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State Mindfulness Scale (SMS): Development and Initial Validation

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The goal of the present research was to develop and test a novel conceptual model and corresponding measure of state mindfulness—the *State Mindfulness Scale* (SMS). We developed the SMS to reflect traditional Buddhist and contemporary psychological science models of mindfulness not similarly reflected in extant published measures of the construct. Study 1 exploratory and confirmatory factor analyses supported a higher order 2-factor solution encompassing 1 second-order state mindfulness factor, and 2 first-order factors, one reflecting state mindfulness of bodily sensations and the other state mindfulness of mental events. Study 2 provided cross-sectional evidence of the convergent, discriminant, and incremental convergent validity of SMS scores with respect to other measures of state and trait mindfulness. Study 3, a randomized control experimental mindfulness intervention study, yielded a number of key findings with respect to SMS stability as a function of time and context, construct validity, incremental sensitivity to change in state mindfulness over time, and incremental predictive criterion-related validity. Findings are discussed with respect to the potential contribution of the SMS to the study of mindfulness as a statelike mental behavior, biopsychobehavioral research on the mechanisms of mindfulness, and clinical evaluation of mindfulness.

Keywords: assessment, mindfulness, State Mindfulness Scale

Though clinical, cognitive, and neuropsychological study of mindfulness has advanced greatly in recent years (Brown, Ryan, & Creswell, 2007; Chambers, Gullone, & Allen, 2009; Chiesa & Serretti, 2009; Hofmann, Sawyer, Witt, & Oh, 2010; Keng, Smoski, & Robins, 2011), efforts to operationalize and measure the construct remains a complex and challenging task (e.g., Grossman & Van Dam, 2011; Sauer et al., 2013). The majority of work to date has focused on self-report measures of mindfulness. Most of these scales measure mindfulness as a traitlike or dispositional pattern of behavior in daily life (e.g., Five Facet Mindfulness Questionnaire [FFMQ], Baer et al., 2008; Freiburg Mindfulness Inventory, Walach, Buchheld, Buttenmüller, Kleinknecht, & Schmidt, 2006; Mindful Attention and Awareness Scale [MAAS], Brown & Ryan, 2003; Philadelphia Mindfulness Scale, Cardaciotto, Herbert, Forman, Moitra, & Farrow, 2008; Southampton Mindfulness Questionnaire, Chadwick et al., 2008; Cognitive and Affective Mindfulness Scale–Revised, Feldman, Hayes, Kumar, Greeson, & Laurenceau, 2007; Mindfulness Process Questionnaire, Erisman & Roemer, 2012). Though such measurement is important to the study of mindfulness as a trait, it is not designed to reflect mindfulness as a mental behavior, which is statelike, context dependent, and variable (Bishop et al., 2004; Sauer et al., 2013). Indeed, in their consensus definition of mindfulness, Bishop and colleagues made this point explicit: "We see it [mindfulness] as much closer to a state than a trait" (Bishop et al., 2004, p. 234). It is thus essential that mindfulness researchers and clinicians have access to a measure that optimally reflects the construct's statelike nature.

There are currently two self-report scales designed to measure state mindfulness (State-MAAS, Brown & Ryan, 2003; Toronto Mindfulness Scale [TMS], Lau et al., 2006). The State-MAAS is a five-item scale adapted from the (dispositional) MAAS. The State-MAAS was designed to measure the recent or current expression of mindful attention and awareness of daily activities. State-MAAS items are rated on a 7-point Likert-type scale and refer to a recent, brief period of time (the last day or hour) or to the present moment. Items include "I was doing something automatically, without being aware of what I was doing"; "I was rushing through something without being really attentive to it." The State-MAAS has demonstrated sound preliminary psychometric properties (e.g., Cronbach's $\alpha = .92$; Brown & Ryan, 2003), including convergent validity with respect to trait mindfulness as measured by the MAAS (Brown & Ryan, 2003). The State-MAAS, however, is limited in a number of important respects: (a) It is not designed to measure state mindfulness in all contexts, but specifically daily activities. For example, it was not designed to measure mindfulness during mindfulness practice. (b) The State-MAAS measures mindful attention and awareness of one's engagement in daily activities (e.g., "I was doing something without paying attention"), specifically. It does not entail attention and awareness of *physical and mental qualia of one's experience* (e.g., attending to or being aware of various passing thoughts, emotional states, physical sen-

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sations)—central to mindfulness practice. The State-MAAS therefore may not comprehensively reflect the construct and phenomenon of state mindfulness and therefore lack content validity. To date, the State-MAAS has been used in four studies to assess state mindfulness. In two of these studies, the State-MAAS was administered within an experience-sampling paradigm to assess levels of mindfulness during everyday activities (Brown & Ryan, 2003; Weinstein, Brown, & Ryan, 2009). In the third study, the State-MAAS was used to measure levels of mindfulness during a conflict discussion (Barnes, Brown, Krusemark, Campbell, & Rogge, 2007). Kiken and Shook used the State-MAAS as a manipulation check following a brief mindfulness induction in an experiment on mindfulness and negativity bias (Kiken & Shook, 2011).

The second published measure of state mindfulness is the TMS (Lau et al., 2006). The TMS includes 13 items, rated on a 5-point Likert-type scale, which represent two separate factors, labeled *Curiosity* and *Decentering*. Curiosity items include, for example, "I was curious about what I might learn about myself by taking notice of how I react to certain thoughts, feelings or sensations." Decentering items include, for example, "I experienced my thoughts more as events in my mind than as a necessarily accurate reflection of the way things really are." The TMS is limited in so far as (a) it incorporates decentering, a putatively distinct construct and proximal outcome of mindfulness rather than a core aspect or dimension of mindfulness (Fresco et al., 2007; Tanay, Lotan, & Bernstein, 2012); a number of models of mindfulness and seminal Buddhist texts distinguish between mindful attention and awareness and related but distinct processes such as decentering (Anālayo, 2004; Bodhi, 1993). (b) As in the State-MAAS, it lacks content validity reflecting the breadth of the state mindfulness construct, by limiting its focus to curiosity only (Bishop et al., 2004). (c) It predominantly reflects curiosity about, and decentering with respect to, thoughts and emotions, and not key physical aspects of experience that may be attended to mindfully (Kabat-Zinn, 1990). The TMS has demonstrated good psychometric properties and has been used to assess state mindfulness during various tasks such as the picture rating task (Ortner, Kilner, & Zelazo, 2007), and emotional responding to film clips (Erisman & Roemer, 2010). In summary, extant efforts and existing tools to measure state mindful attention are relatively limited, especially in light of the scope and growth of the mindfulness literature upon which state-of-the-science measurement is dependent and essential, and thus deserve further research and development (Sauer et al., 2013).

State Mindfulness Scale (SMS): Conceptual Model

The present study presents the development and evaluation of a novel measure of state mindfulness, the *State Mindfulness Scale* (SMS). We developed the SMS to reflect a conceptual model of mindfulness consistent with traditional Buddhist scholarship (Anālayo, 2004; Bodhi, 1993) and Bishop and colleagues' (2004) consensus definition of mindfulness informed by earlier work on mindfulness and related constructs (e.g., Langer, 1989).

First, we review briefly the concept of mindfulness from the perspective of traditional Buddhist scholarship, upon which the SMS is grounded. In so far as this construct was not conceptually born out of contemporary cognitive-behavioral research in the last decade, but ancient tradition, such knowledge is fundamental to its optimal contemporary understanding and measurement. Mindfulness (Sati in Pali, or Smrti in Sanskrit), according to the Theravada Abbhidamma, is a mental factor that signifies "presence of mind, attentiveness to the present" (Bodhi, 1993, p. 86); it is the mental ability to pay attention to the physical or mental events that occur in the present moment (Bodhi, 1993). A second description of mindfulness that complements this relatively narrow definition may be found in the Satipatthana Sutta, a text on mindfulness practice central to various Buddhist traditions (Shulman, 2010; Thera, 1972; Walshe, 1987). The Satipatthana Sutta delineates four domains or objects of experience to which one may be mindful, including body, feeling or sensations, consciousness, and mental objects. Furthermore, mindfulness of object in any of these four domains is characterized, according to the traditional text, by ardency and clear comprehension as well as by the ability to identify and stay in touch with whatever arises within each of these experiential domains.

The conceptual model of mindfulness upon which the SMS was constructed was furthermore informed by Bishop's and colleagues' (2004) two-component definition of mindfulness. They argued that mindfulness involves "(a) self-regulation of attention so that it is maintained on immediate experience, thereby allowing for increased recognition of mental events in the present moment; (b) adopting a particular orientation toward one's experiences in the present moment, an orientation that is characterized by curiosity, openness and acceptance" (p. 232). Thus, traditional Buddhist and contemporary psychological models of mindfulness describe mindfulness as a meta-cognitive process-specific approach toward experiences orthogonal from the content of the experience itself (Koriat, 2007; Teasdale, 1999).

