreys, 2015). In combination with computational modeling, future research should explore this matter using samples that vary in meditative experience across tasks that tap different manifestations of self-bias (Constable et al., 2019; Golubickis et al., 2021; Schäfer et el., 2015, 2016; Sui et al., 2012).

Notwithstanding the assertion that self-prioritization is a ubiquitous feature of mental life (Humphreys & Sui, 2016; Sui & Humphreys, 2015, 2017), the current findings yielded further evidence for the malleability of this allegedly inescapable effect (Caughey et al., 2021; Constable et al., 2019; Falbén et al., 2019, 2020; Siebold et al., 2015; Stein et al., 2016; Svensson et al., in press; Wade & Vickery, 2018; Woźniak & Knoblich, in press). Following a brief period of mindfulness-based meditation, at least in the context of an object-ownership task, it is possible to knock yourself out.

Open Practices Statement

Data are available at the OSF at the following link: https://osf.io/w7zvj/. The current experiment

was not preregistered.

References

Alexopoulos, T., Muller, D., Ric, F., & Marendaz, C. (2012). I, me, mine: Automatic attentional

capture by self-related stimuli, *European Journal of Social Psychology*, *42*, 770-779.

Bargh, J. A., & Pratto, F. (1986). Individual construct accessibility and perceptual

selection. *Journal of Experimental Social Psychology*, *22*, 293-311.

Bernstein, A., Hadash, Y., & Fresco, D. M. (2019). Metacognitive processes model of decentering:

Emerging methods and insights. *Current Opinion in Psychology*, *28*, 245-251.

Bishop, S. R., Lau, M., Shapiro, S., Carlson, L., Anderson, N. D., Carmody, J., ... & Devins, G.

(2004). Mindfulness: a proposed operational definition. *Clinical psychology: Science and

practice*, *11*, 230-241.

Brown, K. W., & Ryan, R. M. (2003). The benefits of being present: mindfulness and its role in

psychological well-being. *Journal of Personality and Social Psychology*, *84*, 822-848.

Carmody, J. (2009). Evolving conceptions of mindfulness in clinical settings. *Journal of Cognitive

Psychotherapy*, *23*, 270-280.

Carmody, J., Baer, R. A., LB Lykins, E., & Olendzki, N. (2009). An empirical study of the

mechanisms of mindfulness in a mindfulness-based stress reduction program. *Journal of

Clinical Psychology*, *65,* 613-626.

Caughey, S., Falbén, J. K., Tsamadi, D., Persson, L. M., Golubickis, M., & Macrae, C. N. (2021).

Self-prioritization during stimulus processing is not obligatory. *Psychological Research*, *85*,

503-508.

Constable, M. D., Welsh, T. N., Huffman, G., & Pratt, J. (2019). I before U: Temporal order judgements reveal bias for self-owned objects. *Quarterly Journal of Experimental Psychology*, *72*, 589-598.

Conway, M. A. (2005). Memory and the self. *Journal of Memory and Language*, *53*, 594-628.

Conway, M. A., & Pleydell-Pearce, C. W. (2000). The construction of autobiographical memories in the self-memory system. *Psychological Review*, *107*, 261-288.

Cunningham, S. J., Turk, D. J., Macdonald, L. M., & Macrae, C. N. (2008). Yours or mine? Ownership and memory. *Consciousness and Cognition*, *17*, 312-318.

Dunne, J. D., Thompson, E., & Schooler, J. (2019). Mindful meta-awareness: Sustained and non-propositional. *Current Opinion in Psychology*, *28*, 307-311.

Epley, N., & Gilovich, T. (2004). Are adjustments insufficient? *Personality and Social Psychology Bulletin*, *30*, 447-460.

Epley, N., Keysar, B., Van Boven, L., & Gilovich, T. (2004). Perspective taking as egocentric anchoring and adjustment. *Journal of Personality and Social Psychology*, *87*, 327-339.

Erisman, S. M., & Roemer, L. (2010). A preliminary investigation of the effects of experimentally induced mindfulness on emotional responding to film clips. *Emotion*, *10*, 72-82.

Falbén, J. K., Golubickis, M., Balseryte, R., Persson, L. M., Tsamadi, D., Caughey, S., & Macrae, C. N. (2019). How prioritized is self-prioritization during stimulus processing? *Visual Cognition*, *27*, 46-51.

