A STUDY OF THE RELATIONSHIP BETWEEN HYPNOTIC RESPONSIVENESS AND DICHOTIC STIMULATION TASK PERFORMANCE

by

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ABSTRACT

The research addressed two issues: firstly the difference in information processing style of subjects of varying degrees of hypnotic responsiveness; secondly, the prediction of hypnotic responsiveness.

To test the first question, lateral ear preference scores on two dichotic stimulation tasks were compared with scores on the Stanford Hypnotic Susceptibility Scale: form C (SHSS:C). To test the second question, the prediction of hypnotic responsivness, four predictive tests were given to subjects: conjugate lateral eye movements, eye roll, handclasp and a visual imagery task. Results of these tasks were compared with scores on the SHSS:C.

Sixty right-handed male and female volunteer subjects, mainly university students and staff were used.

Analysis of the data did not detect any relationship between lateral ear preference in these dichotic stimulation and hypnotic responsiveness as measured by the SHSS:C, for the particular population tested. None of the four predictive tests either singly or in combination predicted scores on the scale of hypnotic responsiveness, the SHSS:C.

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1. INTRODUCTION

Hypnotic responsiveness and information processing style

The major focus of the research is to examine the relationship between hypnotic responsiveness and lateral preference for auditory stimulation when presented dichotically.

Studies which use dichotic stimulation techniques usually show greater accuracy of report of verbal material presented to the right ear of the subject, when the left ear is simultaneously stimulated with different words or syllables of the same length. This right ear advantage is found for most right-handed subjects with left sided cerebral language dominance.

However, ear advantage does not correspond exactly with the location of language dominance. In fact, about twenty per cent of normal right-handed subjects (subjects without brain pathology) show an atypical left ear advantage. The possibility of right sided language dominance of right handed subjects could not be expected to occur in more than five per cent at most. This figure leaves approximately fifteen per cent of right-handed subjects who show an unexplained left ear advantage.

Ear advantage in dichotic stimulation tasks is taken to indicate contralateral cerebral language dominance or specialization. However, ear advantage reflects other factors in addition to that of side of language specialization:memory, attention, and the degree of specialization are some of these factors. None of these factors however, either singly or in combination accounts adequately for the proportion of subjects with the left ear advantage. A possible factor which has not previously been considered is the style of information processing.

Style of information processing as used here refers to processing language stimuli via neural paths leading to a left ear advantage when the normally right ear advantage would be expected. This implies more involvement of the right cerebral cortex, though no specific pathways are proposed here.

The alterations in memory, perception and motor responsiveness shown in hypnotic phenomena such as amnesias, involuntary movement and hallucinations, suggest that subjects with high hypnotic responsiveness also show atypical information processing. Further, one of the known characteristics of subjects of high hypnotic responsiveness is the capacity for great imaginative absorption, a faculty attributed by some to the right side of the cerebral cortex.

Thus, one may hypothesize that the same mechanisms, which result in hypnotic phenomena and imaginative involvement may also be present in producing the atypical left ear preference reported in the dichotic stimulation technique.

Hypnotic responsiveness (defined as the relative ability to produce behavioral, perceptual and cognitive changes as the result of a hypnotic induction), appears to be a relatively stable characteristic. This ability to make use of hypnosis seems to depend more upon an individual's own ability than on practice, motivation, demand characteristics, or skill of the hypnotist. The search for personality correlates of hypnotic responsiveness has yielded no consistent findings.

Hypnotic responsiveness may depend upon a particular style of information processing to a greater degree than the motivational factors or the manner of interaction with the hypnotist. The style of information processing attributed to the right side of the cerebral cortex, imaginative absorption and involvement, is characteristic of the subject with high hypnotic responsiveness. The reflection of a particular style of information processing might be found in atypical performance on a task of information processing. Consequently, subjects of high hypnotic responsiveness may be those who are more likely to show a left ear advantage on a dichotic stimulation task.

The first part of the study examines the relationship between ear advantage on two dichotic stimulation tasks, and hypnotic responsiveness as measured by the Stanford Hypnotic Scale of Susceptibility: form C. One of the two dichotic stimulation tasks involves accuracy of report of whole words, different words presented simultaneously to each ear. The second task requires a simple motor movement in response to simultaneously presented instructions for opposite movements.

Tests to predict hypnotic responsiveness

Because of the length of the experimental sessions which involved measurement of hypnotic responsiveness, the opportunity arose to perform other tests which did not bear directly upon the main focus of the research, but which could address questions stemming from the writer's clinical interests. One such question was the prediction of hypnotic responsiveness.

Prediction of hypnotic responsiveness is necessary in psychotherapy using hypnosis. Hypnosis is particularly effective for patients of naturally high hypnotic ability or responsiveness. While patients of lesser hypnotic responsiveness can still benefit from the use of hypnosis, the strategies or interventions used while the the patient is in the hypnotic state are more limited. Thus a reliable method of predicting or assesing hypnotic potential is required. Predictive techniques exist, but mainly in the form of work samples such as standardized scales of hypnotic responsiveness. These predictive techniques are unsatisfactory in the clinical setting in two ways: firstly they are lengthy; secondly the outcome is evident to the patient, a fact which may predispose to a failure set for the use of hypnosis in therapy if the hypnotic responsiveness is low. Therefore a method of prediction which is rapid and which does not directly indicate the level of performance in hypnosis would be useful. Such a predictive task would therefore need to avoid the use of hypnosis.

Four predictive tasks are the focus of the second part of the research. The aim is to find one predictor or a combination of predictors which accurately predict performance on the Stanford Scale of Hypnotic Susceptibility: form C (SHSS:C).

The SHSS:C is a standardized scale of hypnotic responsiveness which uses a work sample of responses to test suggestions in the hypnotic state.

Three of the four predictive tests use simple tasks of motor behavior which involve neuromuscular organization. The fourth test uses a task of visual imagery.

The four tests were designed to predict performance on the SHSS:C.

2. REVIEW OF THE LITERATURE

The literature which will be discussed is divided into firstly that pertaining to hypnosis and hypnotic responsiveness, and secondly, examples of the dichotic stimulation technique.

The focus of the present research deals with proposed common elements of two widely divergent areas - hypnosis, and bilateral auditory stimlation. Since the variation in performance on each of these two different tasks is taken to be a function of fundamental differences in the manner in which information is processed, studies which have examined these two areas separately will be reported. The purpose of the description and discussion is to elucidate the existence of different information processing mechanisms, various conbinations of which comprise an information processing style. Multiple factors interact which can be seen to account for final cognitive processing. Greater use of visual imaginative mechanisms for example, is but one example of an information processing style.

Studies which have addressed both the areas of hypnosis and dichotic stimulation together are few. Thus most of the discussion will take each technique separately and examine the different information processing mechanisms involved of the areas of the hypnotic process and the dichotic stimulation technique. Firstly, the measure of hypnotic responsiveness will be described.

3. THE MEASURE OF HYPNOTIC RESPONSIVENESS

Scales of hypnotic responsiveness test a subject's ability to use hypnosis directly, by using a hypnotic induction and then testing ideomotor responses and changes in perception and cognition that occur when directly suggested. The long scales commonly used in the research setting are not designed for clinical use, but rather to provide information about the basic cognitive and perceptual changes that are possible as a result of a hypnotic induction.

A formal scale of measurement of hypnotic responsiveness or hypnotic susceptibility was first developed for experimental use by Friedlander and Sarbin (1958). A hypnotic induction was administered, followed by a series of test suggestions in order of increasing difficulty. The earlier Stanford scales, forms A and B (Weitzenhoffer & Hilgard, 1959) were based upon the Friedlander and Sarbin scale, using similar types of test items.

The scale used in the present study is the Stanford Hypnotic Scale of Susceptibility: form C, and was developed to provide more information about cognitive factors operating in hypnosis than was provided by the A and B scales. However, a modificaton of the Stanford A scale was developed for group administration to provide a basic screening of hypnotic responsiveness. This scale, the Harvard Group Scale of Hypnotic Susceptibility (Shor & Orne, 1962) has been administered to some of the subjects used in the present study prior to administration of the SHSS:C.

Three other standardized scales are available, but are mainly used by their authors and associates. Each will be described briefly.

The Barber Suggestibility Scale (Barber,1965) consists of a series of graduated test suggestions. The Scale was designed to be used with or without a hypnotic induction in order to compare the specific effects of the hypnotic induction. Two alternate methods of scoring are provided for. The first method of scoring assesses on a pass or fail basis the subject's behavioral response. The second method of scoring uses the subjects own report of the level of experience of each suggestion in addition to the behavioral response.

The Creative Imagination Scale (Barber & Wilson,1977) was designed to make use of the active processes of the imagination of the subject. In contrast to the usual type of phrasing of the test suggestions which are made in a passive manner, as if the subject responds to an outside force, the emphasis is placed on the active control of the subject's own imagination.

Spiegel (1973) developed the Hypnotic Induction Profile, a test designed for clinical use which gave not only an estimate of hypnotic responsiveness, but a psychopathological profile as well. No hypnotic induction is given. Part of the test involves the eye roll which is included as one of the four prdictive tasks in the present research.

The SHSS:C is the scale of hypnotic responsiveness used in the present research. Subjects are read a hypnotic induction and then given twelve test items in increasing order of difficulty. The test items use many of the phenonmena that have classically been used throughout the history of hypnosis to test an individual's level of hypnosis in clinical settings. For example, hand movement in response to an imagined force is an item which most subjects pass: negative hallucination of an object is considered a difficult item as only approximately 9% of subjects pass this item. Passing or failing an item is based on various subjective and objective criteria: the more items passed, the higher the subject's hypnotic responsiveness.

4. FACTORS OF THE HYPNOTIC PROCESS

Introduction

The state of hypnosis is a combination of several factors or elements, each of which contributes to the production of cognitive and perceptual changes. The relative importance of one or more factors may vary between individuals, and also may vary within individuals on different occasions. Certain factors are weighted differently and interpreted differently according to various theoretical orientations.

The factors which will be described are as follows:

1. The subject's attitudes.
2. The trance state, or altered state of consciousness.
3. The involvement of imagery or primary process thought.
4. Dissociation.
5. Adaptive regression.
6. Physical relaxation.
7. The hypnotist-subject/patient relationship.
8. Suggestibility or cognitive flexibility.

Reported studies in the description of the factors are illustrative of the points being made and are not a complete review of the research.

The subject's attitudes

Attitudes affect the outcome of hypnosis, whether in the experimental or clinical setting. These attitudes may include motivaton to experience hypnosis, motivation for success in psychotherapy, belief in the effectiveness of hypnosis, willingness to undergo unusual experiences, and trust in the integrity and competance of the hypnotist.

Representative studies which have addressed the influence of attitudes will be described.

The manner in which hypnosis is described to a subject can influence the effectiveness of hypnosis. Subjects often have misconceptions and fears about hypnosis which prevent optimal performance. Thus on a scale of hypnotic responsiveness, subjects with a negative view of hypnosis may pass fewer test items than subjects with a more favourable perception of hypnosis. Cronin, Spanos, and Barber (1971) addressed this question. Two groups of subjects were used. One group did not receive any explanation about hypnosis. The second group was given an accurate explanation of the process, and description of the experience. The group given the explanation scored significantly higher on the Barber Suggestibility Scale than the groups which did not receive the explanation. Diamond (1972) found similar results with a different study which addressed the same question.

Barber and Calverly (1964e) compared two groups of subjects. One group received information that they would be tested for their imaginative ability. The second group was informed that they would be tested for their gullibility. Both groups were then given the identical test, the Barber Suggestibility Scale, which contains eight test items. Of the 'gullibility' group, only 6% scored five points or more. Of the 'imagination' group, 41% scored five points or more. The authors concluded from the data that the manner in which the psychological processes involved in hypnosis were defined contributed to the subject's performance.

Anderson (1968) gave subjects a questionnaire designed to reveal attitudes towards hypnosis. The data showed a correlation of .47 between favourable attitudes towards hypnosis and responsiveness to test suggestions on the Stanford Susceptibility Scale: form A. Similar results were found by Melei and Hilgard (1964).

Barber and Calverley (1964,1965) performed two separate studies designed to explore the effect of the term 'hypnosis'. Two groups were used. The first group was informed that hypnosis would be used; the subjects in the second group were informed that they were controls. Both groups were given the same test, the Barber Suggestibility Scale. The group informed of the use of hypnosis showed a small but statistically significant gain in the response to test suggestions compared with the uninformed group. The conclusions drawn were that subjects expecting to be hypnotized had an increased expectation of being able to pass the test suggestions.

From the preceeding studies it appears that a subject's prior attitudes can contribute to or detract from his ability to use hypnosis in an experimental situation.

The trance state

The use of the term 'trance' in the literature is inconsistent. Some clinicians tend to use the word 'trance' interchangeably with the word 'hypnosis'. In research involving hypnosis the term tends to be used to refer to either one of two concepts of cognitive process. The first concept is that a state of consciousness which differs from the normal waking state of consciousness, but which is not sleep (Tart, 1979). The second concept is that of a change of the focus of attention from several different external events to one single internal event; this change in focus of attention is further characterized by a reduction of self-awareness, and also a reduction of awareness of the self within the external context of the environment (Shor,1979). The particular use of the term 'trance' will be specified when discussed.

Bernheim (1866), in his early approach to clinical hypnosis, defined hypnosis as 'the induction of a peculiar psychical condition which increases the susceptibility to suggestion'. Bernheim tested patients for hypnotic responsiveness by using a series of graded suggestions for cognitive and perceptual changes, the prototype of modern scales of responsiveness such as the Stanford Scales. Bernheim later modified his interpretation to focus more on suggestibility, which could be increased by several factors, only one of which was the hypnotic state, which he referred to as 'trance'.