The proposed integration of traditional Buddhist and contemporary psychological definitions of mindfulness helped us shape a working model of state mindfulness entailing two interrelated levels of the construct and process. The first level is focused on the nature of events or aspects of one's experience in the present moment of which one is mindful—or *the objects of mindful attention* (i.e., "*what*" a person attends to). This level includes the two main domains of events or objects of attention of which one may be mindful—physical sensations (comprising Satipatthana Sutta body and physical sensations) and mental events (comprising Satipatthana Sutta consciousness and mental objects that include emotions, patterns of thoughts, and any other internal mental event). The second level is focused on the *qualities of mindfulness as a meta-cognitive state* (i.e., "*how*" a person attends). Five qualities of mindfulness were derived from Buddhist texts describing mindfulness as a mental state, including (a) awareness, (b) perceptual sensitivity to stimuli, (c) deliberate attention to the present moment, (d) intimacy or closeness to one's subjective experience, and (e) curiosity. Importantly, these qualities are not distinct facets or dimensions, but integral properties of mindfulness as a unique mental state. Moreover, the two proposed conceptual levels of mindfulness are, by definition, not discrete facets or dimensions of mindfulness. The proposed two-*level* model of state mindfulness is thus a unidimensional model of mindfulness consistent with the Buddhist tradition as well as with contemporary unidimensional models of mindfulness (Brown & Ryan, 2003)—incorporating *objects* of which one is mindful and the quality of *how* one is mindful of these objects.

Our approach to item development and sampling was intended to facilitate a comprehensive content-valid sample of the putative con-

struct(s) and strong face validity (Messick, 1995) as a function of the proposed two-level conceptual model of state mindfulness. To assist with the iterative process of qualitative content analysis over the course of measure development (Haynes, Richard, & Kubany, 1995), authors systematically elicited feedback from multiple expert scholars—both mindfulness researchers as well as venerable mindfulness instructors—on mindfulness and its assessment, with respect to participant instructions, scope of item sampling and item content, and rating scale construction. The measure was revised iteratively on the basis of experts' feedback prior to data collection. Items were selected per the proposed conceptual model of state mindfulness. Items were discarded due to a number of reasons, including lack of linguistic clarity, item content overlapping with other items, or item content not clearly reflective of the conceptual model through which items were generated. So doing helped generate a final list of 25 items, which we then tested in a series of pilot studies. This pool of 25 items included two reverse-scored items that proved psychometrically limited, and were therefore omitted from the final pool of 23 items tested in the present set of investigations (see Table 1).

We propose that study of the measure may contribute to the contemporary mindfulness literature in a number of ways, including (a) helping to illuminate the nature of mindfulness as a mental behavior in the present moment, (b) advancing the study of the mechanisms of mindfulness by permitting higher resolution measurement of mindfulness, (c) contributing to mindfulness research broadly by providing access to a measure that reflects state mindfulness in a manner that may be most consistent with traditional and contemporary thought on the construct, (d) and by providing clinicians and clinical researchers with a tool to evaluate the effects of mindfulness training in the context of mindfulness-based intervention.

Study 1: Exploratory and Confirmatory Factor Analytic Study

Study Overview

The aims of Study 1 include empirical exploration and evaluation of the SMS latent structural and measurement model by means of the following tests: (a) exploratory factor and parallel analyses of SMS items (O'Connor, 2000), (b) confirmatory factor analysis (CFA) of the exploratory factor analysis (EFA)-extracted solution among an independent sample, and (c) evaluation of the internal consistency and distributional normality of the derived SMS (sub)scale(s). Though we theorize a higher order, two-factor solution—composed of a common second-order mindfulness factor and two covarying first-order factors, one reflecting mindfulness of bodily sensations and one of mental events—a large number of other possible solutions (e.g., various multidimensional models) may be potentially observed. Moreover, as this is a new measure and conceptual model of state mindfulness, no earlier factor analytic study has been conducted. Thus, it is important that we first conduct an EFA and parallel analysis prior to a CFA. Notably, relative to conducting an EFA only or CFA only in single larger sample, conducting an EFA and then CFA on independent, albeit smaller, samples is a significantly more rigorous test of the measurement model and latent structure of state mindfulness.

Table 1
Descriptive Statistics and Forms of Reliability by Sample

Variable	Sample A	Sample B	Sample C	
			Cohort 1	Cohort 2
N	193	53	103	86
Mean (*SD*) age	25.2 (4.3)	23.8 (3.2)	30.3 (10)	32.8 (11.8)
Cronbach's α				
SMS-Total	.94	.92	.97	.95
SMS-Mind	.95	.91	.96	.94
SMS-Body	.89	.85	.89	.88
Mean (*SD*)				
SMS-Total	57.1 (16.6)	56.2 (15.1)	58.7 (21.7)	56.2 (18.5)
SMS-Mind	40.9 (12.5)	41.2 (11.7)	39.5 (14.6)	40.7 (18.5)
SMS-Body	16.2 (4.7)	15.1 (5.3)	14.6 (6.2)	15.5 (5.6)

Note. SMS-Total = State Mindfulness Scale total score; SMS-Mind = State Mindfulness Scale Mindfulness of Mind subscale score; SMS-Body = State Mindfulness Scale Mindfulness of Body subscale score.

Method

Participants. SMS scores of $N = 353$ adults were collected from three studies and samples (see below for details), all of which had identical inclusion/exclusion criteria and sampling methodology. To explore the factor structure of the SMS and prevent overmodeling, the data set was randomly divided into two subsamples: Subsample 1 ($n = 178$) for the EFA, and Subsample 2 for the CFA ($n = 175$). A sample size of 175 is sufficient for EFA (Fabrigar, Wegener, MacCallum, & Strahan, 1999; Gorsuch, 1983) and CFA of this number of endogenous and exogenous variables (the subjects-to-variables ratio was also in the acceptable range = 7–8:1; Henson & Roberts, 2006; MacCallum, Widaman, Zhang, & Hong, 1999). Finally, no imputations were used, and all data were analyzed.

Samples and procedure.

Sample A. One hundred ninety-three adults (74.4% women; $M_{age} = 23.8$ years; SD_{age} = range$_{age}$ = 18–50) were recruited from the Haifa University, Haifa, Israel, community. The sample consisted of 77% Jewish, 8.9% Muslim Arabs, 9.4% Christian Arabs, 1% Druze, and 3.7% who indicated no religious/ethnic identification. Participants completed a battery of online self-report measures for financial reimbursement or credit points. Participants received either $6 or course credit.

Sample B. Fifty-seven adult participants (65.4% women; $M_{age} = 25.2$ years, $SD_{age} = 4.3$ years, range$_{age}$ = 20–52 years) were recruited from the Haifa University community through advertisements posted on public boards and through web-based advertisements inviting participation in mindfulness training study. Ninety-five percent of the participants were Jewish, and 5% were either Christian or Muslim Arabs. The data used in the present data were those collected at baseline (preintervention). Data collection received human subjects research ethics approval by the University of Haifa Department of Psychology Institutional Review Board committee. Participants received up to $30.

Sample C. Sample C consisted of two cohorts of a single study. Cohort 1 included 103 adults (65.3% women; $M_{age} = 30.3$ years, $SD_{age} = 10$, range$_{age}$ = 21–64 years) recruited from the city of Haifa general community using advertisements on public boards, higher education institutes' websites, and general community websites. Eighty-three participants were assigned, using block randomization, to the experimental (mindfulness skills training)

condition (66% women; M_{age} = 30.7, SD_{age} = 10.3) and 20 to the wait-list control (no-intervention) condition (68.4% women; M_{age} = 28.6 years, SD_{age} = 8.8 years). Ninety-one percent of the sample was Jewish, 6% Muslim Arabs, and 3% Christian Arabs. Study 1 included only Cohort 1 participants from Sample C so as to reduce overmodeling in later studies. Cohort 2 included 86 adults (63.6% women; M_{age} = 32.8 years, SD_{age} = 11.8; range$_{age}$ = 21–64 years). Recruitment and randomization procedures were identical to Cohort 1. Fifty-four participants were assigned to the experimental (mindfulness skills training) condition (65.5% women; M_{age} = 33.9, SD_{age} = 12.7) and 32 to the wait-list control (no-intervention) condition (60.6% women; M_{age} = 30.9 years, SD_{age} = 10 years). Of the sample, 79.3% were Jewish, 9.4% Muslim Arabs, 3.8% Christian Arabs, and 7.5% Druze. Participants received up to $50.

Results

EFA. A principal axis factor analysis (PAF) with an oblique rotation, to permit covarying multidimensional factors, was conducted to identify the factor structure of state mindfulness, as measured by the SMS items. Second, first-order factors were examined in a higher order PAF analysis to examine the possible higher order factor structure of these (first-order) factors. Assumptions underlying the common EFA model (e.g., linearity, nonskewed distribution, continuous item-level data; Fabrigar et al., 1999; Gorsuch, 1983) were met. The correlation matrix among the observed variables yielded a representative summary of the relationships between the variables, and thereby interpretable EFA data.

Parallel analysis based on the random permutation of the raw data (matched to the item/variable distributions) of the unrotated solution indicated that two factors among the research data were greater than the 95th percentile random data eigenvalues, and therefore up to two nonspurious factors may be extracted (O'Connor, 2000). The interfactor correlation (r = .56, $p < .01$) was furthermore consistent with the potential of a higher order multidimensional (two-factor) solution. The two first-order factors were examined in a higher order PAF and revealed a higher order factor model.

In evaluation of the two-factor solution, two items were omitted empirically. The omitted items were *Item 6* ("I noticed various sounds [e.g., sounds in the room, sound of my own breathing]") and *Item 11* ("I noticed a thought that came into my mind and then that it passed"). Specifically, Item 6 was omitted because its postrotation communality was small relative to all other retained items (Item 6 community = .33, relative to mean communality of other items = .54) and did not demonstrate a robust univocal factor loading (i.e., loadings = .27, .37, less than a priori < .40 cutoff). Similarly, Item 11 was omitted for the same reasons (Item 11 communality = .30; loadings = .22, .39). Thus, Items 6 and 11 lacked evidence of univocality or theoretically interpretable multivocality.

