

The Contrasting Role of Higher Order Awareness in Hypnosis and Meditation

Rebecca Semmens-Wheeler, MSc^{*†}; Zoltan Dienes, PhD^{*}

Meditation and hypnosis might be regarded as involving similar processes and skills. For example, both meditation and hypnosis are associated with high levels of absorption and imaginative capacity, and both can be used for self-regulation. Research has also shown that meditation improves attentional functioning, and that hypnotic response can involve attentional strategies. However, we argue that hypnosis and mindfulness meditation are essentially different. Crucially, hypnotic experience results from a lack of awareness of mental states (specifically, of intentions); by contrast, mindfulness meditation aims to develop accurate meta-awareness. Hypnosis is a form of self-deception; meditation a way of getting to know your mind. We discuss the empirical relation of both meditation and hypnosis to higher order awareness of mental states, and suggest further research.

INTRODUCTION

Comparisons are frequently made between hypnosis and meditation (e.g. Delmonte, 1984; Holroyd, 2003; Van Nuys, 1973; Yapko, 2011). Both typically involve some physical relaxation, for example; however deep relaxation is not a necessary nor even a necessarily helpful component of either (e.g. Banyai and Hilgard, 1976; Hanh and Nquyen, 2006). So care is needed to disentangle contingent similarities from core ones, and we will attempt in this review to do so. Both hypnosis and meditation are involved in self-regulation—but self-regulation can be performed in different, even opposing, ways. In this review, we highlight similarities and differences between meditation and hypnosis, arguing that they are essentially different. First we indicate what is meant by hypnosis and meditation. Then we consider the relation between the two implied by different theories of hypnosis, in terms of the role of executive systems (attention and metacognition) in hypnosis according to those theories. Next, we consider the empirical evidence for the role of attention and metacognition in each of meditation and hypnosis. Finally, we consider evidence more directly relating meditation and hypnosis. We will argue that at their core, meditation and hypnosis are opposites.

WHAT IS HYPNOSIS?

The word hypnosis can either refer to a state that follows a hypnotic induction (cf. Barnier and Nash 2008); or else to the suggested distortions of perception or sense of involuntariness that some

people can create according to the requirements of the situation (e.g. Dienes, 2012). In the first sense, hypnosis is a state, a way of being; in the second, it is a way of doing (responding to suggestions). Hypnosis as a state could be just a particular pattern of phenomenology (attention absorbed inwards or outwards, time going faster or slower, self talk increased or decreased, and so on; see e.g. Pekala and Kumar, 2007), or, in addition, according to some theories, a global change in how information is processed that causally affects response to suggestions (e.g. impairment of the executive system; Jamieson and Woody, 2007). Responding hypnotically involves a specific motor or cognitive action accompanied by an altered sense of volition or reality. For example, a person can hold their hands out, imagine they are magnets and feel their hands move together seemingly by themselves. The act of the hands moving together is mundane; what makes it hypnotic is the sense that it happens by itself. Or a person can, on request, change the color of an object from say red to green, with the hallucinated color seeming external and real. Imagining an object in a counterfactual color is mundane; what makes the cognitive act hypnotic is the sense of reality that accompanies the act of imagination. These acts constitute hypnotic responding whether or not the person is in a hypnotic state. It is important to bear the distinction between acts and states in mind in comparing hypnosis to meditation: Putative hypnotic and meditative states can be compared; or else hypnotic and meditative actions can be compared. Nonetheless, the two uses are related. For example, on “state” theories of hypnosis, if an induced state did not increase

^{*} Sackler Centre for Consciousness Science, University of Sussex, Brighton, BN1 9RH, United Kingdom

[†] e-mail: rebeccaajsw@gmail.com

response to hypnotic suggestion even slightly, the state would not be a hypnotic state. Conversely, on “non-state theories” of hypnosis, the state is itself just a response to a suggestion (to experience that state, however it is conceived by the subject). Researchers have not settled on a consistent use of the word ‘hypnosis’ (Kirsch et al, 2011) and the word ‘meditation’ can also be used to encompass a wide range of practices (Lutz, Dunne and Davidson, 2007).

Typically, hypnotic suggestibility is measured by giving subjects a hypnotic induction then giving a series of suggestions. The more suggestions a person passes, the more hypnotizable they are. Several predictors of hypnotizability have been found, including response expectancy (Kirsch and Braffman, 1999; Raz, 2006), absorption (Wilson and Barber, 1983; Tellegen and Atkinson, 1974), fantasy proneness (Wilson and Barber, 1982) and imaginative involvement (Spanos and Barber, 1974). While significant correlations have been found, they are often only moderate, with reliable correlations between hypnosis and absorption typically around 0.2–0.3 (Kihlstrom, 2003), for example, and are often smaller when hypnotizability and putative correlates are tested in a different context (e.g. Council, Kirsch and Hafner, 1986, but see Nadon, Hoyt, Register and Kihlstrom, 1991). The most reliable and replicable correlate of suggestibility after an induction is responding to suggestions without being given a hypnotic induction (around 0.7, e.g. Hilgard and Tart, 1966; Braffman, and Kirsch, 1999).

Thus, hypnotic responding can be distinguished from a special altered state of hypnosis (see Raz, 2011, for discussion). Although some researchers do claim that hypnosis is a state (e.g. Crawford, 1994), there is no established theory of a hypnotic state or states. For example, while hypnotic induction has the potential to slightly enhance hypnotic suggestibility and produce a stronger neural response than without an induction (Derbyshire, Whalley and Oakley, 2009)*, an induction is not necessary for highs to successfully respond to hypnotic suggestions (Kirsch and Braffman, 2001). Raz et al (2006) found that although highs were able to reduce Stroop interference following hypnotic suggestion for printed words to become meaningless, a hypnotic induction made no real difference to the effect. McGeown et al (2012) found that highs were able to successfully drain or add color from a colored or grayscale stimulus with and without hypnotic induction, whereas lows were unable to perform the suggestion in either condition. Subjective ratings of hypnotic depth correlated with activation in the color processing region (i.e. left fusiform) in the color adding condition and in frontal and

parietal regions (associated with recruitment of attentional resources) in the draining condition. However, the enhancement seen following hypnotic induction was slight, and highs were able to effectively perform the suggestion even without any hypnotic induction or feeling that they were in any way in a hypnotic state. In sum, there is a hypnotic way of acting (acting cognitively or behaviorally such that the sense of reality or volition is distorted according to task requirements) that can occur either in or out of a hypnotic state.

WHAT IS MEDITATION?

Meditation can be described as a complex family of training practices in attention, emotional regulation (Lutz, Slagter, Dunne and Davidson, 2008) and metacognitive awareness (Thompson, 2006), which (aim to) contribute to the development of a more veridical experience of the world. Meditation practice in the shorter term, in particular mindfulness-based training, is also used (as hypnosis is) for the treatment of stress (Fletcher et al, 1995), depression (Ramel, Goldin, Carmona and McQuaid 2004; Teasdale et al, 2000), addiction (Bowen et al, 2006) and pain management (Kabat-Zinn, Davidson and Houshmand, 1985). Just as hypnotic responding can be distinguished from a hypnotic state, meditative (mindful) activity might be viewed as distinct from a meditative state. Such mindful activities can be everyday occurrences, so long as one is fully present and aware of the sensations of the action. For example walking, making tea, eating a raisin or cleaning one’s teeth can be performed mindfully. (Mindfully eating a raisin in an exercise in mindfulness based stress reduction courses; Kabat-Zinn, Segal, Williams, and Teasdale 2002.)

It is important to distinguish between the various styles of meditation, particularly as some of the terms used in modern psychology and neuroscience are the same as those translated from Buddhist texts, but refer to different constructs (Lutz et al, 2007). There is no single clear and simple definition of meditation as there are many types from different traditions (including those from different religions, as well as within Buddhism). However, Lutz et al (2007) have drawn out some fundamental assumptions that can be made about meditation as a whole. First of all, meditation practices must be learned. They are designed to inhibit undesirable traits (e.g. negative cognitive or emotional patterns) and enhance or cultivate desirable ones (e.g. non-reactivity). Many meditation practices achieve these by focusing on an aspect of one’s experience, commonly the breath. Other practices involve developing an open and non-judgmental

* Although note recent as yet unpublished data from the same lab found a stronger neural response for suggestion without an induction rather than with it, Derbyshire, personal communication, 6 June 2012

awareness of one's emotions and cognitions and/or cultivating particular thoughts of feelings, such as those of compassion. Following on from this, it can be predicted that meditation will produce specific states. Indeed, evidence has shown that compassion meditation leads to improvements in affective regulation (Lutz, Brefczynski-Lewis, Johnstone and Davidson, 2008) and other studies have demonstrated superior attentional performance in meditators than controls and novice meditators (e.g. Moore and Malinowski, 2009; Wenk-Sormaz, 2005; Slagter, Lutz, Gechar, Francis, Nieuwenhuis, Davis and Davidson, 2007). Another feature of meditation practice is that improvements can be seen over time and are reflected in changes in the brain. For example, structural differences have been seen in experienced meditators, who had greater cortical thickness in the right anterior insula (associated with interoception; Critchley, Wiens, Rotshtein, Öhman and Dolan, 2004, integration of cognition and emotion and adaptive decision-making, Damasio, 1996) than controls (Lazar, Kerr, Wasserman, Gray, Greve, Treadway, et al 2005). Crucially, cortical thickness in the

insular cortex was correlated with cumulative meditation experience. Practice effects can be also seen in the aforementioned improved attentional performance of experienced meditators. Brefczynski-Lewis, Lutz, Schaefer, Levinson and Davidson (2007) reported greater activation in the insula and in frontal parietal regions during concentration meditation. These areas are involved in sustained attention and monitoring and making attentional adjustments (Vincent, Kahn, Snyder, Raichle and Buckner, 2006; Eckert, Menon, Walczak, Ahlstrom, Denslow, Horwitz and Dubno, 2009). In meditation such monitoring is used to detect and signal mental drowsiness or over-excitability, which lead to a loss of concentration.

