

HYPNOTIC PHENOMENA AND ALTERED STATES OF CONSCIOUSNESS: A MULTILEVEL FRAMEWORK OF DESCRIPTION AND EXPLANATION

Sakari Kallio¹ and Antti Revonsuo²

¹University of Skövde, Sweden and University of Turku, Finland and ²University of Turku, Finland

Abstract

There is currently agreement that, in addition to the changes in external behaviour, suggestions presented in a hypnotic context may give rise to changes in subjective experience. Yet, there is no general agreement about the theoretical framework within which these changes in experience should be explained. Though different theories about hypnosis overlap in many respects, there is still disagreement on whether reference to a specific internal state of the individual is necessary in order to explain these changes. We place the explanatory task in the context of a multilevel framework of explanation, which reveals that the disagreement between the ‘state’ and ‘nonstate’ view is about the level of description at which the phenomenon ‘hypnosis’ should be conceptualized. We propose a novel approach using the multilevel explanation which helps to formulate empirically testable hypotheses about the nature of hypnosis. We will outline the basic elements of such an approach and hope that our proposition will help hypnosis research to integrate with the multidisciplinary research on other phenomena of consciousness.

Keywords: altered state of consciousness, hypnosis, state debate, trance

Introduction

For more than 200 years the phenomena that comprise the domain of ‘hypnosis’ have attracted the curiosity of researchers, clinicians, and laypersons, who have witnessed the seemingly magical changes in hypnotized persons’ behaviour and experience. Throughout the history of hypnosis, speculation about the basic nature and underlying causes of these phenomena has been full of controversies, conflicts and passion. The views about the nature of hypnosis have been in strong disagreement varying from ‘animal magnetism’ on one hand to ‘imagination’ on the other. Others espouse what is called a ‘credulous’ view while their opponents argue for more ‘sceptical’ positions¹.

At present, there are many different theories about hypnosis in the literature, overlapping in many respects yet also having major differences. Some researchers (e.g. Orne, 1959; Hilgard, 1965; Spiegel and Spiegel, 1978; Bowers, 1992; Barabasz, Barabasz, Jensen, Calvin, Trevisan and Warner, 1999; Gruzelier, 2000; Weitzenhoffer, 2000) state that hypnotic phenomena cannot be explained without positing a special psychological state (e.g. altered state of consciousness, trance, dissociation), while others (e.g. Sarbin and Coe, 1972; Barber, Spanos and Chaves, 1974; Kirsch, 1991; Spanos,

1991) regard all phenomena seen in association with hypnosis as being explainable by using ordinary psychological concepts (e.g. role-playing or expectations).

The most explicit rejection of the notion of a hypnotic or trance state is found in the work of investigators broadly identified with what can be variously labelled as the social-psychological, sociocognitive, cognitive-behavioural or the nonstate approach to hypnosis (Spanos and Chaves, 1991).

In this paper, we will concentrate on this central question: is reference to a special psychological state required when describing and/or explaining 'hypnosis' and hypnotic phenomena? Is there a special psychological state, an altered state of consciousness (ASC), involved in the generation of these phenomena?

We believe that the theoretical approaches to hypnosis can be meaningfully divided into two broad categories depending on their answer to this central question. Thus, in the present paper, any theorist or theory whose answer to the central question is 'yes' is regarded as representing what we call here the State Views (SV) of hypnosis, and those whose answer is 'no' are regarded as representing what we call Nonstate Views (NSV).

We should clarify the scope of our inquiry a little further. We are aware that both SV and NSV, as presently defined, include a number of different theories of hypnosis, and that the theories differ from each other in several respects that are not directly related to the central question of this paper. Thus, we will not deal in any detail with aspects and varieties of the theories that are neutral with respect to the central question. We only deal with the central question and its direct implications to the description and explanation of hypnotic phenomena.

A review of the recent literature shows that there are deep theoretical disagreements concerning the basic nature and explanation of hypnosis and that the central question appears to be the principal cause of this debate. Kirsch and Lynn (1995) tried to suggest that there is actually an agreement among researchers that the impressive effects of hypnosis stem from social influence and personal abilities, not from a trancelike state of altered consciousness. However, at the same time Gruzelier (1996: 316) concludes that 'We can now acknowledge that hypnosis is indeed a "state" and redirect energies earlier spent on the "state-nonstate" debate'. Wagstaff (1996: 20) declares that 'the state-nonstate controversy is still very much alive, and sides in this debate seem to be as far apart as ever'.

Furthermore the issue about the necessity of an ASC creates difficulties in the quest for a definition of hypnosis. According to Wagstaff (1998) the reason for the failure to come up with a meaningful definition of hypnosis has stemmed mainly from semantic disagreements about the status of hypnosis as an ASC. However, what makes the definitional problem seem hopeless is the fact that there is no generally accepted definition for the concept of ASC either, not to mention the lack of a good definition for a normal state of consciousness.

Partly due to these problems, some researchers propose that hypnosis has also suffered from being left outside mainstream experimental psychology and cognitive neuroscience (as was the case for the study of consciousness in general until recently). Dixon and Laurence (1992a: 35) for example, state that: 'No matter at which point along the chronological continuum of hypnosis research one chooses to focus, one cannot help being struck by its continuing battle for scientific status.'

In this paper we argue that the theoretical disagreement between SV and NSV, as formulated in the recent hypnosis literature, is doomed to remain unresolved. This is because the theories and the empirical predictions derived from them are inadequate for testing and settling the central question of whether the description and/or explanation of

hypnosis require reference to an ASC. This unfortunate situation is due to the fact that there is no generally shared, empirically testable understanding or definition of ASC. Different researchers, therefore, understand the notion of ASC in different ways and consequently the relationship between hypnosis and ASC has become difficult to settle by any empirical test.

We try here to break this deadlock by presenting a clear definition of ASC which is somewhat different from the traditional notion. Our definition is based on a widely used framework of scientific explanation in the biological and psychological sciences called 'multi-level mechanistic explanation' (see Bechtel and Richardson, 1993; Machamer, Darden and Craver, 2000; Craver and Darden, 2001; Revonsuo, 2001). According to this framework, the full description and explanation of a phenomenon requires the construction of a multi-level, mechanistic model which represents the organization of the causal-mechanical network that surrounds the phenomenon. We apply this framework first to describe the levels involved in the description of the normal state and the normal contents of consciousness, and then derive from this a general notion of an altered state of consciousness. When applied to hypnosis this notion renders the presence or absence of an altered state of consciousness during hypnosis empirically testable. Thus, we try to show that the multilevel mechanistic approach that has been regarded as useful in the biological sciences is also fruitful for the description and explanation of consciousness in general, and hypnosis in particular.

Based on our model of ASC, we then develop a more detailed theory of hypnosis from which several empirically testable hypotheses can be derived. Our main aim is to formulate a testable theory of hypnosis that is built on the assumption that hypnosis may lead to an ASC (in the sense in which we define ASC). Our interest is not so much in defending such a theory as in just formulating an ASC theory of hypnosis which is empirically testable (and which should be put to rigorous tests). We believe that if the empirical predictions of this theory would be systematically tested in the future, the central question of hypnosis research could be solved once and for all.

The Altered State Theory of hypnosis (AST) that we formulate here invokes many rather early ideas about the nature of hypnosis. According to this conception, hypnotic behaviour is thought to consist of two distinct elements: a special state of hypnosis and a degree of suggestibility that is not dependent on the presence of the state but is affected by it.

AST postulates that hypnosis proper is a rare phenomenon and its occurrence is for the most part confined only to very highly hypnotizable individuals (referred to as 'hypnotic virtuosos' or 'somnambulists'). We shall henceforth call individuals in whom hypnosis proper is realized as virtuosos. According to the literature, when hypnotized these individuals are able to experience extreme changes in their sensation, perception and cognition. AST describes these changes in the content of subjective experience as hallucinations that, without voluntary effort of the subject, replace some of the normal contents of his or her consciousness with the suggested content. Such a replacement process requires a postulation of an altered state of consciousness.

The changes in subjective experience that replace the normal contents of consciousness by the suggested contents are the essence of hypnosis research. Thus, we argue that the core explanandum resides at the phenomenal level of description. A full description and explanation of the ASC requires, however, a multilevel mechanistic model which specifies what happens in the cognitive and neural mechanisms surrounding consciousness. A full description of how a specific suggestion changes the subject's experience furthermore requires a description of the interaction between the subject and

the hypnotist. In the next section we outline the basic problem concerning the different views about the definition of hypnosis.

Defining hypnosis

Before one can proceed into the phase of theoretical explanation, it is crucially important to construct a clear and detailed description of the phenomenon to be explained². It is also obvious that if there are differing views about the nature of the phenomenon to be explained, and if these views are never reconciled, we are extremely unlikely to arrive at an agreement about the proper way of explaining it. The fundamental problem in the SV-NSV debate appears to be that researchers do not agree about the nature of explanandum. The disagreement is reflected in the discussions about the proper definition and the necessary conditions of the phenomenon, reviewed below.

The working definition of hypnosis

The Executive Committee of the American Psychological Association, Division of Psychological Hypnosis (1994) has constructed a definition of hypnosis from the multiplicity of positions of a number of researchers advocating differing theoretical perspectives. The definition offered by the APA regards hypnosis as ‘a procedure during which a health professional or researcher suggests that a client, patient, or subject experience changes in sensations, perceptions, thoughts, or behavior’. No reference to any ‘altered state of consciousness’ is made except that some individuals may report experiencing feelings about being in an altered state when they have received a hypnotic induction. Despite this seeming agreement on a working definition of hypnosis, the concept is still used and understood in widely differing ways by different researchers, and often defined as an altered state.

Can hypnosis occur without a hypnotic induction?

One argument against the APA’s definition is that if hypnosis, i.e. the explanandum, is present only when the situation is labelled by both participants as ‘hypnosis’, then situations where similar elements are present in the absence of this explicit label must be explained in an entirely different way. Some researchers clearly do not accept the APA’s definition, but regard hypnosis as a phenomenon that can occur independently of its label. For example, Hilgard (1973) has stated that highly hypnotizable persons readily drift into hypnosis when given any kind of suggestion, unless explicitly told not to drift into hypnosis (see also Spiegel, 1986). According to this conception of the phenomenon, a person can slip into hypnosis without anyone using a hypnotic induction procedure and without the person knowing that he has been hypnotized.

Wagstaff (1998) argues against this ‘slipping into hypnosis’ by asking that, if there is a special altered state of consciousness associated with hypnosis which differs qualitatively from ‘waking’ experience, how is it possible to experience it without being aware that one is having or has had such an experience? This inquiry leads to the important issue of defining the criteria for an ASC.

Hilgard (1973) had supposedly provided a solution to this problem by suggesting the use of what he calls the ‘domain of hypnosis’ which only describes the phenomena that take place when the hypnotist, with the consent of the subject, attempts to induce hypnosis through conventional procedures which can vary considerably from relaxation and the focusing of attention to active bicycle riding (Banyai and Hilgard, 1976). Hilgard

(1969; 1978) further identified two versions of the state concept labelled as the strong and the weak view by Kihlstrom (1985). The strong view holds that a set of special psychological properties is realized in all hypnotized individuals and that this set of properties constitutes the state of hypnosis. The altered state is viewed as ontologically real, as causally efficient, and as a necessary part of the causal explanation of hypnotic phenomena. The weak state view regards the notion of a state of hypnosis only as a descriptive label, not as an explanatory construct. Even if hypnosis could be described as an ASC, the concept of a 'state' is not taken to refer to any real entity or activity or any set of causally efficacious properties within the individual. Thus, the weak state view does not regard the state of hypnosis as ontologically real, but uses the concept of state as a convenient label only. Such an approach represents philosophical instrumentalism as applied to the state of hypnosis. For instrumentalist theories, the question of whether the entities referred to by the theoretical concepts really exist or not never even arises, but is considered irrelevant or illegitimate.

In this paper, by contrast, we analyse the theoretical explanation of hypnosis from the viewpoint of scientific realism, and, therefore, only views that are committed to the reality of the state of hypnosis are counted as representing the SV. Thus, only the strong view qualifies as an SV.

The lack of clear definitions of both hypnosis and ASC is, however, not the only theoretical question dividing the two viewpoints. Another crucial difference is that the NSV proponents regard the phenomenon to be something that is happening in a social context; it is a phenomenon that occurs between the hypnotist and the subject – a conventional human procedure that two people agree upon during the process. So a theory of hypnosis has to explain how the different aspects in this procedure can bring about the altered experiences that the other person is experiencing. By contrast, the SV proponents regard the crucial phenomena as actually being localized inside the person who is hypnotized. They argue that the theoretical account of hypnosis should seek the ultimate explanation by focusing on the internal brain activities of this person. This leads to a debate wherein some researchers regard the phenomena crucial for the description and explanation of hypnosis as localized at the level of social interaction whereas others regard them as localized inside the person.

Thus SV and NSV seem to harbour very different assumptions about the fundamental nature of both the explanandum and the explanans. Although they may agree that the explanandum consists of the changes in subjective experience during hypnosis, there are no shared criteria for defining when the explanandum is present. Is it present only in situations that are socially constructed and labelled as 'hypnosis' (an observer-relative phenomenon, Searle, 1992), or is it a phenomenon whose presence or absence is independent of how the situation is labelled by human observers (an intrinsic natural phenomenon, Searle, 1992)? Consequently, conceptions about the nature of the explanans are also quite different. If hypnosis is seen as involving an ASC, then an important element of the theoretical explanation of hypnosis is to characterize the ASC in more detail (e.g. at the neurophysiological level). If no ASC is postulated, then the explanans will mostly contain reference to ordinary psychological processes such as changed expectations, social roles, and compliance.

Thus, for the SV, hypnosis is an intrinsic natural phenomenon as opposed to an observer-relative phenomenon (see Searle, 1992). Hypnosis occurs inside an individual person's mind/brain when certain conditions are fulfilled, regardless of whether the phenomenon is detected, observed or labelled. By contrast, for the NSV, whether or not

something constitutes 'hypnosis' is dependent on the beliefs of the participants and given labels, rather than on the intrinsic nature of the phenomenon.

The operationalization of hypnotic responsiveness

Although there seems to be a fundamental disagreement about the nature of the explanandum and explanans, a crucial task in the framework of experimental research is somehow to decide when the explanandum – hypnosis – is present and when absent. That is, there must be a clear view about the empirical criteria for the presence and the absence of hypnosis.

The typical way in the field to operationalize hypnosis is to use behavioural scales which measure so-called hypnotic susceptibility. With these scales, researchers measure or assess to what degree a subject responds to standardized suggestions presented after a standardized hypnotic induction procedure (or by the NSV theorists also, after for example, task-motivational instructions or expectancy-altering information). It should be noted that the responses measured or assessed by most of these scales concern overt behaviour rather than subjective experiences³. Scales including questions about subjective experiences do, however, also exist (Barber, 1965; 1969; Barber and Wilson, 1978/1979; Spanos, Radtke, Hodgins, Stam and Bertrand, 1983b; Spanos, Radtke, Hodgins, Bertrand, Stam and Dubreuil, 1983c). Nevertheless, the most widely used scales are behavioural and they have been used by the majority of researchers, regardless of their theoretical views about hypnosis.

Next we will take a closer look at these hypnotizability scales and focus specifically on the theoretical question: what kinds of suggestions and responses are supposed to discriminate the presence of hypnosis from its absence?

Types of hypnotic suggestions

According to the definition of the APA (1993), hypnosis is a procedure wherein a hypnotist first gives the subject a hypnotic induction and next delivers suggestions whose nature largely depends on whether the situation is clinical or experimental. The types of hypnotic suggestions have been divided into three major categories: Ideomotor suggestions, Response-inhibition (or Challenge) suggestions and Cognitive suggestions (Hilgard, 1965). These types of suggestions also give a representative sample of what are regarded to be hypnotic phenomena in general.

All of these suggestions can be regarded either as aiming to generate mental images of states of affairs that somehow differ from the veridical perception of reality or as altering the experience of information retrieved from long term memory (or to block the access to the memory trace)⁴. The suggestion aims to bring about changes in the subject's content of consciousness, and these non-veridical or misrepresentational contents should replace the veridical contents that would otherwise be experienced. The suggested changes can take place immediately or after a delay in a specified situation which triggers the changes (posthypnotic suggestions).

One of the most essential characteristics of hypnosis is taken to be (especially by the proponents of SV) that responding to these suggestions is experienced as happening by itself without any conscious effort, involuntarily or automatically. Weitzenhoffer (1974) has labelled this experience of nonvolition as the 'classical suggestion effect'. This experience is considered to be in the core of hypnotic phenomena (e.g. Hilgard, 1973; 1977a; 1977b); the external behavioural response is only the observable outcome of this internal phenomenon. The feeling of involuntariness is the crucial difference between

only following the orders or instructions of the hypnotist, and genuine hypnotic responding. For example, if the suggestion is that the subject's hand is lowering down by itself, the person's conscious experience is supposed to be that he is not simply letting the hand go down but that it actually is happening by itself, involuntarily. As people react differently to these suggestions, hypnotizability scales have all three types of suggestion (ideomotor, response-inhibition and cognitive).

The measurement of hypnosis

The first attempts to measure hypnotic ability took place within the context of nineteenth-century clinical practice (Perry and Laurence, 1980). At that time, hypnotists were already debating the question of whether or not everyone was hypnotizable, and they assumed that people could be classified according to the degree to which they reached the hypnotic state (Hilgard, 1965). The early history consisted mainly of different types of scales measuring degrees of 'hypnotic depth' (for a review of the history see, for example, Perry and Laurence, 1980). The work of Weitzenhoffer and Hilgard (1959; 1962) led to the standardization of the measurement of what is now called hypnotic susceptibility or hypnotizability (Perry, Nadon and Button, 1992). In this article we concentrate on the scales currently used and specifically on those used most widely (for review of the current scales see Perry et al., 1992; Weitzenhoffer, 2002).

The scales that are currently used most commonly to measure the responsiveness to suggestions (i.e. hypnotic susceptibility) are 'The Stanford Hypnotic Susceptibility Scale, Form C' (SHSS:C – Weitzenhoffer and Hilgard, 1962) and 'The Harvard Group Scale of Hypnotic Susceptibility, Form A' (HGSHS:A – Shor and Orne, 1962). The latter is very similar to the former, except that it can be applied to large groups of subjects at the same time. The former has become the touchstone against which new measures of hypnotizability are evaluated (Perry et al., 1992). Both of these scales consist of 12 items designed to suit the requirements of Guttman scaling and take approximately one hour to administer⁵. After the original publication of the Harvard scale and the Stanford scale, they have been provided with standardized scoring systems for subjective experiences (Kirsch, Council and Wickless, 1990; Bowers, 1998).

Furthermore, there are scales measuring hypnotic depth, which focus on changes in subjective experience associated with hypnosis per se or related to different suggestions (for reviews see Tart, 1978/1979; 1979; Radtke and Spanos, 1981). For example Field's (1965) 'Inventory Scale of Hypnotic Depth' requires the subject to check off retrospectively from a list of possible experiences those items which apply to him. LeCron (1953) suggested that it is possible to measure the depth of hypnosis simply by asking the subject how deeply he feels himself to be in hypnosis on a scale from 1 to 100. The data suggests, however, that people label their subjective experiences in terms of salient contextual factors when their private experience is ambiguous (see, for example, Schacter and Singer, 1962; Radtke and Spanos, 1981; 1982). Therefore the validity of these measures of hypnotic depth is rather questionable⁶.

Discussion

Hypnosis is operationalized by first applying a standard induction and then a series of standardized suggestions. The responses to these suggestions are then evaluated by a hypnotist or by the subjects who retrospectively evaluate and report their own responses to the suggestions and in, some scales, also report subjective experiences accompanying these responses. There are several problems associated with such an operationalization.

First, it is not clear what these scales actually measure (e.g. Weitzenhoffer, 1980; Kirsch, 1997). They either require the retrospective reporting of behavioural responses to suggestions or a score given by the hypnotist. Even if the behavioural response is accurately scored (e.g. the Stanford scales) or remembered and reported (e.g. the Harvard scale), a purely behavioural scale does not tell us about the causes of the overt response. The very same behavioural responses could be brought about by faking or complying in the absence of any altered experiences, or by the presence of vivid experiences of automaticity in the form of involuntary, effortless and mandatory realization of the suggestions. Thus neither the behavioural information nor the descriptions of subjective experience as supplied by any of the scales currently in use, however, provides us with data that could distinguish between the SV and the NSV.

Second, even though the current scales provide a good behavioural test for responding to suggestions, information we receive by using such scales cannot solve the fundamental question about the nature and localization of hypnosis: is it an intrinsic natural phenomenon inside one person, or an observer-relative phenomenon at the level of social interaction?

Third, it also remains unclear whether the different suggestions used in the scales have an underlying theoretical basis; i.e. whether they are manifestations of the same underlying explanandum (hypnosis) or whether the theoretical explanation of all of them should refer to a common underlying explanans. Why should we assume that such very dissimilar subjective experiences as a visual hallucination of an object and the feeling of heaviness in the hand should have a common underlying mechanism to be explained by a single theory?

Despite the differences in their theoretical background, all researchers agree that these suggestions are paradigm examples of the phenomenon called hypnosis. However, since there is no theoretical account showing how suggestions so different from each other could be intimately related to each other at some deeper level (although the internal consistency in scales is rather high), the question arises why they should reflect one single, well-defined phenomenon at all, instead of many different and entirely independent phenomena. It would be possible to argue (in the spirit of eliminativist materialism) that the phenomenon we call hypnosis does not even exist; what we thought to be one phenomenon ('hypnosis') will turn out to be a set of different kinds of phenomena that have little to do with each other and lack a common ontological core. This group of heterogeneous phenomena may share some superficial similarities and, therefore, the erroneous conception of a common underlying phenomenon has arisen and been labelled hypnosis.