Considerable dissention resulted from Bernheim's modification of the trance concept of hypnosis, and a division into two opposing theoretical positions occurred. The first school was lead by Bernheim at Nancy, in France. The second school was led by Charcot, who as a neurologist in Paris at the Salpetriere Hospital enjoyed considerable influence amongst clinicians. Charcot's school formed the foundation for psychoanalytic and other psychodynamic approaches to the use of hypnosis. Bernheim's School was more behaviorally oriented, and present cognitive-behavioral approaches can be seen to have their roots in the early writings of Bernheim.

Shor (1979) defined hypnosis as an altered state of consciousness characterized by a reduction of the generalized reality orientation, and a temporary loss of self-reflective executive monitoring. The generalized reality orientation, or non-hypnotized state, existed as a certain relationship of perceptions within a context or background. The individual was aware of this contextual background, but could switch voluntarily from increased attention to one item or another. The object of attention could be subjective and internal or objective and external. Minor degrees of loss of this generalized reality orientation were seen to occur in non-hypnotized states, for example, when absorbed in an activity which commended a considerable amount of attention. Shor described the type of absorption commonly found when reading a book as an example of a temporary loss of the generalized reality orientation, which might be experienced to different degrees between individuals and within individuals at different times.

'Self-reflective executive monitoring' was the term given by Shor to the self-awareness and self-consciousness experienced by an individual. This process would occur in a subject undergoing a hypnotic induction until a certain depth of hypnosis was reached, during which time the person was aware of one aspect of the self experiencing hypnosis, while at another level was concurrently observing or monitoring the process. When the subject lost this self-consciousness, the state of hypnosis was claimed to be deeper (Shor,1979).

Studies which have examined the relevance of trance

Because of opposing points of view regarding the existence or importance of trance, one focus of research has been the contribution of the trance state in producing the suggested behavioral changes following a hypnotic induction.

Barber and Hahn (1962) tested suggested analgesia for both hypnotized groups and non-hypnotized groups. They found an increase in analgesia for both groups, with no significant difference between the two. The conclusions drawn from the data were that a state of hypnosis did not exist as such, and that a hypnotic induction procedure did not elicit special perceptual or cognitive changes. The pain stimulus used was cold water, in which subjects placed one hand for as long as possible. However, subjects for all groups were selected on the basis of having high non-hypnotic suggestibiblity, a procedure which would probably minimize the effect due to any hypnotic induction procedure. It is worth noting that it has been observed that the most striking increase in suggestibility following a hypnotic induction as opposed to normal suggestibility was in subjects with low normal (non-hypnotized) suggestibility. Subjects high in normal suggestibility usually retain their suggestibilty in hypnosis. Thus a hypnotic induction for a phenonmenon such as analgesia will show a greater difference between hypnotized and non-hypnotized conditions for subjects of low normal suggestibility only. Barber's findings did not take these observations into account.

A second area of focus of research concerning trance or hypnosis as an altered state of consciousness has been the phenomenological study of the experience of hypnosis. Examples of relevant studies will be described, most of which are based on numerical scales of the subject's experience of depth of hypnosis.

The term 'depth' in clinical literature is taken to imply either the degree of involvement of the subject in hypnosis, or is taken as an inference about the effectiveness of the hypnotic procedure. In the experimental literature, the term 'depth' is used phenomenologically to describe a subject's experience of the degree of the amount of hypnosis he experiences - the amount to which his experience differs from his normal state.

Speculation regarding the relationship between the experienced depth or degree of hypnosis and behavioral outcome arose. While this relationship had been assumed in clinical practice, it was not until recently that this focus of experimental investigation took place.

Le Cron (1953) required subjects to estimate their experienced depth of hypnosis on an imaginary scale from zero to one hundred. This use of a subjective rating scale of experience appears to be the first in the literature. Field (1965) developed an inventory of experiental aspects of hypnosis in the form of a questionaire which was filled out by the subject. He also used a mechanical sliding scale which subjects moved to indicate the numerical value of experienced level of hypnosis.

Hilgard and Tart (1966) compiled the Brief Stanford Scale, a zero to four point scale of subjectively scored hypnotic depth, each depth rating made by the subject immediately after the induction and after each test suggestion. Results were correlated with the SHSS:C. Mean self report of depth scores of the Brief Scale correlated between 0.67 and 0.75 with the score on the SHSS:C. The initial state report taken immediately after the hypnotic induction before the test items was highly predictive of behavioral response, the total score on the SHSS:C.

Tart (1979) constructed an extension of the SHSS:C, the Long Stanford Scale. This scale consisted of the regular SHSS:C induction into hypnosis and test suggestion items, but interspersed with requests for depth state reports from the subjects after each test item. This depth rating was made on a zero to ten point scale. The resulting score from these state reports was termed the SSHS:C Experiential Score. The regular SHSS:C score was referred to as the SHSS:C Behavioral Score. After completion of the scale, subjects completed a detailed questionaire about their experiences, focussing on such factors as the intensity of the experience and the involuntariness of responses. Subjects also completed Field's Inventory. Correlations of the SHSS:C Behavioral Score, the SHSS:C Experiential Score and Field's Inventory with the mean total depth report were 0.74, 0.77, and 0.66 respectively.

Tart (1962,1963) formed the North Carolina Scale in which subjective depth reports by the subject made on a zero to fifty point scale were questioned further for descriptive content of the hypnotic experience at each state. As with other experiental scales, test suggestions for perceptual and cognitive changes were made, and scored by the experimenter in the usual way, with depth state reports between each test item made by the subject. Reported experiences along the depth scale were described as follows, (Tart,1970b).

1. A score of zero refered to the normal waking state.
2. A score of one to twelve was experienced as physical relaxation, a detached experience and production of ideomotor responses to the test suggestions, i.e., the tendancy to move in response to an imagined idea.
3. A score of twenty was associated with the ability to produce analgesia.
4. Hypnotic dreaming when suggested was experienced at a level of twenty-five.
5. A level of thirty produced suggested amnesia, 'mental quiet' and 'very high suggestibility'.
6. At a level of forty, subjects experienced all suggested phenomena as seeming real.
7. 'Mental sluggishness' was reported for the depth of fifty.

Statistical analysis revealed that a subjectively experienced deep state of hypnosis was predictive of hypnotic dreaming 100% of the time, and predictive of post-hypnotic amnesia 82% of the time (Tart,1979). Tart (1979) compiled the most commonly reported experiences described by subjects in hypnosis. They were drowsiness, relaxation, fading of the environment, changes in body image or perceived body position, and a feeling of compulsiveness of responsiveness of reponses. Factor analytic studies of subjective experiences in hypnosis have been made. The questionaires for these studies have been designed to tap any trance-like experiences or alteration in state of consciousness. Representative studies will be described briefly.

Treating questionaire responses with factor analysis, As and Ostvold (1968) observed three factors of the hypnotic experience. The first factor was named the experience of trance; the second, the experience of ego control; the third, the desire for regression. Regression may be described as a return to an earlier more primitive state of cognitive functioning.

Field and Palmer (1969) examined experiences of subjects performing the Stanford Scale of Hypnotic Susceptibility, using Field's Inventory (Field,1965). Both scales were intercorrelated, and the authors took these intercorrelations to reflect not only subjective experiences, but the performance of the test items as well. Unrotated, one major factor emerged, which was interpreted as hypnotic depth. Variables which loaded on this factor were the experiences of absorption, unawareness, compulsiveness of responses and a unusual quality of experience. After rotation, six factors emerged, two described as being related to altered state of consciousness. One of these two factors dealt with the change from awareness to unawareness or the environment (similar to Shor's Generalized Reality Orientation), and the second was the waking-to-drowsiness dimension.

Spanos and McPeake (1975b) observed that subjectively rated experiences of the amount of absorption with the test items, and involuntariness of responses covaried with degree of behavioral responsiveness to hypnotic test suggestions.

It should be observed that hypnotic experience questionaires are made following the hypnotic induction provided by the standardized scale of hypnotic responsiveness, such as the SHSS:C. These induction protocols tend to be of the same type, and feature repeated suggestions of relaxation and drowsiness, and also compliance with the hypnotist's suggestions. The experiences tapped in the questionaire are therefore likely to reflect these suggested phenomena, rather than any absolute or inevitable quality of hypnosis itself.

The involvement of imagery

Imaginative involvement is one of several aspects of the hypnotic process, accepted by all theoretical orientations as relevant to the production of perceptual and cognitive changes using hypnosis.

One aspect of cognitive processing is conscious thought which may be seen to take place along a continuum between non-logical, non-verbal, imaginative activity at one extreme, to logical, verbally mediated, sequentially ordered processing at the other.

Psychoanalytic theory

In psychonanlytic theory, the two types of thought activity described above are referred to as primary and secondary process thought. Primary process thought is characterized by drive-dominated, imaginitive, pre-verbal, pre-logical thought processes; secondary process thought consists of reality oriented, concrete or abstract conceptual, logical, verbal thought (Rappaport,1957). In primary process thought, the reflective self awareness diminishes, thoughts are uncontrolled, and the generalized reality orientation diminishes (Fromm,1979; Shor,1979). Ideas are observed to have diffuse multiple connotations, rather than being focussed and directed. Day dreaming is one example of primary process thought. In night time dreaming the primary process thought is more extreme, with mechanisms of condensation, displacement and symbolic transformation (Fromm,1979). In secondary process thought, the individual consciously directs thoughts, uses language to structure the thinking process, and is aware of himself within his environmental context.

In modern psychoanalytic approaches to hypnosis, a distinction is noted between different types of imagery in the hypnotic state. Erika Fromm separates imagery into the following categories. Firstly, ego active imagery which is voluntarily produced by the subject, and emerges from the conscious or preconscious. Active thought and some day dreams use this form of imagery. Secondly, ego receptive imagery which is less ego controlled and which allows more unconscious images to rise unchecked. Thirdly, ego passive imagery which is entirely unamenable to control by the ego, and is found in hallucinatory states in psychopathological conditions.

Present psychoanalytic approaches to hypnosis are based on Freud's original models of unconscious, preconcious and conscious thought processing, and the superego, ego and id states of basic drive mediation (Freud,1900,1923). Rapaport (1957) added the concept of primary and secondary process mental activity. The terms ego activity and ego passivity were added by Rapaport (1961); Deikman (1971) augmented this model with the inclusion of the concept of ego receptivity.

In addition to the continuum of primary to secondary thought processes, the states of ego receptivity and ego activity may be seen to be a continuum in a similar way. In addition the normal waking state or trance state is seen to form yet a third continuum, all three interacting. Thus the deeper the trance state (a term used synonymously with hypnosis in this model), the more primary process activity and ego receptivity (Fromm,1979). However, the hypnotic process or state does not use primary process thought and ego receptivity exclusively: Fromm holds that a vascillation from primary to secondary process activity occurs within the hypnotic state. She further states that intellectual learning takes place in ego activity states. Psychotherapy requires both intellectual and emotional learning, and hypnosis facilitates an integration of intellectual and emotional learning.

The mechanism by which primary process thought and ego receptive imagery can be therapeutic when manipulated correctly by the psychotherapist is outlined as follows, using Erika Fromm's analysis of the process. When a function, either intellectual or behavioral, is being learned, conscious processes are involved. As the material is learned, a habit is formed, and automatization gradually occurs. Eventually, when the event is fully automatic, the mechanics are dealt with at a preconscious level. This process occurs with all normal skills, but also with pathological behaviors. The unlearning of automatisms occurs by firstly attending to the functions at a conscious level (Van Nuys,1973). When the habit has become de-automatized, restructuring the cognitions in a more effective way can take place. Primary process activity is the means by which this relearning can take place, by using more primitive visual images which then permit a reconstruction of more effective secondary process interpretations and concepts (Gill & Brenman,1959). The process of adaptive regression is an integral part of this mechanism, but will not be discussed until the section dealing with that subject.

Bowers and Bowers (1979) proposed that creativity uses this process of returning to primary process imagery in order to form unexpected new concepts and intellectual events. In such cases a state of hypnosis is not required as the agent of change, but individuals are thought to lapse into an informal trance state spontaneously.

Social psychological model

Sarbin (1950,1972) proposed a role-taking model of hypnotic behavior. He noted parallels between hypnotic processes and the involvement of actors in the theatre. Acting could be technical or heated: technical acting retaining self awareness, and heated acting being the totally absorbed form of acting which would lead to an identification of the actor with his role.

Sarbin stated that differences in position along the role taking continuum best explained the variability in responsiveness to hypnotic test suggestions between subjects. The stable individual differences in reponsiveness, to the extent of being a trait, was based upon a basic ability or aptitude to undetake the hypnotic role. This role taking aptitude was dependent on imaginative involvement, 'as-if' behavior - the ability to repond to physically absent imaginary stimuli as if they were actually present. Self and role were seen to become less differentiated the more organismic involvement the participant had with the role. While other variables contributed to role enactment, such as perception of the intended role, motivational factors, and reinforcing qualities of the hypnotist, the role skill or basis ability was critical. Sarbin saw this ability to take the hypnotic role as analogous to acting ability, which varies considerably among individuals.

Cognitive-behavioral model

Barber proposed that imaginative involvement was the mechanism by which behavior change could be effected: the behavior outcome was dependent upon the degree to which a subject would actively think along with and imagine the relevant ideas. In turn, the involvement a subject would invest in the imaginative activity depended upon the motivation, attitudes and expectancies of the process. Basic ability was not considered important. Barber referred to the imaginative process used in hypnosis as goal directed imaginings (1962,1974).

