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THE UNIVERSITY OF OKLAHOMA

GRADUATE COLLEGE

THE RELATIONSHIP OF WAKING PAIN PARAMETERS AND SUGGESTIBILITY IN HYPNOSIS

A DISSERTATION

SUBMITTED TO THE GRADUATE FACULTY

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degree of

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Norman, Oklahoma

1975

THE RELATIONSHIP OF WAKING PAIN PARAMETERS

AND SUGGESTIBILITY IN HYPNOSIS

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THE RELATIONSHIP OF WAKING PAIN PARAMETERS AND SUGGESTIBILITY IN HYPNOSIS

INTRODUCTION

In a 1962 study of suggested analgesia, Shor (1962, 1964) used electric shock to produce pain for comparing the effects of analgesia suggestions on unsuggestible subjects with their effects on highly suggestible subjects. The unsuggestible subjects were given simulator instructions (Orne, 1954, 1971). Simulators can be defined as a group of unsuggestible subjects, used as controls, who are instructed to attempt to fool a second experimenter, who is blind to their level of suggestibility, into believing that they are highly suggestible. With degree of suggestibility in hypnosis predetermined, Shor's subjects were required, in waking, to select the highest intensity of electric shock they could receive repeatedly and not get unduly disturbed between shocks. This level of shock was to be used later in hypnosis in the analgesia testing section of the experiment. Shor described this shock intensity chosen by the subjects as a tolerance measure. Incidental to the primary purpose of the study, he found that his unsuggestible subjects chose a higher intensity of shock than the highly suggestible subjects. On the basis of this data Shor (1964) speculated that there might be a

pre-existing difference in pain tolerance between highly suggestible and unsuggestible subjects.

In a later study, using ischemic pain, McGlashon, Evans, & Orne (1969) also compared the effects of analgesia suggestions in hypnosis on unsuggestible subjects with their effects on highly suggestible subjects. An incidental finding of the McGlashon, et al. study was that highly suggestible subjects had, in waking, prior to the giving of any analgesia suggestions, a higher threshold for ischemic pain than the unsuggestible subjects. They found no statistically significant differences between the two groups on a tolerance measure. In a recent study Morgan (1972) obtained several measures from a group of subjects and calculated a matrix of intercorrelations of the measures. Suggestibility in hypnosis and waking tolerance for pain from cold pressor were among the measures obtained. The correlation between these two measures was -.01.

The incidental findings of these three studies form the basis for the current investigation. A summary of the relevant results follows. Shor (1962, 1964) found that unsuggestible subjects had higher pain tolerance for electric shock than highly suggestible subjects. He did not obtain a pain threshold measure. McGlashon, et al., (1969) found no differences between the two groups on tolerance for ischemic pain but found that unsuggestible subjects had a lower threshold for ischemic pain than highly suggestible subjects. And,

finally, Morgan (1972), using the entire range of suggestibility, found no relationship between level of suggestibility and waking tolerance for cold pressor pain. The results of the studies do not readily fit together. However, since the studies were not designed to test for the possibility of a pain parameters-suggestibility relationship, there are several areas in which they are not comparable and comparison of the results is probably not justified.

The first area of non-comparability is the pain sources used. Three different sources were used: electric shock, exercise of ischemic muscle, and cold pressor. The degree of relationship between thresholds for pain from different sources was reported by Wolff & Jarvick (1963) to vary widely (from -.15 to -.51). The second area of non-comparability is the pain measures used. Shor and Morgan had no threshold measure, whereas, McGlashon, et al. reported on thresholds. The tolerance measures for the Shor and the McGlashon, et al. studies were defined quite differently and Morgan had no threshold measure. And, finally, the subjects approached the studies with different sets. Unlike McGlashon, et al. and Morgan, Shor used a simulator design with simulator instructions given to his unsuggestible subjects.

On the basis of the information from the three studies, it could be postulated, but not concluded, that there is a relationship between waking pain parameters and level of suggestibility in hypnosis. Ascertaining the presence and

nature, or absence of such a relationship is of importance for at least two reasons. First, and probably foremost for this investigator, are the implications of such a relationship for research design in the study of hypnoanalgesia. And, second, if the relationship were confirmed, some data might be contributed to knowledge of the nature of hypnosis.

The presence of a pain parameters-suggestibility relationship has implications for research design in suggested analgesia because of the frequent use of designs which involve comparing the effects of analgesia suggestions on unsuggestible subjects with their effects on highly suggestible subjects. If there were a pain parameters-suggestibility relationship there would be differences between the two groups on the dependent variable before any experimental operations were carried out. Under these conditions it would be difficult to interpret the results of any comparison of the effects on highly suggestible and unsuggestible subjects of analgesia suggestions.

Information about the pain parameters-suggestibility relationship is important for a second reason. There have been numerous attempts, generally unsuccessful, to find a relationship between degree of suggestibility in hypnosis and some other variable. The assumption apparently is that, if suggestibility could be found to be related to some other variable, perhaps some light could be shed on the nature of hypnosis and suggestibility. To some extent this research

was another attempt to find something to which suggestibility is related. The purpose of the study, then, was to ascertain the presence or absence of a pain parameters-suggestibility relationship in order to evaluate the use, in studies of hypnoanalgesia, of unsuggestible subjects as a control group for highly suggestible subjects.

The requirements of such a study will now be discussed. First, a number of measures are used in pain research (Gelfand, 1964a, 1964b; Gelfand, Ullmann, & Krasner, 1963; Wolff & Horland, 1967; Wolff, Krasnegor, & Farr, 1965). It would be important to look at the relationship of each of the commonly used pain measures to level of suggestibility in hypnosis: threshold, maximum tolerance, range, and Shor's tolerance measure. Threshold is the stimulus intensity at which the subject begins to experience pain. Tolerance measures indicate a maximum intensity the subject is able to withstand. Range measures indicate the amount of the intensity continuum which the subject judges to be painful but tolerable. And, second, it would be possible that the nature of the pain parameters-suggestibility relationship would vary with the pain source. More than one type of pain should be used. Fortuitously the pain sources used by Shor and by McGlashon, et al. produce pain differing widely in the way they are experienced subjectively. The electric shock is experienced as a sharp jab, whereas the ischemic pain is a slow developing, deep ache. The investigator would want to be able

to compare across pain sources and across measures within a pain source. Further, in order to fully explore the possibility of a relationship, it would be advantageous to use the entire range of suggestibility in hypnosis rather than to sample only from the highly suggestible and unsuggestible ends of the continuum. It seems to this investigator that these goals of research could best be approached by using a design in which each subject serves in all conditions; i.e. each subject experiences pain from all sources, reports on all pain parameters, and is given a test of suggestibility in hypnosis.

Specifically, this study proposed to use two methods of producing pain (i.e., those used by Shor (1962) and by McGlashon, et al. (1969)), to extract a variety of measures of pain response from the data and to measure suggestibility in hypnosis in a group of subjects not pre-selected for suggestibility level. Relationships between and among the various measures were evaluated by means of a number of correlational procedures, such as individual correlations, multiple correlation, and cannonical correlation.

Since very little experimental evidence was available on which to base hypotheses, it was assumed that the best procedure was to predict the results to follow what Shor (1962) and McGlashon, et al. (1969) had found previously. Therefore, the following hypotheses were developed:

1. Threshold for one or both types of pain will be

positively related to level of suggestibility. (The finding of McGlashon, et al. was that highly suggestible subjects had a higher threshold for ischemic pain.)

2. Tolerance for one or both types of pain will be negatively related to level of suggestibility. (Shor's finding was that unsuggestible subjects had a higher tolerance level for electric shock.)

One possible synthesis of the two sets of results is that the unsuggestible subjects have a broader range of tolerable pain experience; i.e., a lower threshold and a higher tolerance. Therefore, a third hypothesis was developed.

3. Range of pain (from threshold to maximum tolerance) will be negatively related to level of suggestibility.

METHOD

Subjects

The subjects were 48 volunteers who were paid $5.00 per hour for their participation. Most of the subjects were recruited from the University of Oklahoma by means of advertising placed in the school newspaper. A very small number of the subjects were students at the University of Oklahoma Health Sciences Center, in Oklahoma City, or at Central State University at Edmond, Oklahoma. Recent studies have shown sex differences in pain tolerances (Woodrow, Friedman, Siegelaub, & Collen, 1972). Also it has been shown that the stage of a female subject's menstrual cycle influences pain threshold (Procacci, Corte, Zoppi, & Maresca, 1974). Further, studies (Little & Zahn, 1974) have shown that the stage of the menstrual cycle of female subjects also influences skin conductance readings. Skin conductance was recorded in this study, although the findings are not being reported in this context. It seemed clear that confounding could be introduced by using a sample containing both male and female subjects. For this reason all subjects were men. Their ages ranged from 18 to 30 years.

Pain Production

Electric Shock

Because part of the purpose of the experiment was to

attempt to reconcile some of the apparent differences in results obtained by Shor (1962, 1964) and by McGlashon et al. (1967), the same general methods of producing pain were used.

Electric shock was the method of pain production used by Shor (1962). The subjective experience of the intensity of an electric shock is a function of both amperage, or voltage, and the level of the subject's skin resistance. It follows that if several subjects are given shocks of the same amperage, the shocks would be experienced differently if the subjects had varying skin resistances. It also follows that if skin resistance of an individual subject varies widely within an experimental session, two shocks of the same amperage delivered at different times could be experienced quite differently. This, in fact, does happen, because the delivery of the electrical stimulus itself causes skin resistance to drop. A full discussion of the issues involved in skin resistance changes is available in the literature (Tursky, 1974; and Tursky, Watson, & O'Connell, 1965). In Tursky's methodology the amount of change in skin resistance within an experimental session is minimized by artifically lowering the resistance at the electrode site when the electrode is attached. The surface of the skin at the electrode site is treated with Sanborn Redux electrode paste. A skin resistance level of 5000 ($\pm$ 500) ohms is the goal of the treatment of the skin surface. The Tursky method was followed in this study.

The stimuli were delivered from an American Electronics Laboratory, Model 1004, Stimulator through an annular disc electrode (Tursky, et al., 1965), placed on the dorsal surface of the non-dominant forearm. The design of the electrode and the use of sponges, soaked in Redux paste, to cover the metal parts of the electrode served to minimize skin irritation and burning by assuring equal density of flow all over the area covered by the electrode.

Determination of the threshold for pain from electric shock was not part of the Shor procedure, but threshold was the measure which differentiated the high and low suggestibility subjects in the McGlashon, et al., study. In order to allow comparison across pain methods in this study, threshold for pain from shock was determined. Four ascending and four descending series (Dember, 1960) were carried out using 0.3 ma or 0.5 ma step increases (these figures being determined by calibration limitations of the machine). An ascending series continued upward until two successive stimuli were judged as painful. A descending series began with the last intensity of the preceeding ascending series and continued down until two successive stimuli were judged as not painful. After the first one, an ascending series began with the lowest intensity of the preceeding descending series. Therefore, the actual number of stimuli delivered in determining threshold varied from subject to subject. Duration of all shocks used in the study was 1-second. Response to each pulse was

made by the subject by pressing one of two buttons: one indicated that pain was experienced and the other that "something was felt" but that it was not considered painful. The occurrence and intensity of each pulse and the subject's response was recorded automatically on the subject's oscillograph record, using a Beckman, Type RM, Dynograph. Threshold was the intensity at which pain was reported on four of the eight series given.

Two maximum levels were determined. Shor's subjects were asked to choose the highest level of shock they could receive repeatedly without getting 'unduly upset' between shocks. This he described as a tolerance measure. In this study it is called Tolerance-1 (Tol-1). Although this is an arbitrary definition it was included because it was Shor's measure. The specific instructions given the subjects followed those of Shor and are presented in full in Appendix B. Another tolerance measure that has been used in research is an absolute highest level of shock the subject will allow to be delivered to himself. In this study this measure is called Tolerance-2 (Tol-2). Tol-1 was determined by starting at threshold and increasing the intensity in 0.5 ma steps until the subject pushed the button marked to indicate Tol-1. Then the increase proceeded in 0.5 ma steps until the subject pushed the button marked to indicate Tol-2. As before, the occurrence and intensity of each pulse and each of the subject's responses were indicated on the oscillograph record.

Measures were the intensity of shock for the determined threshold and those at which Tol-1 and Tol-2 were indicated.

Nine subjects exceeded the amperage the experimenter was willing to give without having reached Tol-1 and Tol-2, and in some instances without having reached threshold. Those subjects who exceeded the allowed maximum were all arbitrarily assigned the same scores; i.e., 25 ma for threshold, 30 ma for Tol-1 and 31 ma for Tol-2. The threshold score was just above the highest reached by other subjects, and the assigned tolerance measures were just above the maximum that was considered safe to give.

Ischemia

Ischemic muscle pain, or the 'tourniquet technique', was the pain production method used by McGlashon, et al. (1967). Pain occurs when muscles are exercised in the absence of blood flow (Benjamin, 1958; Elliot & Evans, 1936; and Harrison & Bigelow, 1943). Two forms of the ischemia method exist. The original form, characterized as the 'maximum effort' technique, requires exercise of the ischemic muscle until intolerable pain develops. A modification, characterized as the 'sub-maximum effort' technique, requires the execution of a specified number and type of contractions of the ischemic muscle, and a wait for the pain to develop. A discussion of the relative merits of the two methods is available in the literature (Beecher, 1966; Smith & Beecher, 1969; Smith, Egbert, Markowitz, Mosteller, & Beecher, 1966; and

Smith, Lowenstein, Hubbard, & Beecher, 1969). The group of experimenters cited above believe the 'sub-maximum effort' technique to be the more reliable one. Reliability coefficients of .61, .80, .85, and .91 for mild, moderate, severe, and intolerable levels of pain, respectively, have come from test-retest data with the 'sub-maximum effort' technique. Because of the apparent better reliability of the 'sub-maximum effort' technique, it was chosen for this study even though McGlashon, et al., (1969) used a variant of the 'maximum effort' technique.

Ischemia was produced in the subject's non-dominant arm by elevating and wrapping the arm in an elastic bandage to drain the blood from the arm and then inflating a blood pressure cuff around the upper arm to prevent further blood flow into the arm. The elastic bandage was removed and, with the cuff still in place, the arm was lowered to the arm of the chair. The arm was exercised by squeezing a Stoelting, No. 19114, Smedley Hand Dynamometer. The dynamometer was modified so that the maximum pull was 8 kg. The subject was instructed to squeeze completely and hold it until he was told to release. The length of squeeze was standardized at 2 seconds and the intervals between squeezes at 2 seconds. The experimenter set the rhythm by saying "squeeze" and "release" in time to a metronome. After twenty squeezes, with the cuff still in place, the subject waited quietly until the pain gradually built to the intolerable level. The procedure

follows closely that used by the group doing hypnosis research at Stanford and the instructions to the subjects followed those of the Stanford group (Knox, Morgan, & Hilgard, 1973). The specific instructions are available in Appendix B.

Pain state reports were requested at irregular intervals by turning on a light in the subject's view. Subjects made pain state reports by pressing the appropriate one of 5 buttons marked 'none', 'mild', 'moderate', 'severe', and 'intolerable'. Responses were automatically recorded on the subject's oscillograph record. Measures were the times taken to reach each of the 4 pain state levels. As soon as the subject pushed the button marked 'intolerable' the cuff was removed. In most subjects the acute pain ceased immediately. A few subjects reported experiencing discomfort as blood returned to the arm. After a few seconds the only discomfort the subjects experienced was a slight ache lasting for a few minutes. In a few instances it was discovered that the cuff had deflated sufficiently to allow some blood flow into the arm. On those occasions the cuff was removed and a 15 minute period was allowed to elapse before the procedure was carried out again. No subject refused to allow the procedure to be carried out a second time.

