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Reply

Varieties of attention in hypnosis and meditation ☆,☆☆

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In their commentary, Oakley and Halligan (2011) echo their recent thoughts regarding the cognitive neuroscience of hypnosis and suggestion (Oakley & Halligan, 2009, 2010). Here we address some of the issues they raise concerning the quest for neuropsychological markers of hypnotic states, the use of hypnotic vs. posthypnotic suggestions, and the potential for other forms of atypical attention such as meditative practices to elucidate hypnosis and de-automatization.

Oakley and Halligan twice allude to the paucity of data indicating a special neuropsychological "state" of hypnosis sometimes known as "trance" (2011). The authors note, however, that recent investigations show some promise of identifying a neural marker of hypnosis. Whereas some evidence, including our own research, supports the idea that hypnotic phenomena typically follow suggestions even in the absence of a formal induction procedure (Mazzoni et al., 2009; McGeown et al., 2012; Raz, Kirsch, Pollard, & Nitkin-Kaner, 2006), other research findings may serve to support a distinctive physiological marker unique to hypnosis or to hypnotic suggestions (e.g., Cojan et al., 2009; Demertzi et al., 2011; Pyka et al., 2011; Raz, Fan, & Posner, 2005; Terhune, Cardeña, & Lindgren, 2010; Vanhaudenhuyse et al., 2009). Scholars, however, hardly agree even about the behavioral and phenomenological characteristics that typify ostensible hypnotic planes. For example, distinct sub-types of highly hypnotically suggestible individuals seem to diverge in their experience and behavior throughout hypnosis, challenging the view of hypnosis as a unitary concept (Terhune, Cardeña, & Lindgren, 2011). In addition, the literature provides mixed accounts of how psychological factors such as context, sense of control, relaxation, and expectation relate to hypnosis (Kihlstrom, 2008). An adequate psychological model, therefore, would be instrumental to understanding hypnosis from a physiological perspective.

In research settings, as in clinical practice, specific suggestions often accompany hypnosis. Few reports, however, have investigated brain and behavioral correlates of "neutral" hypnosis sans post-induction suggestions (Cardeña, 2005; Cardeña, Jönsson, Terhune, & Marcusson-Clavertz, 2012; Kihlstrom & Edmonston, 1971; McGeown, Mazzoni, Venneri, & Kirsch, 2009). These few published accounts, moreover, rarely control for the effects of implicit suggestions—for relaxation, drowsiness, and focused attention—that are ubiquitous in classic hypnotic inductions. In addition, it appears that the influence of neutral hypnosis is different from that of hypnosis with explicit suggestions. For example, in response to incongruent Stroop stimuli, highly hypnotically suggestible individuals demonstrated increased conflict-related brain activity in the anterior cingulate cortex (ACC) following neutral induction (Egner, Jamieson, & Gruzelier, 2005); conversely, when offered an explicit suggestion to perceive the stimuli as meaningless symbols, participants showed decreased fMRI signal in the ACC (Raz et al., 2005). Further research, therefore, would need to carefully tease apart such hypnotic variations.

Whether or not hypnosis involves distinct neurocognitive indices, posthypnotic suggestion (PHS) provides a useful experimental alternative to hypnotic suggestion. PHS refers to a condition during common wakefulness following termination of the hypnotic experience, wherein a subject is compliant with a suggestion made during the hypnotic episode. Thus, PHS keeps cognitive performance untarnished by potential confounding factors associated with the ritual of hypnosis. Oakley

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☆ We dedicate this collection of responses to the memory of Bill Banks, founding coeditor of Consciousness and Cognition. This project was the last professional interaction we had with him before his untimely parting.

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and Halligan (2011) propose that upon detecting the post-hypnotic cue, highly hypnotizable individuals might spontaneously re-enter hypnosis. One approach provides preliminary support for the hypothesis of spontaneous hypnosis (Barabasz, 2005), but this theory has been criticized on both theoretical and empirical grounds (Kirsch et al., 2008). More likely, therefore, PHS allows participants to carry out responses during a typical experience of wakefulness, albeit with some attention resources allocated to the processing of suggestion (Tobis & Kihlstrom, 2010).

We concur with Oakley and Halligan that it would be important to study hypnosis and de-automatization in a wider context. The preponderance of the evidence demonstrates that typical and atypical attention (e.g., suggestion) comprise intersecting organ systems (Raz, 2005). Such top-down processes draw on overlapping neural circuitry, functional neuroanatomy, chemical modulators, and cellular structures (Fernandez-Duque & Posner, 2001; Posner & Fan, 2004; Raz, 2006; Raz, Lamar, Buhle, Kane, & Peterson, 2007). Thus, the association between suggestion and attention has been affirmed both theoretically and empirically (Raz, 2004, 2005, 2006, 2007, 2008; Raz & Buhle, 2006; Raz & Campbell, 2011; Raz et al., 2007). Probing the relationship between hypnosis and other forms of atypical attention may elucidate the processes underlying cognitive control. One such set of insights comes from the investigation of meditative practices.