Barber drew attention to observations of Arnold (1946) who stated that

> words may be considered as symbols which stand for the situation or activity they refer to.

Arnold further noted that thinking about and imagining suggested movement or activity tended to bring about that movement activity.

Hadfield (1920) demonstrated that if subjects were asked to imagine that a limb was becoming cold, vasoconstriction (reduction in size of the peripheral blood vessels) and a drop in skin temperature of the limb occurred. Similar results were found by Menzies (1941).

Schultz (1926), using autogenic training for relaxation and psychotherapy, asked subjects to imagine coolness in the forehead. Temperature measurement of the skin surface showed a decrease in forehead temperature in one third of subjects. Likewise, Schultz found that eighty per cent of subjects could produce a rise of up to two degrees centigrade in their hands when asked to imagine that the hands were exposed to heat.

Jacobson (1950,1952) demonstrated that an imagined movement produces measurable muscular contractions which are not of sufficient magnitude to be detected by the subject.

Harano, Ogawa and Naruse (1965) asked subjects to think and imagine and tell themselves "my arms are warm". Subjects tended to show increase in blood volume and temperature in that arm. No changes were found when subjects tried to raise the temperature without imagining warmth.

Thus imagining an event tends to produce a physiological or behavior change.

The relationship of imaginative activity with behavioral response was tested by Spanos (1971). After a hypnotic induction, test suggestions for behavior responses were given, using a scale of hypnotic responsiveness similar in content to the SSHS:C. Afterwards, subjects were interviewed about their imaginative involvement. Most subjects who passed a test suggestion actively imagined an event which would bring about that behavior in a real situation. This process of imagination was independent of the experimenter's suggestions, as the subjects had constructed a suitable image for themselves, a very active process. For example, for the arm heaviness suggestion, one subject described:

> I imagined that there were all kinds of rocks tied to my arm. It felt heavy and I could feel it going down.

Subjects sometimes disregarded the events they were asked to imagine, and substituted a more effective image which helped them to produce the suggested behavior.

Spanos and Barber (1972) tested subjects for their ability to produce involuntary arm levitation. After a hypnotic induction, instructions for arm levitation were given, after which the subjects were questioned about their experiences of imaginative involvement and the involuntary quality of their arm movements. All subjects who used goal directed imagery experienced the arm levitation as being involuntary. Of subjects who did not use goal directed imagery and yet achieved arm levitation, forty per cent experienced involuntariness.

Spanos and Ham (1973) gave hypnotized and non-hypnotized groups suggestions for amnesia. The item to be forgotten was the number four. Most subjects who were successful reported their own images which they directed towards the goal. For example, one subject imagined the numbers one to five drawn on a blackboard, and then imagined herself erasing the number four. When interviewing subjects who did not pass the test items, Spanos noted two main types of cognitive events hindering the goal: either the subjects did not want to pass the test items for various reasons, or they tried hard to cooperate, but did not imagine (Barber,1974).

Thus behavioral outcome is seen as the direct result of the extent of this particular cognitive strategy, goal directed imagery. Barber does not address the question of relative ability to imagine vividly or effectively, but regards the antecedent variables of motivation, attitudes and expectancies which the subject brings to the test situation as critical. The hypnotist's role is seen as the catalyst in producing the required attitudes that predispose the subject to think along with and imagine the ideas.

Imagery - Research Findings

Most research concerning the involvement of imagery in hypnosis has addressed the relationship between the degree of imaginative absorption with hypnotic responsiveness. Fewer studies have been directed at the question or whether or not vividness of imagery is actually increased in the hypnotic state.

Rosse, Sturock and Solomon (1963) studied subjects under normal, placebo and hypnotized conditions. They found increased vividness of imagery reported by the subjects in the hypnotized condition only.

Stross and Shevrin (1967) demonstrated that hypnosis facilitated dream recall when examining counterbalanced conditions of hypnotized and non-hypnotized dream recall.

Volpe (1969) observed that an effective hypnotic induction increased the ability to imagine a hierarchy of stressful images. This technique was used in desensitization for the treatment of phobias.

Fromm, Oberlander and Gruenevald (1970) observed increased primary process responses on Rorschach tests when subjects were in hypnosis, compared with interpretations of the test when performed in the non-hypnotized state.

Levin and Harrison (1976) noted more primary process activity in induced dreams and also in Thematic Apperception Test stories when subjects were in hypnosis compared with the normal state.

Several researchers have thus been able to demonstrate that the hypnotic state facilitates that production of imagery. However, evidence to the contrary has also been put forward.

Poe (1967) found no difference between the vividness of reported imagery in or out of hypnosis for imagined practice of motor and cognitive tasks.

Starker (1974) again found no significant increase of ratings of vividness of imagery following a hypnotic induction.

Coe et al (1980) found no interaction between hypnotic responsiveness and the hypnotic state for vividness of imagery. When subjects knew they would experience the test using hypnosis after a first attempt without hypnosis, greater reported imagery for the hypnotized state was reported. Imagery was not reported as increased in a group which had only received hypnotic suggestions compared with a non-hypnotized group.

Results from the studies described above have indicated that imagery can be a powerful cognitive process in permitting behavior change. It has not however been established conclusively that the vividness of imagery is heightened in the hypnotic state, but only that the production of images directed towards a certain goal may be instrumental in achieving the goal.

Dissociation

Dissociation may be defined as a two factor intrapsychic process of changing relationships of consciousness and unconsciousness, and voluntary and involuntary control systems (Hilgard,1979). Dissociation is also described as the temporary isolation from consciousness of one particular physical or mental event, or a system of mental events. The process may be normal or pathological.

The process of dissociation may occur in normal everyday psychological processing when allowing attention to become focussed on events. For example, in sports an injury can take place witout the individual's awareness. Thus one part of the body can become split off from the mainstream of consciousness.

The term dissociation may also be used to refer to a temporary state of unawareness of context, a process which is termed the reduction of generalized reality orientation (described in detail in the section on that subject). Again, the process serves the function of redistributing attention for effective information processing. An example would be book-reading absorption, in which an individual forgets his surroundings temporarily.

Hilgard (1973a,1974) observed that minor incidents of dissociation took place in normal individuals, in everyday situations. This type of dissociation was seen to be partial rather than total. Neisser (1967) observed that sensory stimuli can be received by the body without an individual being consciously aware of them. Peripheral information can be processed preattentively, to use Neisser's terminology. Dissociation in this sense could be defined as the ability to perceive and respond to stimuli that are not consciously perceived.

In normal states, the process of dissociation is always under the overall control of the ego, or in other words, under the conscious voluntary permission of the self to undergo this process.

In psychopathological states, the individual is unaware of the discriminative process, and so cannot terminate it voluntarily. The dissociation occurs as a way of isolating incompatible conflicting elements of the personality. Fugue and other amnesic states, and multiple personality conditions are examples of pathological dissociation.

Historically, the concept of dissociation was first described by Pierre Janet (1907). Frankel (1976) outlined Janet's use of the term dissociation as:

> that system of ideas split off from the major personality and exist as a subordinate personality, unconscious but capable of becoming represented in consciousness through hypnosis.

Janet regarded the dissociated system of thoughts as completely independent, and attributed the dissociation to an enfeebled state in which there was insufficient mental energy to maintain the integration of ideas (page 40). Janet believed that dissociation was always pathological, and that hypnosis was a state that only existed in psychopathological conditions.

Janet formed this dissociation concept as an extension of Charcot's theory (1886) which had linked hypnosis with hysteria. Charcot held that both hypnosis and hysteria originated from the same neurophysiological principals. The emphasis on psychodynamic mechanisms formed a trend in the development theory of hypnosis. Present psychoanalytic approaches to hypnosis and Hilgard's neodissociation aproach both stem from this particular school of thought.

A continuum of voluntary and deliberate, to non-voluntary and automatic processes occurs in a normal waking state. Many learned behaviors take place at an involuntary and automatic level. An example is the social gesture of hand shaking. In order to refrain from shaking a proffered hand, a deliberate, voluntary inhibition of a normal automatic non-voluntary gesture must take place. Sensory stimuli may may be attended to or not in a similar manner, as has already been noted with pain reception. Observed pain may temporarily be placed out of awareness if a sudden change in another sensory stimulus takes place, such as a loud, unexpected sound. Thus attention to one aspect of consciousness leads to unawareness of other aspects, or inattention towards them.

In hypnosis, this normal tendency to change the focus of attention can be more marked. For example, in the normal non-hypnotized state, the experience of pain can only be unattended to by the process of distraction, in an involuntary manner. In hypnosis, the dissociation of consciousness may take place in such a way that pain is consciously not experienced even when the subject or patient is consciously evaluating the presence, absence and intensity of the pain. However, the sensory reception of pain stimuli still continues at a physiological level, as demonstrated by physiological indicators of pain such as heart rate (Bowers,1976). Thus the pain is dissociated from awareness as opposed to being absent altogether (Hilgard 1973a,1974).

Negative hallucinations are also an example of dissociation - the splitting off from consciousness of a stimulus in the presence of physically attending to that stimulus. The ability to negatively hallucinate, or dissociate in this manner is one of the hallmarks of the deeply hypnotized state, and restricted to individuals with high hypnotic responsiveness. In the scale of hypnotic responsivness used in the present study, the SHSS:C, one negative hallucination test item is included. Subjects are asked to see only two boxes when three have been placed by them. Subjects of high hypnotic responsiveness are able to not perceive the third box, even when asked to look closely. Orne (1962a) has described how a subject who has successfully negatively hallucinated a chair will not bump into it if asked to walk around the room. This type of behavior is carefully separated from compliance or faking by certain methodological procedures. It appears that consciously, the subject does not see the chair - unconsciously he does.

Hilgard (1979) emphasized that this process remains under the ego control of the subject. This view is in contrast to early psychoanalytic theory which held that the hypnotized person surrendered his control to the ego of the hypnotist. The participating ego continues to monitor, and acts in an executive role, giving, as it were, permission for subsystems of the ego to dissociate and change cognitions and perceptions: '... a normal observer standing in the wings and watching the actual subsystem perform at the center of the stage' (1979,page51).

While Hilgard maintains that this monitoring as a doubling of the self occurs throughout the hypnotic process, other researchers observe that deep states of hypnosis produce more complete dissociation from context, or reduction of the generalized reality orientation (Tart,1979; Shor,1979).

Whether or not awareness of the self in the hypnotic process is a reflection of depth, the question of ego control in dissociative tasks has been demonstrated by a study using autohypnosis. Subjects hypnotizing themselves can produce the same phenomena as when the hypnotic test suggetions are made by an experimenter. Subjects can perform the most complex tasks on a standardized scale, indicating the complex levels of ego control that can occur. Results illustrate the retention of executive control of the subject's own ego rather than a passive surrender to that of the hypnotist (Ruch,1975).

The importance of dissociation is described by Hilgard (1973b) who states that the dissociative and absorptive processes are perhaps even more important in determining the domain of hypnosis than behavioral responses.

Adaptive regression

Psychoanalytic approaches to hypnosis perceive the factor of adaptive regression as being coexistent with primary process mentation, and as a result an inevitable element of the hypnotic process. The term regression in the service of the ego may be used synonymously with the term adaptive regression.

The concept of personality regression was first defined by Freud (1909). He stated that in times of severe psychic stress, the personality functioning could revert to a more primitive mode of functioning. Freud emphasized that irreconcilable conflicts between the id and the super-ego were the antecedents of psychic stress of a severity that would lead to psychopathology. If the normal ego defenses were inadequate to resolve the conflict, or the the conflict too great, regression would occur.

The id was defined as that part of the personality that directs energy towards meeting basic drives; this structure is present in infancy. The superego is the aspect of personality that places constraints on the id drives in order to meet the demands and restrictions of society; it develops later than the id, throughout childhood. Freud described the mode of cognitive processing in the id state as preverbal, prelogical and pictorial. The superego used verbal, conceptual modes of processing, with verbalized restrictions of behavior introjected from parents and other significant adults. Freud termed the cognitive mode of the id as primary process thought, and that of the superego as secondary process thought. The ego was perceived by Freud as a form of mediator between these two ego states - the id and the superego. As the id was the first part of the personality to develop, regression invovlved a return to the primitive, drive dominated, prelogical state which characterized the id. The process of regression occurred automatically in psychopathology when the person suffered intrapsychic conflict - the individual would tend to regress to an early personality state which was conflict free.

Freud conceptualized a similar process occurring in hypnosis: the ego no longer controlled the superego-id relations, and the subject temporarily reverted to an id dominated state, relinquishing ego control to the hypnotist.

More recent psychoanalytic theory perceives the ego as a psychological entity in its own right (Hartman,1939; Kris,1934; Rapaport,1938,1953). The ego is judged as having an executive function, able to make use of id and superego forces to serve its own needs. Minor states of regression are noted to take place in the normal functioning of healthy individuals; this view contrasts with the earlier pathological notion of regression. The ego is able to monitor and direct a return to a more primitive personality state in order to benefit the ego and maintain optimum personality function. Erika Fromm (1979) observed that minor temporary states of regression which are a part of normal function are evident in humor and artistic and dramatic expression. The regression is perceived to allow a temporary lowering of ego defenses, and as a result the primary process activity can work through material unhindered. A restructuring can then take palce, so that when secondary process thought does return, it has been enriched and benefited from its temporary absence; thus the terms adaptive regression or regression in the service of the ego. Some creative thinking possibly uses this process (Gill & Brenman,1959: Bowers & Bowers,1979).

Evidently, the regression state concept is intimately bound with the concept of primary process thought. While the two may be inseparable, examination of the processes often addresses one concept in particular, with different emphasis. As a result, a clear seperation of the two concepts is useful.

