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Book review

The emerging neuroscience of hypnosis

A review of '*Hypnosis and Conscious States: The Cognitive Neuroscience Perspective*' by Graham Jamieson (Ed)

In recent years, hypnosis has begun to gain traction as a potentially valuable tool in the increasingly diverse repertoires of cognitive neuroscience and cognitive neuropsychiatry (Oakley and Halligan, 2009). Hypnosis consists of a set of procedures beginning with an induction, which involves instructions and suggestions to promote absorption in (i.e., effortless attention towards) the words of the operator. An induction is typically followed by a series of suggestions for alterations in various dimensions of consciousness, perception, action, and cognition. In response to specific hypnotic suggestions, highly suggestible individuals are capable of experiencing marked changes in affect, attention, memory, and perception. Hypnotic suggestions can be used to model psychiatric and neurological conditions or test predictions that are otherwise difficult to address in the laboratory (*instrumental research*); alternatively, researchers may investigate the phenomenology and mechanisms underlying response to a hypnotic induction and particular suggestions or the determinants of hypnotic suggestibility (*intrinsic research*) (Reyher, 1962; Oakley and Halligan, 2009). As neuroscientific research on hypnosis continues to grow, it becomes increasingly necessary to integrate it with contemporary neurophysiological models of cognition, to ensure that neuroscientists using hypnosis have a sound understanding of its mechanisms, and to critically examine the prospects and limitations of the utilization of hypnotic suggestion as an experimental tool. Taken within this context, Graham Jamieson's edited volume, *Hypnosis and conscious states: A cognitive neuroscience perspective* fulfils a much-needed gap in this literature and is a welcome contribution to this nascent area of neuroscience. In what follows, we briefly review the emerging neuroscience of hypnosis through the lens of this book's chapters.

A common concern among cognitive neuroscientists is whether hypnotic responses are real, in the sense of whether highly suggestible individuals are actually experiencing what they report. Although the extent to which the mechanisms underlying hypnotic responses (e.g., hallucinations) parallel those of their referent non-hypnotic responses is not yet fully clear, there is a wealth of data pointing to a close correspondence. Boly et al. (chapter 2), Miltner and Weiss (chapter 4), De Pascalis (chapter 5), and Lynn et al. (chapter 9) review electrophysiological and functional neuroimaging results bearing on this issue. As an example, Derbyshire et al. (2004) found a remarkably close correspondence between the brain activation patterns associated with *real* pain and *hypnotically suggested* pain, both of which included activation of insula, thalamus, and anterior cingulate, inferior parietal, prefrontal, and secondary somatosensory cortices, which comprise a pain network or neuromatrix. In contrast, *imagined* pain was associated with only minimal activation in the insula and anterior cingulate and secondary somatosensory cortices. These results indicate that the neural substrates of hypnotic pain more closely resemble those of actual pain than imagined pain. On the other hand, the cortical activation patterns associated with hypnotic responses are not always equivalent to comparable non-hypnotic responses. For instance, in two functional magnetic resonance imaging (fMRI) studies of hypnotic and conversion arm paralysis (Cojan et al., 2009a, 2009b), Cojan et al. found clear similarities across both types of paralysis that were not observed with simulated paralysis, including activation of the precuneus and changes in its connectivity with motor cortex but also differential activation patterns in the ventromedial prefrontal cortex and the right inferior frontal gyrus. The former findings suggest that both forms of paralysis are occurring through a core process involving the precuneus whereas the latter point to different supporting mechanisms, perhaps those related to changes in monitoring following a hypnotic induction.

The most well attested empirical finding regarding hypnosis is that the general population displays marked individual differences in hypnotic suggestibility. Investigating the determinants of hypnotic suggestibility is a fundamental part of intrinsic hypnosis research and some preliminary evidence has been gained regarding its genetic basis and neuroanatomical and electrophysiological characteristics (De Pascalis, chapter 5; Lynn et al., chapter 9). A number of studies have linked hypnotic suggestibility with the catechol-O-methyltransferase (COMT) genetic polymorphism (Lichtenberg et al., 2000, 2004; Szekely et al., 2010), although the effects are not always consistent across genders and the particular allele. These results suggest a basis for the heritability of hypnotic suggestibility (e.g., Morgan et al., 1970) and a link with dopaminergic systems and prefrontal cortical functioning (see also Lichtenberg et al., 2008).

There is also evidence that high hypnotic suggestibility is associated with an increased rostrum in the corpus callosum, which would presumably support greater information