Subjects were requested to press the 'mild' button as soon as the sensations could be described as painful, whether the light requesting a pain state report was on or not. If the pain started before the experimenter left the room they

were asked to report the onset of pain verbally. Special emphasis was placed on these instructions. However, in a number of instances the first response to a request for a pain state report was of mild pain. In those instances the actual threshold could not be determined and a single arbitrary value of 70 sec., lower than any other threshold time, was assigned to these subjects. In addition, two subjects reached the 40 minute limit set for total ischemia time without reporting an intolerable level of pain. This limit was a conservative one set to insure that no tissue damage would result from the ischemia. An arbitrary value, of 2356 seconds, slightly above the limit, was assigned for the intolerable level for those subjects who exceeded the limit.

Suggestibility Determination

Determination of degree of suggestibility was made by four means. The Harvard Group Scale (Shor and Orne, 1962) was administered with slight modification to allow taped, individual presentation and with the further modifications described below in the description of Weitzenhoffer's Classical Suggestion Test (CST) (Weitzenhoffer, 1974). The Harvard Scale was scored by the examiner (rather than by the subject, as is usual with the Harvard Scale) according to standard, objective criteria (HS-S) and according to criteria which take subjective experience into account (HS-M). The HS-M will be discussed in greater detail below. Thus the two scorings of the Harvard Scale serve as two measures of suggestibility and

the other two measures are scores from the CST in waking (CST-W) and following induction of hypnosis (CST-H).

In a recent series of studies Weitzenhoffer (1974) has emphasized the traditional view that the 'suggestion effect' involves a subjective experience of nonvoluntariness in the subject's compliance with the communication from the suggestor. Standardized tests of suggestibility such as the Stanford Hypnotic Susceptibility Scales (Weitzenhoffer & Hilgard, 1959, 1962) and the Harvard Group Scale (Shor & Orne, 1962), do not take into account in the scoring the voluntary-nonvoluntary aspect of the response. Weitzenhoffer (1974) has developed a means of measuring suggestibility which does take into account the nature of the subjective experience. Using three variants of the 'hands-moving-together' suggestion (Item 7, SHSS:A, Weitzenhoffer & Hilgard, 1959), he has developed the motor section of the Classical Suggestion Test (CST). A 'passing' response requires the subject to meet the objective criteria of 3 inches of movement and to experience the compliance as nonvoluntary. The first item ('Now', 'N') of the three item instrument is a shortened version of the traditional form of a suggestion which places the subject in a passive position; i.e. "When I next say 'Now' your hands will move toward each other and come together." A 'passing' response to this item earns 3 points. The second item ('Control', 'C') is stated as a command; i.e., "Bring your hands together". A 'passing' response earns 5 points. The third

item ('Standard Suggestion' or 'SS') is, as the name implies, a standard, repeated suggestion which places the subject in a passive position; i.e. "Your hands are going to move toward each other and come together. . . . Soon your hands are going to start moving . . . etc." A 'passing' response to this item earns 1 point. (Detailed instructions are available in Appendix B.)

The CST is given in waking (CST-W) and as the first item of the test of degree of suggestibility following the induction of hypnosis (CST-H). Item 7a of the SHSS:A, or in this instance the Harvard Scale, is then omitted. The 'hands-together-item' is also used as the test of post-hypnotic suggestion (PH) with the signal being the use of the word 'Now' in a sentence. And, finally, a last Control item (C_2) is given following test of the post-hypnotic suggestion. The form of the 'C_2' item is as described for 'C' above. Subjective experience is elicited by means of a standardized, open-ended questionnaire (see Appendix C). Extensive use is made of asking the subject to compare what they experienced on different items, or to compare the experience across conditions, 'W' and 'H'. The concept of nonvoluntariness is never introduced by the experimenter until the end of the questionnaire, if it is necessary to introduce it at all. A further discussion of the issues and description of the CST items, rationale, scoring, and rough norms are available in Weitzenhoffer (1974). The CST-W score is the sum of the three items, 'N',

'C', and 'SS', given in waking and the CST-H is the sum of the same items given following the introduction of hypnosis.

The modification of scoring of the Harvard Scale, mentioned above, also attempted to take into account the subjective experience aspect of the response. A 'passing' response required both meeting objective scoring requirements, and having a subjective experience of nonvoluntary compliance. The objective requirements were those of the Harvard Scale. The subjective experience aspect was elicited by an open-ended questionnaire which asked the subject to describe his experience on the various items (see Appendix C). The criteria for judging whether the response was experienced as nonvoluntary were based on the CST criteria. The following are representative of the responses obtained by the CST and scored as indicating nonvoluntariness: "My hands just moved together by themselves"; "I didn't want my hands to go together but they did anyhow"; "It was like there was a magnet between my hands"; "I felt a force pulling (or pushing) my hands together". A borderline response like "They just moved together", would be questioned thus: "How do you mean, 'They just moved together'"? or "Could you tell me more about it"? The modified Harvard Scale score (HS-M) was the number of items meeting both objective and subjective requirements for 'passing'. The standard Harvard Scale score (HS-S) was the number of items meeting the objective criteria for 'passing'. (A list, with definitions, of all measures is available in

Appendix F.)

Procedure

Half the subjects received the pain procedures in the Shock-Ischemia (S-I) order and half in the Ischemia-Shock (I-S) order. The orders were alternated throughout. All subjects received the pain procedures before the suggestibility determinations and the suggestibility measures were always given in the same order. (See Appendix D for schematic of order of presentation of procedures.)

The experiment took place in a laboratory which has two rooms. The inner room, which is not accessible directly from the hall, is the subject room. The outer room houses the equipment. Closed circuit television makes it possible to view the subject at all times and an audio system makes two way communication possible at any time.

Two experimenters were used with each subject. Experimenter A, one of two men, always did the pain procedures. Experimenter B, a female, always did the suggestibility determinations. Experimenter A made whatever attachments of apparatus and giving of instructions that were necessary and then left the experimental room to assist in operating the equipment in the outer room.

Other experimenters have reported that subjects found the anticipation of, and experience of, a pain situation to be anxiety producing. As much anxiety reduction as possible was thought to be desirable. Therefore, as full a description

was given of what to expect in the pain procedures as was consistent with the goal of not shaping the response to fit the expectations. A detailed report of the specific instructions is available in Appendix B. A detailed protocol was used. Instructions were given in short sections and repeated, with some paraphrasing permitted, until Experimenter A felt the subject understood what to expect and what was expected of him. This never required more than two or three repetitions of a section. Much less information was given about the suggestibility determinations than the pain procedures. A 10 minute rest period was given between the two pain procedures. Another 10 minute rest period, during which the subject was allowed to leave the lab, was given between the last pain procedure and the suggestibility determination.

Experimenter B remained in the experimental room with the subject throughout the suggestibility determinations. The tape used was of experimenter B's voice. The CST-W was done 'live'. The rapport section of the hypnosis induction was done 'live', then the tape was introduced and the body of the induction was 'on tape'. The CST-H was done 'live' and the remainder of the Harvard Scale was 'on tape'. The PH section of the CST (and thus of the Harvard Scale) and the remainder of the questionnaire were done 'live'. Subjects were prepared for part of the procedure to be on tape and part 'live'. Although some subjects complained about the taped presentation, because of its lack of flexibility, no

problems were encountered with regard to switching from 'live' to 'tape' and back. At the end of the suggestibility determinations subjects were paid and asked not to discuss the experiment on campus.

RESULTS

Order of presentation of the pain procedures (S-I or I-S) was counterbalanced by alternating orders. t tests comparing the subjects in the two orders on all seven pain measures were done to see if the order was important. None of the t tests was statistically significant.

There were two Experimenter A's. It was impossible to counterbalance to control for experimenter effect so t tests comparing the subjects in the two experimenter groups on all seven pain measures were done to test for experimenter differences. None of these t tests was statistically significant.

It was not possible to obtain skin resistances with as little variability as Tursky reported (5000 ohms $\pm$ 500) (Tursky & O'Connell, 1964; and Tursky, et al., 1965). After treatment with Redux paste the pre-shock skin resistance levels varied from 3,300 ohms to 45,000 ohms. Of the 48 subjects 87.5 percent fell between 3,300 ohms and 10,000 ohms. Because of the variability it was thought best to convert the electric shock measures to wattage for the data analysis. The data were originally recorded in milliamperes. The following formula was used to convert to wattage: Wattage=I^2R. Skin resistance readings were taken just before the delivery of the first electric shock and after the delivery of the

last shock. The average of these readings was used in the conversion from amperage to wattage.

Suggestibility-Pain Data

All possible correlations between 3 shock, 4 ischemia, and 4 suggestibility measures were calculated using the Pearson *r*. The resulting correlation coefficients were entered in the 11 x 11 matrix reproduced in Appendix E. Three hypotheses were proposed earlier (on pages 6 and 7), and the most appropriate tests of these hypotheses are three sets of correlations from the matrix.

Hypothesis one postulated significant positive correlations between suggestibility measures and measures of threshold for pain. Table 1 contains the relevant correlations. As can readily be seen only the correlation between the CST-H and the threshold for ischemic pain were statistically significant. Hypothesis one is given only slight support.

Hypothesis two postulated significant negative correlations between suggestibility measures and measures of pain tolerance. Table 2 contains the relevant correlations. Two of the correlations were statistically significant. These were the correlations between the CST-H and Tol-1 (r=.29) and between the CST-H and Intol (r=.29). Both correlations were significant at the .05 level. Hypothesis two is not supported in that the two correlations which are significant are positive rather than negative as predicted.

Table 1

Correlations between Suggestibility and Pain Threshold Measures

Suggestibility Measures	Threshold	
	Thresh-S	Mild
CST-W	.0796	.0221
CST-H	.0989	.2799 *
HS-S	.1704	.0713
HS-M	.1357	.0439

* $p < .05$

Table 2

Correlations between Suggestibility and Pain Tolerance Measures

Suggestibility Measures	Tolerance		
	Tol-1	Tol-2	Intol
CST-W	-.0749	-.1254	.1397
CST-H	.2930 *	.2193	.2904 *
HS-S	.1513	.1644	.0963
HS-M	.1669	.1578	.1041

* $p < .05$

Hypothesis three concerned the range of tolerable pain experience and predicted a significant negative correlation between the range measures and the suggestibility measures. The correlation matrix referred to above and shown in Appendix E does not contain range measures. As was noted earlier, arbitrary scores had to be assigned on several pain measures because subjects went above acceptable limits. This occurred with both pain procedures, though not in both procedures in the same subjects. Shock range measures were meaningless for these subjects and ischemia range measures were of doubtful value. The correlations relevant to hypothesis three were based on 39 subjects, since data for the subjects who exceeded the shock limits were removed when these correlations were calculated. The relevant correlations are presented in Table 3. None of these correlations is significant. Hypothesis three is not supported.

Several multiple regressions were done to see if a weighted linear combination of the seven pain measures would predict any of the suggestibility measures. This data is presented in Table 4. All the multiple regressions are significant at the .05 level and the prediction of the CST-H is significant at the .01 level. The finding of the ability of the weighted combination of pain measures to predict the CST-H at better than the .01 level of statistical significance gives some support to the finding of the three significant correlations between pain measures and the CST-H.

Table 3

Correlations between Suggestibility and Range Measures [a]

Suggestibility Measures	Range		
	R-1	R-2	R-3
CST-W	.0990	-.1099	.1717
CST-H	.1345	.1858	.2119
HS-S	.0588	-.1440	.0952
HS-M	-.0429	-.1088	.0959

[a] N=39

Table 4

Multiple Correlations

Predictor	Criteria Predicted			
Linear combination of all pain measures	CST-H	CST-H	HS-S	HS-M
	.2676 *	.4127 **	.2723 *	.2881 *

* p .05
** p .01

Finally, cannonical correlation was also used to look at the possibility of a relationship between suggestibility and pain parameters. This statistical procedure maximizes any linear relationship which may exist between two sets of measures; i.e. suggestibility measures and pain measures, and in this instance may be viewed as a test of the complete linear independence of the two sets of measures. None of the cannonical correlations were significantly different from 0, therefore, the hypothesis of complete linear independence of the two sets of measures cannot be rejected.

Neither Shor (1962) nor McGlashon, et al. (1969) used subjects from the entire range of suggestibility. To approximate the statistical techniques of these investigators the entire group was divided into quartiles on the basis of HS-S scores and t tests were used to compare the means of the four sub-groups on the various pain measures. The Aspin-Welche t was used (Winer, 1962). The Aspin-Welche t provides a formula for computing the degrees of freedom for small samples with unequal variances. The means and standard deviations of the quartile groups on the shock measures are presented in Table 5, and on the ischemia measures in Table 6. Table 7 presents the data on the statistical significance of the comparisons of the shock measures. Five comparisons were statistically significant. For threshold, the difference between the Hi-Med group and the Lo group were statistically significant. For the Tol-1 measures, the comparisons between the Hi-Med

Table 5

Means of Suggestibility Groups on Three Shock Measures [a]

Suggestibility Groups	Shock Measures		
	Thresh-S	Tol-1	Tol-2
Hi			
Mean	215.461	655.077	1987.154
S.D.	323.9927	673.5588	2050.5570
Hi-Med			
Mean	710.385	1895.615	2359.385
S.D.	1006.9146	1718.3383	1773.2491
Lo-Med			
Mean	119.0909	374.1818	1072.000
S.D.	128.3577	240.8248	579.5886
Lo			
Mean	67.7273	455.273	1399.546
S.D.	82.0769	333.7799	1123.6316

[a] The scores on which these means were based were derived as follows: Subject's score = ma^2 x skin resistance

Table 6

Means of Suggestibility Groups
on Four Ischemia Measures [a]

Suggestibility Groups	Ischemia Measures			
	Mild	Mod	Sev	Intol
Hi				
Mean	128.846	218.615	478.615	1074.000
S.D.	71.5084	159.7052	263.1554	649.8658
Hi-Med				
Mean	176.231	404.3846	637.000	1127.154
S.D.	131.2943	317.5824	412.3603	543.5749
Lo-Med				
Mean	174.0909	336.455	606.091	1088.909
S.D.	155.0067	236.4840	362.7160	614.4061
Lo				
Mean	132.000	211.727	389.091	822.091
S.D.	56.5473	122.2465	190.9322	592.3390

[a] Scores are in seconds.

Table 7

Statistical Significance of t Comparisons
of Means of Suggestibility Groups
on Three Shock Measures

Suggestibility Groups	t test significance								
	Hi-Med			Lo-Med			Lo		
	Thresh-S	Tol-1	Tol-2	Thresh-S	Tol-1	Tol-2	Thresh-S	Tol-1	Tol-2
(1) Hi	ns	.05	ns	ns	ns	ns	ns	ns	ns
(2) Hi-Med				ns	.01	.05	.05	.02	ns
(3) Lo-Med							ns	ns	ns

group and each of the other three groups were statistically significant. The comparison between the Hi-Med group and the Lo-Med group on Tol-2 was statistically significant. No statistically significant differences were found between means for the ischemia data.