Falbén, J. K., Golubickis, M., Wischerath, D., Tsamadi, D., Persson, L. M., Caughey, S., Svensson, S., & Macrae, C. N. (2020). It's not always about me: The effects of prior beliefs and stimulus prevalence on self-other prioritization. *Quarterly Journal of Experimental Psychology*, *73*, 1466-1480.

Farb, N. A., Segal, Z. V., Mayberg, H., Bean, J., McKeon, D., Fatima, Z., & Anderson, A. K. (2007). Attending to the present: mindfulness meditation reveals distinct neural modes of self-reference. *Social Cognitive and Affective Neuroscience*, *2*, 313-322.

Gilovich, T., Medvec, V. H., & Savitsky, K. (2000). The spotlight effect in social judgment: an egocentric bias in estimates of the salience of one's own actions and appearance. *Journal of Personality and Social Psychology*, *78*, 211-222.

Goleman, D., & Davidson, R. (2017). *The science of meditation: How to change your brain, mind and body*. Penguin UK.

Golubickis, M., Falbén, J. K., Cunningham, W. A., & Macrae, C. N. (2018). Exploring the self-ownership effect: Separating stimulus and response biases. *Journal of Experimental Psychology: Learning, Memory and Cognition*, *44*, 295-306.

Golubickis, M., Falbén, J. K., Ho, N. S., Sui, J., Cunningham, W. A., & Macrae, C. N. (2020). Parts of me: Identity-relevance moderates self-prioritization. *Consciousness and Cognition*, *77*, 102848.

Golubickis, M., Falbén, J. K., Sahraie, A., Visokomogilski, A., Cunningham, W. A., Sui, J., & Macrae, C. N. (2017). Self-prioritization and perceptual matching: The effects of temporal construal. *Memory & Cognition*, *45*, 1223-1239.

Golubickis, M., Ho, N. S. P., Falbén, J. K., Mackenzie, K. M., Boschetti, A., Cunningham, W. A., & C. N. Macrae (2019). Mine or mother's? Exploring the self-ownership effect across cultures. *Culture and Brain*, *7*, 1-25.

Golubickis, M., Ho, N. S. P., Falbén, J. K., Schwertel, C. L., Maiuri, A., Dublas, D., Cunningham, W. A., & Macrae, C. N. (2021). Valence and ownership: Object desirability influences self-prioritization. *Psychological Research*, 85, 91-100.

Golubickis, M., Tan, L. B., Falbén, J. K., & Macrae, C. N. (2016). The observing self: Diminishing egocentrism through brief mindfulness meditation. *European Journal of Social Psychology*, *46*, 521-527.

Gray, H. M., Ambady, N., Lowenthal, W. T., & Dedlin, P. (2004). P300 as an index of attention to self-relevant stimuli. *Journal of Experimental Social Psychology*, *40*, 216-224.

Hölzel, B. K., Lazar, S. W., Gard, T., Schuman-Olivier, Z., Vago, D. R., & Ott, U. (2011). How does mindfulness meditation work? Proposing mechanisms of action from a conceptual and neural perspective. *Perspectives on Psychological Science*, *6*, 537-559.

Humphreys, G. W., & Sui, J. (2016). Attentional control and the self: The self-attention network (SAN). *Cognitive Neuroscience*, *7*, 5-17.

Jha, A. P., Krompinger, J., & Baime, M. J. (2007). Mindfulness training modifies subsystems of attention. *Cognitive, Affective, & Behavioral Neuroscience*, *7*, 109–119.

Kabat-Zinn, J. (2003). Mindfulness-based interventions in context: Past, present, and future. *Clinical Psychology: Science and Practice*, *10*, 144–156.

Kerr, C. E., Josyula, K., & Littenberg, R. (2011). Developing an observing attitude: an analysis of meditation diaries in an MBSR clinical trial. *Clinical Psychology & Psychotherapy*, *18*, 80-93.

Kim, H., & Florack, A. (2021). Immediate self-information is prioritized over expanded self-information across temporal, social, spatial, and probability domains. *Quarterly Journal of Experimental Psychology*, *74*, 1615-1630.

Kim, H., Stolte, M., & Humphreys, G. W. (2019). The relations between temporal and social perceptual biases: Evidence from perceptual matching. *Attention, Perception, & Psychophysics*, *81*, 599-606.

