Validation of different forms of present-moment awareness using cognitive and behavioral outcomes

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Author Contributions

All authors developed the study concept and design. Testing and data collection were performed by A.G.. A.G. & K.G.D. performed the data analysis and interpretation, with assistance from K.N-G.. K.G.D. drafted the paper, with critical feedback from all authors. All authors approved the final version of the paper for submission.

All study materials and the full data files for both studies as well as the analysis code for the analyses reported are available on OSF (https://osf.io/36mje/?view_only=426cf19b6c444cae86b123f5a561ca1e). These studies were not preregistered.

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Abstract

The recently-developed Multidimensional Awareness scale consists of three subscales assessing individual differences in present moment awareness of internal states (meta-awareness; MAS-MA), present moment awareness of the external world (external awareness; MAS-EA), and in the adoption of a detached, observer perspective on one's current internal states (decentered awareness; MAS-DA). The present paper examines whether the constructs identified during the development of the MAS manifest during behavioral laboratory tasks. Study 1 (*N* = 242) examined participants' memory for incidentally-encountered external stimuli (criterion for external awareness) and reports of awareness of mind wandering during a lengthy vigilance task (criterion for meta-awareness), and Study 2 (*N* = 230) examined tolerance of a painful stimulus and concurrent and retrospective reports of pain (criteria for decentered awareness). Results supported the constructs of meta-awareness and decentered awareness and the corresponding validity of the MAS-MA and MAS-DA, but incidental memory was not related to MAS-EA. Findings generally remained after controlling for previously-established measures of mindfulness or decentering. Results are discussed with respect to theory on awareness-related concepts and potential uses of the MAS subscales.

Keywords: meta-awareness, decentering, mindfulness, metacognition, scale validation

Public Significance Statement

This research examined recently identified components of present moment awareness. People's reports of their trait awareness of their internal states was associated with their performance on a task capturing current awareness, and people's reports of their tendency to adopt a detached perspective was associated with greater tolerance of a painful experience. These findings support the validity of these concepts, suggesting they may manifest in behavior.

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Recent clinical and non-clinical research highlights the importance of different aspects of present moment awareness. Typically studied under the guise of mindfulness or third-wave psychotherapies, concepts related to present moment awareness include meta-awareness, decentering, and defusion, among others (for a review, see e.g., Bernstein et al., 2015). Awareness-related concepts have been implicated in the regulation of mental states, including regulation of one's attention, goals, and emotions (e.g., Kang et al., 2013; Schooler et al., 2015). Awareness-related concepts are also implicated in psychological health, targeted in many therapeutic interventions, change over the course of psychotherapy, and predict recovery and relapse from psychopathology (e.g., Bernstein et al., 2015; Fresco, Segal, et al., 2007; O'Toole et al., 2019; Teasdale et al., 2002). Because of the potential importance of awareness-related concepts, there is growing interest in understanding individual differences in them, as well as change in them over time (e.g., as a function of psychotherapy). In the present manuscript, we examine three awareness-related concepts identified during the development of the Multidimensional Awareness Scale (MAS; DeMarree & Naragon-Gainey, 2021), and identify and test potential behavioral and psychological manifestations of the constructs identified.

Recently, the Multidimensional Awareness Scale (MAS; DeMarree & Naragon-Gainey, 2021) was developed to assess trait variability in several dimensions related to the contents and form of present moment awareness. In developing the MAS, the authors sought to build on conceptual work on awareness-related concepts with a broad item pool reflecting current theory (Bernstein et al., 2015) as well as addressing empirical concerns with existing measures (e.g., Naragon-Gainey & DeMarree, 2017b; Rudkin et al., 2018). Notably, most past measures of decentering and mindfulness-related constructs focused primarily on awareness of *negative* thoughts and feelings and/or often confounded the construct of interest with the direction of item coding (e.g., agreeing with items might indicate higher levels of decentering, but lower levels of defusion). To address these concerns, the MAS item pool included both forward and reverse scored items targeting each of the potential awareness-related concepts considered, and items were generally agnostic with respect to the valence of people's experiences (e.g., they did specify the valence of thoughts and feelings referred to). Critically, items targeted a wide range of the awareness-related concepts proposed in the literature on third-wave approaches to psychopathology and psychotherapy, as well as mindfulness more generally.

What emerged were three factors that speak to individual differences in the contents and form of present-moment awareness. With respect to the contents, two moderately correlated factors emerged, neither of which was uniquely assessed by previous decentering or mindfulness measures: *Meta-awareness* (MA) reflects individual differences in the tendency to be aware of one's ongoing mental activity, whereas *external awareness* (EA) reflects individual differences in one's tendency to be aware of the external world. With respect to the form of awareness, *decentered awareness* (DA) reflects individual differences in awareness of one's internal states (i.e., to be meta-aware) *from a perspective of psychological distance and nonjudgment*.[1] The MAS provides researchers and clinicians with a single measure to

[1] We note that similar concepts have been given various labels in different literatures, including decentering, defusion, self-distancing, and others (Bernstein et al., 2015).

distinguish these aspects of awareness and is broadly applicable to positive, negative, and neutral internal experiences. Its development also suggested two important refinements to theory in this area. First, the factor structure suggested that there may not be a single trait "present moment awareness" concept, as reflected in some existing scales (e.g., the Five Facet Mindfulness Questionnaire's "Observing" subscale); instead, some people may be higher in awareness of internal experiences whereas others are aware of external experiences (see also Rudkin et al., 2018). Second, by finding a single decentered awareness dimension, it contributed to ongoing debates about how many decentering-related concepts exist. Notably, although past research has found two decentering-related concepts (e.g., Hadash et al., 2017; Naragon-Gainey & DeMarree, 2017b; see also Bernstein et al., 2015), in previous research measures of these concepts had confounded the concept measured with features of measurement (e.g., direction of item coding). With items that de-confound item content from direction of coding, DeMarree and Naragon-Gainey (2022) found only one decentering concept.