On the basis of theory guiding the development of the SMS and a qualitative evaluation of the pattern of item-factor loadings, we labeled the observed SMS factors: *H1 State Mindfulness*, *FI State Mindfulness of Body*, and *FII State Mindfulness of Mind*. See Table 2 for item-factor loadings and communalities.

CFA. The CFA plan had two components. First, the sample variance–covariance matrix of the 21-item SMS was analyzed using structural equation modeling in AMOS 18.0 (Arbuckle, 2009) to test the higher order two-factor model derived via EFA and consistent with a priori measurement and latent structural

Table 2
Exploratory Factor Analysis Item Loadings and Extraction Communalities for the Two First-Order Factor Solution

Item	Factor I: State Mindfulness of Mind	Factor II: State Mindfulness of Body	Communality
7. I noticed pleasant and unpleasant emotions.	**.80**	.01	.66
13. I noticed pleasant and unpleasant thoughts.	**.77**	.07	.61
14. I noticed emotions come and go.	**.75**	.11	.63
1. I was aware of different emotions that arose in me.	**.74**	−.04	.54
5. I felt aware of what was happening inside of me.	**.73**	−.01	.57
21. I was aware of what was going on in my mind.	**.73**	−.12	.38
18. I felt closely connected to the present moment.	**.73**	.05	.48
17. I had moments when I felt alert and aware.	**.73**	.04	.47
8. I actively explored my experience in the moment.	**.73**	.03	.54
12. I felt that I was experiencing the present moment fully.	**.70**	−.04	.39
2. I tried to pay attention to pleasant and unpleasant sensations.	**.67**	−.08	.51
22. It was interesting to see the patterns of my thinking.	**.66**	−.04	.42
4. I noticed many small details of my experience.	**.64**	−.04	.49
19. I noticed thoughts come and go.	**.61**	.22	.57
3. I found some of my experiences interesting.	**.58**	−.04	.46
16. I noticed physical sensations come and go.	−.09	**.94**	.79
23. I noticed some pleasant and unpleasant physical sensations.	−.04	**.91**	.64
15. I noticed various sensations caused by my surroundings (e.g., heat, coolness, the wind on my face).	−.02	**.69**	.52
9. I clearly physically felt what was going on in my body.	.06	**.70**	.55
20. I felt in contact with my body.	.26	**.48**	.53
10. I changed my body posture and paid attention to the physical process of moving.	.10	**.55**	.39

Note. Bold values represent item-factor loadings.

theory regarding state mindfulness as measured by the SMS using maximum likelihood estimation (MLE) of ordinal scale data; alternative one-factor and two-factor models were also tested. Each item was constrained to load onto one factor in accordance with the EFA solution and theorized measurement model. In addition, measurement errors were initially forced to be independent, though post hoc modification index-based error-term covariation was subsequently evaluated (Byrne, 2001).

In addition to examination of the overall model chi-square (Bollen, 1989), goodness of fit was evaluated using a comprehensive set of fit indices (i.e., absolute fit, fit adjusting for model parsimony, fit relative to a null model; Hooper, Coughlan, & Mullen, 2008; Hu & Bentler, 1999), including chi-square (Bollen, 1989), root-mean-square residual (RMSR $<$ .08; Hu & Bentler, 1999), root-mean-square error of approximation (RMSEA $<$ .08 and upper $CI_{90\%}$ $<$ .10; Browne & Cudeck, 1993), the comparative fit index (CFI $>$ .90; Bentler, 1990), the Tucker-Lewis Index (TLI $>$ .90; Bentler & Bonett, 1980), and the parsimony normed fit index (PNFI $>$ .60; James, Mulaik, & Brett, 1982; Schumacker & Lomax, 2004). Above-noted cutoff values reflect *adequate or acceptable* fit (Hooper et al., 2008; Hu & Bentler, 1999). Evaluated together, fit indices provide a conservative and reliable evaluation of the tested models (Jaccard & Wan, 1996). Second, Cronbach's alpha was used to test the internal consistency of the (best fitting) derived scale score(s). Derived scale scores were moreover evaluated for normality. Finally, with respect to distributional properties, all 21 indicators (items) demonstrated multivariate normal skew and kurtosis $< \pm 1.5$ (skew range = $-.266$ [Item 21] to .829 [Item 10]; kurtosis range = -1.25 [Item 2] to $-.39$ [Item 10])—meeting distribution properties for reliable application of MLE of ordinal scale data (Schumacker & Lomax, 2004).

First, the higher order two-factor model was fit to the data, yielding a $\chi^2(193, N = 246) = 484.9$, $p < .01$. However, because the chi-square is restricted in a variety of ways, including sensitivity to sample size and the assumption of multivariate normality, there is a likelihood of an indication of poor fit even when the model is properly specified (Bentler & Bonett, 1980; McIntosh, 2007). Therefore, goodness of fit was further evaluated. Overall, the fit was acceptable: RMSR = .08; RMSEA = .079 ($CI_{90\%}$ = [.70, .087]); CFI = .92, TLI = .91; PNFI = .81. All fit indices fell within the cutoff range for acceptable fit. Moreover, a robust pattern of item-factor loadings was observed (see Table 3). Specifically, consistent with good fit, the range of factor loadings for State Mindfulness-Mind (FI) was .66–.81; the range of factor loadings for State Mindfulness-Body (FII) was .62–.88. Inspection of the standardized residuals and modification indices (MIs) indicated potential areas of strain and shared error variances; specifically, several indicator variables may share error variances and nondiscriminantly tap similar facets of the construct. Consequently, four pairs of residual error terms demonstrated nonorthogonality based on initial review of MIs and were thus permitted to covary (SMS-Mind Items 7 and 13, 3 and 14, 12 and 18, 17 and 18; Byrne, 2001). Error variances for all indicators spanned a broad range (.33–1.0). Finally, neither alternative one-factor nor two-factor models approached acceptable absolute, nor relative fit to that demonstrated by the reported higher order two-factor model.

Second, HI State Mindfulness second-order factor (total score) demonstrated sound internal consistency (α = .95) and normal distribution (skew and kurtosis of total score; skew = .11, kurtosis = $-.79$). FI Mindfulness of Body factor (subscale score) demonstrated sound internal consistency (α = .95) and normal distribution (skew = .35, kurtosis = $-.81$). FII Mindfulness of

Table 3
Confirmatory Factor Analysis Item-Factor Loadings

Item	Factor I: State Mindfulness of Mind	Factor II: State Mindfulness of Body
7. I noticed pleasant and unpleasant emotions.	**.81**	
13. I noticed pleasant and unpleasant thoughts.	**.80**	
14. I noticed emotions come and go.	**.80**	
1. I was aware of different emotions that arose in me.	**.67**	
5. I felt aware of what was happening inside of me.	**.79**	
21. I was aware of what was going on in my mind.	**.67**	
18. I felt closely connected to the present moment.	**.71**	
17. I had moments when I felt alert and aware.	**.69**	
8. I actively explored my experience in the moment.	**.78**	
12. I felt that I was experiencing the present moment fully.	**.66**	
2. I tried to pay attention to pleasant and unpleasant sensations.	**.78**	
22. It was interesting to see the patterns of my thinking.	**.67**	
4. I noticed many small details of my experience.	**.78**	
19. I noticed thoughts come and go.	**.74**	
3. I found some of my experiences interesting.	**.74**	
16. I noticed physical sensations come and go.		**.88**
23. I noticed some pleasant and unpleasant physical sensations.		**.83**
15. I noticed various sensations caused by my surroundings (e.g., heat, coolness, the wind on my face).		**.72**
9. I clearly physically felt what was going on in my body.		**.81**
20. I felt in contact with my body.		**.79**
10. I changed my body posture and paid attention to the physical process of moving.		**.62**

Note. Bold values represent item-factor loadings.

Mind (subscale score) demonstrated sound internal consistency ($\alpha = .90$) and normal distribution (skew = .06, kurtosis = −.79).

In contrast with the acceptable model fit and EFA-derived higher order two-factor solution, the magnitude of the first-order factor loadings on the common second-order factor may be interpreted to mean that either a single latent variable (unidimensional factor solution) or a two-factor multidimensional solution may more parsimoniously explain latent individual differences in state mindfulness as measured by the SMS items in the present sample. Specifically, the SMS Body first-order factor loading on the second-order State Mindfulness factor was −.99, and the loading of the Mind first-order factor on the second-order factor was −.74. We nevertheless chose to tentatively retain the higher order two-factor model for the following reasons. First, in early measurement development, and specifically measurement model and related latent variable modeling, it is important to initially side on the side of greater differentiation rather than lesser (Hayton, Allen, & Scarpello, 2004). This is because though strongly related, such factors may potentially have differential functional relations, and in a different sample relations may be of a smaller magnitude. Future work may lead to a unidimensional solution or a two-factor multidimensional solution. Second, the correlation between the two first-order factors in the EFA and CFA were of a magnitude consistent with the possibility of two distinct but related first-order factors or multidimensionality (e.g., $r = .68$ in the CFA, $r = .56$ in the EFA). Third, we explicitly tested the fit of the alternative unidimemsional and two-factor multidimensional solutions, and neither approached acceptable absolute or relative fit to that demonstrated by the reported higher order two-factor model. Fourth, pragmatically and clinically, it may be useful to be able to measure change in mindful attention to body and mind separately—for example, when targeting one or the other in a specific mindfulness intervention exercise. Thus, though perhaps reflecting the same latent variable, distinct subscales may be informed not only by the latent structure of the variable but also by the functional utility of these subscales. Fifth, the functional relations of SMS Body and Mind may demonstrate differential relations to theoretically relevant variables. Prior to ruling out such a possibility by retaining a unidimensional solution, much more extensive study of state mindfulness of mind and body must be conducted. Sixth, the retained solution permits subsequent testing of the higher order scale score as well as the first-order scale scores, just as would be computed for the alternative unidimensional solution or two-factor solution. Thus, we do not lose any information by retaining the higher order multidimensional solution.