We do not advocate, however, this kind of crude eliminativist account of hypnosis. We do believe that the current conception of what constitutes hypnosis will have to be revised to some extent by dividing it into two different types of phenomena. Only one of these two types of the phenomena traditionally discussed under the concept of hypnosis requires the concept of ASC. The rest can be described and explained without the notion or the theory of hypnosis. Our purpose is to point out that the current operationalizations of hypnosis are theoretically weak, for the data that they produce are consistent with several radically opposing views about the nature and existence of the phenomenon.

In the next section we will take a look at how the idea of hypnosis as an altered state of consciousness first developed and how the field of hypnosis research gradually became entangled in the perpetual debate between SV and NSV.

Experimental research today

Sociocognitive research

Are hypnotic experiences real?

A certain scepticism regarding hypnotic phenomena already emerged at the time of Mesmer and still finds its modern forms between credulous and sceptical views described by Sutcliffe (1960). A huge body of research has focused on relieving what is truly perceived in association with e.g. hypnotic hallucinations and what is only a behavioural result of the demands of the experimental situation. Also, the heightened perceptual powers claimed to be associated with hypnosis have resulted in scepticism. A precursor of creating experiments in order to test these claims was Young (1926) and this approach continued in the work of many researchers. The scepticism about making too far reaching conclusions has in many cases appeared to be justified, and this research has helped the field enormously to take account for the possible demands that, for example, the experimental situation creates and how behaviours produced by hypnotic procedures could be created by other nonhypnotic instructions to enhance subjects' motivation to perform identically (e.g. Barber, 1969; Barber et al., 1974; Wagstaff, 1981; 1991).

For example, Erickson (1939) found that subjects who received a hypnotic suggestion for colour blindness responded to the cards on the 'Ishara Test for Color Blindness' in the manner expected from a colour-blind individual. He concluded that hypnotically produced colour blindness is comparable in degree and character with that found in actual colour blindness. Harriman (1942) repeated the experiment but found that adding a 'malingering card' (which all normal and colour-blind individuals can see) had the result that seven out of ten replied being blind to this card as well which showed that the colour blindness was not comparable to actual colour blindness. Harvey and Sippelle (1978) applied the colour-blind suggestion to the Stroop Color and Word Test (Stroop, 1935) and found that hypnotic colour blindness was different to true colour blindness in respect to correct answers. However, it also differed from the colour blindness that resulted from instructions to play the role of being colour-blind.

The influence of the possible awareness of the experimenter's expectations or hypothesis has been noted by many researchers (e.g. Barber, 1969; Sarbin and Coe, 1972), and it is considered to be an important precondition for hypnotic responding, though there are studies which show that their effect should not be exaggerated (e.g. Barabasz, Barabasz and O'Neill, 1991). Orne (1959; 1972) termed these effects as the 'demand characteristics of the experimental situation'. In order to separate real hypnotic responding from social demands he developed a method called the 'real-simulator' paradigm⁷.

When the real-simulator paradigm is used, it has appeared to be rather difficult for the experimenter to detect a simulator. Orne (1959) stated that the major difference between real and simulating subjects was that the real subjects had higher tolerance of logical inconsistencies (e.g. hallucinating a person while the same person actually is present, resulting in an illogical experience of seeing a person in two places at the same time). Orne (1959) labelled this phenomenon as 'trance logic', however, further experiments on the topic have been controversial (e.g. Blum and Graef, 1971; Johnson, Maher and Barber, 1972; Hilgard, 1972; Spanos, 1986). Orne (1959) further found that real subjects reported more transparency in their hallucination experiences than simulators, a finding

that has later found more support (e.g. Stanley, Lynn and Nash, 1986). An extensive literature exists in the area of attempting to find reliable discriminates of hypnotized individuals from those who are simulating. So far no consistently successful ones have been found. Martin and Lynn (1996) reported that when using a 31-item self report scale (Hypnotic Simulation Index) of experiences associated with hypnosis, 94% of the subjects ($n=80$) could be classified correctly. This scale was designed to be used in clinical or forensic settings.

Orne's (1959) work was accompanied by Barber (1969), Barber et al. (1974), and Spanos (1986; 1991). A huge body of experiments by Barber and Spanos further showed the degree to which preconceptions about hypnosis affect the way hypnosis is experienced and how the demand characteristics, rather than the experimental variables, may sometimes even be the major determinant of hypnotic behaviour. The work by these researchers has also made it rather clear that hypnosis does not increase physical capacity in any way.

All researchers seem to acknowledge this tendency for some participants in experiments to comply or even fake, but only very few would postulate that all or most of the subjects fake or comply all of the time. There is a body of evidence supporting the idea that even though subjects could intentionally misreport their subjective experience, they are unlikely to do so (e.g. Perugini, Kirsch, Allen, Coldwell, Meredith, Montgomery and Sheehan, 1998). Subjects are more likely to respond accurately in the absence of untoward pressure to comply or to think that not responding is a failure (Perlini, Haley and Buczel, 1998; Kinnunen, Zamansky and Nordstrom, 2001).

There are, however, some extreme views which emphasize the social role or compliance to please the hypnotist or clinician as being the main reason behind reports of even, for example, hypnotically induced analgesia (e.g. Wagstaff, 1981). A common misinterpretation is that all NSV theories equate hypnotic responding with superficial play-acting or faking (Kirsch, 1998). As early as 1950, however, Sarbin rejected this interpretation and many role-theorists have continued along these lines (e.g. Sarbin and Coe, 1979; see also Spanos, 1971). The research done by NSV theorists has reviled many aspects regarding the conscious experience associated with subjects' behaviour.

The experience of involuntariness

One of the hallmarks of hypnotic phenomena is that hypnotic subjects often experience that things happen by themselves, involuntarily (e.g. Spanos and Barber, 1972; Bowers, 1981). The experienced automaticity is often used as a criterion for 'real hypnotic' experiences. The neodissociation theory (Hilgard, 1977a; 1977b; 1991) describes the process as inhibition of the planning function. The fact that hypnotic responses can be experienced nonvolitionally has also been viewed as an alteration in the underlying control process by which the hypnotic response is generated (Bowers, 1992; Woody, Bowers and Oakman, 1992; Woody and Bowers, 1994). Spanos and Gorassini (1984) stressed the effect of the wording used in the hypnotic test situation (e.g. 'your arm is getting lighter and lighter and is rising'), which invites the subjects to adopt a hypothetical (i.e. imaginary) definition of the situation, a goal-directed fantasy (GDF)⁸. Responses that are accompanied by GDF were found to be rated as more involuntary than responses not associated with GDF (see also e.g. Lynn, Snodgrass, Rhue and Hardaway, 1987; Lynn, Rhue and Weekes, 1990; Lynn and Sivec, 1992). The necessity of GDF has, however, also been challenged (see, for example, Comey and Kirsch, 1999) and the changed experiences have also been explained as results of other cognitive functions e.g.

expectancy related factors (Kirsch, 1985; 1990; Lynn, 1997; Lynn, Vanderhof, Shindler and Stafford, 2002)⁹.

However, the experience of involuntary or automatic action is far from a simple and clearly definable concept. Bowers (1986) states that most responses to suggestion of high hypnotizables are reported as feeling nonvolitional to some degree but many of these subjects also have some responses that they report as feeling voluntary (when measured with a susceptibility scale). Among the responses that feel nonvolitional, a few are described as complete mixtures of volitional and nonvolitional, others start out voluntarily but become nonvolitional, and still other responses are described as happening fully 'on their own', without conscious volition. In the Finnish normative data of HGSHS:A (Kallio and Ihamuotila, 1999) the subjects' responses to a question about automaticity associated to these ideomotor items varied from 'total automaticity' to 'totally conscious intention' including various mixtures between these two (see also Bowers, Laurence and Hart, 1988). Even when two individuals receive an identical total score in HGSHS:A (e.g. ten points for passing ten out of twelve items and typically considered being high susceptibles) it is possible that the one might report automaticity while the other reports deliberate action.

Thus, it is extremely difficult to say what is being measured when a subject is asked to retrospectively report the degree of voluntariness or automaticity of a particular behavioural response. One difficulty is that we do not normally pay very much attention to the degree of voluntariness felt when we perform deliberate actions; we do not introspectively classify them as to how automatic they felt. If we had to do that, perhaps we would notice that many everyday deliberate behaviours are not accompanied by the feeling of voluntariness (for very similar ideas, see also Kirsch and Lynn, 1997; 1999; Kirsch, 2000). Yet, the subjects are asked to retrospect their experiences of volition and classify them in terms of felt control. There is no clear baseline with which to compare what is the 'normal' degree of felt voluntariness, and therefore different subjects may use completely different criteria for evaluating what counts as 'automatic' and what as 'voluntary'.

Correlates of hypnotizability

The research focusing on the correlates of hypnotizability has approached the issue from two perspectives. Personality correlates describe the personal traits or abilities that correlate with hypnotizability and situational correlates describe the social manipulations that have been found to be effective in order to increase suggestibility¹⁰ (for a review see Kirsch and Council, 1992). So far, however, the best predictor of hypnotic suggestibility (i.e. response to suggestions after a hypnotic induction) is the responsiveness to suggestions without a hypnotic induction (see e.g. Weitzenhoffer and Sjöberg, 1961; Hilgard, 1965; Hilgard and Tart, 1966).

Regarding personality correlations, Hilgard (1979) found that highly hypnotizable individuals were more involved with activities such as literature, drama or religion. Hypnotizability and absorption¹¹ are in many experiments found to have a positive correlation (e.g. Tellegen and Atkinson 1974; Braffman and Kirsch, 1999; for a review, see Roche and McConkey, 1990), although it has also been noted that these correlations tend to be higher when absorption is measured in the same context as hypnotizability (see e.g. Kirsch and Council, 1992). Balthazard and Woody (1992) further found that absorption is more strongly related with the difficult hypnotic performances than the easy ones. Closely related to this (e.g. Crawford, Brown and Moon 1993a; Crawford, 1994;

Crawford, Corby and Kopell, 1996; Lyons and Crawford, 1997) is the finding that the capacity to sustain attention in a complex environment without being distracted by competing stimuli correlates with high hypnotizability. Another concept that has been reported to correlate with high hypnotizability is the vividness of images and imagery measured with different standardized imagery tests (e.g. Sutcliffe, Perry and Sheehan, 1970; Coe, St Jean and Burger, 1980; Crawford, 1982; for a somewhat contradictory result see Glisky, Tataryn and Kihlstrom, 1995). Wilson and Barber (1983) further identified a special group of highly hypnotizable individuals which they termed, 'fantasy prone individuals', who typically have been fantasizing vividly and realistically since childhood. This association has been replicated (e.g. Silva and Kirsch, 1992), however, Lynn and Rhue (1988) also noted that the fantasy prone individuals vary widely on their hypnotizability level and the effect of other variables should not be underestimated.

Regarding the situational correlates, the data indicate that the hypnotic induction procedure typically increases suggestibility significantly; the gain is, however, smaller than it is generally believed (Hull, 1933; Weitzenhoffer and Sjöberg, 1961; Hilgard and Tart, 1966; Tart and Hilgard, 1966). Barber and Glass (1962) maintained that with motivational manipulations it is possible to reach the same amount of increase as with a hypnotic induction. Examples of other ways to enhance suggestibility without any induction are to instil positive attitudes and guidance in using GDF (Spanos and Coe, 1992) or to give the subject expectancy altering information¹². Gorassini and Spanos (1986) found that by using a special programme (Carleton Skills Training Program, CSTP) – which consisted of adding positive attitudes to hypnosis and giving instructions about how easy it is for everyone to respond to suggestions – even low susceptibles could be turned into high susceptibles. Further research (e.g. Bates, Miller, Cross and Brigham, 1988) has suggested that though the CSTP does indeed increase hypnotic responsiveness, the demand characteristics may have a great influence and the gains are not maintained at follow-up (see also Milling, Kirsch and Burgess, 1999).

*Neurophysiological concomitants of hypnosis*¹³

The early studies focused on the search for EEG-correlates of hypnosis (e.g. Ulett, Akpınar and Itil, 1972a; 1972b), and it soon became clear that hypnosis and sleep did not share the same EEG pattern (Evans, 1979). Lateral differences, or task related hemisphere specificity with hypnosis (e.g. MacLeod-Morgan and Lack, 1982) have also been studied, and the right hemisphere has been suggested to be an important mediator of hypnosis (e.g. Bakan, 1969a, 1969b; Gur and Gur, 1974; Graham, 1977; Frumkin, Ripley and Cox, 1978; MacLeod-Morgan, 1982; Pagano, Akots and Wall, 1988). For contradicting results see, for example, Levine, Kurtz and Lauter, 1984; Edmonston and Moscovitz, 1990; Otto-Salaj, Nadon, Hyot, Register and Kihlstrom, 1992). The left hemisphere has been suggested to be of some importance (e.g. Gruzelier, Brow, Perry, Rhonder and Thomas, 1984; Gruzelier and Brow, 1985; McCormack and Gruzelier, 1993; Jasiukaitis, Nouriani, Hugdahl and Spiegel, 1997), however, the recent research rather clearly suggests that viewing hypnosis as a function of one hemisphere seems to be an oversimplification (see e.g. Crawford and Gruzelier, 1992; Crawford, Gur, Skolnick, Gur and Benson, 1993b; Crawford, 2001; Rainville, Hofbauer, Bushnell, Duncan and Price, 2002).

One of the most often reported neurophysiological findings has been that highly susceptible individuals possess more Theta EEG-activity (3-7 Hz), either in baseline (Galbraith, London, Leibovitz, Cooper and Hart, 1970; Graffin, Ray and Lundy, 1995) or during both hypnosis and baseline (Akpınar, Ulett and Itil, 1971; Tebecis, Provins, Farnbach and Pentony, 1975; Sabourin, Cutcomb, Crawford and Pribram, 1990; Freeman,

Barabasz, Barabasz and Warner, 2000). Unfortunately, these findings have not appeared to be constant since, for example, Williams and Gruzelier (2001) did not find any correlation between Theta and susceptibility/hypnosis, and Graffin et al. (1995) and Ulett et al. (1972a; 1972b) found a decrease of Theta for highly susceptible subjects during hypnosis. DePascalis (1999) and DePascalis and Penna (1990) have further noted that highly hypnotizable subjects produce more 40-Hz EEG activity both in baseline and hypnosis, which is interpreted as a mark of narrowly focused attention (for reviews of psychophysiological correlates hypnosis/ hypnotic susceptibility see Crawford and Gruzelier, 1992; Ray, 1997; DePascalis, 1999)

Hypnotic hallucinations

Much of the recent research has focused on the brain concomitants of the suggested changes in the content of consciousness associated with hypnosis. Most research is done in association with pain perception, which naturally has an important clinical aspect. Pain perception is a complex experience and seems to involve at least two components: the sensory perception of the pain and the distress caused by it. Low hypnotizables have been reported to be able to reduce the affective aspect, whereas high hypnotizables may be able to reduce or even eliminate both the distress and the sensory dimensions of the pain experience (e.g. Crawford, Knebel and Vandemia, 1998; Rainville, Carrier, Hofbauer, Bushnell and Duncan, 1999a). Recent positron emission tomography (PET) studies have reported differences in the anterior cingulate cortex (ACC) related to pain perception and unpleasantness during hypnosis (Rainville, Duncan, Price, Carrier and Bushnell, 1997; Faymonville, Laureys, Degueldre, Del Fiore, Luxen, Franck, Lamy and Maquet, 2000). These results suggest the attentional and disattentional processes associated with the anterior frontal region to be important mediators in this process (e.g. Crawford et al., 1998). It should be noted that the necessity of hypnotic procedures to produce these changes in pain perception has been challenged (e.g. Barber and Hahn, 1962; Spanos, 1986; Chaves, 1989; Spanos, 1989).

Recent research has also focused on the effect of visual, somatosensory and auditory hallucinations determining the effect of hypnosis and hallucination on Event-Related Potential (ERP) components. This, however, provides a challenging task as several studies have clarified ERPs dependence on various general state factors such as alertness and attention (for a critical review of hypnotic negative hallucinations see Perlini, Spanos and Jones, 1996). There is converging evidence for the N1-component to be larger for attended than for ignored auditory stimuli, without any hypnotic procedures or suggestions (e.g. Näätänen, 1992; see also Crawford et al., 1996). Suggestions provided in a hypnotic context have been reported to diminish the P300 ERPs to somatosensory and visual stimuli when highly susceptible subjects are given suggestions for stimulus diminution or for obstructive hallucinations (Spiegel, Cutcomb, Ren and Pribram, 1985; Spiegel, Birre and Rootenberg, 1989; DePascalis, 1994; for contradictory findings see Barabasz and Lonsdale, 1983; Jasiukaitis, Nouriani and Spiegel, 1996; see also Spiegel and Barabasz, 1998 for a further discussion on the effect of instructions on P300 ERPs). These findings were criticized by Dixon and Laurence (1992a) because of the lack of an imagination-only condition as a control. Recent studies (e.g. Barabasz, Barabasz, Jensen et al., 1999; Jensen, Barabasz, Barabasz and Warner, 2001) have found changes, however, in P300 ERPs in association with a hypnotic induction, but not in a nonhypnotic imagination condition nor in low susceptible subjects. Barabasz, Barabasz, Jensen et al. (1999) have further pointed out how different kinds of suggestions may lead to different results when measuring ERPs in association with hallucinations.

Auditory hallucinations have also been studied using brain activation as revealed by regional cerebral blood flow (rCBF) in positron emission tomography (PET) measurements. Szechtman, Woody, Bowers and Nahmias (1998) found that the right anterior cingulate had increased rCBF during hypnotic hallucination (for further discussion of the results see Woody and Szechtman 2000). Also, Silbersweig, Stern, Frith, Cahill, Holmes, Grootenck, Seaward, McKenna, Chua, Schnorr, Jones and Frackowiak (1995) found that activity in the right anterior cingulate along with activation in subcortical nuclei correlated with measures of auditory hallucination in schizophrenic patients. Dierks, Linden, Jandl, Formisano, Goebel, Lanfermann and Singer (1999) stressed, however, the crucial involvement of primary auditory areas in auditory verbal hallucinations with schizophrenic patients. Szechtman et al. (1998) on the other hand, stated that activation of the auditory cortex alone is insufficient for the experience of hallucination. Halpern and Zatorre (1999) further found that areas of right auditory association cortex, together with right and left frontal cortices, are implicated in imagery for familiar tunes. Taken together these studies suggest that the right frontal area seems to have an important role in the hallucination experience, but the involvement of the primary auditory area remains somewhat controversial.

The only neurophysiological model of hypnosis that has been proposed thus far was presented by Gruzelier (1988; 1990; 1998; 2000) and Crawford and Gruzelier (1992). They hypothesized that the differences in hypnotizability are partly due to the individual differences in attentional abilities. These differences would be seen between low hypnotizables and high hypnotizables not only after an induction of hypnosis but also in the nonhypnotic baseline condition (Crawford et al., 1993a). Gruzelier and Warren (1993) have proposed that in highly hypnotizable individuals frontal lobe functions become engaged through instructions to focus attention during the hypnotic induction procedure. This engagement is followed by the inhibition of other, typically frontal functions such as reflective consciousness, monitoring, and self-awareness (for a very similar cognitive model, see Bowers, 1992; Woody and Bowers, 1994). This hypothesis about the attentional differences related to hypnosis has found support from many recent PET studies (Szechtman et al. 1998; Rainville, Hofbauer, Paus, Duncan, Bushnell and Price, 1999b; Faymonville, Laureys, Degueldre et al., 2000; Halligan, Athwal, Oakley and Frackowiak, 2000; Rainville et al., 2002) which suggest that the right frontal area and the ACC seem to be important mediators in hypnosis per se as well as in some changed experiences associated with hypnosis (see also Crawford et al., 1993b). The Stroop Color and Word Test (Stroop, 1935), a behavioural test that is considered to be sensitive to frontal attentional functions, has, however, shown rather contradictory results in general. Some researchers have reported increased Stroop effects, while others found decreased effects in association with hypnotizability or hypnosis (see, for example, Sheehan, Donovan and MacLeod, 1988; Dixon, Brunet and Laurence, 1990; Dixon and Laurence 1992b; Kaiser, Barker, Haenschel, Baldeweg and Gruzelier, 1997; Nordby, Hugdahl, Jasiukaitis and Spiegel, 1999; Kallio, Revonsuo, Hämäläinen, Markela and Gruzelier, 2001; Mallard and Bryant 2001). An interesting recent finding showed that highly suggestible individuals were able to eliminate the Stroop interference effect following a posthypnotic suggestion designed to avoid attributing meaning to words (Raz, Shapiro, Fan and Posner, in press).

Conclusions

Though research on hypnosis has been going on for over a hundred years, there are many questions that still remain unanswered (see Kirsch and Lynn, 1995 for a comprehensive list of current controversies). One of the most crucial controversies is the disagreement

between the NSV and the SV. The former holds that it is suggestibility that needs to be explained. It is a feature that exists in different persons to a different degree without hypnotic induction (basic level of suggestibility). Situational factors (e.g. hypnotic induction procedures, instructions to increase motivation, creating expectations about the outcome, etc.) may increase it to a different degree in different persons. Highly hypnotizable persons reach a high level of suggestibility either due to their high baseline level of suggestibility, to a large increase in suggestibility by situational factors, or to a combination of both. The latter holds that what needs to be explained is the ability to move into another state (ASC) after hypnotic induction. This state is supposed to be present to a different degree in different persons and situations (for the concept of the 'depth' of the state, see note 6). This special state facilitates the responsiveness to suggestions in some crucial way that cannot be explained by the situational factors only (see also Kirsch and Council, 1992). Here we will focus on the literature which specifically deals with argumentation over this crucial question: is there a special hypnotic state (ASC) that serves as a background and gives rise to altered experiences produced by suggestion?

