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HYPNOTIC DEPTH AND BASAL SKIN RESISTANCE

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Abstract: This study investigated the relationship between a self-report scale for measuring the depth of the hypnotic state and basal skin resistance (BSR). 10 *S*s participated in 2 training and 2 experimental sessions each, and BSR was recorded during the latter two sessions. The self-report depth scale accurately predicted the occurrence of hypnotic dreaming and amnesia, traditional criteria for medium and deep hypnotic states. BSR showed a high, positive correlation with the self-report depth scale. Although the study was exploratory in nature, the data suggest that both the self-report depth scale and BSR may be useful measures for detecting changes in the depth of the hypnotic state, and encourage further research.

The present investigation studied the relationship between a self-report scale of hypnotic depth and basal skin resistance (BSR). The electrical resistance of the skin during hypnosis has been investigated in a number of earlier studies (Barber & Coules, 1959; Brown & Vogel, 1938; Davis & Kantor, 1935; Dynes, 1932; Estabrooks, 1930; Levine, 1930a; Levine, 1930b; Sears & Beatty, 1956; Shor, 1962a; West, Niell, & Hardy, 1952), as well as a related measure, the direct current potential of the skin (Friedman, Becker, & Bachman, 1962; Ravitz, 1950; Ravitz, 1951). These studies have recently been reviewed elsewhere (Barber, 1961; Crasilneck & Hall, 1959; Shor, 1962a). In general, the present writer agrees with Shor (1962a) that methodological differences between the studies, as well as inadequate reporting of procedures, make it quite difficult to draw any firm conclusions about the relationship between hypnosis and BSR. Also, some of these studies tended to treat hypnosis as if it were an "all-or-none" phenomenon rather than one possessing a dimension of "depth."

Because of the complexity of the concept of hypnotic depth, as used in the literature (Shor, 1962b), there will be no attempt in this paper to decide just what "hypnotic depth" or "hypnosis" are. Rather, these concepts will be defined operationally by the procedure described below.

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The investigator's own concepts, which were the basis of the procedures described below, were that a deeply hypnotized *S* is, unless specifically instructed otherwise: (a) physically relaxed; (b) mentally calm and thinking of nothing; and (c) highly suggestible. Such conceptions are found in a multitude of studies of hypnosis.

LeCron (1953) introduced a novel technique for rapidly assessing the depth of hypnosis by means of the *S*'s own verbal estimate of depth. He instructed his hypnotized *S*s to think of hypnotic depth as extending along a continuum which could be measured on a zero to 100% scale. Zero was defined as complete wakefulness and 100% as an extremely deep hypnotic state. LeCron stressed to his *S*s that, when asked for their hypnotic depth, a number would instantly flash into their minds and they would report it to the operator immediately. No conscious deliberation was to be involved. The *S*s were told that these numbers originated in their "unconscious minds."

LeCron felt that this technique, while theoretically questionable, was very accurate in practice, and could replace conventional behavioral tests of hypnotic depth.

Hatfield (1961) has seriously criticized LeCron's technique. She found that its rank order correlations with hypnotic depth measured by the Stanford Hypnotic Scale (Weitzenhoffer & Hilgard, 1959) ranged from only .21 to .37 for her group of *S*s. While these values are *statistically* significant, they are far too low to warrant abandonment of behavioral depth tests. Indeed, a higher correlation (.44) with the Stanford Scale was obtained from the *S*s' conscious estimates of their hypnotic depth after they had been dehypnotized.

In one respect Hatfield's study did not adequately test LeCron's technique. LeCron conceived of the hypnotic state as capable of rapid fluctuations in depth. Hatfield, by only taking two depth estimates from each *S* during the hypnotic state, may not have obtained an adequate sample for evaluating LeCron's scale.

Hatfield speculated that one reason for the poor accuracy of LeCron's technique might have been that it was not clearly enough defined to the *S*s, especially in the middle range of values. The present writer also suspected this and, in addition, felt that LeCron's scale would probably be more useful for detecting sudden fluctuations in hypnotic depth than for assessing its "absolute" value.