Lockwood, P. L., Wittmann, M. K., Apps, M. A., Klein-Flügge, M. C., Crockett, M. J., Humphreys, G. W., & Rushworth, M. F. (2018). Neural mechanisms for learning self and other ownership. *Nature Communications*, *9*, 1-11.

Lutz, A., Greischar, L. L., Rawlings, N. B., Ricard, M., & Davidson, R. J. (2004). Long-term meditators self-induce high-amplitude gamma synchrony during mental practice. *Proceedings of the National Academy of Sciences*, *101*, 16369–16373.

Lutz, A., Slagter, H. A., Dunne, J. D., & Davidson, R. J. (2008). Attention regulation and monitoring in meditation. *Trends in Cognitive Sciences*, *12*, 163-169.

Macrae, C. N., Mitchell, J. P., McNamara, D. L., Golubickis, M., Andreou, K., Møller, S., ... & Christian, B. M. (2016). Noticing future me: Reducing egocentrism through mental imagery. *Personality and Social Psychology Bulletin*, *42*, 855-863.

Malinowski, P. (2013). Neural mechanisms of attentional control in mindfulness meditation. *Frontiers in Neuroscience*, *7*, 8.

McConnell, A. R. (2011). The multiple self-aspects framework: Self-concept representation and its implications. *Personality and Social Psychology Review*, *15*, 3-27.

Mezulis, A. H., Abramson, L. Y., Hyde, J. S., & Hankin, B. L. (2004). Is there a universal positivity bias in attributions? A meta-analytic review of individual, developmental, and cultural differences in the self-serving attributional bias. *Psychological Bulletin*, *130*, 711-747.

Miyake, A., Friedman, N. P., Emerson, M. J., Witzki, A. H., Howerter, A., & Wager, T. D. (2000). The unity and diversity of executive functions and their contributions to complex "frontal lobe" tasks: A latent variable analysis. *Cognitive Psychology*, *41*, 49-100.

Moore, A., & Malinowski, P. (2009). Meditation, mindfulness and cognitive flexibility. *Consciousness & Cognition*, *18*, 176–186.

Oyserman, D. (2007). Social identity and self-regulation. In A. W. Kruglanski & E. T. Higgins (Eds.), *Social psychology: Handbook of basic principles* (pp. 432–453). The Guilford Press.

Papies, E. K., Barsalou, L. W., & Custers, R. (2012). Mindful attention prevents mindless impulses. *Social Psychological and Personality Science*, *3*, 291-299.

Papies, E. K., Pronk, T. M., Keesman, M., & Barsalou, L. W. (2015). The benefits of simply observing: mindful attention modulates the link between motivation and behavior. *Journal of Personality and Social Psychology*, *108*, 148-170.

Posner, M. I., & Petersen, S. E. (1990). The attention system of the human brain. *Annual Review of Neuroscience*, *13*, 25-42.

Ratcliff, R., Smith, P. L., Brown, S. D., & McKoon, G. (2016). Diffusion decision model: Current issues and history. *Trends in Cognitive Sciences*, *20*, 260-281.

Rogers, T. B., Kuiper, N. A., & Kirker, W. S. (1977). Self-reference and the encoding of personal information. *Journal of Personality and Social Psychology*, *35*, 677-688.

Schäfer, S., Frings, C., & Wentura, D. (2016). About the composition of self-relevance: Conjunctions not features are bound to the self. *Psychonomic Bulletin and Review*, *23*, 887-982.

Schäfer, S., Wentura, D., & Frings, C. (2015). Self-prioritization beyond perception. *Experimental Psychology*, *62*, 415-425.

Schooler, J. W. (2002). Re-representing consciousness: Dissociations between experience and meta-consciousness. *Trends in Cognitive Sciences*, *6*, 339-344.

Sedikides, C., & Alicke, M. D. (2012). Self-enhancement and self-protection motives. In R. M. Ryan (Ed.), *The Oxford handbook of human motivation* (pp. 303–322). Oxford University Press.

Shapiro, K. L., Caldwell, J., & Sorensen, R. E. (1997). Personal names and the attentional blink: A visual "cocktail party" effect. *Journal of Experimental Psychology: Human Perception and Performance*, *23*, 504-514.

Shapiro, S. L., Carlson, L. E., Astin, J. A., & Freedman, B. (2006). Mechanisms of mindfulness. *Journal of Clinical Psychology*, *62*, 373-386.

Siebold, A., Weaver, M. D., Donk, M., & van Zoest, W. (2015). Social salience does not transfer to oculomotor visual search. *Visual Cognition*, *23*, 989-1019.