Most forms of meditation share the essential feature of attention regulation. The word meditation describes a broad range of practices aimed at cultivating particular attentional sets to increase cognitive control, promote well-being, and achieve existential insight. Drawing on traditional Buddhist perspectives, scientists generally classify meditation practices into two non-exhaustive categories: focused attention and open monitoring (Lutz, Slagter, Dunne, & Davidson, 2008). Focused attention involves sustained narrowing of attention on an experiential object such as the breath or a mantra. Open monitoring, on the other hand, involves non-discriminatory broadening of attention to include the whole field of moment-to-moment experience. Many meditative techniques draw on both focused attention and open monitoring to cultivate a non-judgmental, receptive awareness of the present moment.

De-automatization is a central theme pervading historical, phenomenological, and scientific accounts of meditative practice. Traditional Buddhist sources, which inspire much of the recent empirical work on this topic, construe meditation as a group of techniques geared at refining attention and meta-awareness with the goal of releasing unwholesome habits of thought and behavior (Gunaratana, 2002; Lutz, Dunne, & Davidson, 2006). Accordingly, studies indicate that meditation training may improve attention and executive control (Brefczynski-Lewis, Lutz, Schaefer, Levinson, & Davidson, 2007; MacLean et al., 2010; Slagter et al., 2007; Tang et al., 2007; but see Jensen, Vangkilde, Frokjaer, & Hasselbalch, 2012), override involuntary emotional reactivity (Farb et al., 2010; Taylor et al., 2011), and alter the experience and neural expression of pain (Brown & Jones, 2010; Gard et al., 2011; Grant, Courtemanche, & Rainville, 2011; Zeidan et al., 2011). Meditative practices, moreover, may reduce the automaticity of mind-wandering (Mrazek, Smallwood, & Schooler, 2012) and alter connectivity within the default-mode network of the brain (Brewer et al., 2011; Farb et al., 2007; Hasenkamp & Barsalou, 2012; Jang et al., 2011; Josipovic, Dinstein, Weber, & Heeger, 2012; Pagnoni, 2012; Pagnoni, Cekic, & Guo, 2008; Taylor et al., 2012). Such functional and behavioral alterations manifest alongside volumetric, morphometric, and tractographic changes in brain structure (Grant, Courtemanche, Duerden, Duncan, & Rainville, 2010; Hölzel et al., 2011; Kang et al., 2012; Lazar et al., 2005; Luders, Clark, Narr, & Toga, 2011; Luders, Kurth et al., 2012; Luders, Phillips et al., 2012; Pagnoni & Cekic, 2007; Tang et al., 2010). Thus, similar to hypnosis, meditation provides a promising vehicle for exploring the top-down modulation, and even transformation, of deeply-ingrained processes.

Comparing de-automatization across both hypnosis and meditation may help illuminate the neural underpinnings of cognitive control. Parallel to our findings involving suggestion, some studies indicate that meditation may lead to reductions in Stroop interference effects (Alexander, Langer, Newman, Chandler, & Davies, 1989; Chan & Woollacott, 2007; Moore & Malinowski, 2009; Wenk-Sormaz, 2005). Oakley and Halligan aptly remark that "an important aim for future studies of hypnotically induced inhibition of the word/color Stroop effect will be to discover at what stage in the reading process the assumed attentionally mediated effect (the suggested deficit) produced its impact" (2011, p. 2). We investigated this question several years ago using combined fMRI and electrical scalp recording. A specific posthypnotic suggestion to perceive the printed words as meaningless symbols of a foreign language produced a general dampening of visual processing in the extra-striate cortex as early as 150 ms following stimulus presentation, along with reduced fMRI signal in the ACC (Raz et al., 2005). Preliminary efforts have begun to explore the brain correlates of ballistic processes, such as the Stroop, among practitioners of meditation (Kozasa et al., 2012; Moore, Gruber, Derose, & Malinowski, 2012; Teper & Inzlicht, 2012). One recent study documented that, compared with participants who were naïve to meditation, long-term meditators with experience in a variety of FA and OM practices demonstrated reduced ACC activity in response to incongruent Stroop stimuli (Kozasa et al., 2012). These results mirror our findings with posthypnotic suggestion (Raz et al., 2005) and intimate that certain meditative practices may override the automaticity of word reading in a Stroop context. Future studies examining de-automatization in both hypnosis and meditation would be instrumental to elucidating the similarities, differences, and neurocognitive substrates of these unique and overlapping forms of self-regulation.

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