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HYPNOSIS AND CONSCIOUSNESS: A STRUCTURAL MODEL

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Abstract

A model of consciousness and hypnosis is presented which has its origins in a series of neuropsychological studies on the role of neocortex in associative learning and memory in animals. It is essentially an evolutionary and hierarchical description of increasingly more sophisticated levels of information processing in vertebrate brains which places the more recently evolved systems that are associated with subjective experience into a more meaningful perspective. With the evolution of representational systems (consciousness systems) with the capacity for parallel processing a need was created for an executive control system to prioritize some currently active representations as the basis for action, particularly in novel situations. Consequently, a major function of the executive control system is in the re-representation of a selected subset of these representations for further processing in a subsystem (self-awareness system) with priority access to action. Representations that enter the latter subsystem constitute the contents of our subjective experience. In hypnosis, it is argued, influence is exerted through the executive control system to orchestrate the re-representation of information into the self-awareness system and hence to influence the nature of subjective experience. Important among the pressures acting on the executive control system are those identified by sociocognitive theories as capable of influencing hypnotic enactment and experience.

Key words: hypnosis, consciousness, self-awareness, executive control system, neuropsychology, neo-state

Introduction

The model of consciousness presented here commences from some very basic neuropsychological observations on the mental capacity of animals. This bottom-up perspective places more emphasis on the totality of representational processes in brains and less on those parts of our mental activity of which we are subjectively aware. It elevates to what I will argue to be their proper place those processes which were once demeaned by labels such as ‘unconscious’ or ‘preconscious’ and acts as a corrective to our habitual emphasis on the primacy of subjective experience. This emphasis is understandable if we approach the question of consciousness from the perspective of our own experience and work downwards, but it is less tenable from the perspective of the evolution of mental processes. I propose that this view from below allows us to make far more sense of consciousness generally and of the subjective phenomena of hypnosis in particular.

Consciousness viewed from below

A striking feature of the evolution of vertebrate brains has been the expansion of neocortex, the neural tissue which forms the surface layers of the cerebral hemispheres. It is a development that has been accompanied by an expansion in mental processing capacity, increased capability for learning and memory, behavioural flexibility and, as far as we know, a broadening of the horizons of consciousness. Some earlier investigations of the relationship between neocortex and adaptive behaviour centred on associative learning and memory in rats and rabbits both with neocortex present and with neocortex surgically removed (Oakley, 1979a, 1983). Even with neocortex totally removed, Pavlovian conditioning, differentiation and reversal, both in the orthodox version (Oakley and Russell, 1976) and in the variant known as autoshaping (Oakley, Eames, Jacobs, Davey and Cleland, 1981), were not only possible but were, if anything, somewhat enhanced. Furthermore, training animals first and then removing neocortex did not disturb the conditioned responses that had already been acquired (Oakley and Russell, 1977). Similarly with instrumental learning, rats and rabbits without neocortex would produce exemplary performance on fixed-ratio schedules in a Skinner box (Oakley and Russell, 1978; Oakley, 1980), in alleyways for food reward (Oakley, 1979b) and in the most complex of Lashley's mazes (Eames and Oakley, 1985).

It would seem evident that neocortex has not evolved to subserve these kinds of flexible and adaptive behaviours, which require associations between the central representations of two or more stimuli or between stimuli and responses. Neocortex might be supposed to subserve more complex manipulations of representations which underlie the processes of perceiving, reasoning, planning, thinking and the formation of personalized biographical (episodic) memories – the safe internal modelling and experimentation that is the domain of cognitive psychology (Oakley, 1979a, 1985).

Labelling the categories of awareness

Before progressing further I would like to offer some labels for the various levels of information processing in order to address more directly the question of consciousness (for a fuller account see Oakley, 1985). First, there is a general capacity of animals to respond appropriately to stimuli originating from outside or within themselves, which I will label 'awareness'. Exemplars of 'simple awareness' in mammalian brains are reflex systems, homeostatic systems and also the associative learning and memory systems (Pavlovian conditioning and instrumental learning) which appear to be adequately served by subcortical tissue.

For those more complex representational systems which underlie personal memories, thinking, reasoning, and so on, in other animals as well as ourselves the label 'consciousness' seems appropriate – this would be very much in line with those comparative psychologists who have equated the interpolation of central modelling or 'imagery' between stimuli and responses as a definition of animal consciousness (for example, Griffin, 1976; Jerison, 1985).