The most essential differences between the pathological and normal uses of regression are as follows. Firstly, the normal use of regression may take only a few minutes; pathological regression takes days or weeks. Secondly, in normal states the process is under the overall control of the ego (the self) so the state can be terminated voluntarily; in pathological regression the return to normal functioning occurs only when sufficient working through of conflict has occurred, and cannot be done voluntarily.

As already discussed, the concept of regression in hypnosis was first outlined by Freud. Gill and Brenman altered Freud's model, viewing the process as regression in the service of the ego. These authors specified that the state was reached by means of a regressive transference relationship between the hypnotist and the patient, sensorimotor disorientation, and reliquishing of overall ego control to the hypnotist. Paradoxically however, the overall ego retained contact with reality, and only a subsystem of the ego was said to undergo the regression.

The most recent psychoanalytic approaches to hypnosis reject the idea that the overall ego gives up control to the hypnotist. Erika Fromm, Gruenwald and Oberlander (1979), state that the ego remains in overall control, permitting only a subset of the ego to regress. The remainder of the ego acts as a detached observer or monitor. This position was first outlined by Schilder (1926). The concept of dual function of the ego is consistent with the position of E. Hilgard, who notes the dissociative processes involved, but who does not address the regression concept.

For Shor,

> Adaptive regression is a multivariate concept encompassing a varying mixture of access to the un-

> conscious, archaic involvement, and trance.(1979, page 130).

By unconscious involvement, Shor specifies primary process thought (as opposed to his concept of non-conscious involvement, which is dissociation). By archaic involvement, Shor means the transference relationship, which will be described further in the section on the hypnotist-subject interaction.

The dimension of regression as part of the hypnotic process is excluded from the social psychological model of Sarbin and also from the cognitive-behavioral model of Barber.

The question of whether or not regression and primary process thought occur in hypnosis was the object of study by Fromm, Oberlander and Gruenwald (1970), and Oberlander, Gruenwald and Fromm (1970). The study also attempted to distinguish between adaptive and maladaptive regression. The first section of the study will be described. Subjects of high hypnotic responsiveness were used, as measured by a modified version of the Stanford Hypnotic Scale of Susceptibility: Form A. The hypnotic induction from the SHSS:C was used for the experimental condition. The Rorschach test was given to subjects in both the hypnotized and non-hypnotized states. Primary process thought and regressive content was significantly greater in the hypnotized condition, but adaptive regression could not be distinguished from maladaptive regression.

An experiment designed to detect adaptive regression was designed by Levin and Harrison (1976), who observed increased adaptive regression only for subjects who had a tendency to be able to use adaptive regression in the non-hypnotized state.

Physical relaxation

The physiologically relaxed state is characterized by reduced muscle tonus, heart rate, and respiratory rate.

The use of physical relaxation in hypnotic inductions appears to have originated with the late eighteenth century view of hypnosis as a sleep-like state.

DePuysegur noted a sleep-like state in patients when attempting a magnetic induction in the style of Anton Mesmer. Normally this procedure seemed to induce a compulsive state; however, DePuysegur observed a state more like that of sleep walkers with ensuing amnesia for the trance events. This state of artificial somnambulism he termed magnetic sleep (Puysegur, 1784a).

From 1813, the Abbe Faria used inductions into what he termed lucid sleep (Faria,1813). He equated this state to some extent with nocturnal sleep. The induction into this state was made by instructing the patient to go to sleep. Occasionally techniques to hold the patient's attention were used in addition.

Braid (1814) termed this state nervous sleep, and described it as characterized

> by a fixed stare, absolute repose of body, fixed attention, and suppressed respiration, concomitant with this fixidity of attention, (Sheehan,1976).

For medical use, Braid formed the term neuro-hypnology, which he briefly contracted to the word 'neuropnology'. Later, he formed the word hynotism. In addition to instructions to focus on sleep, Braid used raised eye fixation to induce eye fatigue as part of his hypnotic induction, a technique which is used to begin the SHSS:C.

Instructions for relaxation, or analogous words, may not have been used until the influence of Jacobson and Schultz earlier this century. Jacobson devised the technique of progressive relaxation (Jacobson,1938). Schultz originated autogenic training. Both techniques concentrated on achieving deep physical and mental relaxation. However, in their original forms of these techniques, the state alone was viewed as therapeutic, and not primarily as a vehicle for suggestions to produce cognitive, perceptual or behavioral changes.

In the last few decades hypnotic inductions gradually incorporated more verbal instructions in contrast to those used previously which used the simple command to sleep, or various physical methods. The use of sleepiness and drowsiness instructions remained however, possibly because the hypnotic state was viewed as a sleep state rather than a waking state.

After electroencephalogram studies had confirmed the waking activity of the brain in hypnosis and disproved the sleep hypotheses, the use of sleep directions began to decline. Relaxation instructions became widely used, given directly or indirectly. Although use of the sleep metaphor in hypnotic inductions has decreased recently, traces remain in the most widely used standardized scales of hypnotic responsiveness such as the SHSS:C. However, one of the most recent scales, the Stanford Hypnotic Clinical Scale (Hilgard & Hilgard,1975) makes only one permissive reference to becoming 'perhaps sleepy' (however, in the dream test item direct instructions to fall asleep are given). In contrast with this scale, the SHSS:C makes use of frequent, repeated instructions to become sleepy and drowsy.

Relaxation instructions in hypnotic inductions are so commonplace that it is difficult to find a protocol for a standardized induction for research use that does not have instructions designed to produce a physically relaxed state. However, one such induction has been compiled (Banyai & Hilgard,1974).

Physical relaxation is a state of especially deep neuromuscular inactivity that is only maintained during the time spent in the state. Techniques for reaching this state were described by Jacobson (1937), who used a system of tensing then relaxing the muscle groups in turn. Autogenic training was originated by Schultz (1932), who used goal directed imaginary activity to achieve the relaxed state.

In a state of deep relaxation, subjects describe phenomena which are very similar to those described by subjects in hypnosis. The question may be raised as to the importance of physiological relaxation in the subject's perception and belief that he is in hypnosis. Rather than being a purely hypnotic experience, the subjective awareness of being in a special state may possibly result from the reduced proprioceptive feedback that occurs in deep physical relaxation.

While most individuals can attain a state of deep physical relaxation unless psychotic, acutely anxious or unmotivated, only a certain proportion of the population (10-20%) can produce the perceptual and cognitive changes that are exclusively hypnotic.

The role of relaxation in hypnosis : Studies

Gill and Brenman (1965) observed a consensus of subjectively experienced phenomena in hypnosis. These phenomena included changes in equilibrium, reduced awareness of the body, apparent change in size of body parts, and change in experienced temperature.

Green, Green and Walters (1970), using relaxation training, found similar reports of disequilibrium and reports of experienced physical distortion.

Barber, Dalal and Calverley (1968) noted that subjects report their depth of hypnosis according to the relaxation attained, in addition to the responsiveness to test suggestions on a standardized scale. If a test item was passed, the subject would rate himself as being further into hypnosis than if the test item were failed.

Barber and Calverley (1969) investigated the reason for the 'hypnotic appearance' of subjects - the limpness, psychomotor slowing and general appearance of relaxation. They concluded that some of these effects were produced by eye closure alone, but especially if relaxation or drowsiness suggestions had been given. If the same subjects were then asked to be alert and to stop the appearance of being hypnotized, they continued to be equally responsive to the test suggestions. Barber concluded from these findings that the drowsy appearance was independent from the ability to produce cognitive and perceptual changes. However, Barber conceeded that the experience of relaxation may contribute to the desired changes by raising the subject's expectation of change. Edmonston (1977) gave questionaires of experiences in hypnosis and attitude set to clinical patients. Most responses centered around the experiences described as relaxation, calmness and peacfulness.

Coleman (1976) compared hypnosis with relaxation, using electromyogram and electroencephalogram recordings, and subjective experiences. The two groups did not differ in their subjective experiences, nor in the baseline electromyogram recordings. One relaxation group scored more highly in the scale of hypnotic test suggestions. Differences were found in the electroencephalogram recordings when recorded in the hypnotic state. However, Evans (1979) in a review of electroencephalogram studies and hypnosis concluded that there were no relationships between hypnotic responsiveness and electroencephalogram alpha levels, nor any difference in alpha production between hypnotized and non-hypnotized states. The very high degree of inter-subject variability in baseline EEG Alpha made any findings difficult to interpret. Coleman concluded from this study that the two states of hypnosis and relaxation were behaviorally and experientally identical - only the term differed.

Paul (1969) compared progressive relaxation with Kline's hypnotic relaxation and self administered instructions to relax. The latter group was considered a control group. Dependent measures were heart rate, respiratory rate, muscle tension, skin conductance, and self reported anxiety. Repeated measures of observation were used. In the second session both experimental groups differed significantly from the control group. In the first session, only the relaxation group differed significantly: this finding was attributed to initial anxiety about hypnosis which prevented the same depth of relaxation as the progressive relaxation group.

Ham and Edmonston (1971) compared three groups: an alert induction into hypnosis group, a relaxation-hypnosis group, and a relaxation only group which was used as a control. Reaction times were measured, and were significantly longer in both relaxation groups than in the alert-hypnotic group and the control group. The authors concluded that hypnosis itself did not inhibit motor responses, but that this inhibition is a function of the relaxed state. It was noted that sleepiness and relaxation would be beneficial if such a state were commensurate with the desired outcome, but that hypnosis itself was basically relaxation.

Benson, Beary and Carol (1975) compared various methods of relaxation and their results on several physiological measures. The relaxation techniques used were hypnosis, Transcendental Meditation, progressive relaxation, Zen, Yoga, and Autogenic Training. The measures were oxygen consumption, repiratory rate, heart rate, EEG Alpha activity, blood pressure and muscle tension. The results were fairly similar for all techniques although only equivocal results for blood pressure recordings were found.

Peters and Stern (1973) compared hypnosis with relaxation using measures of peripheral skin temperature and vasomotor reponses. Both groups showed similar results.

Summary

Studies of subjective experiences and physiological measures show very little difference between the hypnotic state and the deeply relaxed state. Comparison of behavioral items, such as the standardized hypnotic responsiveness test items has not been examined fully with regard to the influence of relaxation. While Barber has addressed these issues, he represents a particular theoretical framework - one which refutes the concept of hypnosis as a particular state. Moreover, Barber's experimental designs reflect this bias, as subjects are not measured and grouped according to hypnotic responsiveness.

The hypnotist / subject relationship

Puysegur (1807) first observed and described a special rapport occurring between the hypnotist and the patient. The patient was believed to be insensible to all but the hypnotist's instructions.

Bernheim (1884,1886) used a neologism, 'credivite' to denote the special belief and trust in the effectiveness and integrity of the hypnotist: this relationship formed the foundation for the increase in response to ideas and suggestions in hypnosis.

Modern approaches perceive the interaction process differently according to various theoretical perspectives. Each will be discussed.

Psychoanalytic theory perceives the role of transference as critical to the hypnotic process in psychotherapy, but not in experimental situations. Transference is defined as primitive modes of relating to the hypnotist that are colored by early significant relationships from the subject's childhood. In psychoanalytic theory the role of transference is important in any form of psychotherapy. However, in the hypnotic state, the primitive nature of the subject's ego state resulting from the induction is believed to intesify the transference relationship. Transference in hypnotic relationships include the following experiences: a wish to please the hypnotist, to obey him, and a tendency to make him overly important.

Shor (1979) termed the transference role in hypnosis as archaic involvement. He noted that this was unlikely to occur in the experimental setting, and moreover only occurs in the clinical seting if deliberately aimed for.

The social-psychological position regarding the nature of the hypnotist-subject relationship contrasts with the psychoanalytic position. Orne (1969,1962b) observed that demand characteristics of the experimental situation account for some of the effects commonly attributed to hypnosis: that the expectation of a certain performance on the subject's part increases the motivation to pass the test items.

Barber's cognitive-behavioral approach attributes the behavioral outcome of hypnotic suggestions to the following factors. Task motivational instructions are made by the hypnotist to the subject in such a way as to produce whatever favourable motivation, expectancies and attitudes are necessary for the subject to believe that behavioral, perceptual or cognitive changes are possible. Then the role of the subject is to think along with or imagine what is being suggested: a process of goal directed imaginary activity which produces the desired effect. The task motivational instructions are a form of social pressure: the subject is told that most people can experience the test items if they cooperate and try hard enough. If they do not try, results cannot be expected, and failure reflects a lack of cooperation. Thus, quite independently from the subject's own motivation to experience the items, demand characteristics are made full use of.

However, this form of pressure leads to a reporting of the experiencing of the items, which is independent from whether the items are really experienced. Studies have examined this possibility, using groups of subjects which have had task motivational instructions in place of a regular hypnotic induction, and comparing these subjects with subjects who have undergone a regular hypnotic induction. When a separate experimenter interviewed subjects after the test sessions and requested honesty, task motivational subjects gave different reports of their experiences - that they experienced less than they had originally reported. However, when regular hypnotic induction were given, honesty demands produced reports which matched the reports given to the hypnotizing experimenter. Therefore it appears that task motivational instructions pressure the subject to report an experience, even if the experience had not occurred (Orne,1966; Bowers,1967; Spanos & Barber,1968).

Suggestibility or cognitive flexibility

The foundations of hypnosis can be seen in the magnetic therapies of the eighteenth century. Magnets or magnetized objects were used in various ways with some form of ritual, with the aim of treating various problems. The magnetic force itself was believed to be the agent of change resulting in alleviation of the symptoms. A Jesuit priest, Father Hehl first used this technique, which was expanded by Anton Mesmer. Scepticism about the process arose, and a French commission chaired by Benjamin Franklin was authorized to investigate magnetic cures. In 1784 the commission concluded that the cures in many cases were genuine, but that magnetic forces did not account for the results : imagination, excitement and imitation were the mechanisms involved.(Colquhoun,1833).

