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ALTERED STATES OF CONSCIOUSNESS AND HYPNOSIS IN THE TWENTY-FIRST CENTURY

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Abstract

The contemporary perspective on altered states of conscious is surveyed as an introduction to commentaries on Kallio and Revonsuo's lead article in *Contemporary Hypnosis* (2003). It is noted that the study of consciousness, unconscious processing, and altered states of consciousness are central issues in neuroscience, heralding fresh approaches to the neuroscientific understanding of hypnosis. These include attempts to bring together new neurophysiological methods with phenomenological report. The alteration in hypnosis of anterior brain processes including the anterior cingulated cortex and left dorsolateral prefrontal cortex are particularly productive areas of research. The lack of engagement with neuroscientific evidence from theorists with a purely social and cognitive orientation to hypnosis is noted, with examples provided from research on attention and relaxation. Unifying the field awaits active collaboration between scientists with neurophysiological and social orientations.

Key words: altered states of consciousness, attention, frontal lobe, hypnosis, relaxation

Introduction

In this issue commentaries are provided on Sakari Kallio and Antti Revonsuo's theoretical article in *Contemporary Hypnosis* (2003) 'Hypnotic phenomena and altered states of consciousness: a multilevel framework of description and explanation'. The writer is in sympathy with a number of their viewpoints.

The contemporary perspective on Altered States of Consciousness (ASC)

The neuroscience of ASC has come in from the cold, largely because the scientific study of consciousness, per se, has for a decade moved centre stage in cognitive and affective neuroscience (Gazzaniga, 2000; Mesulam, 2000; Zeman, 2001). Consciousness is inextricably bound to first person experience. Historically, though phenomenological report was the essential preoccupation of the foundational beginnings of psychology as a science, it was outlawed during much of the twentieth century when scientists were in the thrall of behaviourism and black box experimental psychology. While making a brief reappearance in the 1960s, phenomenological report is again heralded, this time in tandem with objective measures in fields such as psychophysics, metabolic brain imaging and psychophysiology. The EEG, once useful in times past in defining stages of sleep and in providing evidence of seizure discharge, is undergoing a renaissance and together with

MEG is making insightful contributions in the underpinning of cognitive functions through the examination of the role of oscillations throughout the EEG spectrum, but notably the gamma rhythm with its potential for elucidating the binding problem in consciousness (Singer and Gray, 1995; Varela, 1995). This takes us way beyond the foundational work that applied EEG to hypnosis and which measured levels of consciousness in a purely activational sense using as an analogy the alteration of consciousness in sleep.

In the light of these developments we can anticipate a new generation of electrophysiological studies of hypnosis. To provide one example, Croft, Williams, Haenschel and Gruzelier (2002) have shown that as the intensity of painful stimuli increased, so did the amplitude of gamma oscillations recorded over prefrontal cortex. Source localization procedures indicated that the generator was in the anterior cingulated cortex, historically regarded as limbic cortex. Following an hypnotic induction, however, this relation no longer held in hypnotically highly susceptible participants who experienced both hypnosis and analgesia, though it was unaltered in those with low susceptibility who did not experience hypnosis or analgesia. Importantly the hypnotic experience was paralleled by a dissociation between the brain's response to the painful stimuli and the subjective experience of pain.

In cognitive neuroscience strides have also been made through the realization of the importance of unconscious processing as a determinant of everyday behaviour.

> Everyday conscious awareness is but the tip of an iceberg, underneath which there is a realm of relatively uncharted processes, which are likely to be just as complex as those of so-called altered states of consciousness (ASC) which have currently tended to defy systematic elucidation; the brain is functionally in a constant state of flux and alteration (Vaitl, Birbaumer, Gruzelier, Jamieson, Kotchoubey, Kübler, Lehmann, Miltner, Ott, Pütz, Sammer, Strauch, Strehl, Wackermann, Weiss, in press).

Studies with a range of methods in healthy subjects have shown conclusive evidence of how information which is not processed consciously can determine future actions, and particularly motivation (Gazzaniga, 2000; Mesulam, 2000). The question is raised from this perspective as to whether a neurocognitive reframing of Eriksonian dynamics, recently embraced by social theorists (Lynn and Hallquist, 2004), is perhaps not too short a step away?

Coincidentally ASC are coming out of the wilderness of 'fringe' concerns. From 1998 the writer belonged to a German six-year funded consortium on Altered States of Consciousness, which in the author's case included research on hypnosis and schizotypal unreality experiences. The fruits of our consortium are published in the January issue 2005 of *Psychological Bulletin* (Vaitl, Birbaumer, Gruzelier et al., in press). To give the contemporary flavour of ASC, the encompass of the review can best be conveyed by paraphrasing the following catalogue from the abstract of the article:

(a) occurring spontaneously (drowsiness, daydreaming, hypnagogia, sleep, dreaming and near-death-experiences);
(b) evoked by physical and physiological stimulation (pressure, temperature, starvation/diet, sexual activity/orgasm, and respiratory maneuvers),
(c) induced by psychological means (sensory deprivation/homogenization/overload, drumming, dancing, relaxation, meditation, hypnosis, and biofeedback); and
(d) caused by diseases (psychosis, coma, vegetative state, and epilepsy).