Consciousness alone is not enough

The consciousness system described above is intelligent, carries out a wide range of cognitive processes, can make decisions and can form and execute plans. It is as self-sufficient within its own domain as subcortical, simple awareness systems seemed to

be in the domain of reflexes, homeostatic processes and associative mechanisms of learning and memory. Clearly, our hypothetical evolutionary process could stop at this point, but at least two considerations suggest that it shouldn't, and didn't. One reason is a practical one faced by the animal with a rapidly expanding capacity for information processing, where a variety of mental processes and a multiplicity of tasks, such as problem solving, could potentially occur in parallel. The problem lies in the relatively limited range of options an animal has for acting on the outcome of these various mental activities. The other is that the description so far says nothing of what we as humans hold most dear – our subjective awareness of our own mental activity (or at least a part of that activity) and our capacity for voluntary action. On the first of these counts there seems to be an evolutionary need to develop a privileged processing system with priority over action – where the most important actions and best solutions can be selected and implemented without interference from competing mental processes taking place in the burgeoning consciousness system. Possibly also there is a need for this newer, lower-capacity, privileged system to have a different style of processing – more linear and analytical: a style of thinking that is deliberate and affect-free, corresponding to the 'rational' system of mental activity in Epstein's (1990) Cognitive-Experiential Self-Theory (CEST). This is in contrast to the much higher-capacity, more holistic, affect-laden and intuitive style of the phylogenetically older consciousness system. This more fundamental system corresponds to the 'experiential' system in CEST and is associated with gut-feelings, creativity, imagery and more metaphoric representations. This analytical/holistic (rational/experiential) distinction is explored further in Brown and Oakley (1997).

I have previously suggested (Oakley, 1985, Oakley and Eames, 1985) that brains did indeed solve this practical problem by designating a part of their neocortical processing space as a 'priority action system' where those representations in the consciousness system that were relevant to the most urgent environmental, or other, challenge, could be re-represented and form the basis for voluntary action. This suggestion also 'solved' the question of subjective experience. It is assumed that the contents of this specialized subsystem have the unique property which we identify as subjective experience; and actions which result from its operation are experienced as voluntary. I labelled the re-representational, priority action system as 'self-awareness'. An important point to note here is that the consciousness system contains the vast majority of the cognitive processing which is taking place in a given brain at any one time. Only a small proportion of that activity is re-represented in self-awareness, thereby becoming the content of our subjective experience.

A second important part of this view is that the decision of what to place in this priority action system comes from within the consciousness system and not from within self-awareness. In its earlier form the model did not identify any structure or system within consciousness systems which was responsible for the decision to re-represent selected information to self-awareness. What is needed is some form of executive control system similar to the Executive Ego of Hilgard (1977). As this is a more recently evolved part of the consciousness system it would also be fitting if it were to be located in the newly evolved frontal cortex. More recently, Shallice (1988) has used data from neuropsychology to describe the 'supervisory attentional system' (SAS), an executive control system which generates actions based in subjective experience and which are experienced as willed actions. According to Shallice, the SAS is active when:

- Planning and decision making are required
- Carrying out poorly learned or novel action sequences
- Engaging in dangerous or technically difficult actions
- Inhibiting a strong or habitual response
- Resisting temptation.

An important aspect of the action of the SAS is to sustain focused attention and to facilitate disattention to extraneous stimuli. The SAS is based in large part in frontal cortex and its functions are clearly similar to those of the proposed executive control system in the present model. They are also the capacities needed to engage in hypnotic procedures and would be expected to be well developed in highly hypnotizable individuals (Gruzelier, 1998).

In Shallice's model, however, the SAS was *not* involved in re-representing information into a separate self-awareness subsystem but was concerned with the regulation of lower-level cognitive structures (see to the left of the bold dotted line in Figure 1). Subordinate to the SAS there are schemata (simple programmes – especially of acts or part acts such as operating the brake or clutch pedal of a car) above which are 'scripts' or 'memory organization packets' (MOPs) which are concerned with more complex sequences (such as turning right at a road junction). Routine actions can be initiated from this lower-level system automatically through environmental inputs (arrows to lower left of Figure 1) by the process of 'contention scheduling' and these actions are experienced as occurring without being intentionally willed. The latter is most easily seen on occasions when these schemata and MOPs are inappropriately 'captured' by environmental stimuli or events, leading to what Reason (1979) called 'actions-not-as-planned'. An example of this might be that of absent-mindedly unwrapping a sweet, throwing the sweet into the wastepaper bin and putting the wrapper into one's mouth. Mostly, however, MOPs serve us well, saving us from having to expend our limited attentional resources on routine activities. For an experienced driver, as the earlier examples suggested, the process of controlling a car is conducted largely through contention scheduling.