For the purposes of investigation and comparison of meditation types, three main categories have been described by Lutz et al, drawing on practices within the Buddhist traditions (2007; 2008; see Box 1). One prevalent meditation technique, which is used across Buddhist and other religious or spiritual traditions is focusing one's attention on the breath. This practice initially involves focusing on the breath to develop *śamatha* (concentration/sustained attention and resilience to distracting thoughts and emotions) and *vipāśyanā*, which refers to the clarity of perceiving the nature of that which is being attended. *Śamatha* may be practiced with a range of attentional objects other than the breath (shapes, colours, body parts, etc) in order to develop a calm sustained attention. Similarly, *vipāśyanā* involves a range of practices to see how phenomena (including mental states) come and go, and how certain ones tend to lead to certain others. The practitioner, through continually checking where the mind is focused (self-monitoring), begins to develop *samprajanya*, which can be translated as meta-awareness (Lutz, Dunne and Davidson, 2007) or 'clear knowing' (Anālayo, 2010). Meta-awareness, and specifically mindfulness, is a common component across all different meditation styles. Mindfulness can be defined as the practice of bringing awareness to the present moment with non-judgmental acceptance (Brown and Ryan, 2003). In sum, meditation fundamentally involves the development of attentional and metacognitive processes. Intriguingly, such processes have also been fundamental to the main theories of hypnosis.

BOX 1. MEDITATION STYLES

The different meditation styles can be categorized as: 'focused attention' (FA); 'open monitoring' (OM) and non referential compassion meditation. These different meditation styles have overlapping effects, but do recruit different regions of the brain (Lutz et al, 2007).

FA meditation tends to be practiced in stages beginning with breath counting and progressing to focus on the point of entry of the breath into the body, for example. *OM meditation*, also known as 'open presence' or 'just sitting' emphasizes the development of meta-awareness, where there is no such thing as distraction but all experience is part of the meditation and the goal is to neither avert nor attach one's mind to any experience in particular but to become more familiar with one's mental tendencies and habits. The third style is referred to by Lutz et al as *non referential compassion*. However, this is a narrow term for what is a set of meditations called the 'Brahma viharas' (Sanskrit for 'divine abodes'), which essentially aim to develop greater awareness of emotions and to cultivate an attitude of *mettā* (loving-kindness); *karuṇā* (compassion); *mudita* (sympathetic joy) and *upekha* (equanimity).

Visualization practices are also used to cultivate desired qualities and fall partially into the category of FA meditation, yet they go beyond concentration on a simple object. This is commonly done through use of *sādhana*, which is meditation on a text describing various features (shape, insignia, color and other attributes) of a Buddha (enlightened being) or Bodhisattva (a person who is on the brink of enlightenment but who holds back out of compassion for all beings). The aim of *sādhana* practice is to create single-pointed, undistracted focus of the mind on the qualities of this being in order to cultivate them in oneself (Sangharakshita, 2001).

Other practices involve using what are known as supports to concentration (*kammathanas*), which include the four brahma-viharas, meditation on the decomposition of a corpse and the Ten Impurities (various disgusting aspects of bodily experience). These practices are designed not only to develop one-pointed concentration, but also to relinquish attachment to the body by realizing its transitory, impermanent nature (Sangharakshita, 2001) and by breaking down the illusion of separate selfhood, with the aim of promoting greater compassion and non-attachment.

THEORETICAL RELATION OF HYPNOSIS TO MEDITATION

Theories of hypnosis can be classified according to the role of executive system in hypnosis, i.e. with that system responsible for metacognition

BOX 2. METACOGNITION

Metacognition is most broadly construed as cognition about cognition and encompasses monitoring and control processes (see Beran et al, 2012, for an overview of current debates). Nelson and Narens (1990) described a conceptual framework that has been influential for thinking about metacognition. Cognitive processes can be divided into object-level and meta-level. Object-level processes are basic cognitive processes such as perception, encoding or retrieval. Meta-processes monitor object-level processes and control them. For example, when given a memory task, a “feeling of knowing” is a type of metacognitive monitoring that may lead to initiating search processes (metacognitive control). Metacognitive monitoring is constituted both by non-conceptual affective signals, such as feelings of knowing (consider ‘tip of the tongue’ states), as well as by conceptual theories concerning how one’s mind works (cf Koriat, 2007).

Meditation can be seen as a process of cultivating both metacognitive monitoring and control (e.g. sustaining attention, eliminating certain sorts of thoughts). Teasdale (1999) distinguished between metacognitive knowledge and metacognitive insight. For example, we may “know” that we are one day going to die and we will cease to have a point of view (metacognitive knowledge) yet we probably do not have a felt sense of this fact (metacognitive insight).

One of the aims of meditation is to increase metacognitive insight so that one begins more and more to experience thoughts as just thoughts rather than thinking about them as facts that accurately reflect reality. This should, in theory, allow one to have a more veridical experience of the world through overcoming the delusion of thoughts as facts. For example, a thought that one is a failure and worthless could have an associated metacognitive insight that this belief is not factual. This is precisely how mindfulness meditation is used to help individuals overcome depression.

In the context of hypnosis, many theories of hypnosis can be construed as metacognitive, that is, theories about the way object-level processes can be monitored and controlled by meta-level processes. For example in Hilgard’s (1977) neo-dissociation theory, both control and monitoring processes were important in a uniquely hypnotic way, with either control or monitoring fractionated (see also Woody and Sadler, 2008). Similarly, Spanos’ (1986) sociocognitive theory construed hypnosis as an error in monitoring (attributing the causes of our actions to hypnosis rather than our intentions) (cf Lynn et al 2008). Similarly, cold control theory pinpoints hypnotic response as caused by a specific metacognitive process: Thinking one does not have an intention when one does.

and attentional regulation. Metacognition refers to processes that monitor or control thoughts and attention (Fernandez-Duque, Baird, and Posner, 2000): Cognition about cognition (see Box 2). Some theories of hypnosis postulate a disturbance in executive systems, others an enhancement. Given that meditation involves special attentional and metacognitive abilities, theories of hypnosis that postulate impaired attentional or metacognitive processing suggest hypnosis is the opposite from meditation. Theories that postulate that hypnosis involves no special attentional or metacognitive abilities suggest hypnosis is orthogonal to meditation. Finally, overlap is suggested by theories that postulate hypnosis also involves special attentional abilities.

Several theories have explained hypnosis in terms of a deficit in frontal lobe executive function. According to Hilgard’s neo-dissociation theory (1977) the ‘executive ego’ is split in two conscious streams, one which controls the hypnotic

responses, and the other which is unaware of this control. In dissociated control theory (Woody and Bowers, 1994) hypnosis is described as a weakening of frontal lobe function so that the supervisory attentional system (i.e. executive system, Norman and Shallice, 1986) is rendered unable to control behavior, which is thus controlled by the contention scheduling or habit system (hence the feeling of involuntariness). Hence, behavior is directly triggered by hypnotic suggestion. Gruzelier’s (1998) neurophysiological theory also explains hypnosis in terms of diminished attentional abilities. The purported greater attentional abilities of highs leads to a highly concentrated state, which causes exhaustion of the frontal lobes and thus leads to inhibition of executive frontal functioning that contributes toward hypnotic response and experience. These theories imply hypnosis is not conducive to mindfulness; responding hypnotically essentially involves a lack of mindfulness.

Socio-cognitive theories (e.g. Sarbin and Coe, 1972; Spanos, 1986, 1991) do not postulate any deficit in attention regulation; in fact, hypnotic responses are explained in terms of attentional and other strategies (for example, hypnotic pain relief may be produced partly by distraction). By the same token, above-average attentional abilities are not used to explain hypnotic response either; hypnotic behavior is seen as being fundamentally similar to other more mundane forms of social behavior, with anyone capable of producing hypnotic responses if they have the right expectations, beliefs, purposes, and attributions. Although hypnosis may involve neither enhanced nor diminished attentional abilities on this account, it does involve an attributional error, a failure of metacognition, in attributing one’s actions not to oneself but to the hypnotist or a special hypnotic state. Once again, these theories postulate an inherent contradiction between responding hypnotically and being mindful.

In contrast to the above accounts, Crawford (1994) suggests that highs are able to respond hypnotically due to their superior sustained attentional abilities. Relatedly, James Braid, the person who coined the term hypnosis, claimed that successful hypnotic response occurs because highs maintain a persistent uncontradicted image of the required result (a theory revived by Baars, 1988). According to this theory, hypnotic response involves especially good attentional and inhibitory abilities. Actions happen automatically by sustained thoughts about the actions, and there is no inherent contradiction with mindfulness.

In sum, theoretically, the role of attentional ability in producing hypnotic response is controversial. We will consider the actual evidence for a

Box 3. HIGHER ORDER THOUGHTS

According to HOT theory, a mental state is a conscious mental state when we are conscious of being in that mental state (Rosenthal, 1986, 2002). To be conscious of anything being present, for example, a ball in front of you, you need to be in a mental state representing that “there is a ball in front of me”. To be conscious of seeing a ball in front of you, therefore you need to be in a mental state representing “I see a ball in front of me”. That is, you need to be in a mental state about a mental state: A higher order state. The thought asserting that “I am seeing a ball in front of me” is a higher order thought. Seeing “there is

a ball in front of me” is a first order state: Its content is just about the world. It is only by virtue of a second order thought such as thinking “I see that there is a ball in front of me” that we are conscious of the first order mental state of seeing and seeing then becomes a conscious mental state.

A second order thought becomes conscious by virtue of a third order thought; for example, it is by thinking “I am aware that I am seeing that there is a ball in front of me” that one becomes consciously aware of seeing the ball. With second order thoughts we become conscious of

mental states; with third order thoughts we become consciously aware of mental states, i.e. we introspect (Rosenthal, 2002).

Higher order thoughts are metacognitive in that they monitor other mental states. In fact higher order thought theory provides one way of defining what “meta” and “object” level mean. Object-level processes are cognitive processes whose content is just about the world. Meta-level processes must have content which is at least partly about mental states. Higher order thoughts are particular metacognitions, namely, thoughts asserting that one is in a contemporaneous mental state.

