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Alcohol increases hypnotic susceptibility

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ABSTRACT

One approach to hypnosis suggests that for hypnotic experience to occur frontal lobe activity must be attenuated. For example, cold control theory posits that a lack of awareness of intentions is responsible for the experience of involuntariness and/or the subjective reality of hypnotic suggestions. The mid-dorso-lateral prefrontal cortex and the ACC are candidate regions for such awareness. Alcohol impairs frontal lobe executive function. This study examined whether alcohol affects hypnotisability. We administered 0.8 mg/kg of alcohol or a placebo to 32 medium susceptible participants. They were subsequently hypnotised and given hypnotic suggestions. All participants believed they had received some alcohol. Participants in the alcohol condition were more susceptible to hypnotic suggestions than participants in the placebo condition. Impaired frontal lobe activity facilitates hypnotic responding, which supports theories postulating that attenuation of executive function facilitates hypnotic response, and contradicts theories postulating that hypnotic response involves enhanced inhibitory, attentional or other executive function.

1. Introduction

Hypnotic suggestions give rise to a wide range of interesting experiences and behaviours. Typically these involve a sense of involuntariness, such as when one's arm apparently rises by itself. Alternatively they may comprise the experience of an entirely convincing yet fabricated subjective reality, such as the experience of a mosquito on one's hand. While there may be different underlying mechanisms involved in different types of hypnotic suggestions, and individuals may create the experience in different ways (e.g. see Terhune, Cardeña, & Lindgren, 2011; Woody & Barnier, 2008), a number of general theories have been developed in an attempt to explain hypnotic phenomena. Hypnosis can be construed either as a special state or as a way of responding to suggestions (Kirsch et al., 2011). In terms of the latter, hypnotic responding is a way of respondingin which the sense of volition or reality has been deliberately distorted (whether or not one is in a special state). In terms of the former, it is a state that may facilitate such responding. Here we investigate the effect of a drug state on hypnotic response in order to test different theories of hypnosis.

Although several studies have examined the effects of drugs, including cannabis, psilocybin, diazepam and nitrous oxide on hypnotisability (Kelly, Fisher, & Kelly, 1978; Sjoberg & Hollister, 1965; Whalley & Brooks, 2009), surprisingly none has yet investigated the relationship of alcohol to hypnotic suggestibility. Yet, as we now describe, theories of hypnosis often postulate a role of the frontal lobes in hypnotic responding, and alcohol primarily disrupts frontal lobe functioning.

A number of theories have emphasised the role of the frontal cortex and associated executive functions, such as attention. One broad approach posits that hypnotic phenomena arise from a state of hypofrontality (see Dietrich, 2003) and diminished executive functions such as attention. For example, Woody and Bowers (1994) postulate that hypnotic induction leads to impairment of executive functions, causing actions to be controlled by contention scheduling (i.e. habit). Woody and Sadler

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(2008) review a number of ways in which executive control mechanisms may be disrupted in order to produce hypnotic response. Similarly, Gruzelier (1998, 2006) has proposed that hypnosis results from a state of frontal lobe exhaustion and diminished attentional abilities resulting from extreme concentration during hypnotic induction. Gruzelier and Warren (1993), Kallio, Revonsuo, Hämäläinen, Markela, and Gruzelier (2001), and Farvolden and Woody (2004), found that hypnotic induction reduced letter fluency in high rather than low hypnotisables, although similar effects were not detected on other frontal tasks. Thus, responding hypnotically may involve a specific form of hypofrontality. If these theories are true then alcohol should increase hypnotic responding.

Other theories would predict that the alcohol-induced frontal lobe impairment would reduce hypnotic responsiveness. The theories of both Spanos (e.g. 1986) and Hilgard (e.g. 1986) rely on the functioning of the frontal lobes for hypnotic response to be achieved. Spanos (e.g. Bertrand & Spanos, 1985; Spanos et al., 1982) has demonstrated that hypnotic behaviour can involve overcoming pre-potent responses, which necessarily involves executive functioning. Hilgard's theory relies upon two intact but dissociated executive functions. In fact, Hilgard (1986) argued that maintaining the two dissociated streams itself took executive capacity, because the hypnotic rather than non-hypnotic performance of one of two simultaneous tasks involved more dual task interference (see also Tobis & Kihlstrom, 2010; Wyzenbeek & Bryant, 2012). Similarly Crawford, Knebel, and Vendemia (1998) argue that frontal lobe executive functions are required for hypnotic analgesia. Therefore, since alcohol impairs executive function, alcohol should decrease hypnotic susceptibility by these approaches.

