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Control over experience? Magnitude of the attentional blink depends on meditative state

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ABSTRACT

The information processing capacity of the human mind is limited, as is evidenced by the so-called 'attentional-blink' deficit. This deficit is believed to result from competition between stimuli for limited attentional resources. We examined to what extent advanced meditators can manipulate their attentional state and control performance on an attentional blink task. We compared the magnitude of the attentional blink between states of focused attention meditation (in which one focuses tightly on an object) and states of open monitoring meditation (in which one is simply aware of whatever comes into experience) in a sample of experienced meditators. We found a smaller attentional blink during open monitoring compared to focused attention meditation due to reduced T1 capture. Of note, this effect was only found for very experienced meditators (on average 10,704 h of experience). These data may suggest that very advanced practitioners can exert some control over their conscious experience.

1. Introduction

In an ever-changing world, our senses are continuously bombarded with more information than our brain can possibly process up to the level of awareness, necessitating the selection of information for further processing and conscious representation. The challenge our brain faces when presented with an overwhelming amount of information to analyze is well captured by one of the most studied attentional phenomena in the literature: the so-called attentional blink deficit (Raymond, Shapiro, & Arnell, 1992). This deficit occurs when people have to detect two target stimuli (T1 and T2) presented in close temporal succession in a rapid (~10 Hz) stream of distracter events. Specifically, people often fail to identify T2 when it follows T1 within 200–500 ms. Cognitive accounts of the attentional blink (AB) have generally held that competition between different stimuli for limited attentional resources underlies this deficit in target processing (e.g., Chun & Potter, 1995; Duncan, Ward, & Shapiro, 1994; Jolicoeur, DellAcqua, & Crebolder, 2000; Shapiro, Raymond, & Arnell, 1994; Taatgen, Juvina, Schipper, Borst, & Martens, 2009; Wyble, Bowman, & Nieuwenstein, 2009; but see Olivers & Meeter, 2008). For example, it has been postulated that when many resources are devoted to T1 encoding, not enough resources may be available for T2 processing, rendering its representation vulnerable to distractor interference (Chun & Potter, 1995).

Yet, importantly, research suggests that the attentional blink does not represent an immutable bottleneck in human information processing, and can be reduced through manipulations of attention. For example, behavioral studies have shown that the magnitude of the AB is reduced when participants are concurrently engaged in a distracting mental activity such as listening to music (Olivers & Nieuwenhuis, 2005, 2006), when doing a secondary task (Wierda, van Rijn, Taatgen, & Martens,

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2010), when a cue is provided as to when the targets will appear in the visual stream (Martens & Johnson, 2005) and after a relatively brief attention training with a salient T2 (Choi, Chang, Shibata, Sasaki, & Watanabe, 2012). These findings indicate that conditions that counteract an overinvestment of attentional resources in stimulus processing or promote a more optimal distribution of attentional resources over time reduce the AB deficit. Not only externally-driven, but also internally-driven changes in attentional control settings have been shown to affect AB performance (Slagter, Lutz, Greischar, Nieuwenhuis, & Davidson, 2009; Slagter et al., 2007; van Leeuwen, Mueller, & Melloni, 2009). A study by Slagter et al. (2007, 2009), for example, examined the effects of 3 months of intensive training in a style of meditation, Open Monitoring (OM) meditation, which allegedly reduces elaborate object processing (Lutz, Slagter, Dunne, & Davidson, 2008), on the AB. This form of purely mental training was found to reduce higher-order T1 processing, as indexed by a smaller T1-elicited P3b, a brain potential index of resource allocation. Crucially, this reduction in higher-order T1 processing was associated with a reduction in the AB to T2. As participants were not engaged in formal meditation during AB task performance, these observations are in line with the idea that one long-term effect of this style of meditation is a reduction in the propensity to "get stuck" on an object. This conclusion is supported by findings from another study which reported a smaller AB in a group of expert meditators, with 1–29 years of meditation experience, compared to an age-, gender-, and education-matched control group (van Leeuwen et al., 2009). Together with the findings from behavioral studies in non-meditators summarized above, these data are consistent with the idea that the attentional blink is—at least in part—due to an overinvestment of attentional resources in stimulus processing, and that this suboptimal processing mode can be counteracted by manipulations promoting a less object-focused state of attention.