The use of suggestion as therapy began to be used by the Abbe Faria from 1814, and by a physician, Bertand, from 1819. They were the first practitioners to attribute the resulting cures to psychological processes.

Liebeault and Bernheim developed the techniques for using suggestion more fully (Bernheim, 1884, 1886). Bernheim's model of explanation of the hypnotic process became one of the two major theoretical viewpoints, the antecedent of modern cognitive-behavior theory applied to hypnosis. Bernheim observed that the most important agent in the production of a behavior change was the making of a suggestion to the patient, and the patient's ability to act upon it. The function of the hypnotic induction was to raise the patient's natural suggestability. Bernheim defined suggestibility as the ability to transform an idea into an action (Bernheim, 1886). Bernheim's early position viewed the trance state (i.e. state of hypnosis) as necessary. Later he modified his theory, noting that suggestibility could be raised in the waking state, without formal hypnotic induction. (The term 'waking state' was frequently used to refer to the normal, non-hypnotized state.)

> I define hypnotism as the induction of a peculiar psychical condition which increases susceptibility to suggestion. Often, it is true, the sleep that may be induced facilitates suggestion, but it is not the necessary preliminary. It is suggestion that rules hypnotism; (Bernheim, 1886).

> Other suggestions may succeed where that of sleep itself remains useless, for the sleep is also nothing but a suggestion. It is not possible in all cases, and it is not necessary on cases of good somnabulism in order to obtain the most diverse phenomena. They can be dissociated, so to speak, from sleep.

In 1917, Bernheim stated that suggestibility is:

> a psychological property of the conscious brain, activated by credivite that is tendency to accept suggested ideas, and ideodynamisms the ideas to become acts and dynanisms.

Studies involving the role of suggestibility

Moore aimed to explore personality correlates of hypnotic responsiveness. The responsiveness in hypnosis was viewed as suggestibility No relationship was found between hypnotic responsiveness and the traits of compliance, conformity or persuasibility in the non- hypnotized state,(1964).

Tests of waking suggestibility (non-hypnotized suggestibility) and hypnotic resposiveness were found to be correlated, (Weitzenhoffer and Sjoberg, 1961). In addition, it was noted that suggestibility was raised in the hypnotized state. Hilgard and Tart (1966) arrived at similar conclusions. These authors observed that subjects high in waking suggestibility were rarely low in hypnotic suggestibility; subjects low in waking suggestibilty could be either low or high in hypnotic suggestibility.

The term suggestibility reflects the early historical view of the nature of hypnosis as a passive response to the will of the hypnotist. In the last decade, response to hypnotic test suggestions has been understood differently, more as an active process on the part of the subject. As Barber has stated for two decades, the suject's role and input are critical. Evans (1980) has described the process of responding to test suggestions as cognitive flexibility: subjects of high responsiveness have an ability to ignore or trancend an accustomed mental set and deliberately change to another one. This concept is quite different from a passive obedience to the hypnotist's ideas.

5. CORRELATES OF HYPNOTIC RESPONSIVENESS

Introduction

Correlative studies of personality traits, psychopathological traits, and neurophysiological traits with hypnotic responsiveness have been made.

Isolated personality correlations have been found. However the failure of many studies to replicate, and the presence of opposing findings led Hilgard and Lauer (1963) to conclude that poor methodology accounted for the occasional positive findings.

The most consistent findings in correlative research are in the area of information processing style. Sheehan, McConkey and Cross (1978) concluded that there were three distinct cognitive dimensions which differentiated between high and low hypnotic responsiveness: absorbtion, dissociation, and the use of imagery.

Studies of imagery and hypnotic responsiveness

Hypnotic responsiveness and its relationship with the vividness of imagery has been examined. In these studies the experimenter evaluates the report of the subject's experiences: it is not clear how much of the reporting itself might contribute to the judgement of high or low degrees of vividness of imagery. An association of reported vividness of imagery was found by Jenness (1944); Arnold (1946); and Richardson (1969,1972).

The first questionnaire used to evaluate vividness of imagery was Betts' Questionnaire Upon Mental Imagery (Betts,1909). Sheehan (1967) adapted the questionnaire and studied subjects' responses, comparing them with the perfomance on the SHSS:C. Results correlated for males but not for females. Poor imagery was found to be predictive of low hypnotic responsiveness. but vividness of imagery was associated with both high and low hypnotic responsiveness, and so was predictive of high hypnotic responsiveness.

Betts' questionnaire was also used by Shor, Orne and O'-Connell (1976), the vividness of imagery correlating moderately with clinical diagnostic ratings of hypnotic responsiveness.

Sutcliffe (1958) used Betts' questionnaire and also Gordon's test for control of imagery and confirmed the relationship.

J. Hilgard aimed to replicate Sutcliffe's study, but found a significant relationship only for females. As with Sheehan's study, low imagery was predictive of low hypnotic responsiveness; high vividness of imagery had no predictive value (1970). Perry (1970) also found that low imagery was predictive of low hypnotic responsiveness.

Morgan and Lam (1969), and Lehman (1973) failed to find any relationship between imagery and hypnotic responsiveness.

Studies of hypnotic responsiveness and absorption

Tellegen and Atkinson (1974) defined absorption as total that fully engaged the individual's representational resources, resulting in a heightened sense of the reality of the attentional object, imperviousness to distracting events, and an altered sense of reality in general (Hilgard, 1970).

As (1962); As, O'Hara and Munger (1963) gave subjects a questionnaire regarding non-hypnotic experiences. They found two clusters of experiences which correlated with hypnotic responsiveness. The first was the quality of absorption; the second cluster was a tolerance for unusual trance like experiences involving dissociation from ordinary experience.

Tellegen and Atkinson (1974) studied 481 subjects using their own scale designed to search out absorption factors. Other factors were questioned such as two of the Minnesota Multiphasic Personality Inventory factors: introversion-extraversion, and stablity-instability. The absorption factor was found to related to hypnotic responsiveness; neither personality factor showed any relationship with hypnotic respnsiveness.

Other studies have used Tellegen and Atkinson's scale in addition to other scales, resulting in the same relationship between absorption in imaginative activities and hypnotic responsiveness (Spanos & McPeake,1975b; Finke & MacDonald,1978; P.G.Bowers,1978).

Using interviews, J.Hilgard (1970) observed that deep absorption into imaginative activities characterized the highly hypnotizable individual. These activities included reading, drama, savoring of sensory experiences, and childhood daydreams. Absorption in activities such as science, competitive sports, and other non-imaginative activities did not appear to be related to high hypnotic responsiveness (J.Hilgard, 1979).

A concern which does not appear to have been addressed in these studies is the subjectivity of reporting the degree and quality of imagery and absorption. Since imagery cannot be objectively measured, the subject's descriptions must be relied upon. It is possible that subjects vary in their attitude towards imaginative activities and that this factor biases the manner in which they report the imagery. A subject with a negative attitude towards activities of the imagination might well down-grade his report.

Summary / Hypnosis

The perceptual, cognitive and behavioral changes which occur following a hypnotic induction are the result of many interacting factors. Individuals vary considerably in their ability to make use of hypnosis. While a certain cluster of attitudes is essential for successful hypnotic response in any one particular session, it is perhaps the cognitive elements which are the particulary stable components of the overall degree of an individual's responsiveness. These cognitive factors are chiefly those of dissociation and imaginative absorption, and can be seen to make up a certain information processing style. The differences in information processing style between subjects are evident in the stability of subjects' hypnotic responsiveness scores.

6. DICHOTIC STIMULATION

Dichotic stimulation in the context of other tests

Each side of the cerbral cortex is specialized, or dominant, for certain functions. Although most functions are bilaterally represented, some functions tend to have greater representation on one side. The degree of representation is not absolute, and varies between individuals. The left cerebral cortex is specialized for language in the majority of individuals, although this side of specialization is reversed in some left-handed individuals. The side of the brain dominant for language is usually, though not invariably, specialized also for motor function; as a result, most right-handed individuals have left sided cortical specialization.

Dichotic stimulation is one of several methods of indicating the side of cerebral dominance or specialization for language. Handedness, sodium amytal (amobarbital) tests and aphasia in the presence of hemiplegia are other methods. These techniques will be described in historical order.

Left cerebral dominance for language was first described by Broca in 1865, after observations drawn from autopsies of eight aphasic patients, all of which were seen to have left-sided cerebral pathology.

Furthur studies of aphasic patients confirmed Broca's findings of the association between aphasia and left-sided lesions. It was observed that for some patients, usually left-handed, aphasia occurred in conjunction with a right-sided lesion (pathological condition), suggesting the opposite side of language specialization. The incidence of left cerebral specialization compared with right-sided specialization for language was studied by Conrad (1949). Of 203 aphasic patients with unilateral lesions from war injuries, he noted that 175 right-handers (94%) had left-sided lesions; eleven (6%) showed right-sided lesions. Of the left-handed (a total of seventeen patients), ten were found to have left-sided lesions, and seven patients had right-sided lesions.

More recently, similar data were compiled by Zangwill (1967): aphasia was also associated with a left-sided lesion in 94% of cases. Right-sided lesions occurred in 6%, two of which were left-handed. Aphasia in the presence of right hemiplegia can therfore be taken to imply a left hemisphere lesion.

However, from these data described by Conrad and Zangwill, it is evident that the relationship of handedness with side of cerebral language diminance is not perfect. The proportion of right and left-handedness in the population has been calculated to be 82% and 18% respectively (Satz,1979). Using a twelve-point scale, Annett (1972) observed that absolute right-handers (defined as subjects scoring twelve) accounted for only 66% of the population. The remaining 30% were classified as having mixed handedness, although most would describe themselves as either right or left-handed. The numbers of subjects falling into the extremes of handedness are consistent with the aphasia data, but the numbers of subjects falling into the mixed handedness category would mainly be classified as right-handed on a dichotomous scale, simply because of the greater incidence of right-handedness in the population. However, left-handed individuals tend to have mixed cerebral dominance for language, a smaller proportion having absolute dominance compared with right-handed individuals.

Until this point, knowledge of any individual's side of language specialization could only be made in aphasic patients, and even then with some risk of inaccuracy. Aphasia in a right-handed patient gave a high probability of left language dominance, but no such prediction could be made for left-handed patients.

In 1960 Wada and Rasmussen introduced a technique of injecting amobarbital into one carotid artery at a time, a procedure that temporarily anesthetizes the opposite, contralateral hemisphere. If the anesthetized hemisphere is language specialized, the patient becomes temporarily aphasic. Aphasia, occurring on one side of the brain only, indicates conclusively dominance of that side of the brain for language. Cases of mixed language representation are not infrequent, resulting in partial aphasia occurring with injection of either side. All Wada and Rassmussen's right-handed patients showed left language specialization.

Using the same amobarbital injection technique for a larger sample of 123 patients, 90% of the right-handed patients were found to be language dominant. Of the left-handed subjects, 60% showed left sided specialization for language. The reason for testing was to determine the side of language dominance before excision of one temporal lobe to alleviate intractable seizures. Of great importance is the fact that the right-handed subjects were chosen for testing specifically because doubt existed as to the side dominant for language. This very biased sample would tend to include a higher proportion of patients with mixed or right sided language dominance than in the normal population, (Branch, Milner & Rasmussen, 1964). Moreover the use of brain damaged subjects to make an inference regarding normal subjects must be made cautiously if at all; patients with long standing left temporal lesions have often developed compensatory language functions in the right-hand side of the cortex.

Satz (1975) estimated that 95% of normal right-handed subjects are likely to be left language dominant.

Dichotic stimulation, or simulataneous auditory stimulation, is one of several double stimulation techniques involving different senses. The earliest study using binaural presentation of different auditory stimuli was by Stumpf (1916). Broadbent (1954) used the technique to test the response of air traffic controllers towards competing sound stimuli. He noted the tendency towards greater accuracy in the right ear, but did not attribute this finding to specialization of brain function.

Dichotic stimulation was first used with clinical populations by Kimura (1961a, 1961b) who was the first to correlate the differnce in ear accuracy with lateralization or specialization of brain function. She observed that the majority of right-handed subjects showed greater accuracy of the right ear in reporting the presented material. When studies using dichotic stimulation were made with previously amobarbital tested patients, the ear contralateral or opposite to the language dominant side of the cerebral cortex showed more accuracy, regardless of handedness (Kimura, 1967). For 107 proven left language dominant subjects, a mean ear accuracy score for the group was 86% for the right ear and 80% for the left ear. The group with proven right sided language specialization showed a mean accuracy score of 785 for the right ear, and 89% for the left ear. Kimura interpreted this slight difference in ear accuracy referred to as the ear advantage, to reflect contralateral hemisphere language dominance (1961a). In addition, the fact that the difference in ear accuracy was more noticable in the dichotic technique than in the monaural technique was taken to reflect the supremacy of crossed neural pathways from the ear to the cerebral cortex over the uncrossed, ipsilateral pathways (Kimura, 1967).

Studies using the dichotic stimualtion technique have become widely used as a non-invasive technique for the investigation of language processing functions in the brain. Subjects listen through headphones to different sounds presented simultaneously to each ear. The sounds may be verbal or non-verbal. Verbal stimuli may consist of whole words or single syllables, which may be held constant except for vowels or consonants. Spoken numbers, referred to as digits, may be used. Non-verbal sounds may include melodies, chords, and environmental sounds. In the case of verbal stimuli, a sequence of three or four pairs of stimuli are presented in succession, followed by a pause for the subject to repeat as many stimuli as possible out loud.

