



Review

Mechanisms of mindfulness training: Monitor and Acceptance Theory (MAT)



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HIGHLIGHTS

- Mindfulness and mindfulness training are associated with a broad range of outcomes.
- MAT describes mechanisms of mindfulness for cognition, affect, stress, and health.
- Attention monitoring improves cognitive outcomes and increases affect reactivity.
- Monitoring and acceptance interact to improve stress, affect, and health outcomes.
- MAT is a testable account that seeks to stimulate mechanistic mindfulness research.

ARTICLE INFO

Article history:

Received 25 May 2016
 Received in revised form 13 October 2016
 Accepted 16 October 2016
 Available online 05 November 2016

Keywords:

Mindfulness
 Acceptance
 Attention
 Interventions
 Mechanisms

ABSTRACT

Despite evidence linking trait mindfulness and mindfulness training with a broad range of effects, still little is known about its underlying active mechanisms. Mindfulness is commonly defined as (1) the ongoing monitoring of present-moment experience (2) with an orientation of acceptance. Building on conceptual, clinical, and empirical work, we describe a testable theoretical account to help explain mindfulness effects on cognition, affect, stress, and health outcomes. Specifically, *Monitor and Acceptance Theory* (MAT) posits that (1), by enhancing awareness of one's experiences, the skill of *attention monitoring* explains how mindfulness improves cognitive functioning outcomes, yet this same skill can increase affective reactivity. Second (2), by modifying one's relation to monitored experience, *acceptance* is necessary for reducing affective reactivity, such that attention monitoring and acceptance skills together explain how mindfulness improves negative affectivity, stress, and stress-related health outcomes. We discuss how MAT contributes to mindfulness science, suggest plausible alternatives to the account, and offer specific predictions for future research.

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Abbreviations: MAT, Monitor and Acceptance Theory.

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Over the last 15 years there has been a dramatic increase in public interest and scientific research on mindfulness and mindfulness training interventions (e.g., Pickert, 2014), with over 3000 scientific publications on the topic (Black, 2015). Notably, randomized controlled trials indicate that mindfulness training can impact a broad range of outcomes, including effects on cognition and affect (e.g., attention, working memory, emotion regulation; for reviews, see Chiesa, Calati, & Serretti, 2011; Keng, Smoski, & Robins, 2011; Tang, Hölzel, & Posner, 2015), stress reduction (Creswell & Lindsay, 2014), as well as many mental and physical health outcomes (e.g., delaying HIV progression, reducing risk for drug abuse and depression relapse, reducing PTSD symptomatology; Creswell, Myers, Cole, & Irwin, 2009; Bowen et al., 2014; Teasdale et al., 2000; Polusny et al., 2015; for reviews, see Houry et al., 2013; Ludwig & Kabat-Zinn, 2008). Similarly, the dispositional tendency to be mindful in daily life (as measured by validated self-report instruments of trait mindfulness) is associated with an array of beneficial emotion and attention regulation outcomes (Brown, Ryan, & Creswell, 2007).

Now, a new wave of interest seeks to characterize the underlying processes involved in trait mindfulness and mindfulness meditation practices (e.g., Hölzel et al., 2011; Lutz, Jha, Dunne, & Saron, 2015; Vago & Silbersweig, 2012). Yet, despite these advances, still little theory links the psychological mechanisms of mindfulness with the broad variety of mindfulness-related outcomes reported in the literature. Here we offer a parsimonious and testable framework outlining the mechanisms of mindfulness driving cognitive, affective, stress, and health outcomes, called *Monitor and Acceptance Theory* (MAT). We begin by defining two active mechanisms of mindfulness and describe how they are trained in mindfulness interventions. We then describe how these mechanistic components of mindfulness interact to impact a wide range of outcomes, and review preliminary evidence for the MAT account. We conclude with a number of open and testable questions generated by MAT, and discuss how MAT complements existing perspectives on mindfulness.

In doing so, we aim to add to the mindfulness literature in three concrete ways. First, the basic tenets of MAT organize the trait mindfulness literature, outlining when the active components of mindfulness are likely to impact specific outcomes and when they're not. Second, by outlining opportunities for researchers to test novel predictions in their existing datasets, MAT is immediately testable and falsifiable for advancing mechanistic science (given that a large body of evidence has been collected relating components of trait mindfulness with a variety of outcomes, both in basic science and mindfulness intervention studies). Third, MAT offers predictions to motivate new experimental research focused on how specific mindfulness skills drive outcomes in the mindfulness interventions literature. By elucidating the active mechanisms driving a variety of outcomes, the ultimate goal for MAT is to stimulate new evidence that informs how we can tailor more efficient and effective mindfulness training in clinical practice.

1. Components of mindfulness

Mindfulness is commonly defined as a way of paying attention to present-moment experience with a mental stance of receptivity and acceptance (Kabat-Zinn, 1994). A naturally occurring quality that varies across people (a disposition, or trait) and fluctuates across the day (a state of consciousness) (Brown & Ryan, 2003), mindfulness is

specifically trained through mindfulness meditation practices (Creswell, 2016; Visted, Völlestad, Nielsen, & Nielsen, 2014). Although many conceptualizations of mindfulness have been offered (including uni- and multi-dimensional approaches), two components are commonly described across mindfulness definitions and measures: (1) the use of attention to *monitor* one's present moment experiences, and (2) a mental attitude of *acceptance* toward momentary experience (for reviews of the conceptualizations of mindfulness, see Bishop et al., 2004; Quaglia, Brown, Lindsay, Creswell, & Goodman, 2014). MAT posits that the two basic components of mindfulness (attention monitoring and acceptance) speak directly to the active mechanisms distinguishing it from other psychological constructs and intervention elements, and that these components and their interactions help explain an array of mindfulness-specific outcomes reported in the literature.

Attention monitoring and acceptance instructions are central to many well-known mindfulness training interventions, and increases in awareness and nonreactivity are considered common processes across mindfulness-based interventions (Chambers, Gullone, & Allen, 2009). Perhaps most familiar to psychological and behavioral medicine scientists is the Mindfulness-Based Stress Reduction (MBSR) program, an 8-week group-based training program that fosters mindfulness through a series of guided mindfulness meditation practices (Kabat-Zinn, 1982). Other common interventions that involve mindfulness meditation training include variants of basic MBSR (e.g., Mindfulness-Based Cognitive Therapy (MBCT)) and Emotion Regulation Therapy (ERT; Mennin & Fresco, 2014). Interventions like Dialectical Behavior Therapy (DBT) and Acceptance and Commitment Therapy (ACT) train mindfulness skills of monitoring and acceptance outside the context of formal meditation practice. Each of these intervention programs involves additional unique elements (e.g., skillful action) and common elements (e.g., group discussion and social support) not specific to mindfulness that additionally support adaptive outcomes. More recently, the effects of short-term mindfulness training programs (i.e., 5- to 15-minute inductions; 3–4 sessions of training or longer) have been investigated (e.g., Allen et al., 2012; Creswell, Pacilio, Lindsay, & Brown, 2014; Zeidan, Johnson, Diamond, David, & Goolkasian, 2010). These brief training approaches distill mindfulness into its basic components, instructing participants to monitor momentary body sensations and emotional experiences with acceptance, and are thus useful for exploring mindfulness-specific mechanisms among novice meditators.

In these mindfulness training interventions, monitoring practices are often introduced first to train attention to observe present-moment experience. Practitioners aim to stay in direct contact with a chosen focus object (like the breath), to disengage from distractors, and to redirect attention back to the focus object if the mind wanders. Although the type of attention monitoring instructions vary across mindfulness training programs, often mental noting or labeling techniques (e.g., “breathing in, breathing out”; “this is anger”) are used to help monitor momentary experience.

Second, mindfulness interventions train practitioners to be more accepting toward their present moment experience. Acceptance is an objective, non-reactive lens through which to view momentary experience. No matter the content of one's sensory experience, a mental attitude of acceptance is encouraged to allow all experiences – even difficult or stressful ones – to arise and pass without further elaboration,

evaluation, or reactivity. There are also specific instructions used to foster acceptance in mindfulness training programs (e.g., welcoming each experience; encouragement in adopting a receptive and nonreactive attitude). Importantly, these instructions complement initial training and practice with attention monitoring. Particularly when students notice difficult or unpleasant experiences, they are encouraged to approach those experiences with a gentle curiosity and interest, rather than judging, suppressing, or pushing them away.

We note that some intervention approaches train monitoring and acceptance practices concurrently; however, there is evidence to suggest that attention monitoring skills begin to improve more immediately after practice, while acceptance may take longer to cultivate (Baer, Carmody, & Hunsinger, 2012; Desbordes et al., 2015). Thus, we treat attention monitoring and acceptance as distinct and dissociable skills that together comprise the active mechanisms for mindfulness and mindfulness training effects.