A more recent theory has highlighted the role of metacognition in hypnosis. The cold control theory of hypnosis (Dienes, 2012; Dienes and Perner, 2007; also see Barnier, Dienes, & Mitchell, 2009) explains hypnotic phenomena as the result of a strategic lack of awareness of the intention to perform a particular action. In other words, to respond hypnotically, the subject performs an action while thinking that they were not intending to perform that action: hypnosis essentially involves the lack of accurate higher order thoughts (HOTs) of intending. (Hence 'cold control': intentional control without HOTs.) Take, for example, the hypnotic suggestion that one's arm is stiff and rigid as if splinted, so that it cannot bend. In order to perform the suggestion successfully, the subject might intend to contract the antagonistic muscles of the arm simultaneously to prevent it from bending (about 80% of participants do try to bend, Comey & Kirsch, 1999). The hypnotic aspect is the experience of involuntariness, and cold control posits that this occurs by way of avoiding HOTs of intending, which thus lead to the inaccurate HOT, "my arm has become stiff and rigid by itself and I cannot bend it." Similarly, suggestions for analgesia or amnesia may involve distraction away from pain or the to-be-forgotten material. However, the hypnotic component is the ability to deceive oneself about having intended to do so; that is, by cold control theory this is done by avoiding accurate HOTs of intending. Note that on this theory hypnotic experience does not involve any alteration in first-order abilities (i.e. abilities with the function of dealing only with the world), but is achieved purely metacognitively. Thus, according to cold control, impairment of frontal function would enhance hypnotic response in virtue of the role of the frontal lobes in metacognition.

Higher order thoughts of seeing have been linked to the dorsolateral prefrontal cortex (DLPFC). Lau and Passingham (2006) using fMRI found that the brain region that distinguished reports of "seeing" rather than of "guessing" for equivalent perceptual discrimination was the DLPFC; thus, the DLPFC was not linked to the first order mental state of seeing, but to awareness of seeing. In another study, subjects' self-reported awareness of seeing was disrupted when theta burst TMS was applied to the area, even when first order perception was held constant with and without TMS (Rounis et al., 2010). That is, the disruption found was purely related to HOTs, and not first order perception. Fleming, Weil, Nagy, Dolan, and Rees (2010) also found the individual differences in the accuracy of higher order thoughts about perceiving correlated with grey and white matter volume in the same region.

The neural substrate of accurate higher order thoughts may well extend beyond the DLPFC. The monitoring and cognitive control functions of the anterior cingulate cortex (the ACC) make it a likely co-candidate region for the production of HOTs. Indeed, Woody and Szechtman (2011) found in highly hypnotisable participants that there were greater levels of activation in the ACC during auditory hallucination compared to imagination of the same sounds. That is, the ACC may be involved in determining whether internally generated sensory representations are just that – imagination – or else misrepresented as perceptions.

Alcohol impairs both the DLPFC (Wendt & Risberg, 2001) and the ACC (Ridderinkhof et al., 2002). Consistent with the claim these areas are involved in accurate metacognitive awareness, Sayette, Reichle, and Schooler (2009) found that alcohol compared to placebo decreased people's awareness that they were mind wandering. The DLPFC and ACC not only have executive monitoring functions but also control functions. Thus, the effect of alcohol on these areas can also be shown by the effect of alcohol on tasks that test inhibition of pre-potent response (like the Stop Signal Task, SST; Fillimore & Weafer, 2004), or the ability to resist perseveration (like the letter fluency task; Peterson, Rothfleisch, Zelazo, & Pihl, 1990). For example, Marinkovic, Rickenbacher, Azma, and Artsy (2012) reported reduced activation in ACC bilaterally during the incongruent condition on the colour Stroop task. Similarly, Gundersen, Specht, Grüner, Ersland, and Hugdah (2008) observed decreased activation in ACC and cerebellum during a working memory task following alcohol consumption. With a different variant of a working memory task, Paulus, Tapert, Pulido, and Schuckit (2006) found less activation in the DLPFC in participants who consumed alcohol rather than placebo.

In sum, alcohol impairs control and monitoring functions subserved by the DLPFC and ACC. According to theories postulating that hypnosis involves disruptions in executive control mechanisms (e.g. Woody and Sadler, 2008), alcohol should increase hypnotic responsiveness. According to cold control theory, as alcohol impairs the areas responsible for metacognitive monitoring, alcohol should make it harder to have accurate higher order thoughts of intending, and thereby facilitate hyp-