Other questions related to this are:

- Why does a hypnotic induction increase suggestibility? Can it be regarded only as one type of manipulation increasing the motivation, compliance or expectancy that thus increases the level of suggestibility the subject already possesses or can it lead to some kind of hypersuggestibility which needs an additional concept (ASC, trance) in order to be explained?
- Can these changes be explained by referring to the same theoretical entity varying only in degree or by referring to two entirely different theoretical entities?
- Is it possible to find decisive empirical evidence for or against the ASC hypothesis by devising experiments where current brain sensing and imaging methods are used?

In the next section we focus on the NSV and SV and point out some philosophical and methodological limitations that these perspectives face when reaching for an explanation of phenomena associated with hypnosis.

The state-nonstate debate

As far back as the French royal commission's investigation of mesmerism in 1784 (Gauld, 1992), and over the last 200 years, a number of theoretical accounts have been offered to explain hypnotic phenomena. These accounts vary from animal magnetism (Mesmer, 1779/1998) to trance states (James, 1983) to compliance and belief (Wagstaff, 1981). Chaves (1997: 251) lists three notions that have almost always been axiomatic in the history of hypnosis:

- The term 'hypnosis' refers to a denotable state or condition of a person that is in some sense discontinuous from the person's normal waking experience.
- This state can be induced (at least in susceptible individuals) by certain identifiable rituals labelled 'hypnosis induction procedures'.
- The hypnotic state induced by these rituals possesses at least some invariant or characteristic properties, which are independent of the means by which the trance is elicited.

As a reaction to the traditional 'state' views, the social aspects of hypnotic behaviour began to interest researchers. The pioneer of this tradition was Robert White (1941), who

conceptualized hypnotic behaviour in terms of meaningful, goal-directed striving. He maintained that this view gives us a new perspective in which to study hypnotic state. Sarbin (1950) further developed the idea of hypnosis as one form of a more general kind of social psychological behaviour and construed it primarily in terms of a role-enactment. This role theory of hypnosis regards hypnotic interaction as theatrical performance in which both the hypnotist and the subject act reciprocal roles (Sarbin and Coe, 1972; Coe and Sarbin, 1991). According to Kirsch and Lynn (1995) the actual state debate started when T. X. Barber (1969) rejected the idea that the behaviour of a hypnotized person is accounted for by an altered state of consciousness. Barber's view was based on a large body of experiments where he demonstrated how important role concepts such as attitudes, expectations and motivations play in hypnotic responding. Barber's (1969) aim was to show that when subjects are given appropriate instructions about responding, they show an increment in responding to suggestions similar to the one seen after a hypnotic induction. Thus, if all the hypnotic phenomena can be produced without a hypnotic induction, there is no need to posit unusual states of consciousness. Barber (1969) and Sarbin and Coe (1972) both argued that behavioural and subjective responses, and the subjective experience of being in a trance, could be accounted for without postulating any special state or condition.

It seems that from the beginning the NSV theories launched a critical scientific attack against the 'orthodoxical' and traditional ASC explanation (see e.g. Spanos and Chaves, 1970). They apply Occam's razor instead of postulating unnecessary (and mysterious) concepts such as 'trance' or 'altered state of consciousness' to explain something that can be explained without invoking such concepts. Next we focus on some of the central questions concerning the recent research.

The central issues that divide the theoretical landscape

There are many theories which can be labelled as SV or NSV theories. However, they may include considerable similarities or differences which are not necessarily dependent on their account to the state issue. Hilgard's (1977a; 1977b) neodissociation theory is a cognitive model of dissociative phenomena in general although the main focus of it is in hypnosis. Hilgard's theory has further been modified to a dissociated control theory by Bowers (1992) and Woody and Bowers (1994). The expectation theory of Kirsch (1985; 1990) concerns human behaviour in general whereas, for example, the performance standard theory of Lynn and Rhue (1991) or the sociocognitive theory of Spanos (1991) are models of hypnosis. All of the theories do, however, fall in one or the other category when required to answer the fundamental question of the necessity of the concept of ASC when explaining (strong view of ASC) the hypnotic phenomena.

Today, the SV-NSV debate continues. The SV theorists have come up with results where physiological or neurophysiological changes associated with hypnosis have often been interpreted (at least implicitly) to be evidence of the presence of ASC (Wagstaff, 1986). Researchers who search for the neural changes associated with hypnosis are widely using the state concept (e.g. Spiegel and Spiegel, 1978; Gruzelier and Brow, 1985; Gruzelier, 1996, 1998; Maquet, Faymonville, Degueldre, Delfiore, Franck, Luxen and Lamy, 1999; Rainville, Hofbauer, Paus et al., 1999b, 2002; Spiegel, 1991). Also concepts such as 'deeply hypnotized' or 'hypnotic depth' (e.g. De Pascalis, 1999; Evans, 1999) while not referring to subjective experiences of the depth (e.g. Field, 1965) are still used.

The NSV theorists, in turn, come up with new designs to manipulate social variables to demonstrate that factors such as role enactment (Coe and Sarbin, 1991), goal-directed actions, and experiences generated by the tacitly understood test requirements (Spanos,

1991), social compliance (Wagstaff, 1981) or expectations (Kirsch, 1985; 1990) explain the phenomena seen in hypnotic contexts. The physiological data of changes associated with hypnotic responding are not considered to have any bearing on the ASC hypotheses and are actually self evident as all subjective experiences or psychological manifestations are assumed to have physiological substrates (Kirsch and Lynn, 1995; Kirsch, 1999a; Wagstaff, 2000).

The debate about ASC and hypnosis has involved many kinds of arguments. We concentrate here on three major issues that have dominated the discussion. These are:

- the grounds for using the concept of ASC
- the physiological indicators of ASC
- the necessity of a hypnotic induction to produce hypnotic like phenomena.

Next we will briefly present the main arguments and counter-arguments over these central issues.

The grounds for using the concept of ASC

One argument presented against the state view is that the grounds for assuming an ASC are based on circular reasoning. The fact is that hypnotized subjects manifest altered behaviour and they report unusual experiences. The vicious circle is formed when first, the unusual experiences and behaviours are explained as being caused by an ASC. Then the same experiences are seen as evidence of this altered state. The problem then is that there is no independent evidence of an ASC. According to Barber (1969: 5), 'If the behaviours that are to be explained are said to be functionally related to a state of "hypnosis", then criteria for this state are needed which are independent of the behaviors that are to be explained'.

Hilgard (1969) pointed out, however, that many concepts in science can be and have been used in a similarly circular fashion. For example, the concept 'instinct' is a convenient term for specific behaviour, when used in a classificatory sense, to describe characteristic nest building of birds according to their species. The objection is to using these kinds of concepts as if they were explanatorily meaningful (Hilgard 1969). Maybe one should rather use them as convenient descriptions. Also, Kihlstrom (1992) has stated that there should be no embarrassment about using the term 'state' in a hypnotic context and he compares the word 'state' with the word 'condition', like a mode or condition of being. So hypnosis is a state in the same way that one can say 'state of health' or 'state of mind'. If this weak state view truly was the way all the state theorists define the conception of 'state', then it is not difficult to understand why Spanos and Barber (1974) and later Kirsch and Lynn (1995), saw some convergence between the state and nonstate views.

Kihlstrom (1997), however, also uses the concept to refer to changes in the content of consciousness. This view is reflected in the following argument (Kihlstrom 1997: 326):

But there is a state of altered consciousness in hypnosis: amnesic subjects cannot remember things they should be able to remember; analgesic subjects do not feel pain that they should feel; subjects asked to be 'blind' and 'deaf' do not see and hear things that they should be able to see and hear.

Kirsch (2000) on the other hand, sees the concept of ASC (trance) as referring to a 'background hypnotic state' which is supposed to have an effect on how suggestions are experienced. This similar view seems to be shared in the statement by Kosslyn,

Thompson, Costantini-Ferrando, Alpert and Spiegel (2000: 1279): 'These findings support the claim that hypnosis is a psychological state with distinct neural correlates and is not just a result of adopting a role.'

Our analysis of this situation is that there seems to be a confusion of what is meant by the concept of ASC. First, a confusion between what should be considered as a causal explanation of a phenomenon, and what should be regarded as definitional criteria of some category into which the phenomenon falls (i.e. confusion between the strong SV and the weak SV). A causal explanation cannot be based on circularity, for it must refer to phenomena that are distinct from the explanandum itself but which bring it about. Definitional criteria are, however, of a totally different nature. If an ASC is defined in such a way that the presence of unusual subjective experiences is a sufficient criterion for something to count as an ASC, then there is, by definition, an ASC involved in hypnosis. What remains as a matter for debate is whether or not this constitutes an acceptable definition of an ASC, not whether hypnosis fulfils the criteria. But it should be noted that the definition, even if deemed acceptable, would not constitute a causal explanation of the phenomenon; it would merely reveal that hypnosis belongs to the larger class of phenomena called ASCs, and therefore its theoretical explanation (whatever that might turn out to be) will probably be similar to the explanation of other ASCs. There is nothing inherently wrong with such classifications – it is quite informative to know, for example, whether the cause of some disease falls in the category of viruses, bacteria, prions, or fungi – but such a classification should not be taken as somehow replacing the causal explanation of the actual mechanisms at work (what does the virus actually do in the body to cause all the symptoms of the disease?).

Second, the concept of ASC is typically used as referring to a distinct 'background state of consciousness', which is the traditional notion. Changes in the phenomenal contents of consciousness or even shifts in attention (e.g. Spiegel, 1998) are also sometimes referred to as ASCs. These confusions and misunderstandings about the ways to understand the concept of ASC are in need of being clarified in order to proceed fruitfully with the discussion.

The physiological indicators of ASC

Another criticism of the concept of a special state is based on the lack of physiological indicators of the ASC that are to accompany hypnosis. There seem to be, for example, no specific patterns of readily observable neurophysiological changes associated with hypnosis (e.g. Crawford and Gruzelier, 1992). The NSV theorists are inclined to say that there is no physiological evidence of an ASC since there are no phenomena occurring consistently in all hypnotized subjects and all the phenomena associated with hypnosis can also be produced outside the hypnotic context by manipulating motivation or expectation (e.g. Sarbin and Coe, 1972; Barber et al., 1974; Wagstaff, 1981; 1991; Kirsch, 1985, 1990; Spanos, 1986, 1991; Spanos and Coe, 1992). The SV theorists, in contrast, are inclined to say that there are quite plausible alternative explanations for the lack of clear physiological indicators of an ASC. They believe that such indicators do exist, and special brain sensing and imaging methods are already revealing them (e.g. Spiegel, 1991; Gruzelier, 1998; Barabasz, Barabasz, Jensen et al., 1999; Maquet, Faymonville, Degueldre et al., 1999; Kosslyn et al., 2000; Rainville et al., 2002).

Thus, according to SV theorists, evidence for physiological changes already exists, and the changes detected are such that alternative explanations that do not assume an ASC are not sufficient to account for them. All theorists, however, seem to hold that hypnosis occurs

in a social context and the social psychological factors play a crucial role in it. The main problem in this controversy seems to be that there are no proposals of an experimental design that would provide a decisive test of the hypothesis of an ASC. The fundamental theoretical question to be answered is: what would count as neural correlates of an ASC and how should they differ from the neural correlates of normal state of consciousness?

The necessity of a hypnotic induction to produce hypnotic phenomena

One of the main arguments against the hypothesised ASC has been based on the finding that it is possible to have subjects respond to suggestions without any hypnotic induction (e.g. Hull, 1933; Weitzenhoffer and Sjöberg, 1961; Barber and Glass, 1962; Hilgard and Tart, 1966; Tart and Hilgard, 1966; Barber, 1969). The concept of an ASC is unnecessary since even the most extreme phenomena could be produced without a hypnotic induction with, for example, very highly responsive, fantasy-prone individuals (Wilson and Barber, 1983; Barber, 1999; 2000). The same line of argument against the SV continued in the work of Nicholas Spanos (e.g. Spanos, 1971; 1986; 1991) who stated that hypnotic responding could be modified to a substantial degree by exposing subjects to information aimed at changing their attitudes and interpretation about hypnotic responding (with, for example, the CSTP). Thus, the data clearly indicates that it is possible to get people to respond to suggestions with or without an induction and to heighten suggestibility by manipulating expectations or giving task motivational instructions.

There are, however, results that according to SV theorists cannot be explained without postulating some additional constructs. It has been noted by SV theorists that suggestions given after a formal induction procedure may produce some phenomena that cannot be elicited by pure imagery or manipulating contextual variables, i.e. cannot be explained by heightened suggestibility (e.g. Spiegel, 1998; Weitzenhoffer, 2001; for a critical analysis of this hypothesis see Kirsch, Silva, Comey and Reed, 1995). Further, these phenomena are possible for only some individuals (see Hilgard, 1977b). For example, brain imaging and sensing methods suggest that some phenomena occur only after a hypnotic induction but not when the same subjects are using mental imagery (e.g. Kosslyn et al., 2000; Jensen et al., 2001). Thus there seems to be a puzzling little gap which needs to be explained unless we argue that the subjects did not actually try their best during the imagery condition because of either a 'hold-back' effect¹⁴ (Zamansky, Scharf and Brightbill, 1964) or compliance (Wagstaff, 1981; 1991).

Maybe the ways in which hypnosis have been operationalized (i.e. scales that measure hypnotic susceptibility) are not capable of distinguishing between two significantly different types of hypnotic phenomena: those that are more or less like normal mental imagery, and those that are qualitatively different from ordinary mental imagery. The concept of imaginative suggestibility implies that all hypnotic phenomena are in the same category as ordinary mental imagery. Suggestions presented in hypnotic context are assumed to measure this imaginative suggestibility (Braffman and Kirsch, 1999; Kirsch and Braffman, 2001). According to this conception, when given a suggestion, the subject is invited to imagine some alternative state of affairs (i.e. to use his capacity for mental imagery to depict what such a state of affairs would look like). This view implies that the subject is not being deceived or led to believe that such a state of affairs really is the case. By contrast, a deceptive suggestion would aim at convincing the person that the state of affairs described in the suggestion actually holds, i.e. that the world is different from what it actually is. A deceptive suggestion aims at bringing about a true hallucination rather than just ordinary mental imagery.

The view that the traditional scales only measure imaginative suggestibility is somewhat problematic, for there are some items used in traditional hypnotic susceptibility scales which are clearly deceptive. For example, the hallucination item in HGSHS:A is a suggestion where the subject is actually led to believe that there is a fly buzzing around the person's face; the subject is not asked to just imagine such a state of affairs. Thus, the crucial difference not captured by the scales or by the concept of imaginative suggestibility may be between only vividly imaging an experience and truly hallucinating an experience¹⁵.

Our analysis is that it seems that SV and NSV explanations have both tried to provide one overall explanation to all of the phenomena regarded to be part of the domain of hypnosis. The SV seems to have trouble with the 'easier' phenomena like ideomotor responding and the NSV has difficulties in explaining the most extreme phenomena like hallucinations actually experienced. It seems, however, quite probable that one unitary explanation to all phenomena regarded to be hypnotic, simply may not exist (see also Wagstaff, 1996 for similar ideas) and thus the idea of a single overall explanation covering the entire 'domain of hypnosis' may have to be reconsidered.

Summary of central issues

The SV and the NSV disagree as to whether an ASC is needed as an explanan of the explanandum in hypnosis research; whether it is relevant to seek out for physiological correlates of ASC; and whether the explanandum resides only in a few selected subjects or in various degrees in all subjects.

Limitations regarding the current theories

Most NSV theories are in agreement that changes in experience as well as in behaviour do occur, but the explanations of those changes differ (Kirsch, 1998). Different NSV explanations are, however, dissimilar to one another in many details but a view shared by all these approaches is that the ASC concept is not needed. Next we will concentrate on some problems that arise from these explanations.

The problems that nonstate theories face

NSV does not specify the lower level mechanisms of altered experiences

There are several NSV theories of hypnosis but they do not have any relevant differences with regard to our central question. We will use the expectation theory (Kirsch, 1985; 1990) as an example of a social-psychological approach since it clearly accepts the changes in subjective experience. The sociocognitive theory proposed by Spanos (1991) regards that subjective reports of hallucinatory experiences in hypnotic context should not be trusted. This view becomes clear in the following example. Spanos, Flynn and Gabora (1989) gave suggestions of not seeing a number 8 on a piece of paper (a negative hallucination). Most of the subjects first denied seeing the number at all but afterwards they actually remembered it when they were informed that highly hypnotizable subjects typically first see the number and after that it slowly disappears. The interpretation was that the subjects had been less than forthright when claiming that they could see nothing on the paper in the first place. Spanos (1989) admits that some subjects may achieve some level of perceptual distortion but this occurs by using strategies as defocusing their eyes or looking away from the number. On the other hand, Kirsch (1991) sees the

hypnotic experiences as real but as being caused by the expectations that those changes will occur. Kirsch, Wickless and Moffatt (1999) present a body of research where experimental manipulations that produce changes in expectations also produce changes in responsiveness to suggestion, as well as changes in experience. Even dramatic changes in conscious experiences, such as hallucinations, can be explained in the same way. The expectation theory (Kirsch, 1985; 1990) regards these changes in subjective experiences as real and posits that physiological correlates of these changes need to be uncovered (Kirsch, 2000; 2001).

For the sake of argument, let us assume that hypnotic phenomena are simply a result of the expectations that such phenomena should occur. A hypnotized subject experiences automatic actions, hears hallucinatory music, fails to feel any pain when given electric shocks, fails to remember the events afterward, and so on. All of this is completely non-mysterious, as these changes in experience happened simply because the subject expected them to happen.

There are two problems associated with this view. First, even though the expectancy theory does an excellent job in explaining ideomotor and even challenge suggestions (referred to as response expectancies by Kirsch, 1999b), problems arise when positing the same explanation to cognitive suggestions such as hallucinations (for contradictory findings concerning the role of expectations see e.g. Barabasz et al., 1991; Benham, Bowers, Nash and Muenchen, 1998). Our everyday life is full of situations associated with high expectations, but vivid hallucinations in our everyday life are extremely rare. If expectations would produce phenomena such as hallucinations, some kind of distortions in our subjective experience should also occur outside the experimental context where high expectations are present. This would particularly be the case for fantasy prone individuals described by Barber (2000; also Barret, 1996). But even if we are convinced that we left the car keys on the kitchen table (and for some peculiar reason that would not be the case), we never experience a hallucination of the keys if they suddenly are not there (no positive hallucination occurs). Conversely, if someone else has moved the keys to a highly unpredictable place (e.g. in to the bath) we have no difficulties in detecting them (no negative hallucination occurs). However, in cases of a low signal-to-noise ratio we might for a moment experience something that is not there or fail to experience something that we would detect in less noisy conditions. For example, if you expect a phone call in a noisy environment, you might for a moment 'hear' the phone ringing although when you pay more attention you notice that this was not the case. Kirsch (1999b) has referred to alterations in perception in association with ambiguous stimuli as stimulus expectancies.

There are, however, good reasons why expectancies should not produce hallucinatory experiences. It would lead us to extreme difficulties in our everyday life and also, such a tendency of our perceptual system would have been selected against during evolution. Sensitive threat perception might be an exception to this rule: it may lead to frequent false alarms but still be selected for.

Second, it remains somewhat unclear what exactly happens to the subject's expectations (and the underlying neurophysiological mechanisms) after a hypnotic induction (see also, for example, Gruzelier, 2000). Induction increases the probability that any kind of suggestion will be experienced. But it is difficult to understand what kind of expectation could correspond to this situation. Is the subject supposed to expect that absolutely anything can happen next? Or is he supposed to expect that anything described by the hypnotist will magically come true? In any case, the expectation theory remains unclear

about the psychological content of the subject's expectations. The case of hypnotic induction is importantly different from other cases in which expectations change our experiences (e.g. placebo effects), because in the latter cases the psychological content of the expectations is specific (e.g. less pain in a specific location of the body) rather than general. It is clear, however, that the expectations of a person indeed have a very important role in modifying perceptions and researchers are already beginning to find the neurophysiological correlates of these kinds of expectations in the visual domain (Nobre, Coull, Frith and Mesulam, 1999).

Is hypnosis a natural phenomenon or a social convention?

Social factors are important determinants in hypnotic responding, but the preceding causes (the socially grounded facts) that bring something about should be clearly distinguished from the phenomenon itself that is the result of those causes. This can be demonstrated by considering the case of natural phenomena that represent particular natural kinds, such as atoms, molecules, or biological organisms of a particular kind (gold; water; mammal). Whether some entity in front of us is gold, water, or a mammal has nothing to do with the causal pathway that brought that entity about. If we should have to decide whether or not a small piece of a glittering, heavy object is gold, it would be irrelevant to explore where it has come from. It would not matter at all if the object had previously been, for example, an apple turned into gold by the legendary king Midas or if it has been made by using a secret formula created by an ancient alchemist. If the object meets the physico-chemical criteria for gold (i.e. consisting of atoms whose atomic number – the number of protons and electrons in the atom – is 79), then it is gold.

There are, however, facts that are defined by referring to an object's origin. We can conceive of two coins being identical in every possible way including identical atomic structure but excluding an important fact in their history: one is made by the mint and the other by a consummate counterfeiter. As striking as the physical similarity of these coins may be, however, one coin would be legal tender and the other would not. What makes some piece of metal money is not its physical constitution, but the social convention that only pieces of metal produced by the official mint are to be treated as money. Hence money is not a natural kind.