2. Monitor and Acceptance Theory (MAT)

MAT begins with the idea that attention monitoring and acceptance are the basic mechanisms underlying mindfulness and mindfulness training effects. These two components are addressed in most scientific conceptualizations of mindfulness and are the central skills developed across many mindfulness training programs. MAT posits that there are distinct and synergistic effects of attention monitoring and acceptance skills on outcomes reported in the mindfulness literature. Specifically, learning the skill of attention monitoring is sufficient for improving cognitive outcomes (e.g., selective attention, sustained attention, and task switching; working memory; insight) and enhancing attention to affective information (potentially intensifying both negative and positive reactivity). However, training in both attention monitoring and acceptance is necessary for improving affective (e.g., executive function tasks balancing attention and affect regulation; reductions in depressive and anxiety symptoms), stress (e.g., subjective and physiological stress reactivity), and physical health outcomes (e.g., stress-related immune and disease outcomes). Below we describe in more detail these components and their effects.

2.1. Attention monitoring

Attention Monitoring is defined as ongoing awareness of present-moment sensory and perceptual experiences (e.g., sounds in the environment, specific body sensations, mental dialogue and images). This capacity to monitor momentary experience relies on selective and executive attention networks. Specifically, conflict monitoring skills are important for recognizing when the mind wanders from its intended focus (e.g., breath), and orienting skills are necessary to redirect attention back to this focus object (cf. Malinowski, 2013). Over the course of mindfulness training, sustained attention also improves as the ability to maintain contact with present-moment experience develops (Chiesa et al., 2011).

Indeed, meditation training programs that focus on these attention training practices have been shown to improve selective and executive attention ability and working memory (Chiesa et al., 2011; Jha, Krompinger, & Baime, 2007; Lutz, Slagter, Dunne, & Davidson, 2008). Just as practice on cognitive tasks (e.g. working memory tasks; conflict monitoring tasks) activates anterior cingulate cortex (ACC) and prefrontal cortex (PFC) which translates to improved performance on these same tasks (Tang & Posner, 2009), attention monitoring practices may activate frontal and parietal brain regions (e.g., frontal eye field, dorsolateral PFC, inferior and superior parietal lobules) supporting attention orienting, as well as the executive network (e.g., ACC, anterior insula, basal ganglia) that supports conflict monitoring (Tang et al., 2015). Building on this evidence base, MAT posits that attention monitoring practices in mindfulness training interventions are a critical

mechanism for improving cognitive functioning outcomes in affectively neutral contexts.

Still, it is likely that certain attentional skills are further strengthened with the practice and development of acceptance, given that affect plays an important role in executive control processes (Inzlicht & Legault, 2014). When executive attention is exercised in affective contexts, we predict that monitoring increases awareness of affective information, and acceptance facilitates both early engagement with (Teper & Inzlicht, 2013) and disengagement from affective stimuli (Vago & Nakamura, 2011), thus reducing further emotional reactivity. Together, monitoring and acceptance may allow momentary emotional stimuli to be processed efficiently in order to inform and refocus attention on cognitive performance (see Teper, Segal, & Inzlicht, 2013 for a description of how mindfulness skills influence executive function).

MAT views attention monitoring as a skill that enhances awareness of present-moment experience, whether that experience is positive, negative, or neutral. And without concomitant training in acceptance, initial skill development in attention monitoring may increase attention toward salient distressing stimuli, intensifying negative affective states (which may impair cognitive task performance in affective or threatening contexts). As one illustration of this point, when panic disorder patients monitor body sensations (such as their heart rate) during a panic attack, this monitoring can prolong anxiety and panic symptoms (e.g., Ehlers & Breuer, 1996). (In contrast, and to forecast a key MAT prediction about the addition of acceptance, when instructed to adopt an accepting stance toward their monitored experience, panic disorder patients report lower anxiety; Levitt, Brown, Orsillo, & Barlow, 2004). In distressing contexts, monitoring momentary experiences in the absence of acceptance encourages a narrow focus on negative stimuli while excluding available neutral sensory cues (Farb et al., 2010). Given that monitoring skills may improve before acceptance skills (Baer et al., 2012; Desbordes et al., 2015), MAT posits that initial emotional agitation and symptom exacerbation are likely as monitoring is practiced, until acceptance skills are developed to reduce reactivity (though in these early stages, novice practitioners may also apply their usual emotion regulation strategies to help downregulate negative emotion). On the other hand, by enhancing one's focus on present experience, training in attention monitoring may also allow positive stimuli to be noticed more frequently and intensely. Similarly, the trait tendency to monitor experiences without concurrent acceptance skills is expected to enhance attention to salient emotional cues, both negative and positive affective states.

2.2. Acceptance

Acceptance is broadly defined as a mental attitude of nonjudgment, openness and receptivity, and equanimity toward internal and external experiences (cf. Baer, Smith, & Allen, 2004; Brown & Ryan, 2004; Desbordes et al., 2015). Experiential acceptance stands in direct contrast to experiential avoidance, characterized by attempts to alter or avoid unwanted thoughts and feelings (Hayes, Wilson, Gifford, Follette, & Strosahl, 1996). Common reactions to negative thoughts and feelings are to avoid them or try to change them (which is often unsuccessful; Wenzlaff & Wegner, 2000), or to become hyperfocused on negative symptoms while ignoring the rest of experience (e.g., Farb et al., 2010; Mathews & MacLeod, 1994). Instead, maintaining acceptance toward one's experiences means that negative thoughts and feelings are not 'unwanted'; they are welcomed into awareness and allowed to diminish as other experiences enter awareness. Likewise, bringing an accepting mindset toward positive experiences means that these experiences are not actively sought after, nor are they grasped and clung to when they do occur, but they are noticed and embraced as they arise and pass.

In this MAT account, we consider acceptance as a broad construct encompassing a range of acceptance-related constructs (e.g., nonreactivity, equanimity, nonjudgment, openness, non-evaluative, non-elaborative), all of which cluster around and rely upon

an orientation of acceptance toward experiences. While contemplative traditions have made subtle distinctions between acceptance-related constructs, acceptance is used here as an umbrella term. We view the willingness to remain present with experiences without trying to change them (nonavoidance) and the ability to allow momentary events to arise and pass (nonattachment) without evaluating (nonevaluation) them as good or bad (nonjudgment) as highly related and mutually reinforcing features of the broader category of acceptance (Williams & Lynn, 2010). Indeed, scales measuring experiential acceptance, nonattachment, nonreactivity, and nonjudgment are significantly correlated (Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006; Sahdra, Shaver, & Brown, 2010).

MAT views acceptance as a dynamic emotion regulation skill, and a critical mechanism for mindfulness training effects on altering affective responses (including boosting executive attention in affective contexts), stress reactivity, and stress-related health outcomes. In contrast to cognitive change emotion regulation strategies like reappraisal, distraction, and suppression, acceptance is a particular way of relating to emotional experiences with openness rather than an active attempt to change the emotion itself. Acting early in the stage of attentional deployment (Gross, 2015), acceptance allows a person to orient toward arising affective experiences, monitor them as they occur, and let them pass. This early engagement and disengagement with affective stimuli influences the trajectory of the emotional experience, reducing ongoing emotional reactivity and the need for cognitive change and response modulation strategies (Slutsky, Rahl, Lindsay, & Creswell, *in press*).

Very little is currently known about the neural dynamics of acceptance, but since acceptance is most perceptible in salient emotional contexts, its neural correlates may be best captured while individuals are responding to emotional stimuli. Self-reported acceptance correlates with less automatic emotional responding, characterized by decreased anterior insula activity in response to negative stimuli (Paul, Stanton, Greeson, Smoski, & Wang, 2013), and there is some suggestion that acceptance may facilitate self-distancing and reappraisal of negative autobiographical memories, corresponding with comparative decreases in subgenual ACC and medial PFC activity (Kross, Davidson, Weber, & Ochsner, 2009). Similarly, regions responsible for emotion regulation and core affect are also likely to be important correlates of acceptance in affective contexts (e.g., orbitofrontal cortex, amygdala). Specifically, practicing an accepting stance toward emotional experiences may both reduce amygdala activation and quicken amygdala recovery, corresponding with emotion regulatory ability (Desbordes et al., 2015). With long-term practice, though, as acceptance becomes a more automatic response and less effortful regulation of emotion is necessary, the neural correlates of acceptance may change, involving changes in resting state functional connectivity (cf. Brewer et al., 2011; Desbordes et al., 2015).