* It is not merely the absence of accurate HOTs that make an intentional action hypnotic, but the presence of the inaccurate HOT that one is not intending the action (Dienes, 2012). If it were just the absence of HOTs of intending, then every absent minded performance of an intentional action would count as hypnotic, and a creature, perhaps a dog, not capable of HOTs of intention would be permanently responding hypnotically! If inaccurate HOTs are required, it is only an animal which possesses mental state concepts of intention that could in principle respond hypnotically (by believing they did not intend the action).

role of attention in hypnotic response below. But a theme common to some of the theories is that hypnosis involves a failure of metacognition. In Hilgard’s (1977) dissociation theory and also in Spanos’ (1986) socio-cognitive theories, subjects intend to perform various actions without being aware of the intention. That is, hypnosis is essentially a form of self deception. This idea was taken up by Dienes and Perner (2007) as a suggestion for the simplest theory that might explain hypnosis: Hypnotic response consists of nothing more nor less than intending to perform some motor or cognitive act while thinking one is not intending the action* (see Box 4). The Dienes and Perner account draws on Rosenthal’s (2004) higher order thought (HOT) theory of conscious awareness (see Box 3). HOT theory claims that a mental state is a conscious mental state when we are conscious of being in that mental state, i.e. when we have a higher order thought about being in

the state. Thus, hypnosis involves having unconscious intentions. The subject exerts intentional control without having accurate HOTs about those intentions; thus hypnosis is constituted by “cold control”. Hypnosis is a purely meta-cognitive phenomenon in which inaccurate higher order thought is produced (Dienes, 2012), a strategic failure of metacognition. In sum, in terms of metacognition, theories have either postulated hypnosis involves an impairment of metacognition (e.g. Dienes and Perner, 2007; Hilgard, 1977; Spanos, 1986), or postulate no special relation of hypnotic responding to metacognition (e.g. Baars, 1988). We now consider the actual evidence for the relation between each of meditation and hypnosis and attention and metacognition.

ATTENTION IN HYPNOSIS AND MEDITATION

Both meditation and hypnosis have been claimed to involve enhanced attentional skill, particularly in sustained attention (e.g. Ås, 1963; Buttle, 2011; Davidson and Goleman, 1977; Gruzeliier, 1998; Karlin, 1979; Lutz, Slagter and Dunne, 2008; Raz, 2005; Slagter et al, 2007, 2009; Tang, Ma, Wang, Fan, Feng, Yu, et al, 2007; Valentine and Sweet, 1999). Recent research has shown that attentional skills can be trained by meditation practice (see Lutz et al, 2008 and Austin, 2006, for reviews.) The relation of attentional skill to hypnosis is more controversial (e.g. Dienes et al 2009; Jamieson and Sheehan, 2002). We consider meditation and hypnosis in turn.

Meditation can be narrowly viewed as a form of attention training (Bishop et al, 2006). Lutz et al (2009) found that intensive meditation enhanced attentional stability. Meditators were compared before and after a three month intensive meditation retreat, during which they practiced open monitoring, focused attention and loving kindness meditation for 10–12 hours

Box 4. COLD CONTROL THEORY

Cold control theory (Dienes and Perner, 2007) explains hypnotic responding as executive control (e.g. intending to perform a motor or cognitive action, e.g. lifting an arm, imagining something present) while having inaccurate higher order thoughts of intending (“I am not intending to lift my arm/imagine a pink elephant”). On this account, a person has no first order abilities in responding to a hypnotic suggestion that they did not have already. The difference between a hypnotic and non-hypnotic action is that performing the action hypnotically makes it feel like it is happening by itself. For example, an intention to lift one’s arm is usually accompanied by a higher order thought, e.g. “I am intending to lift my arm,” but this is not the case in hypnosis, according to cold control theory. (It is cold control because there is no accurate HOT.)

While cold control theory sees hypnosis as intrinsically involving self-deception, such self deception can be benign or even useful. Hypnosis involves creating illusions of reality or automaticity according to situational requirements; that is, hypnotic responding is “goal directed striving” (White, 1942), where the hypnotic response is consistent with the overall goals and intentions of the subject. Thus, hypnosis is like a metacognitive game: A meta-cognitive strategy of relinquishing metacognition (specifically accurate concerning a specific intention) in order to have the experiences a situation calls for (e.g. pain going away by itself as one imagines a dial being turned; being possessed by a great spirit) (Dienes, 2012). Our contrast of hypnosis with meditation is not to deny the potential usefulness of hypnosis.

per day. Participants in the control condition received a one hour meditation training session before each experimental session and meditated for 20 minutes per day for one week before each testing session. Both groups were asked to perform two versions of a dichotic listening task: the open monitoring version, in which they were asked to identify deviant tones in both ears, and the focused attention version, in which they were asked to identify a deviant tone in the one attended ear, whilst ignoring tones in the other ear. Using EEG, they found that meditators showed increased theta-band phase consistency compared to pre-training and to controls, consistent with sustained attention and on-line cognitive control. Meditators also showed reduced variability in neuronal processing regardless of whether or not the tone was deviant, in line with claims that focused attention meditation develops the monitoring faculty, and so one remains vigilant to distractions while retaining a stable focus, as well as enhanced ability to disengage from distraction. Slagter et al (2007) found that participants in one study using an attentional blink paradigm demonstrated similar detection of T1 (the first target) and increased detection of T2 (the second target), compared to baseline and controls, following three months of intensive meditation training, indicating meditation practice produced a more optimal distribution of attention. On the Stroop task, expert meditators versus controls showed decreased Stroop interference (Moore and Malinowski, 2009; Wenk-Sormaz, 2005). Further, meditators reported higher level of mindfulness (on the KIMS) and mindfulness was linked to fewer errors on the Stroop task (Moore and Malinowski, 2009)

The studies to date consistently point in the direction of good attentional skills in expert rather than novice meditators, though a general problem in the field is accounting for motivational differences between experts and controls. When experts know they are selected for the study based on being experts, they may work harder to meet the demands of the situation, or produce expected responses just because they are expected (response expectancy; Kirsch, 1985; 1997). A frequent control in the hypnosis field is to select high and low hypnotizables for further testing without subjects knowing the basis on which they are being selected (Council, Kirsch, and Hafner, 1986) but many studies on the effects of meditation or mindfulness training have not taken this into account. A recent study, however, tried to disentangle motivational effects by comparing a control group with other groups that received a financial incentive, mindfulness based stress reduction training (MBSR) and non-mindfulness based stress reduction training (NMSR).

They found that while some attentional improvements (sustained, visual and temporal attention) can be accounted for by an increase in attentional effort, only the group who received MBSR training showed improvements on sustained selective attention, suggesting that MBSR training had an effect above and beyond motivation and non-specific stress reduction (Jensen, Vangkilde, Frokjaer and Hasselbalch, 2012).

The above studies compared experts and novices in meditation; the comparable studies in hypnosis are those comparing high and low hypnotizables. Evidence of superior attentional abilities in highs rather than lows is mixed and the issue remains unresolved (contrast e.g. Crawford et al, 1993 with Dienes et al, 2009). Studies using the Stroop test have produced conflicting findings, with either no significant difference between highs and lows or with differences in either direction. Without hypnotic induction or suggestions being used, most studies have found no significant difference between highs and lows on Stroop interference (Aikens and Ray 2001; Egner et al 2005; Kaiser et al 1997; Kallio et al 2001). Dixon et al (1990) and Dixon and Laurence (1992) found significantly more Stroop interference in highs than lows; however, Rubichi et al (2005) found significantly less Stroop interference in highs rather than lows. On a related task Iani et al (2006) found that highs and lows without an induction were not detectably different in terms of the effect of irrelevant flanking items on the classification of a central letter. While procedural differences (e.g. responses given as button presses vs. vocalization) may account for the different results, the pattern allows only nuanced claims about attention and hypnotizability. A component of attention is the ability to inhibit irrelevant information. On a negative priming task, in which participants are instructed to attend to some stimuli and ignore others, Dienes et al (2009) found with 180 participants the correlations between hypnotizability and negative priming or between hypnotizability and latent inhibition were close to zero, with upper limits of about 0.20. Similarly, Varga et al (2011) with 116 subjects found no significant correlations between hypnotizability and reaction time measures of sustained, selective, divided or executive attention. In sum, the consistent findings that expert meditators are superior to novices in attention are not in general matched by evidence for highly hypnotizables being better at attention tasks than lows.

While highs do not seem especially good at attentional tasks when asked to simply perform them, when they are given a relevant strategy, they can outperform lows whether or not they had been given a hypnotic induction (Raz et al,

2006). Specifically, when highs are given the suggestion that words will appear to them as meaningless, the Stroop effect can be substantially reduced (e.g. Parris, Dienes, and Hodgson, in press; Raz et al 2002; Raz et al 2003; see also Iani et al 2006). Similarly, Iani, Ricci Baroni and Rubichi (2009) found that hypnotic suggestion reduced interference from irrelevant spatial stimuli in highs, but not lows in a Simon-like (spatial interference) task. The suggestion that reduces the Stroop effect has been shown to be just as effective whether or not a hypnotic induction is given (Raz et al 2006; contrast Iani et al 2006), so appears not to depend on being in a special state, but on having a certain ability. The effect appears non-existent to weak in lows (Parris and Dienes, submitted; Raz and Campbell 2011). Thus, paradoxically, asking highs to be less mindful (i.e. to act hypnotically) enables them to perform better on the same attention tasks (Stroop) that meditators appear to improve upon by meditation training. We do not have a resolution to the paradox that both being more mindful (meditation) and less mindful (hypnosis) improves Stroop, but it is a problem on which we are currently working.

