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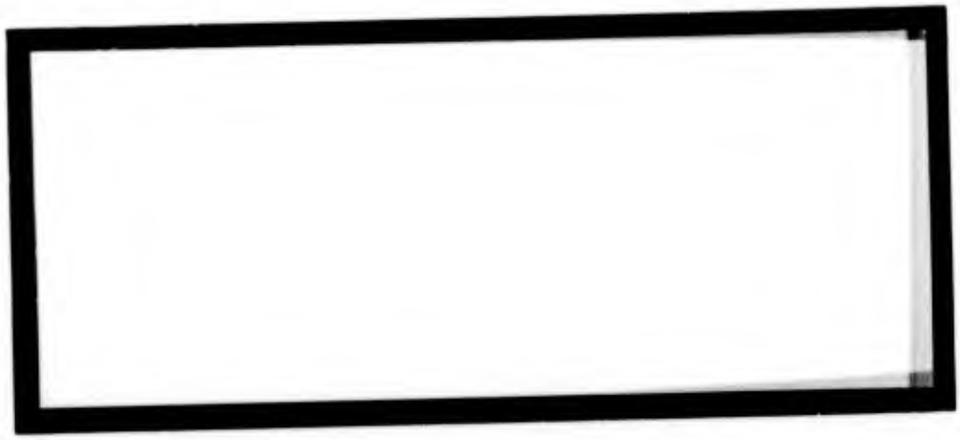
Department of Psychology



A REPORT FROM THE

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Hypnosis and the Psychology of Cognitive and Behavioral Control

Philip Zimbardo, Christina Maslach, and Gary Marshall

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Hypnosis and the Psychology of Cognitive and Behavioral Control

By

Philip Zimbardo, Christina Maslach

and Gary Marshall

Stanford University

"You do what you like. Or is it possible you have ever not done what you liked -- or even, maybe, what you didn't like? What somebody else liked, in short? Hark ye, my friend, that might be a pleasant change for you, to divide up the willing and the doing and stop tackling both jobs at once. Division of labour, sistema americano, sa! For instance, suppose you were to show your tongue to this select and honourable audience here -- your whole tongue, right down to the roots?"

"No, I won't," said the youth, hostiley. "Sticking out your tongue shows a bad bringing-up."

"Nothing of the sort," retorted Cipolla. "You would only be doing it. With all due respect to your bringing-up, I suggest that before I count ten, you will perform a right turn and stick out your tongue at the company here further than you knew yourself that you could stick it out."

> He gazed at the youth, and his piercing eyes seemed to sink deeper into their sockets. "Uno!" said he. He had let his riding-whip slide down his arm and made it whistle once through the air. The boy faced about and put out his tongue so long, so extendedly, that you could see it was the very uttermost in tongue which he had to offer. Then turned back, stony-faced, to his former position.
>
> "Mario and the Magician," Thomas Mann.

If man cannot control himself, his environment, and to some extent the reactions of others, he lives with the threat of being overwhelmed by a mind rebelling, a body refusing to obey, a world extracting exorbitant "protection money" to allow him merely to survive, and a community being indifferent or hostile to his needs. Man's central pursuit, therefore, is knowledge of what factors control him and his destiny, and how he can gain a measure of control over them.

Hypnosis is a process in which the issues of control become salient since it enables new forms of control to be created and old forms suspended or destroyed. As we read the tale of Mario and the Magician we are almost completely convinced that we could not be made so easily to act against our will -- but not completely so. It is precisely this element of doubt that has made hypnosis one of the most fascinating and frightening psychological experiences. Could the mere utterance of a few words by another person exert such powerful control over your behavior? You want to believe not, and in fact, many people live with the illusion of the dominance of their personal control over situational control.

Typically we center the locus of causality for our own behavior within ourselves, prefering to believe in our invulnerability to most situational forces, especially non-physical, psychological ones. Milgram's (1963) research on blind obedience to authority helps shatter this myth. The subtle forces which operate in interpersonal situations can override the motives or values of the individual so much so that he continually follows instructions to harm a stranger all the while protesting that he can not continue to obey. When psychiatrists or students are asked to predict how effective the situation would be in eliciting this behavioral compliance in others or in themselves, they underestimate its efficacy to a remarkable degree.

However, looked at from a different perspective, if words can alter experience and modify behavior, if hypnosis somehow potentiates this effect, and if these words can be incorporated into auto-suggestion, then individuals have at their command a way to introduce control where they thought none was possible, or to relinquish controls which compel apparently determined reactions.

In our view the most fundamental characterization of hypnosis is that it is a unique state of consciousness developed through training experiences (either informally in life situations or formally via induction training programs). This cognitive state allows for a receptivity to change in the attribution of causality. The hypnotic subject comes to believe that he or she can control perceptions, learning, memory, physiology and other processes, making them independent of extrinsic stimulus control. In addition, such people can be made to accept as a valid representation of reality their inability to control functions normally subjugated to personal, inner domination, such as moving one's finger, opening one's eyelids or saying one's own name.

As social psychologists, we are primarily interested in the basic questions underlying the control of human behavior across a number of theoretically and practically relevant situations. We see hypnosis as a valuable methodological tool for the social psychologist to use in manipulating levels of reality, converting hypothetical constructs into operationally sound independent variables and in creating a psychological state which facilitates genuine involvement by the subject in experimental procedures. The authors, as students of hypnosis, are also concerned with understanding the control mechanisms it engages; with the process whereby words, thoughts, images, physiological reactions and behavioral actions are translated from one action code to another; and with helping to demonstrate the validity of the changes induced through hypnosis.

The research reported in the present paper represents a preliminary attempt to integrate our basic interest in cognitive and behavioral control processes with our interest in hypnosis as a method and as an independent area of inquiry.