Study 2: SMS Convergent, Discriminant, and Incremental Convergent Validity

Study Overview

The aim of Study 2 was to evaluate the convergent, discriminant, and incremental convergent validity of SMS scores with respect to published measures of state and trait mindfulness. Specifically, we proposed to test the cross-sectional associations between SMS total and Body and Mind subscale scores with respect to TMS total and subscale scores, MAAS total scores, and FFMQ total and subscale scores. (a) We hypothesized that the SMS total and subscale scores will demonstrate a significant association, of moderate magnitude, with TMS total and subscales' scores. The prediction is grounded in the rationale that these measures putatively index somewhat related aspects of mindfulness as a state mental behavior, though conceptualize and operatioanlize the nature of the construct and mental behavior differently, as reviewed above. (b) We hypothesized that SMS total and subscale scores will demonstrate a nonsignificant association with MAAS total score. The (null) prediction is grounded in the earlier presented rationale that the SMS measures a context-sensitive state mental behavior, whereas MAAS measures dispositional traitlike present moment attention and awareness of activities of daily living. (c) Similarly, we predicted that SMS total and subscale scores would demonstrate nonsignificant associations with FFMQ subscale scores, with the exception of the Observe subscale scores, and that this association would be observed above and beyond the variance in FFMQ Observing explained by TMS scores. The latter was theorized a priori because the SMS and the Observe subscales refer to mindful (endogenous) attention of specific bodily sensations and mental events in a given context (e.g., SMS—"I noticed various sensations caused by my surroundings [e.g., heat, coolness, the wind on my face]")—and FFMQ Observing—"I pay attention to sensations, such as the wind in my hair or sun on my face").

Method

Participants. Study 2 was conducted among Sample A, described above—a subsample of participants among whom the EFA and CFA analyses were conducted (see Study 1 Samples and procedure section).

Procedure. Data were collected using Survey Monkey, a secure web-based survey software. Participants completed a consent form and then the self-report assessment battery. After participants completed the assessment battery, each participant's personal information was encrypted, and data were linked to a random participant number. Notably, multiple published studies have demonstrated no differences in the performance or psychometric properties of various psychological measures administered via paper-and-pencil and computer-based modalities (e.g., Gwaltney, Shields, & Shiffman, 2008).

Measures.

Translation and back-translation process. As in other studies conducted within our laboratory (Tanay et al., 2012), measures were translated from English to Hebrew by laboratory staff, fluent in Hebrew and English. The scales were then back-translated by a separate party using structured guidelines (Geisinger, 1994). The accuracy of the translated measure was then evaluated; no major discrepancies were detected in the back-translation procedure. However, through the back-translation procedure, wording of certain questions was adjusted in minor ways to enhance their readability in Hebrew. This is a recommended approach for translation, and it has been used extensively in past work (e.g., Brislin, 1970; Kotov, Schmidt, Zvolensky, Vinogradov, & Antipova, 2005).

Descriptive and eligibility baseline measures. Participants provided demographic and related personal background information by means of interview, when determining participant eligibility by telephone.

The TMS (Lau et al., 2006). The TMS is a 13-item questionnaire in which respondents indicate on a 4-point Likert-type scale

(from 0 = *not at all* to 4 = *very much*) what they just experienced. This measure assesses two subscales: Curiosity and Decentering. The Curiosity subscale is intended to reflect the degree of one's awareness of the present moment, as well as the degree to which the quality of that awareness is characterized by openness and curiosity (e.g., "I was curious about my reactions to things"). The Decentering subscale is intended to reflect the ability to be aware of one's thoughts and feelings without becoming entangled in them (e.g., "I experienced my thoughts more as events in my mind than as a necessarily accurate reflection of the way things 'really' are"). The Curiosity subscale has demonstrated sound internal consistency ($\alpha = .90$), though the Decentring subscale has demonstrated only marginally adequate internal consistency ($\alpha = .69$; Erisman & Roemer, 2010). In the present sample, similar estimates of internal consistency were observed (Cronbach's $\alpha = .92$ and .64, respectively).

The MAAS (Brown & Ryan, 2003). The MAAS is a 15-item questionnaire in which respondents indicate on a 6-point Likert-type scale (from 1 = *almost always* to 6 = *almost never*) their level of habitual or trait awareness and attention to present events and experiences ("I rush through activities without being really attentive to them"; Brown & Ryan, 2003). The MAAS has demonstrated good internal consistency across a range of samples ($\alpha = .80–.87$; Brown & Ryan, 2003; present study $\alpha = .85$) and strong test–retest reliability data over a 1-month time period ($r = .81$; Brown & Ryan, 2003).

The FFMQ (Baer et al., 2008). The FFMQ is a 39-item questionnaire in which respondents indicate on a 5-point Likert-type scale (from 1 = *never or very rarely true* to 5 = *often or always true*) how much various statements describe them. The FFMQ aims to measure five facets of habitual or trait mindfulness: Observing ("When I'm walking, I deliberately notice the sensations of my body moving"), Describing ("I'm good at finding words to describe my feelings"), Acting with Awareness ("When I do things, my mind wanders off and I'm easily distracted"), Non-Judging of Internal Experiences ("I make judgments about whether my thoughts are good or bad"), and Non-Reactivity to Inner Experiences ("I perceive my feelings and emotions without having to react to them"). The FFMQ has demonstrated acceptable internal consistency across a range of samples (.72–.92, Baer et al., 2008; present sample $\alpha = .80$).

Results

Please see Table 4 for a summary of tests of convergent and discriminant validity.

SMS-TMS. First, as predicted, SMS Total and subscale scores demonstrated significant correlations of moderate magnitude with TMS Total, Decentering, and Curiosity subscale scores ($r_{range} = .31–.43$, $p < .01$).

SMS-MAAS. As predicted, SMS total and subscale scores demonstrated a nonsignificant association with MAAS scores ($r = .00–.07$).

SMS-FFMQ. Finally, consistent with prediction, SMS total and subscale scores were significantly related to FFMQ Observing subscale scores ($r = .39–.47$, $p < .01$). In addition, SMS total and SMS subscale scores demonstrated significant, though small negative correlations ($r = -.22, -.20, -.20$; $p < .01$, respectively) with FFMQ Non-Judging subscale scores. SMS total and subscales demonstrated a small correlation ($r = .20, .18, .20$; $p < .01$, respectively) with FFMQ Non-Reactivity subscale scores. To test incremental convergent validity of SMS relative to TMS with respect to the FFMQ Observing subscale scores, we entered SMS and TMS total scores simultaneously in a linear regression equation and evaluated FFMQ Observing scores as the dependent variable.

Above and beyond variance explained by TMS scores, SMS scores accounted for unique significant variance in FFMQ Observing scores ($\beta = .41$, $t = 5.1$, $sr^2 = .37$, $p < .01$); in contrast, above and beyond SMS scores, TMS did not account for unique variance in FFMQ Observing scores ($\beta = .08$, $t = .97$, $sr^2 = .005$, *ns*).

Study 3: SMS Temporal Stability, Construct Validity, Incremental Sensitivity to Change, and Incremental Predictive Validity Within a Mindfulness Training Intervention

Study Overview

We tested the following four aims in Study 3: (a) the stability of SMS scores as a function of time and context; (b) the construct

Table 4
Associations Between State and Dispositional Measures of Mindfulness (n = *180*)

Measure	SMS-Total	SMS-Body	SMS-Mind	TMS-Total	TMS-Decentering	TMS-Curiosity
TMS-Total	**.43****	**.41****	**.43****	**1**	**.80****	**.91****
TMS-Decentering	**.32****	**.31****	**.32****	**.91****	**1**	**.48****
TMS-Curiosity	**.41****	**.36****	**.41****	**.80****	**.48****	**1**
MAAS	.05	.00	.07	−.06	−.07	−.06
FFMQ-Observe	.42**	.47**	.39**	.26**	.23**	.22**
FFMQ-Describe	.06	.07	.07	.20*	.27**	.09
FFMQ-Act Awareness	−.04	−.08	−.01	−.07	−.11	−.03
FFMQ-Non-Judging	−.22**	−.20**	−.20**	−.04	.02	−.08
FFMQ-Nonreactivity	.20**	.18**	.20**	.34**	.37**	.24**

Note. SMS-Total = State Mindfulness Scale total score; SMS-Body = State Mindfulness Scale Mindfulness of Body subscale score; SMS-Mind = State Mindfulness Scale Mindfulness of Mind subscale score; TMS = Toronto Mindfulness Scale (Lau et al., 2006); MAAS = Mindful Attention and Awareness Scale (Brown & Ryan, 2003); FFMQ = Five Facet Mindfulness Questionnaire (Baer et al., 2008). Bold cells refer to correlations between state mindfulness measures. All other cells refer to correlations between state and dispositional mindfulness measures.
* $p < .05$. ** $p < .01$.

validity of the SMS as a putative index of state mindfulness within the context of a mindfulness training intervention; (c) the incremental sensitivity to change in state mindfulness as measured by the SMS (Haynes & Lench, 2003), relative to the State-MAAS, over the course of a mindfulness training intervention; and (d) the predictive incremental validity of change in SMS scores, above and beyond change in State-MAAS scores, over the course of the training with respect to the development of dispositional mindfulness. These aims were tested among Sample C (please see Study 1 Samples and procedure section) among the (no-intervention) control and mindfulness intervention conditions.