In the present paper, we describe two studies that further investigate constructs suggested in the development of the MAS, using specific behavioral tasks that were chosen because of their relevance to the concepts suggested by each of the MAS subscales. In Study 1, we used tasks predicted to be outcomes of the constructs of meta-awareness and external awareness. For meta-awareness, we chose real-time awareness of mind wandering (i.e., meta-awareness of mind wandering; Smallwood et al., 2007), as this should be a specific instance of the general meta-awareness concept believed to be indexed by MAS-MA. We predicted that people who score higher on MAS-MA would be more likely to report that they were aware of their mind wandering when it occurred. This task should not be related to a measure of external awareness, given that awareness of mind wandering does not require attention to the external world. In addition, decentered awareness should not be as strongly associated with awareness of mind wandering because noticing one's mind wandering does not require the psychological distance or non-judgmental stance afforded by decentering. For our criterion related to external awareness, we chose incidental memory for external stimuli – memory for things encountered by chance (i.e., not focal to one's task goals). Memory, including incidental memory, follows from the active direction of attention to the stimuli encountered (e.g., Castel et al., 2015). Because people high in trait external awareness should deploy more attention to features of the external world, we predicted increased incidental memory performance as scores on MAS-EA increased. One key feature of an incidental memory paradigm, over other memory paradigms, is that people do not realize they are in a memory task until after exposure to the relevant stimuli. This was critical for our purposes, as instructions relating to a memory task might override people's natural tendencies to attend to the environment that should be characteristic of high levels of the external awareness concept.

In Study 2, we examined a hypothesized consequence of the construct of decentered awareness – pain tolerance. Building on the idea that one consequence of the psychological distance characteristic of decentering is decreased reactivity to internal experiences (Bernstein et al., 2015; Naragon-Gainey & DeMarree, 2017a), some research using a cold pressor task has found that as decentering increased, the experience of pain during the task was less extreme and the ability to tolerate it was greater (DeMarree et al., 2019). With these outcomes, the psychological distance associated with decentering is key, as awareness of a painful stimulus without psychological distance could potentially exacerbate the experience of pain (e.g.,

Ferguson & Ahles, 1998), reducing tolerance (Hayes et al., 1999). The original publication of these data examined the differential associations of different decentering measures because, at the time, evidence suggested there were two decentering-related concepts. Findings indicated that, in general, the concept of reduced struggle with, or reactivity to one's mental contents had the stronger relationship to responses to pain (DeMarree et al., 2019). However, as noted above, in the development of the MAS, only one decentering-related factor emerged, suggesting there is a single decentering-related concept rather than two. To examine whether this single decentering concept predicts pain tolerance outcomes, we re-analyzed the original data, which included the MAS candidate items. We hypothesized that higher scores on the MAS-DA would be associated with increased ability to tolerate a painful stimulus.

Both studies use measures predicted to capture specific instances of the constructs identified in the development of the MAS to determine whether the corresponding MAS subscale is associated with those momentary experiences; we expected small to moderate effect sizes (rather than large) given the different methods of assessment. In both studies, primary analyses involve all three MAS subscales as simultaneous predictors of the focal outcomes to examine the specificity of associations. Follow-up analyses include other established measures of mindfulness and decentering as simultaneous predictors to examine the incremental validity of MAS subscales over these measures.

We report how we determined our sample size, all data exclusions, all manipulations, and all measures in the studies. These studies were not preregistered. Sample size in both studies was based on the number of participants we could recruit by the end of the academic term in which the study was run. Sensitivity power analysis with a three-predictor regression model (i.e., all MAS subscales) revealed that we had 80% power to detect relatively small effect sizes in both studies ($f^2 \geq .033$ in Study 1, and $\geq .034$ in Study 2). All study materials, including those variables not described in this report, and the full data files for both studies as well as the analysis code for the analyses reported are available on OSF (https://osf.io/36mje/?view_only=426cf19b6c444cae86b123f5a561ca1e).[2] Both studies were approved by the IRB of the first author's institution.

Study 1: Mind Wandering Awareness and Incidental Memory

Method

Participants and Procedure

Participants were 242 students (M_{age} = 19.24, *SD* = 1.62; 149 male, 93 female; 24 Hispanic, 129 White, 41 Black, 70 Asian, 4 American Indian or Alaska Native, 5 Pacific Islander; multiple selections possible) at a large public university in the Northeastern United States who participated in exchange for partial course credit.[3] Not all participants completed every measure, so the degrees of freedom in analyses reflect this.

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[2] Additional measures collected, but not reported in this paper included measures of trait affectivity, other measures of mindfulness-related concepts, alexithymia (Study 1 (S1)), interoceptive awareness (S1), emotion- and emotion-regulation-related beliefs, psychological distress (S2), self-consciousness (S2), rumination (S2), and self-compassion (S2).

[3] All participants completed validity questions, embedded throughout the questionnaires (e.g., "I often ride wild animals at the zoo"). Consistent with previous work (Naragon-Gainey & DeMarree, 2017a; 2017b), we removed participants who scored ≥2SD above the mean of these

Participants were greeted by an experimenter who obtained informed consent. Participants began the study by completing an incidental memory task, followed by a go/no-go task accompanied by thought probes, and lastly completed a series of questionnaires, beginning with the Multidimensional Awareness Scale (other measures were presented in a random order). Finally, participants were debriefed and dismissed.