The present study consists of a portion of the data of a project comparing hypnotic and nocturnal dreams (Tart, 1962) in which a modified version of LeCron's scale was used. In explaining the scale to the hypnotized *S*s, the analogy of measuring depth with a yardstick, instead of

percentages, was used, as suggested by LeCron.[2] The following scale values were suggested to the hypnotized *S*s: (a) from 1 to 12 is a state in which you feel very relaxed and detached, and your arm can rise up or rotate if suggested; (b) a depth of 20 or greater is required for your hand to become numb; (c) a depth of 25 or greater is required for you to experience a dream while in hypnosis; and (d) a depth of 30 or greater is required for you to develop amnesia for the events of the hypnotic state. No upper limit was set on the scale, although depths greater than 30 were not required of the *S*s. As with LeCron's original scale, it was stressed to the *S*s that their replies to the question, "Trance depth?" would be virtually instantaneous and not the result of conscious deliberation.

Because the present study was not primarily oriented toward evaluating the self-report depth scale, certain desirable controls were omitted which would have made the interpretation of the results clearer. Because of the consistency of the results found, however, the study is presented to illustrate the promise of the technique employed.

Method

In order to select potentially good hypnotic *S*s, tests of arm levitation were administered to 345 undergraduate students enrolled in the introductory psychology course at the University of North Carolina in the fall semester of 1961. They were tested in groups of 20 to 30, and reported their reactions to the test on a questionnaire. Eleven male *S*s were finally selected who: (a) reported that their arms rose during the test; (b) were very interested in participating in the study; (c) recalled dreaming once per week or oftener; and (d) did not seem seriously maladjusted, as judged by their profiles on the Minnesota Multiphasic Personality Inventory.

These 11 *S*s were each given two individual training sessions in order to familiarize them with the hypnotic state and train them to enter it quickly. The hypnotic technique in the training and later experimental sessions was generally permissive, and the *S*s were not challenged to resist any of the suggestions.

In the first training session the procedure was: (a) induction of hypnosis by arm levitation technique; (b) arm rotation in response to suggestion; (c) illusion of one hand becoming warm and the other becoming cold; (d) glove analgesia; (e) dreaming about taking a walk in the country and describing the dream to the *E* after it had ended; (f) explanation of the depth scale to the *S*; (g) suggestions to facilitate the induction of hypnosis in the next session; (h) suggestions of posthyp-

[2] LeCron, L. M. Personal communication, 1957.

notic amnesia; and (i) dehypnotizing the *S* by slowly counting backwards from the last number reported for hypnotic depth, along with general suggestions to reorient the *S* to the waking state.

In the second training session, approximately one week later, the procedure was: (a) induction by arm levitation technique; (b) review of the depth scale; (c) suggestions to deepen the hypnotic state until the *S* gave a report of 30 or greater; (d) suggestions that the *S* would be hypnotized almost instantly in future sessions when the *E* gave a certain signal; (e) suggestions that the *S* would dream about anything he wished for a few minutes and then describe the dream to the *E*; (f) dreaming about a short narrative read by the *E* and subsequently describing the dream; (g) same as step e; (h) same as step d; (i) suggestions of amnesia; and (j) dehypnotizing the *S* in the manner previously described.

Suggestions for deepening the hypnotic state were intermixed with all the procedures of the training and experimental sessions.

After successfully completing the training sessions, each *S* participated in two experimental sessions, the Hypnotic Dream Session (HDS) and the Sleep Dream Session (SDS). These sessions were approximately one week apart, with five *S*s participating in the HDS first and five others in the SDS first. The eleventh *S* was dropped from the study after his first experimental session, but his performance will be reported separately below because of some features of special interest.

For the HDS the *S* reported to the laboratory at eight P.M. and a number of electrodes were applied for measuring his electroencephalogram and eye movements. A pure, zinc electrode of three square centimeters area was applied to the sole of each foot with zinc sulphate paste, and BSR was measured continuously through these electrodes with a Fels model 22A Dermohmmeter, using a constant *S* current of 70 microamperes. The output of the Dermohmmeter and the other physiological measures, not reported on here, were recorded on an Offner polygraph at a paper speed of 2.5 millimeters per second.

