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REDEFINING HYPNOSIS: THEORY, METHODS AND INTEGRATION

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Abstract

An integration between neurobiological and sociocognitive perspectives is advocated to advance and overhaul the concept of hypnosis and its humanistic applications. The thesis is presented that hypnosis is an altered state of brain functional organization involving interrelations between brain regions initiated by the intervention of the hypnotist – that is, an atypical alteration of brain systems through an interpersonal and cultural context. Experimental evidence shows that the hypnotic process produces a brain state that is different from everyday neurophysiology, as shown by evidence of differential effects of attention and relaxation, and by evidence of cognitive and neurophysiological dissociation, which are central features of hypnosis. The hypnotic induction has a neurophysiological logic involving a temporal process that becomes conditioned to facilitate future induction and self-hypnosis. Our integrative perspective of brain systems in a social context includes a neuropsychological translation of the hypnotic induction and draws out the implications of orbital-frontal suppression for subjects being oblivious to embarrassment and being able to endure stage hypnosis. Wasteful pursuits in the field of hypnosis include the search for a single marker, premature closure of neurophysiological investigation, attributions and inferences such as 'suggestion' and goal-directed striving without validation and without consideration of process and mechanism, and the use of dichotomies such as 'waking' versus 'sleeping'. Recommendations include considerations of multidimensionality regarding trance and levels of susceptibility; the modifiability of susceptibility; formal assessment of social conceptions about hypnosis; concurrent validation of susceptibility during experimental procedures; consideration of both objective and subjective measures of susceptibility together with cross-checking for inconsistencies; the feasibility of control conditions; assessment of processes underpinning suggestibility; distinguishing the social impact of experimental, clinical and stage hypnosis; and assessment of after-effects.

Key words: hypnosis, hypnotizability, neurophysiology, sociocognitive perspective, neurobiological perspective, frontal cortex

Introduction

There is a general consensus that the time for overhauling the concept of hypnosis is long overdue. As Kihlstrom (1992) infers, perhaps this has always been the *Zeitgeist*

since Braid (1960, originally published in 1843, 1970, originally published in 1855). Here it is contended that a new synthesis of neurophysiological and sociocognitive theories from the perspective of cognitive neuroscience, a synthesis that cuts across current schools of thought and the sterility of the 'state/non-state' debate, may offer a way out of the current impasse. Such a synthesis would invite collaboration between cognitive neuroscience and social psychology and would advance humanistic science. In the confines of this essay it will not be possible to take more than a few tentative steps towards a pluralist approach, but signposts and suggestions for methodology will be presented. More narrowly this essay has been invited following the publication of a commentary from a sociocognitive perspective by Wagstaff (1998a) and has initially been structured in response to some of the challenges contained in that commentary and other similar accounts (for example, Kirsch and Lynn, 1998).

The writer is not alone in envisaging potential integration between neurocognitive and sociocognitive perspectives (see Bowers, 1992; Kirmayer, 1992; Perry, 1992; Woody and Sadler, 1998a,b). Wagstaff (1998a: 158) too has seen affinities between the two perspectives, but in general those who begin with sociocognitive hypotheses seem less inclined to accept such possibilities, or opine that neurobiology is mundane in explaining the obvious. Some go further and suggest that concepts such as hypnotic state, special state or trance do not 'point to fruitful topics for research' or even 'inhibit the discovery of new knowledge' (Coe, 1992). This essay is an attempt to provide an alternative to what seems to me to be a particularly restrictive sociocognitive perspective. It outlines some of the experimental evidence that refutes that restrictive position and attempts to remove at least some impediments from reciprocal interaction between disciplines. Such constructive collaboration will not occur easily, not least because various orthodoxies in hypnosis research will be challenged along the way.

In what follows criticism will be levelled at both state and non-state approaches. Disagreements will be seen over issues that are held by some state adherents, some non-state adherents, and some issues shared by both. In fact I would agree with Coe (1992) that the concentration on a special state has to some extent inhibited the discovery of knowledge, but not perhaps in the way that that author intended. It is sometimes helpful to have an understanding of a scientist's background. In my own case this is not from within any particular school of hypnosis but rather from interests in other fields.[1]

The 'state/non-state' debate

The death knell of neurobiological investigation: The rush to judgement

Kirsch and Lynn (1998) and Wagstaff (1998a) claim that no marker of a hypnotic state has been discovered after decades of investigation, and that the search for one should be discontinued. A neurobiological explanation does not exist. Neurobiologists may rightly wonder how such an unworldly view exists. Current ideas about brain function, although they gained impetus during the 1990s, are impressive yet primitive. EEG recordings performed in the 1960s to the 1980s (the neurophysiological measure more widely applied to hypnosis over the years) are considerably outmoded by the current renaissance in EEG methodology (Gruzelier, 1996a; Pfurtscheller and Lopes da Silva, 1999), and in no way provide a basis for abdicating an altered state position in favour of psychological explanations of hypnosis. Other forms of functional brain imaging are only just being applied to hypnosis and their methodology is still at a developmental stage. Consider the analogous field of

schizophrenia. This condition is much more intensively researched than hypnosis, and brain imaging approaches are used extensively. Annual meetings are held boasting over a thousand contributions, currently all predominantly with a neurobiological basis, yet there is not a marker in sight. When we understand the neural underpinnings of hypnosis and schizophrenia, will there be much more about brain function to discover? If we understand the neurobiological aspects of consciousness and have not understood hypnosis, then it *will* be time to give up. Woody and Sadler (1998a) have also addressed this unseemly rush to judgement.

The 'process' lacunae: labelling does not explain mechanism

This stricture is exemplified by the diagnosis Wagstaff (1998a) offered for a fascinating case study that was innovatively treated (Davies and Wagstaff, 1991). After the death of her husband a 73-year-old woman was diagnosed with signs of ataxia over the course of three years, but with no evidence of an organic cause. She was successfully treated with guided imagery and the suggestion that she could walk normally. According to Wagstaff (1998a: 150), there were only two possibilities for how the treatment worked: the patient 'feigned the symptoms to gain attention after the death of her husband' – what sociologists and health psychologists call assuming 'the sickness role' and what clinicians call 'malingering'; or, alternatively, the patient genuinely believed that she could not walk – a mistaken attribution. Either way there was no need to propose an underlying neurophysiological condition.