SMS score stability by context. First, we evaluated the temporal stability of SMS scores measured within a single theoretically relevant context. Among the (no-intervention) control group, we evaluated SMS scores at weekly assessment sessions over 4 successive weeks (parallel to the four-session intervention time points) and then at 1 week and 6 weeks. Among the intervention condition, we evaluated the stability of SMS scores immediately following in-session mindfulness meditation weekly over 4 successive weeks, and then in the neutral assessment-only context at 1-week and 6-week follow-up assessment time points. We hypothesized that SMS scores would demonstrate relatively stable levels that may be expected from a statelike construct (e.g., test–retest $r > .60$) *within* each context. Second, among the intervention condition, we evaluated the association of SMS scores *between* theoretically relevant contexts—immediately following in-session mindfulness meditation versus completion of the SMS within a neutral assessment-only context at 1-week and 6-week follow-up assessments. We hypothesized that levels of SMS scores between these contexts would demonstrate a small association consistent with relative instability between contexts.

Construct validity of SMS as index of state mindfulness: Experimental test in a mindfulness intervention. First, we evaluated whether SMS scores collected immediately after in-session mindfulness meditation practice were significantly greater than SMS scores collected at baseline (preintervention), and moreover whether SMS scores collected in a neutral assessment-only context at 1-week and 6-week postintervention follow-up were then significantly lower relative to SMS collected immediately after the in-session mindfulness practice. Second, we evaluated whether the theorized changes (elevation) in SMS scores over the course of the mindfulness intervention were unique to the intervention and not the similarly observed among the control condition participants.

Incremental sensitivity to change relative to State-MAAS: Experimental test in a mindfulness intervention. We then tested the incremental sensitivity of SMS, relative to the State-MAAS, to detect and reflect changes in state mindfulness engendererd through mindfulness training and practice. This test is a rigorous means to evaluate whether the SMS reflects levels of and change in state mindfulness in a way that is not similarly reflected by an already available measure of state mindfulness. This is therefore one important, rigorous test of whether the SMS makes a unique and incremental contribution to the mindfulness assessment literature.

Predictive incremental validity of SMS scores relative to State-MAAS with respect to the development of dispositional mindfulness. First, we evaluated the relations between prospective change in state mindfulness over the course of a mindfulness intervention, as reflected by SMS scores, and longer term prospective change in dispositional mindfulness at postintervention follow-up, as reflected by MAAS scores. We hypothesized that among treatment completers—who participated in ≥ 3 mindfulness intervention sessions—degree of improvement in SMS scores from baseline to the final mindfulness session (Session 4) would predict the degree of improvement in MAAS scores from baseline to 6-weeks postintervention. Furthermore, we predicted that the effect of SMS would remain a unique, significant incremental predictor of the development of dispositional mindfulness even above and beyond the effect of improvement in State-MAAS scores over the course of the intervention (measured at identical time points as the SMS). This is a second important, rigorous test of whether the SMS makes a unique and incremental contribution to the mindfulness assessment literature.

Method

Participants. Study 3 was conducted among Sample C (see Study 1 Samples and procedure section). In exchange for participation, participants received up to $50.

Measures.

The MAAS (Brown & Ryan, 2003). See Study 1.

State-MAAS (Brown & Ryan, 2003). The State-MAAS entails five items from the 15-item MAAS and measures state mindful attention and awareness (Brown & Ryan, 2003). The State-MAAS demonstrated sound preliminary psychometric properties (e.g., Cronbach's $\alpha = .92$; Brown & Ryan, 2003).

Procedure.

Brief mindfulness skills training program. Following the baseline assessment, participants randomly assigned to the experimental condition received four weekly 60-min mindfulness skills training sessions (Tanay et al., 2012; see also Table 5). Mindfulness training sessions were held 7 days apart, over 21 days. In these sessions, participants were taught fundamentals of mindfulness practice (i.e., directing attention to present moment physical sensations, to thoughts and emotions as they come and go) based

Table 5
Mean and (Standard Deviation) SMS Scores From Baseline (Preintervention) to Follow-Up Assessments by Condition

Condition	Baseline	Session 1[a]	Session 2[a]	Session 3[a]	Session 4[a]	Follow-Up 1	Follow-Up 2
Experimental ($n = 127$)	54.1 (19.9)	**74.2 (14)**	73.8 (14.4)	71.5 (17)	76.5 (18.2)	57.8 (21.2)	54.6 (19.8)
Control ($n = 49$)	57.6 (18.4)	57.1 (18)	53 (16.1)	51.4 (18.9)	58.4 (18.9)	54.9 (18.6)	50.5 (17.7)

Note. Bold cells mark SMS scores observed immediately following mindfulness meditation exercise. SMS = State Mindfulness Scale.
[a] Participants in the control condition completed an assessment (no-intervention) session at these time points to parallel the intervention sessions completed by those in the experimental condition.

on established techniques from the mindfulness literature (Gilpin, 2008; Kabat-Zinn, 1990). The first mindfulness skills training session included a short introduction to mindfulness and the purpose of mindfulness training (i.e., to enhance participants' ability to pay attention to their moment-to moment subjective experience). Participants then engaged in a 20-min guided practice of a core mindfulness technique (i.e., mindful attention using the breath as an attentional anchor). Specifically, participants were guided to sit with closed eyes and to direct their attention to the physical sensations of their breath. Participants were further guided to use these sensations as an attentional anchor in order to orient and maintain their attention to the present moment. Participants were asked to pay attention to any other sensation(s), thought, or emotion as it occurs or appears and to use an additional mindfulness technique—mental labeling of these events (i.e., "aching sensation"; "planning"; "worrying"; "hearing"). Participants were instructed to label their immediate experience in present tense. Labels referred to internal experiences whether physical (pain, heat, cold, movement, etc.) or mental (anger, fear, worry, planning, boredom, etc.). Participants were encouraged to take a curious approach toward their experiences, and the process of developing mindfulness gradually over the course of mindfulness practice will be emphasized. At the end of the 20-min guided practice period, participants had the time to ask questions about the practice of mindfulness for 15 min. Then participants had an additional 10-min period to practice mindfulness as described above. In addition, participants in the mindfulness group were requested to practice the mindfulness techniques at home (15 min, three times in the first week; 20 min, four times in the second week; and 25 min, four times in the third week) using a compact disc with audio-guided instructions for mindfulness practice (reinforcing the in-session training and practice). Training also entailed encouraging participants to monitor how mindful they are in their daily activities and to integrate mindful attention and awareness, as a way of being, into their daily lives—not only during mindfulness meditation exercises. Finally, participants were encouraged to continue to practice mindfulness following completion of the intervention. The compact disc was given to each participant at the end of Session 1. Sessions 2–4 also included a discussion of participants' mindfulness skills practice at home since the previous session. Participants were asked to report the frequency and duration of their practice of mindfulness skills exercises between sessions, at home.

Results

SMS score stability within context. Please see Table 6. As predicted, SMS scores demonstrated strong levels of test–retest reliability among controls within the neutral assessment-only context from 1-week (mean $r = .65$, $p < .01$) through 6-week (mean $r = .68$ $p < .01$) intervals. Among the intervention condition within the mindfulness meditation context, SMS scores also demonstrated strong levels of test–retest reliability from 1 week (mean $r = .64$, $p < .01$) to 2 weeks (mean $r = .63$, $p < .01$) as well as within the neutral assessment-only context at 6 weeks ($r = .59$, $p < .01$).

SMS score (in)stability between contexts. Furthermore, as predicted, among the intervention condition, the test–retest reliability of SMS scores between these contexts were small to moderate in magnitude from 1 week ($r = .47$, $p < .01$) through 2 weeks ($r = .22$, *ns*), to 6 weeks ($r = .45$, $p < .01$)—broadly consistent with theorizing regarding the context sensitivity of state mindfulness as reflected by SMS scores. Notably, in three Fisher's *r*-to-*z* transformation (one-tailed) tests, the magnitude of the mean 1-week, 2-week, and 6-week test–retest correlation coefficients observed *within context* were significantly or nearly significantly greater than those observed *between contexts* at the same time

Table 6
Associations Between SMS Scores Over Time by Condition by Context

	Control condition	Intervention condition		
Condition	Within assessment-only context	Within mindfulness meditation context	Between contexts–Mindfulness meditation vs. assessment-only contexts	Within assessment-only context
1 week				
Session[a] 1–Session 2	.69**	.68**		
Session 2–Session 3	.79**	.60**		
Session 3–Session 4	.74**	.65**		
Session 4–Follow-up 1[b]	.39*		.47**	
Mean *r*	.65**	.64**		
2 weeks				
Session 1–Session 3	.59**	.58**		
Session 2–Session 4	.46**	.68**		
Session 3–Follow-up 1[b]	.59**		.22	
Mean *r*	.55**	.63**		
5 weeks				
Session 1–Follow-up 1[b]	.57**		.45**	
Follow-up 1–Follow-up 2	.79**			.59**
Mean *r*	.68**			

Note. SMS = State Mindfulness Scale.
[a] Among the control condition, Sessions 1–4 reflect (no-intervention) assessment-only sessions. [b] Follow-up 1: Participants were asked to complete the first follow-up 7 days after Session 4 and were given 7 days to complete it. Follow-up 2: Participants were asked to complete the second follow-up 6 weeks after Session 4 and were given 2 weeks to complete it.
* $p < .05$. ** $p < .01$.

points ($z_{1\ week} = 1.3$, $p = .09$; $z_{2\ week} = 2.7$, $p < .01$; $z_{4\text{-}\ week} = 1.6$, $p = .05$, respectively).