Figures 1-7 present the quartile means, connected by a line, plotted with the scores of individual subjects. HS-S score is on the X axis and the particular pain measure is on the Y axis. In these figures the pain data for electric shock is in milliamperes.

Interrelations among Pain Measures

The intercorrelations among the shock measures are presented in Table 8. Each shock measure correlated with each other shock measure at a high level of significance. The correlations range from .51 to .75.

The ischemia intercorrelations are presented in Table 9. Each ischemia measure correlated significantly with each other ischemia measure. There is a broader range of correlations with the ischemia than with the shock; that is, from .41 to .84.

Intercorrelations among the two sets of pain measures are shown in Table 10. As can be seen, there is some degree of relationship between the two types of pain. Moderate and Severe from ischemia and Tol-1 from electric shock show the highest degree of relationship to the greatest number of measures from the alternate pain source. The two threshold

Table 8

Intercorrelations among Shock Measures

Shock Measures	Intercorrelations		
	Thresh-S	Tol-1	Tol-2
Thresh-S	--	.68 **	.51 **
Tol-1		--	.75 **
Tol-2			--

** $p < .01$

Table 9

Intercorrelations among Ischemia Measures

Ischemia Measures	Intercorrelations			
	Mild	Mod	Sev	Intel
Mild	--	.73 **	.61 **	.41 **
Mod		--	.84 **	.57 **
Sev			--	.75 **
Intol				--

** $p < .01$

Table 10

Correlations between Ischemia and Shock Measures

Ischemia Measures	Shock Measures		
	Thresh-S	Tol-1	Tol-2
Mild	.05	.37 *	.26
Mod	.49	.64 **	.52 **
Sev	.34	.53 **	.45 **
Intol	.26	.37 **	.36 *

* $p < .05$
** $p < .01$

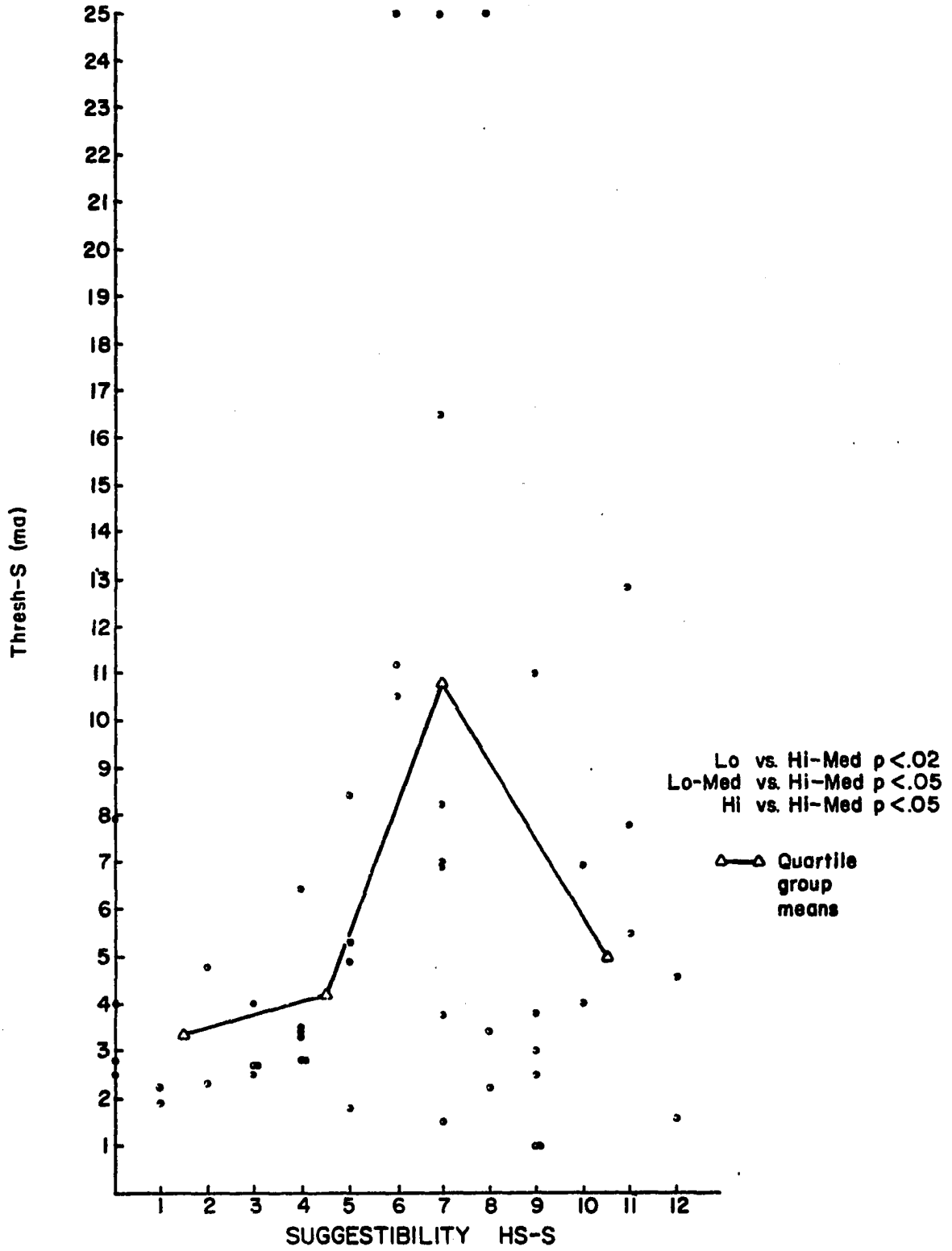

Fig. 1. Plot of Thresh-S and HS-S scores with Thresh-S quartile means superimposed.

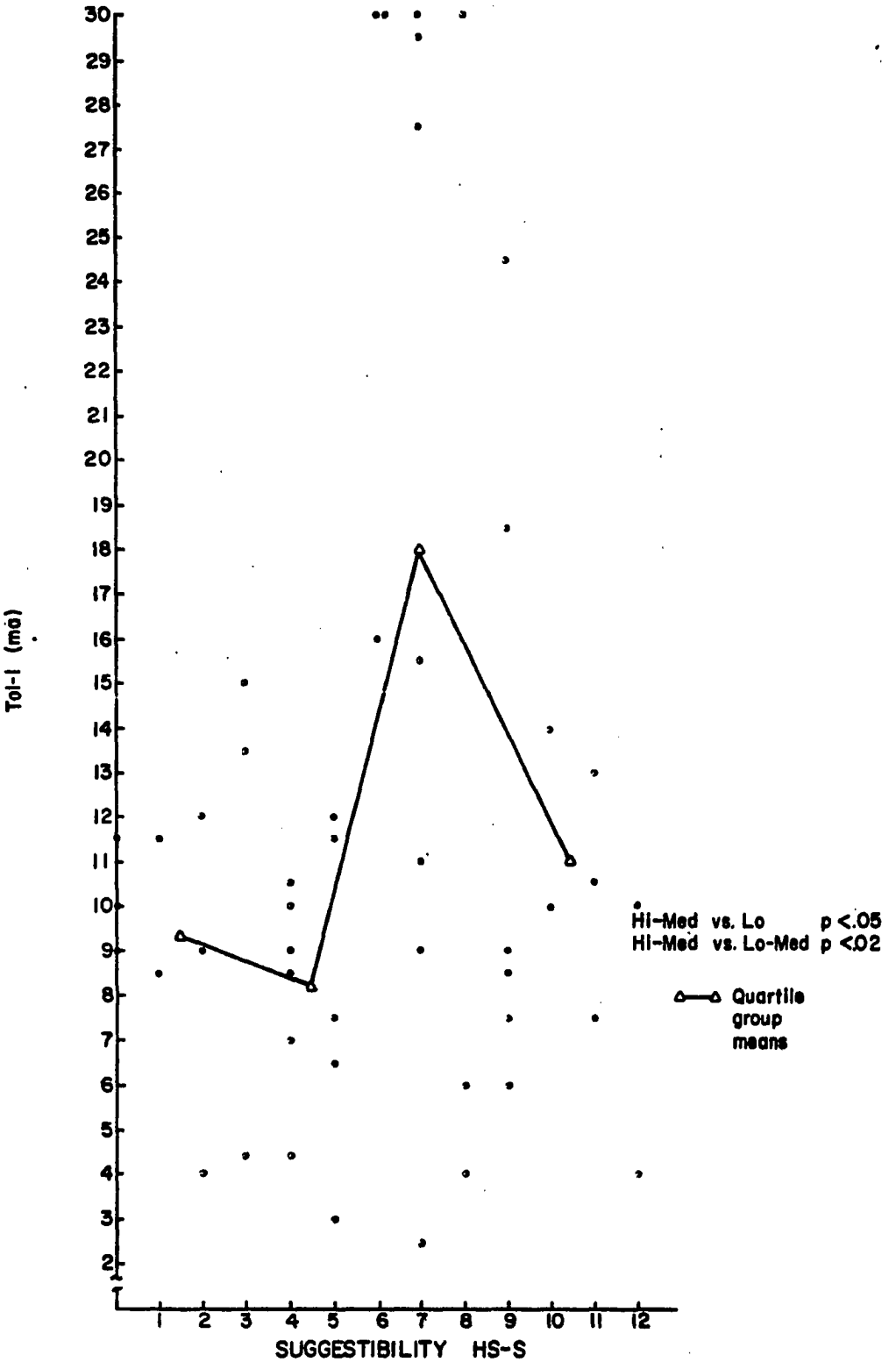

Fig. 2 Plot of Toi-I and HS-S scores with quartile group Toi-I means superimposed.

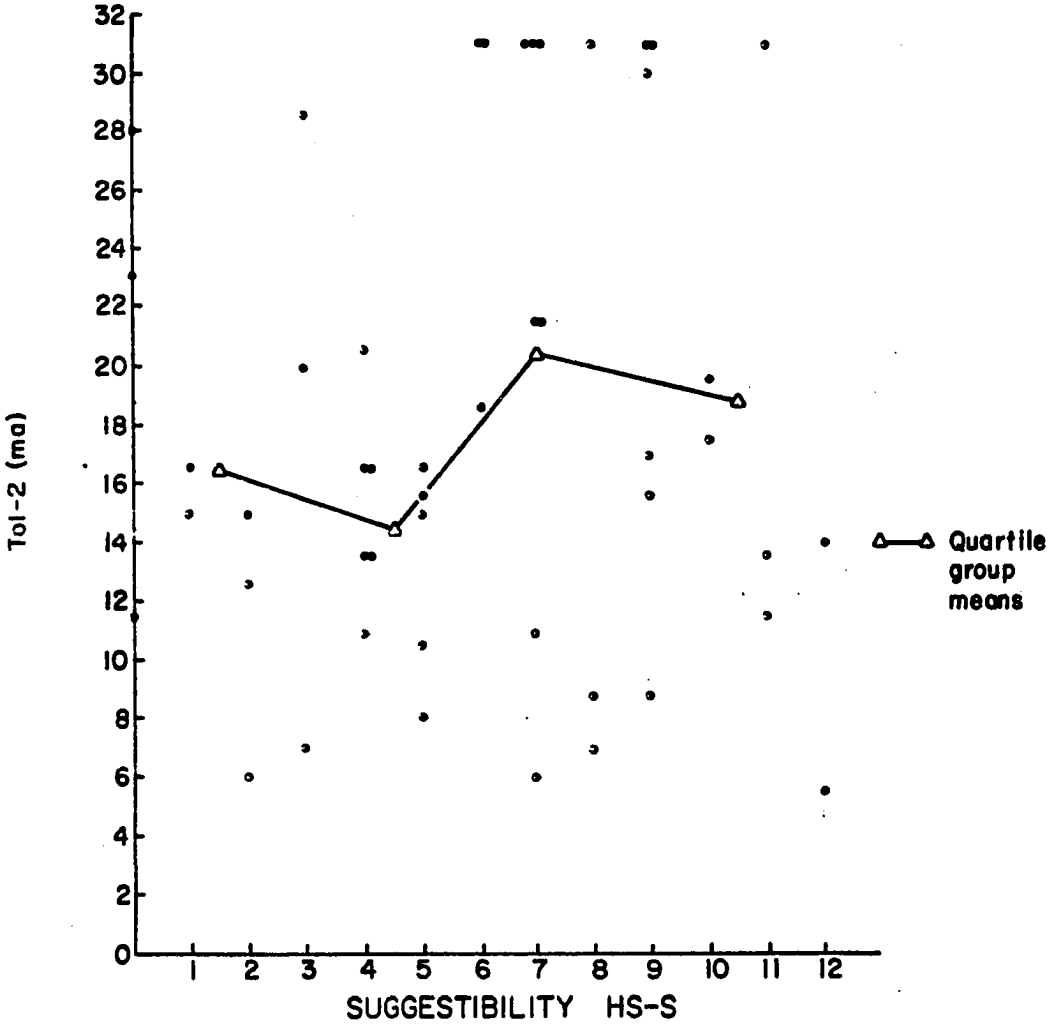

Fig. 3. Plot of Tol-2 and HS-S scores with quartile group Tol-2 means superimposed.

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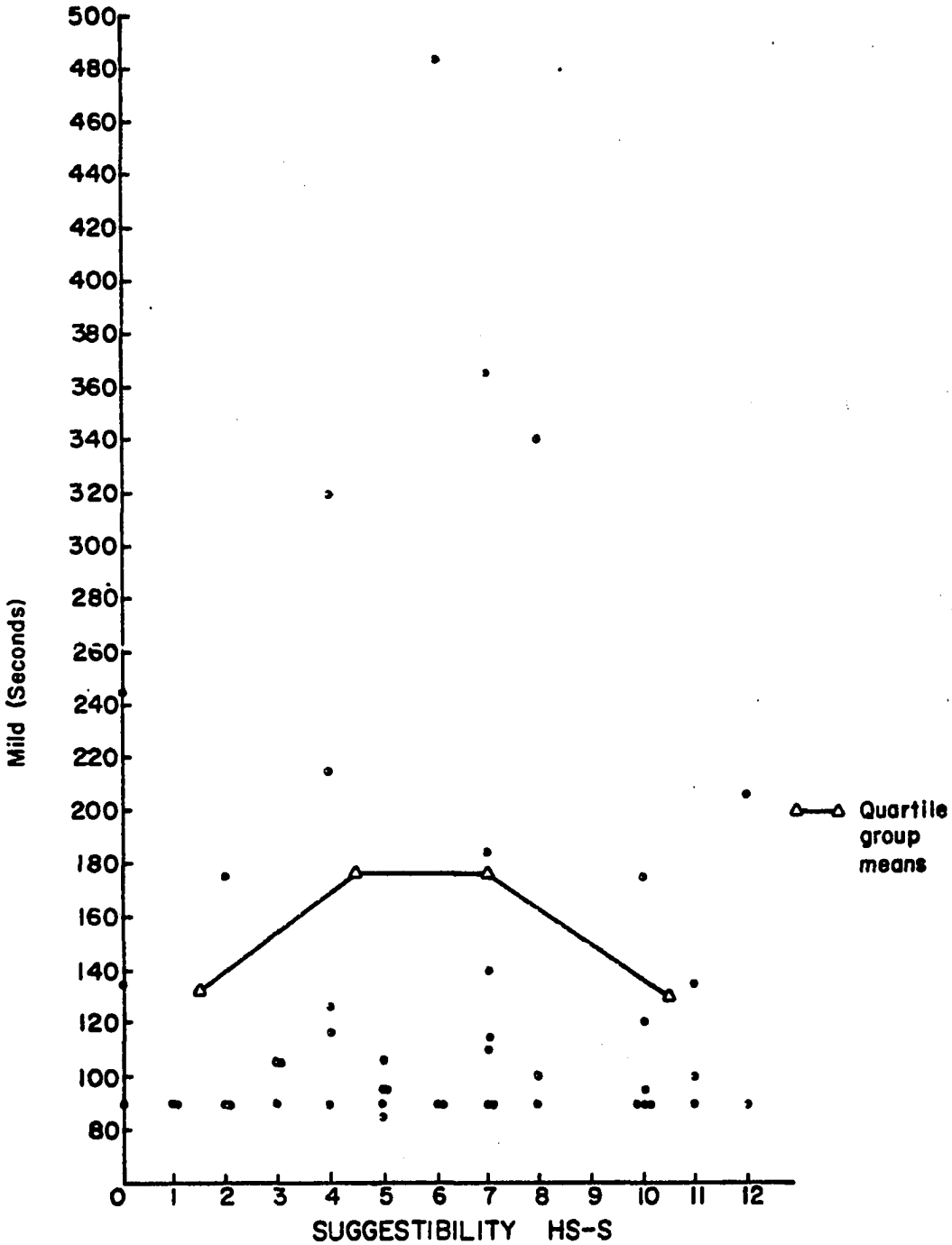

Fig. 4. Plot of Mild and HS-S scores with quartile group Mild means superimposed.