Thus, if hypnosis is treated as a natural phenomenon, then the criterion of what counts as hypnosis should not be sought in the preceding causes of the phenomenon, but in the intrinsic features of the phenomenon itself. Hilgard (1981: 31) has stated that 'if one really believes in a hypnotic state, it can be described only by its own terms, without recourse to a prior condition'. If, however, hypnosis is taken to be a social convention, a fact determined by mutual agreement rather than by states of affairs in the world, then what counts as hypnosis becomes dependent on what we decide to treat as hypnosis, and it has nothing to do with any features intrinsic to the person hypnotized. The NSV theorists have decided to treat as hypnosis only situations originating from the 'official mint', the hypnotic induction procedure where the situation is labelled 'hypnosis' through social convention. Going through the same motions and behaviours but failing to label the situation as hypnosis would mean that the situation does not involve 'real' hypnosis at all; it would only be 'counterfeit hypnosis'.

The problems that SV theories face

Even if the SV theorists would settle on the definition by the APA of hypnosis being a 'procedure taking place in social interaction process' they should be able to test the hypothesis whether this procedure leads to an altered state of consciousness. Even then,

there are two problems to be faced: (1) what would constitute sufficient behavioural criteria for an 'altered state' and (2) what would the neurophysiological correlates of this 'state' be like?

Definitions of ASC

The concept of ASC has been defined in the literature in the following ways. Tart (1972) defined the altered state of consciousness as a 'qualitative alteration in the overall pattern of mental functioning, such that the experiencer feels his consciousness is radically different from the way it functions ordinarily' (p.1203). Farthing (1992) has further defined ASC as a 'temporary change in the overall pattern of subjective experience, such that the individual believes that his or her mental functioning is distinctly different' (p. 205). He admits, however, that there are many difficulties related to this definition (see Farthing 1992). If his proposal that changes in subjective experience are sufficient criteria for an ASC is accepted, then there is no doubt that an ASC is involved in hypnosis. As Shapiro (1977) has argued, however, an ASC must be defined in terms of both a changed pattern of subjective experience and a changed pattern of physiological responses.

Thus, there seem to be several different ways in which ASC has been defined in the literature:

- ASC as the having of a changed pattern of experiences: ASC is a state in which the overall pattern of subjective experiences has been changed (e.g. Kihlstrom, 1997).
- ASC as the reflective awareness of altered experiences: ASC is a state in which the overall pattern of subjective experiences has been changed and the subject is or becomes reflectively aware of this changed pattern (e.g. Tart, 1972; Farthing, 1992).
- ASC as a changed pattern at multiple levels, both psychological and biological: a changed overall pattern of experience coupled with a changed pattern at the neuro-physiological level (e.g. Shapiro, 1977).

The first definition has the problem that all unusual patterns of experience (including those in the hypnotic context) are automatically included as ASCs. Thus, hypnosis becomes an ASC by definition, if one agrees (as most do) that it involves altered patterns of experience. This conception of ASC has no explanatory power. The question of whether hypnosis involves an ASC would become trivial: if there's a changed pattern of experiences then hypnosis is an ASC. Since most researchers agree that there is a changed pattern of experiences, this cannot be the concept that underlies the state debate in hypnosis research. If it were, the debate would have been solved for good long ago. Our conclusion is that a changed pattern of experience alone is not a sufficient condition for an ASC.

The second definition has the problem that the subject is required to be aware of the fact that his experiences are different from normal. This requirement appears too limiting because it leaves too many phenomena that are generally considered to be ASCs, for example, dream experience during which we normally have no idea that our experiences are radically different from normal. Our conclusion is that the reflective awareness of altered experiences is not a necessary condition for there to be an ASC (and it may not even be a sufficient condition, i.e. we may come to believe that we are in an ASC without actually being in one).

The third definition is in our view the least problematic. Still, it remains to be specified as to what kind of changed patterns at the neurophysiological level count as the micro-level correlates of an ASC and how those could be objectively detected by brain

sensing and imaging methods. Our conclusion is that if these could be defined, then we could get a viable definition of ASC that specifies both the necessary and the sufficient conditions of an ASC. The ASC described in this way would have genuine explanatory power in showing how the changed patterns of experience result from changes at lower level mechanisms.

Operationalizing ASC

The next problem concerns the neural criteria for an ASC. The hypothesized changes at the neurophysiological level should be operationalized so that it would be clear what kinds of changes observed by brain sensing and imaging methods would count as necessary and/or sufficient for the presence of an ASC. After this it would be possible to create an experimental design to test this hypothesis: if the right kinds of changes are found, then there is direct empirical evidence of an ASC. But the problem here is to define exactly what kind of neurophysiological changes would indicate the presence of an ASC, and how the available brain sensing and imaging methods are supposed to capture such changes (Revonsuo, 2001). It is almost inevitable to find some changes in brain processes between two different conditions, but it is an entirely different matter whether those differences constitute incontestable evidence of an ASC.

Furthermore, even outside the context of hypnosis in the study of the neural correlates of consciousness there are several different ways in which a change in subjective experience can be operationalized. It is possible to study the correlates of conscious versus unconscious states (wakefulness versus anesthesia, for example Alkire, Haier and Fallon, 2000); the correlates of different kinds of conscious states (wakefulness versus dreaming, for example Hobson, 2001); or the correlates of particular contents of consciousness as dissociated from the correlates of the physical stimuli (correlates of the visual consciousness of faces or objects in binocular rivalry tasks, for example Kanwisher, 2001).

In the context of hypnosis, the problem is as follows: should we look for the correlates of pure hypnotic induction (also referred to as neutral hypnosis, for example Edmonston, 1979) that is the changes at the neurophysiological level following the induction but in the absence of any further suggestions in particular contents of consciousness? Should we look for correlates of the particular changes in the contents of consciousness following specific suggestions (i.e. the presence and absence of a hallucinatory visual experience while the subject is all the time 'hypnotized')? Or should we contrast the same content of consciousness caused by two different mechanisms: first by a hypnotic suggestion (e.g. the hallucinatory experience of seeing a tapir in front of you) and second by an actual visual stimulus (by showing an actual tapir to you during wakefulness)?

We conclude that these methodological questions of operationalizing ASC should be resolved before it is possible to start a systematic empirical research programme that tries to reveal the possible neural correlates of the ASC of hypnosis.

The problem of defining when someone is 'in hypnosis'

Since the inter-individual differences in reacting to a hypnotic induction are huge, it cannot be taken for granted that a person is 'in hypnosis' if they have received a hypnotic induction. Neither is it possible to ask a person if they felt being in hypnosis or in an ASC since it would be impossible to know what the criteria for being in hypnosis or ASC would be. A subject may answer 'yes' when asked about feeling hypnotized after a hypnotic induction because their hands were feeling heavy and their eyes tired while another subject would interpret the identical feelings as being due to relaxing. So even

identical feelings could be interpreted differently. Though Perry and Laurence (1980) have found that subjective ratings of hypnotic depth correlate highly with objective measures, Radtke and Spanos (1981) have argued that since experiences are ambiguous, the subjects rely on contextual factors to make inferences of their internal states. They have further noted (Radtke and Spanos 1982) that even among high hypnotizables, less than two-thirds defined themselves as 'hypnotized' when explicitly asked after a hypnotic induction.

This possible lack of subjective insight into being in an ASC is also shared by other similar phenomena regarded as ASCs. There can be clear alterations in a state of consciousness without the person being aware of them happening. Sleep onset is a good example of a situation where a person 'slips' into an ASC without necessarily realizing it and can experience vivid hypnagogic hallucinations during sleep onset, for example, without knowing that they have actually fallen asleep. People whose EEG show clear signs of sleep onset often deny having been asleep if asked. Lucid dreaming (LaBerge, 1985; LaBerge and Gackenbach, 2000) is a rare but significant exception, where a lucid dreamer might retain awareness of their true state while falling asleep or gain it during REM sleep and dreaming. Also, Farthing (1992) states that ASCs are not necessarily recognized by the individual at the time they are happening; they may be inferred afterwards.

Nevertheless, the fact the state theorists have to face is that there is no unambiguous behavioural criterion of someone being in hypnosis, nor a test battery which provides one with a litmus test revealing whether or not a person actually is hypnotized (Weitzenhoffer, 1996) and nor is it possible to rely on a person's subjective experience of feeling hypnotized.

The criteria of the presence of hypnosis used in different studies

The experiments that have been carried out during the past twenty years reveal that very different criteria among researchers have been used when deciding whether or not hypnosis has been present. The subjects are typically pre-tested with the Harvard Group Scale of Hypnotic Susceptibility, form A (HGSHS:A; Shor and Orne, 1962) and subsequently with the Stanford Hypnotic Susceptibility Scale, form C (SHSS:C; Weitzenhoffer and Hilgard, 1962). Then according to the result achieved in these tests, two groups are formed: one labelled as high susceptibles or 'highs' and the other one as low susceptibles or 'lows' (for a critical review of this method see Woody, 1997). It is also possible to use the real-simulator paradigm (Orne, 1959) described earlier. After this procedure the group labelled as 'highs' is considered to be the group which, after receiving a hypnotic induction, will somehow be influenced by this procedure or enter a 'hypnotic state'. The other group, labelled as 'lows', will not be influenced by the hypnotic induction and does not enter this state. Weitzenhoffer (1980) and Kirsch (1997) have adequately criticized the hypnotizability scales for not measuring hypnotizability as they argue that it should be defined as the difference between waking and hypnotic suggestibility. But even if we measured only the increase followed by the hypnotic induction, we would end up with subjects that have the same score but who may differ from each other in many respects (e.g. Hilgard, 1981).

Furthermore, the definitions of 'highs' and 'lows' vary significantly from one study to another. For example, Gruzelier and Warren (1993) divided a cohort of volunteers into two groups – highs and lows – using the Barber scale (Barber, 1969). Kaiser et al. (1997) used a scale in which the subjects responded to traditional hypnotic challenges. In some studies (e.g. Dixon and Laurence, 1992b) the threshold value for high hypnotizability has

been a score of 8 or more on the SHSS:C whereas others have used a score of 9 or more on the same scale (e.g. Maquet, Faymonville, Degueldre et al., 1999) or 10 or more (e.g. Sheehan et al., 1988) on the HGSHS:A.

Neurophysiological markers of complex cognitive phenomena

We have noted that many different underlying psychological processes may be involved even behind an identical score obtained on a given behavioural scale (e.g. SHSS:C or HGSHS:A). Keeping this in mind, it would be surprising to find consistent neurophysiological or neuropsychological results when measuring the brain activity associated with a complex process involving different subjective experiences in a large group of subjects. This leads us to question the usefulness of the traditional criterion for the presence or absence of the explanandum: first, the measurement of the susceptibility of a large group of subjects with a behavioural scale and then the search for neurophysiological correlates of the varying experiences of this extremely heterogeneous group of people. With such a design, it may be very difficult to find any clear correlates at the neural levels, for the phenomenon as identified at the higher level would seem to be rather heterogeneous and ill-defined.

Furthermore, even if subjects are collected by using the current behavioural scales and then divided into two groups (highs and lows) by using the same criteria (e.g. a score of 10–12 for highs and 0–2 for lows), it still is impossible to get homogeneous groups of subjects. No matter how strict the score limits for defining highs and lows would be, they would still reflect only behavioural similarities.

Summary

The problem of the NSV is that the level of social interactions and expectations may be a partial explanation, but referring to preceding causes of a phenomenon does not lead us to understand its intrinsic features. Further, the most extreme phenomena associated with hypnosis seem to be difficult to explain without assuming any additional accounts. The SV, in turn, faces a crucial problem in its lack of clear definitions of, and criteria for 1) being in hypnosis or hypnotized and 2) altered state of consciousness. As long as these concepts lack a definition which can be empirically evaluated, there will be no possibility even to theorize about the possible changes in the state of consciousness associated with hypnosis.

Towards an empirically testable account of hypnosis

An analysis of the explanatory domain

We believe that the controversy over hypnosis and ASC can be analysed (and perhaps even solved) if placed in the context of a particular explanatory framework: the multilevel framework of biological explanation (also referred to as mechanistic explanation by Bechtel and Richardson, 1992; 1993). This has appeared to be a successful strategy in the discovery and explanation of complex biological phenomena (Bechtel and Richardson 1992; 1993). The basic idea in this framework is that phenomena are seen to be arranged in a hierarchy of levels of organization in nature¹⁶. Conceptual frameworks in science reflect this hierarchy and form corresponding levels of description. When a phenomenon that requires explanation is encountered, it should first be clearly described and identified: the proper levels of description for the phenomenon should be determined. This may be a difficult task, for it is not necessarily very clear where the phenomenon should be localized in the explanatory hierarchy. Different levels also use very different

vocabularies in describing phenomena; thus, the vocabulary should be appropriate for the phenomenon in question (see Figure 1).

In the history of biology, deep disagreements have sometimes emerged concerning the level of organization at which a certain phenomenon resides and at which level of description the theoretical explanations should be constructed. For example, biological respiration was argued by some researchers to be realized and explained at the level of specific organs (lungs), by others at the level of tissues (blood), and by yet others at the level of the individual cell (Bechtel and Richardson, 1993). The individual cell turned out to be the correct level of organization. The problem of identifying the mechanisms of cellular respiration within the cell was not easy either; finally, the complex internal structure of the mitochondrion – a specific structural component within the cell – was established as critical for the chemical reactions involved (Bechtel and Richardson, 1992).

Determining the appropriate levels of description for hypnosis research

The debate between SV and NSV also seems to boil down to a debate about the level of description at which hypnosis resides: what is the true explanandum of hypnosis research and how should it be described? Determining the correct level of description of any phenomenon is absolutely vital, for otherwise the details of the explanatory task will remain unclear: what conceptual framework and vocabulary should be used to describe the phenomenon? What are the lower-level mechanisms that could be invoked to explain the phenomenon? What are the proper research methods to study the phenomenon and its underlying mechanisms?

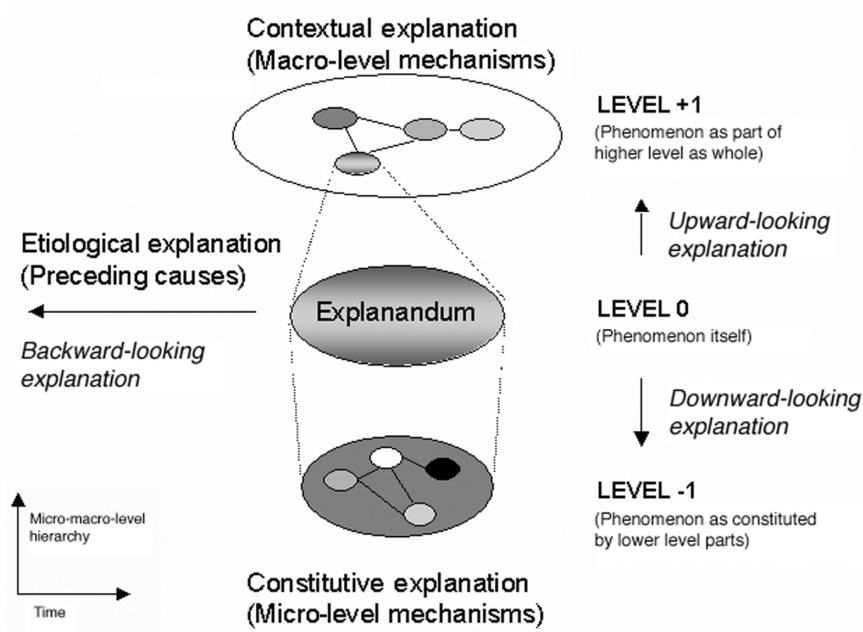


Figure 1. General scheme of multilevel framework of biological explanation.

It should be noted that the complete description and explanation usually crosses several levels of description. Still, a particular phenomenon resides at a particular level of description, and as long as it is unclear what the proper level of description is, the explanatory task cannot be completed.

Now, the SV versus NSV debate is really a disagreement about the level of description at which the phenomenon of 'hypnosis' should be conceptualized and the level at which an explanation should be construed (see also e.g. Gruzelier 2000; Wagstaff 2000). The levels involved in this debate are, roughly, the following (see Figure 2):

- The social-psychological level, which conceptualizes and describes the interaction between persons, in this case the interaction between the subject and the hypnotist, by referring to concepts such as roles, role-playing, compliance, etc.
- The personal level, which describes the behaviour of the whole person in terms of the folk-psychological concepts such as beliefs, desires, attitudes, expectations, etc.
- The sub-personal levels (describing various phenomena that reside inside¹⁷ the person):
- The phenomenal level, which describes only the subjective conscious experiences of the person.
- The cognitive level, which describes how the individual receives and processes information and uses it to guide behaviour.
- The neural level, which describes the underlying neurophysiological correlates and mechanisms of the subjective and cognitive levels.

The NS theories postulate that hypnosis is a phenomenon that resides at the social-psychological level and a sufficient explanation should be explained by referring to the psychological processes residing at the personal level (e.g. expectations). According to NS theories no sub-personal levels are expected to reveal decisive evidence of the existence of ASC, only evidence of normal psychological functioning. Should physiological evidence of ASC appear, however, then the NS theory would have to be rejected and the evidence 'would support the idea that hypnosis is a unique altered state' (Kirsch and Lynn, 1995: 855). The state theories postulate that hypnosis is a phenomenon that resides at the sub-personal levels of organization and should be described and explained there¹⁸.

In the multilevel explanatory framework, phenomena are explained by situating them within the hierarchical mechanical network. Two fundamental aspects of a full mechanistic explanation are called the 'etiological explanation' and the 'constitutive explanation' (Salmon, 1984). The etiological explanation traces backwards the causal path that brought about the explanandum; it explains how the explanandum came to be there, came to pass or came to have some property. It is the backward-looking explanation in the mechanical network. The constitutive explanation explains how the phenomenon is realized by lower level mechanisms in the hierarchy of different levels of description; thus, it can be described as a downward-looking explanation in the mechanical network. Furthermore, there is an upward-looking explanation as well, which places the phenomenon in the context of other phenomena at a higher level of organization and describes its role as a part of the mechanism that constitutes the higher levels. (Craver, 2001; Craver and Darden, 2001).

We propose that a full explanation of hypnosis should also have at least these three different aspects: constitutive (downward-looking,) etiological (backward-looking) and contextual (upward-looking). We further propose that the particular changes in subjective

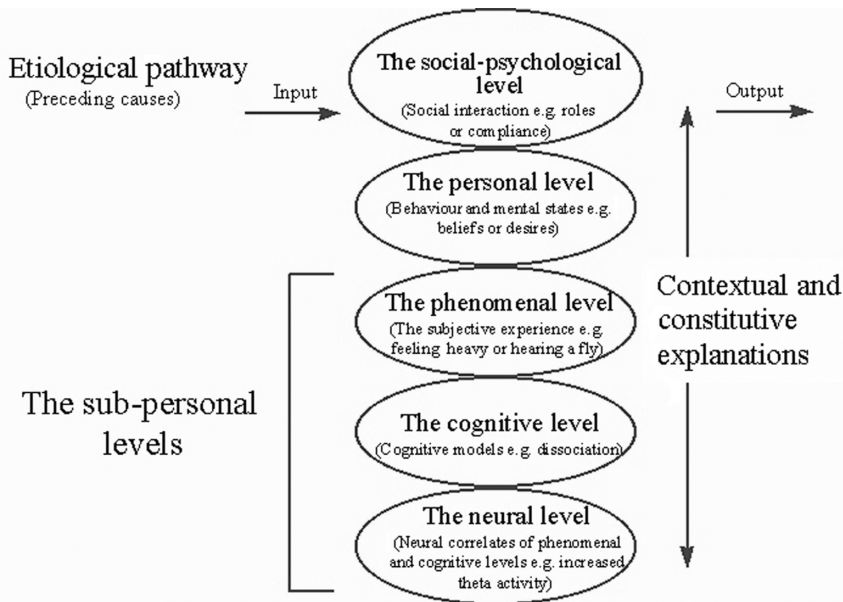


Figure 2. The explanatory domain of hypnosis.

conscious experience experienced by the subject (the phenomenal level) form the core explanandum of any theory of hypnosis.

To explain those changes, they should be placed in a mechanical network that describes, among other things, first, the causal path backwards that brought about the changes in experience. Let us call it the etiological explanation of hypnosis. Second, it should explain how the changes of experience are realized by changes at the lower sub-personal levels of cognitive and neural mechanisms. Let us call this the constitutive explanation of hypnosis. If one accepts the mind-brain supervenience thesis that every change in subjective experience at the phenomenal level must be accompanied by a corresponding change at the neural level (Kim, 1998), then it follows that the changes in experience associated with hypnosis are necessarily accompanied by changes at the underlying cognitive and neural mechanisms. Even if we deny that those changes should require 'an altered state of consciousness', it will not change the fact that a full explanation of them includes both the etiological story and the constitutive story. Third, the explanation should place the changes at the phenomenal level in the context of the higher levels, which in this case are the behaviour of the subject and the social interaction of the subject with the hypnotist.

The etiological and the contextual explanations can be typically given in terms of the social-psychological and the personal levels of description. The etiological explanation describes the preceding causes that brought about the changes in experience. The contextual explanation sees the subject's experiences in the higher level context of external behaviour and social interaction: experiences are modulated by the social context, and they in turn cause behaviours that modulate the social context.