Smith, H., & Novak, P. (2003). *Buddhism: A concise introduction*. New York, NY: Harper Collin

Stein, T., Siebold, A., & van Zoest, W. (2016). Testing the idea of privileged awareness of self-relevant information. *Journal of Experimental Psychology: Human Perception and Performance*, *42*, 303-307.

Sui, J., & Gu, X. (2017). Self as object: Emerging trends in self research. *Trends in Neurosciences*, *40*, 643-653.

Sui, J., & Humphreys, G. W. (2015). The integrative self: How self-reference integrates perception and memory. *Trends in Cognitive Sciences*, *19*, 719-728.

Sui, J., & Humphreys, G. W. (2017). The ubiquitous self: What the properties of self-bias tell us about the self. *Annals of the New York Academy of Sciences*, *1396*, 222-235.

Sui, J., He, X., & Humphreys, G. W. (2012). Perceptual effects of social salience: Evidence from self-prioritization effects on perceptual matching. *Journal of Experimental Psychology: Human Perception and Performance*, *38*, 1105-1117.

Sumantry, D., & Stewart, K. E. (2021). Meditation, mindfulness, and attention: A meta-analysis. *Mindfulness*, *12*, 1332-1349.

Svensson, S. L., Golubickis, M., Maclean, H., Falbén, J. K., Persson, L. M., Tsamadi, D., ... & Macrae, C. N. (in press). More or less of me and you: Self-relevance augments the effects of item probability on stimulus prioritization. *Psychological Research*.

Symons, C. S., & Johnson, B. T. (1997). The self-reference effect in memory: A meta-analysis. *Psychological Bulletin*, *121*, 371-394.

Tan, L. B., Lo, B. C., & Macrae, C. N. (2014). Brief mindfulness meditation improves mental state attribution and empathizing. *PloS One*, *9*, e110510.

Tan, L., & Martin, G. (2013). Taming the adolescent mind: Preliminary report of a mindfulness-based psychological intervention for adolescents with clinical heterogeneous mental health diagnoses. *Clinical Child Psychology and Psychiatry*, *18*, 300-312.

Tan, L., & Martin, G. (2015). Taming the adolescent mind: A randomised controlled trial examining clinical efficacy of an adolescent mindfulness-based group programme. *Child and Adolescent Mental Health*, *20*, 49-55.

Tang, Y. Y., Ma, Y., Wang, J., Fan, Y., Feng, S., Lu, Q., ... & Posner, M. I. (2007). Short-term meditation training improves attention and self-regulation. *Proceedings of the National Academy of Sciences*, *104*, 17152-17156.

Teper, R., & Inzlicht, M. (2013). Meditation, mindfulness and executive control: the importance of emotional acceptance and brain-based performance monitoring. *Social Cognitive and Affective Neuroscience*, *8*, 85-92.

Vago, D. R., & David, S. A. (2012). Self-awareness, self-regulation, and self-transcendence (S-ART): a framework for understanding the neurobiological mechanisms of mindfulness. *Frontiers in Human Neuroscience*, *6*, 296.

Van Vugt, M. K., & Jha, A. P. (2011). Investigating the effect of mindfulness meditation training on working memory: A mathematical modelling approach. *Cognitive, Affective, & Behavioral Neuroscience*, *11*, 344-353.

van Vugt, M., Moye, A., & Sivakumar, S. (2019). Computational modelling approaches to meditation research: Why should we care? *Current Opinion in Psychology*, *28*, 49-53.

van Vugt, M. K., & van den Hurk, P. M. (2017). Modeling the effects of attentional cueing on meditators. *Mindfulness*, *8*, 38-45.

Wade, G. L., & Vickery, T. J. (2017). Self-relevance effects and label choice: Strong variations in label-matching performance due to non-self-relevant factors. *Attention, Perception, and Psychophysics*, *79*, 1524-1534.

Wagenmakers, E. J. (2009). Methodological and empirical developments for the Ratcliff diffusion model of response times and accuracy. *European Journal of Cognitive Psychology*, *21*, 641-671.

White, C. N., & Poldrack, R. A. (2014). Decomposing bias in different types of simple decisions. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *40*, 385-398.

Woźniak, M., & Knoblich, G. (in press). Self-prioritization depends on assumed task-relevance of self-association. *Psychological Research*.