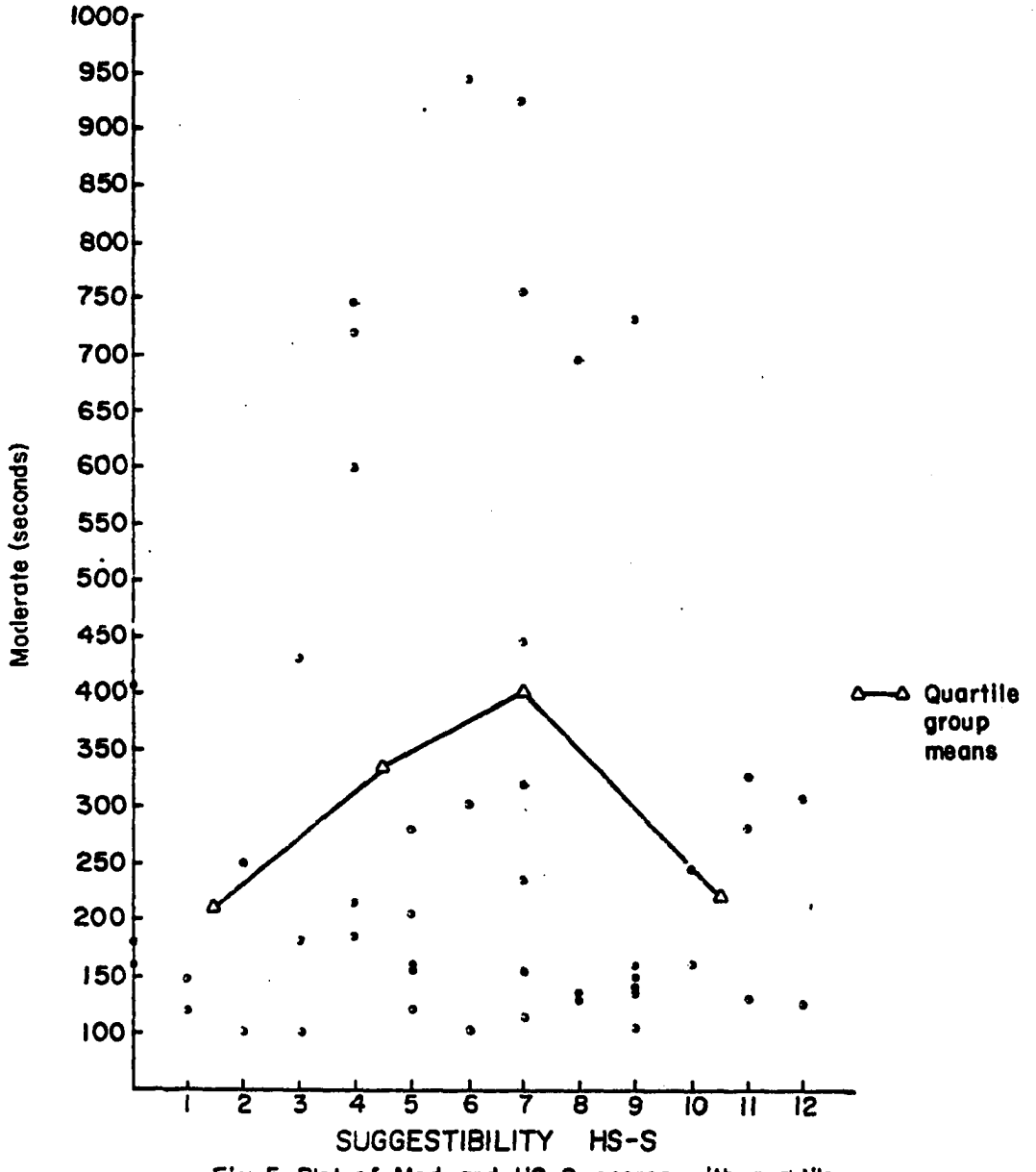

Fig. 5. Plot of Mod. and HS-S scores with quartile group Mod. means superimposed.

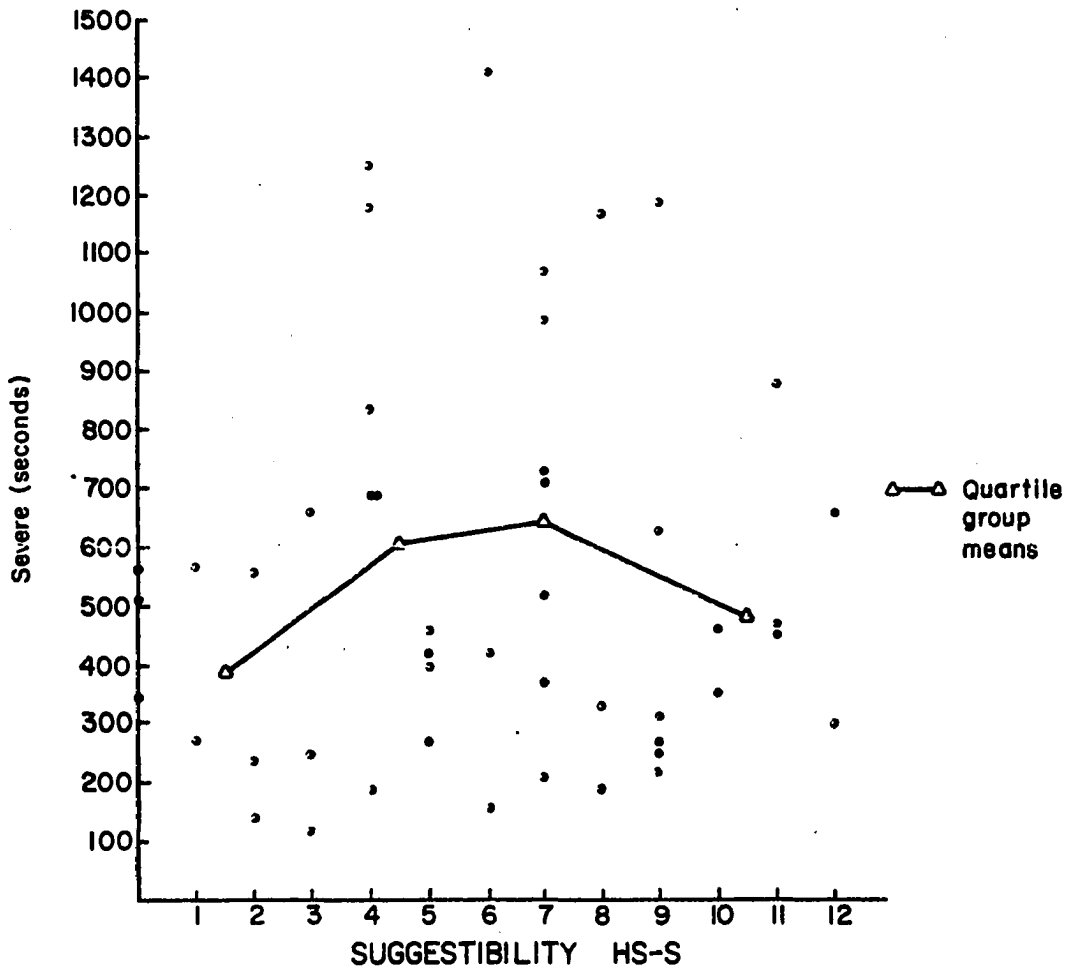

Fig. 6. Plot of Sev and HS-S scores with quartile group Sev means superimposed.

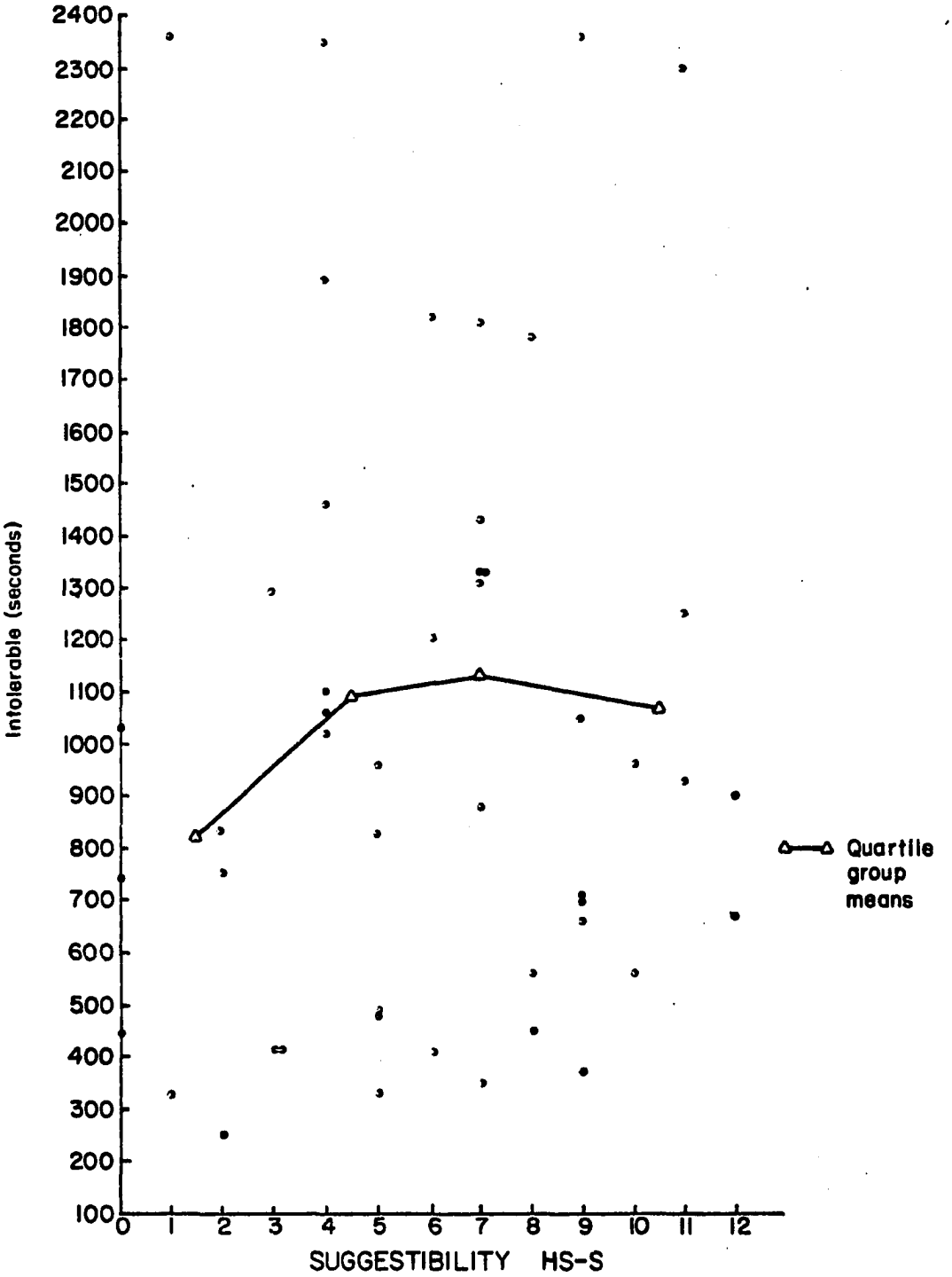

Fig. 7. Plot of Intol and HS-S scores with quartile group Intol means superimposed.

measures, Mild and Thresh-S, are completely unrelated (r=.05). The two maximum tolerance measures, Tol-2 and Intol, have a slight degree of linear relation as is evidenced by the correlation, r=.36.

The structure of the relationships among the pain measures was further examined with a principle components analysis which included all the pain measures (except the range measures) from both sources. Two factors were rotated which accounted for 77 percent of the variance. The results of this analysis are shown in Table 11. Factor 1 is best defined by the ischemic pain measures. Factor 2 loadings are heaviest among the electric shock measures. Tol-1 and Mod show some degree of crossloading.

Interrelations among Suggestibility Measures

The intercorrelations among the suggestibility measures are shown in table 12. The two scorings of the Harvard Scale are virtually colinear (r=.97). The CST-H correlates moderately with the CST-W (r=.40) and the Harvard Scale scorings (HS-S, r=.42; HS-M, r=.43). A second principle components analysis was done using the suggestibility measures. Two factors were rotated which accounted for 86 percent of the variance. The results of the analysis are presented in Table 13. The relationships described above with regard to the individual correlations were confirmed by the principal components analysis. Factor 1 is best defined by the two Harvard Scale scorings and their loadings on Factor 1 are

Table 11

Principle Components Analysis
of Pain Measures

Pain Measures	Factors	
	Factor 1	Factor 2
Thresh-S	.0556	.8754
Tol-1	.3401	.8550
Tol-2	.2652	.7961
Mild	.8545	.0110
Mod	.8137	.4537
Sev	.8722	.3125
Intol	.7453	.2143

Table 12

Intercorrelations among Suggestibility Measures

Suggestibility Measures	Intercorrelations			
	CST-W	CST-H	HS-S	HS-M
CST-W	--	.40 **	.17	.15
CST-H		--	.42 **	.43 **
HS-S			--	.97 **
HS-M				--

** $p < .01$

Table 13

Principle Components Analysis
of Suggestibility Measures

Suggestibility Measures	Factors	
	Factor 1	Factor 2
CST-W	-.0206	.9128
CST-H	.4096	.7092
HS-S	.9722	.1417
HS-M	.9776	.1342

virtually identical. The CST-H takes a somewhat intermediate position, loading on both factors. However, it appears more clearly to have its principal relationship to the CST-W than was shown by the individual correlations. Factor 2, then, is best defined by the CST-W and secondarily by the CST-H.