In other types of altered experience (e.g. dreaming), the neurocognitive mechanisms are actively explored, and there seems to be no good reason why the altered experience during hypnosis should not be explored in a similar way. As we have shown, the NSV

adequately explains most of the phenomena associated with hypnosis. We argue that in order to solve the question about the existence of an ASC associated with those aspects of hypnosis that the NSV cannot adequately explain, we should turn our attention to lower levels of description (as has been done in dream research). That is, we propose an empirical test to determine whether or not the explanandum must reside at the phenomenal level (with the explanans thereby residing at lower levels of description). Specifically we propose an experimental approach that will test to see if there are aspects of hypnotic experience that can only be described at the phenomenal level. That is, these tests would attempt to detect the existence of hypnotic phenomena that could not in principle be explained by sole reference to higher levels of description. If the results of these tests show that the phenomenal level is the proper level of description for some aspects of hypnosis, the next step in determining the existence of an ASC would be to look to the lower levels of description to determine if they can explain the results at the phenomenal level (keeping in mind that the explanans are always located at a lower level of description than the explanandum). If the explanandum is found to properly reside at the phenomenal level, and the explanans are found to reside at the lower levels of description, then one could conclude once and for all that an additional construct is needed in order to explain at least some aspects of hypnotic experience.

The explanatory scope of ASC

An implicit idea behind both SV and NSV explanations of hypnosis has been that there should be a single set of theoretical constructs that can be used to explain all phenomena belonging under the domain of hypnosis. The SV theorists propose that this explanation includes the concept of an ASC, while the NSV proponents argue that concepts such as imaginative suggestibility are sufficient to account for the whole domain. We believe that the implicit assumption that there is one single explanation is mistaken and that different concepts can account for different sets of phenomena that all belong under the domain of hypnosis. This idea can be found in Bowers (1992: 259) where he states that: 'the social psychological model of hypnosis applies reasonably well to Ss who are low to moderate in hypnotic ability ... but is progressively less relevant the more hypnotic ability increases to a level required to pass truly difficult suggestions'.

The sociocognitive research indicates that we do not need any ASC hypothesis to explain phenomena that Kirsch and Braffman (2001) and Braffman and Kirsch (1999) have labelled imaginative suggestibility. We fully accept these results and their implications. We believe that it is fully possible to respond behaviourally to all suggestions in, for example HGSHS:A without there being any ASC involved. We also accept that it is possible to experience involuntariness or be incapable to bend an arm imagined to be stiff without any ASC. These behavioural responses and changes in experience can be explained by vivid mental imagery and associated responses. On the other hand, arguing that nothing unusual ever takes place in hypnotic suggestions becomes extremely difficult given that there is a body of research indicating that for some individuals, the deceptive type of suggestions (leading the subject to believe that the world is different than it really is) can turn into hallucinatory realities.

As to the explanatory scope of the concept of ASC, we thus conclude that the concept of ASC is not necessary to account for all hypnotic phenomena, but that it may be necessary to account for some of them. We also conclude that imaginative suggestibility is not sufficient to cover all of them either, although it does explain many of them convincingly enough. Thus, the question is: is the concept of an ASC required to account

for the small subset of hypnotic phenomena that imaginative suggestibility cannot explain? We propose that it is, which leads us to the view that the ASC of hypnosis is a rare phenomenon, restricted only to a few individuals (virtuosos), and therefore has been difficult for the scientific community to study and accept.

There are many other phenomena which have had a similar history in psychology. For example, synesthesia and lucid dreaming were for a long time considered to be just weird anecdotes originating in a few unreliable individuals who must be mistaken, lying or at least grossly exaggerating. These phenomena could not be studied experimentally or fitted into the accepted scientific views of neurophysiology or experimental psychology and, therefore, were dismissed and ignored for a long time. Before their induction to scientific theories it seemed impossible to understand that a person could truly see colours when hearing music or that someone could actually be aware of being in a middle of a dream world and even able to decide what to do in this world while still physiologically remaining in REM sleep. When experimental research finally invented testable predictions and focused on these rare individuals, researchers realized that the descriptions of the subjective experiences of these individuals are accurate (e.g. LaBerge, 1985; LaBerge and Gackenbach, 2000; Ramachandran and Hubbard, 2001) and that they must be accounted for by the theories and models in cognitive neuroscience.

AST definition of ASC

Distinction between ‘state’ and ‘content’ of consciousness

Hypnosis research requires a clear understanding of the concept of ‘state of consciousness’. We propose the following. First, the concepts ‘state’ and ‘contents’ of consciousness should be clearly differentiated from each other. The ‘contents’ of consciousness refer to the patterns of subjective experience at the phenomenal level: percepts, emotions, sensations, mental images, etc. Block (1995) uses the concept of ‘phenomenal consciousness’ to refer to the same thing. To emphasize that we are here talking about subjective experiences at the phenomenal level, we will henceforth use the term ‘phenomenal contents of consciousness’. The ‘state’ of consciousness refers to the underlying context in the brain in which the phenomenal contents of consciousness are brought about. Thus, the ‘state’ does not refer to the subjective experiences themselves, but to the background mechanisms outside the phenomenal contents of consciousness that are inside the brain and modulate or realize those contents. We shall henceforth refer to these mechanisms by the term ‘background state of consciousness’. These background mechanisms could also be referred to as the non-conscious causal context of consciousness since strictly taken, the context which brings the contents about is not a state of consciousness in the sense that it is not a state of subjective experience per se¹⁹.

Distinction between baseline state of consciousness and ASC

The paradigmatic baseline of the background state of consciousness is the state of being awake and perceiving the environment. When in this baseline state, the etiological pathway to and the constitutive mechanisms of subjective experience work in such a manner as to create veridical perceptual experience and non-delusional beliefs of the surrounding world and oneself. Paradigmatic altered states of consciousness are such that the background state of consciousness (i.e. the etiological pathway to or the constitutive mechanisms of subjective experience) is temporarily predisposed to create phenomenal contents of consciousness that misrepresent or create delusional beliefs of the

surrounding world and oneself. For example, when we fall asleep, we become functionally blind even if our eyes are open. Thus, the etiological pathway from peripheral sensory organs to subjective experience ceases to function as it does in the baseline condition. Now it prevents veridical perception of the environment. If we take LSD, there will be micro-level changes in the neurochemistry of the etiological and constitutive mechanisms of experience, leading to highly unusual hallucinatory and delusional contents of consciousness. An identical content of consciousness (e.g. the experience of seeing an elephant in front of you) may be produced during the baseline background state of consciousness (if you're at the zoo) or during an altered background state of consciousness (if you're at home and dreaming or under the influence of LSD).

The phenomenal content of consciousness does not by itself determine whether the background state of consciousness is normal or somehow altered. The alteration in the background state of consciousness is the predisposition of the etiological and constitutive mechanisms of subjective experience to process and represent available information non-veridically and/or delusionally so that the resulting phenomenal content of conscious experience will misrepresent reality (see Figure 3). When such a predisposition exists, there is an altered state of consciousness regardless of what the specific contents of consciousness are. Thus, the phenomenal contents of consciousness and the background state of consciousness can be specified independently of each other.

The ASC of hypnosis

Let us now apply this analysis to hypnosis. If hypnosis constitutes a background state of consciousness different from the normal baseline state of waking perception, then the hypnotic induction should lead (at least in virtuosos) to changes in the background

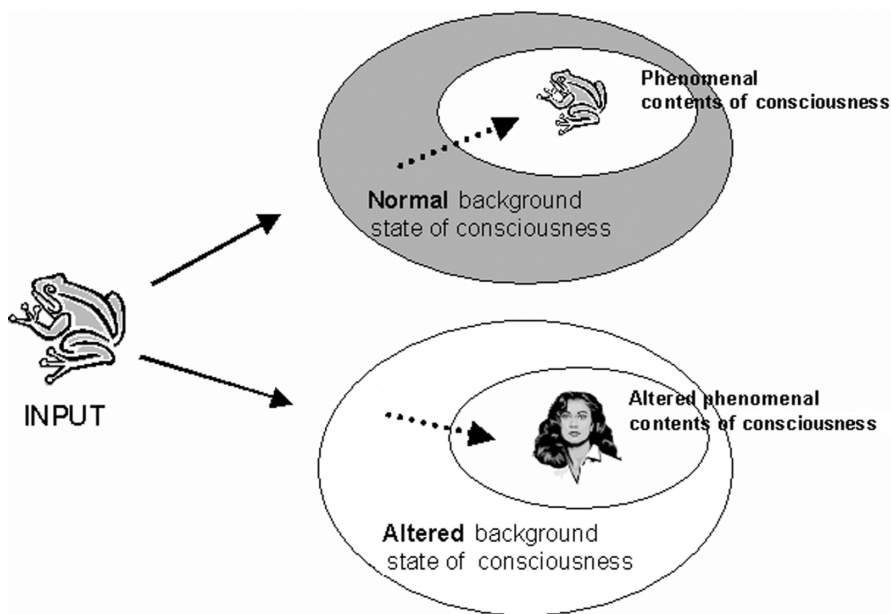


Figure 3. An illustration where the same input causes two different phenomenal contents of consciousness, depending on the background state of consciousness.

mechanisms modulating or realizing the phenomenal contents of consciousness. Due to the changes, there should be a predisposition for the etiological and constitutive mechanisms of subjective experience to process and represent available information non-veridically and/or delusionally so that the resulting phenomenal content of conscious experience will (in some way characteristic to hypnosis) misrepresent reality. This change in the background state of consciousness would then serve as the mechanism for enhanced suggestibility: the etiological pathway of conscious experience would tend to take external verbal suggestions as input and turn them into non-verbal patterns of experience at the phenomenal level. Analogously, the altered state of sleep tends to take internal neural activations (such as PGO waves) as input for the etiological pathway and turn them into patterns of hallucinatory dream experience. The very aim of suggestions in a hypnotic context is to create an experience of the world (or the self) as being in a configuration that differs from the way reality would have been experienced had the suggestion not been given.

According to AST, a distinction should be made between two phases of the altered background state of hypnosis: The first phase ('input phase', during which the suggestion is given) is realized after the hypnotic induction. This state allows altered processing of verbal suggestions so that the states of affairs described by the suggestions activate corresponding representations in any sensory modality (e.g. verbal descriptions of objects activate visual representations; of smells, olfactory representations; of sounds, auditory representations, and so on). The second phase ('output phase', during which the suggestion is experienced as an altered content of phenomenal consciousness) releases the representations so that they modulate the phenomenal content of consciousness.

The input and the output phases usually occur in close succession in the temporal dimension (i.e. the suggestion turns into a pattern of altered experience almost instantaneously) but this need not necessarily be the case. In post-hypnotic suggestions, the input and output phases may be separated by a considerable length of time (hours or even days). Post-hypnotic suggestions are different from ordinary suggestions in that, in addition to the suggested phenomenal content, they also include a simple 'if – then' rule specifying the conditions under which the output phase should be automatically triggered. Thus, the post-hypnotic suggestion builds a somewhat more complex network of strong associations than ordinary suggestions do. These suggestions include a description of the perceptual states of affairs that should immediately precede the output phase and which will function as the trigger or cue to the output phase. Although post-hypnotic suggestions may at first seem much more difficult to explain than ordinary suggestions, they are not. Only simple 'if – then' rules connected to specified perceptual contents are required in AST to account for post-hypnotic suggestions.

AST postulates that the triggering and the onset of the output phase happen entirely outside the subject's conscious experience or voluntary control. Thus, the altered phenomenal contents of consciousness simply appear in the subject's consciousness, without any special effort on the subject's part to produce them. This is qualitatively different from mental imagery, whose production requires voluntary intention, subjective effort and focused attention. Genuine hypnotic hallucinations, by contrast, require none of the above. If the suggested content is perceptual in nature, it simply appears as a pattern of subjective experience in the subject's consciousness as if it were the normal output of perceptual input modules. If the suggested content is action related in content, then the subject will either automatically perform an action or at least feel a strong urge to perform it. It may be possible, however, to deliberately try to control and inhibit the urge if it is in conflict with current goals and intentions.

The concept of dissociation

Currently the most influential theory of hypnosis has been provided by Hilgard (1973; 1977a; 1994) and termed as the neodissociation theory. Another recent theory called 'the dissociated control theory' (Bowers, 1992; Woody and Bowers, 1994) has been proposed to be a modification of Hilgard's theory (for a critical review of these theories see Kirsch and Lynn, 1998a; 1998b). Both of these theories hold that behaviour is organized as a hierarchical series of subsystems of control that carry out habitual action sequences (e.g. Hilgard, 1977a; see also Norman and Shallice, 1986; Shallice and Burgess, 1991). In Hilgard's theory the concept of dissociation includes the idea that part of the attentive effort and planning function may continue without any phenomenal awareness of it at all, for example, the person may simultaneously hold his elbow stiff (e.g. in a challenge suggestion) and feel that he is actually trying to bend it. This may happen because in hypnosis (ASC) it is possible that the executive system is divided into two parts. This view of two or more streams of consciousness has been criticized by many researchers (Bowers, 1992; Kirsch and Lynn, 1998a; 1998b; Woody and Sadler, 1998). Thus, hypnosis should not be interpreted in terms of a 'hidden observer', for this concept seems to refer to something even more difficult to define and explain than the original behavioural data that it was supposed to explain²⁰.

Bowers (1992) and Woody and Bowers (1994) use the term in a different way and suggest that it is not consciousness that is divided but rather that the subsystems are dissociated from executive control. Therefore, the concept of dissociation does not need to rely on special mechanisms such as the hidden observer (e.g. Woody and Sadler, 1998). They further suggest that hypnosis produces a state similar to that experienced by frontal lobe patients, and because of weakened frontal lobe control, the subsystems of control may be directly and automatically activated.

We hold that the control of behaviour can be divided into two parts only on very rare occasions. The clearest example is of split-brain patients whose cerebral hemispheres have been separated from each other (Gazzaniga, 1972). Even they require special experimental conditions of lateralized stimuli to manifest the dissociation of behavioural control. By contrast, in the case of hypnosis, no division of consciousness needs to be postulated. Instead, the theory of dissociated control gives a plausible cognitive model of what is occurring. Thus, the concept of dissociation can be used in hypnosis research in the same sense as elsewhere in cognitive neuroscience (e.g. in cognitive neuropsychology where it is used to describe how separate cognitive modules and subsystems may be temporarily or permanently incapable of communicating with each other normally). Such dissociations may lead to unusual patterns of experience (e.g. prosopagnosia) or behavioural control (implicit object oriented actions; Milner and Goodale, 1995). But we are suspicious about any use of the concept which implies that our normal integrated phenomenal consciousness could somehow be divided into two isolated but simultaneous streams by a hypnotic induction.

Is it possible to find neural correlates of hypnosis?

The problem of group studies

In traditional neuropsychology, as well as in hypnosis research, the dominant approach has been one in which the performance of a group of subjects (e.g. patients, high susceptibles) on one or more tasks is contrasted with the performance of another group of subjects (e.g. healthy controls, low susceptibles). It is, however, generally acknowledged

that traditional syndrome categories in cognitive neuropsychology are too coarse grained (e.g. Poeck, 1983). Unfortunately, much potentially valuable information can be lost in such an averaging procedure as well as notable information about individual differences between patients assigned to the same groups (Shallice, 1979). An increasing number of cognitive neuropsychologists now agree upon the value of intensive single case studies of patients with deficits in different areas of cognitive processing. We have many interesting phenomena that can be seen in only a few people in the world (e.g. blindsight), yet they do exist and we can learn a great deal by studying these individuals. This same tension has also been acknowledged (Ramachandran and Blakeslee, 1998) in neurology between those who believe that the most valuable lessons about the brain can be learned from statistical analyses involving large numbers of patients and those who believe in doing the right kind of experiments on the right patients, even a single patient. Ramachandran and Blakeslee (1998: 13) actually go so far as to say that 'in neurology, most major discoveries that have withstood the test of time were, in fact, based initially on single case studies and demonstrations'.

We propose that the critique of overly coarse-grained categories is justified in hypnosis research and that even single case studies would probably provide much valuable information (see e.g. Barabasz and Barabasz, 1992). The point is, however, that we should only perform single case studies on those subjects who possess the capability to experience the most extreme phenomena such as hallucinations and amnesia.

The virtuoso as a model system in hypnosis research

Studies using virtuosos in hypnosis research could serve the same role as do studies on model systems in general. The history of science has shown that an efficient way to capture a phenomenon through empirical studies is to identify a 'model system'. A model system is one in which the phenomenon of interest manifests itself in a particularly clear form. In the ideal case, the phenomenon is clearly isolated from others with which it might otherwise be confused, and it is accessible to easy observation or manipulation by the researchers. The model system may not be prominent – just consider the significance of the lowly fruit fly (*Drosophila Melanogaster*) for the development of genetics. If suitable model systems can be identified, researchers can concentrate on the description and explanation of these systems first. Charting the phenomenon in the limited but maximally clear cases provided by model systems may lead to rapid progress in revealing fundamental theoretical principles needed in the explanation of the phenomenon.

We suggest that individuals referred to as 'hypnotic virtuosos' should be regarded as the principal model system for hypnosis research (see also Register and Kihlstrom, 1986; Kihlstrom, 1992). In these cases, the 'hypnotic' phenomena are manifested in their clearest form and will not be easily confused with any other phenomena, such as simple compliance or faking. Furthermore, we are more likely to get a firm empirical grasp of the state of consciousness implied by hypnosis by first exploring what kind of changes in subjective experience, information processing and neural activity can be found in these rare but illuminating cases. This view is rather close to the one already presented by Braid (1855) in which the term hypnotism ought to be restricted to the phenomena manifested in patients who actually pass into a state of sleep (Kihlstrom, 1992). Also Weitzenhoffer (2000) has pointed out that in order to study the hypnotic state per se, one should focus attention on 'ultraresponsive' or 'ultrasuggestible' individuals. He has further argued that hypnosis research is usually done in the context of studying certain suggested behaviours but never deliberately in the study of the hypnotic state.

The experimental study of virtuosos

Since there are no behavioural criteria for defining a virtuoso, we have to come up with other suitable criteria when selecting subjects. Green, Lynn and Carlson (1992) and Register and Kihlstrom (1986) have provided some guidelines in order to detect the virtuosos in a large group. Shallice (1979) has further made recommendations about how single-case studies should proceed. He stresses the importance of 'baseline' data when comparisons between subjects are being made. In hypnosis research, this baseline data could provide a detailed picture of the successfully completed suggestions (behavioural outcome) as well as a description of the subjective experiences (see e.g. McConkey, Glisky and Kihlstrom, 1989; McConkey, Wende and Barnier, 1999) connected to these suggestions²¹. These experiences should be described in such a way that the degree of experienced changes in conscious experience, e.g. the vividness of a hallucination, can be estimated or quantified. The appropriate scale for defining a virtuoso should thus include a behavioural scale combined with an experiential scale. True virtuosos are probably so rare (as, for example, subjects with true eidetic imagery e.g. Stromeier and Psotka (1970) or synesthesia) that group studies on virtuosos may not be feasible for practical reasons. If virtuosos with highly similar behavioural and experiential profiles can be gathered, however, then group studies (or at least studies on multiple single cases) should be carried out.

Using the virtuoso or case approach may lead to empirical criteria for distinguishing the hypnotically altered background state of consciousness from the baseline state of consciousness. These criteria can be defined either at the behavioural level or at the level of neurophysiological changes which could be consequently detected by brain sensing or imaging methods.

At the behavioural level, an experiment supporting the involvement of an ASC during hypnosis would be one which would test whether the subject's responses could be modified by the altered experiences in a way that could not be explained by faking, compliance or the use of mental imagery. We will describe a possible experiment of this kind below (a similar experiment has been used to show that the experiences reported by subjects with synesthesia are real).

An ideal experimental design to test the ASC hypothesis (specifically, the ASC postulated by AST during the input phase) at the level of neural mechanisms could be something like the following. The assumed 'altered background state' of hypnosis should be produced in the virtuoso with a neutral induction (see Edmonston, 1979) or, even better, with a posthypnotic suggestion about entering hypnosis. The use of a posthypnotic suggestion would minimize the need for suggestions of relaxation, drowsiness, etc. which are typically used in a hypnotic induction. No additional suggestions aiming to change the phenomenal contents of consciousness should be given. In the control condition, the baseline state of consciousness should be matched as closely as possible without giving a hypnotic induction (e.g. focus on listening to a story).

If reliable information processing or neural activity differences between these two different background states of consciousness can be found, then there would be empirical support for the view that the input phase of hypnosis involves changes in the background state of consciousness and, therefore, counts as an ASC. A study by Kallio, Revonsuo, Lauerma, Hämäläinen and Lang (1999) is an example of an attempt to reveal differences in the background state between baseline and hypnotic situations. After the induction, but without further suggestions as compared to the baseline state, the mismatch negativity component of the auditory ERPs was found to be larger in a virtuoso subject. This

demonstrates that there are physiological changes associated with a hypnotic induction that are not present in a closely matched relaxed state.

An ideal experimental design to test the ASC hypothesis at the level of neural mechanisms (specifically, the ASC postulated by AST during the output phase) could be something like the following. The subject is given a post-hypnotic suggestion about a specified change in the phenomenal contents of consciousness (e.g. seeing hallucinated colours in black and white pictures, or hallucinated objects or faces before his eyes) when given a pre-specified cue. The neurophysiological correlates of these types of phenomenal contents of consciousness should be well known, as is already the case for the conscious perception of faces and houses which are known to require an increased activation level in the fusiform face area or the parahippocampal place area, respectively (Kanwisher, 2001; Zeki, 2001). Thus, the prediction would be that whenever the subject reports that they are consciously experiencing the hallucination, an increased level of activation, similar to that typically found for this type of phenomenal content, should be found in the appropriate areas. The output phase should thus activate the relevant perceptual modules in a way that is similar to everyday veridical perception.

The study by Kosslyn et al. (2000) is one of the best examples thus far of empirical hypnosis research that has revealed changes at the neurophysiological level which correlate with changes in the phenomenal content of consciousness. They found that, in a hypnotic context, a suggestion of the presence of colours in a black and white image led to an experience of colour. These experiential changes were accompanied by changes in blood flow in the brain areas associated with conscious colour perception.