The emphasis was on psychological and neurobiological investigations while inclusion required in most cases consideration of more than one level of enquiry, with

levels ranging from the subjective to the biological. We specifically did not include pharmacologically induced ASC. As an aid to clarification and future research including hypnosis, our phenomenological analysis characterized four dimensions: activation, awareness span, self-awareness and sensory dynamics. The review disclosed that as well as arising from compromised brain structure, different states of consciousness mainly arose from transient changes in brain dynamics such as disconnectivity, and changes in neurochemical and metabolic processes. At a more subtle level of brain functioning, conscious experience could also be altered temporarily by environmental stimuli and their restriction, mental practices and techniques of self-control.

The reawakening of interest in ASC will offer new perspectives and will facilitate the revisiting of old considerations in a fresh way. As observed before, an example may be given by reconsidering the striking parallels between hypnosis and dreaming for the processes involved. In Llinas and Pare's model (1991) dissociations between specific and nonspecific thalamocortical systems underpin dreaming, which is conceptualized as a state of hyperattentiveness to intrinsic activity, without registering sensory input. Consider Fuster's (1995) description of cognitive features of dreaming which include the altered sense of time and absence of temporality, the lack of guiding reality and critical judgement, the anchoring in personal experience, affective colouring and dissociation from sensory input and context. 'The fragmented networks activated in the dream seem to lack the associative links to a time frame, anchored as they are in the present, without time tags and references. This could equally be a description of the hypnotic state as high susceptibles experience it' (Gruzelier, 1998: 18).

Evidence for an ASC in hypnosis

Aside from neutral hypnosis, attempts are being made to map brain states evoked by specific challenges involving discrete phenomena that contribute to the domain of hypnosis, and unambiguously reside within ASC. These for example include hypnotic visual hallucinations and analgesia (e.g. Crawford, Knebel, Kaplan, Vendenia, Xie, Jamison and Pribram, 1998; Wik, Fischer, Bragee, Finer and Frederikson, 1999; Faymonville, Laureys, Degueldre, Delfiore, Luxen, Franck, Lamy and Maquet, 2000; De Pascalis, Magurano, Bellusci and Chen, 2001; Rainville, Duncan and Price, 2002; Ray, Keil, Mikuteit, Bongartz and Elbert, 2002; Spiegel, 2003; Derbyshire, Whalley, Stenger and Oakley, 2004).

In the case of neutral hypnosis, modest attempts have been offered (Gruzelier, 1998, 2004), to begin to capture that state of altered brain functional organization which represents neutral hypnosis when it is induced by classical hypnotic relaxation procedures, and to approach the temporal nature of the process (see Ray and De Pascalis, 2003, who tested an aspect of the model with affirmative results).

The greater investment of research has involved investigation of altered and disconnected frontal functions with hypnosis. It would appear that Kallio and Revensuo (page 46, this volume) have some sympathy for the findings: 'So far we believe that the neural correlates of the ASC of hypnosis might be found in the changed activity of the frontal areas (e.g. Gruzelier, 1998, 2000)'. Evidence in support of frontal alterations will not be gone in to here (see Gruzelier, 1998, 2000, 2004 and for recent empirical evidence see Croft et al., 2002; Gruzelier, Gray and Horn, 2002; Egner, Jamieson and Gruzelier, 2005). But this is not a flash in the pan as exemplified by the range of measures used which included event related potentials (Jutai, Gruzelier, Golds and Thomas, 1993; Kaiser, Barker, Haenschel, Baldeweg and Gruzelier, 1997; Gruzelier et al., 2002); EEG

coherence (Gruzelier, 1998; Egner et al., 2005); gamma oscillations (Croft et al., 2002); haptic sorting (Gruzelier, Brow, Perry, Rhonder and Thomas, 1984; Cikurel and Gruzelier, 1990); word and design fluency tasks (Gruzelier and Warren, 1993; Kallio, Revonsuo, Hamalainen, Markela and Gruzelier, 2001) and fMRI (Egner et al., 2005).

Two regions frequently implicated have been the anterior cingulate cortex (ACC), which is of central relevance to hypnotic analgesia, and the left dorsolateral prefrontal cortex (DLPFC), with evidence of decoupling between the two (Egner et al., 2005). While there is more neurophysiologically to hypnosis than this (e.g. Gruzelier, 1998; Rainville, Hofbauer, Bushnell, Duncan and Price, 2002), one cannot turn a blind eye to the involvement of the ACC and DLPFC.