Incidental Memory Task

Adapting past work on incidental memory (Forgas et al., 2009; for a review see Castel et al., 2015) we assessed memory for incidentally encountered environmental stimuli as the criterion measure of external awareness. After indicating consent, participants were asked to turn off their cellphones and were led to a waiting area. Each participant waited for at least 2 minutes before they were invited into the lab. This waiting period served as the incidental exposure for the memory task. The rest of the study took place on the computer. The first task was a surprise recognition memory task for the details of the waiting room. Participants were presented with a list of 27 items, in random order, and asked to indicate which of the items they recalled being present in the waiting area. Ten of the items presented were objects in the waiting area (e.g., a blue chair), while the other 17 items presented on the list were lures that were not actually present (e.g., a keyboard). Items correctly identified by participants, or "hits" were then summed, while items incorrectly identified by participants, or "false alarms" were also summed. From these, a measure of sensitivity, d-prime, was computed from the hit and false alarm rates using a loglinear correction for zeroes per the recommendations of Stanislaw and Todorov (1999). Higher scores indicate better memory performance. Sensitivity served as the primary dependent measure of incidental memory.

Sustained Attention Response Task with Thought Probe

Participants next completed the Sustained Attention Response Task (SART). This paradigm is frequently used to investigate mind-wandering (e.g., Mrazek et al., 2012; Smallwood et al., 2007, 2008). In our version of this task (adapted from Smallwood et al., 2007), participants were instructed to respond to one stimulus (W) with a key press on 83% of the trials and to withhold a response to another stimulus (M) on the remaining trials. The task was repetitive (552 total trials), long (15-20-minutes), and boring, and consequently, people tend to mind-wander. During the task, participants were probed 10-times at quasi-random intervals and asked whether they were mind wandering, and if so, whether they were aware of it (i.e., meta-awareness of their mind wandering). Specifically, participants were given the following explanation, adapted from Smallwood and colleagues (2007):

> "Occasionally you may find as you are completing the task, you begin thinking about something completely unrelated to what you are doing; this is what we refer to as "mind wandering". Every once in a while, you will be asked whether or not your mind is on task or "wandering" off task. If your mind was wandering off task you will also be asked whether or not you were aware that your mind was wandering; that is sometimes your mind wanders and you know it all along, while other times you don't realize your mind is wandering until you catch yourself doing so some time after."

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questions from analyses (17 participants in Study 1, 11 participants in Study 2). The numbers reported in text reflect participants remaining after this exclusion.

Participants were told which keys to press to indicate whether they were on task or engaging in mind wandering with or without awareness, and the definitions and reminders of these response options were available in hard copy at participants' computer stations. For each participant, we summed the number of probes with endorsement of mind wandering *with awareness* and divided it by the total number of mind-wandering probes (with or without awareness). This variable—percent mind-wandering with awareness— was the primary measure for this task. We also report mind-wandering frequency (with or without awareness) and SART performance (i.e., number of successful response inhibitions), as these were also assessed as part of the task and are both often used in research with other goals. Specifically, SART performance (often called a go/no-go task outside of the mind wandering literature) is often used as a measure of the response inhibition aspect of self-control (for a meta-analysis of associations with mental health problems, see Wright et al., 2014), whereas frequency of probe-caught mind wandering is often used in research on mind wandering (Schooler et al., 2011; Smallwood & Schooler, 2006). We did not have any specific hypotheses regarding whether any MAS subscales would be associated with these outcomes.

Self-Report Measures

Multidimensional Awareness Scale (MAS). The focal variables were measured using the Multidimensional Awareness Scale (DeMarree & Naragon-Gainey, 2022). This is a 25-item measure of individual-differences in three forms of present moment awareness. The Meta-Awareness (MAS-MA) subscale contains 7 items assessing present moment awareness of inner states in a manner that is agnostic to the contents or forms of the inner awareness (e.g., "I can observe my feelings as they unfold"). The External Awareness (MAS-EA) subscale contains 6 items assessing present moment awareness of the external world in a manner that is agnostic to the contents or forms of the awareness (e.g., "I am usually aware of what is going on around me"). The Decentered Awareness (MAS-DA) subscale contains 12 items assessing meta-awareness with psychological distance – as an outside observer of one's inner states (e.g., "I experience my thoughts and feelings without being carried away by them").

Cognitive Fusion Questionnaire (CFQ). The CFQ (Gillanders et al., 2014) is a 7-item measure of fusion (the Acceptance and Commitment Therapy concept that most closely aligns, albeit negatively, with decentering; Bernstein et al., 2015) that reflects the extent to which people struggle with or emotionally respond to their thoughts. Participants indicate the frequency with which each item was true of them on a 7-point scale anchored at *never true* and *always true*. In multidimensional characterizations of decentering described in the introduction, items from this measure have been categorized as primary indicators of the reduced reactivity to or reduced struggle with mental contents facet (Hadash et al., 2017; Naragon-Gainey & DeMarree, 2017b). The CFQ is coded such that higher scores indicate *less* decentering (i.e., greater fusion).

Experiences Questionnaire (EQ). The EQ (Fresco, Moore, et al., 2007) is an 11-item measure of decentering guided by an MBCT framework. Items were generated to represent changes thought to occur as a result of MBCT, including lack of identification with one's thoughts and non-reactivity to negative experiences. Participants indicate the frequency with which each statement reflects their experiences on a 5-point scale anchored at *never* and *all*

the time. In multidimensional characterizations of decentering, items from this measure have been categorized as primary indicators of the observer perspective/disidentification facet of decentering (Naragon-Gainey & DeMarree, 2017b).