In the health psychology literature, an accepting mindset has been effective for adjusting to chronic pain (McCracken, 1998).¹ Acceptance has also been described as an important mechanism of change in a number of psychotherapeutic treatment approaches (e.g., ACT and Cognitive Behavioral Therapy (CBT); Hayes, Villatte, Levin, & Hildebrandt, 2011; Herbert, Forman, & England, 2009) that balance momentary acceptance of inner experiences with active cognitive and behavioral change strategies. For example, increases in self-reported acceptance underlie decreases in symptom severity for patients with anxiety and depressive disorders (Arch et al., 2012; Forman, Herbert, Moitra, Yeomans, &

Geller, 2007). In psychotherapy, acceptance plays a role in cognitive defusion, allowing burdensome or intrusive negative experiences and memories to be described so that cognitive processing and possibly meaning-making can take place; the patient integrates these difficult experiences into his or her narrative, or lets them go (e.g., Dryden & Still, 2006). Systematic desensitization and exposure therapies also involve a willingness to monitor difficult experiences with a stance of acceptance (e.g., Becker & Zayfert, 2001).

It is important to note that mindfulness training programs do not teach acceptance skills in isolation. Rather, attention monitoring practices provide a scaffold for noticing moment-to-moment experience, which are viewed through an accepting lens. Thus, the MAT account focuses on the synergistic effects of monitoring and acceptance when considering the importance of acceptance on outcomes. We propose that the combination of monitoring and acceptance drives the effects of mindfulness training on affective, stress reduction, and health outcomes. Adopting a mental stance of acceptance modifies one's relationship with all monitored experiences: salient negatively-valenced experiences become less potent, neutral cues can become a source of rest and subtle pleasure, and positive experiences can be savored in the moment. Active acceptance fosters a middle way between suppressing experiences and over-identifying with them. One important question we return to in the discussion section is whether acceptance alone (without attention monitoring) may be possible to train and study in isolation. However, because acceptance is taught along with attention monitoring training with the aim of increasing mindfulness, MAT focuses on their synergistic effects for affective, stress, and health outcomes.

2.3. MAT core tenets

MAT provides an explanatory lens for three categories of research in the burgeoning mindfulness literature: correlational studies of self-reported trait mindfulness, intervention studies measuring changes in self-reported mindfulness to test mechanisms of mindfulness effects, and intervention studies that experimentally dismantle the components of mindfulness to test the effects of specific active ingredients of mindfulness (and their interactions). In sum, the core tenets of MAT are as follows:

1. Attention monitoring skills enhance awareness of present-moment experience. As such, attention monitoring alone:
 - a. is a mechanism for the effects of mindfulness on improving cognitive functioning outcomes in affectively neutral contexts.
 - b. heightens affective experience and reactivity, both exacerbating negative symptoms and enhancing positive experiences. As such, attention monitoring skills alone are not sufficient for improving performance on cognitive tasks that balance attentional control with emotion regulation.
2. Acceptance skills modify the way one relates to present-moment experience, regulating reactivity to affective experience. As such, attention monitoring and acceptance skills together:
 - a. boost performance on cognitive tasks that involve emotion regulation.
 - b. reduce negative reactivity (e.g., anxiety, depression, stress) and reduce grasping of positive experiences (e.g., craving, substance use).
 - c. improve stress-related health outcomes.

3. What is the evidence for MAT?

Though MAT ultimately seeks to explain the mechanisms of mindfulness training effects, it is a new theoretical account and as such there is little experimental work directly testing it. Nonetheless, there

¹ We note that acceptance is conceptualized differently in the coping literature (Carver, Scheier, & Weintraub, 1989) than the mindfulness and clinical psychology literatures. For example, Stone, Kennedy-Moore, and Neale (1995) found that accepting the reality of problems and relinquishing control was effective for coping with stress on a daily scale. However, when acceptance refers to passive resignation as a strategy to cope with important situations, worse health outcomes are commonly observed (e.g., Reed, Kemeny, Taylor, Wang, & Visscher, 1994). We distinguish acceptance in the mindfulness tradition as equanimity with momentary experiences (in contrast to conceptualizations of acceptance as a resigned acquiescence in response to unwanted situations; Nakamura & Orth, 2005).

Table 1
Multidimensional self-report mindfulness measures included in the literature review testing MAT core tenets. Subscales mapping onto monitoring and acceptance skills are described, and skills not directly measuring monitoring or acceptance are listed.

Scale	Monitoring skills	Acceptance skills	Other skills
PHLMS	<i>Present-moment awareness</i> ($\alpha = 0.81$): continuous monitoring of ongoing internal and external stimuli; "I notice changes inside my body, like my heart beating faster or my muscles getting tense."	<i>Acceptance</i> ($\alpha = 0.85$): nonjudgmental stance toward experience; "If there is something I don't want to think about, I'll try many things to get it out of my mind."	None
FFMQ	<i>Observe</i> ($\alpha = 0.83$): the tendency to notice and attend to subtle perceptual events; "I pay attention to sensations, such as the wind in my hair or the sun on my face."	<i>Nonreactivity</i> ($\alpha = 0.75$): ability to maintain contact with experience, watch them from a distance, and allow them to pass without further reactivity; "I perceive my feelings and emotions without having to react to them." <i>Nonjudgment</i> ($\alpha = 0.87$): acceptance of one's thoughts and feelings; "I think some of my emotions are bad or inappropriate and I shouldn't feel them."	<i>Describing and Acting with Awareness</i> scales do not discretely measure monitoring or acceptance.
KIMS	<i>Observe</i> ($\alpha = 0.91, 0.85$): the tendency to notice and attend to subtle perceptual events; "I pay attention to sensations, such as the wind in my hair or the sun on my face."	<i>Accept without judgment</i> ($\alpha = 0.87$): acceptance of one's thoughts and feelings; "I think some of my emotions are bad or inappropriate and I shouldn't feel them."	<i>Describing and Acting with Awareness</i> scales do not discretely measure monitoring or acceptance.

is a growing mindfulness literature relating self-report questionnaires of mindfulness (that include attention monitoring and acceptance subscale measures) with a variety of outcomes (Baer, 2011). Despite parallels between monitoring and acceptance components as trained in mindfulness interventions and as measured in multi-faceted self-report mindfulness scales, there is ongoing debate about the validity of self-report mindfulness measures in relation to mindfulness meditation training (Brown, Ryan, Loverich, Biegel, & West, 2011; Goldberg et al., 2016; Grossman, 2011). Thus, in the hopes that this review will spur future experimental work, we cautiously present evidence based on self-report scales, assuming meaningful (albeit imperfect) associations between the development of monitoring and acceptance skills through mindfulness training and the self-reporting of these same skills.

Specifically, many studies report distinct outcomes related to monitoring and acceptance subscales assessed by the Five Facet Mindfulness Questionnaire (FFMQ; Baer et al., 2006), the Kentucky Inventory of Mindfulness Skills (KIMS; Baer et al., 2004), and the Philadelphia Mindfulness Scale (PHLMS; Cardaciotto, Herbert, Forman, Moitra, & Farrow, 2008). These scales and their attention monitoring and acceptance features are described in Table 1.² FFMQ and KIMS *Observe* and PHLMS *Awareness* subscales correspond with attention monitoring, measuring the tendency to notice and monitor subtle perceptual events in the present moment (without addressing one's orientation toward that incoming experience). FFMQ *Nonjudgment* and *Nonreactivity*, KIMS *Accept without Judgment*, and PHLMS *Acceptance* subscales correspond with the construct of acceptance, measuring a lack of evaluation of one's inner experiences, as well as impartiality and willingness to experience distress while maintaining mental composure.

These attention monitoring and acceptance subscales offer an opportunity to initially evaluate the MAT account ideas. After searching the abstracts of articles citing the original publications describing the FFMQ, KIMS, PHLMS, CAMS-R, and SMQ scales for reports of individual mindfulness subscale outcomes, studies were further examined and included in this review if they tested one of the core MAT tenets. However, we note that there are many more published studies that report overall effects of self-reported mindfulness (combining subscale scores) rather than differential or interactive effects of mindfulness components. Here we evaluate the basic MAT tenets, assessing whether the extant literature supports (or refutes) the MAT predictions that (1a) attention monitoring skills alone co-vary with better cognitive outcomes in non-

affective contexts, but (1b) these same monitoring skills intensify affective, stress reactivity, and stress-related health outcomes, and do not predict better performance on cognitive tasks that balance attention and emotion regulation (e.g., Stroop). Then we review evidence testing whether (2) higher levels of acceptance skills moderate the relationship between high attention monitoring and affective, stress, and health outcomes, such that monitoring is associated with improved outcomes only at high levels of acceptance. The evidence reviewed tests how attention monitoring skills co-vary with predicted outcomes, how monitoring and acceptance skills interact to predict outcomes, and also whether changes in these skills predict these outcomes following interventions.