This type of condition is common in neurology and is termed hysterical conversion. Without addressing the whys and wherefores of such a diagnosis, what is missing, not only from a sociocognitive analysis but also from the neurological diagnosis of conversion hysteria, is any explanation of how psychological factors, whether they be hysteria, mistaken attributions or anything else, could lead to the physiological outcome. In other words, the 'process' is missing. This is not an isolated example or idiosyncratic failing, for it characterizes virtually all the literature on the role of suggestion in the treatment of illness. Suggestion, for instance, is the process inherent in the placebo effect. A century of sociocognitive and medical theorizing and the explaining away of phenomena as a placebo effect has in a curious way closed the door on further thought and enquiry into the nature of a process whereby suggestion can produce psychophysiological effects, as has been demonstrated (Black, 1963; Black and Friedman, 1965). More pernicious is the consequence that the categorizing of an improvement in health as a placebo effect has diminished the value of suggestion in medical and psychological treatment – universally the placebo effect has negative or even derogatory implications. Insightful empirical contributions about the role of suggestion in hypnosis are unlikely to help in reversing this neglect in the absence of consideration of mechanism. Our time, more than any other, is the age of neurobiology, but what is emergent is the consideration of neurobiology in a social context.

Whereas other psychological processes are giving way to respectable accumulations of knowledge about their neurophysiological underpinnings – as is the case with sensation, perception, mood, attention, learning, memory and even consciousness – the neurophysiology of expectation and suggestion is still an open book. This should not demean the role of such processes in understanding the psyche, although this does reflect a historical tendency – consider the lowly status of the processes of emotion, motivation and expectancy in textbooks of cognitive neuroscience. Promising work is now beginning to disclose the importance of frontal lobe functions in expectancy, in particular the orbital frontal cortex (Schoenbaum, Chiba and Gallagher, 1998; Nobre, Coull, Frith and Mesulam, 1999). It is worth noting that in

the context of researching the role of hypnosis in pain relief, we have found that electroencephalographic (EEG) gamma oscillations recorded over the orbital frontal cortex in the non-hypnosis condition correlate positively with the subjective experience of pain, and this topographical relation shifted away from the frontal region with hypnosis (Croft, Williams and Gruzelier, 2000).

Returning to the Davies and Wagstaff (1991) case study, sociocognitive theory and humanistic science are considered, but what about the patient's perspective? Let us imagine this interpretation applied to the more controversial and well-known condition myalgic encephalomyelitis (ME). ME presents as a profound loss of physical energy and what becomes a chronic inability to carry on life as before, with the need for constant rests after minor physical or mental exertion. It occurs in healthy, often high-achieving people, and afflicts all ages and walks of life. There is no agreed organic explanation. Would an attribution error or malingering prove a satisfactory explanation of the condition? An understandable response by the patient would be outrage at being regarded as a malingerer or a fool or delusional, as has occurred recently in the case of a concert pianist who was on the threshold of an international career. It would seem to make more sense to suspend psychological explanations and moralistic judgements until the search for an underlying neurophysiological cause has been exhausted or a cause has been discovered.

In sum, the sociocognitive analysis ignores the issue of neurocognitive process, which is fundamental to a complete scientific understanding of psychological problems, and by so doing may have the unfortunate propensity for insulting the patient.

The evidence base

In marshalling reasons for a redefinition of hypnosis Wagstaff (1998a) draws on the public's conceptions of the nature of hypnosis. However, irrespective of how many of the public consider hypnosis to be an altered state of consciousness – a sizeable proportion (Wagstaff, 1998a: 150) – a consideration of neurophysiological evidence would surely seem to offer a more plausible evidential base than lay opinion, and have the potential to provide greater insights towards a scientific understanding. Furthermore I would extend this reservation to surveys of practitioners' beliefs (Wagstaff, 1998a 152); in countries without accreditation, such as the UK, hypnosis can be practised without scientific training. In other words objective evidence is preferable to subjective evidence, particularly when the latter is based on lay opinion or the opinion of practitioners with unknown qualifications.

Hypnosis and persuasion in role enactment

The sociocognitive and neurobiological perspectives can usefully combine to facilitate understanding of the various components of the hypnotic procedure. This approach is exemplified by our neuropsychological translation of the induction process (for example, Gruzelier, Brow, Perry, Rhonder and Thomas, 1984; Gruzelier, 1988, 1990, 1998). We propose that the instructions of the conventional hypnotic induction are there for a neurophysiological purpose, and are not simply a cultural artefact to bolster the demonstrable power of contextual suggestion. The commencement of hypnotic induction with fixation and focusing engages left anterior selective attention processes. The suggestions of tiredness at fixation that then follow initiate a process of selective anterior inhibition. This in turn is followed by guided imagery that invokes posterior involvement which is greater on the right than the left side of the brain (Gruzelier, 1998).

Contrary to Wagstaff's claim (1998a: 158) that we were explaining the obvious – specifically that the instructions of hypnosis 'require a left hemispheric analytic process which is replaced by right hemispheric holistic processing' – this was not thought to be the case at the time of our report. First, until we demarcated the left to right hemispheric shift as one dynamic of the hypnotic process (Gruzelier et al., 1984) the delineation of hypnosis as a *temporal process* was rarely considered, let alone accepted, and to our knowledge in an experimental context is unique to our approach. Second, this was the first demonstration of the significance of the left hemisphere for the hypnotic process. Hitherto high susceptible subjects were theorized to be in possession of right hemisphericity and hypnosis simply consolidated and enhanced this ongoing state. In fact in one such demonstration we reported that in non-hypnosis conditions, scheduled as long as one month before the hypnosis session, high susceptibles were shown to manifest left hemispheric functional advantages (Gruzelier and Brow, 1985). Notwithstanding, there is much more to hypnosis than a left to right hemispheric shift (Gruzelier, 1990), as has been outlined previously in this journal (Gruzelier, 1998).