Five Facet Mindfulness Questionnaire. The short form (FFMQ-SF; Bohlmeijer et al., 2011) of the Five Facet Mindfulness Questionnaire (FFMQ; Baer et al., 2006) is a 24-item measure of trait mindfulness. The FFMQ-SF subscales represent a breadth of mindfulness conceptualizations, assessing awareness of sensations/mental contents (Observing), non-judgment of ongoing experience (Nonjudging), nonreactivity to inner experience (Nonreactivity), acting with awareness (Awareness), and labeling experiences with words (Describing). Participants report the extent to which each of a series of statements is true of them on a 5-point scale anchored at *never or rarely true* and *very often or always true*. This measure was selected as a very commonly-used measure of mindfulness that conceptually is related to but distinct from the MAS subscales, given its greater breadth.[4] However, for several of its subscales there are potential confounds between the constructs measured and direction of wording (see introduction for discussion of similar issues applied to measures of decentering).

Analytic Strategy

We used correlations and regression models to examine relationships with criteria. For the primary analyses, relevant criteria were regressed on all MAS subscales. Two follow-up models examining incremental validity controlled for either the FFMQ subscales or the other measures of decentering (i.e., the EQ and CFQ). Missing data were handled with listwise deletion, given low rates of missingness (0-3 observations per measure, except for percent of mind wandering in awareness (8 observations missing; 6 of these were missing because there were no reports of mind wandering from which to compute this index).

[4] At the suggestion of an anonymous reviewer, we conducted structural analyses (exploratory structural equation models that allow cross-loadings) of the FFMQ and MAS items in both studies, in order to assess their discriminant validity. Model fit was good as indexed by RMSEA and SRMR in both studies (.03-.05), but CFI reached acceptable levels only in Study 2 (CFI = .86 in Study 1 and .90 in Study 2). We note that some overlap in items (e.g., cross-loadings) is to be expected for these measures, given that both measures have scales and items assessing present-moment awareness and non-reactivity, albeit at different levels of breadth.

Table 1: Descriptive statistics and correlations among Study 1 variables

		N	Mean	SD	α	A	B	C	D	E	F	G	H	I	J	K	L	M
A	MAS-MA	242	5.309	.736	.81													
B	MAS-EA	241	5.295	.959	.82	.386**												
C	MAS-DA	242	4.067	.878	.83	.019	.142*											
D	FFMQ-Act	242	3.120	.654	.70	.070	.192**	.348**										
E	FFMQ-Lab	242	3.239	.666	.74	.314**	.151*	.259**	.327**									
F	FFMQ-NJ	242	3.031	.791	.79	-.217**	-.046	.360**	.315**	.158*								
G	FFMQ-NR	242	3.040	.687	.75	.098	.012	.498**	-.026	.208**	.007							
H	FFMQ-Obs	242	3.634	.725	.72	.392**	.421**	-.064	-.056	.181**	-.144*	.046						
I	EQ	239	3.534	.597	.83	.385**	.294**	.563**	.189**	.353**	.134*	.520**	.199**					
J	CFQ	241	3.926	1.293	.91	.108	-.091	-.730**	-.426**	-.196**	-.527**	-.273**	.171**	-.341**				
K	PctAware	234	.572	.286		.194**	.147*	.077	-.013	.051	-.043	.072	.033	.159*	-.002			
L	MW Freq	240	5.779	2.464		-.113	-.184**	-.159*	-.172**	-.067	-.024	-.008	-.075	-.198**	.123	.040		
M	SART Perf	240	57.74	16.51		-.007	.125	.077	.064	-.016	.039	.053	.001	.022	-.126	.019	-.235**	
N	Sensitivity	242	.820	.585		-.018	.019	-.003	.029	-.011	.083	-.083	.095	-.102	-.025	-.005	-.014	-.043

MAS-MA = MAS Meta-awareness, MAS-EA = MAS External awareness, MAS-DA = MAS Decentered Awareness, FFMQ-Act = FFMQ - Acting with Awareness, FFMQ-Lab = FFMQ - Labeling with words / describing, FFMQ-NJ = FFMQ - Non-judging, FFMQ-NR = FFMQ - Non-reacting, FFMQ-Obs = FFMQ - Observing Sensations, EQ = Experiences Questionnaire, CFQ = Cognitive Fusion Questionnaire, PctAware = Percent of Mind Wandering in Awareness, MW Freq = Frequency of mind wandering (any type), SART Perf = Number of Successful Response Inhibitions during SART, Sensitivity = sensitivity of memory in incidental memory task as indexed by d-prime

* $p < .05$, ** $p < .01$

Results and Discussion

For descriptive statistics, internal consistency, and correlations among variables, see Table 1. We report both the analyses focal to the present investigation as well as those examining outcomes unrelated to our central hypotheses (e.g., SART performance) in Table 2. The incremental validity analyses are reported in the online supplement Table A.

Awareness of Mind Wandering

In the correlations and primary regression model (see Table 2), only MAS Meta-Awareness was significantly and positively associated with the percent of mind wandering that occurred with awareness, consistent with predictions. In the incremental validity regression models (see Supplemental Table A) controlling for FFMQ subscales, this effect remained significant and no other variables approached significance. In the incremental validity regression models controlling for other measures of decentering, this effect dropped to non-significance, but no other variables approached significance. Thus, trait self-reports of meta-awareness (MAS-MA) were uniquely associated with specific reports of awareness of mind wandering in most models, consistent with the presence of an underlying meta-awareness trait.