3.1. Tenet #1: attention monitoring alone enhances awareness

We first consider the evidence testing whether the tendency to monitor experiences, by itself, predicts improved cognitive functioning in neutral contexts (but not in affective contexts) and heightened affective reactivity outcomes. Since monitoring skills (*Observe*) are consistently unrelated to or negatively correlated with acceptance subscales among non-meditators (e.g., Baer et al., 2008; Baer et al., 2006), we consider associations with the *Observe* subscale alone, assuming that the tendency to monitor experience in the samples reviewed does not necessarily correspond to a tendency to accept those experiences.

3.1.1. Do self-reported monitoring skills relate to cognitive functioning outcomes in affectively neutral contexts?

MAT predicts that attention monitoring improves performance on affectively neutral cognitive functioning outcomes; five studies have tested this prediction. First, the self-reported tendency to monitor (*Observe*) was associated with higher task-based perceptual accuracy in two student samples, while acceptance was unrelated to perceptual accuracy; this relationship between monitoring and perceptual accuracy held across tasks with and without working memory load (Anicha, Ode, Moeller, & Robinson, 2012). Second, in a combined sample of meditators and non-meditators, monitoring skills (*Observe*) (and also acceptance skills) were related to performance on a focused attention task (Moore & Malinowski, 2009). Third, creative performance in a student sample related to attention monitoring only, rather than monitoring and acceptance together (Baas, Nevicka, & Velden, 2014); specifically, monitoring (*Observe*), but not acceptance (*Accept without Judgment*) correlated with creative ideation and self-reported creativity. In an experimental study that selectively trained attention monitoring only in an 8-week mindfulness meditation course, monitoring skills (*Observe*), but not acceptance (*Accept without Judgment*), increased following training compared to a waitlist control. Notably, self-reported creative behavior increased following this attention monitoring training, and

² Though other multidimensional self-report mindfulness scales are available that measure subscales mapping onto attention monitoring and acceptance skills (Cognitive and Affective Mindfulness Scale-Revised (CAMS-R): Chadwick et al., 2008; Southampton Mindfulness Questionnaire (SMQ): Feldman, Hayes, Kumar, Greeson, & Laurenceau, 2007), in our literature search, we did not find studies which tested the MAT core tenets using these instruments.

increases in *Observe* skills from pre- to post-training predicted these increases in creative behavior (Baas et al., 2014).

Together, these studies begin to suggest that the ability to monitor and attend to stimuli drives the relationship between mindfulness and cognitive functioning (creativity, perceptual accuracy, attentional performance), while acceptance of one's experience (in four of five studies reviewed) adds no additional benefits for these non-affective cognitive outcomes.

3.1.2. Do self-reported monitoring skills heighten affective reactivity without acceptance?

Whereas attention monitoring skills correlate with cognitive performance in affectively cold contexts, this same tendency to monitor experience is predicted to heighten emotional reactivity in affectively hot contexts. For affective, stress, and stress-related health outcomes, MAT predicts that paying close attention to one's experiences (high attention monitoring) will exacerbate negative reactivity (and enhance positive reactivity) independent of acceptance. Monitoring negative thoughts and feelings without acceptance can increase the intensity of negative experiences and prolong reactivity and symptoms, but this same tendency to monitor positive cues may heighten positive experiences. Second, because monitoring increases focus on affective cues without concurrent emotion regulation, MAT predicts that attention monitoring alone is not sufficient for improving performance on cognitive tasks that balance attention and emotion regulation.

Across a number of healthy and patient populations, the tendency to monitor (*Observe*) one's experiences has been consistently related to greater psychological distress outcomes in affective contexts. In one sample, monitoring (*Observe*) was correlated with Behavioral Inhibition System (BIS) sensitivity, an increased focus on fear and anxiety (Hamill, Pickett, Amsbaugh, & Aho, 2015). Further, BIS sensitivity – which normally predicts maladaptive emotion regulation and a variety of depressive and anxiety disorders (cf. Hamill et al., 2015) – only correlated with anxiety symptoms among student participants reporting high monitoring skills (*Observe*) and low acceptance (Hamill et al., 2015), suggesting that in the absence of an accepting orientation toward distressing experiences, closely monitoring these experiences may exacerbate them.

In another student sample, participants high in monitoring (*Observe*) but low in acceptance (*Nonjudgment*) had higher levels of depressive and anxiety symptoms, affective lability, and distress intolerance than participants low in both monitoring and acceptance skills (Pearson, Lawless, Brown, & Bravo, 2015). This same relationship was observed in a third student sample: monitoring (*Observe*) again predicted higher depressive symptoms among those with low levels of acceptance (*Nonreactivity*) (Barnes & Lynn, 2010). In a clinical sample, acceptance (*Nonreactivity*) moderated the effect of monitoring (*Observe*) on symptoms; among participants low in acceptance, high monitoring predicted higher rumination, worry, and depressive symptoms, and lower reappraisal (Desrosiers, Vine, Curtiss, & Klemanski, 2014). Other studies have similarly found associations between monitoring and psychological distress: the tendency to monitor experience (*Observe*) has been correlated with higher depressive symptoms (Barnes & Lynn, 2010), stress symptoms (Brown, Bravo, Roos, & Pearson, 2015; Hamill et al., 2015), and anxious arousal (Desrosiers, Klemanski, & Nolen-Hoeksema, 2013; Hamill et al., 2015).

In one study, higher attention monitoring was associated with lower negative reactivity; the tendency to monitor (*Observe*) present experience correlated with lower feelings of body uneasiness in a combined sample of binge-eaters, non-bingeing obese, and normal weight women (Compare, Callus, & Grossi, 2012). However, it may be that this association was driven by binge-eaters' lower monitoring tendencies and higher body uneasiness compared to non-bingeing women.

In accordance with previous theoretical work (Creswell & Lindsay, 2014), MAT suggests that attention monitoring skills may impact stress-related health outcomes through their association with affective reactivity and increased focus on negative cues. Indeed, monitoring

(*Observe*) predicted higher anorexic symptoms among young women (Adams et al., 2012); in this case, self-reported monitoring may be related to hyper-focus on weight and food cues and self-focused attention. Monitoring (*Observe*) has also been associated with poorer subjective health and more physician visits for psychological and physical health (Consedine & Butler, 2014); a strong tendency to monitor may increase focus on somatic sensations and intensify them unless viewed with acceptance.

In contrast to this consistent pattern of attention monitoring associating with heightened distress and negative reactivity, it is important to note that the tendency to monitor one's experiences has also been shown to enhance some positive outcomes. By bringing attention to present-moment experiences, MAT posits that monitoring may intensify and heighten all experiences: negative, positive, and neutral alike. There is some preliminary support for this idea; independent of acceptance, monitoring (*Observe*) was positively associated with self-esteem and satisfaction with life among healthy students (Christopher & Gilbert, 2010), and with positive growth in the months and years following trauma exposure among police officers (Chopko & Schwartz, 2009). Monitoring (*Observe*) also correlated with pro-environmental behavior (as did acceptance; Barbaro & Pickett, 2016). Further, following an 8-week MBCT training, increases in the tendency to monitor (*Observe*) predicted increases in positive affect (although it's possible that monitoring was correlated with acceptance among these mindfulness-trained participants; Schroevers & Brandsma, 2010). We suspect that these associations between monitoring and positive outcomes are not about increasing motivation or anticipation of positive rewards, as monitoring (*Observe*) has not consistently predicted BAS reward responsiveness (Hamill et al., 2015; Reese, Zielinski, & Veilleux, 2015), but rather may be driven by a tendency to take note of pleasant experiences in the present moment. In these studies linking monitoring skills with positive outcomes, populations were in good psychological health, underwent mindfulness training that also included acceptance instruction, or arrived at positive outcomes after months or years; we speculate that monitoring skills alone would not predict these same benefits in clinical populations or in situations involving acute distress.

Finally, because monitoring heightens affective experience, monitoring is not predicted to improve cognitive performance on affectively-charged tasks; affect can disrupt cognitive performance unless effectively processed and quickly regulated. The ongoing monitoring of present experience by itself may strengthen executive attention. However, without an attitude of acceptance to facilitate processes of early engagement and disengagement with emotional stimuli (Vago & Nakamura, 2011), attention may be biased toward emotional cues (and attempts to regulate reactivity) and away from task performance. The Stroop color-word task is an executive function task that requires cognitive flexibility to balance cognitive and affective task demands; it requires emotion regulation in the face of time pressure and frequent errors, as well as attention regulation to inhibit automatic response tendencies. Specifically, Stroop error commission produces a quick affective response that contributes to heightened cognitive performance if acknowledged and processed early, then effectively let go (processes facilitated by acceptance; Teper et al., 2013). This early processing of affective stimuli also reduces the need for further emotion regulation strategies, which may interfere with cognitive performance. Across three studies that tested the association between mindfulness skills and Stroop performance, monitoring was unrelated to performance in two studies (instead, acceptance predicted performance; Anicha et al., 2012; Teper & Inzlicht, 2013), and predicted fewer errors but not faster reaction time in another study (while acceptance predicted both; Moore & Malinowski, 2009). While monitoring did not interfere with performance in these studies, neither did it consistently predict improved cognitive performance on a task involving affect regulation.

