Cognitive mechanisms of mindfulness: A test of current models

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Ben Isbel *, Doug Mahar

School of Social Sciences, Faculty of Arts and Business—ML7, University of the Sunshine Coast, Locked Bag 4, Maroochydore DC, QLD 4558, Australia

ABSTRACT

Existing models of mindfulness describe the self-regulation of attention as primary, leading to enhanced decentering and ability to access and override automatic cognitive processes. This study compared 23 experienced and 21 non-meditators on tests of mindfulness, attention, decentering, and ability to override automatic cognitive processes to test the cognitive mechanisms proposed to underlie mindfulness practice. Experienced meditators had significantly higher mindfulness and decentering than non-meditators. No significant difference between groups was found on measures of attention or ability to override automatic processes. These findings support the prediction that mindfulness leads to enhanced decentering, but do not support the cognitive mechanisms proposed to underlie such enhancement. Since mindfulness practice primarily involves internally directed attention, it may be the case that cognitive tests requiring externally directed attention and timed responses do not accurately assess mindfulness-induced cognitive changes. Implications for the models of mindfulness and future research are discussed.

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1. Introduction

The last ten years has seen a surge of interest in the use of mindfulness-based techniques in the treatment of psychological conditions, producing a growing body of empirical evidence for the efficacy of such an approach (Fraser, 2013; Sedlmeier et al., 2012). In spite of this, evidence for the cognitive mechanisms theorised to underlie mindfulness practice is mixed. Contemporary psychological models describe the intentional self-regulation of attention towards present experience as constituting the core of mindfulness practice, with ancillary attitudinal factors variously added (Bishop et al., 2004; Holas & Jankowski, 2013; Kang, Gruber, & Gray, 2012; Shapiro, Carlson, Astin, & Freedman, 2006). Current models describe mindfulness-induced decentration as the primary mechanism for positive therapeutic change, as previously automatic cognitive processes become increasingly consciously attended to. A review of existing models of mindfulness highlights the primacy of attention in mindfulness practice.

1.1. Models of mindfulness

Bishop et al. (2004) propose a two-component model of mindfulness, in which self-regulation of attention towards present experience and adopting an orientation of curiosity, openness and acceptance towards one's experiences are the main factors. The cultivation of attention towards cognition and its contents in a moment-by-moment, non-elaborative manner is the core component, resulting in enhanced metacognitive monitoring and control of cognitive processes. This process leads to a

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* Corresponding author.
  E-mail addresses: Ben.Isbel@research.usc.edu.au (B. Isbel), dmahar@usc.edu.au (D. Mahar).

changed relationship with the contents of experience, known as decentering, characterised by the capacity to adopt a detached perspective towards one's thoughts and emotions. Decentering is a result of mindfulness practice, and is described as an important mechanism for positive self-change in cognitive therapy (Safran & Segal, 1990; Teasdale, Segal, & Williams, 1995).

Shapiro et al. (2006) propose a three-component model of mindfulness including the cognitive elements of intention, attention and attitude. Attention is directed towards present-moment experience, leading to a shift in perspective called reperceiving, or decentering. Mindfulness-induced decentering allows for the de-automatisation of cognitive processes that have become automated, by reinvesting attention towards these processes, allowing cognitive and emotional responses to become more flexible (Deikman, 1983; Sedlmeier et al., 2012).

Kang et al. (2012) outline a four-component model of mindfulness where attention is primary. In this model, attention is cultivated with awareness, present-moment focus, and non-judgemental acceptance of thoughts, experiences and events. The training of attention leads to de-automatisation through reduced automatic inference processing, enhanced cognitive control, and facilitation of metacognitive insight, and decentering (Kang et al., 2012).

Holas and Jankowski (2013) propose a two-component model in which attentional processes are described as fundamental to initiating and maintaining mindfulness. The training of these processes enhances metacognition, leading to decentering. Decentering mediates beneficial psychological outcomes by providing a changed perception of the nature and content of internal experience (Holas & Jankowski, 2013).

The four models of mindfulness reviewed all propose that attention is the core feature of mindfulness practice, and differ only in the formulation of secondary components. Attention must be the core component of mindfulness practice since it is the training of attention that leads to enhanced decentering in these models. The intentional regulation of attention to present-moment experience facilitates metacognitive monitoring of this experience, leading to enhanced decentering, which is a detached perspective upon the contents of this experience (Holas & Jankowski, 2013; Shapiro et al., 2006).

Each of the models describe three subcomponents of attention to be enhanced by mindfulness practice: sustained attention, attention switching, and conflict monitoring and resolution. These subcomponents accord with the elements of attention proposed by Posner and Petersen (1990), who suggest the existence of three functionally distinct neural networks each performing specific operations: alerting, orienting, and executive functions. The alerting network functions to provide a vigilant and alert state of preparedness, resulting in sustained attention. The orienting network regulates attention by prioritising sensorial input to a specific location or modality, resulting in attention switching and selection. Executive attention exercises control over competing thoughts, feelings and responses, providing conflict monitoring and resolution. While executive attention was further elaborated upon by Miyake et al. (2000), since only the model of Holas and Jankowski (2013) describes these components, it is treated singularly in this study. Importantly, each of the models reviewed predict measurable improvements on cognitive tests of sustained attention, attention switching, and executive attention with increased development of mindfulness.

1.2. Mindfulness and the attention network test

The Attention Network Test (ANT; Fan, McCandliss, Sommer, Raz, & Posner, 2002) is a combined flanker and cued reaction time task specifically designed to measure the performance of each of the neural networks of attention proposed by Posner and Petersen (1990). This computerised task involves the presentation of a row of five arrows, with participants asked to indicate the direction of the central arrow by means of a key press. Arrows flanking the central arrow may point in congruent or incongruent directions, thereby introducing conflict. Cues in the form of asterisks are sometimes presented prior to the target, indicating where and when the stimulus will appear. No-cue trials offer no spatial or temporal warning of the coming target stimulus. Executive attention is measured by comparing timed responses to the congruent and incongruent arrow conditions. Alerting and orienting attention are assessed through comparing timed responses on trials comprising temporal and spatial visual cues with times on trials with no cue. Lower scores indicate improved attentional performance.

In examining the effects of mindfulness on attention Jha, Krompinger, and Baime (2007) found no significant increases in ANT performance from pre- to post-testing in either experienced meditators who undertook a one-month meditation retreat, or meditation-naive participants who engaged in an 8-week mindfulness-based stress reduction (MBSR) program. Enhanced ANT executive performance was found at pretesting in experienced meditators compared to non-meditators. Both Ainsworth, Eddershaw, Meron, Baldwin, and Garner (2013) and Tang et al. (2007) used very brief mindfulness-based training to demonstrate improved ANT executive attention from pre- to post-intervention in meditation-naive participants. No significant improvement in ANT alerting or orienting attention was found in either study. Van den Hurk, Giommi, Gielen, Speckens, and Barendregt (2009) found improved orienting attention, but not alerting or executive attention, in mindfulness practitioners with long-term experience (mean 14.5 years) compared to matched controls. These studies provide mixed evidence to support the models' predictions of improvement in all three components of attention with mindfulness training.

1.3. Mindfulness, decentering, and automatic cognitive processes

Kang et al. (2012, p. 193) define automaticity as an "ability to effortlessly engage in behaviours without paying conscious attention to their operational details." Such processes are described as being difficult to suppress, and are resistant towards attempts to control them (Norman & Shallice, 1986; Shiffrin & Schneider, 1977, 1984). Automaticity conserves limited attentional resources by freeing conscious attention from tasks in which they are no longer needed, thereby reducing the