Incidental Memory

In the correlations and primary regression model, MAS External Awareness was unrelated to sensitivity of incidental memory, inconsistent with predictions. In the incremental validity regression models, the FFMQ Observing facet was positively and marginally associated with sensitivity while the Experiences Questionnaire was negatively and marginally associated with sensitivity. These relationships were not significant in the zero-order analyses, though both were directionally consistent with these regression models. The FFMQ Observing effect is consistent with the notion that people who tend to pay more attention to the present moment in general would attend to, and consequently remember, details from a specific experience. In this study as well as in past work, the Observing subscale has been found to relate to (DeMarree & Naragon-Gainey, 2021) or contain items related to (Rudkin et al., 2018) multiple forms of present moment awareness (e.g., meta-awareness and external awareness), though the short form we used in the current study only contains items relating to external awareness. However, because the MAS-EA was not associated with incidental memory performance in any of the analyses, this paradigm failed to provide support for the construct validity of this MAS subscale.

Table 2: Primary regression models predicting each outcome variable.

Criterion / Predictor	*B*	*SE*	*Beta*	*p*
PctAware				
^MAS-MA	.065	.027	.167	.017
MAS-EA	.022	.021	.075	.291
MAS-DA	.023	.021	.069	.293
Sensitivity				
MAS-MA	-.024	.056	-.030	.673
^MAS-EA	.019	.043	.031	.663
MAS-DA	-.004	.044	-.007	.918
MW Freq				
MAS-MA	-.180	.230	-.054	.435
MAS-EA	-.368	.178	-.143	.041
MAS-DA	-.386	.180	-.138	.033

SART Perf				
MAS-MA	-1.257	1.554	-.057	.419
MAS-EA	2.371	1.207	.139	.051
MAS-DA	1.097	1.216	.059	.368

Note: MAS-MA = MAS Meta-awareness, MAS-EA = MAS External awareness, MAS-DA = MAS Decentered Awareness, FFMQ-Act = FFMQ - Acting with Awareness, FFMQ-Lab = FFMQ - Labeling with words / describing, FFMQ-NJ = FFMQ - Non-judging, FFMQ-NR = FFMQ - Non-reacting, FFMQ-Obs = FFMQ - Observing Sensations, EQ = Experiences Questionnaire, CFQ = Cognitive Fusion Questionnaire, PctAware = Percent of Mind Wandering in Awareness, MW Freq = Frequency of mind wandering (any type), SART Perf = Number of Successful Response Inhibitions during SART, Sensitivity = sensitivity of memory in incidental memory task as indexed by d-prime. Predictors marked with a carrot (^) were ones which we had a priori predictions regarding the relevant outcome.

Other Outcomes

Although not central to the current research questions, we also examined whether MAS subscales were associated with two other outcomes measured as part of the SART task: frequency of mind wandering and performance on the SART (as indexed by frequency of correct response inhibition on "no go" trials). We had no specific predictions regarding either measure. As seen in Table 2, both MAS-EA and MAS-DA were significantly associated with reduced frequency of mind wandering, and MAS-EA was marginally associated with higher SART performance.

Study 2: Experience and Response to Cold Pressor

Study 2 is a new analysis of previously published data (DeMarree et al., 2019) that examined decentering (not as measured by the MAS) associations with responses to a cold pressor task. As this study included the candidate items for the MAS, we present a re-analysis of this study using the MAS subscales as predictors. As described in the introduction, we predicted that MAS-DA should be associated with increased tolerance and decreased distress (small to moderate effect sizes) in response to a painful stimulus, but that other MAS subscales would not. Because this study, including all cold-pressor outcomes, has been published elsewhere (DeMarree et al., 2019), we present a condensed description of the methods below.

Method

Participants and Procedure

Participants were 230 students (M_{age} = 19.09, *SD* = 1.23; 143 male, 87 female; 14 Hispanic, 98 White, 27 Black, 105 Asian, 3 American Indian or Alaskan Native, 1 unreported, multiple selections possible) at a large public university in the Northeastern United States who participated in exchange for partial course credit. Not all participants completed every measure, so the degrees of freedom in analyses reflect this. After indicating informed consent, participants first completed a series of questionnaires, presented in random order, including the MAS and other decentering measures. Participants then completed the cold pressor task described below, with dependent measures collected during and immediately after the task. Finally, participants were debriefed.

Study Tasks and Materials

Self-report Questionnaires. Participants completed the same self-report measures as Study 1.

Cold Pressor Task. This task was adapted from protocols used in earlier research (e.g., Ruiz-Aranda et al., 2010; Seery et al., 2013; Sharpe et al., 2013; von Baeyer et al., 2005). The cold pressor task began with participants submerging their non-dominant hand in a warm water bath (~35°C) to create a uniform baseline, during which time the research assistant described the questions participants would be asked during the cold water submersion (i.e., intensity and unpleasantness, see below). Participants were instructed to submerge their hand in the cold-water bath for as long possible, but to remove it when it became too uncomfortable or hurt too much. Participants then placed their hand in a recirculating cold-water bath set at 5°C for a maximum of four minutes. After completion of the task, participants were allowed to dry and warm their hand, and then completed the short-form of the McGill Pain Questionnaire.

Cold Pressor Pain Tolerance and Momentary Experience. The research assistant asked participants to rate the intensity and unpleasantness of their experience at the beginning of the cold pressor task and then every 30 seconds, and then immediately after removing their hand. Participants responded verbally on 10-point scales, anchored at *no pain at all* and *the most intense pain you've experienced* for intensity, and *not bothered by the pain at all* and *extremely bothered by the pain* for unpleasantness. Questions were adapted from previous research using the cold pressor (Ruiz-Aranda et al., 2010; Seery et al., 2013). The averages across available time points for intensity and unpleasantness separately served as dependent measures. In addition, tolerance (i.e., total time in the cold-water bath) was recorded for all participants.