In sum, the available evidence relating attention monitoring skills with cognitive and affective outcomes provides preliminary support

for Tenet #1. The tendency to monitor present-moment experiences – by itself – is often predictive of higher levels of psychological distress, but also relates to positive outcomes (although it's unclear whether the relationship between monitoring and positive outcomes is driven by a combined tendency to monitor to experiences with acceptance, a hypothesis not tested in any of the reviewed studies). Monitoring skills may increase focus on all types of experiences: without acceptance, this tendency may increase affective reactivity to negative and positive events, and negative affective reactivity may hinder flexible responding on executive attention tasks that involve affect regulation.

3.2. Tenet #2: monitoring + acceptance mitigates affective reactivity

Second, we review the evidence testing whether the combination of monitoring and acceptance skills reduces affective and stress reactivity, boosts performance on cognitive tasks involving affect regulation, and improves stress-related health outcomes. Several studies lend evidence to this hypothesis by testing how interactions between monitoring and acceptance skills affect psychological distress (depressive, anxiety, and stress symptoms; substance use) or physical health outcomes in healthy student and patient samples.

However, the majority of published work tests the independent effects of acceptance on these outcomes; because these studies don't directly address the MAT hypotheses, they are not reviewed here. Since all conceptualizations of mindfulness include attention monitoring, but some do not view acceptance as a defining component of mindfulness (cf. Desbordes et al., 2015; Dreyfus, 2011), Tenet #2 focuses on evaluating whether high attention monitoring skills predict specific outcomes at high vs. low levels of acceptance (rather than comparing how high levels of acceptance predict outcomes at high vs. low levels of monitoring). Still, in the discussion, we return to the possibility that acceptance may be beneficial in the absence of monitoring skills.

3.2.1. Do self-reported monitoring and acceptance skills improve performance on cognitive tasks involving affect regulation?

MAT predicts that monitoring skills in combination with acceptance skills drive improvements in cognitive functioning on tasks requiring effective emotion regulation for task performance. Executive attention depends on noticing when attention is pulled away from its intended focus (monitoring) and letting go of these distractors (acceptance). Affect is critically involved in this process, as conflicts in attention create a momentary state of distress that can either be utilized to refocus on the intended task or can build into a distracting condition of frustration, failure, and rumination (Inzlicht & Legault, 2014). Monitoring momentary experiences with acceptance may further enhance executive attention ability by facilitating both engagement and disengagement with emotional stimuli in order to refocus on cognitive performance. Although three studies found that acceptance, which may help regulate emotional reactivity and free resources for more flexible task responding, was an important component predicting better performance on the Stroop task (Anicha et al., 2012; Moore & Malinowski, 2009; Teper & Inzlicht, 2013), no studies have reported testing the interactive effects of attention monitoring and acceptance on this task (such that monitoring predicts better performance at high levels of acceptance, but not low acceptance). Thus, we are unable to evaluate this prediction here.

3.2.2. Do self-reported monitoring and acceptance skills drive reductions in affective reactivity and stress?

MAT predicts that attention monitoring is an important mechanism of mindfulness effects on improved affective and stress reduction outcomes, but only with concomitant high levels of acceptance skills. MAT predicts that high levels of monitoring and acceptance together drive reductions in affective reactivity and distress outcomes in healthy populations and reduce symptoms among clinical populations.

Three studies have highlighted a critical role for acceptance of one's experiences in moderating the relationship between attention monitoring and psychological distress outcomes. At multiple time points throughout a semester, while the tendency to monitor (*Observe*) was associated with high depressive symptoms among students with low levels of acceptance (*Nonreactivity*), at high levels of acceptance, attention monitoring was not associated with depression, emphasizing the importance of maintaining an accepting orientation toward attended experiences (Barnes & Lynn, 2010). Further, acceptance (*Nonreactivity* and *Nonjudgment*) explained the relationship between higher trait mindfulness and lower depressive symptoms (Barnes & Lynn, 2010), suggesting a mediating role of acceptance on reducing negative affective outcomes. Similarly, students with high monitoring skills (*Observe*) and high levels of acceptance (*Nonjudgment*) reported significantly lower levels of depressive and anxiety symptoms, affective lability, and distress intolerance than students high in monitoring (*Observe*) with low levels of acceptance (*Nonjudgment*) (Pearson et al., 2015). Likewise, among adults with mood and anxiety disorders, acceptance (*Nonreactivity*) moderated the effects of monitoring (*Observe*) on depressive symptoms: high monitoring skills correlated with higher depressive symptoms only at low levels of acceptance, and not at high levels of acceptance (Desrosiers et al., 2014). Further, high monitoring skills (*Observe*) in combination with high acceptance (*Nonreactivity*) correlated with more adaptive cognitive processing tendencies (lower rumination and worry, and higher reappraisal use), which statistically explained the relationship between monitoring with acceptance on lower depressive and anxiety symptoms (Desrosiers et al., 2014).³

The interaction between monitoring and acceptance skills has also predicted substance use. By itself, greater emotional and body awareness has been linked with greater alcohol use (e.g., Leigh & Neighbors, 2009), but this tendency to monitor inner experiences may not be detrimental in predicting substance use when coupled with acceptance skills. High attention monitoring (*Observe*) correlated with heavy alcohol use only at low levels of acceptance, while participants who maintain acceptance (*Nonreactivity*) toward their monitored experiences reported lower tobacco and alcohol use (Eisenlohr-Moul, Walsh, Charnigo, Lynam, & Baer, 2012).

In sum, studies testing the interaction between monitoring and acceptance suggest that acceptance (*Nonreactivity*, *Nonjudgment*) moderates the relationship between monitoring (*Observe*) and psychological distress outcomes, such that a high tendency to monitor experiences is associated with adaptive outcomes only with concomitant high levels of acceptance. While monitoring heightens and enhances experiences, acceptance promotes an adaptive response to these experiences.

3.2.3. Do self-reported monitoring and acceptance skills drive improvements in stress-related health outcomes?

By reducing distress and stress reactivity, MAT predicts that monitoring and acceptance together explain how mindfulness interventions may improve stress-related health outcomes (Creswell & Lindsay, 2014; Grossman, Niemann, Schmidt, & Walach, 2004). One study suggests that the positive effects of trait mindfulness on circulating markers of inflammation are driven by the combined effects of monitoring and acceptance skills. Tomfohr, Pung, Mills, and Edwards (2015) tested for interactions between attention monitoring and acceptance in predicting circulating IL-6 levels (a marker of systemic inflammation) in a sample of healthy young adults. Higher monitoring skills (*Observe*) were associated with lower IL-6, but this relationship was driven by acceptance (*Nonreactivity*) toward these experiences: participants reporting higher

³ While they do not directly test Tenet #2 (comparing the effects of high attention monitoring and high acceptance skills vs. high attention monitoring with low acceptance skills), two studies suggest that the ability to accept distressing feelings may be crucial for buffering the negative consequences of monitoring these feelings. Acceptance moderated the impact of BIS sensitivity, such that this attention to fear stimuli did not predict stress, anxiety, and depressive symptoms (Hamill et al., 2015) or emotion dysregulation (Reese et al., 2015) among participants high in acceptance.

monitoring and acceptance skills had low IL-6 levels, while the tendency to monitor experiences without a stance of acceptance was not associated with IL-6 levels.

3.3. Literature review: summary

Studies of self-reported monitoring and acceptance mindfulness components provide some preliminary support of MAT. First, attention monitoring alone is related to better cognitive functioning in neutral contexts (better perceptual accuracy and attentional performance; higher creativity) and not consistently related to executive function when affect regulation is involved (Stroop performance). In affective domains, monitoring skills are often related to higher negative psychological and somatic symptoms, as well as some positive outcomes (satisfaction with life and posttraumatic growth). These results suggest that focusing attention on negative or positive affective experiences can heighten them in the absence of acceptance.

