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Hypnosis and top-down regulation of consciousness

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ABSTRACT

Hypnosis is a unique form of top-down regulation in which verbal suggestions are capable of eliciting pronounced changes in a multitude of psychological phenomena. Hypnotic suggestion has been widely used both as a technique for studying basic science questions regarding human consciousness but also as a method for targeting a range of symptoms within a therapeutic context. Here we provide a synthesis of current knowledge regarding the characteristics and neurocognitive mechanisms of hypnosis. We review evidence from cognitive neuroscience, experimental psychopathology, and clinical psychology regarding the utility of hypnosis as an experimental method for modulating consciousness, as a model for studying healthy and pathological cognition, and as a therapeutic vehicle. We also highlight the relations between hypnosis and other psychological phenomena, including the broader domain of suggestion and suggestibility, and conclude by identifying the most salient challenges confronting the nascent cognitive neuroscience of hypnosis and outlining future directions for research on hypnosis and suggestion.

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1. Introduction

A remarkable feature of the human brain is its ability to translate endogenous mental representations into perceptual states. One of the most striking instances of such top-down regulation is the phenomenon of hypnosis, in which verbal suggestions are capable of eliciting pronounced changes in the contents of consciousness (Oakley and Halligan, 2013). Following specific suggestions, responsive individuals are able to experience alterations in a diverse array of psychological functions and thus hypnotic suggestion has considerable potential for studying the intersections of cognitive control, sense of agency, metacognition, and germane functions. In turn, hypnosis is becoming increasingly recognized as a valuable method for modeling different psychological phenomena (Cox and Bryant, 2008; Oakley and Halligan, 2009), including pathological symptomatology (Woody and Szechtman, 2011), that may otherwise be resistant to manipulation in controlled settings. Such an approach offers new vistas for cognitive neuroscience. The opportunities afforded by top-down regulation of consciousness in hypnosis extend beyond the laboratory: hypnotic suggestion can be utilized in the treatment of different conditions and disorders (Elkins, 2017) and as an adjunct method for producing analgesia in surgery (Agard et al., 2016; Facco, 2016; Faymonville et al., 1995). Together, these approaches point to hypnosis as a valuable, but understudied, technique for modulating the contents of consciousness with implications for both basic and clinical science.

This review aims to synthesize contemporary research and theory in the domains of clinical and experimental hypnosis. We first introduce hypnosis as a form of top-down regulation and describe its principal characteristics and provide examples of different psychological phenomena that can be modulated via suggestion. Subsequently, we turn to the use of hypnosis as a method for cognitive neuroscience and experimental psychopathology, describing the rationale of this approach and providing some illustrative examples. Hypnosis has a rich history as a therapeutic vehicle and we next review its use in therapeutic contexts and its clinical efficacy. In describing the mechanisms of hypnosis, we aim to place it in a broader context by considering its relations to different psychological phenomena. We conclude by highlighting outstanding challenges and questions that we anticipate will be the foci of future research.

2. Hypnosis as top-down regulation

Top-down regulation refers to the process whereby mental representations cascade downstream to override physiology, perception, and behavior. Although persistent reductionism in psychology and neuroscience traditionally led researchers to favor bottom-up explanations in which psychological phenomena are based in low-level neurobiological mechanisms, there is now widespread recognition that mental representations, such as expectations, regularly impact perception (Summerfield and de Lange, 2014). Moreover, ample evidence has accumulated for a role of long-range signals from, and interactions with, prefrontal and partial cortices in the implementation of top-down control over lower-level brain regions and corresponding psychological functions (Gazzaley and D'Esposito, 2007; Miller and Cohen, 2001). Superficially, hypnosis appears as a bizarre or spectacular phenomenon, but it is increasingly being understood as a unique form

of top-down regulation that occurs within a culturally-sanctioned social context (Raz, 2011).

Theories of hypnosis frequently highlight the top-down view and tend to emphasize the roles of cognitive control and executive (or metacognitive) monitoring functions based in prefrontal and anterior cingulate cortices and broader frontal-parietal networks (Dienes and Perner, 2007; Egner and Raz, 2007; Gruzelier, 2006; Jamieson and Woody, 2007; Lynn et al., 2008; Woody and Sadler, 2008). Indeed, despite broad disagreements regarding the specific mechanisms underlying hypnosis, nearly all theories propose that suggestions are implemented through some form of top-down regulation (for an exception, see Woody and Bowers, 1994). On most of these accounts, specific perceptual states and behavioral routines originating from suggestion-based mental representations (*rogue representations*; Brown and Oakley, 2004) are implemented through mundane goal-directed cognitive control mechanisms. However, the hypnotic context, and the expectations, beliefs, motivational states, and cognitive and experiential sets that it engenders, coupled with the wording of suggestions, promotes impaired or atypical monitoring (Brown et al., 2001; Dienes and Perner, 2007; Lynn et al., 2008; Woody and Szechtman, 2011) and, concomitantly, the perception that one is not the author of one's own behavior and experience (see §7.2). This distortion in one's sense of agency constitutes the core phenomenological feature of response to suggestion (Bowers, 1981; Polito et al., 2014; Weitzenhoffer, 1980). Some theories of hypnosis have emphasized specific top-down factors including response expectancies and there is broad evidence that they contribute to individual differences in hypnotic suggestibility (Lynn et al., 2008). Neuroimaging and brain stimulation research has implicated prefrontal, anterior cingulate, and parietal cortices in different facets of hypnotic responding or in individual differences in hypnotic suggestibility (Cojan et al., 2009; Dienes and Hutton, 2013; Egner et al., 2005; Huber et al., 2014; Jiang et al., 2017 in press; McGeown et al., 2009; Terhune et al., 2011a), thereby implicating regions known to contribute to the top-down regulation of lower-level brain structures (Gazzaley and D'Esposito, 2007; Miller and Cohen, 2001). However, the specific cognitive mechanisms and roles of different cortical and subcortical regions in the implementation of the top-down control that subserves responsiveness to suggestion remains poorly understood (see also §7.6).

3. A hypnosis primer: measurement, individual differences, and phenomenology

Hypnosis can be understood as an elaborate form of suggestion that occurs within a specific sociocultural context. In contrast to instructions, which imply self-agency (e.g., "raise your hand"), suggestions are verbal communications for involuntary responses (e.g., "your hand will raise"; Kirsch, 1999b). Hypnosis involves a set of procedures that are embedded within an interaction between an experimenter (or therapist) and a participant (or client). In contrast to the popular imagination, a typical hypnosis protocol is a relatively mundane affair that is at odds with the many pervasive myths regarding this phenomenon (Raz, 2011). The primary components of hypnosis include an induction followed by one or more suggestions.

Hypnotic inductions can be understood as the first suggestion in a hypnosis protocol (Nash, 2005). Although they vary markedly,

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