In terms of what happens to attentional ability after a hypnotic induction, Gruzelier and Warren (1993) found that highs performed worse on letter fluency (particularly associated with activation in the dorsolateral prefrontal cortex; DLPFC) and finger tapping dexterity but improved on design fluency (a measure of planning and cognitive flexibility) following a hypnotic induction. The reduction in performance on the letter fluency task was replicated by Kallio et al (2001) and Wagstaff, Cole and Brunas-Wagstaff (2007). However, Wagstaff et al also found that subjects who reported greater hypnotic depth (strongly correlated with hypnotic suggestibility) demonstrated better performance on a phonemic fluency test during hypnosis than during the non-hypnotic condition. Egner et al (2005) found evidence using neuroimaging techniques that there is a dissociation of frontal executive and conflict monitoring systems. They used EEG to examine functional connectivity and event-related fMRI to image highs and lows while they performed on a task measuring attentional conflict resolution (the Stroop task) following a hypnotic induction. There was an increase in gamma band coherence (associated with concerted attentional focus) in lows and a decrease in highs, along with an increase in ACC activation, consistent with poorer efficiency of conflict monitoring in highs (although no difference in Stroop performance was observed). The (albeit checkered) evidence for a general reduction in attentional functioning after hypnotic induction contrasts to claims about meditation (though little research has tested

people in versus out of a “meditative state”). It may be that the act of producing feelings of an altered state takes up capacity, and thus leaves less capacity for other tasks.

One interesting marker of attention to task is activity in the default mode network (DMN). The DMN is associated with mind-wandering and self-referential thought and reduced activation is usually seen when focusing or paying attention during goal-directed and externally oriented tasks (Christoff, Gordon, Smallwood, Smith and Schooler 2009; Uddin, Kelly, Biswal, Xavier Castellanos, and Milham, 2009). Further, activity tends to be lower during high rather than low cognitive load (Uddin et al, 2009). Consistent with the claim that an induction encourages highs to pay attention to the hypnotist and/or specific strategies, McGeown et al (2009) found activity in the anterior DMN (ventromedial prefrontal cortex and DLPFC) was reduced following hypnotic induction during rest periods between suggestions in highs. Lows, on the other hand, showed reduced activity in areas related to alertness, probably in response to the relaxation induction used. Deeley et al (2012) conducted a similar study, scanning participants during passive viewing condition, however no suggestions were provided. Reduced activity was seen in the DMN and anterior cingulate cortex and increased activity in prefrontal attentional systems after hypnotic induction, compared to pre-induction. Furthermore, participants reported greater levels of self-reported attentional absorption, which was inversely related to activity in the DMN. The results of McGeown et al and Deeley et al support the notion that an induction informs subjects to pay attention to whatever strategies are needed to maintain a feeling of being hypnotized.

A number of studies have also shown decreased activation in the DMN in meditators during concentration (FA), mettā bhavana (loving kindness) and choiceless awareness (OM) meditation, compared to non-meditators (Brewer et al, 2011). This may reflect high cognitive load in these styles of meditation. In support of this conjecture, another study that investigated activity in the DMN in meditators gained the opposite results: greater activation in mid frontal brain regions overlapping the DMN during meditation practice (Travis et al, 2009). Participants were performing transcendental meditation (TM), which is reported to be a simple, easy and non-demanding task. Thus, work on DMN activity has shown that hypnosis and meditation generally involve acts of paying attention, but this is consistent with meditation, which is explicitly associated with mental training, involving especially good attentional abilities and hypnotic responsiveness requiring only average attentional abilities.

In sum, both hypnosis and meditation involve paying attention, but whereas experienced meditators have better attentional skills than novices, hypnotizability appears unrelated to attentional skill, and the induction of a hypnotic state may even be associated with impoverished attentional skills (though contrast Iani et al, 2006).

META-AWARENESS AND THE DORSOLATERAL PREFRONTAL CORTEX

A fundamental difference between hypnotic suggestion and meditation is that hypnosis often involves an altered or distorted experience of reality. The purpose of meditation for long-term practitioners, on the other hand, is to stimulate change and development towards seeing reality more clearly (Kamalashila, 1992), partly by developing meta-awareness, or accurate higher order thoughts (HOTs).

Accurate HOTs, i.e. awareness of mental states, has been linked to the dorsolateral prefrontal cortex (DLPFC) (Lau and Passingham, 2006). Lau and Passingham found two masking conditions in which people could discriminate one of two shapes to an equal degree but differed in the extent to which they were aware of seeing the shapes rather than just guessing about them. That is, the DLPFC was not linked to the first order mental state of seeing, but to awareness of seeing. Further, when Rounis et al (2010) disrupted the area with theta burst TMS, subjects' self-reported awareness of seeing was disrupted even when first order perception was titrated to be the same with and without TMS. That is, the disruption Rounis et al found was purely related to HOTs. We might expect to see differences between highly hypnotizables and meditators in the dorsolateral prefrontal cortex (DLPFC). Specifically, we might expect less activation in highs and greater activation in meditators.

If the DLPFC is responsible for accurate higher order thoughts in general, disrupting the region with rTMS or alcohol should make it harder to be aware of intending to perform an action. Given that people who are highly hypnotizable seem to have less accurate HOTs, disrupting the function of the DLPFC should make it easier to subjectively respond to a hypnotic suggestion (according to cold control theory)*.

Dienes and Hutton (submitted) tested this with TMS. Subjects gave ratings on a 0–5 scale of the extent to which they experienced the response, for four suggestions (magnetic hands, arm levitation, rigid arm and taste hallucination). Overall, rTMS to the DLPFC rather than vertex increased degree of hypnotic response by about a third of a rating point on average. Further,

subjects did not differ in their expectancy that they would respond in the two conditions, so the rTMS had an effect on hypnotic experience above and beyond expectancies. A further study conceptually replicated the effect, but this time using alcohol, which has been shown to particularly affect the DLPFC (Wendt and Risberg, 2001). We recently explored the effect of alcohol on hypnotic response with Theodora Duka at Sussex University. Medium hypnotizables were assigned to either an alcohol or placebo alcohol condition and were then tested on nine suggestions and various frontal tasks. Alcohol indeed disrupted frontal function and crucially, alcohol increased hypnotic response by one scale unit compared to placebo, on the same scale as used in the TMS study. Although both the TMS and alcohol would have affected regions of the brain outside the DLPFC, the evidence is consistent with cold control, hypnosis as self deception. The evidence is also consistent with other theories that postulate hypnosis involves diminished executive control (Woody and Bowers, 1994) or metacognitive control (Jamieson and Woody, 2007). Either way, the increase of hypnotizability following disruption of the dLPFC supports the distinction between hypnosis and meditation, during which increased activation is seen in the DLPFC.

In contrast to findings in hypnosis literature, several studies have shown increased activation in the DLPFC, among other areas, in meditation practitioners during and after meditation practice (Brewer et al, 2011; Farb et al, 2007; Kosaza et al, 2008; Lazar, 2009). For example, Brefczynski-Lewis et al (2007) used fMRI to compare experienced and novice meditators and found greater activation in the DLPFC. Concordantly, it has been claimed that meditators are better at giving self-reports than non-meditators (Kabat-Zinn, 2011). In sum, the differential activation seen in the DLPFC during meditation and hypnosis seems to support the suggestion that hypnosis and meditation differ in metacognitive capabilities subserved by the DLPFC (Dienes, 2012; Woody and Sadler, 2008).

MEDITATION IS HOTTER THAN HYPNOSIS

One apparent similarity between hypnosis and meditation is that both seem to involve absorption. Like high versus low hypnotizables, expert versus novice meditators score more highly on absorption as measured by the Tellegen absorption scale (TAS) (Davidson, 1976). We have since replicated this finding in our lab at Sussex University (in an as yet unpublished study), and found that absorption also correlated positively

* Cold control theory makes a more precise set of predictions. Namely, if the frontal lobes are impaired sufficiently that the relevant cognitive or motor action cannot be performed with conscious intentions then the same action cannot be performed as a hypnotic suggestion (Dienes and Perner, 2007). However, if the impairment allows the relevant actions to be performed, but is targeted to impair HOT accuracy, then hypnotic performance will be facilitated. Thus far at least, in making these predictions, cold control theory has remained one step ahead of the data.

with self-reported mindfulness as measured by the Kentucky Inventory of Mindfulness Skills (KIMS; Baer, Smith and Allen, 2004). Although the phenomenological states of hypnosis and meditative absorptions (*dhyanas* in Sanskrit) appear to be similar in some respects (Holroyd, 2008), the feeling of absorption involved in both hypnotic and meditative states may reflect different processes, as we now discuss.

Although absorption and hypnosis appear to be related, we need to take care in our understanding of what precisely absorption is. The subjective sense of being absorbed could represent four distinct modes of mental processing. Firstly, one could be mind wandering without being aware that one was doing so, thus one could believe one was or had been absorbed in the main task (c.f. Schooler, 2006). Particularly when engaging in open-ended imaginative activity, such mind wandering may not show in any obvious way, and indeed may blend with the imaginative activity itself. Secondly, there could be thoughts distracting the mind, but there is meta-awareness of this distraction, allowing disengagement from the distraction to take place. Thirdly, irrelevant thoughts may be present, but attention is neither attached to nor averted from them; the mind is not distracted. Finally, one could actually be single-mindedly or one-pointedly thinking about the object of thought (see Taylor, 2002). The first state of absorption is only apparent absorption; it appears to be absorption because of a lack of accurate HOTs (call it cold absorption). In meditation, one aims to progress through these states, becoming aware of the mental chatter that usually pervades our minds, letting go of thoughts and entering the *dhyanas* (absorptions, in which one becomes aware of more subtle thoughts and sensations; see Austin, 2006 and Holroyd, 2003 for more in-depth description). Meditation and mindfulness practice involve training in the development of second-order awareness (Teasdale, 1999; Wallace 1999). This could be described as a state of absorption that involves meta-awareness (Lutz, Dunne and Davidson, 2007) and is a goal state of meditation. We could call meditative absorption ‘HOT’ absorption (absorption with HOTs), reflecting a state of absorbed attention in which one remains meta-aware of the contents of one’s consciousness as opposed, possibly, to hypnotic absorption: ‘cold’ absorption (absorption without HOTs), in which one has less meta-awareness of the contents of one’s consciousness and thus may more easily create inaccurate HOTs about their experience.