Second, across studies testing interactions between attention monitoring and acceptance skills, the tendency to pay attention to momentary experiences predicts lower psychological distress and clinical symptoms and better markers of health only when combined with high levels of acceptance, suggesting that present-focused attention monitoring is only linked with effective affect regulation when one's experiences are viewed with acceptance. Many have proposed that mindfulness meditation practice trains this way of paying attention with an accepting lens, and as a result, the relationship between the observer and the attended experience changes. Indeed, the FFMQ *Observe* subscale is consistently unrelated to or negatively correlated with other mindfulness subscales among non-meditators, but positively correlated among meditators (e.g., Baer et al., 2008; Baer et al., 2006). Further, whereas high monitoring skills (*Observe*) correspond with a strong relationship between potentially stressful life events and distress symptoms among non-meditators, stressful events do not predict distress among meditators high in monitoring skills (Neale-Lorello & Haaga, 2015). Thus, noticing and attending to one's experiences becomes potentially more adaptive when one's attitude toward the focus object becomes open and accepting.

Given the correlational nature of the evidence reviewed, it is premature to make strong conclusions about the active mechanisms driving mindfulness effects. Similarly, the majority of participants in the reviewed studies had no exposure to mindfulness training interventions, and it's possible that the interpretation of mindfulness scale items differs between mindfulness-trained and mindfulness-naïve individuals (Grossman, 2008). We also only reviewed results from mindfulness subscales that clearly map onto attention monitoring and acceptance. In particular, we did not present results from *Act with Awareness* or *Describe* subscales from the FFMQ and KIMS. These subscales often show positive relationships with beneficial outcomes, but the skills they measure do not purely reflect monitoring or acceptance, and thus do not directly evaluate the MAT account.⁴ Despite these limitations, the body of evidence evaluated here follows a consistent pattern supporting the MAT account, suggesting that MAT may be helpful and generative for future mechanistically-focused mindfulness research.

⁴ *Act with Awareness*, a tendency to relate to one's behaviors with full awareness, reflects both an implicit orientation of acceptance toward experience (the opposite of automatic and distracted behavior being an openness to engaging with one's experiences), and also measures attention monitoring (on one's actions or not) (see Brown & Ryan, 2003 for a discussion of the Mindful Attention and Awareness Scale (MAAS) development, on which *Act with Awareness* is primarily based). *Describe* is not central to the construct of mindfulness (cf. Cardaciotto et al., 2008), as it involves additional cognitive processing and elaboration beyond monitoring one's experiences; while *Describe* can foster attention monitoring by keeping one anchored in describing present moment experiences, it also involves elaborating on emotional experiences and reflecting on the content of thoughts and feelings rather than simply noticing arisings and passings in present experience.

4. General discussion

MAT builds on conceptual, clinical, and empirical work to provide a theoretical framework outlining the putative active mechanisms of mindfulness training, with the hope that by understanding mechanisms we can develop and deliver more effective and efficient interventions. More specifically, MAT organizes the wide-ranging outcomes described in the mindfulness literature. It depicts the basic skills acquired in mindfulness training interventions (attention monitoring and acceptance) that may help explain specific and dissociable effects on cognitive, affective, stress reduction, and stress-related health outcomes.

MAT complements recent theoretical work identifying psychological mechanisms of change following mindfulness interventions (e.g., emotion regulation, attention control, and self-awareness; Hölzel et al., 2011; Shapiro, Carlson, Astin, & Freedman, 2006; Vago & Silbersweig, 2012; Tang et al., 2015) by specifying the underlying components of mindfulness that interact to change these downstream psychological processes and resultant outcomes. And though additional active features are identified in other multi-dimensional models of mindfulness training (which are important to rigorously evaluate; e.g., self-management, dereification, intention; Baer, 2003; Lutz et al., 2015; Shapiro et al., 2006), the basic components of attention monitoring and acceptance are common factors across these models. Moreover, MAT makes unique predictions about the mechanistic pathways underlying specific outcomes. In contrast to many perspectives that extol the benefits of mindfulness, MAT makes predictions about the aspects of mindfulness training that underlie certain adaptive outcomes, but also specifies aspects of mindfulness training that are likely to exacerbate symptoms (i.e., when one monitors negative affect without an accepting stance). Indeed, MAT is congruent with anecdotal reports of novice meditators early in mindfulness training, who often experience agitation when effortfully engaging in attention monitoring (before an attitude of acceptance is potentially fostered).

In this review we highlight correlational findings that address MAT's predictions (see Table A.1 in Appendix A). These findings indicate that attention monitoring skills alone (1a) are associated with better cognitive functioning on non-affective tasks (e.g., perceptual accuracy, attentional performance, creativity), but (1b) do not reliably predict executive attention on tasks that rely on both attentional control and affect regulation (e.g., Stroop task). Attention monitoring skills (without concomitant acceptance skills) (1b) are associated with greater psychological distress in affective contexts (e.g., depressive, anxiety, and stress symptoms, sensitivity to and intolerance of distress, anorexic symptoms, and poor subjective health), and in the few studies that look at positive affective contexts, attention monitoring skills also relate to higher satisfaction with life, positive growth, and positive behaviors. By enhancing awareness of experience, attention monitoring may heighten both negative and positive affective states; noticing and monitoring a broad range of pleasant feelings, thoughts, and body sensations may allow positive experiences to be appreciated and savored (Garland, Farb, Goldin, & Fredrickson, 2015; Lindsay & Creswell, 2015). Second, as specified by MAT, the combination of high attention monitoring and acceptance skills has been related to (2b) lower negative affective reactivity outcomes (e.g., lower depressive and anxiety symptoms, rumination and worry, distress intolerance, affective lability, substance abuse) and (2c) lower systemic low-grade inflammation (i.e., circulating IL-6). These interactions suggest that high acceptance skills may moderate the impact of attention monitoring skills on negative affective states, psychological distress and physical health. Given these promising correlational findings reported in previous studies, MAT provides an organizing and potentially generative theoretical framework for predicting outcomes in the emerging mindfulness scientific literature.

Our review of the literature, in light of MAT tenet #2, was constrained because few studies examined the interactive effects of monitoring and acceptance skills in predicting outcomes (most studies examined independent effects of monitoring and acceptance subscales separately). In

order to more rigorously evaluate MAT, more studies are needed to test whether acceptance moderates the association of attention monitoring skills and cognitive, affective, and stress-related outcomes (e.g., Barnes & Lynn, 2010; Desrosiers et al., 2014; Eisenlohr-Moul et al., 2012; Tomfohr et al., 2015). And more importantly, experimental studies are needed that dismantle attention monitoring and acceptance training instructions into separate mindfulness training interventions (e.g., Baas et al., 2014; Evans, Eisenlohr-Moul, Button, Baer, & Segerstrom, 2014). Specifically, we are currently conducting pre-registered randomized controlled trials that compare a mindfulness program with both monitoring and acceptance training to a mindfulness training program that includes monitoring instructions only. We suspect that it will be important to offer a reasonable dose of mindfulness training (at least 5–10 h) in these experimental studies in order to observe measurable dissociable effects of training in monitoring vs. monitoring and acceptance training (cf. Evans et al., 2014). Indeed, one study indicates that it takes at least 1–2 weeks of mindfulness training and practice to foster increases in acceptance (as measured by the FFMQ *Nonjudgment* and *Nonreactivity* subscales; Baer et al., 2012), and another study suggests that only those already familiar with acceptance strategies are able to effectively utilize very brief training focused on acceptance to manage acute pain (Blacker, Herbert, Forman, & Kounios, 2012).

Thoroughly exploring these possibilities will be important for translating basic MAT research into clinical practice. For example, in line with the correlational evidence reviewed, randomized controlled trials may find that mindfulness interventions aiming to reduce cognitive decline can be strengthened by focusing mainly on attention monitoring techniques, but interventions targeting physical health may be more efficacious with an emphasis on acceptance. Or, future mechanistic research may find that individuals resistant to learning explicit acceptance techniques can eventually adopt an implicit stance of acceptance after extended practice with attention monitoring only. By clarifying the active components of mindfulness training for a variety of specific populations and outcomes, this research can help to tailor more powerful mindfulness interventions.

4.1. Plausible alternative accounts to MAT

MAT provides a broad evidence-based theoretical framework for mindfulness training effects, and certainly there are a number of related plausible alternative mechanistic accounts to be evaluated. First, one possibility is that training in attention monitoring alone may be sufficient for improving most outcomes in the mindfulness training literature. Focused attention monitoring of moment-to-moment experience might engender an implicit acceptance of experience, as careful attention monitoring may naturally give rise to a more accepting mode of processing moment-to-moment experience. Indeed, some theoretical perspectives advocate for the power of attention monitoring only (e.g., Bodhi, 2011), and there is additional evidence that focused attention monitoring of the sensory qualities of pain can foster accelerated recovery after a cold-pressor task (Cioffi & Holloway, 1993). Monitoring may also facilitate effective self-regulation in some contexts; it is certainly possible that under mildly arousing contexts, using attention to monitor somatic cues (e.g., racing heart) when giving a speech could result in taking some deep breaths to bring it down.