DISCUSSION

Of the 40 correlations between pain measures and suggestibility measures, only 3 were found to be statistically significant (at the .05 level). All such significant correlations were below .30. All three were between pain measures and the CST-H. There was no significant linear relationship between the conventional measure of suggestibility in hypnosis (HS-S) and any pain measure. Further, the two sets of data; i.e. pain measures and suggestibility measures are completely linearly independent as evidenced by the non-significant cannonical correlation. The significant multiple correlations have more theoretical than practical import because of their low absolute values (all less than .42). That is, level of suggestibility cannot be predicted for individuals from the combination of pain measures. Multiple regression procedures maximize multiple correlation and, in so doing, take advantage of any correlated errors or specific variations. Thus, they give an overoptomistic picture of the predictive value of the linear combination (Guilford, 1954, p. 405). Because of this the size of the multiple correlations could be expected to "shrink" if the same combinatory formula were used with data collected from another sample (Anastasi, 1968, p. 144, 181-184; Guilford, 1954, p. 405-407). It is apparent from these data that there is little or no linear

relationship between level of suggestibility in hypnosis and waking pain parameters. Further, the t tests which compared the highest and lowest quartiles of suggestibility did not show statistically significant differences between the two groups on any of the 7 pain measures.

Methodological issues were of primary concern in this study. The question under consideration was whether unsuggestible subjects are an appropriate control group for highly suggestible subjects in studies of hypnoanalgesia. To this point in this paper none of the data that has been discussed seriously questions the appropriateness of this methodology. Neither Shor's (1962, 1964) nor McGlashon, et al's (1969) findings of differences between these specific groups on pain measures was supported. There are, however, other aspects of the data which do raise methodological concerns.

Large amounts of variability were found in all the pain data, but especially in the electric shock data; e.g., in comparing the upper and lower quartiles, in several instances one mean was twice as large as the one it was being compared with, but the variability was so large that even a difference of that size was not statistically significant. This variability was dealt with by Shor (1962, 1964) by the use of log transformations to 'normalize' the data. He also used an analysis of covariance to take into consideration initial skin resistance, even though he manipulated intensity in terms of watts. Reanalysis of his raw data (Shor, 1964,

p. 260) indicates that he also had a large amount of variability, and the t test of the difference between the two means was not statistically significant. It is important to note that the Shor study and this study found differences between the groups of roughly the same magnitude but in opposite directions. Since the data did not indicate significant differences between upper and lower Harvard Scale quartiles on any pain measure, one might at least speculate that the 'normalization' of the Shor data resulted in a false positive, or Type I error.

Two serious problems are pointed up by this discussion of the variability of the pain measures. First, statistical significance is very hard to achieve with such large variances. And, second, in any pain study comparing groups constructed by random sampling, one runs a risk of choosing groups with large pre-existing differences on the dependent variable. Interpretation of results are difficult under these conditions. There apparently is no way to reduce the amount of variability in the pain data. The use of large samples will make the effects of the variability on the statistical procedures less severe.

With regard to the second problem caused by the variability, three courses of action are possible. One is to use the subject as his own control. In doing this the experimenter runs into the problem Orne (1954, 1971) has written of, involving the demand characteristics of the experimental procedure and setting.

A second solution is to use some statistical treatment of the data which will take the pre-existing differences between groups into consideration. In this situation McGlashon, et al. (1969), used as their scores the regression of the analgesia score on the baseline, or waking, score. The problem here is that, the relationship between stimulus intensity and subjective experience of pain is thought to be non-linear (Hilgard, 1969). A non-linear relationship is accepted as holding for several sense modalities (Dember, 1960; Woodworth & Schlosberg, 1954). How is one to assume then, that an increase of x number of units at one point on the intensity scale is equal to an increase of the same x number of units at another point on the intensity scale? In other words, is it known that an increase in tolerance from 8 ma to 15 ma in an unsuggestible subject would be subjectively equivalent to an increase from 25 ma to 32 ma in a highly suggestible subject?

A third approach to the problem of pre-existing differences is to match the subjects of the two groups on the waking, or baseline, pain parameters. This approach has its own major tactical considerations. The number of subjects that it would be necessary to pretest before the sample was completed could be quite large. There is usually a limited supply of available subjects in both the highly suggestible and unsuggestible categories. And, time is usually an issue. Theoretically, the matching approach appears to be the best

one.

Some other aspects of the data are of theoretical interest. The finding of small but statistically significant correlations (all below .30) between the CST-H and three of the pain measures is of particular interest. One obvious aspect of the CST is that it is a motor item. On the speculation that this was the important aspect, a 'motor sub-scale' was constructed from the Harvard Scale data. However, the correlations between this sub-scale and the three pain measures were not significant. The meaning of these three significant CST-H correlations remains unclear and may, in fact, be spurious. Considering the number of correlations that were calculated, one or two of them might be expected to be significant by chance.

The results of the a posteriori t test comparisons of the quartiles are also of theoretical interest. While none of the comparisons of the means of the highest and lowest quartiles were significant, some other comparisons did produce significant differences. All the significant comparisons involved the Hi-Med group (HS-S scores of 6 to 8). Ordering of the means (from highest to lowest) for each of the seven pain measures suggests that there may be a non-linear relationship between pain parameters and level of suggestibility in hypnosis. Although the degree of relationship is not likely to be high enough to allow prediction for individuals the possibility should be explored further. Again,

the meaning of such a relationship, in terms of what it reveals about suggestibility, is not clear.

As was indicated in the introduction, some of the data made available because of the design of the study, is rather tangential to its purpose. A full discussion of this data is not appropriate in this context. Only such discussion as is relevant will be presented here. Although there is some degree of overlap, the principle components analysis of the pain measures indicates that there were two pain factors: one for response to ischemic pain and one for electric shock pain. Wolff & Jarvick (1963) compared three types of pain: radiant heat, hypertonic solution in the muscle and hypotonic solution in the muscle. Radiant heat and hypotonic solution produced experientially similar types of pain (a sharp jab) and the thresholds correlated -.49. Hypertonic and hypotonic solutions both produced pain in the muscle and the thresholds correlated -.51. For the two methods which had no type of similarity, radiant heat and hypertonic solution, the thresholds correlated -.15. In the current study the correlations between scores from the two types of pain ranged from .05 (for the two threshold measures) to .64 (for Mod and Tol-1). What emerges clearly is that, while there is some relatedness between reactions to different types of pain, one cannot speak of a threshold for pain or a tolerance for pain in a certain individual. The type of pain must be specified. One cannot generalize from one type of pain to another.

With regard to the suggestibility measures, it is obvious that more than one characteristic of the subject was measured by the 4 suggestibility measures. The CST-W measures something entirely different from the Harvard Scale. The CST-H is intermediate between the CST-W and the Harvard Scale. However, the fact that some of the correlations of the CST-H with pain measures were significant, when none of the other suggestibility and pain correlations were significant, suggests that the CST-H has some unique aspect of its own; an aspect shared with neither the CST-W nor the Harvard Scale.

The purpose of the modified scoring of the Harvard Scale used in this study was to provide some gross estimate of how many subjects give responses that are scored as 'passes', but which are actually experienced as voluntary, and what proportion of the responses of these subjects are so scored. The estimate provided by the HS-M in this study is, for several reasons, rather gross but should provide some information in the direction of that goal. Both the principle components analysis and the individual correlations indicate that the HS-S and the HS-M measured essentially the same thing. The rate of false positives; i.e. voluntary responses that were falsely scored as 'passes' by the standard Harvard Scale criteria, was 28 out of 576. The conclusion to be drawn is that, while there were instances in which a subject's score was changed significantly by including in the criteria

for 'passing' a requirement of a subjective experience of nonvoluntariness, most subjects who respond do experience nonvoluntariness. If, in further studies, the rate of false positives holds at the level found in this study, general research using hypnosis would not be affected by the false positives that do occur.

Therefore, the choice of which measure of suggestibility to use in a study would depend on the purpose for measuring suggestibility. The CST is still in the developmental stage, and its uses have not been clearly defined. However, since the statistically significant linear relationships between pain measures and suggestibility measures involved the CST, it might be informative to obtain CST scores when hypnoanalgesia studies are done. For general research the HS-M does not seem to have a sufficient advantage over the HS-S to justify the considerable amount of time involved in the interview. If, of course, one were doing research directly concerned with the nature of suggestibility it would be imperative to ascertain that a 'suggestion effect' had indeed occurred.

CONCLUSIONS

It seems clear that there is little or no linear relationship between level of suggestibility in hypnosis and waking pain parameters. There are, however, indications that there is a non-linear relationship present and this possibility should be investigated. This non-linear relationship, itself, does not signal risk in doing hypnoanalgesia studies comparing upper and lower quartiles of suggestibility. The large variability present in the pain data does, however, make any unmatched group comparisons of pain data risky. This risk does not apply only to hypnoanalgesia studies. With large variance and small numbers of subjects, one may easily get two groups that have pre-existing differences on the pain measures. The large variance also makes it more difficult to obtain statistical significance in comparisons of treatment effects. Three possible procedures for dealing with the pre-existing differences between groups problem were discussed. The solution of the use of groups matched on the basis of baseline pain parameters was recommended.

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APPENDICES

APPENDIX A

PROSPECTUS

PROSPECTUS

INTRODUCTION

On the basis of incidental findings of two studies of suggested analgesia in hypnosis (McGlashon, Evans, and Orne, 1969; Shor, 1962, 1964) the possibility has been raised that a relationship exists between aspects of waking pain experience; e.g. threshold and tolerance, and degree of suggestibility in hypnosis. This investigator proposes to test for the presence of such a relationship and explore its nature if the relationship is found to exist.

Using electric shock as his means of pain production, Shor (1962, 1964) compared the effects of hypnotic analgesia on a group of highly suggestible subjects with its effects on a group of unsuggestible subjects who had been given simulator instructions (Orne, 1954, 1971). With degree of suggestibility in hypnosis pre-determined, subjects were required in waking, to select the highest intensity of electric shock they could receive repeatedly and not get disturbed between shocks. This level of shock was used later in testing the effects of hypnoanalgesia suggestions. Shor found that the unsuggestible subjects chose shock of a higher intensity than did the highly suggestible subjects. McGlashon, et al. (1969) studied the effect of suggested analgesia in hypnosis

on pain produced by the exercise of ischemic muscle. They, too, compared highly suggestible subjects with unsuggestible subjects. They found that, in waking, their highly suggestible subjects had a higher threshold for pain than the unsuggestible subjects. There was also a statistically non-significant tendency for the highly suggestible subjects to have a higher waking pain tolerance level than the unsuggestible subjects (the opposite of the Shor (1962, 1964) findings).

In a more recent study Morgan (1972), searching for possible relationships between measures of cognitive controls and suggestibility in hypnosis, also had available tolerance scores for pain from cold pressor. She calculated a matrix of intercorrelations and found the correlation between pain tolerance and suggestibility, as measured by the Stanford Hypnotic Susceptibility Scale, Form A, to be $r=-.01$.

The results of the studies are thought-provoking but it is not clear whether they are contradictory or complementary. The Shor (1962, 1964) results might indicate that highly suggestible subjects are more responsive to pain in the waking state than are unsuggestible subjects; whereas, the McGlashon, et al. (1969) results might suggest the opposite, that is that unsuggestible subjects are more responsive to pain than are highly suggestible subjects. On the other hand, the Shor and McGlashon, et al. studies may be complementary. That is, unsuggestible subjects may have a broader

range of tolerable pain experience (from threshold to maximum tolerance) than highly suggestible subjects. The kind of information necessary to resolve these questions and to detail the nature of the relationship, if one actually exists, between pain experience and suggestibility is not available from these two studies.

Non-comparability of the studies

The studies were not designed to provide the necessary information and they are not directly comparable. One major difference between them is with regard to the pain sources used; i.e., electric shock and exercise of ischemic muscle. Another is the different pain parameters measured; i.e., threshold and maximum tolerance. And, finally, the subjects of the two studies approached the experiment with different sets. The best that can be said is that there appears to be a difference of some type, in waking pain experience, between subjects who score high and those who score low on measures of general suggestibility in hypnosis.

Looking in more detail first at the difference in means of producing pain, the electric shock used by Shor produces a sharp jab of pain, whereas the ischemic method of McGlashon, et al., produces a more sustained, slow developing, deep ache. In a study of the relationship of pain from three different sources, Wolff & Jarvick (1963) compared threshold for muscle pain produced by injection into the muscles of a hypertonic solution with that produced by an injection of an

hypotonic solution. The correlation between these thresholds was r=-.51. In the Wolff & Jarvick study (1963) radiant heat thresholds were also determined. There was a low but statistically significant correlation (r=-.49) between the thresholds for hypotonic pain and radiant heat pain. The authors pointed out that significant correlations were found between measures of pain sources operating in the same place (hyper- and hypo-tonic solutions in the muscles) and between measures of pain sources producing similar types of pain (hypotonic solution and radiant heat producing sharp pain). The Wolff & Jarvick methods of producing pain most closely resembling the pain of Shor (1962) and McGlashon, et al. (1969) were hypertonic solution (a deep ache) and radiant heat (a sharp jab). The correlation for thresholds from these two methods was r=-.15. From these results it could be predicted that thresholds for pain produced by electric shock and by the exercise of ischemic muscle would not be significantly related. It also seems entirely possible that the relationship between hypnotic suggestibility and measures of pain parameters may vary with the means used to produce the pain.

A second major difference between the two studies under discussion (McGlashon, et al., 1969; Shor, 1962) was in the pain measures found to be important. Shor apparently measured only the maximum wattage tolerable for repeated application and found it related to suggestibility in hypnosis. McGlashon, et al. measured threshold and absolute maximum

tolerance, with only threshold showing a significant relationship to suggestibility in hypnosis. In studies in which different measures of pain from a common source were compared, the correlations between threshold and maximum tolerance have ranged from .61 to .91 (Clark & Bindra, 1956; Gelfand, 1964b; Gelfand, Ullmann & Krasner, 1963; Wolff & Jarvick, 1963). However, Shor's measure was not actually maximum tolerance so it is questionable whether this same relationship would hold between Shor's measure and McGlashon's measure even if they had been produced by a common source. In a study which uses all measures on the same subjects it may be found that the results of the two studies under discussion (McGlashon, et al., 1969; Shor, 1962) are complementary. That is, that for the unsuggestible subjects the range from threshold to maximum tolerance is broader than for the highly suggestible subjects. Again, the nature of the relationship may be found to vary with the type of pain production method used.

The third major difference between the two studies under discussion (McGlashon, et al., 1969; Shor, 1962) is in the set with which the low suggestible subjects approached the experiment. Many studies (Blitz & Dinnerstein, 1968; Buss & Portnoy, 1967; Clark & Bindra, 1956; Gelfand, 1964b; Gelfand, et al., 1963; Hall & Stride, 1954; Hill, Kornetsky, Flanary, & Wikler, 1952; Kanfer & Goldfoot, 1966; Nichols & Tursky, 1967; Wolff & Horland, 1967; Wolff, Krasnegor & Farr, 1965; Wolff & Goodell, 1942), have shown that, for pain in

general, cognitive and affective variables contribute significantly to the measures obtained in pain studies. Shor's unsuggestible subjects had, prior to the pain measures determinations, been given simulator instructions (Orne, 1954; 1971). These instructions direct the unsuggestible subjects in an hypnosis experiment to try to fool an experimenter, who is blind to their actual degree of suggestibility, into believing that they are indeed hypnotized. The portion of McGlashon et al.'s unsuggestible subjects that were included in the threshold data under discussion were not given simulator instructions. Sheehan (1971a, 1971b) has clearly shown that, with some types of tasks, subjects gave a set of baseline data, that is waking control data, when they were given simulator instructions, that was quite different from what they had given previously when tested in an apparently unrelated situation. There is no knowledge about the effect of simulator instructions on the specific situation of measuring pain. However, given the general effect of differing instructions on pain measures and the specific effect of simulator instructions in at least some situations, it would not be surprising if the differences in the instructions to the subjects in the two studies could have produced some of the differences between the results of the two studies.