As we have shown with neuropsychological and neurophysiological measures, the enactment of behavioural roles by the subject in response to the hypnotist's instruction is essential to the unfolding of neurophysiological processes. The sequence of instructed behaviour alters everyday relations between the various anterior–posterior, left–right and cortical–subcortical axes of brain functional organization. Such alterations have been shown to fundamentally differentiate high, medium and low susceptibles. However, sensory fixation, relaxation, sleepiness, concentrated attention, suggestion and so on are not an arbitrary mix of instructions that the subject is persuaded to follow. In other words, the traditional induction is not a haphazard assortment of roles that the subject is encouraged to enact, but follows a sequence with a neurophysiological logic – the engaging of anterior left-sided attentional mechanisms, which once engaged can be suppressed, which in turn allows selective inhibition of frontal functions permitting cardinal features of the hypnotic experience such as automaticity and involuntariness to take place. Accordingly, I would go further than Wagstaff, who would replace hypnosis with suggestion. In my view *persuasion* is nearer the mark than suggestion.

Hypnosis and conditioning

The question of how the process is initiated in the absence of the hypnotist, as in auto-hypnosis, is answered with conditioned association. A remarkable neurophysiological demonstration of savings in learning was shown by a schizophrenic patient who was being trained with neurofeedback in the self-regulation of interhemispheric slow potentials across the central motor strip (Gruzelier, Hardman, Wild, Cheesman and Jones, 1999). Initially, learning in response to the associative cue (the letters A or B signifying the direction of the hemispheric shift) was unreliable from session to session, so that after 10 sessions training was suspended. On resuming training three months later when the patient's clinical condition had stabilized, a huge microvolt differentiation between the hemispheres was disclosed, one being four times more than the differentiation shown by controls (Hardman, Gruzelier, Cheesman, Jones, Liddiard, Schleichert and Birbaumer, 1997) and the patient's best performance three months before. This was sustained across 10 further sessions and continued to increase. Theoretically, hypnosis may follow the same principles; the instructions of the hypnotist substituting for the instructions of neurofeedback.

Hypnosis is not a category error, hypnosis is different

Wagstaff (1998a) in the cause of conceptual revision proposed that hypnosis is nothing more than 'a global term' to cover involvement in fulfilling instructions intended to elicit the repertoire of behaviour associated with hypnosis. All of this, he argued, was in the normal repertoire of the individual and was accompanied by nothing more than customary alterations in neurophysiology. In fact to attribute a distinctive process or processes that require a special label or category, such as 'hypnosis', was to make what philosophers term a 'category error', as when the description 'a pair of limbs' is applied to the description of a left arm and a right arm.

Of course inherent in this is the most obvious Achilles' heel of some sociocognitive theorists, namely the inference that hypnotic behaviour is nothing more than the fulfilling of task demands. This fundamentally contradicts the phenomenology of hypnosis in susceptible subjects. Furthermore, in contradiction to the proposal that hypnosis is no different or no more than the ordinary processes of focusing attention, imagining and suchlike, cognitive neuroscience analyses have clearly shown that hypnosis *is different*. Additionally, as mentioned above, the differences are not random and unsystematic, but have helped evolve working models of hypnosis, which in turn have led to predictable results and neuropsychological translations of the instructions, tasks and metaphors of the hypnotic induction process (Gruzelier, 1988, 1990, 1996b, 1998). Consideration of this evidence speaks directly to some of the concerns of sociocognitive theorists.

Attention

When responding to hypnosis instructions, is the shifting and focusing of attention no more than the ordinary processes of selective attention? We have contradictory evidence from measurement of electrodermal orienting responses and auditory event-related cortical potentials, both of which are not susceptible to self-regulation without training. We found the attention of high susceptibles when responding to hypnosis instructions to be: (1) different from their attention when absorbed in a story, (2) different than when they were deeply relaxed, (3) different from simulation of hypnosis, (4) different from the attention of low susceptibles who were responding to hypnosis instructions (Gruzelier and Brow, 1985; Gruzelier, Allison and Conway, 1988; Jutai, Gruzelier, Golds and Thomas, 1993; Gruzelier, 1996b, 1998). This difference may be extended to cover distraction because Miltner, Weiss, Friederich, Trippe and Özcan (2000) have shown, with event-related potentials to painful somatosensory stimuli, that the attention of high susceptibles with hypnosis is different than in a distraction condition.

However, it does not follow that hypnosis involves processes that are outside the normal repertoire of attentional processes. Indeed, our evidence has charted the focusing of attention that occurs in high susceptibles through the engagement of normal anterior attentional mechanisms with event-related potentials. These begin with normal configurations, but become progressively abnormal as the hypnotic induction proceeds (Gruzelier, 1996b). Normal and efficient attention processes are certainly a necessary prerequisite of initiating the induction of hypnosis (Gruzelier, 1988, 1998), but this evidence does not support the claim that hypnosis itself is simply a more efficient, accomplished, motivated, clever or effective deployment of everyday psychological processes.

Relaxation

Relaxation in hypnosis has also been shown to be different from relaxation in other contexts:

1. Electrodermal orienting responses were found to differentiate hypnosis from a relaxation control condition scheduled a month earlier or later than the hypnosis session and without differences in tonic arousal (Gruzelier and Brow, 1985).
2. The left to right hemispheric shift in hypnosis – a shift from an instrumental cognitive orientation to a passive sensory mode – was disclosed with haptic processing to involve inhibition of left hemispheric functions (Gruzelier et al., 1984). This 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).
3. Furthermore, the lateral shift with the haptic task with hypnosis was differentiated from deep relaxation while subjects were in a flotation tank (Raab and Gruzelier, 1994). Whereas with hypnosis there was an inhibition of left hemispheric processing, the degree of which correlated with the scale of hypnotic susceptibility (Gruzelier et al., 1984), this was absent with flotation, yet flotation shared with hypnosis right hemispheric enhancement. These dynamics with flotation were also mirrored in lateralized recognition memory tasks (Raab and Gruzelier, 1994).
4. Alpha and theta activity have also distinguished hypnosis from the effects of relaxation, not only during hypnosis but after 'dehypnosis' (Williams and Gruzelier, 2000).