Guidelines for a research programme

Empirical tests and predictions of AST

AST postulates that the ASC of hypnosis is a rare phenomenon realized only in virtuosos. Thus, the first task would be to identify hypnotic virtuosos and systematically chart their responses to all types of hypnotic suggestions at the behavioural level. This stage of research resides in the mechanistic framework at the level of identifying and systematically describing the explanandum. It would imply finding answers to the following questions:

- What kinds of responses to suggestions are possible without any hypnotic induction and how does the induction change the suggestibility?
- Is the same subject capable of producing hallucinations in different modalities?
- Are these capabilities consistent over time?
- What kinds of differences are there between different subjects? Are there consistent inter-individual differences between the types of hallucinations or the vividness or transparency of the hallucinations?
- Are hallucinations in some sensory modality more common than in others e.g. is it 'easier' to produce an auditory or visual hallucination than a somatosensory one?
- What kinds of hallucinations are possible and what are impossible?

After this initial stage of describing the explanandum, it is possible to advance to the next stage, where predictions are derived from the theory and are put to empirical test at the behavioural level.

One example of this type of test is the pop-out effect (Treisman and Gelade, 1980), which has been successfully used to show the reality of colour experiences in synesthesia

(Ramachandran and Hubbard, 2001). The pop-out effect is a well researched phenomenon seen in visual search tasks where the targets among a large number of otherwise similar distractors are defined by some unique basic feature (e.g. different colour). The targets immediately 'pop out' from the background of distractors and the reaction time for the detection of a target is fast and independent of the number of distractors. However, if any unique basic feature does not define the targets, the visual search is serial and focused attention must be applied to each individual item separately. The reaction time increases linearly with the number of targets.

An experiment that uses the pop-out effect could be designed along the following lines. A virtuoso is given the suggestion that all 5s are red and he would be expected to report that when looking at single numbers (printed in black), the 5s are red. Then he is shown displays full of similar-looking distractors (e.g. 'S', '6', '3', '2'), all printed in black, with and without the target. If his reaction times are fast and do not depend on the number of distractors, then he is truly seeing phenomenal redness bound with the 5s in exactly the same way as we would see 5s that were actually printed in red or as the number > colour synesthet sees them. This would be a result that could only be explained by reference to an ASC.

A second possibility could be that his search times increase with the number of distractors, but he still claims that whenever he detects a 5 it is red. In this case there are two possible explanations. Either the hypnotic hallucination is real but is dependent on focused attention, or the subject is just faking, complying or imagining. To separate these two hypotheses, a modification of the experiment should be made wherein there would be several targets in a large display. The targets would together make up a high level geometric pattern or gestalt (e.g. the symbol '?'). Now, after scanning through the whole display, the subject should be able to see all the 'red' 5s simultaneously and, consequently, the higher level pattern they form. But if he cannot report the gestalt, then he must not be able to see several 5s as red automatically at the same time (although he already knows where they are located) or perhaps he cannot truly see them as red at all.

AST predicts that the virtuoso subjects should experience pop-out effect or at least they should be able to report the gestalts that the targets form. If the former, then the hypnotic hallucination of colour is produced by bottom-up mechanisms independent of focused attention. If only the latter, the hallucination is produced by top-down mechanisms somehow dependent on selective attention. But if all virtuosos consistently fail to report either effect, AST would not be supported, and the competing NSV hypotheses of faking, complying or deliberate use of mental imagery would gain substantial support.

If AST is supported by behavioural experiments such as those described above (i.e. at least some virtuosos are found that repeatedly fulfil the predictions of AST), then the next stage in the research programme would be to use these virtuosos in brain sensing and imaging experiments in which the neural correlates of the ASC of hypnosis could be uncovered. We have already described above what would be the ideal experimental designs to use and what the AST would predict in such cases. In brief, in the input phase of the ASC, AST predicts that changes in the background mechanisms of consciousness should be detected particularly in the processing of auditory and verbal information. These changes should be consistent with the idea of altered spreading of activation between the different input modules. In the output phase of ASC, these changes should be consistent with the activation of the neural correlates of the modules that produce or modulate specific phenomenal contents of consciousness.

If these kinds of behavioural and neurophysiological experiments are carried out using a number of different virtuosos in different laboratories, we would be able to accumulate

decisive converging evidence either for or against AST and, hence, for or against the existence of an ASC in hypnosis. Thus, we believe that an empirical research programme such as the one proposed here would finally be able to settle the question that has haunted hypnosis research since its inception.

Conclusions

We have argued that the debate concerning hypnosis as an ASC is a disagreement concerning some fundamental assumptions of the basic nature of the phenomenon and of the acceptable means of explaining it. The subjective experiences associated with the behavioural responses during hypnosis should have a central role in hypnosis research, for they constitute the core explanandum of the field. The full explanation of hypnotic phenomena requires several levels of description, including social-psychological, cognitive, phenomenal, and neurophysiological. Hypnosis should be investigated in the context of multilevel mechanistic explanation, and thus, hypnosis research could be integrated with the currently increasing multidisciplinary research on the other phenomena of consciousness. In order to approach the problem of hypnosis leading as an ASC, we suggest that hypnosis research should concentrate on the 'model systems', 'pure cases' of hypnotic virtuosos. The concept of consciousness also requires a clarification. The background state of consciousness needs to be differentiated from the specific phenomenal contents of consciousness. One of the most important features of the theory we propose is that the domain of hypnotic phenomena should be divided into two sets of qualitatively distinct phenomena. First, those phenomena involving deliberate imagery and focused attention which exist in all persons to a lower or higher degree and second, those involving an ASC, which exist in only very few subjects (if they exist at all). The research programme we propose would thus give a clearer view of the explanatory task and of the different dimensions of a satisfactory explanation. Most importantly, the proposed programme leads to the possibility of empirically resolving for good the lingering question of whether or not hypnosis involves an ASC, and thus would help the field to move forward.

Notes

- 1 The 'credulous' view takes a subject's testimony on faith. For example, if it is suggested to a subject after a hypnotic induction that a blank card is a photograph, and the subject describes it in detail, the credulous view would be that in some sense the subject does 'see' it. In opposition, the 'sceptical view' doubts the subject's testimony that he actually perceives the situation as suggested by the hypnotist (Sutcliffe, 1960).
- 2 In the philosophy of science, the phenomenon to be explained is called the explanandum, and the phenomena that explain it are called the explanans.
- 3 Occasionally, the discrepancy between the nature of the explanandum (altered experiences) and the phenomena assessed by the scales (overt behaviour) has been noted and debated in the literature. For example, Weitzenhoffer (1980) criticized the use of laboratory instruments such as the Stanford scales for overlooking the automaticity and involuntariness of the responses. Hilgard (1981) noted, however, that although the critique is justifiable, the empirical evidence points out that correlations between experiential and behavioural scores are generally high (see, for e.g. Bowers, 1981; Bowers, 1982). Thus uncorrected scores on the Stanford scales reflect automaticity even though inquiries regarding subjective experience are not included.

- 4 Self-hypnosis is a form of hypnosis in which the person gives suggestions to himself, i.e. the same person is the hypnotist and the subject at the same time. According to our theory, most cases of self-hypnosis are usually nothing but relaxation (although relaxation is not necessary; see, for e.g. Banyai and Hilgard, 1976) combined with vivid mental imagery and, therefore not hypnosis proper. We cannot at this stage exclude the possibility that some people (e.g. hypnotic virtuosos) might be able to induce in themselves a state of hypnosis proper, however, it is highly unlikely that a person could give himself posthypnotic suggestions and include an amnesia suggestion e.g. that he will not be able to remember these suggestions afterwards. The nature of experiences associated with this self-induced hypnosis should, however, be further investigated. We shall not discuss the concept of self-hypnosis any further in the present paper.
- 5 In an ideal Guttman scale (Guttman, 1947) items are tested in the order of their difficulty (the cognitive suggestions are typically presented at the end) so that once an item is failed all the subsequent ones should also be failed. According to Hilgard (1965) the results in the Stanford scales are valid if testing is continued to the third failure.
- 6 The concept 'depth of hypnosis' has a long history in hypnosis research (for a review, see Weitzenhoffer, 2000). In the 1800s it was understood (on the model of the depth of natural sleep) as the degree of responsiveness, sensitivity to external stimulation and the degree of relaxation. Around the 1930s the concept of depth had been transformed to indicate the degree of suggestibility after hypnotic induction, i.e. the deeper the hypnotic state of a subject, the greater the number of different types of suggestions were realized for him. Recently, a third way of understanding the concept of depth has been introduced – as the subjective experience of the state of being in hypnosis. All of these conceptions of depth imply that hypnosis is a graded state and that the different grades constitute one single continuum or dimension from 'light' to 'deep'. In our view, the concept of depth is deeply problematic for at least two separate reasons. First, the idea that hypnosis is a continuum of graded levels is an ungrounded assumption and, as we argue elsewhere in this paper, probably false. We view hypnosis as consisting of two qualitatively distinct sets of phenomena rather than as a single continuum. Second, all the different ways of conceptualizing depth are difficult to operationalize, and there seem to be no objective criteria or measurements by which it would be possible to determine the degree of 'depth'. There is no reason to believe that different subjects would be able to estimate the depth of their own hypnosis in an objective manner, nor that different types of suggestions should reflect one common underlying state. As Weitzenhoffer (1997) now admits, the Stanford scales include the implicit assumption of a hypnotic state, and that this state has a 'depth', and that there exists a linear relationship between depth and suggestibility. Nowadays, the concept of suggestibility (or susceptibility) has largely replaced the concept of depth because the former concept is regarded as less problematic and more easily operationalized. Still, in spite of these many problems, the concept continues to be brought up every once in a while by different researchers (Hilgard, 1965; Tart, 1978/1979; Perry and Laurence, 1980; Weitzenhoffer, 1997). In our view, it should first be clearly established whether any hypnotic 'state' exists at all, and if it does, what the empirical criteria for its presence are. Only after those questions have been resolved is it time to enquire as to whether or not the state is a graded continuum of levels of 'depth'. Until then such discussions are premature and irrelevant.
- 7 In the real-simulator paradigm, hypnotic phenomena are studied using two groups of

subjects: high hypnotizables and low hypnotizables. Hypnotic responding of highly hypnotizable subjects is compared to the responding of a group of low hypnotizable subjects who have been given instructions to try to deceive the experimenter by behaving 'as if' they were excellent hypnotic subjects. The experimenter should be unaware of the true status of the subjects. The rationale behind the experiment is withheld from both real subjects as well as from simulators. Thus, it could be theoretically concluded that the difference in behaviour between these two groups reveals something which is characteristic to true hypnotic responding. This paradigm has proved to be very useful, but it has also been adequately criticized (e.g. Chaves, 1968; Spanos and Chaves, 1970) due to the confounding of the antecedent variables caused by the different instructions given to the two groups (a problem also noted by Orne 1972).

- 8 Goal-directed fantasy (GDF) means imagined situations that, if they were to occur in reality, would involve an involuntary occurrence of the behaviour called for by a suggestion (Spanos, 1971; see also Lynn and Sivec, 1992).
- 9 It has been reported (e.g. Spanos and Barber, 1972; Weitzenhoffer, 1974) that some subjects report involuntariness even when they are given direct requests like 'please raise your arm'. Zamansky and Clark (1986) further found that high and medium hypnotizable individuals were able to respond to suggestions, despite being given incompatible or contradictory imaginings (see also Zamansky, 1977). On the other hand, low hypnotizable subjects' responding was degraded. They concluded that low hypnotizable subjects might be able to experience involuntariness only if it is possible to become imaginatively involved in the suggestions. Zamansky and Ruehle (1995) further stated that control of suggested experience is taking place outside of conscious awareness and that conflicting thoughts do not affect responding. Most data indicate, however, that subjects do not totally lose control as they can stop responding if they want to (Lynn et al., 1990).
- 10 In the examination of situational correlates the word suggestibility is used in order to stress that the focus is on situational variables (other than hypnotic induction) which heighten a subject's ability to respond to suggestions. Hypnotic susceptibility (i.e. hypnotizability) refers to heightened suggestibility after a hypnotic induction.
- 11 Absorption has been described by Tellegen and Atkinson (1974) as a state of total attention, fully engaging one's representational resources, which results in imperviousness to distracting events.
- 12 Response expectancies are expectancies of one's own automatic reactions or behaviours to various situations, for example, feeling more alert after a cup of coffee or feeling intoxicated after drinking alcohol, etc. (see for e.g. Kirsch, 1985; 1990; Gearan and Kirsch, 1993).
- 13 It is difficult to clearly differentiate concomitants to hypnosis per se, since most of the experiments done in the field have used various suggestions in addition to a hypnotic induction. Thus it is not always clear what the results tell us about concomitants of hypnosis as such.
- 14 Zamansky et al. (1964) noticed that subjects who had already been assessed in the hypnosis condition responded to fewer nonhypnotic suggestions than those subjects who had not experienced hypnosis and did not know that they would also be assessed in the hypnotic condition.
- 15 Gheorghiu, Koch and Hübner (1994) found that the decisive type of suggestibility does not correlate with imaginary suggestibility. Also, the normative data for

- HGSHS:A in different countries generally suggests that the item scale correlation for decisive items (hallucinating a fly, amnesia, posthypnotic suggestion) is rather poor. This may be an indication that there are two independent types of phenomena (e.g. imagination and true hallucination) that different items in these scales measure (see also Bowers, 1992). The overall internal consistency of the scales is thus likely to reflect the similar behavioural aspects of the different items, rather than similarity of the underlying cognitive or neural mechanisms. Comey and Kirsch (1999), for example, found that most subjects who respond to deceptive suggestions did not actually believe that the state of affairs had truly changed.
- 16 Multilevel explanation refers to a general strategy or metatheory of explanation, not to any particular biological theory. The scientists themselves may be unaware of using this explanatory strategy, but recent work in the philosophy of science has shown that the strategy is widely used in biological explanation.
 - 17 We follow Dennett (1987) in making the division between personal and sub-personal levels with the exception that, according to our view, consciousness or the phenomenal level resides at the subpersonal levels rather than at the personal level (see Revonsuo, 1993; 1994).
 - 18 According to Machamer, Darden and Craver (2000), the explanation of the phenomenon 'bottoms out' at some level below which no further microlevels need to be specified because they are too many steps removed from the explanandum to add any relevant information to the explanation of the phenomena. According to NSV, the explanation bottoms out before we reach the neurophysiological levels, because no mechanisms specific to hypnosis can be found there. Only mechanisms shared by other, ordinary psychological phenomena should be found at this level, according to NSV theorists. By contrast, the SV proponents see the neurophysiological levels as absolutely necessary for the explanation of hypnosis because at those levels mechanisms specific only to hypnosis should be found. The explanation would then bottom out at some lower biological level.
 - 19 We are indebted to Dan Lloyd for suggesting the term non-conscious causal context.
 - 20 Hilgard (1992) describes an interesting phenomenon which he accidentally found when offering a course of hypnotic phenomena. A volunteer subject was given a suggestion of deafness after a hypnotic induction followed by an eruption of loud sounds created by banging together wooden blocks. The same subject had previously shown no response even to a starter's pistol when hypnotically deaf. One student in the class, however, raised the question of whether some part of this subject might know what was going on. Hilgard told the subject in a low voice that there are parts in our nervous system that carry on activities that occur without awareness. He further added that although the subject was deaf, perhaps some part of the subject was 'hearing' his voice. If that were the case the subject's right index finger would rise as a sign. As a surprise to all, the subject's finger rose and the subject said: 'Please restore my hearing so that you can tell me what you did. I felt my finger rise in a way that was not a spontaneous twitch, so that you must have done something to make it rise'. After Hilgard had restored the subject's hearing, the subject reported that he had been a little bored so he had been busying himself with a statistical problem when suddenly he had felt his finger lift. Hilgard called this phenomenon the 'the hidden observer', and it was later studied widely (for a review see Hilgard, 1991). The nature of this phenomenon is, however, rather unclear and later research has suggested it to reflect the constructions that subjects develop from the instructions used in these experiments

(e.g. Coe and Sarbin, 1977; Spanos and Hewit, 1980; Spanos, Gwynn and Stam, 1983).

- 21 One has to be aware of all the limitations regarding these kinds of introspective reports for example, demand characteristics, forgetting, complying, etc. (for a more comprehensive list see Farthing, 1992). The same assumption applies in other domains which rely on the introspective reports of the subjects (e.g. dream research). It is also important to be aware of the possible 'hold-back effect' (Zamansky et al., 1964) described earlier.

References

- Akpınar S, Ulett GA, Itil TM (1971) Hypnotizability predicted by digital computer-analyzed EEG pattern. *Biological Psychiatry* 3: 387–92.
- Alkire MT, Haier RJ, Fallon JH (2000) Toward a unified theory of narcosis: brain imaging evidence for a thalamocortical switch as the neurophysiologic basis of anesthetic-induced unconsciousness. *Consciousness and Cognition* 9: 370–86.
- APA (American Psychological Association, Division of Psychological Hypnosis) (1994) Definition and description of hypnosis. *Contemporary Hypnosis* 11: 142–62. (Released in 1993, reproduced with commentaries in *Contemporary Hypnosis* in 1994.)
- Bakan P (1969a) Hypnotizability, laterality of eye-movements and functional brain asymmetry. *Perceptual and Motor Skills* 28: 927–32.
- Bakan P (1969b) Resting EEG-alpha and asymmetry of reflective eye-movements. *Nature* 223: 975–6.
- Balthazard CG, Woody EZ (1992) The spectral analysis of hypnotic performance with respect to 'absorption'. *International Journal of Clinical and Experimental Hypnosis* 40: 21–43.
- Banyai EI, Hilgard ER (1976) A comparison of active-alert hypnotic induction with traditional relaxation induction. *Journal of Abnormal Psychology* 85: 218–24.
- Barabasz A, Barabasz M (1992) Research designs and considerations. Recent research and future directions. In: E Fromm, M Nash (eds) *Contemporary Hypnosis Research*. New York: Guilford Press, 173–200.
- Barabasz A, Barabasz M, Jensen S, Calvin S, Trevisan M, Warner D (1999) Cortical event-related potentials show the structure of hypnotic suggestions is crucial. *International Journal of Clinical and Experimental Hypnosis* 47: 5–22.
- Barabasz A, Barabasz M, O'Neill M (1991) Effects of experimental context, demand characteristics, and situational cues: new data. *Perceptual and Motor Skills* 73: 83–92.
- Barabasz A, Lonsdale C (1983) Effects of hypnosis on P300 olfactory-evoked potential amplitudes. *Journal of Abnormal Psychology* 92: 520–3.
- Barber TX (1965) Measuring 'hypnotic-like' suggestibility with and without 'hypnotic induction'; psychometric properties, norms, and variables influencing response to the Barber Suggestibility Scale (BSS). *Psychological Reports* 16: 809–44.
- Barber TX (1969) *Hypnosis: A Scientific Approach*. New York: Van Nostrand Reinhold.
- Barber TX (1999) Hypnosis: a mature view. *Contemporary Hypnosis* 16: 123–7.
- Barber TX (2000) A deeper understanding of hypnosis: its secrets, its nature, its essence. *The American Journal of Clinical Hypnosis* 42: 208–72.
- Barber TX, Glass LB (1962) Significant factors in hypnotic behavior. *Journal of Abnormal and Social Psychology*. 64: 222–8.
- Barber TX, Hahn K (1962) Physiological and subjective responses to pain producing stimulation under hypnotically-suggested and waking-imagined 'analgesia'. *Journal of Abnormal and Social Psychology* 65: 411–18.
- Barber TX, Spanos NP, Chaves JF (1974) *Hypnosis, Imagination, and Human Potentialities*. Elmsford, NY: Pergamon Press.