Results from dichotic stimulation techniques depend on the type of tasks used. A right-ear advantage (ie. greater acuracy of report from the right-ear than the left-ear) is found for whole words, syllables, consonants and digits; approximately 70-80% of subjects show this effect. No particular ear advantage is found for vowel sound stimuli.

Three studies which have used dichotic stimulation will be described. They are examples of the technique used for verbal material. These particular studies have been chosen because the tests have been repeated with a time interval in between each presentation, giving an indication of the degree of reliability of the ear advantage within subjects.

Blumstein, Goodglass and Tarter (1975) tested right-handed subjects, using consonants and vowels. Musical stimuli were also given. Two trials were given, with an interval of one week between each. Of 38 subjects, 30 showed a right-ear advantage on the first trial, twenty-three of which retained this direction of ear advantage on the subsequent test; seven subjects changed their ear advantage to the left-hand side. Of the eight subjects who first showed a left-ear advantage, four retained this direction on the second trial, and four changed to a right-ear advantage. A total of 27 of the 38 (71%) retained the original ear advantage, regardless of ear. Looking at the number of subjects whose ear advantage was consistent over the two trials, 85% showed a right-ear advantage, and 15% a left-ear advantage. Subjects who showed a greater difference between their right and left ear scores were more likely to retain their ear preference than subjects with less difference between their ear scores.

Pizzamiglio, De Pascalis and Vignati (1974) tested right-handed subjects using digits (spoken numbers) on two separated occasions. While 76% showed a right ear advantage on the first trial, only 68% of the total group retained this ear advantage on the second trial.

Fennell, Bowers and Satz (1977) tested right-handed subjects with words, giving four trials one week apart. 68% showed a right-ear advantage on the first trial; by the fourth trial 81% showed a right-ear advantage. The authors predicted that at any given trial about 20% of the right-handed subjects would show a left ear advantage.

These three studies indicate that the side of language specialization cannot be predicted as accurately with dichotic stimulation as with the amobarbital test.

Dichotic stimulation studies using non-spoken reporting methods

The majority of studies using dichotic stimulation for verbal material require the subject to report out loud the stimuli he is able to recall. Recognition methods of identification which avoid a spoken report are more commonly used in musical and environmental sound stimuli.

When verbal material is presented dichotically, the sound in each ear passes along the neural pathways until final processing and understanding of the heard material takes place in Wernicke's area in the left temporal cortex. Words heard by the left ear reach the left temporal cortex in two ways. Firstly, some ipsilateral transmission of the neural impulses takes place, although probably less than in monaural stimuation. Secondly, after contalateral transmission of neural impulses to the left temporal cortex, further transmission of the neural impulses to the left hand side takes place. Crossing over, or decussation of the nerve fibres takes place along the auditory pathways at several levels, and it is not clear how this process takes place. For perceived material to be repeated out loud the left frontal cortex is involved in addition to the left temporal lobe. The question has been raised that the requirement of verbalization of responses might account for some of the right ear advantage.

In order to explore the possibility that spoken report accounted for the right ear advantage, Broadbent and Gregory (1964) used written report for perceived dichotic stimuli. This method was not compared with normal spoken recall for the same group of subjects. A right-ear advantage resulted, but not as marked as expected.

Kimura (1967) presented nonsense syllables separately after the dichotic presentation. A right-ear advantage was found; however, Kimura did not discuss the finding that the mean difference between the ear scores was larger than usual, 68% for the right ear, 47% for the left ear.

Springer, Sidtis, Wilson and Gazzaniga (1978) tested subjects who had previously undergone dissection of the corpus callosum. They used both spoken report and written report, but did not specify any differences between the two methods of reporting.

Kinsbourne and Swanson (1974) tested patients who had undergone hemispherectomy, i.e. removal of one cerebral hemisphere excluding the motor strip and anterior areas of the frontal lobe. Subjects pressed a button to match dichotically presented words. Results were similar to those found with spoken recall.

The few studies using a non-spoken method of report have not yielded consistent findings. It is unlikely that a large proportion of the ear advantage is accounted for by using this method.

Models of explanation for the right ear advantage

An underlying assumption runs through the various explanations of the right ear advantage for verbal material in studies using dichotic stimulation: that the left cerebral cortex subserves the major proportion of language functions in right-handed subjects (Milner, 1967, Geschwind, 1965). However, the reflection of this specialization into a greater accuracy of report for words heard by the right ear than the left ear is subject to different interpretations. Expanations of the right-ear advantage for verbal material include the effect of memory, attention, neural competition, and the degree of specialization of the left cerebral cortex for language. Each explanation will be discussed.

Neural competition

According to this explanation, the right-ear advantage for verbal material is accounted for by greater effectiveness of neural impulse transmission of crossed rather than the uncrossed fibres from each ear to the cortex for processing. This effectiveness of the contralateral fibres occurs in competition with the ipsilateral, same-side pathways, but only in the dichotic technique; in the monaural technique, the input reaches the contralateral hemisphere from the crossed pathways, and also reaches the ipsilateral hemishere from the uncrossed pathways. For material such as musical chord discrimination, a function which is subserved to a greater extent by the right cerebral cortex, a slight left-ear advantage is found, again reflecting the greater potency of the contralateral fibres from the ear to the opposite cortex, (Kimura, 1961b, 1964).

At each ear, the auditory impulse is transmitted from the cochlear nucleus in two directions: along ipsilateral fibres via the lateral lemniscus to Heschl's gyrus in the auditory cortex for primary perceptual processing; and also along pathways which cross over in the brain, and which join the lateral lemniscus of the opposite side of the brain, and which then ascend to Heschl's gyrus on the same side of the brain. After joining the lateral lemniscus, more decussation, or crossing of neural pathways occurs to a lesser extent at the mid-brain level, between the inferior colliculi and nuclei of the lateral lemnisci. After processing in Heschl's gyrus in each temporal lobe more complex processing takes place in Wernicke's area, also in the temporal lobes. At this level in the cortex more crossing over of nerve fibres takes place thrugh the corpus callosum.

Evidence of the superiority of contralateral pathways over the ipsilateal pathways has been gained by animal and dicate that the latency of response of the contralateral pathways is shorter, in other words, that the neural impulse takes less time to be transmitted, (Rosenweig & Rosenblith, 1953). Evoked potentials of the brain contralateral to the side of stimulation are larger, (Rosenweig, 1954; Tunturi, 1946; Hall & Goldstein, 1968). In addition, Rosenweig observed that the contralateral fibres inhibit ipsilateral fibres (1961). In humans auditory stimulation produces larger evoked responses with shorter latencies in cortical potentials (Butler, Keidel & Spreng, 1969). Human studies of temporal lobe lesions support this contralateral superiority: in dichotic stimulation there is usually a decrement in performance in the ear contralateral to the lesion (Milner, 1967; Jerger & Mier, 1960; Kimura, 1961, 1967; Goodglass, 1967).

The decrement in right-ear advantage in left temporal lobe lesions is particularly noticeable, athough there is some reduction in the left ear accuracy in addition. While language functions are invariably damaged in left temporal lobe lesions, the greater reduction in right-ear accuracy for verbal material denotes the functional importance of the crossed neural pathways.

Studies of patients who have undergone dissection of the corpus callosum for intractable seizures give further evidence of the role of the crossed neural pathways. In monaural studies of these patients, the normal accuracy for each ear is found. In dichotic tests, there is a marked reduction in the left-ear accuracy. This finding reflects the effectiveness of the crossed pathways in transmitting the right-ear impulses to the left Heschl's gyrus, the ear-to-cortex transmission occurring subcortically and so not being affected by the cutting of the callosal fibres. However, since the left-ear accuracy is reduced, the corpus callosum must be instrumental in normal subjects for the transmission of the material which has reached the right cortex from the left-ear to the left cortex for processing. In some patients with the corpus callosum dissected there is negligible left-ear accuracy in the dichotic situation; for the remaining patients who do show some left-ear accuracy, the remaining efect could be accounted for by right hemisphere language processing or by some neural transfer through the ipsilateral fibres or the crossing of fibres at the the nucleus of the lateral lemniscus or inferior colliculus.

Attention

Broadbent (1954) and Moray (1960) noted that when subjects were required to report material in successive order from each ear, they were more accurate than if they were required to report in alternating order. Perception of a stimulus at one particular sensory channel tended to be faster if the same channel had just been used. They observed that time was necessary to switch attention from channel to channel.

Gray and Wedderburn (1960) investigated the presentation of different classes of material to each ear, and found that report of different classes of material from the same ear was as difficult as switching attention to a different ear. For example: the right-ear hears "one; aunt; three", the left-ear hears "dear; two; Jane".

Broadbent and Gregory (1964) noted that subjects switched classes of type of presented material to the ears more accurately if the mateial was presented slowly: same-class material presented to the same ear was reported more accurately at a higher speed.

These studies show that some of the difference in ear accuracy may be accounted for by a tendency for a subject to attend to a particular ear.

Kinsbourne (1970, 1973) suggested that each cerebral hemisphere subserved the contralateral side of the body and also the contralateral half-space of the area surrounding the body. Stimulation of one side of the body activated the contralateral side of the brain. As the left side of the cerebral cortex is specialized for language, individuals tend to attend to the right half-space, which then activates the left cerebral hemisphere. He found that ear accuracy was affected by the side of presentation of sound through loudspeakers, so that the normal right-ear advantage could be reduced by left-sided presentation.

Kinsbourne's findings were consistent with a study by Goldstein and Lackner (1974). Using prisms to distort perceived spatial orientation, subjects whose spatial environment was given the illusion of being more leftward reduced their normal right-ear for dichotically presented syllables.

Spellacy and Blumstein (1970) observed that a dichotic test for vowels sound (which normally does not yield an ear advantage) would produce a right-ear advantage or a left-ear advantage if the tests were performed in a biasing manner by having the subject expect to hear either verbal or non-verbal material. This study was consistent with other findings of the influence of attentional set, but specifically the influence of task rather than spatial location. However, the normal right-ear advantage was found for consonant stimulation regardless of biasing procedures.

Further support for the influence of attention and the nature of the task was given by Moray and Landercy (1973). When subjects were required to maintain a melody while performing a test using dichotic stimulation, a left-ear advantage instead of a right-ear advantage was found. The right-ear advatage was retained when subjects were required to maintain a sentence while performing a dichotic task at the same time.

The findings of the above studies show that while attention does have some influence on relative ear accuracy, it does not account completely for the remaining right-ear advantage found for words, consonants an syllables. There is, in fact, no attentional manipulation which has removed the right-ear advantage for words (Satz, 1968).

Memory

The left temporal lobe of the brain is involved with verbal memory; the right temporal lobe with pictorial and other non-verbal memory (Milner, 1958).

When several successive stimuli are presented to subject which are then to be reported out loud, short-term memory is inevitably involved. One of the most noticeable effects of left temporal lobe damage is disturbance in the learning and recall of verbal material (Milner, 1962, 1968).

Yeni-Komshian and Gordon (1974) hypothesized that if memory accounted for, or contributed to the right-ear advantage in verbal material, the right-ear advantage would increase with a memory load on the task. In their studies using dichotic stimulation tasks, they used techniques to delay and interfere with recall. The usual right-ear advantage was found in the no-delay task and in tasks involving a fifteen second dely before report. However, the right-ear advantage was absent in the five or ten second delay intervals. The findings were interpreted by the authors as indicative of some contribution of memory to the right-ear advantage.

Satz and coworkers observed that when the numbers of stimuli presented before reporting were increased, the difference between right and left-ear scores was more noticeable, again indicating the involvement of memory, (1975).

Spreen, Spellacy and Reid (1970) observed that when musical stimuli and tonal patterns were presented dichotically, overall ear accuracy decreased as the length of interstimulus interval increased, especially for musical stimuli to the left ear. However, deterioration of between-ear differences was greater for tonal patterns. The results were interpreted to show that perceptual differences can have some bearing upon ear advantage differences.

Degree of Specialization

This explanation observes the difference between right and left ear scores, and makes an inference regarding the degree of language specialization within the individual. For example, an absence of difference in the ear scores would denote mixed lateral dominance for language; a high right-ear score and a low left-ear score would indicate strong left hemisphere language specialization.

This quantification of language specialization may be criticized for two reasons. Firstly, a peripheral measure of a central process has questionable validity when one considers the complexity of the neural mechanisms involved (Colbourn, 1978). Secondly, the discrepancy between the results of amobarbital testing (90% left-sided language dominance in a right-handed brain-damaged population) and dichotic stimulation (70-80% inferred left-specialization for right-handed normal subjects) adds weight to criticisms of the use of dichotic stimulation as measure of lateral specialization. The predicted left-sided cortical dominance for language for the normal population is estimated to be 95% (Satz,1975).

Despite the theoretical challenges to the explanation of the difference in ear accuracy as a quantification of language representation, there is some evidence to support the model. Left-handed subjects usually show a left-ear advantage as a group, but the degree of ear advantage is less pronounced than the right-ear advantage for right-handed subjects, (Kimura, 1961). This finding is consistent with aphasia data which indicate that left-handed subjects are more likely to have mixed cerebral language representation than right-handed subjects. These data have been closely matched by Satz (1974) and Curry (1967).

Using eight and ten-year old boys, Orlando (1971) found that the degree of handedness as measured by various tests of manual praxis correlated with the degree of ear asymmetry. Shankweiler and Studdert-Kennedy performed similar tests, again using a measure of handedness based on manual tests, and measured on a continuum. Again they found that the more right-handed the subject, the more right-ear advantage was found. This study was later replicated with similar results (1975).