Construct validity of SMS as index of state mindfulness: Experimental test in a mindfulness intervention. To evaluate the hypothesized pattern of change in SMS scores, we conducted a mixed multilevel model of SMS standardized scores by time and group (intervention vs. control) (Singer & Willett, 2003). Because we expected elevation in state mindfulness specifically following mindfulness practice in each of the four intervention sessions (cf. pre- and postintervention assessment-only sessions), we modeled this expected nonlinear (parabolic) change vis-à-vis a quadratic transformation of time. Results showed significant fixed effects of $time_{quad}$, $F(1, 176.2) = 24.0$, $p < .001$; group, $F(1, 225) = 23.4$, $p < .001$;and, as predicted, the interaction of $Time_{quad} \times$ Group, $F(1, 176.2) = 5.4$, $p < .05$. As predicted, participants in the intervention group, but not the control group, demonstrated elevated SMS scores immediately following mindfulness meditation practice in each of the four intervention sessions relative to pre- and postintervention assessment-only time points (see Figure 1).

Incremental sensitivity to change relative to State-MAAS: Experimental test in a mindfulness intervention. To evaluate the incremental sensitivity of change in state mindfulness in the SMS relative to a published measure of state mindfulness, we examined an identical mixed multilevel model of change in State-MAAS scores. Results showed a significant fixed effect of $time_{quad}$, $F(1, 174.7) = 45.3$, $p < .001$; group, $F(1, 228) = 4.3$, $p < .05$; but not the interaction of $Time_{quad} \times$ Group, $F(1, 174.7) = 1.8$, $p = .18$. Thus, in contrast to the SMS, the State-MAAS did not reflect the same sensitivity to change in state mindfulness immediately following mindfulness meditation practice in each of the four intervention sessions relative to pre- and postintervention assessment-only time points, nor did the intervention and control groups demonstrate different patterns of change in State-MAAS scores over time (see Figure 2).

Predictive incremental validity of SMS scores with respect to the development of dispositional mindfulness. We conducted a hierarchical linear regression. In Step 1 of the equation, we entered baseline levels of MAAS, SMS Total, and State-MAAS scores; in Step 2, we entered Session 4 SMS and State-MAAS scores (immediately following final intervention session); 6-week postintervention MAAS scores served as the dependent variable. Accordingly, we were able to test the unique incremental predictive effect of improvement in state mindfulness over the course of the intervention, as measured by the SMS and State-MAAS, with respect to the prospective development of dispositional mindfulness postintervention, as measured by the MAAS. Among participants who attended at least three sessions of the mindfulness intervention ($n = 56$), as hypothesized, Step 1 accounted for 44% of the variance in MAAS scores at 6-weeks postintervention (Step 1 $F = 13.5$, $p < .01$; MAAS baseline $t = 5.6$, $\beta = .78$, $sr^2 = .35$, $p < .01$; SMS baseline $t = -.49$, $\beta = -.05$, $sr^2 = .003$, *ns*; State-MAAS baseline $t = -1.5$ $\beta = -.20$, $sr^2 = .02$, *ns*). Above and beyond Step 1 baseline levels of dispositional and state mindfulness as well as Session 4 State-MAAS scores entered in Step 2, Session 4 SMS scores ($t = 3.2$, $\beta = .33$, $sr^2 = .09$, $p < .01$) accounted for a large and significant proportion of unique variance in MAAS scores at 6-weeks postintervention. Furthermore, Session 4 State-MAAS demonstrated a

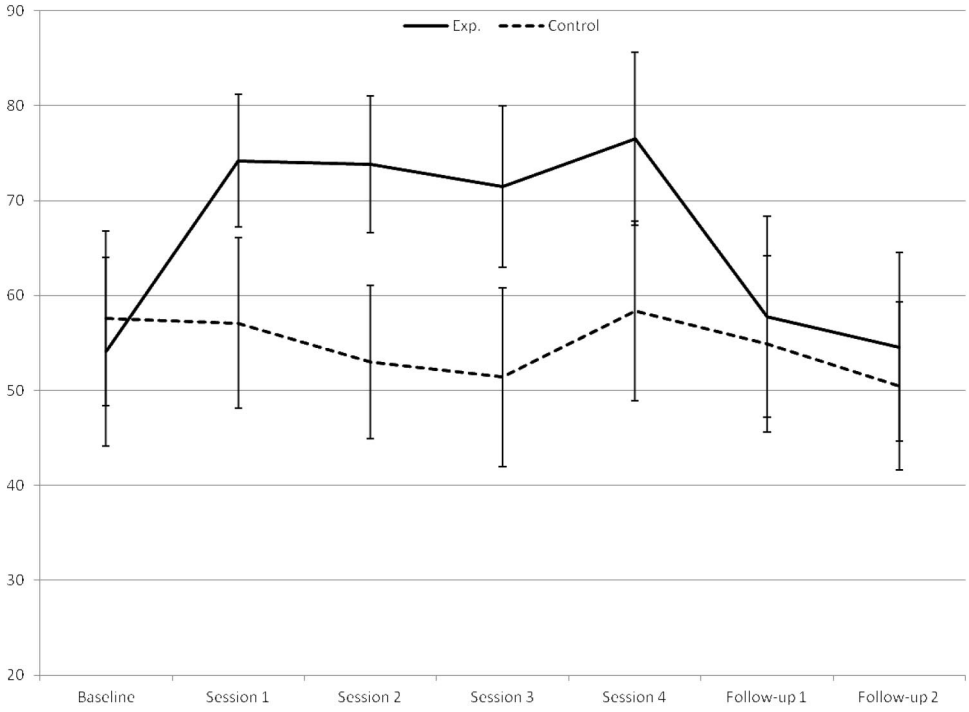

Figure 1. SMS scores by condition over time. Among control condition, Sessions 1–4 were assessment-only sessions, in contrast to the intervention condition that engaged in mindfulness training in each of these sessions. Error bars represent standard error. SMS = State Mindfulness Scale; Exp. = Experimental.

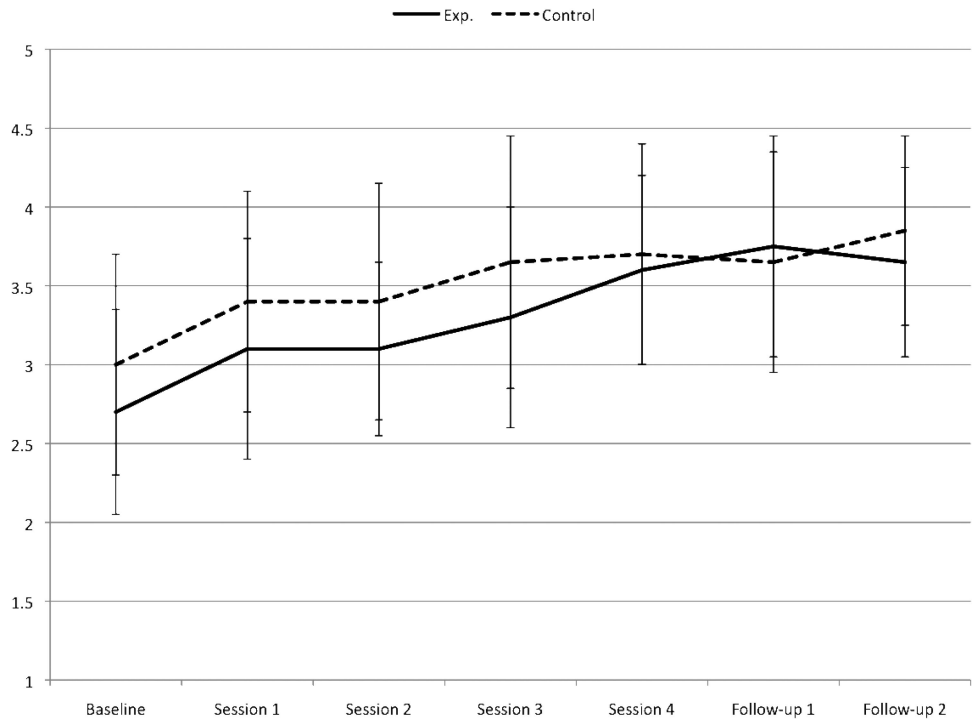

Figure 2. State-MAAS scores by condition over time. Error bars represent standard error. MAAS = Mindful Attention and Awareness Scale; Exp. = Experimental.

marginally significant incremental effect ($t = 2.3$, $\beta = .24$, $sr^2 = .04$, $p = .03$) above and beyond Step 1 variables and Session 4 SMS scores. Thus, as predicted, improvement in state mindfulness measured by the SMS between baseline and the final mindfulness intervention session predicted development of dispositional mindfulness from baseline to 6-weeks postintervention, and this effect was large and significant above and beyond the effect of improvement in State-MAAS over this time period.