The central role of cognitive and neurophysiological dissociation

Dissociation has always been central to a definition of hypnosis (Janet, 1889; Hilgard, 1965; Bowers, 1992). Wagstaff (1988: 154) reviews the use of this concept in connection with hypnosis and rightly concludes that the application of the word, particularly in its psychopathological sense, is overinclusive. Historically, dissociation has been the dominating theory of hypnosis. We can now add to what is currently seen to be a cognitive theory evidence of neurophysiological dissociations.

With hypnosis a different and unusual pattern of abilities and disabilities is brought into play, involving selective inhibition and enhancement of cognitive processes (Gruzelier, 1998). Consider our examination of the fluency of ideational generative processes involving words belonging to semantic- or letter-designated categories and visual designs. Subjects were compared who were classified on the basis of the Barber Suggestibility Scale as high or low hypnotically suggestible groups and were compared both before hypnosis instructions and towards the end of a hypnotic induction. Group designation was validated with challenges monitored both throughout the induction and neuropsychological test procedure, together with self-report scales of hypnotic depth. This is a precaution we believe to be essential for validity, but a safeguard that is seldom entertained in the field of experimental hypnosis, leaving results open to ambiguities of interpretation. A profile of results was shown in high susceptibles that cannot be contained by a sociocognitive approach. Low susceptibles who did not show evidence of hypnosis became *more fluent on all three tasks* when tested after hypnosis instructions compared with before, as indeed might occur with practice. In contrast high susceptibles showed a pattern of ability and disability with hypnosis as follows:

1. *Reduced performance* with hypnosis in fluency of words belonging to letter designated categories – the letters Q, X, V or J, Y, U;
2. *No difference in fluency* of words belonging to semantic categories – colour, fruits or animals, towns/cities; and
3. *Improvement* in the generation of visual designs (Gruzelier and Warren, 1993).

These results were interpreted as showing with hypnosis an inhibition of anterior dorsolateral prefrontal functions underpinning fluency for letter categories, a maintenance of left temporal functions which underpin generation of semantic categories, and improvement in design fluency underpinned by the enhancement of right anterior functions. This pattern of results was compatible with our neurophysiological model involving an imbalance in frontal functions disadvantaging the left hemisphere (letter designated word fluency) and favouring the right (design fluency), and a maintenance of left temporal function (word fluency for semantic categories) which remains activated by listening to the verbal induction. This differential pattern with the two types of verbal fluency has been tested and replicated in a Finnish experiment with subjects classified with the Harvard group scale (Kallio, Revonsuo, Hamalainen, Markela and Gruzelier, 2000). In this experiment the reduction in fluency correlated positively both with susceptibility and with Stroop interference.

In other words we saw a pattern of dissociations between cognitive abilities. This could not be anticipated by social factors including expectation or task demands, and was not part and parcel of normal functioning.

Cognitive and neurophysiological dissociations have also been shown in other processing modalities: in three experiments comparing left versus right haptic processing times after correction for movement times (Gruzelier et al., 1984; Cikurel and Gruzelier, 1990); comparing left versus right hemisphere sensory sensitivity (d-prime) to brightness of flashes while at the same time evaluating attitudinal influences on thresholds (response criterion-beta) that were adopted for each visual field (McCormack and Gruzelier, 1993); dissociations between error detection and error evaluation processes measured with event-related potential and behavioural reaction time indices and attributed to anterior cingulate (Kaiser, Barker, Haenschel, Baldeweg and Gruzelier, 1997); dissociations between subjective reports of pain and reaction times on the one hand and event-related potentials on the other (Williams, Croft, Ferdinand and Gruzelier, 1999; and see Miltner et al., 2000 for reference to four demonstrations, three of which are published in German).

Without detailing these paradigms and data, they combine with the word and design fluency results to question the possibility of attributing such neurophysiological and cognitive dissociations that occur with hypnosis, as Wagstaff (1998a, b) claims, to any sort of intense attention to or involvement in various activities that involve these processes. His postulate that the state versus non-state controversy would seem to be one mainly of semantics must be seen to be untenable. The retort, and if so, we might ask, what has all the fuss been about? is misplaced, and it serves to introduce the next qualification about the restrictive sociocognitive view and its overzealous advocacy.

Overzealous and restrictive theorizing

The sociocognitive position is maintained by ignoring much of the neurophysiological evidence (Kirsch and Lynn, 1998), which seriously weakens these theorists' case (see also Kirsch, 1998: 166 concerning ignoring data and logic). Additionally, where cognitive results make the sociocognitive view untenable, in the absence of other evidence

far-fetched motivations may be attributed to hypnotically susceptible subjects. Alternatively, consideration of the neurophysiology may be piecemeal, overlooking sources of evidence refuting such a speculative approach. Finally, in some instances, results may be disbelieved, at which point scientific discourse is lost completely.

Consider Wagstaff's (1998a) discussion of the experiment reported by McCormack and Gruzelier (1993). In the McCormack and Gruzelier (1993) study the brightness discrimination of subjects trained in hypnosis and classified as medium and high susceptibles was examined in a non-hypnosis, hypnosis, non-hypnosis design with sessions conducted on separate days. Stimuli were presented tachistoscopically and randomly in either left or right peripheral visual field while the subject maintained a central fixation – an established neuropsychological device that allows comparison of left versus right hemispheric processing. Instead of the time-efficient ascending and descending method of limits psychophysical threshold procedure, a lengthy signal detection paradigm requiring 210 trials was used to provide enough trials to enable the delineation of sensory sensitivity (d-prime) from putative attitudinal biases (response criterion-beta) that could influence sensory threshold (Gruzelier and Corballis, 1970; McNichol, 1972). This precaution was taken in view of supposed attitudinal contamination with hypnosis of sensory threshold results. For example, according to sociocognitive theory, a subject might be culturally biased to suppose that hypnosis might impair perception, or alternatively in a more optimistic social context hypnosis may supposedly enhance perception. Either way these attitudes would be manifested in beta – a conservative versus lax response criterion respectively. Both the sensory and the cognitive variables were subject to a laterality analysis.