Scope of the proposed study

The findings of these two studies, which indicate a difference in pain experience between highly suggestible and

unsuggestible subjects, need to be confirmed in a study designed for this purpose. Also a study can be designed which will give a more detailed knowledge of the nature of the proposed relationship. The requirements of such a study will now be discussed. First, a number of pain parameters have been measured in pain research (Gelfand, 1964a, 1964b; Gelfand, et al., 1963; Wolff & Horland, 1967; Wolff, et al., 1965). In order to have a fuller knowledge of the nature of the suggestibility-pain relationship, if one exists, more of the various aspects of pain should be measured: range and rate of development, along with threshold and maximum tolerance. And, second, it is possible that the nature of the suggestibility-pain relationship might vary with the pain production method. It seems to this investigator that these goals of research could best be approached by using a design in which each subject serves in all conditions; i.e., each subject experiences pain from all sources and reports on all pain parameters.

Specifically then, it is proposed to investigate, in this study, several aspects of the relationship between measures of general suggestibility in hypnosis and measures of pain parameters such as threshold and maximum tolerance for pain produced by two widely differing means. The presence of such a relationship has been only suggested, not confirmed. Since it is part of the purpose of this study to try to synthesize or contrast the two studies that have been discussed

in detail above (McGlashon, et al., 1969; Shor, 1962, 1964) pain production methods used in both studies will be administered to each subject. Fortunately, in terms of designing a comprehensive study, they differ widely in the type of pain they produce. Because it is also the purpose to add to the amount and type of information available, several more pain parameters will be obtained and/or extracted from the data than were obtained in the two studies under consideration.

The data obtained from these subjects will be strictly baseline data. It should be stated clearly that there are three issues that are very important to methodology in the study of suggested analgesia, one of which was discussed above as a difference between the two studies, which cannot be dealt with in this study. First, no information will be obtained about the effect on the pain parameters of previous knowledge of level of suggestibility. In both studies under consideration, subjects' level of suggestibility was known when pain testing was done. Second, no information will be gathered about these subjects' responses to analgesia suggestions. And third, none of the subjects will be given simulator instructions, so the specific effects of these instructions on the suggestibility measures, pain parameters, or their relationship, cannot be assessed.

Within the framework of the proposed study, data could be gathered which would be essentially unrelated to the stated purposes of the study, but which would add to knowledge

in other areas. First, electric shock and the exercise of ischemic muscle as methods of producing pain have not been compared. Since both methods will be used in this study on all subjects, this data will be available.

Also, recently Weitzenhoffer (submitted for publication) has raised serious questions about current approaches to the measurement of degree of suggestibility (Shor & Orne, 1962; Weitzenhoffer & Hilgard, 1959, 1962) because they do not take account of subjective aspects of the response, specifically an experience of nonvoluntariness of response. He has contended that adequate measurement of suggestibility requires a 'passing' response to be experienced as nonvoluntary as well as to meet certain observable criteria. He has developed the Classical Suggestion Test (CST), an approach to measurement which incorporates the nonvoluntariness requirement. This investigator is proposing a method of measurement of suggestibility in hypnosis which is, in some respects, an expansion of the CST. This method, a modification of the scoring of the Stanford Hypnotic Susceptibility Scale: Form A and the Harvard Group Scale of Hypnotizability, has not previously been compared with the CST. Also the relationships of suggestibility, as measured by several methods, to the pain parameters will be determined and compared.

Implications of positive results

Should this postulated relationship between the experience of pain and level of suggestibility be confirmed,

some problems of confounding in research in suggested analgesia could be posed. If the relationship is confirmed, in any studies which compare the effect of analgesia suggestions on highly suggestible subjects with their effect on unsuggestible subjects, in which means of absolute scores are used, the risk is run that there are significant differences between the high and low suggestibility groups on the dependant variable from the very start. Any differences between the groups after the analgesia suggestions would be more difficult to interpret. If the results of the Shor data (1962, 1964) can be replicated and the unsuggestible group has a higher waking tolerance, then results of other studies which show highly suggestible subjects to have a higher tolerance in suggested analgesia might be considered even more striking since they would actually have a lower maximum tolerance in waking.

Even the use of change scores, or percentage of change, will not solve the initial differences problem. Knowledge of the psychophysics of pain is, like knowledge of many other aspects of the pain experience and response, rudimentary. It is not at all certain that an increase of a certain number of units of intensity of the pain stimulus results in equivalent increases in units of subjectively experienced pain at different levels of the intensity scale. In fact, it is specifically known that, in the case of other senses, the relationship between stimulus characteristics and

subjective experience of the stimulus is not linear (Dember, 1960; Woodworth & Schlosberg, 1954). There is evidence of a non-linear relationship between stimulus intensity and subjective experience for pain (Hilgard, 1969). In suggested analgesia studies, then, the significance of an increase in tolerance, or threshold, of x number of units of intensity of the stimulus might, in terms of a difference in the subject's pain experience, not be the same for high and low suggestibility subjects whose waking thresholds and maximum tolerances are different. The knowledge necessary to deal statistically with such relativities simply is not available.

There are several studies in the suggested analgesia literature which could contain such confounding as was just discussed, if the degree of suggestibility-pain experience relationship holds up. The Shor (1962) study which is under discussion used a simulator design (Orne, 1954, 1971). The simulator design involves the use of subjects with a high level of suggestibility and subjects with a low level of suggestibility. The study obviously uses comparisons of the two groups under discussion here. Shor's data consisted of physiological measures which are several steps removed from the actual pain experience, even several steps removed from measures which are under discussion here, such as maximum intensity of stimulus tolerated or length of time tolerated. It is difficult even to speculate about the effect the problem under discussion might have had on data this far removed from

the subject's statement about his pain. It is noteworthy, however, that Shor's highly suggestible and unsuggestible groups gave quite different baseline, waking, poststimulus data. In the waking control condition the difference between the two groups in the effect of the shock on some of the physiological measures was marked. The significance of this difference between the two groups in their waking physiological response to the shock was not tested statistically and the report does not contain sufficient data to do so, but a difference in waking physiological response to the stimulus would appear to be consistent with the finding of a difference in waking maximum tolerance.

The McGlashon, et al. (1969) suggested analgesia data might also have been confounded by initial differences between the high and low suggestibility groups. If the form of the relationship for pain, between stimulus intensity and the subjective intensity, follows what has been postulated for loudness (Woodworth & Schlosberg, 1954, p. 239), pitch (Woodworth & Schlosberg, 1954, p. 241), or brilliance (Woodworth & Schlosberg, 1954, p. 245); i.e. ones graphed as positively accelerated or ogive curves, the effectiveness of the analgesia suggestions would be more striking than statistical treatment of the data indicated. The Sutcliffe (1961), study of suggested analgesia also could be vulnerable to the confounding under discussion but the report does not contain enough data to allow even speculation about the nature of the

confounding.

The solution to the problems of initial differences between groups in a simulator study or other study using highly suggestible and unsuggestible groups for the investigation of suggested analgesia, might lie in matching the groups on the basis of their waking pain measures scores. The intent of the design would be maintained but the initial differences problems eliminated.

Hypotheses

Because there is very little data on which to base predictions of the outcome of the study, the hypotheses will follow the findings of the Shor (1962, 1964) and the McGlashon, et al. (1967) studies. The following hypotheses have been developed:

1. Threshold for one or both types of pain will be positively related to level of suggestibility. (The finding of McGlashon, et al. was that the highly suggestible subjects had a higher threshold for ischemic pain.)
2. Tolerance for one or both types of pain will be negatively related to level of suggestibility (Shor's finding was that unsuggestible subjects had a higher tolerance level for electric shock.)

A possible synthesis of the two sets of results is that unsuggestible subjects have a broader range of tolerable pain

experience; i.e., a lower threshold and a higher tolerance. Therefore a third hypothesis has been developed:

3. Range (from threshold to maximum tolerance) will be negatively related to level of suggestibility.

Summary

It is proposed that the possibility that degree of suggestibility in hypnosis is related to aspects of pain experience, and the nature of such a relationship, if it exists, be explored. Two studies with differing results will serve as the take-off points and attempts will be made to synthesize or contrast the results of the two studies. Additional data can be gathered which is relevant to the relationships of pain from differing sources, and to the nature of the relationship between differing approaches to the assessment of suggestibility.

METHODS

Subjects will be 48 paid, male volunteers. Subjects will be required to be 18 years of age and free of any condition that might be compromised by the ischemic pain technique or the electric shock. Subjects will be recruited from several universities and colleges in the surrounding area by requests to the Psychology Departments, advertisements in the newspapers, and notices posted on bulletin boards. Subjects will be paid $5.00 per hour for their participation.

Pain Methods

Electric Shock

Because part of the purpose of the study is to attempt to reconcile the differences between the Shor (1962, 1964) and the McGlashon, et al. (1969) studies, the same techniques of producing pain will be used. Shor used electric shock in his study of hypnotic analgesia in which his subjects were allowed to set the intensity of the shocks they were to receive. They were asked to choose a level which would be quite painful but which would not cause them to become upset between shocks. Wattage was the measure of intensity. Much of this procedure will be incorporated into the proposed study. Shocks will be delivered from an American Electronic Laboratories model 1004, stimulator through an annular disc

electrode (Tursky, Watson, & O'Connell, 1965) attached to the dorsal surface of the non-dominant forearm. The delivery of electrical stimuli is known to reduce the skin resistance at the site of the electrode. Such a reduction across an experimental session causes a confounding because subjective experience of intensity is a function of both amperage, or voltage, and resistance. In a method advocated by Tursky (1974), the resistance is artificially lowered at the site of the electrode before the electrode is attached.

Determination of the threshold for pain was not part of the Shor procedure but it was the measure that differentiated the high and low suggestibility subjects in the McGlashon, et al. study. In order to allow comparison across pain methods threshold for pain from shock will be determined. Four ascending and four descending determinations will be done (Dember, 1960) using 0.3 ma step increases. Duration of all shocks will be 1-second. Response to each pulse will be made by the S by pressing one of two buttons: one indicating that pain was experienced and the other that pain was not experienced. The occurrence and intensity of each pulse and the subject's response will be recorded automatically on the subject's oscillograph record.

To determine the two maximum levels (maximum repetitive and maximum single pulse) the intensity will be increased in 0.5 ma steps until the subject presses the appropriate button to indicate the highest level he would allow to be pre-

sented to him repeatedly has been reached. The response will be indicated automatically on the subject's oscillograph record. The same procedure will be followed to determine the highest intensity the subject will allow to be delivered only once. Occurrence and intensity of the stimulus will again be recorded automatically on the oscillograph record.

Ischemic Pain

McGlashon, et al. (1969) used the ischemic pain or tourniquet technique. The method was originally devised as an experimental analog of angina pectoris (LaPlace & Crane, 1934; MacWilliams & Webster, 1923; Perlow, Markle & Katz, 1934) and intermittent claudication (MacWilliams & Webster, 1923; Lewis, Pickering & Rothschild, 1931; Perlow, et al., 1934). The pain occurs when muscles are exercised in the absence of blood flow (Benjamin, 1958; Elliot & Evans, 1936; Harrison & Bigelow, 1943; Horisberger & Robard, 1966; LaPlace & Crane, 1934; Lewis, et al., 1931; Perlow, et al., 1934). Two forms of the ischemia method exist. The original form, characterized by Beecher and his colleagues (Smith, Egbert, Markowitz, Mosteller & Beecher, 1966; Smith, Lowenstein, Hubbard, & Beecher, 1968) as the "maximum effort" technique, requires exercise of the ischemic muscle until intolerable pain developes. A modification, characterized by Beecher and colleagues as the "sub-maximum effort" technique, requires the execution of a specified number and type of contractions of the ischemic muscle, and a wait for the pain to develop.

Reliability coefficients, as such, are not available for the "maximum effort" technique. Criticism of the "maximum effort" technique has come from Smith and his colleagues and Beecher (Beecher, 1966; Smith, et al., 1966; Smith, et al., 1968). They found that pain from this method did not respond in expected ways to well studied doses of narcotic analgesics. They then continued their studies with the "sub-maximum effort" technique. By using the modification they got the expected dosage-response relationship (Beecher, 1966; Smith & Beecher, 1969; Smith, et al., 1966; Smith et al., 1969). Reliability coefficients of .61, .80, .85, and .91 for mild, moderate, severe, and intolerable pain respectively have come from test-retest data for the "sub-maximum effort" technique (Beecher, 1968).

Because of the apparently greater reliability of the "sub-maximum effort" technique, it will be used in this study, although McGlashon used the "maximum effort" technique.

The production of the ischemia is the same for both techniques. The subject is reclined on a bed or in a reclining chair and his non-dominant arm is drained of blood by raising it vertical to his body and then wrapping it in an elastic bandage from the ends of the fingers to slightly above the elbow. Leaving the bandage in place and the arm up, a blood pressure cuff is placed around the upper arm. The cuff is inflated to well above the subject's blood pressure level and left in place. Then the elastic bandage is removed and

the arm is lowered to the subject's side. At this point the "maximum" and "sub-maximum effort" techniques diverge in methodology. In the "sub-maximum effort" technique the subject squeezes a hand dynamometer 20 times with length of squeeze standardized at 2 seconds and the intervals between squeezes at 2 seconds. A metronome maintains the rhythm. A Stoelting, No. 19117, Smedley Hand Dynamometer modified to make the maximum pull equal 8 kg. will be used for the exercise. After the twenty squeezes the cuff is left in place and the subject waits quietly until the pain gradually builds to the intolerable point. Pain state reports are requested at irregular intervals during the waiting period. The measures standardly obtained are the lengths of time required to reach each of four levels of subjective report of pain; i.e., mild, moderate, severe, and intolerable. In this study requests for pain state reports will be made by turning on a light in the subject's view. The subject will respond by pushing the appropriate one of five available buttons and the response will be recorded automatically on the subject's oscillograph record. When the subject indicates pain has reached the intolerable level the cuff is removed. The pain ceases immediately. Times to reach each pain state level and a range measure of log time to move from mild to intolerable pain constitute the measures.

Suggestibility Determination

Determination of the degree of suggestibility in

hypnosis will be made by three means. The Harvard Group Scale (HGS:A) (Shor & Orne, 1962) will be administered and scores will be obtained according to the standard, objective criteria and also according to a modification to be described below. The motor section of Weitzenhoffer's Classical Suggestion Test (CST_m) (Weitzenhoffer, 1974) will be administered in waking and following the induction of hypnosis.

In a recent series of studies Weitzenhoffer has re-emphasized the traditional view that the "suggestion effect" involves, for the subject, a subjective experience of nonvoluntariness in his compliance with the communication from the suggestor. Standardized tests of suggestibility, such as the Stanford Hypnotic Susceptibility Scales (Weitzenhoffer & Hilgard, 1959, 1962) and the Harvard Group Scale (Shor & Orne, 1962), do not take into account in the scoring the voluntary-nonvoluntary aspect of the response. Weitzenhoffer has developed a means of measuring suggestibility which does take into account the subjective experience of nonvoluntariness. Using several variants of the "hands-moving-together" suggestion (Item 7, SHSS:A, Weitzenhoffer & Hilgard, 1959), he has developed the motor section of the Classical Suggestion Test (CST_m) (Weitzenhoffer, 1974). A 'passing' response requires both a sufficient observable response and an experience of nonvoluntary compliance.