We have tested the hypothesis that highs have fewer accurate HOTs than meditators and controls at Sussex by asking subjects to keep looking

at images while trying to either a) remain at all times aware of seeing the image (meditation task; cf. Van Nuys, 1973) or b) not consciously see the image for 15 minutes (ignore task; compare Wegner’s, 1994, ‘white bear’ ironic control task, where people are asked to not think of a white bear). Subjects were asked at random intervals (roughly once a minute) whether they were just that instant before aware of seeing the image. Because people remained physically looking at the images there was a persistent first order visual representation of each image; but to what extent did people have accurate higher order thoughts about seeing it? The difference between a) and b) in reports of seeing the image was taken as measuring control in having accurate HOTs, and the total number of reports of seeing the image in both a) and b) as measuring coupling of HOTs to first order states, i.e. the tendency to have an appropriate HOT given that a first order state exists. We found that highs had poorer HOT coupling than lows, i.e. less accurate higher order thoughts across both tasks (Dienes, 2012, and Semmens-Wheeler and Dienes, 2011). This greater propensity to mind-wander meant highs were marginally better at ironic control than lows (and non-significantly worse at meditation). This apparent weak coupling may allow highs to decide in appropriate contexts to forgo higher order thoughts of intending in order to respond hypnotically to suggestions. In contrast, we found that meditators were poor at ironic control compared to highs, a finding which could be explained by the fact that they had significantly more HOTs than both lows and highs. (It is intriguing to find meditators bad at a mental control task!) Thus it seems unlikely that meditators would experience hypnotic suggestion through a lack of HOT coupling and we might even expect that they would not be very hypnotizable.

Consistent with the evidence that highs are not absorbed in an undistracted way, hypnotic responding itself does not require attending “one-pointedly” to one idea. Zamansky and Clark (1986) asked subjects to engage in imagery inconsistent with the hypnotic suggestions given (e.g. for a rigid arm suggestion, to imagine a different world in which their arm is bending). Highs were just as responsive to suggestions (e.g. that the arm is unbendable) when engaged in imagery inconsistent with the suggestion as when having consistent imagery, even as they concurrently reported the imagery. That is, their arm remains unbent, even as the subjects described an image of the arm bending. Thus, the theory that highs attend to one idea in order to achieve hypnotic response is false. Hypnotic response will tolerate not only mind wandering but also contradictory

ideas. By contrast, the absorption in meditation can be specifically directed at making the mind hold to one idea without distraction.

Shaw (2006 p 98), based on the descriptions of meditation in the Pali canon, describes how the meditator gradually acquires the feeling of control of entering, sustaining and leaving absorbed states—in contrast to the lack of control a hypnotized subject may feel (indeed, needs to feel in some way for a response to be hypnotic). In a related way, Gombrich (1996 p 163) emphasizes the self control and self awareness cultivated in Buddhism as an antithesis to spirit possession. Dienes and Perner (2007) identified spirit possession as the same natural kind as hypnosis (i.e. as a case of cold control).

Mindfulness versus self deception are general principles defining the nature of meditation and hypnosis in broad brush stroke; of course specific hypnotic and meditative experiences may draw on the other in detail. For example, vajrayana meditation (Gyatso, 2005) involves coming to see imagination as reality, but this does not take away from the fact that meditation must involve cultivation of mindfulness generally to be Buddhist meditation at all. (Even such cultivation will always leave scope for inaccurate higher order thoughts; cf. Shaw, 2006, p 66, points 2, 4, 5, 6, and 7 for mistaken beliefs the Buddha apparently had about his mental states, e.g. recalling past lives.*) Just as an episode in a hypnotic context may involve some cognitive activities being consciously controlled in a mindful way (Dienes, 2012; Yapko, 2011) so meditation may involve inaccurate higher order thoughts. Nonetheless, if a person were aware and mindful of all intentions they would have failed to respond hypnotically; and a meditator misrepresenting a mental state would have failed to be mindful. Where each succeeds in its goals, meditation is hotter than hypnosis.

DIRECTLY COMPARING MEDITATION AND HYPNOSIS?

So far we have compared meditation and hypnosis indirectly. We will now consider directly the relationship between meditation and hypnosis. First we consider the correlation between success at meditating and responding to hypnosis, then whether training can improve meditation and hypnosis, and finally the hypnotizability of people who meditate extensively.

Van Nuys (1974; also Spanos, Rivers, and Gottlieb, 1978) found that performance on a meditation task significantly predicted hypnotizability. Participants carried out a meditation task, which involved participants pressing a button whenever they experienced an intruding thought.

(Note that participants were not probed, but were asked to report whenever they noticed thoughts, i.e. when they had a HOT.) Based on our discussion of hot and cold absorption (i.e. absorbed attention with and without meta-awareness, respectively), there is an obvious methodological problem with the Van Nuys task. The task may not have really been measuring the number of intrusive thoughts, but the awareness of such thoughts arising. Thus, another way of interpreting the results could be to say that it was the lack of awareness of intrusive thoughts i.e. a lack of meta-awareness that predicted hypnotizability (see Smallwood and Schooler, 2006 for description of meta-awareness and mind wandering). On this account highs may even have more intrusive thoughts than lows (as found by Bryant and Idey, 2001, on a self-report questionnaire). When we determined on-line number of intrusive thoughts by probes, as described above (Dienes, 2012, and Semmens-Wheeler and Dienes, 2011), allowing the measure of intrusive thoughts to be separated from meta-awareness (as per the methodology of Smallwood and Schooler, 2006), hypnotizability was not associated with concentration on the task in our data (hypnotizability was non-significantly associated with more intrusions, $r = .21$, 95% CI [-.09, .51], the confidence interval ruling out the size of effect Van Nuys obtained, i.e. r about -.3)

Without training, hypnotic suggestibility is relatively stable, with test-retest correlations ranging from 0.64 to 0.82 (Barnier and McConkey, 2004). So far a number of attempts have been made to enhance participants' hypnotic suggestibility, with some success (e.g. Cooper, Banford, Schubot, and Tart, 1967; Diamond, 1972; Engstrom, Perry and Hart, 1970). Apparently successful attempts have involved changing subjects' beliefs, expectations and attitudes to hypnosis in a single session (e.g. the Carleton Skills Training Package, see Gorassini, 2004; see also Wickless and Kirsch, 1989, and contrast Benham, Bowers, Nash, and Muenchen, 1998). These training schemes contrast dramatically with the extensive attentional training required to make progress in meditation. Brief meditation training has not yet been found to increase hypnotic ability (e.g. Heide, Wadlington and Lundy, 1980).

What is the effect of extensive meditation training on hypnotic response? We compared scores of twelve expert meditators on the Waterloo Stanford Group Scale of Hypnotic Susceptibility (WGSC; Bowers, 1998) with scores of over 500 screened participants in the University of Sussex database; our preliminary findings show that meditators, passing on average 3/12 suggestions, were less susceptible than the average of all subjects in the database combined (average 5.5

* Accurate higher order thoughts depend as much on having a good theory of mental states as on cultivating the process of noticing mental states - just as accurate observation of the world depends crucially on good theory (consider telescopes) (cf Hurlburt and Schitzgebel, 2007, and Petitmengin, 2009, for a discussion of the capabilities and limits of introspection). In Bayesian terms, accurate beliefs about one's mental states are improved by having good priors. Because of this, empirical results from experimental psychology may inform good meditation practice (and vice versa).

suggestions). Furthermore, in an as yet unpublished study at Sussex we found that highly hypnotically suggestible individuals ('highs') scored significantly lower on measures of mindfulness, which is associated with meditation experience (Semmens-Wheeler and Erskine, 2009). The correlation between hypnotizability and mindfulness was $-.38$. The tendency for meditators to be less hypnotizable than non-meditators may reflect poor attitudes and low expectations on the part of meditators about hypnosis; we are directly testing this possibility now. We predict that meditators will score low on hypnotizability even after controlling for beliefs and expectations, precisely because they have cultivated having accurate higher order thoughts.

CONCLUSION

There are certainly some areas of overlap between meditation and hypnosis, yet this relationship may turn out to be orthogonal or opposed, particularly with regard to meta-awareness. We have argued that the essential nature of hypnotic response, that which makes it hypnotic at all, is a strategic self deception with respect to one's intentions (Dienes, 2012; Hilgard, 1977; Spanos, 1986; Spanos and Gorassini, 1999); by contrast, an essential component of meditative practice is mindfulness, seeing plainly what is there. However, it is important to take into account response expectancy

both theoretically and methodologically, as it can explain some effects in both meditation and hypnosis. For example, if one expects that either meditation or hypnosis will impair or enhance performance on a particular task, then one is likely to conform to this belief (Kirsch, 1997). In clinical practice, techniques called hypnotic or mindful may overlap (Lynn, Das, Hallquist, and Williams, 2006), but we need to be careful which specific activities we call hypnotic. Just calling relaxation or the use of imagination or a suggestion for improvement 'hypnotic' does not make it so. As we said in the introduction, to turn cognitive activities into hypnotic responses, those activities must involve distortion in the sense of voluntariness or reality. Further, similar clinical outcomes may be produced by opposite strategies, for example, analgesia may be produced by seeing pain for exactly what the experience is (Salomons and Kucyi, 2011), or by using cognitive strategies of distraction and reinterpretation (strategies one intended without knowing, Dienes, 2012). As urged by Lynn et al and Yapko (2011), research exploring whether hypnosis and mindfulness are useful as complimentary integrated clinical strategies is important. Future studies could explore metacognition and cognitive flexibility (e.g. cognitive set-shifting ability) in meditators and high hypnotizables and also provide more in-depth analysis of phenomenological experience (Pekala, 1982, 1991).