- Barber TX, Wilson SC (1978/1979) The Barber Suggestibility Scale and the Creative Imagination Scale: experimental and clinical applications. *American Journal of Clinical and Experimental Hypnosis* 21: 84–108.
- Barret D (1996) Fantasizers and dissociates: Two types of high hypnotizables, two different imagery styles. In: RG Kunzendorf, NP Spanos, B Wallace (eds) *Hypnosis and Imagination*. Amityville, NY: Baywood Publishing, 123–136.
- Bates BL, Miller RJ, Cross HJ, Brigham TA (1988) Modifying hypnotic susceptibility with the Carleton Skills Training Program. *Journal of Personality and Social Psychology* 55: 120–7.
- Bechtel W, Richardson RC (1992) Emergent phenomena and complex systems. In: A Beckermann, H Flohr, J Kim (eds) *Emergence or reduction? Essays on the Prospects of Nonreductive Physicalism*. Berlin: de Gruyter, 257–88.
- Bechtel W, Richardson RC (1993) Discovering complexity. Decomposition and localization as strategies in scientific research. Princeton: Princeton University Press.
- Benham G, Bowers S, Nash M, Muenchen RSO (1998) Self-fulfilling prophecy and hypnotic response are not the same thing. *Journal of Personality and Social Psychology* 75: 1604–13.
- Block N (1995) On a confusion about a function of consciousness. *Behavioral and Brain Sciences* 18: 227–87.
- Blum GS, Graef JR (1971) The detection over time of subjects simulating hypnosis. *International Journal of Clinical and Experimental Hypnosis* 19: 211–24.
- Bowers KS (1981) Do the Stanford scales tap the ‘classic suggestion effect’? *International Journal of Clinical and Experimental Hypnosis* 29: 42–53.
- Bowers KS (1992) Imagination and dissociation in hypnotic responding. *International Journal of Clinical and Experimental Hypnosis* 40: 253–75.
- Bowers KS (1998) Waterloo-Stanford group scale of hypnotic susceptibility, form C manual and response booklet. *International Journal of Clinical and Experimental Hypnosis* 46: 269–79.
- Bowers PG (1982) The classic suggestion effect: relationships with scales of hypnotizability, effortless experiencing, and imagery vividness. *International Journal of Clinical and Experimental Hypnosis* 30: 270–9.
- Bowers PG (1986) Understanding reports of nonvolition. *Behavioral and Brain Sciences* 9: 469–71.
- Bowers P, Laurence JR, Hart D (1988) The experience of hypnotic suggestions. *International Journal of Clinical and Experimental Hypnosis* 36: 336–49.
- Braffman W, Kirsch I (1999) Imaginative suggestibility and hypnotizability: an empirical analysis. *Journal of Personality and Social Psychology* 77: 578–87.
- Chaves JF (1968) Hypnosis reconceptualized: an overview of Barber’s theoretical and empirical work. *Psychological Reports* 22: 587–608.
- Chaves JF (1989) Hypnotic control of clinical pain. In: NP Spanos, JF Chaves (eds) *Hypnosis: The Cognitive-Behavioral Perspective*. Buffalo, NY: Prometheus Books, 242–72.
- Chaves JF (1997) The state of the ‘state’ debate in hypnosis: a view from the cognitive-behavioral perspective. *The International Journal of Clinical and Experimental Hypnosis* 45: 251–65.
- Coe WC, Sarbin TR (1977) Hypnosis from a standpoint of a contextualist. *Annals of the New York Academy of Sciences* 296: 2–13.
- Coe WC, Sarbin TR (1991) Role theory: hypnosis from dramaturgical and narrational perspective. In: SJ Lynn, JW Rhue, (eds) *Theories of Hypnosis: Current Models and Perspectives*. New York, NY: Guilford Press, 303–23.
- Coe WC, St. Jean RL, Burger JM (1980) Hypnosis and the enhancement of visual imagery. *International Journal of Clinical and Experimental Hypnosis* 28: 225–43.
- Comey G, Kirsch I (1999) Intentional and spontaneous imagery in hypnosis: the phenomenology of hypnotic responding. *International Journal of Clinical and Experimental Hypnosis* 47: 65–85.
- Craver CF (2001) Role functions, mechanisms, and hierarchy. *Philosophy of Science* 68: 53–74.
- Craver CF, Darden L (2001) Discovering mechanisms in neurobiology: the case of spatial memory. In: P Machamer, R Grush, P McLaughlin (eds) *Theory and Method in the Neurosciences*. Pittsburgh: University of Pittsburgh Press, 112–37.

- Crawford HJ (1982) Hypnotizability, daydreaming styles, imagery vividness, and absorption: a multidimensional study. *Journal of Personality and Social Psychology* 42: 915–26.
- Crawford HJ (1994) Brain dynamics and hypnosis: attentional and disattentional processes. *International Journal of Clinical and Experimental Hypnosis* 42: 204–32.
- Crawford HJ (2001) Neuropsychophysiology of hypnosis: towards an understanding of how hypnotic interventions work. In: GD Burrows, RO Stanley, PB Bloom (eds) *International Handbook of Clinical Hypnosis*. New York: Wiley, 61–82.
- Crawford HJ, Brown AM, Moon CE (1993a) Sustained attentional and disattentional abilities: differences between low and highly hypnotizable persons. *Journal of Abnormal Psychology* 102: 534–43.
- Crawford HJ, Corby JC, Kopell B (1996) Auditory event-related potentials while ignoring tone stimuli: attentional differences reflected in stimulus intensity and latency responses in low and highly hypnotizable persons. *International Journal of Neuroscience* 85: 57–69.
- Crawford HJ, Gruzelier JH (1992) A midstream view of the neuropsychophysiology of hypnosis: recent research and future directions. In: E Fromm, M Nash (eds) *Contemporary Hypnosis Research*. New York: Guilford Press, 227–66.
- Crawford HJ, Gur RC, Skolnick B, Gur RE, Benson D (1993b) Effects of hypnosis on regional cerebral blood flow during ischemic pain with and without suggested hypnotic analgesia. *International Journal of Psychophysiology* 15: 181–95.
- Crawford HJ, Knebel T, Vandemia JMC (1998) The nature of hypnotic analgesia: neurophysiological foundation and evidence. *Contemporary Hypnosis* 15: 22–33.
- De Pascalis V (1994) Event-related potentials during hypnotic hallucination. *International Journal of Clinical and Experimental Hypnosis* 42: 39–55.
- De Pascalis V (1999) Psychophysiological correlates of hypnosis and hypnotic susceptibility. *International Journal of Clinical and Experimental Hypnosis* 47: 117–43.
- De Pascalis V, Penna PM (1990) 40-Hz eeg activity during hypnotic induction and testing. *International Journal of Clinical and Experimental Hypnosis* 38: 125–38.
- Denet DC (1987) *The Intentional Stance*. Cambridge, MA: MIT Press.
- Dierks T, Linden DE, Jandl M, Formisano E, Goebel R, Lanfermann H, Singer W (1999) Activation of Heschl's gyrus during auditory hallucinations. *Neuron* 22: 615–21.
- Dixon M, Brunet A, Laurence J-R (1990) Hypnotizability and automaticity: toward parallel distributed processing model of hypnotic responding. *Journal of Abnormal Psychology* 99: 36–43.
- Dixon M, Laurence J-R (1992a) Two hundred years of hypnosis research: questions resolved? Questions unanswered! In: E Fromm, M Nash (eds) *Contemporary Hypnosis Research*. New York, NY: Guilford Press, 34–68.
- Dixon M, Laurence J-R (1992b) Hypnotic susceptibility and verbal automaticity: automatic and strategic processing differences in the Stroop-color-naming task. *Journal of Abnormal Psychology* 101: 344–7.
- Edmonston WE Jr (1979) The effects of neutral hypnosis on conditioned responses: implications for hypnosis as relaxation. In: E Fromm, RE Shor (eds) *Hypnosis: Developments in Research and New Perspectives*. New York: Aldine, 415–55.
- Edmonston WE Jr, Moscovitz HC (1990) Hypnosis and lateralized brain functions. *International Journal of Clinical and Experimental Hypnosis* 38: 70–84.
- Erickson MH (1939) The induction of color blindness by a technique of hypnotic suggestion. *Journal of General Psychology* 20: 61–81.
- Evans FJ (1979) Hypnosis and sleep: techniques for exploring cognitive activity during sleep. In: E Fromm, RE Shor (eds) *Hypnosis: Developments in Research and New Perspectives*. New York: Aldine, 139–83.
- Evans FJ (1999) Hypnosis and sleep: the control of altered states of awareness. *Sleep and Hypnosis* 1: 232–7.
- Farthing GW (1992) *The Psychology of Consciousness*. Englewood Cliffs, NJ: Prentice-Hall.
- Faymonville EM, Laureys S, Degueldre C, Del Fiore G, Luxen A, Franck G, Lamy M, Maquet P (2000) Neural mechanisms of antinociceptive effects of hypnosis. *Anesthesiology* 92: 1257–67.

- Field PB (1965) Inventory scale of hypnotic depth. *The International Journal of Clinical and Experimental Hypnosis* 13: 238–49.
- Freeman R, Barabasz A, Barabasz M, Warner D (2000) Hypnosis and distraction differ in their effects of cold pressor pain. *American Journal of Clinical Hypnosis* 43: 137–48.
- Frumkin LR, Ripley HS, Cox GB (1978) Changes in cerebral hemispheric lateralization with hypnosis. *Biological Psychiatry* 13: 741–50.
- Galbraith GC, London P, Leibovitz MP, Cooper LM, Hart JT (1970) EEG and hypnotic susceptibility. *Journal of Comparative and Physiological Psychology* 72: 125–31.
- Gauld A (1992) *A history of hypnotism*. Cambridge, NY: Cambridge University Press.
- Gazzaniga MS (1972) One brain – two minds. *American Scientist* 60: 311–17.
- Gearan P, Kirsch I (1993) Response expectancy as a mediator of hypnotizability modification: a brief communication. *The International Journal of Clinical and Experimental Hypnosis* 41: 84–91.
- Gheorghiu VA, Koch E, Hübner M (1994) A group scale for the influence of suggestions in sensory judgements. *Hypnos* 21: 49–56.
- Glisky ML, Tataryn DG, Kihlstrom JF (1995) Hypnotizability and mental imagery. *International Journal of Clinical and Experimental Hypnosis* 43: 34–54.
- Gorassini DR, Spanos NP (1986) A social cognitive skills approach to the successful modification of hypnotic susceptibility. *Journal of Personality and Social Psychology* 50: 1004–12.
- Graffin NF, Ray WJ, Lundy R (1995) EEG concomitants of hypnosis and hypnotic susceptibility. *Journal of Abnormal Psychology* 104: 123–31.
- Graham KR (1977) Perceptual processes and hypnosis: support for a cognitive-state theory based on laterality. In: WE Edmonston Jr (ed.) *Conceptual and Investigative Approaches to Hypnosis and Hypnotic Phenomena*. *Annals of the New York Academy of Sciences* 296: 274–83.
- Green JP, Lynn SJ, Carlson BW (1992) Finding the hypnotic virtuoso – another look: a brief communication. *International Journal of Clinical and Experimental Hypnosis* 40: 68–73.
- Gruzelier J (1988) The neuropsychology of hypnosis. In: M Heap (ed.) *Hypnosis: Current Clinical, Experimental, and Forensic Practices*. London: Croom Helm, 68–76.
- Gruzelier J (1990) Neurophysiological investigations of hypnosis: cerebral laterality and beyond. In: R Van Dyck, PH Spinhoven, AJW Van der Does (eds) *Hypnosis: Theory, Research and Clinical Practice*. Free University Press, 38–51.
- Gruzelier J (1996) The state of hypnosis: evidence and applications. *Quarterly Journal of Medicine* 89: 313–17.
- Gruzelier J (1998) A working model of the neurophysiology of hypnosis: a review of the evidence. *Contemporary Hypnosis* 15: 3–21.
- Gruzelier J (2000) Redefining hypnosis: theory, methods and integration. *Contemporary Hypnosis* 17: 51–70.
- Gruzelier J, Brow TD (1985) Psychophysiological evidence for a state theory of hypnosis and susceptibility. *Journal of Psychosomatic Research* 29: 287–302.
- Gruzelier J, Brow TD, Perry A, Rhonder J, Thomas M (1984) Hypnotic susceptibility: a lateral predisposition and altered cerebral asymmetry under hypnosis. *International Journal of Psychophysiology* 2: 131–9.
- Gruzelier J, Warren K (1993) Neuropsychological evidence of reductions on left frontal tests with hypnosis. *Psychological Medicine* 23: 93–101.
- Gur RC, Gur RE (1974) Handedness, sex and eyedness as moderating variables in the relation between hypnotic susceptibility and functional brain asymmetry. *Journal of Abnormal Psychology* 83: 635–43.
- Guttman L (1947) The Cornell technique for scale and intensity analysis. *Educational and Psychological Measurement* 7: 247–79.
- Halligan PW, Athwal BS, Oakley DA, Frackowiak RSJ (2000) Imaging hypnotic paralysis: implications for conversion hysteria. *Lancet* 335: 986–87.
- Halpern AR, Zatorre RJ (1999) When that tune runs through your head: a PET investigation of auditory imagery for familiar melodies. *Cerebral Cortex* 9: 697–704.
- Harriman, PL (1942) Hypnotic induction of color vision anomalies: I. The use of the Ishihara and

- the Jensen tests to verify the acceptance of suggested color blindness. *Journal of General Psychology* 26: 289–98.
- Harvey MA, Sipprelle CN (1978) Color blindness, perceptual interference, and hypnosis. *The American Journal of Clinical Hypnosis* 20: 189–93.
- Hilgard ER (1965) *Hypnotic Susceptibility*. New York: Harcourt, Brace & World.
- Hilgard ER (1969) Altered states of awareness. *Journal of Nervous and Mental Diseases* 149: 68–79.
- Hilgard ER (1972) A critique of Johnson, Maher, and Barber's 'Artifact in the "essence of hypnosis": an evaluation of trance logic' with a recomputation of their findings. *Journal of Abnormal Psychology* 79: 221–33.
- Hilgard ER (1973) The domain of hypnosis: with some comments on alternative paradigms. *American Psychologist* 28: 972–82.
- Hilgard ER (1977a) *Divided Consciousness: Multiple Controls in Human Thought and Action*. New York: Wiley.
- Hilgard ER (1977b) The problem of divided consciousness: a neodissociation interpretation. In: WE Edmonston Jr (ed.) *Conceptual and Investigative Approaches to Hypnosis and Hypnotic Phenomena*. *Annals of the New York Academy of Sciences* 296: 48–59.
- Hilgard ER (1978) States of consciousness in hypnosis: divisions or levels? In: FH Frankel, HS Zamansky (eds) *Hypnosis at its Bicentennial: Selected Papers*. New York: Plenum, 15–36.
- Hilgard ER (1981) Hypnotic susceptibility scales under attack: an examination of Weitzenhoffer's criticisms. *International Journal of Clinical and Experimental Hypnosis* 29: 24–41.
- Hilgard ER (1991) A neodissociation interpretation of hypnosis. In: SJ Lynn, JW Rhue (eds) *Theories of Hypnosis: Current Models and Perspectives*. New York: Guilford Press, 105–43.
- Hilgard ER (1992) Dissociation and theories of hypnosis. In: E Fromm, M Nash (eds) *Contemporary Hypnosis Research*. New York: Guilford Press, 69–101.
- Hilgard ER (1994) Neodissociation theory. In: SJ Lynn, JW Rhue (eds) *Dissociation: Theoretical and Research Perspectives*. New York: Guilford Press, 83–104.
- Hilgard ER, Tart CT (1966) Responsiveness to suggestions following waking and imagination instructions and following induction of hypnosis. *Journal of Abnormal Psychology* 71: 196–208.
- Hilgard JR (1979) Imaginative and sensory-affective involvements in everyday life and in hypnosis. In: E Fromm, RE Shor (eds) *Developments in Research and New Perspectives*. New York: Aldine, 483–517.
- Hobson JA (2001) *The Dream Drugstore. Chemically Altered States of Consciousness*. Cambridge, MA: MIT Press.
- Hull CL (1933) *Hypnosis and Suggestibility: An Experimental Approach*. New York: Appleton-Century-Crofts.
- James W (1983) *The Principles of Psychology*. Cambridge, MA: Harvard University Press. (Original work published 1890).
- Jasiukaitis P, Nouriani B, Hugdahl K, Spiegel D (1997) Relateralizing hypnosis: or, have we been barking up the wrong hemisphere? *International Journal of Clinical and Experimental Hypnosis* 45: 158–77.
- Jasiukaitis P, Nouriani B, Spiegel D (1996) Left hemisphere superiority for event-related potential effects of hypnotic obstruction. *Neuropsychologia* 34: 661–8.
- Jensen SM, Barabasz A, Barabasz M, Warner D (2001) EEG P300 event-related markers of hypnosis. *American Journal of Clinical Hypnosis* 44: 127–39.
- Johnson RF, Maher B, Barber TX (1972) Artifact in the essence of hypnosis: an evaluation of trance logic. *Journal of Abnormal Psychology* 79: 221–33.
- Kaiser J, Barker R, Haenschel C, Baldeweg T, Gruzelier JH (1997) Hypnosis and event-related potential correlates of error processing in a stroop-type paradigm: a test of the frontal hypothesis. *International Journal of Psychophysiology* 27: 215–22.
- Kallio S, Ihamuotila M (1999) Finnish norms for the Harvard Group Scale of Hypnotic Susceptibility, form A. *International Journal of Clinical and Experimental Hypnosis* 47: 227–35.

- Kallio S, Revonsuo A, Hämäläinen H, Markela J, Gruzelier J (2001) Anterior brain functions and hypnosis: a test of the frontal hypothesis. *International Journal of Clinical and Experimental Hypnosis* 49: 95–108.
- Kallio S, Revonsuo A, Lauerma H, Hämäläinen H, Lang H (1999) The MMN amplitude increases in hypnosis: a case study. *NeuroReport* 10: 3579–82.
- Kanwisher N (2001) Faces and places: of central (and peripheral) interest. *Nature Neuroscience* 4: 455–6.
- Kihlstrom JF (1985) Hypnosis. *Annual Review of Psychology* 36: 385–418.
- Kihlstrom JF (1992) Hypnosis: a sesquicentennial essay. *International Journal of Clinical and Experimental Hypnosis* 40: 301–14.
- Kihlstrom JF (1997) Convergence in understanding hypnosis? Perhaps, but perhaps not quite so fast. *International Journal of Clinical and Experimental Hypnosis* 45: 324–32.
- Kim J (1998) *Mind in a Physical World*. Cambridge, MA: MIT Press.
- Kinnunen T, Zamansky HS, Nordstrom BL (2001) Is the hypnotized subject complying? *International Journal of Clinical and Experimental Hypnosis* 49: 83–94.
- Kirsch I (1985) Response expectancy as a determinant of experience and behavior. *American Psychologist* 40: 1189–202.
- Kirsch I (1990) *Changing Expectations: A Key to Effective Psychotherapy*. Pacific Grove, CA: Brooks/Cole.
- Kirsch I (1991) The social learning theory of hypnosis. In: SJ Lynn, JW Rhue (eds) *Theories of Hypnosis: Current Models and Perspectives*. New York: Guilford Press, 439–65.
- Kirsch I (1997) Suggestibility or hypnosis: what do our scales really measure? *International Journal of Clinical and Experimental Hypnosis* 45: 212–25.
- Kirsch I (1998) Social psychological theories are not based on compliance: setting the record straight. *American Journal of Clinical Hypnosis* 41: 158–61.
- Kirsch I (1999a) Setting the record straight (again). *American Journal of Clinical Hypnosis* 41: 226–30.
- Kirsch I (1999b) Response expectancy: an introduction. In I Kirsch (ed.) *How Experiences Shape Experience*. Washington DC: APA, 3–13.
- Kirsch I (2000) The response set theory of hypnosis. *American Journal of Clinical Hypnosis* 42: 274–92.
- Kirsch I (2001) The response set theory of hypnosis: expectancy and physiology. *American Journal of Clinical Hypnosis* 44: 69–73.
- Kirsch I, Braffman W (2001) Imaginative suggestibility and hypnotizability. *Current Directions in Psychological Science* 10: 57–61.
- Kirsch I, Council JR (1992) Situational and personality correlates of hypnotic responsiveness. In: E Fromm, M Nash (eds) *Contemporary Hypnosis Research*. New York: Guilford Press, 267–91.
- Kirsch I, Council JR, Wickless C (1990) Subjective scoring for the Harvard Group Scale of Hypnotic Susceptibility, form A. *International Journal of Clinical and Experimental Hypnosis* 38: 112–24.
- Kirsch I, Lynn SJ (1995) The altered state of hypnosis: changes in the theoretical landscape. *American Psychologist* 10: 846–58.
- Kirsch I, Lynn SJ (1997) Hypnotic involuntariness and the automaticity of everyday life. *American Journal of Clinical Hypnosis* 40: 329–48.
- Kirsch I, Lynn SJ (1998a) Dissociation theories of hypnosis. *Psychological Bulletin* 123: 100–15.
- Kirsch I, Lynn SJ (1998b) Social-cognitive alternatives to dissociation theories of hypnotic involuntariness. *Review of General Psychology* 2: 66–80.
- Kirsch I, Lynn SJ (1999) Automaticity in clinical psychology. *American Psychologist* 54: 504–15.
- Kirsch I, Silva CE, Comey G, Reed S (1995) A spectral analysis of cognitive and personality variables in hypnosis: empirical disconfirmation of the two-factor model of hypnotic responding. *Journal of Personality and Social Psychology* 69: 167–75.
- Kirsch I, Wickless C, Moffitt KH (1999) Expectancy and suggestibility: are the effects of environ-

- mental enhancement due to detection? *International Journal of Clinical and Experimental Hypnosis* 47: 40–5.
- Kosslyn SM, Thompson WL, Costantini-Ferrando MF, Alpert NM, Spiegel D (2000) Hypnotic visual illusion alters color processing in the brain. *American Journal of Psychiatry* 157: 1279–84.
- LaBerge S (1985) *Lucid dreaming*. New York: Ballantine.
- LaBerge S, Gackenbach J (2000) *Lucid dreaming*. In: E Cardena, SJ Lynn, S Krippner (eds) *Varieties of Anomalous Experience: Examining the Scientific Evidence*. Washington DC: APA, 151–82.
- LeCron LM (1953) A method of measuring the depth of hypnosis, and the experience of nonvolition. *International Journal of Clinical and Experimental Hypnosis* 31: 284–95.
- Levine JL, Kurtz RM, Lauter JL (1984) Hypnosis and its effect on left and right hemisphere activity. *Biological Psychiatry* 19: 1461–75.
- Lynn SJ (1997) Automaticity and hypnosis: a sociocognitive account. *International Journal of Clinical and Experimental Hypnosis* 45: 239–50.
- Lynn SJ, Rhue JW (1988) Fantasy proneness. Hypnosis, developmental antecedents and psychopathology. *American Psychologist* 43: 35–44.
- Lynn SJ, Rhue JW (1991) An integrative model of hypnosis. In: SJ Lynn, JW Rhue (eds) *Theories of Hypnosis: Current Models and Perspectives*. New York: Guilford Press, 397–438.
- Lynn SJ, Rhue JW, Weekes JR (1990) Hypnotic involuntariness: a social cognitive analysis. *Psychological Review* 97: 169–84.
- Lynn SJ, Sivec H (1992) The hypnotizable subject as creative problem-solving agent. In: E Fromm, M Nash (eds) *Contemporary Hypnosis Research*. New York: Guilford Press, 292–333.
- Lynn SJ, Snodgrass M, Rhue J, Hardaway R (1987) Goal-directed fantasy, hypnotic susceptibility, and expectancies. *Journal of Personality and Social Psychology* 53: 933–8.
- Lynn SJ, Vanderhof H, Shindler K, Stafford J (2002) Defining hypnosis as a trance vs. cooperation: hypnotic inductions, suggestibility, and performance standards. *American Journal of Clinical Hypnosis* 44: 231–40.
- Lyons LC, Crawford HJ (1997) Sustained attentional and disattentional abilities and arousability: factor analysis and relationship to hypnotic susceptibility. *Personality and Individual Differences* 26: 1071–84.
- McConkey KM, Glisky ML, Kihlstrom JF (1989) Individual differences among hypnotic virtuosos: a case comparison. *Australian Journal of Clinical and Experimental Hypnosis* 17: 131–40.
- McConkey KM, Wende V, Barnier AJ (1999) Measuring change in the subjective experience of hypnosis. *International Journal of Clinical and Experimental Hypnosis* 47: 23–39.
- McCormack K, Gruzelier J (1993) Cerebral asymmetry and hypnosis: a signal detection analysis of divided visual field stimulation. *Journal of Abnormal Psychology* 102: 352–7.
- MacLeod-Morgan C (1982) EEG lateralization in hypnosis: a preliminary report. *Australian Journal of Clinical and Experimental Hypnosis* 10: 99–102.
- MacLeod-Morgan C, Lack L (1982) Hemispheric specificity: a physiological concomitant of hypnotizability. *Psychophysiology* 19: 687–90.
- Machamer P, Darden L, Craver CF (2000) Thinking about mechanisms. *Philosophy of Science* 67: 1–25.
- Mallard D, Bryant RA (2001) Hypnotic color blindness and performance on the Stroop test. *International Journal of Clinical and Experimental Hypnosis* 49: 330–8.
- Martin DJ, Lynn SJ (1996) The hypnotic simulation index: successful discrimination of real versus simulating participants. *International Journal of Clinical and Experimental Hypnosis* 44: 338–53.
- Maquet P, Faymonville ME, Degueldre C, Delfiore G, Franck G, Luxen A, Lamy M (1999) Functional neuroanatomy of hypnotic state. *Biological Psychiatry* 45: 327–33.
- Mesmer FA (1779/1998) *The Discovery of Animal Magnetism*. Edmonds, WA: Holmes Publishing Group.