General Discussion

The primary goal of the present research was to develop and test a conceptual and measurement model of state mindfulness that reflects the nature of this mental quality as it is formulated in contemporary psychological science and traditional Buddhist texts. Study 1 EFA and CFA supported a higher order two-factor solution entailing one higher order state mindfulness factor and two first-order factors, one reflecting state mindfulness of bodily sensations and the other state mindfulness of mind. These findings are consistent with the theoretical model of mindfulness guiding our work (Bishop et al., 2004; Bodhi, 1993; Shulman, 2010; Thera, 1972; Walshe, 1987). Specifically, observed factors distinguish between the *objects of mindful attention*—physical sensations and mental events (i.e., emotions, patterns of thoughts, other internal mental events). Notably, as theorized, the factor solution did not distinguish between the *qualities of mindfulness as a metacognitive state*—awareness, perceptual sensitivity to stimuli, deliberate attention to the present moment, intimacy or closeness to one's subjective experience, and curiosity. This is consistent with theorizing that these qualities are not distinct facets or dimensions, but integral properties of mindfulness as a unique mental state. These findings thus provide a novel measurement tool, and a corresponding conceptual and operational definition of state mindfulness, that may be theoretically and pragmatically important for basic and clinical science of mindfulness and related processes.

Study 2 cross-sectional analyses provided preliminary evidence of the convergent, discriminant, and incremental convergent validity of SMS scores with respect to other measures of state and trait mindfulness. As theorized, relations between SMS and TMS subscales were only moderate in magnitude, highlighting the intended empirical difference in the construct(s) that each was designed to measure. Furthermore, we observed evidence of discriminant validity with respect to dispositional mindfulness, as measured by the MAAS and most FFMQ subscales, with the key exception of the FFMQ Observing subscale, as predicted a priori. Furthermore, we observed preliminary evidence of incremental convergent validity, above and beyond the TMS, an available measure of state mindfulness, with respect to dispositional mindful attention and awareness, and specifically dispositional "noticing or attending to internal and external experiences, such as sensations, cognitions, emotions, sights, sounds, and smells" (Baer et al., 2008, p. 330). Study 2 thus provided an initial set of modest cross-sectional data relevant to the nomological relations between state mindfulness as measured by the SMS and other state and trait mindfulness variables.

Study 3 provided rigorous controlled experimental evidence of the context-specific prospective stability, construct validity, incremental sensitivity to change, and incremental predictive validity of the SMS. First, we observed strong evidence of prospective sta-

bility over multiple time intervals (1 week to 6 weeks) of SMS scores when tested *within* a similar context over time. These contexts included an assessment-only context and a mindfulness meditation context. As predicted, we observed somewhat lesser levels of stability in SMS scores over time *between* contexts. This context-related dissociation of SMS score stability provides preliminary evidence for the construct validity of SMS scores as reflecting a context-sensitive construct of state mindfulness. Moreover, these data are consistent with emerging findings on the importance of context in understanding mindfulness (Hayes, Villatte, Levin, & Hildebrandt, 2011) and evidence of the real-time functional neurobiological differences in activation between default mode and mindfulness meditation (Brewer et al., 2011).

Second, in the mindfulness intervention condition, prospective multilevel modeling demonstrated that participants reported elevated SMS in the context of mindfulness meditation specifically and not at pre- and postintervention when not engaged in mindfulness meditation; participants in the no-intervention control condition demonstrated no such change in SMS scores over the same time period. These data provide controlled experimental evidence of the construct validity of SMS scores as reflecting state mindfulness. In contrast to the SMS, State-MAAS scores were not specifically elevated following mindfulness practice, nor did the intervention and control groups demonstrate different patterns of change in State-MAAS scores over time. These data provide controlled experimental evidence of the incremental sensitivity to change in state mindfulness of the SMS relative to an existing measure of state mindfulness. Thus, though the mindfulness assessment literature is "crowded" (Sauer et al., 2013), we argue that the reported findings suggest that the SMS may make a unique and important contribution to the conceptualization and measurement of state mindfulness.

Third, as predicted, the degree of elevation in SMS scores (between preintervention and the final intervention session) prospectively predicted the development of dispositional mindfulness as measured by the MAAS at 6-weeks postintervention. We furthermore found strong evidence of the incremental predictive validity of SMS with respect to the development of dispositional mindfulness above and beyond the State-MAAS. In light of the incremental sensitivity to change findings, these incremental predictive validity data provide further evidence of the potential contribution of the SMS to the mindfulness literature.

The present studies have a number of limitations that may be addressed by future research. First, the sample sizes of the EFA and CFA analyses, though statistically sufficient and reliable, were relatively modest. Second, the studies were completed in Israel in the Hebrew language. Study of the SMS in other sociocultural contexts is important, though we expect the observed effects to generalize. Third, no established behavioral criterion measure (i.e., "gold standard") of state mindfulness was tested with respect to SMS scores,–as no such established, objective measure is available (Sauer et al., 2013). This limitation is not unique to the present study per se, but characteristic of the mindfulness measurement literature more broadly. Future research could evaluate SMS scores with respect to other proxies of mindfulness, such as functional neurobiological indices (Hölzel et al., 2011) or known-group criterion validity studies in which individuals with high levels of mindfulness (such as people who practice mindfulness on a daily basis) may be compared with meditation-naïve participants (Grossman & Van Dam, 2011). That said, the reported controlled experimental intervention data (Study 3) provide a strong randomized control experimental illustration of such criterion validity. Finally, Study 3 was limited by an imbalance in the size of the intervention and control conditions. However, longitudinal analyses were robust to such differences, and a sufficient number of participants were included in both conditions for the reliable and statistically powered interpretation of the reported analyses.

In summary, we hope that the findings and measure (a) broadly contribute to study of mindfulness as a statelike mental behavior in addition to a trait, process, and practice; (b) contribute to research on the mechanisms of mindfulness, from psychological to neurocognitive levels of analysis, by permitting sound measurement of mindfulness as a statelike mental behavior in the present moment; and (c) provide clinicians and researchers a simple, yet robust tool with which to evaluate state mindfulness.

References

Anālayo. (2004). *Satipaṭṭhāna: The direct path to realization*. Cambridge, England: Windhorse.

Arbuckle, J. L. (2009). *Amos 18 user's guide*. Crawfordville, FL: Amos Development Corporation.

Baer, R. A., Smith, G. T., Lykins, E., Button, D., Krietemeyer, J., Sauer, S., . . . Williams, J. M. G. (2008). Construct validity of the Five Facet Mindfulness Questionnaire in meditating and nonmeditating samples. *Assessment, 15,* 329–342. doi:10.1177/1073191107313003

Barnes, S., Brown, K. W., Krusemark, E., Campbell, W. K., & Rogge, R. D. (2007). The role of mindfulness in romantic relationship satisfaction and responses to relationship stress. *Journal of Marital and Family Therapy, 33,* 482–500. doi:10.1111/j.1752-0606.2007.00033.x

Bentler, P. M. (1990). Comparative fit indexes in structural models. *Psychological Bulletin, 107,* 238–246. doi:10.1037/0033-2909.107.2.238

Bentler, P. M., & Bonett, D. G. (1980). Significance tests and goodness of fit in the analysis of covariance structures. *Psychological Bulletin, 88,* 588–606. doi:10.1037/0033-2909.88.3.588

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. doi:10.1093/clipsy.bph077

Bodhi, B. (1993). *A comprehensive manual of abhidhamma: The abhidhammattha sangaha of ācariya anuruddha*. Seattle, WA: Pariyatti.

Bollen, K. A. (1989). *Structural equations with latent variables*. Oxford, England: Wiley.

Brewer, J. A., Worhunsky, P. D., Gray, J. R., Tang, Y. Y., Weber, J., & Kober, H. (2011). Meditation experience is associated with differences in default mode network activity and connectivity. *Proceedings of the National Academy of Sciences, 108,* 20254–20259. doi:10.1073/pnas.1112029108

Brislin, R. W. (1970). Back-translation for cross-cultural research. *Journal of Cross-Cultural Psychology, 1,* 185–216. doi:10.1177/135910457000100301

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. doi:10.1037/0022-3514.84.4.822

Brown, K. W., Ryan, R. M., & Creswell, J. D. (2007). Mindfulness: Theoretical foundations and evidence for its salutary effects. *Psychological Inquiry, 18,* 211–237. doi:10.1080/10478400701598298

Browne, M. W., & Cudeck, R. (1993). Alternative ways of assessing model fit. In K. A. Bollen & J. S. Long (Eds.), *Testing structural equation models* (pp. 136–162). Newbury Park, CA: Sage.

Byrne, B. M. (2001). *Structural equation modeling with AMOS: Basic concepts, applications, and programming*. Mahwah, NJ: Laurence Erlbaum Associates.