The rigorous experimental protocol placed unusual demands on sustained attention and the maintenance of hypnosis in experimental subjects which was coupled with the need to perform the task with their eyes open. In view of these constraints the subjects were given practice sessions with hypnosis before the study, and in the experiment hypnosis was administered live and refreshed between blocks of trials. Susceptibility to hypnosis was validated with challenges throughout the experimental procedure. By virtue of this requirement we are able to refute any allegation that our subjects were not hypnotized. Interestingly, low susceptible subjects were unstable in their level of hypnosis (an issue returned to later) leaving us with high and medium susceptible groups.

The results were as follows. First, there was no difference within the groups between the two non-hypnosis conditions for either d-prime or beta, and nor did the groups differ at baseline. In other words the baseline measures showed retest reliability. This extended in the non-hypnosis conditions to between-group effects where there was no difference between the high and medium susceptibles. Second, with hypnosis high susceptibles showed an improvement in their right hemisphere sensitivity (d-prime) whereas the left hemisphere remained at baseline levels. Medium susceptibles in contrast showed a bilateral improvement in sensitivity, but this enhancement was to a lesser extent than the right hemispheric improvement of high susceptibles. Third, the response criterion measure disclosed no attitudinal differences between the groups in any of the three sessions, and importantly this measure was not changed by hypnosis. Finally, throughout the experiment there was a stricter criterion (conservative judgement) in the right hemisphere of both groups.

In commenting Wagstaff (1998a) offered two conflicting interpretations attempting to explain away the perceptual changes with hypnosis found in both groups, but these interpretations overlooked the response criterion parameter, and were not

consistent with the data. One interpretation accepted our neurophysiological model which predicts a shift to posterior right hemispheric processing with hypnosis in high susceptibles, enhanced inter alia by the imagery of the induction. But in order to explain why medium susceptibles differed in performing the same task with the same demands, Wagstaff discarded our neurobiological explanation for the bilateral d-prime enhancement in medium susceptibles and imputed reduced involvement in the later parts of the induction. He said: 'However, whereas "highs" who (being "practised") might be more involved in "holistic activity" showed only right hemisphere improvements in the hypnosis context, "mediums" showed bilateral improvements, indicating perhaps less involvement in the later parts of the induction' (1998a: 159). This implication of the later part of the induction discloses the arbitrary nature of the speculation; as in fact block effects were examined, but not reported because they disclosed no significant impact on the results. Furthermore, reduced involvement in the task would influence the response criterion, but this was not influenced by hypnosis. The same objection applies to Wagstaff's second and alternative interpretation, namely that the improvements in sensitivity (d-prime) with hypnosis were 'possibly because of the tendency in within-subjects hypnosis designs for hypnotic subjects to "hold back" and attend away from the stimulus in the non-hypnotic context (which would affect discriminability)' (1998a: 159). This speculative comment also fails to appreciate signal detection methodology. Attitudinal influences such as holding back will affect the response criterion (beta). But beta remained invariant nor did beta differ between the groups and there was no evidence of attending away through errors of omission.

What is exemplified is an overzealous approach to scientific analysis, which is becoming a hallmark of the contemporary sociocognitive position – in response to contradictory results speculative sociocognitive variables are invoked while disregarding evidence that is incompatible with them. It is encouraging nevertheless that unlike some theorists Wagstaff acknowledges the existence of neurobiological evidence and that it is worthy of consideration. Furthermore, there is in his commentary agreement about an alteration of neurophysiology with hypnosis in line with neurophysiological models; the difference of opinion concerns the extent to which this is different from everyday functioning.

The nature of low susceptibility

In addition to illuminating what is happening in hypnotic susceptibles, and validating notions about what cognitive strategies from the considerable list available are in fact being adopted, neurophysiology is helpful in showing what is occurring in low susceptibles.

It has been generally assumed that all that is involved in low susceptibles is a failure of hypnosis role enactment. Yet psychophysiological recording may elucidate why there is a failure of response given intention. Recording has disclosed at a neurophysiological level that attentional mechanisms were not engaged, or that the ensuing process of frontal suppression was absent. In fact our evidence shows that low susceptibles as well as high susceptibles undergo progressive changes, and a surprising accumulation of evidence indicates that not only are low and high susceptible subjects different in their neurophysiology but the effects of hypnotic induction are often opposing (Gruzelier, 1996b, 1998; Croft et al., 2000b; Miltner et al., 2000). To give one example, frontal evoked potentials in an oddball discrimination task changed progressively from the non-hypnosis baseline and through the induction (Gruzelier, 1996b). In low susceptibles, despite adequate behavioural detection performance the

difference waves between targets and standards were absent in the non-hypnosis baseline, but were detectable in the traces with hypnosis and grew in size by the end of a prolonged induction. In high susceptibles the opposite transition in difference waves was seen. These opposing changes from non-hypnosis to hypnosis in the two groups were not accompanied by conscious differences in cognitive strategy.

Understanding the nature of susceptibility is a far from academic exercise, because irrespective of individual beliefs in the existence of a hypnotic state, medical and psychotherapeutic benefits are considerable, and gaining insights about how to instate hypnosis, or merely the effect of suggestion in low susceptibles is a worthwhile endeavour. Many low susceptibles in a medical setting are desperate to undergo the experience and to comply vigorously with instructions, as evidenced by subjective reports and behavioural signs. Exploration in these areas may provide insights into how to train non-susceptible subjects to achieve hypnosis.