REFERENCES

- Anālayo (2010). *Satipatthana: The Direct Path to Realization*. Cambridge, England: Windhorse Publications.
- Ås, A. (1963). Hypnotizability as a function of nonhypnotic experiences. *Journal of Abnormal and Social Psychology*, 66, 142–150.
- Baars, B. J. (1998). *A Cognitive Theory of Consciousness*. Cambridge, England: Cambridge University Press.
- Baer, R. A., Smith, G. T. & Allen, K. B. (2004). Assessment of mindfulness by self-report: The Kentucky inventory of mindfulness skills. *Assessment*, 11(3), 191–206.
- Banyai, E. I., Hilgard, E. R. (1976). A comparison of active-alert hypnotic induction with traditional relaxation induction. *Journal of Abnormal Psychology*, 85(2), 218–224.
- Barber, T. X., Wilson, S. C. (1978). The Barber Suggestibility Scale and the Creative Imagination Scale: Experimental and clinical applications. *American Journal of Clinical Hypnosis*, 21, 84–108.
- Barnier, A. J. Dienes, Z. & Mitchell, C. J. (2008). How hypnosis happens: New cognitive theories of hypnotic responding. In M. Nash & A. Barnier (Eds.) *The Oxford Handbook of Hypnosis: Theory, Research, and Practice* (pp. 141–178). Oxford, England: Oxford University Press.
- Barnier, A., & McConkey, K. (2004). Defining and identifying the highly hypnotizable person. In M. Heap, R. J. Brown & D. A. Oakley (Eds.). *The Highly Hypnotizable Person* (pp. 30–60). London, England: Routledge.
- Barnier, A., & Nash, M. R. (2008) Introduction: A roadmap for explanation, a working definition. . In M. R. Nash & A. Barnier (Eds.). *The Oxford handbook of hypnosis: Theory, research and practice* (pp. 1–18). Oxford, England: Oxford University Press.
- Beran, M., Brandl, J., Perner, J., & Proust, J. (Eds.). (2012). *The Foundations of Metacognition*. Oxford, England: Oxford University Press.
- Bishop, S., Lau, M., Shapiro, S., Carlson, L., Bishop, S. Anderson, N. D., . . . Devins, G. (2006). Mindfulness: A proposed operation definition. *Clinical Psychology: Science and Practice*, 11, 230–241.
- Bowen, S., Witkiewitz, K., and Dillworth, T., Chawla, N., Simpson, T., Ostafin, B., . . . Marlatt, G. (2006). Mindfulness meditation and substance use in an incarcerated population. *Psychology of Addictive Behaviors*, 20(3), 343–347.

- Bowers, K. S. (1998). Waterloo-Stanford group scale of hypnotic susceptibility, form C: Manual and response booklet. *International Journal of Clinical and Experimental Hypnosis*, 46, 250–268.
- Braffman, W., & Kirsch, I. (1999). Imaginative suggestibility and hypnotizability: An empirical analysis. *Journal of Personality and Social Psychology*, 77, 578–587.
- Braffman, W., & Kirsch, I. (2001). Reaction time as a predictor of imaginative suggestibility and hypnotizability. *Contemporary Hypnosis*, 18(3), 107–119.
- Brefczynski-Lewis, J. A., Lutz, A., Schaefer, H. S., Levinson, D. B., & Davidson, R. J. (2007). Neural correlates of attentional expertise in long-term meditation practitioners. *Proceedings of the National Academy of Sciences*, 104(27), 11483–11488.
- Brown, K. W., & Ryan, R. M. (2003). The benefits of being present: Mindfulness and its role in psychological well-being. *Journal of Personality and Social Psychology*, 84(4), 822–848.
- Bryant, R. A., & Idey, A. (2001). Intrusive thoughts and hypnotisability. *Contemporary Hypnosis*, 18, 14–20.
- Buttle, H. (2011). Attention and Working Memory in Mindfulness-Meditation Practices. *Journal of Mind and Behavior*, 32(2), 123–134.
- Carruthers, P. (2000). *Phenomenal consciousness naturally*. Cambridge, England: Cambridge University Press.
- Chan, D., & Woolacott, M. (2007). Effects of Level of Meditation Experience on Attentional Focus: Is the Efficiency of Executive or Orientation Networks Improved? *The Journal of Alternative and Complementary Medicine*. 13(6), 651–658.
- Christoff, K., Gordon, A. M., Smallwood, J., Smith, R., & Schooler, J. W. (2009). Experience sampling during fMRI reveals default network and executive system contributions to mind wandering. *Proceedings of the National Academy of Science. U. S. A.*, 106, 8719–8724.
- Clayton, P. (2006). *The Oxford Handbook of Science and Religion*. Oxford, England: Oxford University Press.
- Council, J. R., Kirsch, I., & Hafner, L. P. (1986). Expectancy versus absorption in the prediction of hypnotic responding. *Journal of Personality and Social Psychology*, 50, 182–189.
- Cooper, L., Banford, S., Schubot, E., & Tart, C. (1967). *International Journal of Clinical and Experimental Hypnosis*, 15(3), 118–124.
- Crawford, H. (1994). Brain dynamics and hypnosis: Attentional and disattentional processes. *Journal of Clinical and Experimental Hypnosis*, 42(3), 204–232.
- Crawford, H., Brown, A., & Moon, C. (1993). Sustained attentional and disattentional abilities: Differences between low and highly hypnotizable persons. *Journal of Abnormal Psychology*, 102(4), 534–543.
- Critchley, H. D., Wiens, S., Rotshtein, P., Öhman, A., & Dolan, R. J. (2004). Neural systems supporting interoceptive awareness. *Nature Neuroscience*, 7, 189–195.
- Davidson, R., & Goleman, D. (1977). The role of attention in meditation and hypnosis: A psychobiological perspective on transformations of consciousness. *International Journal of Clinical and Experimental Hypnosis*, 25(4), 291–308.
- Deeley, Q., Oakley, D. A., Toone, B., Giampietro, V., Brammer, M. J., Williams, S. C., & Halligan, P. (2012). Modulating the default mode network using hypnosis. *The International journal of clinical and experimental hypnosis*, 60, 206–228.
- Delmonte, M. M. (1984). Meditation: Similarities with hypnoidal states and hypnosis. *International Journal of Psychosomatics*, 31, 24–34.
- Derbyshire, S. W., Whalley, M. G., & Oakley, D. A. (2009). Fibromyalgia pain and its modulation by hypnotic and non-hypnotic suggestion: An fMRI analysis. *European Journal of Pain*, 13, 542–550.
- Diamond, M. J. (1972). The use of observationally presented information to modify hypnotic susceptibility. *Journal of Abnormal Psychology*, 79(2), 174–180.
- Dienes, Z. (2012). Is hypnotic responding the strategic relinquishment of metacognition? In M. Beran, J. Brandl, J. Perner & J. Proust (Eds.). *The Foundations of Metacognition*. Oxford, England: Oxford University Press.
- Dienes, Z., Brown, E., Hutton, S., Kirsch, I., Mazzoni, G., & Wright, D. B. (2009). Hypnotic suggestibility, cognitive inhibition, and dissociation. *Consciousness and Cognition*, 18, 837–847.
- Dienes, Z., & Perner, J. (2007). The cold control theory of hypnosis. In G. Jamieson (Ed.). *Hypnosis and conscious states: The cognitive neuroscience perspective* (pp 293–314). Oxford, England: Oxford University Press.
- Dienes, Z., & Hutton, S. (submitted). Understanding hypnosis metacognitively: rTMS applied to DLPFC increases hypnotic suggestibility.
- Dixon, M., Brunet, A., & Laurence J.-R. (1990). Hypnotizability and automaticity: toward a parallel distributed processing model of hypnotic responding. *Journal of Abnormal Psychology*, 99, 336–343.
- Dixon, M., & Laurence, J.-R. (1992). Hypnotic susceptibility and verbal automaticity: Automatic and strategic processing differences in the Stroop-colour naming task. *Journal of Abnormal Psychology*, 101, 344–347.
- Eckert, M. A., Menon, V., Walczak, A., Ahlstrom, J., Denslow, S., Horwitz, A., & Dubno, J. (2009). At the heart of the ventral attention system: The right anterior insula. *Human Brain Mapping*, 30(8), 2530–2541.
- Engstrom, D., Perry, P., & Hart, J. (1970). Hypnotic Susceptibility increased by EEG Alpha Training. *Nature*, 227, 1261–1262.
- Farb, N., Segal, Z. V., Mayberg, H., Bean, J., McKeon, D., Fatima, Z., & Anderson, A. (2007). Attending to the present: Mindfulness meditation reveals distinct neural modes of self-reference. *Social Cognitive and Affective Neuroscience*, 2, 313–322.
- Fernandez-Duque, D., Baird, J. A., & Posner, M. I. (2000). Executive attention and metacognitive regulation. *Consciousness and Cognition*, 9, 288–307.
- Gfeller, J. D., Lynn, S. J. Pribbe WE (1987). Enhancing hypnotic susceptibility: Interpersonal and Rapport Factors. *Journal of Personality and Social Psychology*, 52, 586–595.
- Gombrich, R. F. (1996). *How Buddhism began: The conditioned genesis of the early teachings*. New Delhi, India: Muchiram Manoharlal Publishers.
- Gorassini, D. (2004). Enhancing Hypnotizability. In M. Heap, R. J. Brown & D. A. Oakley (Eds.). *The Highly Hypnotizable Person*. New York, NY: Brunner-Routledge.
- Gruzelier, J. (1998). A working model of the neurophysiology of hypnosis: A review of evidence. *Contemporary Hypnosis*, 15(1), 3–21.
- Gyatso, G. K. (2005). *Mahamudra Tantra: The supreme heart jewel nectar, a reduction to meditation on tantra*. Cumbria, UK: Tharpa Publications.
- Hanh, T. N., & Nquyen, A. (2006). *Walking meditation*. Louisville, CO: Sounds True Inc.
- Heap, M., Brown, R. J., & Oakley, D. A. (Eds.) (2004) *The Highly Hypnotizable Person*. London, England: Routledge.
- Heide, F. J., Wadlington, W. L., & Lundy, R. M. (1980). Hypnotic responsivity as a predictor of outcome in meditation. *International Journal of Clinical and Experimental Hypnosis*, 28, 358–385.
- Hilgard, E. R. (1977). *Divided consciousness: Multiple controls in human thought and action*. New York, NY: Wiley-Interscience.