The CST_m has three items. In the first, the communication to the subject regarding moving his hands together is

a single sentence, worded as a traditional suggestion placing the subject in a passive position; i.e., "When I next say 'Now' your hands will move toward each other and come together" (Now or N item). The second is worded as a command; i.e., "Bring your hands together" (Control, or C item). In the third task a standard repeated suggestion is given (SS item). As was said above, a 'passing' response requires both a specified amount of movement (three inches) and an experience of nonvoluntariness of the movement. The determination of the voluntary-nonvoluntary dimension of the response is made on the basis of an open-ended, non-directive, but standard questionnaire administered to the subject immediately after the completion of the three items. The percentage of subjects expected to 'pass' each item has been empirically determined (Weitzenhoffer, 1974) and, assuming that the percentage 'passing' indicates the difficulty of the item, graduated scores are assigned for 'passing' each item. Then there is a cumulation of the item scores for a total score for waking and a total for hypnosis. Such an approach to measurement assumes a single response dimension running through the SS, N, and C tasks; the latter two simply being harder forms of the SS task. The higher the score, then, the higher the subject's degree of suggestibility.

The items of the Harvard Group Scale of Hypnotic Susceptibility Form A (HGS:A) (Shor & Orne, 1962) will form the basis of the determination of hypnotic suggestibility in this

proposed study. The induction and most of the testing of suggestibility will be taped to ensure standard presentation. The Harvard Group Scale is easily modified for taped presentation to individual subjects. In order to allow the incorporation of the CST_m into this determination, Item 7 of the Harvard Scale will be replaced by the CST_m. The CST_m items are administered once before induction of hypnosis and once as the first of the test items after the induction of hypnosis. A questionnaire concerning subjective experience will be given after each administration of the CST_m. Then the Harvard Scale will be administered according to standardization (except omitting item 7), until the post-hypnotic suggestion is reached. Weitzenhoffer's modification (1974) of the Harvard Scale post-hypnotic suggestion will be used. In this modification the response required is moving the hands together to the signal word "Now" used in a sentence. This is followed by a repetition of the C item of the CST (see above). Following the testing and removal of the post-hypnotic amnesia, a questionnaire will be administered concerning subjective experience of the CST_m items. Scoring of the CST_m is as follows: Meeting the overt movement requirements and experiencing the movements as nonvoluntary are given scores of 1, 3, 5 and 3 points for the SS, N, C and PH items, respectively. The total score is a cumulation of the scores for individual items. Separate scores are given for the CST_m in waking and following the hypnotic induction.

two threshold measures (Thresh-S and Mild) and the four suggestibility measures are relevant to the first hypothesis. The twelve correlations between the tolerance measures (Tol-1, Tol-2, and Intol) and the suggestibility measures are relevant to the second hypothesis. And, the correlations relevant to the third hypothesis are the twelve between the range measures (R-1, R-2, and R-3) and the suggestibility measures. By using multiple regression it will be possible to determine the degree to which the suggestibility scores are predictable from a weighted linear combination of all the pain scores. One multiple regression will be done for each suggestibility measure. A further step in looking at the relatedness of the two sets of data (pain measures and suggestibility measures) is the calculation of a cannonical correlation. A cannonical correlation develops the maximum correlation possible between a linear function of one set of data (i.e., a weighted, linear combination of the 10 pain measures) and a weighted, linear function of a second set of data (i.e., a weighted, linear combination of the suggestibility measures). Finally, principle components analyses will be used to look at the nature of the relationships within the sets of data. One principle components analysis will be done for the pain measures and a second principle components analysis for the suggestibility measures.

Questioning about the nature of the Ss subjective experience will be continued with an open-ended questionnaire covering the remainder of the Harvard Scale items. Subjects will be asked, for example, "Tell me what you experienced when I told you that your hand was getting heavy and going down." Criteria for determining nonvoluntariness will be patterned after that used in the CST_m (Weitzenhoffer, 1974). Scores for both standard and modified Harvard Scale scoring are accumulations of single points for 'passing' responses on each item.

Procedure

For half the subjects (S-I Group) (24 Ss) the electric shock section will be done before the ischemia section, and for the other half (I-S Group) the opposite order will be used. Subjects will be alternately assigned to the two groups. Determination of degree of suggestibility in hypnosis will follow the pain parameters determination.

Statistical Analysis

Correlational procedures are thought to be the best statistical tools for evaluating the degree of linear relationships between sets of data which sample from entire spectrums of possible responses. Therefore, a matrix of intercorrelations of the 10 pain measures and the 4 suggestibility measures will be calculated. The eight correlations that result from calculating the degree of relationship between the

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APPENDIX B

PROTOCOL

Electrode Placement

1. Have S wash his hands with soap and water.

2. Have S be seated in recliner.

3. Take GSC electrodes in your hand and say:

   One of the things we are interested in looking at in people is their physiological response to the things that happen. These electrodes will carry electrical impulses from you to a machine in the other room. You will not feel anything from these electrodes.

4. Place GSC electrodes according to diagram. Prepare sites by rubbing briskly with acetone and alcohol on a gauze pad. Put electrode paste on prepared site and put electrodes in place. Secure with tape.



Dominant hand

5. Hold finger blood pressure (fp) apparatus and say:

   This apparatus will be used in measuring another aspect of your physiological functioning. First, I will tape this [indicate crystal] to your middle finger, and then I will put this on your finger over it [indicate cuff]. In a little while this cuff will inflate and remain inflated most of the time. I will occasionally deflate it to help keep your finger from 'going to sleep'. When it does deflate you could wiggle your finger if you want to.

6. Place crystal according to diagram and then put cuff in place and hook up crystal lead and air hose.

7. Say:

   I need to get a blood pressure reading before we begin.

Take blood pressure according to clinical procedure (cp).



Dominant hand

8. Have S recline recliner.

   Say:

   Now we are going to adjust the equipment and allow you to relax for a few minutes. No pain stimulus will ever occur as a surprise to you--you will be informed beforehand. So, just relax remaining as quiet as you can. I'll be back in 15 or 20 minutes.

Calibrate equipment and record skin conductance (sc) and fp for 15 minutes of relaxation.

9. Take blood pressure (cp).

Electric Shock

1. Put threshold template on response box.

2. Take shock electrode and say:

   This is what the electric shocks will come through. I will clean a spot on your arm and then put this stuff on it and work it into your skin. Then I will put the electrode on it and fasten it down.

3. Attach electrode: Clean a spot on the dorsal surface of the forearm with alcohol and acetone. Work Redux paste into the sponge soaking it thoroughly. Work Redux paste into the cleaned spot with finger for 30 to 45 seconds. Wipe surface of skin dry with gauze. Place electrode on the prepared site and test impedence of skin-electrode circuit. Repeat the rubbing and checking procedure until an impedence of 5000 to 6000 ohms has been obtained.

4. Say:

There are several parts to what we will do with the electric shock. The first thing is that I will give you some shocks of different strengths. Some of these you won't feel. You will feel some but they won't really be painful--more like prickles. Each time you feel something, but it isn't painful, indicate it is not painful by pressing the button marked 'NONE'. When you receive impulses that you would classify as painful, press the button marked 'PAIN'. That is press 'NONE' when you feel something that is not yet painful, and press 'PAIN' when you feel something that is painful.

5a. Deliver shocks of 1-sec. duration beginning at 1.0 ma, increasing the intensity in 0.3 ma steps until 2 consecutive pain responses have been given. Give that intensity a second time and start down decreasing in 0.3 ma steps until 2 consecutive no-pain responses have been given. Give that intensity twice and begin increasing as before. Do four ascending and four descending series.

b. Set interstimulus intervals on the timer as follows:

29, 24, 36, 17, 38, 38, 30, 25, 33, 25

6. Throughout threshold determination record SC and fp.

7. Place maximum tolerance template on response box and say:

This is the second part of the shock section. Now, I'm going to let you set the strength for some shocks I will give you later. They should be strong enough so that they are quite painful, but not so painful that you will be upset in the interval between shocks. Okay, then, the shocks will start again and increase in strength until we get to the strength that you want to choose as your level. Indicate this by pressing the button marked 'H-1'. You are to choose the highest shock you can take being given repeatedly without getting upset between shock. Press 'H-1' when we get there. [Answer any questions with a paraphrase of the above]

8. Set timer for the following sequence:

21, 24, 38, 25, 33, 28, 30, 24, 39, 29

9. Deliver shocks--duration 1-sec.--increasing intensity in 0.5 ma steps from S's threshold to 'H-1'.

10. Record SC and fp.

Take blood pressure

11. Take blood pressure (cp) and say:

    This is the third part of what we do with the electric shock. We are going to continue on from where we just stopped on the scale of increasing strength. This will continue until they get so bad that you absolutely don't want it to go any higher, even for just one shock. Then press 'H-2'. Okay, we will go on up until you say no more, not even once. Then press 'H-2'.

12. Continue delivering shocks in 0.5 ma increments until S presses 'H-2'. Use 1-sec. duration.

13. Set following intervals on timer:

    33, 24, 39, 24, 39, 28, 40, 23, 33, 25

14. Record SC and fp.

S-I Order

15. Take blood pressure (cp).

16. Remove shock electrode and say:

    Actually we will not use the shock you chose as 'H-1'. This is all for the electric shock part. Relax now for a while before we go on to the part with the other pain. You will not be surprised by any pain causing stimuli.

17. Record 10 minutes of post-stimuli relaxation. Take blood pressure (cp).

I-S Order

15. Take blood pressure (cp).

16. Remove shock electrode and say:

    Actually we will not use the shock you chose for 'H-1'. This is the end of the pain section.

17. Remove all electrodes and say:

    You may get up and walk around, get a drink, or whatever you want to do for 10 minutes before we start the hypnosis part.

Ischemia

1. Put ischemia template on response box. Mild, mod., etc.

2. Say:

Let me explain this part of the experiment to you. The procedure involves the principle of ischemic muscle pain. The technique we are using here is widely used by psychologists and has been shown to be completely safe. What I will ask you to do in a moment is to hold your left hand over your head while I wrap it in an ace bandage in order to drain any excess blood from your arm. After a minute, I shall place a blood pressure cuff on the upper part of your arm and inflate it to the point where the blood flow will be temporarily cut off. In other words, it will be like a tourniquet. Then, when you lower your arm, I will ask you to exercise your hand briefly. After that, you will just remain with your arm relaxing on the arm of the chair.

As the experiment proceeds, you may feel any or all of a number of sensations in your arm. When you first lower your arm after the blood pressure cuff has been inflated, your arm will feel essentially the same as it always did, with the exception that you will be aware of the pressure of the cuff. As we continue, you will notice a gradual change in sensation. What you feel at this point is difficult to describe because it varies from subject to subject. For some it is a tingling sensation or a feeling of numbness. For others it feels like the onset of fatigue, or weakness; and for still others the sensation is unpleasant. There is a gradual buildup of discomfort, something like a mild muscle cramp. Most often, subjects feel a mixture of these sensations. However, at some point, you will begin to perceive these sensations as being painful, and your arm will start to hurt. Finally as you can guess, the pain will reach its maximum tolerable limit. I would like you to keep the tourniquet on as long as possible, but when you have reached the point where you absolutely do not want to go any further, let me know, and we will immediately terminate this part of the experiment. Okay? Any questions?

3. Hold exerciser and say:

This is what you will exercise your hand and arm with. There will be a metronome going. In time with it, I will say 'squeeze' and 'release'. When I say 'squeeze' squeeze it completely and hold until I say 'release'. On 'release', relax until I say 'squeeze', etc. After the 20th relax period, you will stop

exercising and wait as the pain begins and increases until it becomes intolerable. When the cuff is released the pain goes away immediately. I have done it myself and nothing is left but, perhaps, a slight ache which will go away in a short time.

4. Set metronome in action at 1 beat per second. Say 'squeeze' and 'release' in time with the metronome: 'squeeze' 2 seconds and 'release' 2 seconds. Observe S closely and reinstruct if necessary. Allow several cycles as necessary.

5. Say:

Several times during the time the pain is mounting this light will go on--[indicate]. When it does you are to evaluate the pain you feel and press the appropriate one of these buttons to indicate how much you have: none, mild, moderate, severe, intolerable--[indicate buttons as you talk]. For example, the first time the light comes on after you begin to experience pain, push 'MILD', and so forth. It is possible that you will begin to experience pain before the end of the exercise period. If you do, say so verbally. You continue to evaluate your pain whenever the light comes on until it becomes intolerable. When it does become intolerable push that button <u>whether the light has come on or not</u>. Then I will come and release the cuff.

6. Raise the S's non-dominant hand in the air toward the ceiling. Wrap tightly with the elastic bandage from fingertips to just above the elbow. With the arm still raised (be sure S doesn't lower it while you are getting the cuff). Place blood pressure cuff in position for clinical appraisal of blood pressure. Remove elastic bandage and return the arm to the S's side.

7. Set metronome in action. Count 20 cycles--squeeze 2 seconds, release 2 seconds--at the end of the 20th relax tell S to stop exercising and take exerciser from S.

8. Record SC and fp.

9. Pain state reports: Illuminate signal light at irregular intervals varying around 20 seconds.

S-I Order

10. When intolerable level is reached remove cuff and say:

Just relax now for a few minutes. This is the end of the pain section.

11. Take blood pressure (cp).

12. Remove electrodes and say:

    You may get up and walk around, get a drink or whatever you want to do for 10 minutes before we start the hypnosis part.

I-S Order

10. When intolerable level is reached remove cuff and say:

    Just relax now for a few minutes before we go on to the other type of pain. You will not be surprised by any pain so just relax.

11. Take blood pressure (cp).

12. Record SC and fp for 10 minutes.

Classical Suggestion Test

Condition W

1. Ask S to sit in the subject chair. As soon as S appears settled say:

   We are ready for the hypnosis part; however, first I will do one thing with you before I hypnotize you. Would you close your eyes and keep them closed until I tell you otherwise. . . . Raise your hands and arms straight ahead in front of you. . . . That's it, hold them out parallel at shoulder level, palms facing, about a foot apart. . . . When I next say "NOW" your hands will move toward each other and come together. . . . All right, "NOW". Allow 10 seconds.

   a. If no movement or less than a total of 3", tell S to bring his hands together and down. Go on to 2. (Control)

   b. If movement appears any time before 10" period is up, allow 10" from that point on before saying, if hands moved 3" or more but have not touched: "Bring your hands together and down . . . and relax." Go on to 2. (Control)

2. Say:

Bring your hands up again as you just did, straight out in front of you palms facing. . . . Fine, now bring them together. . . . That's good. You may bring your hands down again and relax . . . Go on to 3.

3. Say:

Raise your arms and hands again straight ahead of you. . . . That's it, hold them out parallel at shoulder level, palms facing, about a foot apart. . . . Now listen closely to what I say. Keep your attention on my words . . .

(a) Your hands are going to move toward each other and come together . . . (b) Soon your hands are going to start moving . . . (c) They are going to move toward each other and come together . . .
(d) Your hands are beginning to feel like they want to move toward each other . . . (e) You are starting to feel the beginning of a movement . . . (f) Your hands are going to move toward each other . . .
(g) They are beginning to move toward each other . . .
(h) Your hands are moving toward each other . . .
(i) They are moving . . . moving . . . moving toward each other . . . closer . . . moving closer . . . closer toward each other . . . closer . . . closer . . .
(k) Wait 10" without saying anything more.

