Consciousness and Cognition 19 (2010) 230–234

Contents lists available at ScienceDirect

Consciousness and Cognition

journal homepage: www.elsevier.com/locate/concog

Hypnosis and hemispheric asymmetry

Peter L.N. Naish *

Dept. of Psychology, The Open University, Briggs Building, Walton Hall, Milton Keynes MK7 6AA, United Kingdom

ARTICLE INFO

Article history:
Received 19 May 2009
Available online 8 November 2009

Keywords:
Hypnosis
Hemispheric asymmetry
Temporal order judgement
Global–local

ABSTRACT

Participants of low and high hypnotic susceptibility were tested on a temporal order judgement task, both with and without hypnosis. Judgements were made of the order of presentation of light flashes appearing in first one hemi-field then the other. There were differences in the inter-stimulus intervals required accurately to report the order, depending upon which hemi-field led. This asymmetry was most marked in hypnotically susceptible participants and reversed when they were hypnotised. This implies not only that brain activity changes in hypnosis, but also that there is a difference in brain function between people of low and high hypnotic susceptibility. The latter exhibited a faster-acting left hemisphere in the waking state, but faster right when hypnotised.

1. Introduction

For much of the latter part of the 20th Century hypnosis research and theory were influenced by the fact that typical 'hypnotic' phenomena are subjective, and hence unverifiable. Even observable behaviour, such as a participant's arm gradually lifting following suggestions that it was getting lighter, could in principle be faked since it was not possible for a researcher to know whether the action was 'real' or a deliberate attempt at deception (Orne, 1979). 'Real' in this context can be treated as meaning 'believed in by the participant'. Thus, Wagstaff (1981, 1986) proposed that a person being given hypnotic suggestions would attempt to use strategies to imagine those suggestions vividly, then (wrongly) attribute the experience to 'being hypnotised'. He proposed that not all were able to perform this self-deception, so they might proceed to act-out the suggestions through simple compliance to the perceived wishes of the experimenter.

The advent of functional-imaging techniques has clarified the reality issue somewhat. For example, hypnotically-induced experiences in both hearing (Szechtman, Woody, Bowers, & Nahmias, 1998) and vision (Kosslyn, Thompson, Costantini-Ferrando, Alpert, & Spiegel, 2000) appear to have neural correlates that are more akin to those of real experiences than to imagining. Blakemore, Oakley, and Frith (2003) compared neural activity associated with either hypnotically-induced movement (of a finger, rather than a whole arm) or with deliberate, voluntary movement. The hypnotic movement (experienced as 'happening by itself') produced more parietal activity, as would be expected had the movement genuinely been caused by an external agent. These findings all imply that a successful hypnotic participant is able to generate experiences that go beyond simple imagination, although they do not explain how this is achieved.

From early on (e.g., Crawford et al., 1998) scanning studies have implicated the anterior cingulate cortex (ACC) as playing a significant role in hypnosis, suggesting that the process involves an unusual deployment of attentional resources. Also, changes in gamma-band EEG during hypnosis have been interpreted as revealing a reduction in connectivity between brain regions (Fingelkurts, Fingelkurts, Kalio, & Revonsuo, 2007). Overall, results can be described as supporting a long-standing description of hypnosis: that it involves an abandonment of reality testing. In line with this, many researchers have

* Tel.: +44 (0) 1908 654485; fax: +44 (0) 1908 654167.
E-mail addresses: p.naish@open.ac.uk, pnaish@psych2000.fsnet.co.uk

1053-8100/$ - see front matter © 2009 Elsevier Inc. All rights reserved.
doi:10.1016/j.concog.2009.10.003

concluded that highly susceptible participants (commonly known as 'Highs', while the unresponsive are termed 'Lows') achieve their experiences by being adept at focusing attention strategically and keeping some key material out of attention (e.g., Barber, Spanos, & Chaves, 1974; Crawford & Gruzelier, 1992; Hilgard, 1977).