The *S* lay upon a bed and was hypnotized by means of the previously suggested signal. Then: (a) suggestions for deepening the hypnotic state were given for at least five minutes; (b) depth reports were obtained and the hypnotic state deepened until a depth of 30 or greater was reported; (c) arm rotation; (d) glove analgesia was induced and the *S* was pinched with a sterile, spring-loaded clip for 10 seconds; (e) the signal for rapid hypnotic induction was reinforced; (f) a tape recorded narrative was played for the *S* and he dreamed about it immediately (the narrative placed the *S* in an anxiety-inducing situation); (g) the *S* was dehypnotized, as previously described, without suggestions of amnesia; (h) the *S* described his dream; (i) the *S* was rehypnotized by means of the sig-

nal; (j) the hypnotic state was deepened until a report of 30 or greater was obtained; (k) amnesia for the entire experimental session was suggested; and (l) the *S* was dehypnotized, as previously described.

The *S* reported to the laboratory at 10 P.M. for the SDS, and the procedure was identical with that of the HDS through step e. The recorded narrative was then played but the *S* was told not to dream about it until he was naturally asleep that night. Amnesia was suggested and the *S* dehypnotized. He then slept through the night in the laboratory.

The 10 *S*s were seen as a group for a final session. Their amnesia for the experimental sessions was checked, then all were simultaneously hypnotized and the amnesia removed. They were warned not to allow themselves to be hypnotized by unqualified persons. After being dehypnotized the design of the study was explained to them.

More details concerning the procedure may be found in the original study (Tart, 1962).

Results

Two behavioral criteria of hypnotic depth were tested frequently enough to allow comparison with the self-report depth scale, viz. hypnotic dreaming and posthypnotic amnesia. At least a medium depth of hypnosis is necessary for dreaming to occur (Mazer, 1951), and the depth scale required the *S*s to be at a depth of 25 or greater in order to dream. The 50 suggestions to dream in hypnosis were all given at a depth of 25 or greater, and were successful in all cases. Insofar as hypnotic dreaming is a reliable criterion of the hypnotic state's being medium or deep, the self-report depth scale was an excellent predictor of the presence of a medium or deeper hypnotic state.

Posthypnotic amnesia is a traditional criterion of the deep hypnotic state. The *S*s of the present study should have manifested amnesia if they reported a depth of 30 or greater during the amnesia suggestions. Table 1 presents the data on amnesia for the 40 training and experimental sessions. The predictions from the self-report depth scale were correct in 82% (32/39) of the cases. It might also be argued that the case in the third row of the table was correct, as the amnesia was complete immediately following hypnosis, and that the case in the fourth row should not be counted, as the critical depth report was not "virtually instantaneous." If these arguments are accepted as valid, the predictions were correct in 87% (33/38) of the cases. The other failures of prediction were not gross errors, and it should also be noted that three of these five errors were from one *S* (B).

In order to ascertain the course of BSR throughout the hypnotic sessions for the group as a whole, BSR (in kilohms) for all 10 *S*s was aver-

TABLE 1
Amnesia and Hypnotic Depth

Number of Cases	Outcome
31	Depth ≥30, amnesia was + immediately after hypnosis and, when tested, + at next session.
4	Depth ≥30, amnesia immediately following hypnosis was <+ but not −, and, when tested, was at the same or a better level in the following session.
1	Depth ≥30, amnesia was + immediately following hypnosis, but ½+ at following session.
1	Depth ≥30, amnesia was + immediately following hypnosis, but − at following session. But experimenter's impression at the time was that *S*'s depth estimates were inaccurate, as they were given too slowly.
1	Depth = 29, amnesia was + immediately following hypnosis, but ½+ at following session.
1	Depth = 25, amnesia was − immediately following hypnosis and − at following session.
1	Amnesia was not induced due to time pressure.

Note: + indicates complete amnesia; ½+ indicates partial amnesia; − indicates no amnesia at all.

aged at each of the following times: (a) start of hypnotic induction; (b) just prior to arm rotation; (c) lowest BSR immediately following arm rotation; (d) just prior to pinching *S*; (e) playing of the recorded dream stimulus; (f) highest BSR after any fall following the playing of the dream stimulus; and (g) lowest BSR immediately after waking from the hypnotic state. This was done for both the HDS and SDS, as the hypnotic procedures were virtually identical. In addition, the BSR of eight *S*s (the procedure was different for the ninth *S* and the equipment failed for the tenth *S*) was averaged at each of the following times in the second hypnotic state of the HDS: (h) start of hypnotic induction; (i) first depth report; (j) last depth report; and (k) moment of waking from hypnotic state.[3] The intervals between these various events were averaged to the nearest minute. The resulting curves are plotted in Figure 1. The original data are presented in Table A, elsewhere.[4]

[3] These particular events were picked for measurement as (in the *E*'s judgment) the group curve plotted on this basis showed maximum resemblance to the curves of each *S* plotted individually.