Not all situations can be met adequately by routine actions though and, to save us from complete dependence on MOPs, habits and contention scheduling, overall control is provided by the SAS. The SAS moderates the activation of lower-level systems to orchestrate novel responses and to execute more deliberately planned behaviours (lower left of Figure 1). It is an important implication of Shallice's model that any processing through the SAS is subjectively experienced and any actions which ensue are experienced as voluntary. However, for the reasons outlined above I would wish to distinguish self-awareness from the actions of the executive control system, tentatively indentified here as the SAS, and suggest that, while the SAS is responsible for determining what enters subjective experience, the activities of the SAS do not form part of that experience. Specifically, the model being proposed in this paper has the additional layer shown to the right of the bold dotted line in Figure 1. The executive control system has the role of selecting currently active representations for re-representation in the self-awareness system – at which point (and not before) the representations become available as part of the contents of the individual's current subjective experience. Any action that results from the processing of these re-representations in self-awareness in turn is experienced as a planned or 'voluntary' action.

How does all of this relate to hypnosis?

In this model, hetero-hypnosis (that is hypnosis involving a second individual, the 'hypnotist', who directs the procedure) can be seen as a 'contract' between the hypnotist and the individual's consciousness systems to manipulate, through the executive control system, the contents of self-awareness. It is assumed that this process is facilitated by focusing of attention, disattention to extraneous stimuli and absorption in inner mental processes, and that it is dependent, in its early stages at least, on the engagement of frontal (especially left-frontal) cortical attentional systems (Gruzelier, 1998). Hypnotizability may relate to the openness, or flexibility, of the frontal executive control system in responding to externally generated pressures to modify the way in which information is passed from consciousness to self-awareness.

In more dramatic terms the hypnotic procedure could be seen as a way of 'hacking into' the executive control system and influencing its decision making. Where the control over subjective experience and voluntary action is concerned it is as though the subject's executive control system becomes extended, or its boundaries blurred, to include within it influences from an outside source. This would be congruent with a hypnosis experience in which there is a partial relinquishing of planning functions – where the hypnotized individual would rather follow ideas than initiate them, would rather be passive than active. In the case of self-hypnosis and hysteria, neither of which will be considered further in this paper, it could be said that a similar 'contract' is formed unilaterally within consciousness systems and again outside the realm of self-awareness (for further discussion in relation to conversion hysteria see Oakley, 1999).

If we accept the view that the consciousness systems are intelligent and have the capacity through their incorporation of an executive control system to influence the entry of information into the self-awareness system, or in the case of actions to bypass it or inhibit its motor outflows, it is a simple matter to describe the production of hypnotic experiences. The various possibilities are shown in Figure 1 and numbered 1–4.

They are:

(1) Positive sensory or cognitive phenomena such as hallucinations and age regressions reflect the selective passage of appropriate representations as percepts or in the form of structured narratives into self-awareness where they are experienced as 'real'.
(2) Negative sensory and cognitive phenomena such as hypnotic blindness, deafness, analgesia and amnesia correspond to the withholding of representations from entry into self-awareness.
(3) Negative motor phenomena such as the inhibition of movement, limb paralysis or finger lock can be seen as the result of the inhibition by the central executive of what to the individual are experienced as willed movements (or attempted movements) originating from processing taking place within self-awareness.
(4) The central executive also has the ability to generate motor actions directly from within consciousness systems, and phenomena such as arm levitation produced in this way are experienced by the subject as involuntary.

An important, and testable, aspect of this model is that the changes underlying all of these events are seen as taking place at a late stage of information processing. This