The distinction between Highs and Lows invites enquiry into how or why they differ. Apart from their responsiveness to hypnosis, there are no very obvious differences between the two groups and, because correlations between susceptibility and other variables are low, Highs and Lows have to be selected by screening with hypnotic susceptibility tests. Nevertheless, it is tempting to speculate that there may be subtle neural differences between those who can achieve hypnotic effects and those who cannot, differences that may be detectable without recourse to hypnosis. A recently reported diffusion tensor imaging study (Dennis, Gabrieli, Whitfield-Gabrieli, Haas, Spiegel, & Hoeft, unpublished 2008 conference poster) showed that hypnotic Highs have greater functional connectivity between dorsal ACC and the left dorso-lateral prefrontal cortex. The authors speculate that this may facilitate the alteration of sensory and motor functions in hypnosis, but do not comment upon the possibility of behavioural differences outside hypnosis. The studies of Gruzelier and colleagues (see Gruzelier (2006) for a review) lend support to the idea that Highs have a particular asymmetry in brain function, showing that in hypnosis left hemispheric activity is reduced, leaving the right to predominate. These shifts were demonstrated behaviourally in a haptic shape-discrimination task. Outside hypnosis, the right hand (left hemisphere) advantage in this task was more marked in Highs, but hypnosis brought about a left hand improvement which was correlated with depth of hypnosis.

The hemispheric effects highlight another difference that awaits full explanation; not only is there a difference between Lows and Highs, but also between the conditions of waking and hypnosis. (Note: 'waking' is frequently used to distinguish from hypnotised, but does not imply that the latter is akin to sleep.) One approach to the issue would be to claim that there is no waking/hypnosis difference. This position is based on the fact that people pass almost as many susceptibility test items when simply asked to imagine what is suggested, as they do when the suggestions are delivered in a formal hypnosis session (Kirsch, 1997; Kirsch & Braffman, 2001). It is not intended in this paper to address the questions of whether a hypnotic induction actually effects any changes, nor whether asking a High to imagine is tantamount to performing hypnosis. Instead, based on the non-controversial observation that Highs are able to switch from interacting with a veridically perceived world to having vivid, but unreal experiences, two questions are asked. First, is the switch associated with a distinctive change in brain behaviour, and second, does their normal brain state differ from that of Lows? For convenience, 'hypnosis' and allied terms will continue to be used, but the parsimonious reader may prefer to interpret them as mere labels for any situation in which suggestible people can achieve the effects traditionally described as 'hypnotic'.

The findings discussed earlier suggest that Highs may have more flexibility within the left hemisphere than do Lows, perhaps leading to more effective processing in this hemisphere during the waking state, but permitting some degree of disconnection during hypnosis. It would be valuable to be able to test this suggestion with a simple technique, rather than resorting to scanning or EEG technologies, but with a more sensitive task than sorting objects by feel, as used in the Gruzelier (2006) study. The task that was chosen uses temporal order judgements (TOJ).

In a typical TOJ study two visual items are presented, one in each hemi-field, with some small inter-stimulus interval (ISI) between the presentations; the participant is required to decide which item was presented first. Whether it is the left or the right event that leads, the sizes of ISI required to detect the order are generally broadly similar, although with a tendency for a shorter ISI when the left visual field (LVF) leads (Stelmach & Herdman, 1991). However, the task has been used in situations leading to a greater difference in ISIs. It has been shown, for example, that neglect patients have a marked asymmetry, requiring a much longer lead time when the first event occurs in the contra-lesional hemi-field (Rorden, Mattingley, Karnath, & Driver, 1997). Additionally, the task appears to be able to identify children with reduced ability for sustained attention (as with ADHD) who prove to be relatively slow at detecting items appearing in the LVF (Dobler, Anker, Gilmore, Atkinson, & Manly, 2005). Thus, this form of TOJ task appears to be sufficiently sensitive to detect hemispheric asymmetries, and moreover, being simple enough for children to perform, lends itself to use within hypnosis, where a highly complex task might be undesirable.

It was hypothesised that, in the waking state, when the leading stimulus occurred in the right hemi-field, highly hypnotisable participants would demonstrate their putative left hemisphere advantage by being more successful than Lows at making TOJs. However, if hypnosis resulted in the Highs reducing left hemisphere activity, their right-leading superiority would then be reduced.

2. Method

After giving informed consent, students attending an Open University Summer School were screened, using a standard hypnotic susceptibility test (Waterloo-Stanford Group Scale C; Bowers, 1998). Ten high scorers and 10 low were selected to participate in the study; all were right handed.

Stimuli were presented using two red light emitting diodes (LEDs) mounted on a pair of spectacle frames. One LED was placed on each outer edge of the frame, such that it was visible only with the adjacent eye. Positioning was near the outer corner of the eye, so that each LED delivered a stimulus to the corresponding hemi-field. Stimuli comprised 1 ms flashes of the LEDs, presented sequentially, either left–right or right–left. The participant then responded by pressing a left- or right-hand button, indicating that the left or right LED had flashed first. If the presentations appeared simultaneous the participant pressed both buttons simultaneously. Following the response there was a 2 s delay before the next stimulus pair was