[4] A 1-page table giving the BSR data for each individual subject has been deposited with the American Documentation Institute. Order Document No. 7499, remitting $1.25 for 35-mm. microfilm or $1.25 for 6 by 8 in. photocopies.

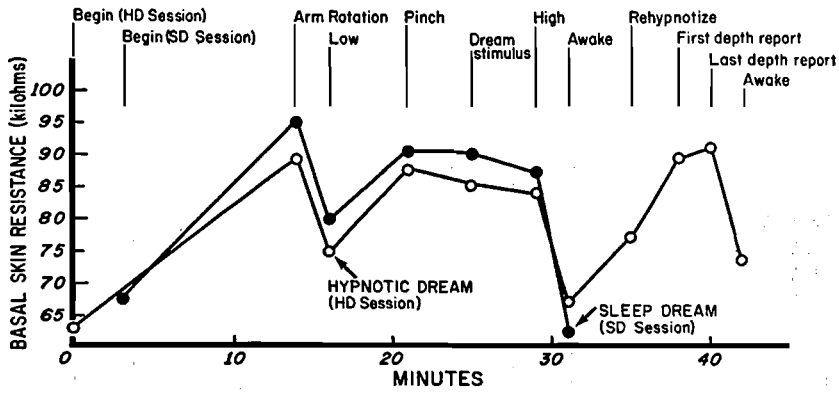

FIG. 1. Average basal skin resistance for all 10 subjects

The group curves of Figure 1 are fairly representative of the actual individual curves. For the first hypnotic state of the HDS and SDS there was always a sharp drop in BSR following arm rotation, but in only one case did this drop below the initial value of BSR at the start of induction. In eight cases BSR dropped during the hypnotic dream, but in two it continued to rise. The sudden fall of BSR with dehypnotization always occurred, and in 8 of the 20 cases actually went below the initial BSR at the start of induction.

The parallelism between the group BSR curves for the first hypnotic state of the HDS and SDS is quite pronounced. They show a rank order correlation of .96, which is significant at less than the .01 level, two-tailed. The correlations between these curves for each *S* individually are presented in the last row of Table 2, and are also uniformly high. These individual rank order correlation coefficients are each based on an N of seven, except for subject F, where N is six (one event was not marked on the polygraph record).

The relationship between BSR and the self-report depth scale was evaluated by measuring BSR at the times the *E* asked for depth reports and computing rank order correlation coefficients, which are presented in Table 2. The Ns ranged from 4 to 11. When N was less than 4, no correlation was computed, although all such coefficients would have been high and positive. In addition to the overall correlations for each hypnotic state, separate correlations were computed for the time up to arm rotation and for the time after arm rotation, as a rough estimate of how the correlations would have turned out if there had not been such a large BSR drop following arm rotation. These are also presented in Table 2, and are generally higher than the overall correlations. Although many

TABLE 2
Correlations of Hypnotic Depth and BSR and Correlations of BSR Patterns

	Subjects									
	A	B	C	D	E	F	G	H	I	J
Hypnotic Dream Session:										
1st hypnosis, overall	.73	.71*	.46	.41	.56	.67	.57	.45	.60	.73*
1st hypnosis, up to AR	1.00*	.70							1.00*	1.00**
1st hypnosis, after AR		.83	.35	.20	.35		.67	.95		.95
2nd hypnosis, overall	.75	#	.95	.95	.88	.67	.88	.95	.99*	.75
Sleep Dream Session:										
1st hypnosis, overall	.47	.68*	.17	.35	.76*	.42	.32	.42	.81*	.81**
1st hypnosis, up to AR		.94**	1.00*							1.00**
1st hypnosis, after AR	.93*	−.20	.75	.20	.83	.80	−.03	.80	.80	.80
BSR Patterns, 1st hypnosis of HDS and SDS:	.69	.51	.82*	.65	.89**	.72	.64	.74*	.76*	.71

Notes: * indicates $p \leq .05$, one-tailed. ** indicates $p \leq .01$, one-tailed. AR: arm rotation. #: no data due to equipment failure.

of the individual correlation coefficients are not statistically significant, the total group is highly significant, for only 2 of the 63 are negative.