Thus the data from left-handed subjects who show a reduced ear preference, and the correlation of ear difference scores with degree of manual praxis, are suggestive of the degree of ear advantage as a measurement of language specialization.

<u>Information Processing Style</u>

Spellacy and Wilkinson tested right-handed subjects using the same dichotic words task used in the writer's present study. Subjects were also given the SHSS:C. Subjects of high hypnotic responsiveness tended to show a left-ear advantage in the non-hypnotized state which showed a rightward shift in the hypnotized state.

Spellacy gave the SHSS:C to a group of subjects with a previously established left-ear advantage for the same dichotic words task. The mean SHSS:C score was markedly higher than the norm.

Spellacy and Wilkinson (1979) tested right-handed subjects with the dichotic instructions-for-movement task used in tne present research (described in the Method Section). Hypnotic responsiveness was again measured with the SHSS:C. Subjects of the high hypnotic responsiveness were more likely to show a left-ear advantage, especially in the non-hypnotized state.

Frumkin, Ripley and Cox (1978) explored the notion that the right cerebral cortex would be more active in hypnosis, using dichotic stimulation results as an indicator of lateral activation. Subjects showed a right-ear advantage in the non-hypnotized state and a left-ear advantage in the hypnotized state. The authors concluded from these data that the right cerebral cortex became more active in the hypnotic state.

The studies which addressed hypnotic responsiveness and ear preference on dichotic listening tasks found that subjects with high scores on the hypnotic responsiveness scale were more likely to produce a left ear advantage than subjects of low hypnotic responsiveness. Since differences in hypnotic responsiveness between subjects reflect their manner of information processing, the difference in ear advantage may be partly accounted for by this difference in information processing style.

Summary and Hypothesis

Studies using dichotic stimulation for verbal material show the influence of several interacting factors accounting for the ear advantage. The side of language specialization, neural competition, attention, memory, and information processing style may all contribute to the difference in ear accuracy.

With the exception of the information processing style explanation of ear advantage, all the explanations have sought to account for the existence or proportion of the right-ear advantage. No adequate explanation has been attempted for the stable left-ear advantage seen in about 20%

of subjects. The incidence of right-sided cortical language dominance in the right-handed population is not more than 5%, and so cannot account for the 20% of subjects with the left-ear advantage. The question of ear advantage as a reflection of information processing style remains.

Subjects of high hypnotic responsiveness use a different style of cognitive processing compared with subjects of low hypnotic responsiveness: this is evident from the striking differences in performance when in the hypnotic state. It has been suggested that the information processing style of subjects of high hypnotic responsiveness involves more right-sided cortical processing, since imaginative activities are probably more represented in this area of the brain. However, since no direct measure of brain activity is used in the present research, no inferences regarding hemisphere activation will be made.

To determine whether or not ear advantage is a function of information processing style, it is necesary to eliminate contributing sources of variation in the ear accuracy scores. The dichotic-instructions-for-movement technique was devised for this purpose. The task uses single word pairs, each of which is an instruction to move in a different direction; a response is made after each word pair. As a result, memory processes are not involved. The words used in the pairs have previously been described to the subject;

so that no complex perceptual processing is required. Attentional bias is minimized by asking subjects to deliberately attend to both ears. Any bias in ear effect associated with spoken recall is avoided by using a movement response. Any effect attributable to the degree of lateral language specialization is eliminated as far as possible by selecting only strongly right-handed subjects. As a result any difference in ear advantage between subjects is likely to be the result of neural competition and side of language specialization; or of information processing style.

If the difference in ear advantage is accounted for by side of language specialization and neural competition, one would expect to find a consistent right-ear advantage for both the instructions-for-movement task and the words task. However, one would expect to find an increase in the memory load, and the complex perceptual processes required. Five percent of the subjects would be predicted to show a left-ear advantage attributable to right-sided language specialization regardless of information processing style.

If the variation in ear advantage is partly accounted for by information processing style, one would expect to find that subjects of high hypnotic responsiveness would account for most, but not all of the 20% incidence of predicted left-ear advantage. Subjects of low hypnotic responsiveness are expected to show the usual right-ear advantage, except for the occasional subject who might show a left ear advantage on account of right-sided language dominance.

Hypotheses

Subjects of high hypnotic responsiveness (SHSS:C score 9-12 out of a possible 12) will show a mean left-ear advantage on both dichotic stimulation tasks. Subjects of low hypnotic responsiveness (SHSS:C score 0-3) will show a right-ear advantage on both tasks.

A greater difference between the mean left-ear and right-ear scores is expected for the dichotic words task than for the dichotic instructions-for-movement task, for both hypnotic responsiveness groups.

A trend is expected for subjects of high hypnotic responsiveness to show a slight rightward shift of ear accuracy scores in the hypnotized state.

7. PREDICTIVE TESTS FOR HYPNOTIC RESPONSIVENESS

Conjugate lateral eye movements

When people converse they tend to maintain eye contact when listening, and then look away before replying. When beginning to reply, eye contact is usually regained. The breaking of eye contact and looking to one side is termed conjugate lateral eye movement. The term conjugate refers to the fact that both eyes move together, and so the movement is not a function of eye muscle abnormality.

Day (1964) noted that subjects tended to look consistently either to the left or right. He considered the possibility that the direction of the movement would be related to personality characteristics. He found a preference for a certain cognitive style associated with consistency of eye movement direction: subjects who more often looked to the right tended to use a logical, analytical mode of thought, whereas subjects who more often looked left used a more subjective, imaginative mode. Similar observations were made by Duke (1968).

Bakan (1969) found a relationship between hypnotic responsiveness and consistency of direction of eye movements.

Left eye movements were associated with high hypnotic responsiveness, and right eye movements associated with low hypnotic responsiveness. In the same study, verbal and mathematical scores on the scholastic aptitude test indicated a tendency for left eye movements to be associated with high verbal scores, and right movements with high mathematical scores. As a result, Bakan considered that subjects of high hypnotic responsiveness might make more use of the right cerebral hemisphere that subjects of low hypnotic responsiveness.

Kinsbourne (1972) and Kocel, Galin, Ornstein and Merrin (1972) hypothesized that any leftward shift in attention to any stimulus would engage and activate the contralateral cerebral hemisphere.

These and seventeen other studies were reviewed by Erlichman and Weinberger (1978). Nine of the nineteen studies found a significantly greater proportion of right lateral eye movements for questions which required the cognitive functions attributed to the left cerebral hemisphere (mathematical, logical and verbal). One study found a greater proportion of right lateral eye movements for questions designed to tap the processes of the right hemisphere (imaginative, and visual-spatial). Nine studies found no significant differences.

Gur and Gur (1974) and Kinsbourne (1972) observed that this consistency of lateral eye movements according to the type of question was only found when the subject and experimenter were separated, and the subject faced a blank wall. When the subject and experimenter were face to face, the type of question made no difference - a general tendency to move the eyes in a consistent direction was noted.

Gur and Gur also studied hypnotic responsiveness and its relationship with the direction of lateral eye movements. Variables of handedness, sex and eye preference were also assesed. A relationship between left lateral eye movements and high hypnotic responsiveness was found for right-handed males.

The use of direction of lateral eye movements as a predictor of hypnotic responsiveness requires a certain method. In the experimental setting, the environment is controlled by stimuli which might influence eye movement direction. If used in a clinical setting, these factors cannot be strictly controlled. Therefore, the task would only be of use if direction of eye movements predicted hypnotic responsiveness regardless of the visual stimuli in the room, in the face to face position, and regardless of the type of question. The clinician should be able to note informally a general tendency to look in a certan direction in the course of a normal interview.

In the present study however, the questions designed to elicit eye movements are equally divided as to the cognitive strategy required of the subject. It is hypothesized that subjects of high hypnotic responsiveness will show more left conjugate lateral eye movements than right eye movements. Subjects of low hypnotic reponsiveness are expected to show more right movements than left movements. No difference in direction of eye movements is expected according to different question style.

Ball rolling image

When subjects engage in a task involving visually imagined movement, eye movements beneath the closed lids of the subjects are frequently noted.

Crawford raised the question that a visually imagined movement would tend to be in the direction of the imaginary movement of the object. She did not test this notion.

If an imagined direction of movement consistently follows the direction of conjugate lateral eye movements, and if conjugate lateral eye movement direction is predictive of hypnotic responsiveness, then the direction of the imagined movement will also predict hypnotic responsiveness.

In the present study it is hypothesized that subjects of high hypnotic responsiveness will imagine a leftward movement of the imagined object; subjects of low hypnotic responsiveness will imagine a rightward movement of the imagined object.

Eye roll

The extent to which a subject can keep the eyes rolled upwards while closing the lids is termed eye roll. Spiegel (1972) observed that subjects with a high eye roll score showed greater hypnotic responsiveness than subjects with a low eye roll score. The population tested was a clinical one, using 2,000 psychiatric out-patients. The eye roll was considered to be an indicator of a biological capacity for hypnosis.

At the same time, Spiegel introduced a brief test of hypnotic responsiveness, the Hypnotic Induction Profile (1973). This test was designed for clinical use: it aimed to give information about the particular dimensions of an individual's hypnotic responsiveness, a profile of psychopathology, and a guide for therapeutic strategy.

The eye roll was later found to be poorly correlated with the rest of the Hypnotic Induction Profile, but forms a basis for assesment of personality and psychopathology in conjunction with the remainder of the Profile (Spiegel et al,1975).

Orne et al (1979) compared the Hypnotic Induction Profile with two Stanford scales using student volunteer subjects, the SHSS:C and the Stanford Hypnotic Susceptibility Scale: form A. The correlation of the Hypnotic Induction Profile with the former scale was 0.34; with the latter 0.27. Correlation of the Eye-Roll Sign with the SHSS:C was 0.10. The correlation of the two Stanford scales with each other is 0.65.

The Eye-Roll Sign is seperated into three parts. Firstly the upgaze is observed. This is the extent to which the subject can roll the eyes upward. The upgaze is given a score on a zero to four scale, but this score is not used in the Eye-Roll Sign score. The second part of the Eye-Roll Sign is the eye roll itself, which is the extent to which the subject can keep the eyes rolled up while closing the lids. The eye roll is scored on a scale from zero to four and this score is included in the Eye-Roll Sign score. While the eye roll is being performed the experimenter observes any tendency to turn the eyes inwards during the movement: if this does occur a squint score is included in the Eye-Roll Sign. Sometimes the eye-roll score appears to be used by itself.

In a study of the Hypnotic Induction Profile items, Sheehan, Latta, Regina and Smith (1979) found the following intercorrelations of Hypnotic Induction Profile items. The correlation of up gaze and eye roll was 0.66. The correlation of squint with up gaze was 0.01. The correlation of squint with eye roll was 0.04. Correlations of each of these items with the rest of the hypnotic Induction Profile items were very small; however, correlations with the squint item were the smallest.

The Eye-Roll Sign by itself is not considered to be predictive of hypnotic responsiveness. However, Spiegel concluded that a relationship occurred between any positive eye-roll score and the presence of clinically usable hypnotic responsiveness (1977).

The squint item does not appear to add useful information to the eye-roll score, and will not be used in the present study.

In the present research it is hypothesized that subjects of medium and high hypnotic reponsiveness will gain scores on the eye roll test between one and four. Subjects with very low hypnotic responsiveness scores will be more likely to show a score of zero. The task is not expected to be of predictive value by itself, but only in conjunction with the other predictive tasks.

Handclasp

Spiegel and Spiegel (1978) observed that of 946 subjects asked to clasp their hands together with fingers interlocking, approximately 50% placed the thumb of the dominant hand in the superior position. It was found that these subjects scored in the low range of the Hypnotic Induction Profile. Subjects who placed the thumb in the non-dominant hand uppermost scored in the high range on the Hypnotic Induction Profile.

In the present study it is hypothesized that subjects of low hypnotic responsiveness as defined by low scores on the SHSS:C will more often place the dominant thumb uppermost than subjects with high SHSS:C scores who will more often place the non-dominant thumb uppermost.

This task was added to the test battery after consultation with the authors who designed the task. Eight subjects out of the sixty in this study did not perform the task.

8. METHOD

Subjects

Sixty subjects were used, male and female who were unpaid volunteers, mainly students and staff from the university population. Ages ranged from eighteen to forty-seven.

Subjects were selected on the basis of being strongly right-handed, and were excluded from further testing if they did not meet the criteria for handedness. Handedness was established by two methods. In the first part of the study a questionnaire developed by Porac and Cohen was used. Later a series of six tasks of demonstration of hand preference was used, compiled by the writer. Subjects were required to attain the maximum score on the handedness items.

Most of the subjects had had no previous experience with hypnosis. Some had previously taken a group screening test, the Harvard Scale of Susceptibility: form A, which had been used for subject recruitment and screening in previous studies. A few subjects had experienced hypnosis in other situations.

Experimenter

The design of the study did not involve 'blindness' of the experimenter to the subject's scores.

Two research assistants were used to conduct the testing: both were female. Their own scores on the SHSS:C were eleven and twelve respectively out of a maximum of twelve points.

Procedure

Hand Preference

This was established at the beginning of the testing as previously described.

Explanation

The assistant discussed hypnosis and answered any questions the subjects wished. Guidelines for the explanation and answers to questions had been described in detail by the writer in the assistants' training sessions. Points that were covered in the explanation were the subjects' own locus of control, being awake rather than asleep, and being able to discontinue the procedure at any time if he wished. The experimenter described the type of test items that were to be included in the testing and demonstrated one of the motor movement items. She specified that age regression would be one item, and that the subject would be asked to imagine being back in grades two and five. The subject was questioned to ensure that those years had been normally pleasant ones. If the subject remembered a bad experience, the year for regression was changed to another one. This caution was to prevent possible abreaction.