McGill Pain Questionnaire – Short form (MPQ-SF). The MPQ-SF (Melzack, 1987) asked participants to indicate the extent to which each of 15 pain-related descriptors (11 sensory; 4 affective) characterized their experience during the cold pressor task. Each of the descriptors was rated on a 4-point intensity scale (0 = *none*, 1 = *mild*, 2 = *moderate*, 3 = *severe*).

Results and Discussion

We used the same analytic strategy as Study 1. For descriptive statistics, internal consistency, and correlations among variables, see Table 3. Focal analyses are reported in Table 4 and incremental validity analyses are reported in the online supplement Table B.

The correlations and primary regression models (Table 4) with all MAS subscales as predictors indicate that scores on the MAS-DA, but not on the other MAS subscales, were associated with increased tolerance of the cold pressor, lower retrospective reports of pain (MPQ-SF), and lower momentary reports of pain intensity and unpleasantness. These patterns support the construct validity of the MAS-DA and are consistent with the predictions of theory on decentering.

Table 3: Descriptive statistics and correlations among Study 2 variables

		N	Mean	SD	α	A	B	C	D	E	F	G	H	I	J	K	L	M
A	MAS-MA	228	5.125	.736	.80													
B	MAS-EA	228	5.101	.899	.75	.470**												
C	MAS-DA	228	4.201	.822	.82	.055	.228**											
D	FFMQ-Act	230	15.874	3.535	.80	.020	.233**	.391**										
E	FFMQ-Lab	230	16.378	3.850	.87	.314**	.299**	.360**	.275**									
F	FFMQ-NJ	230	15.352	3.838	.79	-.060	.030	.401**	.403**	.219**								
G	FFMQ-NR	230	15.600	3.176	.76	.197**	.175**	.507**	-.087	.262**	-.065							
H	FFMQ-Obs	230	14.113	3.186	.79	.452**	.551**	.099	-.125	.129	-.099	.283**						
I	EQ	230	3.455	.622	.86	.369**	.301**	.459**	-.038	.184**	-.006	.356**	.307**					
J	CFQ	229	3.714	1.239	.92	.024	-.187**	-.739**	-.439**	-.305**	-.536**	-.254**	.006	-.334**				
K	Tolerance	227	83.59	83.14		.127	.188**	.278**	.065	.130	.168*	.193**	.115	.158*	-.203**			
L	MPQ-SF	226	1.022	.615	.90	-.042	-.136*	-.175**	-.133*	-.060	-.214**	-.017	-.057	.020	.180**	-.236**		
M	MeanInt	226	6.361	1.977		-.066	-.124	-.188**	.019	-.114	-.123	-.108	-.129	-.023	.120	-.358**	.375**	
N	MeanUnpl	226	7.119	2.022		-.021	-.025	-.210**	.030	-.032	-.172**	-.184**	-.046	-.026	.088	-.421**	.354**	.805**

MAS-MA = MAS Meta-awareness, MAS-EA = MAS External awareness, MAS-DA = MAS Decentered Awareness, FFMQ-Act = FFMQ - Acting with Awareness, FFMQ-Lab = FFMQ - Labeling with words / describing, FFMQ-NJ = FFMQ - Non-judging, FFMQ-NR = FFMQ - Non-reacting, FFMQ-Obs = FFMQ - Observing Sensations, EQ = Experiences Questionnaire, CFQ = Cognitive Fusion Questionnaire, Tolerance = Total Time in Cold Water Bath (sec), MPQ-SF = Short-form McGill Pain Questionnaire, MeanInt = Mean Intensity of Pain During Cold Pressor Task, MeanUnpl = Mean Unpleasantness of Pain During Cold Pressor Task

* $p < .05$, ** $p < .01$

Table 4: Regression models predicting each outcome variable.

Criterion / Predictor	*B*	*SE*	*Beta*	*p*
Tolerance				
MAS-MA	7.226	8.178	.064	.378
MAS-EA	9.180	6.869	.099	.183
^MAS-DA	25.539	6.703	.251	<.001
MPQ-SF				
MAS-MA	.016	.062	.019	.798
MAS-EA	-.075	.052	-.110	.155
^MAS-DA	-.113	.051	-.150	.028
Mean Intens				
MAS-MA	-.056	.199	-.021	.778
MAS-EA	-.160	.167	-.074	.339
^MAS-DA	-.408	.164	-.169	.014
Mean Unpl				
MAS-MA	-.077	.205	-.028	.707
MAS-EA	.088	.172	.039	.608
^MAS-DA	-.539	.168	-.218	.002

Note: EQ = Experiences Questionnaire, CFQ = Cognitive Fusion Questionnaire (note this is a negative indicator of decentering), Tolerance = total time in seconds submerged in cold water bath, Mean Intens = average intensity of pain across available observations during the task, Mean Unpl = average unpleasantness of pain across available observations during the task. Predictors marked with a carrot (^) were ones which we had a priori predictions regarding the relevant outcome.

The incremental validity regression models added either the FFMQ subscales or the other decentering measures, in addition to the MAS subscales, to predict each outcome. As seen in Supplemental Table B, the MAS-DA continued to be significantly associated with relevant outcomes in 4 of the 8 incremental validity analyses, generally supporting the incremental validity of the MAS-DA subscale. In the analyses with FFMQ subscales, the Nonjudging facet was associated with reduced pain on the retrospective measure and on momentary ratings of unpleasantness. The Nonjudging subscale of the FFMQ shares some conceptual overlap with decentering, and the two models where it was a significant predictor were models in which the MAS-DA slope was not significant. Interestingly, the outcomes that the FFMQ nonjudging subscale was associated with may share some methodological variance – those outcome measures and the FFMQ-NJ questions are all ones in which agreement reflects more of a negative outcome (i.e., self-judgment or pain). No other variable included in these models had significant slopes in more than a single regression model.