The BSR and hypnotic depth curves for a "typical" S (G) are plotted in Figure 2. BSR was measured every two minutes as well as at the times hypnotic depth was ascertained.

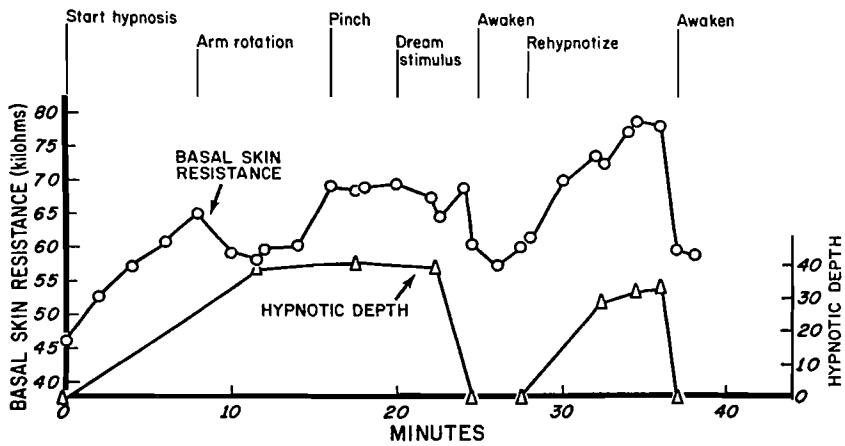

FIG. 2. Basal skin resistance and hypnotic depth during the HDS, subject G

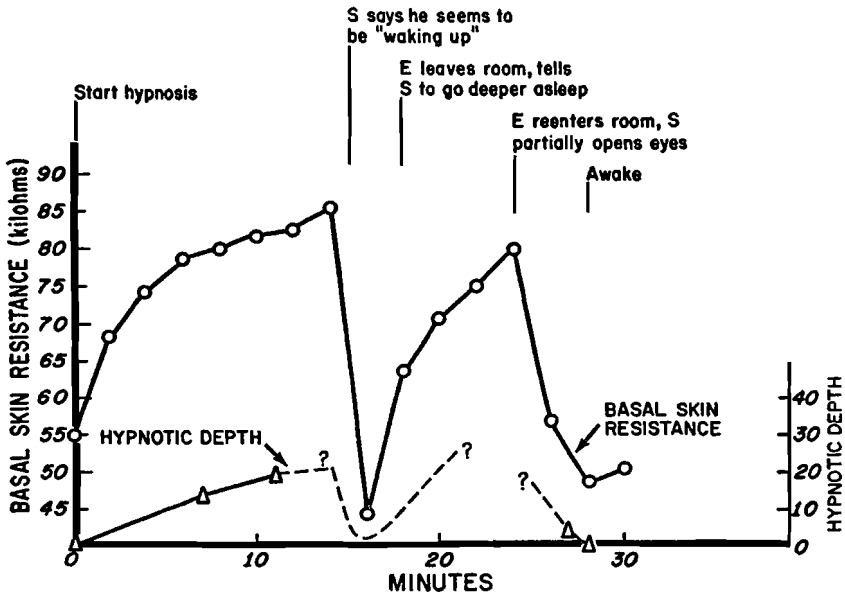

FIG. 3. Basal skin resistance and hypnotic depth during the HDS, subject K

Figure 3 presents the BSR and hypnotic depth curves of the eleventh *S*, who did not complete the entire study. The dashed parts of the hypnotic depth curve are based on the *E*'s clinical judgment, as no depth reports were obtained from the *S*. After reporting a depth of 19, the *S* suddenly opened his eyes partially and complained that he was "waking up." The *E* then suggested to the *S* that his problems about being hypnotized would resolve themselves and he would enter a deep hypnotic state within a few minutes. The *E* then left the room and observed the *S* through a one-way mirror. The *S* relaxed and seemed to enter a deeper hypnotic state, but when the *E* re-entered the room the *S* again opened his eyes partially and, when asked for his depth, reported "three or four," at which point the *S* was completely dehypnotized by the *E*. In both cases where hypnotic depth decreased suddenly there were large, rapid falls in BSR.