All of this evidence substantiates the fundamental importance of individual differences in hypnosis, as endorsed by Hilgard (1965) (compare Kihlstrom, 1997 with Kirsch and Lynn, 1995).

Reasons for revising the term 'hypnosis'

1. 'Hypnos'

The very word 'hypnosis' is a misnomer, arising from 'hypnos', the Greek word for sleep, an association that has been abandoned in the field of hypnosis in general. This should also be done with the descriptor 'waking' when applied to non-hypnotic baseline conditions. However, the mechanism of sleep is not without theoretical importance – consider Llinás and Paré's (1991) theorizing relating sleep mechanisms to dreams, hallucinations and altered states of consciousness. Furthermore, the ability to fall asleep in novel contexts is one correlate of hypnotic susceptibility (Evans, 1991). Sleep may provide an important clue about underlying mechanisms, but to align hypnosis with sleep is mistaken.

2. The multidimensionality of trance

As with 'hypnosis', the term 'trance' has a host of associations that have changed through the centuries. From the 16th century it has denoted extreme apprehension or dread, a state of doubt or suspense; an unconscious or insensible condition, a swoon or faint; an intermediate state between sleeping and waking, a stunned or dazed state, and more recently a state of mental abstraction from external things; absorption, exaltation, ecstasy. The recreational drug MDMA, known popularly as 'ecstasy', and which is widely used to the extent that an estimated 500 000 tablets are consumed every weekend in the UK alone, has reinstated elevation of mood as a popular association of the word trance, as also found with spiritual and sexual states. This is an uncommon feature of hypnotic induction, as currently practised. However, socio-cognitive theorists have emphasized this particular connotation of the term, namely elevation of mood, and often paired it with the descriptor 'exotic' (Wagstaff, 1998a).

Although given prominence by some (Spiegel and Spiegel, 1978), the term trance is absent from most psychophysiological investigations of hypnosis by contemporary investigators. In fact trance is just as worthy of redefinition (and examination) as hypnosis. Pekala (1991a) has usefully approached this task with his multidimensional Phenomenology of Consciousness Inventory, and has gone on to examine correlations between these dimensions and the items of the Harvard group scale (Pekala and Kumar, 1995; Pekala and Forbes, 1997). Differentiation was found between

characteristics of trance, general characteristics of altered states of consciousness, and those specific to hypnosis.

3. The quest for a marker

No generalized or focal neurochemical, brain wave or other neurobiological marker is likely to underpin complex and diverse whole-mind conditions such as hypnosis or schizophrenia. The aspiration for a marker of hypnosis is naïve and 'state' and 'non-state' adherents are equally to blame for this misconception. Left frontal theta (see Spiegel, 1998: 175), while consistent with left frontal inhibition, cannot by itself define a hypnotic state. A more fruitful approach is to consider dynamic interrelations between brain regions, brain rhythms, neurotransmitters and the like (Gruzelier, 1990; 1998; Crawford and Gruzelier, 1992; Crawford, 1994). Anterior–posterior, left–right and subcortical–cortical relationships are altered with hypnosis as brainstem and thalamic systems known to underpin conscious awareness are modulated with hypnosis instructions.

4. Conceptions about hypnosis

The potency of the descriptor 'hypnosis' in facilitating suggestibility has been well demonstrated (Spanos, Gabora, Jarrett and Gwynn, 1989). This underscores the hazards inherent in using the word hypnosis as a consequence of cultural connotations which will be idiosyncratic and uncontrolled. Importantly, cultural preconceptions can militate against the induction of hypnosis, such as may be the case with ideas arising from the televising of stage hypnosis shows involving outrageous behaviour that would be embarrassing and humiliating under conditions of everyday awareness. Such anxieties require reassurance and typically will be overcome when fears are dispelled by the benign induction experience.

Standardized assessment of subjects' conceptions in an attempt to tap into the cultural beliefs that they bring to the hypnosis context should be as common as the assessment of susceptibility in scientific experiments in order to control for variance in cognitive neurophysiological assessment.

5. Trait, state and heterogeneity

Although there is acceptance that there is a general trait of hypnotic susceptibility, as measured by conventionally used standardized scales (Hilgard, 1965), and with convincing evidence of test-retest reliability (Piccione, Hilgard and Zimbardo, 1989), susceptibility is also modifiable. This has been shown through explicit training procedures such as the Carlton procedures (Spanos, Radtke, Hodgins, Bertrand, Stam and Dubreuil, 1983), but the phenomenon is more pervasive. We have discovered in our laboratory that both the explaining away of misconceptions and worries, and the experience of listening to induction and dehypnosis instructions, may increase susceptibility; as have other investigators who have incorporated a lecture demystifying negative conceptions about hypnosis such as loss of control and failure to return to a non-hypnotic state (Crawford, Hilgard and MacDonald, 1982; Page and Handley, 1993). Conversely, negative experiences with hypnosis, such as headache and dysphoria or stressful abreaction in response to age regression, may lower susceptibility. In fact clinicians know modifiability to be commonplace.

Additionally, hypnosis in susceptibles is not a unitary state. There is a well accepted threefold categorization supported by factor analysis of susceptibility scale items on the Harvard group scale into cognitive items, ideomotor suggestions and challenge items (see Kirsch and Lynn, 1998). Virtually every factor analysis of

hypnotic responding discloses factorial complexity (Bowers, 1992). Recently Barber (1999) has enriched his earlier perspective (Barber, 1969) by adding amnesic and fantasizing subgroups to a subgroup characterized by positive motivations towards the hypnosis context. Barrett (1996) has compared fantasizers and dissociaters. Woody and colleagues have found categorizing items into easy versus difficult to be useful in the search for correlates of susceptibility (Woody, Bowers and Oakman, 1992). The research of Pekala and colleagues (Pekala, 1991a, b) perhaps represents the more developed of contemporary approaches to the heterogeneity of high susceptibility, which they have extended to subgroups of low susceptibles. There is a growing awareness of the diversity of individual differences in susceptibility to hypnosis instructions in contemporary perspectives. Despite this, though, some neurophysiological approaches have used a single item as a primary criterion, as in the study of hypnotic analgesia defining the susceptible group by those showing glove anaesthesia (Crawford et al., 1993; Rainville et al., 1999; Miltner et al., 2000), or in the study of hallucinations in those with or without the capacity for negative hallucinations (Szechtman et al., 1998). These attempts only begin to grapple with the complexity of individual differences in brain structure and function.