- Milling LS, Kirsch I, Burgess CA (1999) Brief modification of suggestibility and hypnotic analgesia: too good to be true? *International Journal of Clinical and Experimental Hypnosis* 47: 91–103.
- Milner AD, Goodale MA (1995) *The Visual Brain in Action*. Oxford: Oxford University Press.
- Näätänen R (1992) *Attention and Brain Function*. Hillsdale, NJ: Lawrence Erlbaum.
- Nobre AC, Coull JT, Frith CD, Mesulam MM (1999) Orbitofrontal cortex is activated during breaches of expectation in tasks of visual attention. *Nature Neuroscience* 2: 11–12.
- Nordby H, Hugdahl K, Jasiukaitis P, Spiegel D (1999) Effects of hypnotizability on performance of a Stroop task and event-related potentials. *Perceptual and Motor Skills* 88: 819–30.
- Norman DA, Shallice T (1986) Attention to action: willed automatic control of behaviour. In: RJ Davidson, GE Schwartz, D Shapiro (eds) *Consciousness and Self-Regulation: Advances in Research and Theory*. New York: Plenum, 1–8.
- Orne MT (1959) The nature of hypnosis: artifact and essence. *Journal of Abnormal and Social Psychology* 58: 277–99.
- Orne MT (1972) On the simulating subject as a quasi-control group in hypnosis research: what, why, and how. In: E Fromm, RE Shor (eds) *Hypnosis: Developments in Research and New Perspectives*. New York: Aldine, 519–65.
- Otto-Salaj L, Nadon R, Hyot IP, Register PA, Kihlstrom JF (1992) Laterality and hypnotic response. *International Journal of Clinical and Experimental Hypnosis* 40: 12–20.
- Pagano RR, Akots NJ, Wall TW (1988) Hypnosis, cerebral laterality and relaxation. *International Journal of Clinical and Experimental Hypnosis* 36: 350–8.
- Perlini AH, Haley A, Buczel A (1998) Hypnosis and reporting biases: telling the truth. *Journal of Research in Personality* 32: 13–32.
- Perlini AH, Spanos NP, Jones B (1996) Hypnotic negative hallucinations: a review of subjective, behavioral, and physiological methods. In: RG Kunzendorf, NP Spanos, B Wallace (eds) *Hypnosis and Imagination*. Amityville, NY: Baywood Publishing, 199–222.
- Perry C, Laurence J-R (1980) Hypnotic depth and susceptibility: a replicated finding. *International Journal of Clinical and Experimental Hypnosis* 28: 272–80.
- Perry C, Nadon R, Button J (1992) The measurement of hypnotic ability. In: E Fromm, M Nash (eds) *Contemporary Hypnosis Research*. New York: Guilford Press, 459–90.
- Perugini EM, Kirsch I, Allen ST, Coldwell E, Meredith JM, Montgomery GH, Sheehan J (1998) Surreptitious observation of responses to hypnotically suggested hallucinations: a test of the compliance hypothesis. *International Journal of Clinical and Experimental Hypnosis* 46: 191–203.
- Poeck K (1983) What do we mean by ‘aphasic syndromes’? A neurologist’s view. *Brain and Language* 20: 79–89.
- Radtke HL, Spanos NP (1981) Was I hypnotized? A social-psychological analysis of hypnotic depth reports. *Psychiatry* 44: 359–76.
- Radtke HL, Spanos NP (1982) The effect of rating scale descriptors on hypnotic depth reports. *The Journal of Psychology* 111: 235–45.
- Rainville P, Carrier B, Hofbauer RK, Bushnell MC, Duncan GH (1999a) Dissociation of sensory and affective dimensions of pain using hypnotic modulation. *Pain* 82: 159–71.
- Rainville P, Duncan GH, Price DD, Carrier B, Bushnell MC (1997) Pain affect encoded in human anterior cingulate but not somatosensory cortex. *Science* 277: 968–71.
- Rainville P, Hofbauer RK, Bushnell MC, Duncan GH, Price DD (2002) Hypnosis modulates activity in brain structures involved in the regulation of consciousness. *Journal of Cognitive Neuroscience* 14: 887–901.
- Rainville P, Hofbauer RK, Paus T, Duncan GH, Bushnell MC, Price DD (1999b) Cerebral mechanisms of hypnotic induction and suggestion. *Journal of Cognitive Neuroscience* 11: 110–25.
- Ramachandran VS, Blakeslee S (1998) *Phantoms In the Brain: Probing the Mysteries of the Human Mind*. New York: Quill William Morrow.
- Ramachandran VS, Hubbard EM (2001) Synesthesia: a window to perception, thought and language. *Journal of Consciousness Studies* 8: 3–34.
- Ray WJ (1997) EEG concomitants of hypnotic susceptibility. *International Journal of Clinical and Experimental Hypnosis* 45: 301–13.

- Raz A, Shapiro T, Fan J, Posner MI (in press) Hypnotic modulation of the Stroop interference effect. *Archives of General Psychiatry*.
- Register PA, Kihlstrom JF (1986) Finding the hypnotic virtuoso. *International Journal of Clinical and Experimental Hypnosis* 34: 84–97.
- Revonsuo A (1993) Is there a ghost in the cognitive machinery? *Philosophical Psychology* 6: 387–405.
- Revonsuo A (1994) The ‘multiple drafts’ model and the ontology of consciousness. *Behavioral and Brain Sciences* 17: 177–8.
- Revonsuo A (2001) Can functional brain imaging discover consciousness in the brain? *Journal of Consciousness Studies* 8: 3–23.
- Roche SM, McConkey KM (1990) Absorption: nature, assessment, and correlates. *Journal of Personality and Social Psychology* 59: 91–101.
- Sabourin ME, Cutcomb SD, Crawford HJ, Pribram K (1990) EEG correlates of hypnotic susceptibility and hypnotic trance: spectral analysis and coherence. *International Journal of Psychophysiology* 10: 125–42.
- Salmon W (1984) *Scientific explanation and the causal structure of the world*. Princeton: Princeton University Press.
- Sarbin TR (1950) Contributions to role-taking theory: I. Hypnotic behavior. *Psychological Review* 57: 255–70.
- Sarbin TR, Coe WC (1972) *Hypnosis: A Social Psychological Analysis of Influence Communication*. New York: Holt, Rinehart & Winston.
- Sarbin TR, Coe WC (1979) Hypnosis and psychopathology: replacing old myths with fresh metaphors. *Journal of Abnormal Psychology* 88: 506–26.
- Schacter DL, Singer JE (1962) Cognitive, social, and physiological determinants of emotional state. *Psychological Review* 69: 379–99.
- Searle J (1992) *The Rediscovery of the Mind*. Cambridge, MA: MIT Press.
- Shallice T (1979) Case-study approach in neuropsychological research. *Journal of Clinical Neuropsychology* 1: 183–211.
- Shallice T, Burgess PW (1991) Deficits in strategy application following frontal lobe damage in man. *Brain* 114: 727–41.
- Shapiro D (1977) A biofeedback strategy in the study of consciousness. In: NE Zinberg (ed.) *Alternate States of Consciousness*. New York: The Free Press, 145–37.
- Sheehan PW, Donovan P, MacLeod CM (1988) Strategy manipulation and the Stroop effect in hypnosis. *Journal of Abnormal Psychology* 97: 455–60.
- Shor RE, Orne EC (1962) *Harvard Group Scale of Hypnotic Susceptibility: form A*. Palo Alto, CA: Consulting Psychologists Press.
- Silbersweig DA, Stern E, Frith C, Cahill C, Holmes A, Grootenck S, Seaward J, McKenna P, Chua SE, Schnorr L, Jones T, Frackowiak RSJ (1995) A functional neuroanatomy of hallucinations in schizophrenia. *Nature* 378: 176–9.
- Silva CE, Kirsch I (1992) Interpretive sets, expectancy, fantasy proneness, and dissociation as predictors of hypnotic response. *Journal of Personality and Social Psychology* 63: 847–56.
- Spanos NP (1971) Goal-directed fantasy and the performance of hypnotic test suggestions. *Psychiatry* 34: 86–96.
- Spanos NP (1986) Hypnotic behavior: a social psychological interpretation of amnesia, analgesia, and ‘trance logic’. *Behavioral and Brain Sciences* 9: 449–67.
- Spanos NP (1989) Experimental research on hypnotic analgesia. In: NP Spanos, JF Chaves (eds) *Hypnosis: The Cognitive-Behavioral Perspective*. Buffalo, NY: Prometheus Books, 206–40.
- Spanos NP (1991) A sociocognitive approach to hypnosis. In: SJ Lynn, JW Rhue (eds) *Theories of Hypnosis: Current Models and Perspectives*. New York: Guilford Press, 324–61.
- Spanos NP, Barber TX (1972) Cognitive activity during ‘hypnotic’ suggestibility: goal-directed fantasy and the experience of nonvolition. *Journal of Personality* 40: 510–24.
- Spanos NP, Barber TX (1974) Toward a convergence in hypnosis research. *American Psychologist* 29: 500–11.

- Spanos NP, Chaves JF (1970) Hypnosis research: a methodological critique of experiments generated by two alternative paradigms. *The American Journal of Clinical Hypnosis* 13: 108–26.
- Spanos NP, Chaves JF (1991) History and historiography of hypnosis. In: SJ Lynn, JW Rhue (eds) *Theories of Hypnosis: Current Models and Perspectives*. New York: Guilford Press, 43–82.
- Spanos NP, Coe WC (1992) A social-psychological approach to hypnosis. In: E Fromm, M Nash (eds) *Contemporary Hypnosis Research*. New York: Guilford Press, 102–30.
- Spanos NP, Flynn DM, Gabora NJ (1989) Suggested negative visual hallucination in hypnotic subjects: when no means yes. *British Journal of Experimental and Clinical Hypnosis* 6: 63–7.
- Spanos NP, Gorassini DR (1984) Structure of hypnotic test suggestions and attributions of responding involuntarily. *Journal of Personality and Social Psychology* 46: 688–96.
- Spanos NP, Gwynn MI, Stam HJ (1983) Instructional demands and ratings of overt and hidden pain during hypnotic analgesia. *Journal of Abnormal Psychology* 92: 479–88.
- Spanos NP, Hewitt EC (1980) The hidden observer in hypnotic analgesia: discovery or experimental creation? *Journal of Personality and Social Psychology* 39: 479–88.
- Spiegel D (1986) Painstaking reminders of forgotten trance logic. *Behavioral and Brain Sciences* 9: 484–5.
- Spiegel D (1991) Neurophysiological correlates of hypnosis and dissociation. *Neuropsychiatric Practice and Opinion* 3: 440–5.
- Spiegel D (1998) Social psychological theories cannot fully account for hypnosis: the record was never crooked. *American Journal of Clinical Hypnosis* 41: 161–4.
- Spiegel D, Barabasz AF (1998) Effects of hypnotic instructions on P300 event-related-potential amplitudes: research and clinical implications. *American Journal of Clinical Hypnosis* 31: 11–7.
- Spiegel D, Birre P, Rootenberg J (1989) Hypnotic alteration of somatosensory perception. *American Journal of Psychiatry* 146: 749–54.
- Spiegel D, Cutcomb S, Ren C, Pribram K (1985) Hypnotic hallucination alters evoked potentials. *Journal of Abnormal Psychology* 94: 249–55.
- Spiegel H, Spiegel D (1978) *Trance and Treatment: Clinical Uses of Hypnosis*. Washington DC: American Psychiatric Press Inc.
- Stanley SM, Lynn SJ, Nash MR (1986) Trance logic, susceptibility screening, and the transparency response. *Journal of Personality and Social Psychology* 50: 447–54.
- Stromeyer CF, Psotka J (1970) The detailed texture of eidetic images. *Nature* 225: 346–9.
- Stroop JR (1935) Studies of interference in serial verbal reactions. *Journal of Experimental Psychology* 18: 643–62.
- Sutcliffe JP (1960) ‘Credulous’ and ‘skeptical’ views of hypnotic phenomena: a review of certain evidence and methodology. *International Journal of Clinical and Experimental Hypnosis* 8: 73–101.
- Sutcliffe JP, Perry CW, Sheehan PW (1970) Relation of some aspects of imagery and fantasy to hypnotic susceptibility. *Journal of Abnormal Psychology* 76: 279–87.
- Szechtman H, Woody E, Bowers KS, Nahmias C (1998) Where the imaginal appears real: a positron emission tomography study of auditory hallucinations. *Proceedings of The National Academy of Sciences* 95: 1956–60.
- Tart CT (1972) States of consciousness and state-specific sciences. *Science* 176: 1203–10.
- Tart CT (1978/1979) Quick and convenient assessment of hypnotic depth: self-report scales. *American Journal of Clinical Hypnosis* 21: 186–207.
- Tart CT (1979) Measuring the depth of an altered state of consciousness, with particular reference to self-report scales of hypnotic depth. In: E Fromm, RE Shor (eds) *Hypnosis: Developments in Research and New Perspectives*. New York: Aldine, 567–601.
- Tart CT, Hilgard ER (1966) Responsiveness to suggestions under ‘hypnosis’ and ‘waking-imagination’ conditions: a methodological observation. *International Journal of Clinical and Experimental Hypnosis* 14: 247–56.
- Tebeccis AK, Provins KA, Farnbach RV, Pentony P (1975) Hypnosis and the EEG: a quantitative investigation. *Journal of Nervous and Mental Disease* 161: 1–17.

- Tellegen A, Atkinson G (1974) Openness to absorbing and self-altering experiences ('absorption'), a trait related to hypnotic susceptibility. *Journal of Abnormal Psychology* 83: 268–77.
- Treisman A, Gelade G (1980) A feature-integration theory of attention. *Cognitive Psychology* 12: 97–136.
- Ulett GA, Akpınar S, Itil TM (1972a) Hypnosis: physiological and pharmacological reality. *American Journal of Psychiatry* 128: 799–805.
- Ulett GA, Akpınar S, Itil TM (1972b) Quantitative EEG analysis during hypnosis. *Electroencephalography and Clinical Neurophysiology* 33: 361–8.
- Wagstaff GF (1981) *Hypnosis, Compliance and Belief*. New York: St. Martin's Press.
- Wagstaff GF (1986) State versus nonstate paradigms of hypnosis: a real or false dichotomy. *Behavioral and Brain Sciences* 9: 486–7.
- Wagstaff GF (1991) Compliance, belief and semantics in hypnosis: a nonstate sociocognitive perspective. In: SJ Lynn, JW Rhue (eds) *Theories of Hypnosis: Current Models and Perspectives*. New York: Guilford Press, 362–96.
- Wagstaff GF (1996) Compliance and imagination in hypnosis. In: RG Kunzendorf, NP Spanos, B Wallace (eds) *Hypnosis and Imagination*. Amityville, NY: Baywood Publishing, 19–40.
- Wagstaff GF (1998) The semantics and physiology of hypnosis as an altered state: towards a definition of hypnosis. *Contemporary Hypnosis* 15: 149–65.
- Wagstaff GF (2000) On the psychophysiological redefinition of hypnosis: a reply to Gruzeliér. *Contemporary Hypnosis* 17: 154–62.
- Weitzenhoffer AM (1974) When is an 'instruction' an 'instruction'? *International Journal of Clinical and Experimental Hypnosis* 22: 258–69.
- Weitzenhoffer AM (1980) Hypnotic susceptibility revisited. *American Journal of Clinical Hypnosis* 22: 130–46.
- Weitzenhoffer AM (1996) Catalepsy tests: what do they tell us? *International Journal of Clinical and Experimental Hypnosis* 44: 307–23.
- Weitzenhoffer AM (1997) Hypnotic susceptibility: a personal and historical note regarding the development and naming of the Stanford scales. *International Journal of Clinical and Experimental Hypnosis* 45: 126–43.
- Weitzenhoffer AM (2000) *The Practice of Hypnotism*. New York: Wiley.
- Weitzenhoffer AM (2001) For the record: a commentary on the role of suggestion in hypnosis. *American Journal of Clinical Hypnosis* 44: 155–7.
- Weitzenhoffer AM (2002) Scales, scales and more scales. *American Journal of Clinical Hypnosis* 44: 209–19.
- Weitzenhoffer AM, Hilgard ER (1959) *Stanford Hypnotic Susceptibility Scale: forms A and B*. Palo Alto, CA: Consulting Psychologists Press.
- Weitzenhoffer AM, Hilgard ER (1962) *Stanford Hypnotic Susceptibility Scale: form C*. Palo Alto, CA: Consulting Psychologists Press.
- Weitzenhoffer AM, Sjöberg BM Jr (1961) Suggestibility with and without 'induction of hypnosis'. *Journal of Nervous and Mental Diseases* 132: 204–20.
- White RW (1941) A preface to a theory of hypnotism. *Journal of Abnormal and Social Psychology* 36: 477–505.
- Williams JD, Gruzeliér JH (2001) Differentiation of hypnosis and relaxation by analysis of narrow band theta and alpha frequencies. *International Journal of Clinical and Experimental Hypnosis* 49: 185–206.
- Wilson SC, Barber TX (1983) The fantasy-prone personality: implications for understanding imagery, hypnosis, and parapsychological phenomena. In: AA Sheikh (ed.) *Imagery: Current Theory, Research, and Application*. New York: Wiley, 340–87.
- Woody EZ (1997) Have the hypnotic susceptibility scales outlived their usefulness? *International Journal of Clinical and Experimental Hypnosis* 45: 226–38.
- Woody EZ, Bowers KS (1994) A frontal assault on dissociated control. In: SJ Lynn, JW Rhue (eds) *Dissociation: Clinical and Theoretical and Research Perspectives*. New York: Guilford Press, 52–79.

- Woody EZ, Bowers KS, Oakman JM (1992) A conceptual analysis of hypnotic responsiveness: experience, individual differences, and context. In: E Fromm, M Nash (eds) *Contemporary Hypnosis Research*. New York: Guilford Press, 3–33.
- Woody EZ, Sadler P (1998) On reintegrating dissociated theories: Comment on Kirsch and Lynn (1998). *Psychological Bulletin* 123: 192–7.
- Woody EZ, Szechtman H (2000) Hypnotic hallucinations: towards a biology of epistemology. *Contemporary Hypnosis* 17: 4–14.
- Young PC (1926) An experimental study of mental and physical functions in the normal and hypnotic states. *American Journal of Psychology* 37: 345–56.
- Zamansky HS (1977) Suggestion and countersuggestion in hypnotic behavior. *Journal of Abnormal Psychology* 86: 346–51.
- Zamansky HS, Clark LE (1986) Cognitive competition and hypnotic behavior: whither absorption. *International Journal of Clinical and Experimental Hypnosis* 34: 205–14.
- Zamansky HS, Ruehle BL (1995) Making hypnosis happen: the involuntariness of the hypnotic experience. *International Journal of Clinical and Experimental Hypnosis* 43: 386–98.
- Zamansky HS, Scharf B, Brightbill R (1964) The effect of expectancy for hypnosis on prehypnotic performance. *Journal of Personality* 32: 236–48.
- Zeki S (2001) Localization and globalization in conscious vision. *Annual Review of Neuroscience* 24: 57–86.

Acknowledgements

This work was supported by the Finnish Cultural Foundation (SK) and the Academy of Finland (project 45704, AR). The following people are thanked for reading and commenting on the manuscript: Zoltan Dienes, Jay Fournier, John Gruzelier and Dan Lloyd.

Address for correspondence:

Sakari Kallio

Department of Psychology/Centre for Cognitive Neuroscience

University of Turku

Finland

Email: shakal@utu.fi