The dichotic tasks were then described to the subject with details of how the words would be presented, and how to respond. The hand position for the dichotic instructions-for-movement task was demonstrated, and the subject was told the dichotically presented words he would hear. For both dichotic tasks, the subject was asked to attend to both ears at all times.

The assistant then stated that there would be other short tests afterwards, but did not describe them.

Tests

(a) Dichotic words

The subjects listened through headphones to a tape of word pairs. Each pair consisted of different words presented to each ear simultaneously. Three pairs were presented at one second intervals with an eleven-second pause between each interval for the subject to repeat out loud all possible words in any order. The tape contained twenty-two series of three word pairs. Eleven series of the three pairs were presented in hypnosis, the remaining eleven in the non-hypnotized state. The order of the hypnotized state and non-hypnotized state was counterbalanced.

(b) Dichotic instructions for movements

Subjects listened to the tape which consisted of dichotically presented opposing instructions. The subject heard in both ears, "raise your right hand to the position I have shown you, and now move it to the...". Then the left ear was presented with the instructions "left", and the right ear was presented with the word "right" at the same time. The tape continued with "left/drop", "forwards/backwards". Each hand was used. Six responses were made, and then the tape continued with a repetition of the instructions, but with reversed ear channels.

The procedure was performed in the hypnotized state and again in the non-hypnotized state, the state order being counterbalanced between subjects.

(c) Predictive tests

1. Hand clasp:

The subjects were asked to clasp their hands together with fingers interlocking. The assistant then observed which thumb was in the superior position.

2. Eye roll:

The subjects were asked to raise their eyes as high as they could while keeping the head still, then to close the eyelids, trying to keep the eyes rolled up. This was demonstrated by the assistant (both asistants gained maximum eye roll scores). The eye roll was repeated once by the subject unless he gained the maximum score the first time. This test was scored from zero to four.

3. Ball rolling image:

Subjects were asked to close their eyes and imagine that a ball or balloon on a table in front of them would roll off the table in front of them would roll off the table past the subject. Then the subject was asked which side he imagined the ball rolling towards.

4. Lateral eye movements:

Subjects were asked twenty short questions, ten verbal or analytical, and ten spatial and imaginitive. The assistant was positioned facing the subject. The assistant asked each question, looked down briefly at the question sheet as if to write the response; then looked up again to note the direction of gaze of the subject. After the questions the assistant informed the subject that the purpose of the questions was to note the direction of eye movements.

SHSS:C

The hypnotic induction provided for the test was used for the dichotic stimulation items which were performed in hypnosis. In order to perform these tasks, the administration of the SHSS:C was interrupted either immediately after the induction into hypnosis and before the test items, or after the first eleven test items before the instructions for the amnesia test items.

Debriefing

The opportunity for a complete discussion of the experience was scheduled in the appointment time.

9. RESULTS

Analysis of hypnotic responsiveness and dichotic stimulation tasks

Subjects were divided into three hypnotic responsiveness groups: low (SHSS:C 0-3), medium (SHSS:C 4-8), high (SHSS:C 9-12).

Tables 1 and 2 present the mean scores for each of the three groups for the dichotic stimulation tasks. The data were treated with multivariate analysis of variance in order to compare the relationship between the hypnotic responsiveness group and the dependant variables of ear accuracy scores for the two ears for the hypnotized and non-hypnotized conditions. Roy's Greatest Characteristic Root test was chosen to test the significance of the results. No significant relationship was found for any of the three multivariate tests: the interaction of group with hypnotic state indicated no relationship (p less than 0.13); the effect of the hypnotic state alone showed no relationship with the hynotic respponsiveness group (p less than 0.17); nor did the ear accuracy differences alone (p less than 0.37).

Application of analysis of variance to these data thus failed to detect any relationship between hypnotic responsiveness and side of greater ear accuracy in either of the two dichotic stimulation tasks. This technique also failed to detect any significant change in ear advantage as a result of the hypnotic condition.

The right and left ear scores of the total subject sample were examined for each dichotic task to establish that the normally significant right ear advantage was present in this study. Analysis of variance detected greater accuracy of right ear scores than left ear scores ($F = 31.8$, p less than 0.000001) for the words task, and also for the movements task ($F = 11.86$, p less than 0.001).

This analysis confirmed the expected greater difference in between ear accuracy for the words task than for the movements task.

Analysis of variance addressed the question of relative ear accuracy. The possibility remained that the absolute side of ear advantage might be related to hypnotic responsiveness - that scoring of subjects on the basis of an overall left or right preference might yield a difference with another statistical treatment. In order to examine this possibility the overall ear preference for each subject was noted. The observed frequencies of left ear advantage and right ear advantage for the three groups is given in Table 3. The frequencies of overall ear preference in the groups of high and low hypnotic responsiveness were treated by Chi square analysis for the dichotic words task in the non-hypnotized condition. No significant difference in frequency of the side of ear preference was found between the two groups (Chi Square = 7.78, p less than 0.1) .

As with the analysis of variance, this technique of analysis with absolute ear preference revealed no difference between groups. There appears to be no evidence of a relationship between lateral preference for auditory material as measured by the two dichotic stimulation tasks used, and hypnotic responsiveness.

Predictive tasks

In order to determine whether or not the four predictors could either singly or in combination predict hypnotic responsiveness as defined by subjects' scores on the SHSS:C the following analysis was performed. The data were subjected to multiple regression analysis using the four task scores as predictors and the SHSS:C score as the criterion. A multiple correlation coefficient of 0.331 was obtained: R squared 0.11; and R squared adjusted of 0.029, (F = 1.36, p = 0.263).

The number of subjects with the right thumb-superior position on the hand-clasp task was compared with the number of subjects with the left thumb superior, for each of he three hypnotic responsiveness groups. No significant relationship between the side of thumb dominance and hypnotic responsiveness was found (Chi Square = 0.44, p less than 0.97) .

Eye-roll score was compared with the hypnotic responsiveness group and no significant difference of score was found between the groups (Chi Square = 9.65, p less than 0.65) .

Direction of ball rolling image compared with the hypnotic responsiveness group did not show a significant difference of the direction of image between the groups (Chi Square = 0.67, p less than 0.71) .

Lateral eye movement direction was compared with hypnotic responsiveness and again no relationship of direction of movement with hypnotic responsiveness group was found (Chi Square = 51.5, p less than 0.33) .

Thus the analysis did not detect any predictive value of any of the tasks, either singly or in combination.

Observation of the handclasp positions of the sujects showed that thirty-four of all subjects placed the left thumb uppermost in the superior position while seventeen placed the right thumb in the superior position.

Of the eighteen subjects with low scores on the SHSS:C, six placed the right thumb in the superior position and twelve placed the left thumb uppermost. Of the subjects of high hypnotic responsiveness, five placed the right thumb and thirteen the left thumb in the superior position. Subjects with medium hypnotic responsiveness showed the right thumb uppermost in eight cases, and the left thumb uppermost in nine cases. Thus in this particular sample, no prediction of hypnotic responsiveness according to whether the dominant or non-dominant thumb was placed in the superior position could be made.

Spiegel had concluded from his study of eye roll in clinical populations that an eye roll score of zero indicated absence of usable hypnotic responsiveness, whereas any positive score, from one to four indicated the presence of usable hypnotic responsiveness. However the present research did not find the same correlations for the particular scale used - the SHSS:C. Two subjects with zero eye roll scores gained scores of nine and eight respectively on the SHSS:C. Three subjects who gained scores of zero on the SHSS:C showed eye roll scores of three, four, and four respectively. Although Spiegel did not specify if any of his patients with zero eye roll scores gained medium or high scores on the Hypnotic Induction Profile, for such a task to have useful predictive value in the clinical setting, such a finding would need to be rare.

Discussion

The data showed no relationship between hypnotic responsiveness and ear advantage for dichotically presented auditory stimuli, nor between the four predictive tasks and hypnotic responsiveness. These findings in the context of other published studies and the two pilot projects will be discussed.

The two pilot studies for the present research indicated a relationship between hypnotic responsiveness and ear advantage on each of the two dichotic stimulation tasks. Subjects with high hypnotic responsiveness showed more left-ear accuracy compared with subjects of low hypnotic responsiveness. It was concluded from these data that a particular cognitive style accounted for this lateral preference. The information processing style explanation was further supported by the unexpected finding that this left ear advantage for the subjects showed a tendency to change to the right in the hypnotized state.

Only two other studies exploring hypnosis and dichotic stimulation have been reported in the literature. Frumkin, Ripley and Cox (1978) did not address hypnotic responsiveness, but the supposition that the right cerebral hemisphere would be involved in the hypnotic state to a greater degree than in the non-hypnotized state. They made a direct inference that ear accuracy scores were a measurement of hemisphere activiation. They found that subjects (with medium and high hypnotic reponsiveness - subjects of low responsiveness were not tested) showed a right-ear advantage in the non-hypnotized state, but this changed to a left-ear advantage in the hypnotized state. The authors took this finding to demonstrate an increase of right-hemisphere involvement in the hypnotic state.

Since all the studies described above have shown rather divergent results, one or both of the types of tests are perhaps not measuring precisely what they are intended to measure. Suggested explanations will be discussed.

As shown by three studies of repeated trials of dichotic stimulation, some subjects change their ear preference over trials. These studies have been described in the review of the literature (Pizzamiglio, DePascalis and Vignati,1974; Blumstein, Goodglass & Tarter,1974; Fenell, Bowers and Satz,1977). Instability of ear advantage may have accounted for the differing results found by Crawford, Frumkin, Spellacy, and the writer.

The four predictive tasks used in the second part of the study were inadequate for predicting hypnotic responsiveness. Studies which have examined conjugate lateral eye movement direction have shown equivocal results. The present study does not confirm the assertion of several writers that the direction of eye movement is related to hypnotic responsiveness.

The findings of Spiegel that handclasp style was related to hypnotic responsiveness was not upheld for this population. Likewise, Spiegel's observation that positive or zero scores on the eye roll task predicted useable hypnotic ability was not confirmed in the present study. Subjects with zero eye roll scores were as likely to show high hypnotic responsiveness as subjects with very low scores on the SHSS:C. These contrasting findings may be accounted for by methodological differences. The scale of hypnotic responsiveness used by Spiegel for both his studies, the Hypnotic Induction Profile, correlates poorly with the SHSS:C as well as with other scales. The population used by Spiegel is a clinical one compared with the normal population tested in this study. The fact that the Hypnotic Induction Profile does not involve the use of hypnosis raises the question that the scale may not measure hypnotic responsiveness at all, but some other factor such as suggestibility or dissociation.

The divergent results found in all the tests used in the present study in comparison with previous findings of other authors, as well as the pilot projects for this study are interesting. The illustrate the caution with which conclusions from correlative research of this nature must be thoroughly replicated before conclusions are drawn.

The aim of the research was to explore cognitive differences between subjects of different degrees of hypnotic responsiveness. The very different performance in hypnosis between these subjects demonstrates the use of a different information processing style; subjects of high hypnotic responsiveness seem able to alter their manner of information processing to achieve a desired effect. The use of ear advantage on dichotic stimulation tasks did not reflect this difference between subjects. Again, the contrasting results illustrates the influence of unknown variables in this area.

Recent interest in the right side of the cerebral cortex as being the locus of the hypnotic experience has led many authors to search for a technique that would reflect lateral preference or activiation of the right cerebral cortex. While dichotic stimulation tasks may give a rough guide as to the side of language dominance, the results of the present study indicate no reason to believe that the right side of the cortex is more involved in hypnosis, or in subjects of high hypnotic responsiveness. Moreover, one would not expect in a highly verbal task such as dichotic stimulation, to find a paradoxical activation of the right hemisphere.

TABLE 1

Means and standard deviations of ear accuracy scores on the dichotic words task

		Non-Hypnotized State		Hypnotized State	
		Left ear	Right ear	Left ear	Right ear
HYPNOTIC RESPONSIVENESS GROUP	high	13.731 (4.78)	19.667 (4.42)	15.000 (5.52)	20.333 (5.04)
	medium	12.154 (5.43)	21.769 (4.99)	11.692 (4.21)	20.231 (5.15)
	low	13.762 (5.23)	18.115 (3.93)	14.538 (5.55)	17.037 (4.45)

(Standard Deviations in Parentheses)

TABLE 2

Means for scores on the dichotic instructions for movement task

		Non-Hypnotized State		Hypnotized State	
		Left ear	Right ear	Left ear	Right ear
HYPNOTIC RESPONSIVENESS GROUP	high	4.571	6.571	5.381	6.096
	med	4.692	7.231	5.154	6.615
	low	5.269	6.654	5.308	6.269

TABLE 3

The incidence of absolute ear advantage for subjects on the dichotic words task in the non-hypnotized state

HYPNOTIC RESPONSIVENESS GROUP	Side of ear advantage: Left	Side of ear advantage: Right
high	3	16
med	3	14
low	9	13

TABLE 4

Correlation Matrix of SHSS:C Scores With Predictive Task Scores

Correlations of SHSS:C scores, eye-roll score, ball image direction, handclasp dominance, lateral eye movement difference score.

	SHSS	ER	BALL	CLAS	LDIF
SHSS	1.00	0.17	-0.17	0.24*	-0.02
ER	0.17	1.00	-0.17	-0.09	-0.47**
BALL	-0.17	-0.17	1.00	-0.05	0.15
CLAS	0.24	-0.09	-0.05	1.00	0.21
LDIF	-0.02	-0.46	0.15	0.21	1.00

* p less than 0.05
** p less than 0.01

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