Discussion

Some limitations of the present study should be pointed out as possible qualifications of the conclusions reached below.

The range of values of both hypnotic depth and BSR was limited in the present study in that both variables showed a generally steady rise to a plateau, followed by a sudden drop, with the exception of the BSR

drop following arm rotation. This latter drop was probably due to the muscular effort involved, and body movements during the dehypnotization procedure are probably at least partially responsible for the BSR drops at that time. There were six instances in which hypnotic depth decreased a few points from one assessment to the next, with no intervening body movements, and BSR always dropped also. In future research of this nature, however, hypnotic depth should be systematically varied over a period of minutes while recording BSR, and physical movement should be controlled by instructing the *S*s to remain still during and after dehypnotization.

Bearing these limitations in mind, one may tentatively conclude that the self-report depth scale employed was a useful indicator of fairly gross differences in hypnotic depth, as estimated by the behavioral criteria of hypnotic dreaming and amnesia. A factor which probably partially accounts for this is that the *S* "commits" himself to manifesting certain hypnotic phenomena by reporting a given depth. Whether the scale would be useful for finer discriminations of hypnotic depth must be ascertained by future research.

A second tentative conclusion is that BSR is highly correlated with hypnotic depth, as estimated by the self-report scale. The *S*s' ability to estimate their BSR by the intermediary variable of hypnotic depth is strikingly similar to *S*s' ability to estimate the magnitude of their galvanic skin responses (GSRs) by the intermediary variable of their subjective reactions to stimuli presented them (McCurdy, 1950). A *S*'s own estimate of his behavior and internal state is a rich and promising source of data which some *E*s tend to ignore in their passionate search for "objectivity."

Hypnotic depth, as defined to the *S*s of the present study, consisted of three intermixed dimensions, viz.: (a) physical relaxation; (b) mental calmness; and (c) enhanced suggestibility. The question arises as to which of these dimensions account for the correlations of the depth scale with BSR. The present data can provide no final answer to this question, but it seems probable that the first two are the important dimensions. It is known that both physical relaxation and mental calmness generally lead to a state of decreased activation (Malmo, 1959) and a concomitant increase in BSR. Whether the factor of suggestibility enters into the correlations at all is questionable. Future research on this problem should employ a group of simulating *S*s (Orne, 1959) as well as genuinely hypnotized *S*s to see if BSR patterns and their correlations with the depth scale would distinguish the two groups. The simulating *S*s would not show enhanced suggestibility, and would probably not be

able to attain the same degree of physical and mental relaxation that the genuinely hypnotized *S*s would.

Another question raised by the present study is whether the *S*s' ability to estimate their BSR via estimating hypnotic depth is a special feature of the hypnotic state or merely a similar ability to that shown by normal *S*s in estimating the magnitude of their GSRs. Future research should have both hypnotized and unhypnotized *S*s estimate: (a) their degree of physical relaxation, alone; (b) their degree of mental calmness, alone; and (c) a combination of the two. A comparison should also be made of "instant" judgments versus prolonged, conscious deliberation.

For the particular procedure of the present study the course of BSR through the experimental sessions was found to be quite reliable, on both the group and individual level. Because of procedural differences it is difficult to compare the BSR patterns of the present study with those reported in earlier studies (Barber & Coules, 1959; Davis & Kantor, 1935; Estabrooks, 1930; Levine, 1930a; Ravitz, 1950; Ravitz, 1951), but, tentatively, it could be concluded that BSR shows a general tendency to rise during hypnosis. Arousing stimuli, however, such as muscular activity or affectively loaded dreams, produce significant drops in BSR. If the latter types of stimuli occur frequently during the hypnotic state, BSR would probably show an overall decrease, as some studies have reported (Barber & Coules, 1959; Davis & Kantor, 1935; Levine, 1930a).

The data of the present study indicate that BSR shows promise of being a *practically useful* indicator of sudden changes in hypnotic depth where there is little muscular activity during the hypnotic state. If, e.g., a *S* is being given suggestions of relaxation and peace, a sudden drop in BSR would probably indicate that the *S* was no longer responding to the suggestions, and the operator could modify his approach appropriately.

Despite the limitations of the present study, it is felt that the relationships found are of sufficient interest and promise to warrant further investigation.

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