6. Concurrent validation of susceptibility

It follows from the above that modifiability of susceptibility to hypnosis can produce a methodological confound in experiments that rely on prior categorization of susceptibles without concurrent measurement to validate the initial classification. Concurrent validation has been a fundamental feature of our methodology (Gruzelier et al., 1984, Gruzelier, 1998) and our scale contains self-ratings of the depth of the hypnotic experience (Wagstaff's recommendation, 1998a: 160). Miltner's work, until recently written and published in German, has also been characterized by this approach (Miltner et al., 2000).

7. Uncritical reliance on susceptibility scales

Given the alterations of function that many subjects experience with hypnosis, and which virtually all researchers accept or have come to accept as valid, as incorporated in the Stanford and Harvard scales, the use of reported experience on susceptibility scales when it relies on episodic memory for the induction may be incomplete. In our own work we have found discrepancies when comparing subjective responses on the Harvard Group Scale of Susceptibility with ratings by observers. Some of the medical student subjects we tested, for example, were observed to respond to hypnotic suggestions but denied that they did. Their written explanations indicated that rather than this reflecting an acknowledgement that they responded simply through compliance, the discrepancies reflected amnesia. Objectively scored items may also be open to question. A smaller number of students have been so deeply influenced by the induction that they have found it impossible to move their arms in response to ideomotor challenges, with the consequence that they failed to pass the item and fell into the low susceptible category. Accordingly, in the absence of cross-checking, non-compliance with instructions may be misleading. The wording of items is also problematical. To give one example, with arm immobilization 'an inch is as good as a mile' – the evidence of movement takes no account of the effort involved (Williams, Croft and Gruzelier, 1999). Clearly scales must continue to evolve.

8. Controls and feasibility

Fashions in research emphases come and go in any subject. In an ideal world with

unlimited resources research designs in hypnosis could have control groups without limit. Consider Wagstaff's by no means exhaustive list of 14 processes associated with the start of hypnosis: motivation, relaxation, imagination, absorption, expectancies, attitudes and so on. Multiply these by susceptibility (high, medium, low), include simulating controls, ensure sufficient numbers per group for statistical reliability, and it is obvious that it is impossible to satisfy all theorists all of the time. To consign evidence to 'the dustbin of history' (Kirsch, 1998: 166) because one's current favourite control (suggestibility) has yet to be examined seems premature. Notwithstanding this, Kirsch and Wagstaff have provided valuable evidence of the importance of suggestibility in hypnosis research, and as indicated above suggestibility is an important, pervasive and poorly understood process. In a clinical trial involving self-hypnosis training with patients with chronic and virulent genital herpes we found that positive expectations generated through participation in the study produced remarkably beneficial effects on health and immune function, effects that were independent of practice (Fox, Henderson, Barton, Champion, Rollin, Catalan, McCormack and Gruzelier, 1999; Gruzelier, Rollin, Champion, Fox, McCormack, Barton, Catalan and Henderson, 2000). In short, controls for suggestibility in the present *Zeitgeist* would be of value in neurobiological approaches, but these will for purposes of feasibility in most instances require exclusion of controls for other factors.

9. Adverse effects

Undesirable sequelae of hypnosis is an underrated issue in the contemporary experimental literature. It is important that the potential for negative after-effects is recognized and that strategies are routinely adopted to minimize their likelihood (Gruzelier, 2000). In the first instance it is essential that care is taken to screen for psychopathology in the first instance. Then, ideally, standardized instructions should be incorporated in all experimental studies to help alleviate the likelihood and severity of adverse effects. These should include statements to the effect that no treatment of any kind will be given and that following the experiment no permanent as distinct from transient change will be expected (Orne, 1965). It would be advantageous if scientists from different theoretical backgrounds could agree on a text that demystifies hypnosis, a stategy incorporated by Crawford et al. (1982), Page and Handley (1993) and Williams and Gruzelier (2000) assuring subjects inter alia that they will not be powerless and will not fail to be dehypnotized at the end. To safeguard against the lowering of arousal and mood, cognitive confusion and headache, instructions should be given towards the end of hypnosis to the effect that the subjects will feel refreshed and alert afterwards. This requires systematic research – see an attempt by Crawford et al. (1982). Throughout, the experimenter should be sensitive to the possible occurrence of transient negative effects so as to resolve these before the subject leaves the experiment.

Recommendations from Crawford and her colleagues are apposite:

> What would be our present recommendations in regard to the avoidance or handling of transient experiences following hypnosis? The development of good rapport between S and hypnotist must begin during the initial discussion. Next, a careful assessment of S's reactions should continue throughout. It is important for the hypnotist to define clearly the end of the hypnosis experience and to ensure that S or client is completely out of hypnosis before leaving. In accomplishing this, a discussion of the experiences which have occurred during hypnosis, in addition to casual enquiry about any that might still be occurring, is essential. A sensitivity to possible transient experiences following hypnosis needs to be a part of the training of those health care professionals who use

> hypnosis whether in an experimental or a clinical setting. A useful course of termination is to maintain an attitude of genuine interest and to make oneself available to S or client without communicating undue concern. It is important that no suggestions be made of potential difficulties. One makes it easy for the subject to come back if troubled in any way, but subtly indicates that this is not expected. Finally, if further attention is indicated, a well-trained health care professional is prepared to provide the small amount of help that may be needed. In the present author's experience with thousands of Ss in the laboratory setting, this program has worked well without incident (Crawford et al., 1982: 124).