It is prudent to mention that some Buddhist accounts of mindfulness as ‘clear awareness’ focus on attention monitoring as a sole component, and consider acceptance to be a separate distinct construct (rather than a central component of mindfulness; Desbordes et al., 2015). Even so, deliberate techniques to foster acceptance of present-moment experience are considered a skillful means to instruct mindfulness (Dreyfus, 2011). Further, some suggest that applying an accepting, non-judgmental stance is a prerequisite to clearly anchor one’s attention on momentary processes as they arise (cf. Quaglia et al., 2014). These perspectives emphasize important interactions between attention monitoring and acceptance components of mindfulness, and suggest that

the two basic skills may be mutually reinforcing. Indeed, with experience in practicing mindfulness, an accepting orientation may merge with attention monitoring, such that acceptance becomes the default mental stance toward all present-moment experiences.

Related to these considerations, it’s possible that differences between attention monitoring and acceptance skills are observed initially after several hours or days of training, such that monitoring training may exacerbate symptoms early on compared to training in both monitoring and acceptance, but in later stages of training, careful monitoring of experience is sufficient to foster an implicit acceptance of these experiences and is therefore equally beneficial. As such, MAT suggests that it’s important to consider (and measure) important developmental trajectories of attention monitoring and acceptance skills when predicting outcomes. Additionally, baseline individual differences in monitoring and acceptance skills (as well as history of psychopathology) may impact the time course of further developing these skills through training.

Another plausible alternative account (or more specifically, a challenge to MAT account Tenet #2) is whether acceptance skills alone may be the critical mechanism for mindfulness training intervention effects on affective, stress, and stress-related health outcomes. Certainly, studies show that self-reported acceptance alone is associated with lower depressive, anxiety, and stress symptoms (Barnes & Lynn, 2010; Brown et al., 2015; Cash & Whittingham, 2010; Desrosiers et al., 2013; Hamill et al., 2015); lower worry, rumination, negative cognitions, and emotion dysregulation (Christopher & Gilbert, 2010; Fisak & von Lehe, 2012; Paul et al., 2013; Reese et al., 2015); reductions in clinical symptoms (anxiety, depressive, and personality disorders, eating pathology and substance use, and posttraumatic stress disorder) (Adams et al., 2012; Boden et al., 2012; Compare et al., 2012; Fernandez, Wood, Stein, & Rossi, 2010; Hoge et al., 2015; Kalill, Treanor, & Roemer, 2014; Lavender, Gratz, & Tull, 2011; Ostafin & Marlatt, 2008; Owens, Walter, Chard, & Davis, 2012; Peters, Eisenlohr-Moul, Upton, & Baer, 2013; Schoorl, Mil-Klinkenberg, & Does, 2015; Thompson & Waltz, 2010; Vujanovic, Youngwirth, Johnson, & Zvolensky, 2009; Wahbeh, Lu, & Oken, 2011); higher well-being, self-esteem, and pro-environmental behavior (Barbaro & Pickett, 2016; Cash & Whittingham, 2010; Christopher & Gilbert, 2010); and better physical health outcomes (Considine & Butler, 2014; Daubenmier, Hayden, Chang, & Epel, 2014; Klein et al., 2015).

We recognize the possibility that acceptance skills are independently valuable for improving a broad range of outcomes (particularly reducing psychological symptoms), even in the absence of a strong tendency to notice momentary experiences. For example, those with high levels of acceptance tend to worry and ruminate less than those with low levels of acceptance, even at low tendencies to monitor experiences (Desrosiers et al., 2014). However, those with high levels of both monitoring and acceptance worry and ruminate the least (Desrosiers et al., 2014). Further, the tendency to both monitor and accept experiences may be particularly important in contexts requiring self-regulation; in one sample, high acceptance predicted higher alcohol use among participants low in monitoring skills compared to those high in monitoring skills (Eisenlohr-Moul et al., 2012). Thus, there is mixed evidence about the benefits of high trait levels of acceptance without parallel monitoring skills.

Moreover, MAT is focused on the mechanisms of mindfulness training interventions where acceptance is not taught independent of monitoring training; instead, mindfulness training interventions teach attention monitoring skills for careful observation of one’s moment-to-moment experience, and acceptance skills are applied to these monitored experiences to regulate automatic reactivity. In our view, it’s not clear how acceptance would be trained in the absence of a target object to monitor with acceptance. As such, pursuing the development and testing of acceptance-only interventions may not advance our understanding of the mechanisms of mindfulness interventions. Furthermore, MAT highlights key roles of both monitoring and acceptance in fostering psychological well-being: acceptance appears to be essential for

reducing symptoms (and the grasping of positive experiences), while noticing experiences is crucial for appreciating them and building positive states (Garland et al., 2015; Lindsay & Creswell, 2015).

However, it may be appropriate to explore the efficacy of mindfulness training that further emphasizes acceptance techniques (while still including some monitoring instruction) for specific populations and outcomes. For example, brief acceptance training – which involves monitoring a target object (e.g., momentary pain sensations, feelings of sadness) through an accepting and detached lens – is useful for regulating emotion (cf. Hayes et al., 1999). A meta-analysis suggests that acceptance is more effective than other emotion regulation strategies (e.g., distraction, reappraisal, rumination, suppression) for increasing pain tolerance, and equally effective for reducing pain ratings and negative affect (Kohl, Rief, & Glombiewski, 2012). We caution that these brief acceptance-focused interventions are less effective for those inexperienced with acceptance strategies (Blacker et al., 2012; Evans et al., 2014), and among clinical populations, an accepting orientation may be difficult to immediately adopt (Singer & Dobson, 2009). Still, emphasizing acceptance techniques in mindfulness interventions, especially those geared toward reducing affective reactivity, is a promising direction for research.

A final alternative is that MAT and its core tenets about basic mechanisms of mindfulness (monitoring and acceptance) may have missed some or all of the active psychological mechanisms underlying mindfulness training. For example, the training context of many mindfulness interventions includes a supportive instructor and a group discussion format, and in addition, social ties, emotional disclosure, and positive treatment expectancies are likely also important drivers of mindfulness intervention effects. Still, there is evidence that mindfulness training studies that either control for these factors or lack these intervention elements (e.g., group support) have been linked with affective and physical health outcomes (e.g., Kabat-Zinn et al., 1998; Polusny et al., 2015; Rosenkranz et al., 2013; Taren et al., 2015), suggesting a mindfulness-specific impact on a broad array of outcomes. And, as mentioned previously, other mechanistic models of mindfulness training describe additional underlying processes that may be equally important in fostering mindfulness and influencing its associated outcomes (e.g., Lutz et al., 2015). Still, we suspect that since attention monitoring and acceptance are central features of all mindfulness accounts, they are likely to be important mechanisms for mindfulness training intervention effects.

Although quite speculative, one intriguing possibility is that attention monitoring and acceptance may be important mechanisms for other behavioral intervention effects. Indeed, MAT might help explain the effects of interventions such as expressive writing or Cognitive Behavioral Therapy (CBT) on cognitive, affective, stress and health outcomes observed in those literatures (e.g., Mennin, Ellard, Fresco, & Gross, 2013). For example, there is evidence that dispositional mindfulness increases following cognitive behavioral therapies (Boden et al., 2012; Owens et al., 2012), and acceptance skills are particularly important for symptom improvement following interdisciplinary acceptance-based therapy (McCracken, Vowles, & Eccleston, 2005). At this early stage of research, we hope the MAT account and its plausible alternatives motivate new mechanistic studies of mindfulness interventions for advancing our understanding in this growing area.

5. Conclusions

MAT is a new framework that identifies the putative active mechanisms underlying mindfulness training interventions: attention monitoring and acceptance. Practice in monitoring one's experiences trains attentional processes and enhances these experiences as they occur in the present moment. Acceptance modifies the way an individual relates to the content of monitored experience, tempering affective reactivity to produce a variety of beneficial outcomes across affective and physical health domains. Building from the conceptual foundations of mindfulness and initial correlational evidence, MAT offers a number of testable

predictions based on the perspective that attention monitoring and acceptance components of mindfulness independently and synergistically underlie a broad range of outcomes. Ultimately, MAT aims to stimulate new evidence to inform more tailored and effective mindfulness interventions.

Supplementary data to this article can be found online at <http://dx.doi.org/10.1016/j.cpr.2016.10.011>.

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Supplementary Online Table 1 Studies testing the MAT core tenets.