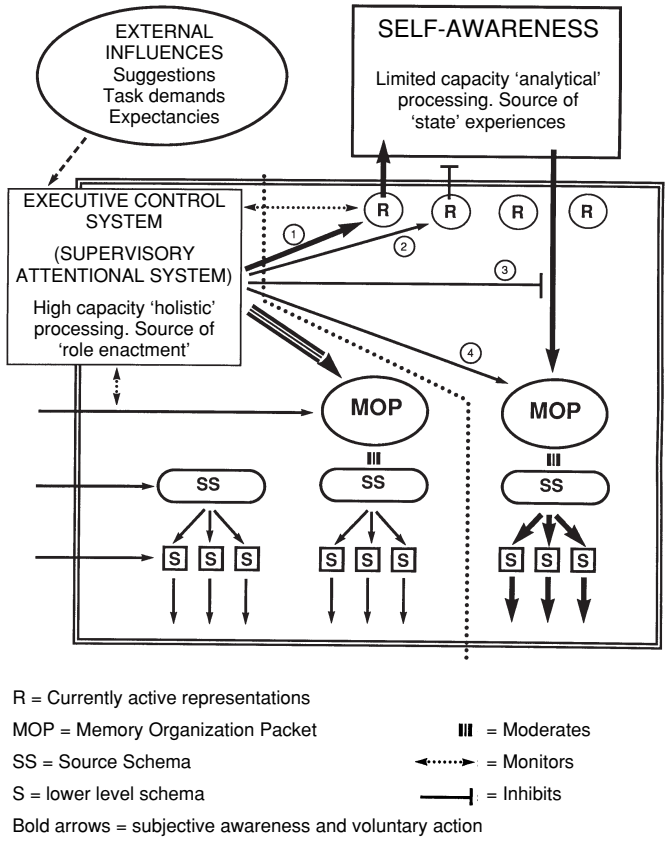

Figure 1. A model of consciousness and self-awareness based on Shallice (1988) and Oakley and Eames (1985) showing the effects of external influences on the executive system's control over the contents of self-awareness. The double-outlined box represents the consciousness system, which incorporates the executive control system. The area of this box to the left of the bold dotted line corresponds to the supervisory attentional system as described by Shallice (1988). See text for further explanation.

is most evident perhaps in the case of positive sensory and cognitive phenomena but is also considered to be true of the corresponding negative effects. In the case of hypnotic amnesia, for example, it is assumed that the phenomenon is not caused by a relatively low-level inhibition or failure of retrieval. Rather it is proposed that the relevant material is in fact retrieved by the consciousness system, and is available to it as the basis for action, but is not made available to subjective experience. Similarly, analgesia is not seen as the product of blocking pain information early in its pathways; rather pain processing is assumed to be complete until its final point of entry into self-awareness. For motor effects, the positive motor phenomena are executed directly through normal systems with the exclusion solely of the self-awareness

system. Negative motor effects such as limb paralysis occur not because of some low-level inhibition of motor processes, but are the product of inhibition after the intention to move has been generated within self-awareness so that only the final stage of carrying out that intention is missing.

Theories of hypnosis and the hypnotic paradox

There are two further aspects of the model which are important in respect to hypnosis. One is that, as already suggested, the cognitive styles of the consciousness and the self-awareness systems may differ and this would be congruent with traditional views that emphasize a shift from analytical to more holistic or experiential styles of information processing in hypnosis (Brown and Oakley, 1997) or that hypnotic susceptibility may reflect a natural tendency to entertain more holistic and emotional modes of thought (Brown and Oakley, 1998).

The other aspect is that the model allows two very different perspectives on the hypnotic experience. From the perspective of the hypnotized individual the events feel involuntary and outside their direct control. The account they give of their experience is very much a state-like one and those, like Hilgard (1977), who have set out to explain hypnotic phenomena starting from the description given by highly hypnotizable subjects will tend towards state-like theories involving amnesic barriers and other dissociative mechanisms. On the other hand, the model allows that external influences, such as those represented by the hypnotist, affect the quality and the content of the hypnotic experience. If it is also accepted that other external influences can operate in much the same way, then social psychological factors such as task demands and expectancies have an important part to play. From this perspective hypnotic experiences can be described as the result of an enactment, a role-play or the product of compliance – which, of course, at the level of the consciousness system and its executive control structures, is exactly what they are. Consequently, those researchers who have looked primarily at the factors that influence the hypnotic process at the level of the central executive and consciousness systems, rather than at the subjective experiences of the hypnotized person, have tended towards non-state, sociocognitive accounts (for example, Spanos, 1991; Wagstaff, 1991). The present model thus reconciles the traditional state and non-state views and provides a resolution of the hypnotic paradox that phenomena which are experienced by the individual as 'real' and involuntary can be seen to an outside observer to be the products of compliance and role-play.

Conclusion

In the structural, or neo-state (Oakley, 1998), model presented here, hypnotic influence and suggestion both operate at the level of the executive control system. Suggestion is one of the external influences along with expectancy, task demands, compliance needs, pressure towards role enactment, and so on, which form part of 'hypnotic influence'. State, or dissociation, models generally do not make adequate provision for sociocognitive factors. The self-awareness system experiences hypnotic phenomena in an involuntary, state-like way and, as noted above, if we listen to what 'good' hypnotic subjects tell us of their experience, as clinicians tend to do, we would lean towards 'state' explanations involving dissociation, involuntary actions and amnesic barriers. If, however, we take account of the conditions that are capable of

influencing the content and nature of those subjective experiences, as experimentalists are wont to do, then we would incline towards sociocognitive explanations. In the structural model both views can be accommodated.

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