Conclusion

In conclusion, hypnosis research is gaining momentum and is being considered worthy of attention by the wider scientific and medical community. At the same time, the nature of hypnosis is proving to be much more complex than social psychology or neurophysiology has allowed for. From my perspective hypnosis is better conceptualized as involving alteration of brain systems which are currently determined by the social context and the hypnotist's influence. These alterations will reflect individual differences within high and low susceptibles as operationally defined and will vary widely according to the nature, aims and context of hypnosis – for example, experimental, clinical or stage hypnosis.

As a final consideration, one further and important piece in the neurocognitive puzzle will be outlined, one relating to frontal inhibition (for example, Gruzelier, 1990; 1998; Gruzelier and Warren, 1993; Woody and Bowers, 1994; Kaiser, Barker, Haenschel, Baldeweg and Gruzelier, 1997; Woody and Sadler, 1998a, b; Kallio, Revonuso, Hamalainen, Markela and Gruzelier, 2000). This topic has been chosen for the concluding section because it exemplifies the potential of an integrative approach between sociocognitive and neurobiological research in elucidating the nature of hypnosis, which is the thesis of this essay. The main empirical findings relating to frontal inhibition and hypnosis have thus far been as follows:

1. Left anterior inhibitory processes have been shown using haptic discrimination tasks which involve sensory motor cortex and were correlated with the depth of hypnosis (Gruzelier et al., 1984). These processes were sustained with an active-alert induction (Cikurel and Gruzelier, 1990), and were also found with verbal fluency tasks that depended on the left dorsolateral prefrontal cortex (Gruzelier and Warren, 1993; Kallio et al., 2000). All of these procedures fulfilled double or triple dissociation localizing criteria;
2. Abolition of error-related positivity has been demonstrated with cortical evoked potentials while error-related negativity and corresponding errors in performance are maintained, processes which have been attributed to the anterior cingulate;
3. The progressive abolition in frontal electrodes of mismatch negativity to deviant stimuli has been shown in an oddball task (see also the discussion above on dissociation for further evidence).

It has been suggested that the selective inhibition of frontal functions underpins the giving over of planning functions under the hypnotist's influence, the suspension of critical evaluation and reality testing, as well as alterations in supervisory attentional system control, automaticity and will (Gruzelier, 1990, 1998; Crawford and Gruzelier, 1992; Woody and Bowers, 1994; Woody and Sadler, 1998a).

Now let us consider the most dramatic social context in which hypnosis can be demonstrated, that of stage entertainment. A neurocognitive explanation for why

subjects allow themselves to be made a fool of, to suffer humiliation without embarrassment, and so provide the necessary theatrical display is offered by considering the research of Damasio and colleagues (Damasio, 1994; Bechara, Damasio, Damasio and Anderson, 1994; Bechara, Tranel, Damasio and Damasio, 1996). First, take the landmark historical case of Phineas Gage, the railway worker who in 1848 in Vermont underwent a change of personality and character following an accident in which an iron bar was driven through the frontal lobes of his brain. After the accident the socially abiding and popular worker displayed extraverted, nefarious, impulsive and profane behaviour, making decisions against his best interest and social convention. Reconstruction with magnetic resonance imaging from photographic images of the skull has disclosed that it was the ventomedial or orbital aspects of the frontal cortex that were damaged (Damasio, 1994). To explore this further a programme of research has been carried out on patients with damage to the ventromedial prefrontal cortex. This work has included the use of a task that simulates real-life decision making and has shown that although intellectual functions are unaffected, patients are guided only by immediate prospects and are oblivious to the future consequences of their actions together with their associated positive or negative value (Bechara et al., 1994). Recordings of electrodermal activity have shown an absence of anticipatory responses, interpreted as an unavailability of emotionally related knowledge of social situations. Extrapolate this to a situation with selective suppression of frontal functions, including those of the orbital frontal cortex, and the relevance to an understanding of stage hypnosis is apparent. On stage the hypnotically susceptible subject responds, without embarrassment, to the immediate contingencies – that is, the instructions of a hypnotist to enact behaviour making the subject appear a fool in order to provide entertainment for the audience.

In conclusion, it would be helpful if the hypnosis community now adopted a more integrative and coherent approach rather than restricting research to one theoretical orientation or another as has been the case in the past. Collaboration between current sociocognitive and neurobiological perspectives promises more than either perspective can offer alone, and a refinement of terminology and methods along the way will be an inevitable outcome. The time for overhauling the concept of hypnosis is long overdue. This is necessary not only from an academic perspective, but more importantly from a humanistic perspective, because for more than a century after the term 'hypnosis' was coined contemporary mainstream medicine, as distinct from psychotherapy, is being deprived of a non-invasive tool that could treat and prevent illnesses in lawful ways, quite apart from alleviating pain and distress. Formal evidence has long existed showing that suggestions with or without hypnosis *cause* neurobiological changes (for example, Black, 1963). This evidence is widely overlooked.

It is salutary that Black and Friedman (1965) observed, 'In general, the use of hypnosis as a research tool in both allergy and neurophysiology has shown the extreme delicacy of the informational mechanisms involved' (1965: 566). One cannot help reflecting 35 years later that, despite a wealth of experimentation on hypnosis, little progress has been made, surely as a result of a lack of appreciation of the intricacy of psychological and physiological mechanisms. Am I overly optimistic in believing then that a coming together of sociocognitive theorists with cognitive neuroscience is what is required to provide both the expertise and sophistication that is necessary to advance the landscape of clinical and experimental hypnosis?

Note

The writer is foremost a hypothesis-driven empiricist, and only secondly a theorist, working in fields of experimental psychology, psychophysiology, experimental neuropsychology, psychoneuroimmunology and individual differences. Our basic research is informing clinical and applied applications involving self-hypnosis training and EEG operant conditioning. As an aside, the writer's possession of medium to high hypnotic susceptibility has been salutary as a cross-checking device.

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