Cardaciotto, L. A., Herbert, J. D., Forman, E. M., Moitra, E., & Farrow, V. (2008). The assessment of present-moment awareness and acceptance. *Assessment, 15,* 204–223. doi:10.1177/1073191107311467

Chadwick, P., Hember, M., Symes, J., Peters, E., Kuipers, E., & Dagnan, D. (2008). Responding mindfully to unpleasant thoughts and images: Reliability and validity of the Southampton mindfulness questionnaire (SMQ). *British Journal of Clinical Psychology, 47,* 451–455. doi:10.1348/014466508X314891

Chambers, R., Gullone, E., & Allen, N. B. (2009). Mindful emotion regulation: An integrative review. *Clinical Psychology Review, 29,* 560–572. doi:10.1016/j.cpr.2009.06.005

Chiesa, A., & Serretti, A. (2009). Mindfulness-based stress reduction for stress management in healthy people: A review and meta-analysis. *The Journal of Alternative and Complementary Medicine, 15,* 593–600. doi:10.1089/acm.2008.0495

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. doi:10.1037/a0017162

Erisman, S. M., & Roemer, L. (2012). A preliminary investigation of the process of mindfulness. *Mindfulness, 3,* 30–43. doi:10.1007/s12671-011-0078-x

Fabrigar, L. R., Wegener, D. T., MacCallum, R. C., & Strahan, E. J. (1999). Evaluating the use of exploratory factor analysis in psychological research. *Psychological Methods, 4,* 272–299. doi:10.1037/1082-989X.4.3.272

Feldman, G., Hayes, A., Kumar, S., Greeson, J., & Laurenceau, J. P. (2007). Mindfulness and emotion regulation: The development and initial validation of the cognitive and affective mindfulness scale-revised (CAMS-R). *Journal of Psychopathology and Behavioral Assessment, 29,* 177–190. doi:10.1007/s10862-006-9035-8

Fresco, D. M., Moore, M. T., van Dulmen, M., Segal, Z. V., Teasdale, J. D., Ma, H., & Williams, J. M. G. (2007). Initial psychometric properties of the Experiences Questionnaire: Validation of a self-report measure of decentering. *Behavior Therapy, 38,* 234–246. doi:10.1016/j.beth.2006.08.003

Geisinger, K. F. (1994). Cross-cultural normative assessment: Translation and adaptation issues influencing the normative interpretation of assessment instruments. *Psychological Assessment, 6,* 304–312. doi:10.1037/1040-3590.6.4.304

Gilpin, R. (2008). The use of Theravāda Buddhist practices and perspectives in mindfulness-based cognitive therapy. *Contemporary Buddhism, 9,* 227–251.

Gorsuch, R. L. (1983). Three methods for analyzing limited time-series (N of 1) data. *Behavioral Assessment, 5,* 141–154.

Grossman, P., & Van Dam, N. T. (2011). Mindfulness, by any other name . . .: trials and tribulations of sati in Western psychology and science. *Contemporary Buddhism, 12,* 219–239. doi:10.1080/14639947.2011.564841

Gwaltney, C. J., Shields, A. L., & Shiffman, S. (2008). Equivalence of electronic and paper-and-pencil administration of patient-reported outcome measures: A meta-analytic review. *Value in Health, 11,* 322–333. doi:10.1111/j.1524-4733.2007.00231.x

Hayes, S. C., Villatte, M., Levin, M., & Hildebrandt, M. (2011). Open, aware, and active: Contextual approaches as an emerging trend in the behavioral and cognitive therapies. *Annual Review of Clinical Psychology, 7,* 141–168. doi:10.1146/annurev-clinpsy-032210-104449

Haynes, S. N., & Lench, H. C. (2003). Incremental validity of new clinical assessment measures. *Psychological Assessment, 15,* 456–466. doi:10.1037/1040-3590.15.4.456

Haynes, S. N., Richard, D. C. S., & Kubany, E. S. (1995). Content validity in psychological assessment: A functional approach to concepts and methods. *Psychological Assessment, 7,* 238–247. doi:10.1037/1040-3590.7.3.238

Hayton, J. C., Allen, D. G., & Scarpello, V. (2004). Factor retention decisions in exploratory factor analysis: A tutorial on parallel analysis. *Organizational Research Methods, 7,* 191–205. doi:10.1177/1094428104263675

Henson, R. K., & Roberts, J. K. (2006). Use of exploratory factor analysis in published research: Common errors and some comment on improved practice. *Educational and Psychological Measurement, 66,* 393–416. doi:10.1177/0013164405282485

Hofmann, S. G., Sawyer, A. T., Witt, A. A., & Oh, D. (2010). The effect of mindfulness-based therapy on anxiety and depression: A meta-analytic review. *Journal of Consulting and Clinical Psychology, 78,* 169–183. doi:10.1037/a0018555

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. doi:10.1177/1745691611419671

Hooper, D., Coughlan, J., & Mullen, M. (2008). Structural equation modeling: Guidelines for determining model fit. *Electronic Journal of Business Research Methods, 6,* 53–60.

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal, 6,* 1–55. doi:10.1080/10705519909540118

Jaccard, J., & Wan, C. K. (1996). *LISREL approaches to interaction effects in multiple regression*. Thousand Oaks, CA: Sage.

James, L. R., Mulaik, S. A., & Brett, J. M. (1982). *Causal analysis: Assumptions, models, and data*. Beverly Hills, CA: Sage.

Kabat-Zinn, J. (1990). *Full catastrophe living: Using the wisdom of your mind and body to face stress, pain, and illness*. New York, NY: Delacorte.

Keng, S. L., Smoski, M. J., & Robins, C. J. (2011). Effects of mindfulness on psychological health: A review of empirical studies. *Clinical Psychology Review, 31,* 1041–1056. doi:10.1016/j.cpr.2011.04.006

Kiken, L. G., & Shook, N. J. (2011). Looking up mindfulness increases positive judgments and reduces negativity bias. *Social Psychological and Personality Science, 2,* 425–431. doi:10.1177/1948550610396585

Koriat, A. (2007). Metacognition and consciousness. In P. D. Zelazo, M. Moscovitch, & E. Thompson (Eds.), *Cambridge handbook of consciousness* (pp. 289–325). New York, NY: Cambridge University Press. doi:10.1017/CBO9780511816789.012

Kotov, R., Schmidt, N. B., Zvolensky, M. J., Vinogradov, A., & Antipova, A. V. (2005). Adaptation of panic-related psychopathology measures to Russian. *Psychological Assessment, 17,* 242–246. doi:10.1037/1040-3590.17.2.242

Langer, E. J. (1989). *Mindfulness*. Reading, MA: Addison Wesley.

Lau, M. A., Bishop, S. R., Segal, Z. V., Buis, T., Anderson, N. D., Carlson, L., . . . Devins, G. (2006). The Toronto Mindfulness Scale: Development and validation. *Journal of Clinical Psychology, 62,* 1445–1467. doi:10.1002/jclp.20326

MacCallum, R. C., Widaman, K. F., Zhang, S., & Hong, S. (1999). Sample size in factor analysis. *Psychological Methods, 4,* 84–99. doi:10.1037/1082-989X.4.1.84

McIntosh, C. N. (2007). Rethinking fit assessment in structural equation modelling: A commentary and elaboration on Barrett (2007). *Personality and Individual Differences, 42,* 859–867. doi:10.1016/j.paid.2006.09.020

Messick, S. (1995). Validity of psychological assessment: Validation of inferences from persons' responses and performances as scientific inquiry into score meaning. *American Psychologist, 50,* 741–749.

O'Connor, B. P. (2000). SPSS and SAS programs for determining the number of components using parallel analysis and Velicer's MAP test.

Behavior Research Methods, Instruments, & Computers, 32, 396–402. doi:10.3758/BF03200807

Ortner, C. N. M., Kilner, S. J., & Zelazo, P. D. (2007). Mindfulness meditation and reduced emotional interference on a cognitive task. *Motivation and Emotion, 31,* 271–283. doi:10.1007/s11031-007-9076-7

Sauer, S., Walach, H., Schmidt, S., Hinterberger, T., Lynch, S., Büssing, A., & Kohls, N. (2013). Assessment of mindfulness: Review on state of the art. *Mindfulness, 4,* 3–17.

Schumacker, R. E., & Lomax, R. G. (2004). *A beginner's guide to structural equation modeling* (2nd ed.). Mahwah, NJ: Erlbaum.

Shulman, E. (2010). Mindful wisdom: The sati-paṭṭhāna-sutta on mindfulness, memory, and liberation. *History of Religions, 49,* 393–420. doi:10.1086/649856

Singer, J. D., & Willett, J. B. (2003). *Applied longitudinal data analysis: Modeling change and event occurrence*. New York, NY: Oxford University Press.

Tanay, G., Lotan, G., & Bernstein, A. (2012). Salutary proximal processes and distal mood and anxiety vulnerability outcomes of mindfulness training: A pilot preventive intervention. *Behavior Therapy, 43,* 492–505.

Teasdale, J. D. (1999). Metacognition, mindfulness and the modification of mood disorders. *Clinical Psychology & Psychotherapy, 6,* 146–155. doi:10.1002/(SICI)1099-0879(199905)6:2<146::AID-CPP195>3.0.CO;2-E

Thera, N. (1972). *The heart of Buddhist meditation*. Boston, MA: Weiser Books.

Walach, H., Buchheld, N., Buttenmüller, V., Kleinknecht, N., & Schmidt, S. (2006). Measuring mindfulness—The Freiburg Mindfulness Inventory (FMI). *Personality and Individual Differences, 40,* 1543–1555. doi:10.1016/j.paid.2005.11.025

Walshe, M. (1987). *Thus have I heard: The long discourses of the Buddha Digha Nikaya*. London, England: Wisdom.

Weinstein, N., Brown, K. W., & Ryan, R. M. (2009). A multi-method examination of the effects of mindfulness on stress attribution, coping, and emotional well-being. *Journal of Research in Personality, 43,* 374–385. doi:10.1016/j.jrp.2008.12.008

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