- Hilgard, E. R., & Tart, C. T. (1966). Responsiveness to suggestion following waking and imagination instructions and following induction of hypnosis. *Journal of Abnormal Psychology, 71*, 196–208.
- Holroyd, J. C. (2003). The science of meditation and the state of hypnosis. *American Journal of Clinical Hypnosis, 46*(2), 109–128.
- Hölzel, B. K., Ott, U., Hempel, H., Hackl, A., Wolf, K., Stark, R., & Vaitl, D. (2007). Differential engagement of anterior cingulate and adjacent medial frontal cortex in adept meditators and non-meditators. *Neuroscience Letters, 421*, 16–21.
- Hurlburt, R. T., & Schwitzgebel, E. (2007). *Describing inner experience: Proponent meets skeptic*. Cambridge, MA: MIT Press.
- Iani, C., Ricci, F., Gherri, E. & Rubichi, S. (2006). Hypnotic suggestion modulates cognitive conflict. *Psychological Science, 17*, 721–727.
- Jamieson, G. A. & Woody, E. Z. (2007). Dissociated control as a paradigm for cognitive neuroscience research and theorizing in hypnosis. In G. Jamieson (Ed.). *Hypnosis and conscious states: The cognitive neuroscience perspective* (pp 111–129). Oxford, England: Oxford University Press.
- Jamieson, G. A., & Sheehan, P. W. (2002). A critical evaluation of the relationship between sustained attentional abilities and hypnotic susceptibility. *Contemporary Hypnosis, 119*, 62–74.
- Jensen, C. G., Vangkilde, S., Frokjaer, V., & Hasselbalch, S. G. (2012). Mindfulness training affects attention—or is it attentional effort? *Journal of Experimental Psychology: General, 141*(1), 106–123.
- Jha, A., Krompinger, J., & Baime, M. J. (2007) Mindfulness training modifies subsystems of attention. *Cognitive, Affective, and Behavioral Neuroscience, 7*(2), 109–119.
- Kabat-Zinn, J. (2011). Some clinical applications of mindfulness meditation in medicine and psychiatry: The case for mindfulness-based stress reduction (MBSR). In J. Kabat-Zinn, R. Davidson & Z. Houshmand (Eds.) *The mind's own physician: A scientific dialogue with the Dalai Lama on the healing power of meditation*. Oakland, CA: New Harbinger Publications.
- Kabat-Zinn, J., Davidson, R. & Houshmand, Z. (Eds.) (1985). *The mind's own physician: A scientific dialogue with the Dalai Lama on the healing power of meditation*. Oakland, CA: New Harbinger Publications.
- Kabat-Zinn, J., Massion, A. O., Kristeller, J., Peterson, L. G., Fletcher, K. E., Pbert, L., . . . Santorelli, S. F. (1992). Effectiveness of a meditation-based stress reduction program in the treatment of anxiety disorders. *American Journal of Psychiatry, 149*(7), 936–943.
- Kabat-Zinn, J., Segal, Z. V., Williams, J. W. G., & Teasdale, J. D. (2002). *Mindfulness-based cognitive therapy for depression*. New York, NY: The Guildford Press.
- Kaiser, J., Barker, R., Haenschel, C., Baldeweg, T., & Gruzelier, J. H. (1997). Hypnosis and event-related potential correlates of error-processing in a Stroop type paradigm: A test of the frontal hypothesis. *International Journal of Psychophysiology, 27*, 215–222.
- Kallio, S., Revonsuo, A., Hämäläinen, H., Markela, J., & Gruzelier, J. (2001). Anterior brain functions and hypnosis: A test of the frontal hypothesis. *International Journal of Clinical and Experimental Hypnosis, 49*, 95–108.
- Kamalashila. (1992). *Meditation: The Buddhist way of tranquility and insight*. Cambridge, England: Windhorse Publications.
- Karlin, R. J. (1979). Hypnotizability and attention. *Journal of Abnormal Psychology, 88*(1), 92–95.
- Kihlstrom, J. (2003). The fox, the hedgehog, and hypnosis. *International Journal of Clinical and Experimental Hypnosis, 51*, 166–189.
- Kirsch, I. (1985). Response expectancy as a determinant of experience and behavior. *American Psychologist, 40*, 1189–1202.
- Kirsch, I. (1997). Response expectancy theory and application: A decennial review. *Applied and Preventive Psychology, 6*, 69–79.
- Kirsch, I., & Braffman, W. (1999). Correlates of hypnotizability: The first empirical study. *Contemporary Hypnosis, 16*, 224–230.
- Kirsch, I., Cardeña, E., Derbyshire, S., Dienes, Z., Heap, M., Kallio, S., . . . Whalley, M. (2011). Definitions of hypnosis and hypnotizability and their relation to suggestion and suggestibility: A consensus statement. *Contemporary Hypnosis and Integrative Therapy, 28*(2), 107–111.
- Koriat, A. (2007) Metacognition and consciousness. In P. D. Zelazo, M. Moscovitch, & E. Thompson (Eds.), *The Cambridge handbook of consciousness* (pp. 289–325). Cambridge, England: Cambridge University Press.
- Kubose, S. (1976). An experimental investigation into the psychological aspects of meditation. Cited in D. Shapiro, & R. Walsh (Eds.). *The science of meditation: Research, theory and practice*. New York, NY: Van Nostrand Reinhold.
- Lau, H. C., & Passingham, R. E. (2006). Relative blindsight in normal observers and the neural correlate of visual consciousness. *Proceedings of the National Academy of Science, 103*, 18763–18768.
- Lazar, S. W., Kerr, C., Wasserman, R. H., Gray, J. R., Greve, D., Treadway, M. T., . . . Fischl, B. (2005). Meditation experience is associated with increased cortical thickness. *NeuroReport, 16*, 1893–1897.
- Lichtenberg, P., Bachner-Melman, R., Gritsenko, I., & Ebstein, R. P. (2000). Exploratory association study between catechol-O-methyltransferase (COMT) high/low enzyme activity polymorphism and hypnotizability. *American Journal of Medical Genetics, 96*, 771–774.
- Lutz, A., Brefczynski-Lewis, J., Johnstone, T., Davidson, R. J. (2008) Regulation of the Neural Circuitry of Emotion by Compassion Meditation: Effects of Meditative Expertise. *PLoS ONE, 3*(3), e1897.
- Lutz, A., Slagter, H. A., Dunne, J., & Davidson, R. J. (2008). Attention regulation and monitoring in meditation. *Trends in Cognitive Sciences, 12*(4), 163–169.
- Lutz, A., Slagter, H., Rawlings, N. B., Francis, A. D., Greischar, L. L., & Davidson, R. J. (2009). Mental training enhances attentional stability: Neural and behavioral evidence. *Journal of Neuroscience, 29*, 13418–13427.
- Lutz, A., Dunne, J., & Davidson, R. (2007). Meditation and the neuroscience of consciousness: An introduction In P. Zelazo, M. Moscovitch, E. Thompson (Eds.). *Cambridge Handbook of Consciousness* (pp.499–554). Cambridge, England: Cambridge University Press.
- Lynn, S. J., Das, L. S., Hallquist, M. N., & Williams, J. C. (2006). Mindfulness, acceptance, and hypnosis: Cognitive and clinical perspectives. *International Journal of Clinical and Experimental Hypnosis, 54*(2), 143–166.
- Lynn, S. J., Kirsch, I., & Hallquist, M. (2008). Social cognitive theories of hypnosis. In M. R. Nash, & A. Barnier (Eds.). *The Oxford handbook of hypnosis: Theory, research and practice* (pp. 111–140). Oxford, England: Oxford University Press.