Instructions for Administration and Scoring of Above. The material being suggested is divided into four main fractions and further subdivided within all but the last. Administer Fraction I. If any movement starts anywhere prior to its end, stop talking and do not resume unless movement stops. If movement continues without further suggestions, allow 10" to pass before proceeding to Step b. If, on the other hand Fraction I fails to elicit continued motion, pass on to Fraction II, then III and IV if necessary. In each case proceed as indicated for the first fraction. If at all possible try to note where in the passed fraction S began his response. In any case take note of the first fraction in which the adequate response began.

This manner of proceeding will apply to all other parts of this experiment to which they are obviously applicable and will not be repeated for these.

a. If no movement in last fraction, or less than a total of 3", tell S "That's all right. Bring your hands together and down . . . and relax." Go on to 4.

b. If hands have moved 3" or more in any fraction, but have not touched consider fraction as passed, insofar as movement is concerned and say: "Bring your hands together." Go on to 4.

4. Say: "You may open your eyes now."

5. CST questionnaire (1-2).

6. Go to condition H.

Condition H

1. Say:

Before I hypnotize you I want to say that a few of the instructions I will give you in the course of this part of the experiment will sound very much like those you were given earlier. In carrying out these instructions try not to let yourself be influenced by what you did or did not do then. That is, don't feel you are expected to perform or not perform the same way you did earlier. Just do what seems most natural to you to do at the time the instructions are given.

2. Induction of hypnosis: Harvard Group Scale (on tape).

3. Say:

Raise your arms and hands straight out in front of you (about a foot apart), palms facing each other. When I next say "NOW" your hands will move toward each other and come together. . . . All right, "NOW." Allow 10 seconds for the movement to appear.

a. If no movement or less than a total of 3", tell S to bring his hands together and down. Go on to 4. (Control)

b. If movement appears any time before 10" period is up, allow 10" from that point on before saying, if hands moved 3" or more but have not touched: "Bring your hands together and down . . . and relax." Go on to 4. (Control)

4. Say:

Bring your hands up again as you just did, straight out in front of you palms facing. . . . Fine, now bring them together. . . . That's good. You may bring your

hands down again and relax. . . . Go on to 5.

5. Say:

Raise your arms and hands again straight ahead of you. . . . That's it, hold them out parallel at shoulder level, palms facing, about a foot apart. . . . Now listen closely to what I say. Keep your attention on my words . . .

(a) Your hands are going to move toward each other and come together . . . (b) Soon your hands are going to start moving. . . . (c) They are going to move toward each other and come together . . .
(d) Your hands are beginning to feel like they want to move toward each other . . . (e) You are starting to feel the beginning of a movement . . . (f) Your hands are going to move toward each other . . .
(g) They are beginning to move toward each other . . .
(h) Your hands are moving toward each other . . .
(i) They are moving . . . moving . . . moving toward each other . . . closer . . . moving closer . . . closer toward each other . . . closer . . . closer . . .
(k) Wait 10" without saying anything more.

6a. Say:

I am going to ask you some questions. You will be able to answer these questions and remain just as deeply hypnotized as you are now. Remaining hypnotized then . . .

b. Questionnaire (3 & 4).

7. Continue with Harvard Scale (on tape).

Harvard Scale

1. Do items 3a-6a and 8a-10a (on tape).

2. Modified PH suggestion (on tape).

3. Continue termination (on tape).

4. Testing PH
When subject opens his eyes say:

How do you feel? Do you feel wide awake? (Proceed as necessary) Would you raise your arms and hands straight out in front of you . . . palms facing . . . hands about a foot apart.

1st Now--say: "Now let's try something else . . ." (allow 10". If hands have not started to move go to 2nd now.)

2nd Now--say: "When I next say 'Now' your hands will move toward each other and come together" (allow a few seconds. If hands have not started to move go on to 3rd now.)

3rd Now--say: "All right, 'Now'."

5. $Control_2$

Say:

Raise your arms and hands again straight ahead in front of you, palms facing, hands about a foot apart. O.K., bring your hands together. . . . You may put them down now.

6. Questionnaire (5).

7. Test amnesia.

8. Questionnaire
CST (6-9)
Expanded (all).

Beckman, Type RM, Dynograph

Dial Settings

Channel 1--Finger systolic blood pressure
From a Winston Blood Pressure Follower through a Statham P23-series blood pressure transducer and a Beckman, Type 98 53 A, Voltage/Pulse/Pressure Coupler

+/off/-: at -
vol./pulse = DC
5 mv/cm x .1
3

Channel 3--Monitor of output of stimulator
Type 9806 A, AC Coupler
DC
1v/cm x 1
3

Channel 4--Galvanic Skin Conductance
    Type 9844 Skin Conductance Coupler
        1mv/cm x .1
        3

Channel 5--Response Box
    Type 9806A, AC Coupler
        DC
        5 v/cm x 1
        3

APPENDIX C

QUESTIONNAIRES

CST Questionnaire

Harvard Scale Modification Questionnaire

SUBJECT NO._____

Name of S:_____

SUMMARY OF W and H

Waking	Hypnosis
N	N
C	C
S	S
	PH
	C
I	II

HGS:A Score_____

CST-W Score_____

CST-H Score_____
with PH & C_2_____

Code:

/ "Suggestion"

X "Voluntary"

\- No (Overt Criterion) Response

\+ Some Subjective Effects but no overt criterion response.

NOTE TO SCORER: The "No Criterion Overt Response" (-) category is the same as the "No Response" category of the Summary W-H form 571. These are Ss who either produce no overt response or one less than the 3 inch criterion, notwithstanding possible subjective experience being present.

SUBJECT_____

1a. If S does not respond, say: "You have just had three opportunities of moving your hands toward each other. I would like for you to tell me in your own words what you experienced in each situation."

1b. If S responds, say: "You have just had three opportunities of experiencing the movement of your hands toward each other (while hypnotized). I want you now to compare your experience of this movement on each of these three occasions. . . . That is, tell me whether or not you experienced the motion of your hands the same way each time. Were there differences?"

[With some Ss it may be necessary to remind them what the tasks consisted of. In this case it will be best to remind them first of task No. 1 and No. 2 and let them make the comparison for these two, then if still necessary remind them of task No. 3 and get comparison with task No. 2 (and possibly with task No. 1). Questions c through e aim to supplement the above general question.]

1c. "Well, comparing the first (third) and second time, did you do anything different to bring about the movements?"

1d. "Well, comparing the movements of your hands the first (third) and second time, did the movements seem different in any way?"

1e. "Did your hands and arms feel the same each time?"

2. IF S EXPERIENCED ANY SUGGESTION EFFECT, then say:

Remember how you told me that you experienced . . . [paraphrase or quote S accordingly]?. . . . What about when I asked you to bring your arms up?. . . . Well, did you experience anything like that when I asked you to bring your arms and hands up?" . . .

3a. If S does not respond, say: "You have just had three opportunities of moving your hands toward each other. I would like for you to tell me in your own words what you experienced in each situation."

3b. If S responds, say: "You have just had three opportunities of experiencing the movement of your hands toward each other (while hypnotized). I want you now to compare your experience of this movement on each of these three occasions. . . . That is, tell me whether or not you experienced the motion of your hands the same way each time. Were there differences?"

[With some Ss it may be necessary to remind them first of task No. 1 and No. 2 and let them make the comparison for these two, then if still necessary remind them of task No. 3 and get comparison with task No. 2 (and possibly with task No. 1). Questions c through e aim to supplement the above general question.]

3c. "Well, comparing the first (third) and second time, did you do anything different to bring about the movements?"

3d. "Well, comparing the movements of your hands the first (third) and second time, did the movements seem different in any way?"

3e. "Did your hands and arms feel the same each time?"

4. IS S EXPERIENCED ANY SUGGESTION EFFECT, then say:

Remember how you told me that you experienced . . . [paraphrase or quote S accordingly]?. . . . What about when I asked you to bring your arms up?. . . . Well, did you experience anything like that when I asked you to bring your arms and hands up?" . . .

CONDITION H ONLY (Re p.h. experience). Done before amnesia is removed, after the final control and regardless of whether or not S passed.

5. a. Say to S: "You have just moved your hands together twice. I want you to compare your experience both times. Did you notice any differences between them?"

b. "Well, did you do anything different in bringing about the movement?"

c. "Well, did the movements seem different in any way?"

d. "Did your hands and arms feel the same each time?"

CONDITION H ONLY (Re p.h. experience). Done after p.h. amnesia is removed.

6. Say:

Remember how earlier in the experiment today the first three things I had you do sometime after you closed your eyes was to ask you three times to extend your two arms and hands straight out?. . . . Do you remember what happened then in each case?. . . . "[If necessary help S to answer--but do this as little as possible.] . . . Fine. . . . Do you also remember how after I told you to open your eyes and be wide awake I asked you again to extend both your arms and hands straight out?. . . . Do you remember what happened next? (Well, did you just stay that way? . . ., etc. . .) . . . OK. . . . Was your experience this fourth time like any of the others. . . . What about the fifth time? Was it like any of the others?

a. "Well, comparing the first (etc.) and this fourth (or fifth) time did you do anything different to bring about the movements?"

b. "Well, comparing the movements of your hands the first (etc.) and fourth (or fifth) time, did the movements seem different in any way?"

c. "Did your hands and arms feel the same each time?"

CONDITION H ONLY, --AND FOR THOSE WHO EXPERIENCED ANY SUGGESTION EFFECT.

7. Remember how you told me that you experienced . . . [paraphrase or quote subject accordingly]?. . . . Did you have this sort of experience at any other time during the session with me, that is other than those we already discussed?. . . . What about when I asked you to . . .

   a. Bring your fingers together and interlock them?

   b. What about when I asked you to raise your left arm up?

   (c. I asked you to do that twice. . . . What about the other time? . . .

   d. What about when I asked you to raise both your arms up after I woke you up?

CONDITION H ONLY (Re p.h. experience) Follows and only if no amnesia.

8. a. IF S DOES NOT pass, say:

As you recall, just before I woke you up I told you that your hands would move together the next time I used the word "now" again? Can you recall when it was that I first used the word "now" after you woke up?"

b. If S PASSES BUT NOT on the first use of "Now". Say:

As you recall, just before I woke you up I told you that your hands would move together the next time I used the word "now" again? Instead, you moved your hands together only after I used the word "now" two (three) times. That's all right, but do you have any idea why this was so?

9. (Comparison across conditions W and H). Say:

I realize that the questions I am going to ask you will sound an awfully lot like those you have already been asked. I hope you will bear with me. These questions are actually being asked each time in a somewhat different context. This time you will be comparing your experiences before you were hypnotized with those while you were hypnotized. So remember, a little while ago the first thing I had you do was put your hands and arms out three times and did something similar to what we <u>just</u> did. Was there any difference in your experiences then as compared to what you experienced later? [If necessary have S make comparisons pairwise by specifying the trials to be compared.]

QUESTIONNAIRE FOR MODIFIED SCORING OF HARVARD GROUP SCALE

To be administered in waking, following removal of amnesia.

For 1, 2, 3 say: "Would you tell me what you experienced when I talked about [specify item]."

1.

2.

3.

For 4, 5, 6, 8, 10 say: "Would you tell me what you experienced when I told you [specify for each item] and then asked you to [specify for each item]

4.

5.

6.

8.

10.

For 9 say: "What about the fly? How real did it seem to you?"

For 12 say: "What did you experience when I told you that you would not remember anything?"

"What did you experience later when I asked you to tell me everything that had happened since you began looking at the target?"

"What did you experience when I told you that you could remember?"

If sufficient information is not elicited by previous procedure and

a. S has described a "suggestion effect" on CST say: "Using your experience of [repeat S's description of "suggestion effect"] when you were putting your hands together as an example . . . did you have that kind of an experience at any other time during the experiment?"

When necessary ask specifically about individual items.

b. If S has not described "suggestion effect" on CST say:

I want to be sure that I get your ideas here and not my own, so be sure to express your disagreement if you do disagree. Many people report the following kinds of experiences when they are given suggestions: 'my hands moved by themselves', 'I did not make it happen', 'it just happened', 'it felt like a magnet was pulling my hands', 'I did not want my hands to move but they did anyhow', 'I did not control the movement'. Would one of those phrases describe your experience at any time during the experiment?"

Mark each item according to the following scheme:

✓ both observed and subjective sufficient

x observed only sufficient

\+ subjective only sufficient

\- neither observed or subjective sufficient

1.	5.	9.
2.	6.	10.
3.	7.	11.
4.	8.	12.

APPENDIX D

SCHEMATIC OF ORDER OF PRESENTATION OF EXPERIMENTAL PROCEDURES

APPENDIX D

Schematic of Order of Presentation of Experimental Procedures

S-I Order

Pain parameters determination
- Electric shock
- 10 minute rest period
- 'Sub-maximum effort' ischemia

10 minute rest

Suggestibility determination
- Waking CST
- Induction of hypnosis
- Hypnosis CST
- Harvard Scale & questionnaires

I-S Order

Pain parameters determination
- 'Sub-maximum effort' ischemia
- 10 minute rest
- Electric shock

10 minute rest

Suggestibility determination
- As above

APPENDIX E

CORRELATION MATRIX

APPENDIX E

11 x 11 Correlation Matrix - All Measures

Measures	Correlations										
	Thresh-S	Tol-1	Tol-2	Mild	Mod	Sev	Intol	CST-W	CST-H	HS-S	HS-M
Thresh-S	--	0.6796	0.5116	0.023	0.4890	0.3395	0.2576	-0.0796	0.0989	0.170	0.1357
Tol-1		--	0.7453	0.3651	0.6442	0.5259	0.3745	-0.0749	0.2930	0.151	0.1669
Tol-2			--	0.2617	0.5153	0.4481	0.3642	-0.1254	0.2193	0.1640	0.1578
Mild				--	0.7346	0.6140	0.4114	0.0221	0.2799	-0.0710	0.0439
Mod					--	0.8352	0.5672	-0.0269	0.2397	0.0150	0.0066
Sev						--	0.7507	-0.0008	0.2318	0.0840	0.0758
Intol							--	0.1397	0.2904	0.0960	0.1041
CST-W								--	0.4049	0.1660	0.1466
CST-H									--	0.4170	0.4335
HS-S										--	0.9701
HS-M											--

APPENDIX F

LIST AND DEFINITION OF MEASURES

APPENDIX F

List and Definition of Measures

Electric Shock

Thresh-S	Threshold, or point at which subject reported pain 50% of the time; 4 ascending and 4 descending trials
Tol-1	Highest intensity the subject could receive repeatedly and not get unduly upset between shocks; Shor's measure
Tol-2	Highest intensity the subject would allow to be delivered to him only once
R-1	Tol-1 minus Thresh-S
R-2	Tol-2 minus Thresh-S

Ischemic Pain

Mild	Time at which subject began reporting mild pain
Mod	Time at which subject began reporting moderate pain
Sev	Time at which subject began reporting severe pain
Intol	Time at which subject reported an intolerable level of pain
R-3	Intol minus Mild

Suggestibility

CST-W	The Classical Suggestion Test administered in waking
CST-H	The Classical Suggestion Test administered following an induction of hypnosis
HS-S	Harvard Scale: standard scoring
HS-M	Harvard Scale: modified scoring