Engaging with the evidence

What is conveyed by Kallio and Revonsuo's lucid discourse, and the conflicting view points in the commentaries on their article in this issue, is an impasse in the field between state and nonstate hypnosis theorists. One of the primary reasons in the writer's opinion for the current impasse is one of lack of engagement with the neurocognitive evidence. This is due in turn to differences in pedagogical background and to the complexity of the more reductionist levels of explanation such as the neuroscientific. As has been spontaneously admitted by virtually all the nonstate proponents that I have met, the neuroscientific evidence is beyond their field. As one manifestation of this, carry out a citation search and this will disclose virtually no discussion by those representing the so-called sociocognitive school of the more than 30 empirical and theoretical articles I have published. Now, while it is one thing to make the admission of a lack of understanding, it is quite unscientific to opine that there is no evidence for an ASC perspective, and to go on and attribute hypnosis to purely psychological constructs. Especially when this flies in the face of evidence which contradicts such a restrictive attribution (Gruzelier, 2000).

Those who prefer a nonstate perspective commonly attribute background alterations in brain function in hypnosis to focussed attention and/or to relaxation. This is based on wishful thinking rather than on any scientific analysis of neurocognitive evidence. Some of this 'unacknowledged' ground has been covered before in *Contemporary Hypnosis* (Gruzelier, 2000: 57) and is paraphrased here. Examples of just two processes will be given.

Focussed attention

Our evidence contradicts the view that when responding to instructions of hypnosis the shifting and focussing of attention is no more than the ordinary processes of selective attention. This evidence comes from measuring electrodermal orienting responses and auditory event-related cortical potentials, both of which are not susceptible to self-regulation without extensive training. The attention of highly susceptible subjects when responding to instructions of hypnosis we found to differ from their attention when absorbed in a story and from when they were deeply relaxed. It also differed from simulation of hypnosis and it was different from the attention of subjects with low susceptibility who were responding to instructions of hypnosis (Gruzelier and Brow, 1985; Gruzelier, Allison and Conway, 1988; Jutai et al., 1993; Gruzelier, 1998).

Relaxation

Alterations of brain function resulting from hypnosis in highly susceptible subjects have been distinguished from relaxation in the following ways:

1 Electrodermal orienting responses of fronto-limbic origin differentiated hypnosis from a relaxation control condition which had been experienced a month earlier or later than the hypnosis session, and there were no differences in levels of tonic arousal indexing sympathetic autonomic activity (Gruzelier and Brow, 1985).
2 The pattern of response during hypnosis also differentiated subjects who simulated hypnosis (Gruzelier et al., 1988).
3 A left to right anterior hemispheric shift in hypnosis disclosed with a haptic sorting task requiring the identification of objects through active touch while blind folded (Gruzelier, Brow, Perry, Rhonder and Thomas, 1984) withstood an *active-alert* induction whereby subjects pedalled a stationary bicycle while following instructions of hypnosis with suggestions of mental invigoration (Cikurel and Gruzelier, 1990).
4 The lateral shift with hypnosis in the haptic task was also differentiated from relaxation by comparing performance with relaxation in a floatation tank (Raab and Gruzelier, 1994). Whereas with hypnosis there was a decline (inhibition) of left hemispheric processing, the degree of which correlated with the scale of hypnotic depth obtained during the task (Gruzelier et al., 1984), this left anterior relation was absent with floatation, yet floatation shared with hypnosis a right hemispheric enhancement in haptic processing. These dynamics with floatation were also mirrored in lateralized recognition memory tasks (Raab and Gruzelier, 1994).
5 Alpha and theta activity have also distinguished hypnosis from the effects of relaxation, not only during hypnosis but after 'dehypnosis' (Williams and Gruzelier, 2001). (Gruzelier, 2000: 57)

Unification of the hypnosis field and understanding

Consideration of levels of explanation by Kallio and Revonsuo (2003), also entertained by Hasegawa and Jamieson (2002) from my laboratory, is helpful in this regard. However, just as it is clear that the phenomenological level is of fundamental importance to hypnosis as it is to ASC in general, and the methodological innovations of McConkey (McConkey, Wende, Barnier, 1999) are welcomed, it is also clear that ASC require biological changes that are different from ordinary SC. Theoretical differences between social and physiological theories of hypnosis are not simply a difference in levels of explanation.

In fact an integrated multilevel approach has been the underlying ethos of our research exemplified by a neurocognitive translation of the psychophysiological and neuropsychological results (Gruzelier et al., 1984; Gruzelier, 1998). This has been an attempt to gain an understanding of the hypnotic induction process, and in so doing tackle the question of why we induce hypnosis the way we do from a neurocognitive perspective.

As indicated earlier, and echoed here by Lynn, much, much more can be gained towards the goal of unification. Perhaps this may be accomplished not only through open-minded discussion and interaction, but best of all by formulating investigations by neurophysiologists, cognitive and social psychologists collaboratively.

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