Study	Sample	N	Age %F	Study Design	Outcome Measure	Monitoring Outcomes	Monitoring + Acceptance Interactions
Tenet 1a: Do self-reported monitoring skills relate to cognitive functioning outcomes in affectively neutral contexts?							
Anicha et al., 2012 (Study 1)	student	71	^a 49%	correlational	Perceptual accuracy (working memory load)	<i>FFMQ Observe</i> -> greater perceptual accuracy	Not reported
Anicha et al., 2012 (Study 2)	student	56	^a 59%	correlational	Perceptual accuracy (no working memory)	<i>FFMQ Observe</i> -> greater perceptual accuracy	Not reported
Baas et al., 2014 (Study 2)	student	225	20 64%	correlational	Creative ideation; creative achievements; creative behavior	<i>FFMQ Observe</i> -> higher self-reported creative achievements and behavior, and creative ideation	Not reported
Baas et al., 2014 (Study 3)	student	74	24 77%	RCT: Pre-post 8-week Observe training vs. waitlist control	Creative behavior	increases in <i>FFMQ Observe</i> -> increased self-reported creative behavior	Not reported
Moore & Malinowski, 2009	meditators and non-meditators	50	28 52%	correlational	d-2 concentration test	<i>KIMS Observe</i> -> higher d-2 test performance	Not reported
Tenet 1b: Do self-reported monitoring skills heighten affective reactivity without acceptance?							
Adams et al., 2012	student smokers	112	20 100%	correlational	EAT-26; BULIT-R; BSQ	<i>FFMQ Observe</i> -> higher anorexic symptoms	Not reported
Anicha et al., 2012 (Study 3)	student	155	^a 61%	correlational	Stroop task	<i>FFMQ Observe</i> unrelated to Stroop performance	Not reported
Barbaro & Pickett, 2016 (Study 1)	student	360	20 68%	correlational	CNS, PEB	<i>FFMQ Observe</i> -> greater nature connectedness and pro-environmental behavior	Not reported
Barbaro & Pickett, 2016 (Study 2)	MTurk	296	38 60%	correlational	CNS, PEB	<i>FFMQ Observe</i> -> greater nature connectedness and pro-environmental behavior	Not reported
Brown et al., 2015	student	944	^a 64%	correlational	PSS, PSWQ, CESD-R, B-YAACQ	<i>FFMQ Observe</i> -> higher perceived stress	Not reported
Chopko & Schwartz, 2009	police officers (trauma exposure)	183	38 8%	correlational	PTGI	<i>KIMS Observe</i> -> greater posttraumatic growth	Not reported
Christopher & Gilbert, 2010	student	365	22 71%	correlational	CESD, CCI, SWLS, RSES	<i>KIMS Observe</i> -> high self-esteem and satisfaction with life	Not reported

Study	Sample	N	Age %F	Study Design	Outcome Measure	Monitoring Outcomes	Monitoring + Acceptance Interactions
Compare et al., 2013	binge eating disorder; non-bingeing obese; normal weight	450	50 65%	correlational	BES, EDE-Q, BUT	<i>FFMQ Observe</i> -> less body uneasiness	Not reported
Consedine & Butler, 2014	adults across lifespan	121	47 67%	correlational	health conditions, healthcare utilization, WPSI, HADS	<i>FFMQ Observe</i> -> poorer subjective health, more physical and mental healthcare visits	Not reported
Desrosiers et al., 2013	mood & anxiety disorder	187	38 65%	correlational	MASQ	<i>FFMQ Observe</i> -> higher anxious arousal	Not reported
Hamill et al., 2015	student	467	21 77%	correlational	DASS, BIS, BAS	<i>FFMQ Observe</i> -> higher anxiety, stress, BIS sensitivity, and BAS reward responsiveness and fun seeking	Not reported
Moore & Malinowski, 2009	meditators and non-meditators	50	28 52%	correlational	Stroop task	<i>KIMS Observe</i> -> fewer Stroop errors; unrelated to Stroop reaction time	Not reported
Reese et al., 2015	student	242	19 62%	correlational	BIS, BAS, DERS	<i>FFMQ Observe</i> -> lower BAS reward responsiveness	Not reported
Schrovers & Brandsma, 2010	adults (53% with history of depression /anxiety)	64	43 72%	pre-post MBCT	PANAS	increases in <i>KIMS Observe</i> -> higher positive affect	Not reported
Teper & Inzlicht, 2013	meditators and non-meditators	38	35 71%	correlational	ERN during Stroop task	<i>PHLMS Awareness</i> unrelated to Stroop performance	Not reported
Tenet 2b: <i>Do self-reported monitoring and acceptance skills drive reductions in affective reactivity and stress?</i>							
Barnes & Lynn, 2010	student	145	19 69%	correlational	BDI	High <i>FFMQ Observe</i> + Low <i>FFMQ Nonreactivity</i> -> higher depressive symptoms	High <i>FFMQ Observe</i> + High <i>FFMQ Nonreactivity</i> -> lower depressive symptoms
Desrosiers et al., 2014	mood and anxiety disorder	189	38 65%	correlational	PSWQ, RRS, ERQ, MASQ	<i>FFMQ Observe</i> -> lower rumination and worry, and higher reappraisal; High <i>FFMQ Observe</i> + Low <i>FFMQ Nonreactivity</i> -> higher depression symptoms, rumination, and worry, and lower reappraisal	High <i>FFMQ Observe</i> + High <i>FFMQ Nonreactivity</i> -> lower rumination and worry, and higher reappraisal; mediated relationship between High <i>FFMQ Observe</i> + High <i>FFMQ Nonreactivity</i> on lower depression symptoms;

Study	Sample	N	Age %F	Study Design	Outcome Measure	Monitoring Outcomes	Monitoring + Acceptance Interactions
							rumination and worry mediated relationship between High <i>FFMQ Observe</i> + High <i>FFMQ Nonreactivity</i> on lower anxiety symptoms
Eisenlohr-Moul et al., 2012	student (substance use)	296	19 55%	correlational	Alcohol and tobacco use	High <i>FFMQ Observe</i> + Low <i>FFMQ Nonreactivity</i> -> heavy alcohol use	High <i>FFMQ Observe</i> + High <i>FFMQ Nonreactivity</i> -> less tobacco and alcohol use, and fewer periods of heavy alcohol use
Pearson et al., 2015	student	941	21 64%	correlational	CESD-R, PSWQ, ALS, DTS	High <i>FFMQ Observe</i> + Low <i>FFMQ Nonjudgment</i> -> higher depressive and anxiety symptoms, affective lability, and distress intolerance	High <i>FFMQ Observe</i> + High <i>FFMQ Nonjudgment</i> -> lower depressive and anxiety symptoms, affective lability, and distress intolerance
Tenet 2c: <i>Do self-reported monitoring and acceptance skills drive improvements in stress-related health outcomes?</i>							
Tomfohr et al., 2015	healthy adults	130	22 56%	correlational	Circulating IL-6; Blood Pressure	<i>FFMQ Observe</i> -> lower IL-6 levels; High <i>FFMQ Observe</i> + Low <i>FFMQ Nonreactivity</i> unrelated to IL-6 levels	High <i>FFMQ Observe</i> + High <i>FFMQ Nonreactivity</i> -> lower IL-6 levels

^aAge unreported. %F % female; **ALS** Affective Lability Scale; **B-YAACQ** Brief-Young Adult Alcohol Consequences Questionnaire; **BAS** Behavioral Activation System; **BDI** Beck Depression Inventory; **BES** Binge Eating Scale; **BIS** Behavioral Inhibition System; **BSQ** Body Shape Questionnaire; **BULIT-R** Bulimia Test-Revised; **BUT** Body Uneasiness Test; **CCI** Crandell Cognitions Inventory; **CESD** Center for Epidemiological Studies Depression; **CESD-R** Center for Epidemiological Studies Depression-Revised; **CNS** Connectedness to Nature Scale; **DASS** Depression, Anxiety, and Stress Scales; **DERS** Difficulties in Emotion Regulation Scale; **DTS** Distress Tolerance Scale; **EAT-26** Eating Attitudes Test-26; **EDE-Q** Eating Disorder Examination Questionnaire; **ERN** Error-Related Negativity; **ERQ** Emotion Regulation Questionnaire; **FFMQ** Five Facet Mindfulness Questionnaire; **HADS** Hospital Anxiety and Depression Scale; **IL-6** Interleukin-6; **KIMS** Kentucky Inventory of Mindfulness Skills; **MASQ** Mood and Anxiety Symptom Questionnaire; **MBCT** Mindfulness-Based Cognitive Therapy; **PANAS** Positive and Negative Affect Schedule; **PEB** Pro-Environmental Behavior; **PHLMS** Philadelphia Mindfulness Scale; **PSS** Perceived Stress Scale; **PSWQ** Penn State Worry Questionnaire; **PTGI** Posttraumatic Growth Inventory; **RCT** Randomized Controlled Trial; **RSES** Rosenberg Self-Esteem Scale; **RRS** Ruminative Response Scale; **SWLS** Satisfaction With Life Scale; **WPSI** Wahler Physical Symptom Inventory.