General Discussion

The goal of this paper was to identify cognitive and behavioral manifestations of the present moment-awareness concepts identified during the development of the Multidimensional Awareness Scale. Notably, we examined outcomes that reflect ongoing cognitive, emotional, or behavioral responses that the identified concepts should predict, rather than trait reports of global tendencies. For the concept of meta-awareness (indexed by MAS-MA), we examined the proportion of mind wandering that occurred with awareness as the criterion in Study 1. Scores on MAS-MA were positively related to meta-awareness of mind wandering, consistent with our argument that meta-awareness of mind-wandering is a specific

instance of the general concept of meta-awareness indexed by the MAS-MA. For the concept of external awareness (indexed by MAS-EA), we examined memory for incidentally-encountered stimuli as the criterion in Study 1. Scores on the MAS-EA were unrelated to memory performance, producing uncertainty about the external awareness concept and the MAS-EA's ability to index the construct. For the construct of decentering (indexed by the MAS-DA), we examined responses to a cold pressor task in Study 2. Scores on the MAS-DA were associated with increased tolerance of the cold pressor task, reduced experience of pain during the cold pressor, and reduced retrospective reports of pain, consistent with our argument that pain tolerance is a specific consequence of trait decentering, which is indexed by the MAS-DA.

Thus, results were consistent with the presence of general meta-awareness and decentering concepts, and the validity of the MAS-MA and MAS-DA as measures of these concepts. Given the very different methodological approaches for the predictors and criteria in these studies, this suggest that the hypothesized constructs can manifest both in people's self-assessment of their general tendencies towards meta-awareness and decentering as well as their reports and in vivo behavioral performance during tasks that are relevant to these processes. This is encouraging, in that it suggests that both methods (i.e., self-report and behavioral/cognitive tasks) may be tapping into the same construct. Furthermore, there was often specificity in the findings, indicating that the statistical distinctions among self-reported facets of awareness in the MAS subscales are borne out in theoretically-distinct behavioral tasks. In addition, in most analyses these associations remained after controlling for well-validated self-report measures of mindfulness and decentering. As such, the narrower measurement of aspects of present moment awareness in the MAS may be beneficial when examining related specific behavioral outcomes.

However, Study 1 failed to support the validity of MAS-EA. Indeed, because external awareness has not been heavily studied in any domain, we initially struggled to identify an appropriate behavioral manifestation. Incidental memory seemed to be most promising to us at the time we ran the study, though admittedly, incidental memory would be a downstream consequence of external awareness. That is, incidental memory is not a mere instance of being externally aware, but rather would be a consequence of that awareness. This is less directly related to the target concept than the awareness of mind wandering criterion used to examine the trait external awareness in the same study, and could account, at least in part, for the nonsignificant effects observed. However, it is worth noting that the criteria examined in Study 2 were not specific instances of decentering, but rather consequences of decentering in the moment. Incidental memory itself is not a heavily studied topic (Castel et al., 2015), and as such, there is less information on optimal conditions for examining the phenomenon. It is thus plausible that our paradigm did not provide optimal conditions to examine external awareness. It is also possible that MAS-EA does not adequately capture the external awareness concept. Given that the concept itself is not well established in the psychological literature, the original publication of the MAS noted that limited the field of potential variables to consider for convergent and discriminant validity analyses, leaving uncertainty regarding measure validity (DeMarree & Naragon-Gainey, 2022). Finally, it is possible that MAS-EA is a valid measure of external awareness *and* incidental memory is related to the construct of external awareness, but that the two measures (i.e., MAS-EA and incidental memory) are sensitive to different levels of the latent trait (Lang & Tay, 2021).

Implications for Use of the MAS

Given the central postulated role of decentering in guiding adaptive responses to distress, the MAS-DA can be a useful tool for examining not only responses to pain, as tested in Study 2, but also to one's emotions. Supporting the role decentering is thought to play in third wave perspectives on psychopathology (e.g., Hayes et al., 2012; Segal et al., 2013), past research has found that decentering predicts reduced distress typically linked with negative affect (Naragon-Gainey & DeMarree, 2017a). Previous research (Naragon-Gainey et al., 2022), combined with the current Study 2, suggests that the MAS-DA can predict this effect as well, and thus may be a useful tool for process-oriented research. Less research has studied meta-awareness independent of decentering, but there are several promising directions to consider. One is that meta-awareness, or awareness in general, can develop in the absence of decentering and related concepts (Lindsay & Creswell, 2017), and having a valid measure of meta-awareness that is independent of decentering, like the MAS-MA, can help researchers to study these processes and their consequences.

In addition, the MAS-MA and MAS-DA may be useful tools for studying self-regulation. Self-regulation theories often differentiate monitoring processes from operating (or regulatory or control) processes (Carver & Scheier, 1998). Monitoring processes identify opportunities for regulation by comparing one's current state against one's desired states, whereas "operating" processes engage strategies directed at reducing the discrepancy between current and desired states (e.g., controlled responses, changing strategies, disengagement, etc.). Meta-awareness may facilitate monitoring of internal states (Kang et al., 2013; Schooler et al., 2015), and if goal-incongruent states are identified, this should initiate attempts to resolve the inconsistency (Carver & Scheier, 1998). The Study 1 findings are consistent with the idea that MAS-MA may be associated with monitoring processes – at least of mind wandering. Because decentering is thought to promote flexible responding in general (Hayes et al., 2012), it may similarly promote regulatory flexibility (see also Lindsay & Creswell, 2017). Because any regulatory opportunity could be met via multiple strategies (e.g., regulating one's anger at a friend could be attempted via reappraisal of the friend's action, suppression of the anger, accepting one's anger, etc.), the psychological distance decentering affords allows a person to step outside of the immediate undesired state and consider how one wants to respond. To the extent that this leads people to thoughtfully select situationally-appropriate regulatory strategies and abandon unsuccessful strategies, decentering would be expected to predict more successful regulatory outcomes. The Study 2 findings are consistent with the idea that MAS-DA may be associated with regulatory success, as people who scored higher on it were able to keep their hands in the ice bath longer.