- Lyons, L. & Crawford, H. (1997). Sustained attentional and disattentional abilities and arousability: Factor analysis and relationships to hypnotic susceptibility. *Personality and Individual Differences*, 23(6), 1071–1084.
- Lynn, S. J. & Rhue, J. W. (Eds.) (1991). *Dissociation: Clinical and Theoretical Perspectives*. New York, NY: Guilford Press.
- McGeown, W. Mazzoni, G., Venneri, A. & Kirsch, I. (2009). Hypnotic induction decreases anterior default mode activity. *Consciousness and Cognition*, 18, 848–855.
- Nadon, R., Hoyt, L., Register, P., & Kihlstrom, J. (1991). Absorption and hypnotizability: Context effects reexamined. *Journal of Personality and Social Psychology*, 60(1), 144–153.
- Nash, M. & Barnier, A. (Eds.), (2008). *The Oxford Handbook of Hypnosis: Theory, Research, and Practice*. Oxford, England: Oxford University Press
- Nelson, T. O., & Narens, I. (1990). Metamemory: A theoretical framework and new findings. In G. Bower, (Ed.), *The psychology of learning and motivation: Advances in research and theory* (pp. 12 5–17 3). New York, NY: Academic Press.
- Norman, D., & Shallice, T. (1986). Attention to action: Willed and automatic control of behavior. In R. Davidson, G. Schwartz, & D. Shapiro (Eds.), *Consciousness and self regulation: Advances in research and theory*, Vol. 4 (pp. 1–18). New York, NY: Plenum.
- Pekala, R. J. (1982). *Phenomenology of Consciousness Inventory* (PCI). (Unpublished psychological test).
- Pekala, R. J. (1991). *Quantifying consciousness: An empirical approach. Emotions, personality, and psychotherapy*. New York, NY: Plenum Press.
- Pekala, R. J., & Kumar, V. K. (2007). An empirical-phenomenological approach to quantifying consciousness: With particular reference to understanding the nature of hypnosis in G. Jamieson (Ed.). *Hypnosis and conscious states: The cognitive neuroscience perspective* (pp 167–194). Oxford, England: Oxford University Press.
- Petitmengin, C. (Ed.). (2009). *Ten years of viewing from within: The legacy of Francisco Varela*. Exeter, England: Imprint Academic.
- Proust, J. (2012). *Philosophy of Metacognition: Mental agency and self-awareness*. Oxford, England: Oxford University Press.
- Ramel, W., Goldin, P., Carmona, P., & McQuaid, J. (2004). The effects of mindfulness meditation on cognitive processes and affect in patients with past depression. *Cognitive therapy and research*, 26(4), 433–455.
- Raz, A. (2011). Does neuroimaging of suggestion elucidate hypnotic trance? *International Journal of Clinical and Experimental Hypnosis*, 59(3), 363–377.
- Raz, A., & Buhle, J. (2006). Typologies of Attentional Networks. *Nature Reviews Neuroscience*, 7(5), 367–379.
- Raz, A., & Campbell, N. K. J. (2011). Can Suggestion Obviate Reading? Supplementing Primary Stroop Evidence with Exploratory Negative Priming Analyses. *Consciousness and Cognition*, 20(2), 312–320.
- Raz, A., Fan, J., & Posner, M. I. (2005). Hypnotic suggestion reduces conflict in the human brain. *Proceedings of the National Academy of Sciences of the United States of America*, 102(28), 9978–9983.
- Raz, A., Kirsch, I., Pollard, J., & Nitkin-Kaner, Y. (2006). Suggestion reduces the stroop effect. *Psychological Science*, 17(2), 91–95.
- Raz, A., Shapiro, T., Fan, J., & Posner, M. I. (2002). Hypnotic suggestion and the modulation of Stroop interference. *Archives of General Psychiatry*, 59(12), 1155–1161.
- Raz, A., Landzberg, K. S., Schweizer, H. R., Zephrani, Z. R., Shapiro, T., Fan, J., & Posner, M. I. (2003). Posthypnotic suggestion and the modulation of Stroop interference under cycloplegia. *Consciousness and Cognition*, 12(3), 332–346.
- Rosenthal, D. M. (1986). Two concepts of consciousness. *Philosophical Studies*, 49, 329–359.
- Rosenthal, D. M. (2002). Consciousness and higher-order thought. In L. Nadel. *Macmillan encyclopedia of cognitive science* (pp. 717–726). Basingstoke, England: Macmillan Publishers Ltd.
- Rosenthal, D. (2005). *Consciousness and mind*. Oxford, England: Oxford University Press.
- Rounis, E., Maniscalco, B., Rothwell, J., Passingham, R. E., & Lau, H. (2010). Theta-burst transcranial magnetic stimulation to the prefrontal cortex impairs metacognitive visual awareness. *Cognitive Neuroscience*, 1, 165–175.
- Rubichi, S., Ricci, F., Padovani, R., & Scaglietti, L. (2005). Hypnotic susceptibility, baseline attentional functioning, and the Stroop task. *Consciousness and Cognition*, 14, 296–303.
- Salomons, T. V., & Kucyi, A. (2011). Does meditation reduce pain through a unique neural mechanism? *The Journal of Neuroscience*, 31(26), 12705–12707.
- Sangharakshita. (2001). *A Survey of Buddhism*. Cambridge, England: Windhorse Publications.
- Sarbin, T. R., & Coe, W. C. (1972). *Hypnosis: A social psychological analysis of influence communication*. New York, NY: Holt Rinehart and Winston.
- Schjoedt, U., Stødkilde-Jørgensen, J., Geertz, A., Lund, T., & Ropestorff, A. (2011). The power of charisma—perceived charisma inhibits the frontal executive network of believers in intercessory prayer. *Social Cognitive and Affective Neuroscience*, 6(1), 119–127.
- Semmens-Wheeler, R., & Erskine, J. (2009, April). *Mindfulness and the myth of control*. Talk presented at British Psychological Society Annual Conference, Brighton.
- Semmens-Wheeler, R., & Dienes, Z. (2011, December) *Similarities and Differences in Meditation and Hypnosis*. Talk presented at the David Waxman Memorial Lecture, Royal Society of Medicine, London.
- Shapiro, D., & Walsh, R. (Eds.) (1980). *The science of meditation: Research, theory and practice*. New York, NY: Van Nostrand Reinhold.
- Shaw, S. (2006). *Buddhist meditation: An anthology of texts from the Pali canon*. New York, NY: Routledge.
- Shor, R. E., Orne, M. T., & O'Connell, D. N. (1962). Validation and cross-validation of a scale of self-reported personal experiences which predicts hypnotizability. *Journal of Psychology*, 53, 55–75.
- Slagter, H. A., Lutz, A., Greichar, L. L., Francis, A. D., Nieuwenhuis, S., Davis, J., & Davidson, R. J. (2007). Mental training affects distribution of limited attentional resources. *PLoS Biology*, 5(6), 138.
- Spanos, N. P., & Barber, T. X. (1974). Toward a convergence in hypnosis research. *American Psychologist*, 29(7), 500–511.
- Spanos, N. (1986). Hypnotic behavior: A social–psychological interpretation of amnesia, analgesia, and ‘trance logic.’ *Behavioral and Brain Sciences*, 9, 449–502.
- Spanos, N., & Gorassini, D. (1999). *The Carleton Skill Training Program for modifying hypnotic suggestibility: Original version and variations*. In I. Kirsch, A. Capafons, E. Cardeña-Buelna & Amigó, S. (Eds.). *Clinical hypnosis and self-regulation: Cognitive-behavioral perspectives. Dissociation, trauma, memory, and hypnosis book series* (pp. 141–177). Washington, DC: American Psychological Association.

- Spanos, N. P., Rivers, S. M., & Gottlieb, J. (1978). Hypnotic responsivity, meditation, and laterality of eye movements. *Journal of Abnormal Psychology, 87*, 566–569.
- Tang, Y.-Y., Ma, Y., Wang, J., Fan, Y., Feng, S., Yu, Q., . . . Posner, M. (2007). Short-term meditation training improves attention and self-regulation. *Proceedings of the National Academy of Sciences of the United States of America, 104*(43), 17152–17156.
- Teasdale, J. (1999). Metacognition, mindfulness and the modification of mood disorders. *Clinical Psychology and Psychotherapy, 6*, 146–155.
- Teasdale, J. D., Moore, R. G., Hayhurst, H., Pope, M., Williams, S., & Segal, Z. V. (2002). Metacognitive awareness and prevention of relapse in depression: Empirical evidence. *Journal of Consulting and Clinical Psychology, 70*, 278–287.
- Thompson, E. (2006). Neurophenomenology and contemplative experience. In P. Clayton (Ed.) (2006). *The Oxford Handbook of Science and Religion* (pp. 226–235). Oxford, England: Oxford University Press
- Travis, F., Haaga, D. A., Hagelin, J., Tanner, M., Nidich, S., Gaylord-King, C., . . . Schneider, R. H. (2009). Effects of Transcendental Meditation practice on brain functioning and stress reactivity in college students. *International Journal of Psychophysiology, 71*(2), 170–176
- Uddin, L., Kelly, A., Biswal, B., Xavier Castellanos, F., & Milham, M. (2009). Functional connectivity of default mode network components: Correlation, anticorrelation, and causality. *Human Brain Mapping, 30*, 625–637
- Valentine, E. R., Sweet, P. L. G. (1999). Meditation and attention: A comparison of the effects of concentrative and mindfulness meditation on sustained attention. *Mental Health, Religion and Culture, 2*, 59–70.
- Van Nuys, D. (1973). Meditation, attention and hypnotic susceptibility: A correlational study. *International Journal of Clinical and Experimental Hypnosis, 21*, 59–69.
- Varga, K., Németh, Z., & Szekely, A. (2011). Lack of correlation between hypnotic susceptibility and various components of attention. *Consciousness and Cognition, 20*, 1872–1881.
- Vincent, J. L., Kahn, I., Snyder, A. Z., Raichle, M. E., Buckner, R. L. (2008). Evidence for a Frontoparietal Control System Revealed by Intrinsic Functional Connectivity. *Journal of Neurophysiology, 100*, 3328–3342.
- Wagstaff, G. F., Cole, J. C., & Brunas-Wagstaff, J. (2007). Effects of hypnotic induction and hypnotic depth on phonemic fluency: A test of the frontal inhibition account of hypnosis. *Revista Internacional de Psicología y Terapia Psicológica/ International Journal of Psychology and Psychological Therapy, 7*, 27–40.
- Wallace, B. A. (1999). The Buddhist tradition of Samatha: Methods for refining and examining consciousness. *Journal of Consciousness Studies, 6*, 175–187.
- Walsh, R. (1979). Meditation research: An introduction and review. *Journal of Transpersonal Psychology, 11*, 161–174.
- Wendt, P. E., & Risberg, J. (2001). Ethanol reduces rCBF activation of left dorsolateral prefrontal cortex during a verbal fluency task. *Brain and Language, 77*(2), 197–215.
- White, R. W. (1942). A preface to a theory of hypnotism. *Journal of Abnormal and Social Psychology, 36*, 477–505.
- Wilson, S. C., & Barber, T. X. (1982). The fantasy-prone personality: Implications for understanding imagery, hypnosis, and parapsychological phenomena.. In S. J. Lynn & J. W. Rhue (Eds.). *Theories of Hypnosis: Current Models and Perspective*, London, England: The Guildford Press.
- Woody, E. Z., & Sadler, P. (2008). Dissociation theories of hypnosis. In M. R. Nash & A. J. Barnier (Eds.). *The Oxford Handbook of Hypnosis: Theory, Research and Practice*. Oxford, England: Oxford University Press.
- Woody, E. Z., & Bowers, K. (1994). A frontal assault on dissociated control. In S. J. Lynn & J. W. Rhue (Eds.). *Dissociation: Clinical and Theoretical Perspectives* (pp. 52–79). New York, NY: Guilford Press.
- Yapko, M. D. (2011). *Mindfulness and hypnosis: The power of suggestion to transform experience*. New York, NY: Norton.
- Zamansky, H. S., & Clark, L. E. (1986). Cognitive competition and hypnotic behaviour: Whither absorption? *International Journal of Clinical and Experimental Hypnosis, 34*, 205–214.