Yet, it should be noted that in these previous meditation studies, participants were aware of the nature of the study, i.e., that they participated in a study looking at effects of meditation experience on performance. It is well known that such knowledge can affect study outcome, e.g., via effects on demand characteristics or motivation (for a more detailed discussion of these issues, see MacCoon et al., 2012; Slagter, Davidson, & Lutz, 2011). The observed reductions in AB size in these previous studies cannot hence be definitely attributed to long-lasting changes in attentional style related to OM practice (or 'trait' effects). In addition, in both studies, the practitioners practiced other styles of meditation as well as OM meditation, including Focused Attention (FA) meditation, which is claimed to differentially affect cognition (see below for more details). This raises the question of the extent to which the observed reduction in AB magnitude can be ascribed to experience with OM meditation per se, and more generally, how different kinds of meditation may differentially affect information processing and experience.

The current study examined the extent to which experienced meditators can manipulate their mental state from moment to moment and thereby influence the way stimuli are processed and perceived using an AB task. Specifically, expert meditators performed an AB task twice within the same experimental session, once while practicing FA meditation and once while practicing OM meditation. These two meditation styles are often combined, whether in a single session or over the course of practitioner's training, but, importantly, are explicitly designed to train different cognitive processes (Hölzel et al., 2011; Lutz et al., 2008; Vago & Silbersweig, 2012). By directly comparing AB performance during OM meditation with AB performance during FA meditation within the same participant, we could hence examine how AB magnitude is affected by different cognitive states, while controlling for non-specific effects, such as motivation, since the expert practitioners served as their own control. In contrast to previous studies (Slagter et al., 2007, 2009; van Leeuwen et al., 2009), the current study examined effects of cognitive state on the AB, rather than effects of through practice acquired cognitive traits that persist outside the meditative state.

The first style of meditation, FA meditation, entails voluntary focusing attention on a chosen object, such as a visual object, a visualized image, or breath sensations in a sustained fashion. To sustain this focus, the practitioner must constantly monitor and regulate the quality of attention. Thus, FA meditation is thought to not only train one's ability to sustain attention on a particular object, but also to develop skills that regulate the focus of attention, and to disengage from sources of distraction. The second style of meditation, OM meditation, involves non-reactively monitoring the content of experience from moment-to-moment, without focusing on any explicit object. The instructions encourage the practitioner to distinguish between the experience itself and the interpretation of the experience. Consequently, the practitioner will tend to be less engrossed in the experience but rather observe the thinking process itself (Perlman, Salomons, Davidson, & Lutz, 2010). This mental state can be said to be associated with a reduction in cognitive and affective emotional elaboration. While in FA meditation, there is a strong attentional bias towards the to-be-attended stimulus (e.g., the breath), in OM meditation all attentional selection of memories, emotions, and perceptions is reduced as much as possible (Raffone & Srinivasan, 2010). For example, the instructions for OM use phrases such as "whatever thoughts or emotions arise, just let them arise. Simply be aware of whatever appears in the mind." This means that in OM, there is no strong distinction between selection and deselection, since all of the items remain in the attentional background (Lutz et al., 2008).

Despite this clear conceptual distinction, it must be mentioned that in practice, OM meditation typically starts by calming the mind and reducing distractions using FA meditation. The practitioner then gradually reduces the focus on an explicit object in FA, cultivating a non-reactive form of awareness. This form of awareness is non-reactive in the sense that, ideally, one does not become caught up in judgments and affective responses about sensory or mental stimuli. While initially the practitioner frequently "clings" to objects in a way that takes up resources available to process information related to current experience, eventually a trait is thought to emerge such that one can sustain the "non-clinging" state in which one is attentive to the content of experience from moment to moment. While the initial perceptual processing of stimuli may be the same as during "ordinary cognition", cognitive resources are released more quickly during OM meditation.