Limitations and Constraints on Generality

Our logic for the hypotheses tested in this paper was that the trait concepts identified during the development of the MAS should manifest in individual instances of cognitive or behavioral activity. This is perhaps too lofty of an expectation and may be risky at times, as individual instances of a person's thoughts, feelings, and behavior, although partially reflective of broader patterns, are also subject to a host of situation-specific constraints. Consequently, it is generally advisable to match the specificity of measurement between the predictor and relevant outcomes (e.g., Paunonen et al., 2003; Weigel & Newman, 1976). We generally advise that researchers consider the specificity of measurement when using the MAS, such as by including multiple opportunities for awareness-related processes to manifest. For example,

ecological momentary assessment (EMA) study designs asking people to report on their current experience multiple times per day for an extended period would allow for greater capture of patterns of responding that might be missed in the examination of specific instances. Indeed, recent work found that MAS-DA, when included in a composite index of decentering with the other scales used in this research (i.e., the CFQ and EQ), does predict more frequent instances of decentering in daily life using an EMA study design (Naragon-Gainey et al., 2022).

Although the mind wandering and pain tolerance tasks we used in this research have been heavily studied and are generally seen as valid paradigms for examining the relevant concepts, they still lack in mundane realism. That is, monitoring mind wandering during a vigilance task and tolerance of a cold pressor – as instructed by experimenters – may not represent the instances of meta-awareness and decentering that occur in real world settings. Indeed, by drawing attention to people's ongoing experiences during these tasks, we might have increased the operation of relevant metacognitive processes, potentially producing stronger effects than would occur in daily life. On the other hand, since both tasks are self-regulatory, a person's motivations, goals, and values are relevant, and with an experimenter-provided task, these motivational forces may differ from people's day-to-day experiences. This is particularly important, because some third-wave approaches note that not only do one's present-moment awareness and the perspective on their awareness matter for understanding one's thoughts, feelings, and behavior, but so too does the extent to which a person's actions connect with their values (e.g., Hayes et al., 2012). Critically, these concepts are thought to work in concert with each other, so it is plausible that the effects we observed in the present work might be stronger when the situation was more value-relevant.

In addition, our samples were both college student samples from the same university. Although ethnically diverse, the samples came from a single cultural context and had a very restricted age range. In addition, they were mostly psychologically healthy (Study 1: 17% reported lifetime mental health treatment, with 12% currently in treatment; Study 2: 12% lifetime and 6% current) and had limited meditation experience (Study 1: 26% had any mindfulness experience; Study 2: 23% with experience; In both studies, over half of those who meditated reported experience of 1 year or less). Notably, some aspects of mind wandering vary as a function of age (McVay et al., 2013) and symptoms of psychopathology (Seli et al., 2019), though no work we are aware of has examined whether *awareness* of mind wandering varies as a function of either variable. Similarly, mean levels of cold pressor tolerance decrease with age, at least for men (Walsh et al., 1989), though it is not clear if the effects of decentering on tolerance would vary as a function of age. The research examining effects of mindfulness variables in East Asian cultural contexts (e.g., Cho et al., 2017; Du et al., 2019; Keng & Tong, 2016) has found similar results to those examined in Western contexts. However, we are not aware of any work that has examined the outcomes we examined, so the generalizability of these effects to East Asian contexts is unknown. In addition, limited research on mindfulness-related concepts has been conducted in other cultural contexts (especially in the global South), further limiting the generalizability of these findings. Importantly, no published work has used the MAS outside of Western contexts, so its validity outside of these contexts is unknown.

Although the present studies, combined with data from the initial publication of the MAS, can speak to the construct validity of the MAS using correlational methods based on classical test theory, they do not address all forms of validity that may be of interest. For

example, measures of mindfulness-related concepts have been shown to respond to experimental manipulations, such as mindfulness training or psychotherapeutic interventions (e.g., Gillanders et al., 2014). Information on responsiveness of MAS subscales to therapeutic interventions could offer information on the clinical significance of MAS subscale scores that go beyond correlations with psychopathology examined in previous research (DeMarree & Naragon-Gainey, 2022). Such data could also offer insight into the temporal time course of changes (e.g., whether changes in meta-awareness precede changes in decentered awareness). In addition, item response theory approaches (for a review, see Lang & Tay, 2021) can offer insights into the sensitivity and informational value of MAS subscale items across the latent trait dimensions they purport to assess. For example, as noted above, one possible reason the MAS-EA subscale might not relate to the performance on the incidental memory task is that the MAS items and the incidental memory task might be sensitive to different levels of the latent construct of external awareness. Knowing what levels of each construct the MAS subscales are sensitive to could help researchers make better decisions about the appropriate situations for use, and may point to potential ways to refine measurement of awareness-related concepts. Further, item-response theory approaches, when used in conjunction with experimental designs, could offer further insights into the sensitivity of the MAS subscales to variations in levels of the purported constructs, as well as potential differential sensitivity of individual items to such changes (Embretson, 1998; Lang & Tay, 2021). Such an approach would also allow for greater insights into the psychological processes that produce levels of construct each MAS subscale purports to assess by allowing greater experimental control over these processes. With these caveats in mind, we believe these studies do offer compelling support for the validity of the MAS-MA and MAS-DA subscales, at least in Western cultural contexts, and point to potentially interesting directions for use.

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