Previous research by the senior author has established the influence which cognitive variables (such as choice, justification and dissonance) can exert on biological and psychological motives (Zimbardo, 1969a). The first of our studies extends this interest in cognitive control to an attempt at controlling an autonomic function -- skin temperature -- by means of direct hypnotic suggestions.

The second and third studies reported reflect our conviction that one of the most potent yet least recognized variables controlling behavior is time, or our temporal sense. Two different aspects of time will be considered,

temporal perspective and temporal awareness. The first raises questions pertinent to the way in which man's conception of past, present and future "fix" his behavior in systems of history, religion and law, and lend it to controls imposed by expectation, responsibility, commitment and obligation, to mention only a few. The liberation of behavior from such time-bound controls is both a cause and consequence of deindividuated states in which behavior is directed toward self-gratification and released from social inhibitions (Zimbardo, 1969b). The second aspect of time we have studied experimentally is the awareness of the rate at which events occur, what might be called the tempo of life. Intervention in man's normal conception of clock time may have far-reaching consequences for changing pathological conditions and improving deficient performance which depend upon rate of functioning. While the first of our time studies uses gross measures (although intentionally comparing reactive to non-reactive ones), the second employs the rather precise index of behavior modification provided by operant conditioning recording techniques.

The final study to be reported began with the narrow focus of believing hypnosis would be a better technique for inducing a state of emotional arousal than a drug such as epinephrine. We hoped to replicate and extend the very important findings of Schachter and Singer (1962) relating physiological arousal to cognitive cues in determining the experience of emotion. However, our observations and data forced us to expand our focus to recognize, as of even greater importance, the role of unexplained arousal in creating emotional pathology.

Before describing each of these studies individually, we should mention briefly their common features of subject selection and formal hypnotic

induction training. With few exceptions, all subjects were undergraduates at Stanford University, recruited through the introductory psychology course. They participated in our training program and/or in the experiments voluntarily, being paid for each hour of participation. The subjects were selected from among the high scorers on a group administration of the Stanford Hypnotizability Scale (see Hilgard, 1965) and randomly assigned to training or no-training groups. The no-training groups for some of the studies were divided into those instructed to simulate hypnosis, and controls given the same task instructions without hypnosis or simulation suggestions. Both males and females were used in every group in each of the four studies; their data being combined in the absence of any statistically significant differences between them.

The hypnotic training, which averaged about 10 hours per subject, was conducted in small groups varying in size from 2 to 8 per session. The group procedure is a standard part of our training approach because of its efficiency, because subjects usually find it more reassuring especially early in training, and because it allows the hypnotist to bring to bear additional social forces upon the occasional subject who is recalcitrant, "slow," or not confident in his ability to experience hypnosis. The training is permissive in orientation, stressing the subject's choice to follow each suggestion and directed toward getting the subject to achieve self-hypnosis. It also attempts to be personal, to establish a relationship of trust and mutual respect between hypnotist and subjects. A variety of induction techniques are used over the course of training (during which time the subjects were exposed to all three of the present authors in their capacity as hypnotists). However, common to

the verbal and non-verbal techniques was the development of a state of very deep relaxation. Specific training was given in motoric control, perceptual control, fantasy experience, amnesia, post-hypnotic suggestions, and analgesia. Underlying these phenomena was the ability, encouraged through training, to concentrate, to dissociate, and to image vividly. All subjects reported that it was only after at least several hours of training that they began to believe something special was happening, that they were indeed "hypnotized." Only one of over two dozen subjects so trained did not complete the entire training program (dropping out of school for psychiatric reasons). Every one of the subjects was able to alter ischemic pain tolerance significantly more in hypnosis than in a waking, motivated state. On an additional criterion test, all of the subjects successfully carried out a post hypnotic suggestion and appeared to have amnesia for it.

In evaluating their experiences as a consequence of the training received, there was virtual unanimity in the beneficial effects it had on some aspect of the subject's lives; relaxing, sleeping, studying, controlling addictions, tuning out at will, being happier, getting a new level of self-awareness, etcetera. Although it remains to be demonstrated whether the considerable investment of time and energy required by such a training program is a necessary condition for producing the kind of behavioral effects to be reported in this paper, there is no question that the subjects find it worthwhile and come away from it holding both hypnosis and the hypnotist in higher regard. This personal effect and the positive propaganda it generates among our subject population creates a greater acceptance of the legitimacy of hypnosis and hypnotic research.

Control of Complex Skin Temperature

Maintenance of a relatively constant level of body temperature is a vital physiological function in man. It is so efficient and automatic that we become aware of the process only when pathological internal conditions cause us to react with fever or chills, and when extremes of environmental conditions markedly alter the skin temperature of our limbs. To what extent can such a basic regulatory function be brought under volitional control?

In 1938, the Russian scientist, A. R. Luria, performed an interesting experiment which bears directly upon this question. He had been studying the remarkable mental feats of a man who appeared to have eidetic imagery. Apparently, his subject not only had "photographic memory" but could induce such vivid visual images that they exerted a profound influence on his behavior. When he was instructed to modify the skin temperature in his hands, it took only several minutes before he had made one hand hotter than it had been by two degrees, while the other became colder by one and a half degrees. These changes were attributed by the subject to the "reality" of his visual images:

> I saw myself put my right hand on a hot stove. . .Oi, was it hot! So, naturally, the temperature of my hand increased. But I was holding a piece of ice in my left hand. I could see it

there and began to squeeze it. And, of course, my hand got colder. . .(Luria, 1969, pp. 140-141).

Is such a phenomenon replicable with "normal" individuals not born with the remarkably developed eidetic ability of this man? We were led to believe so on the basis of converging research findings coming from three rather different sources: visceral learning, cognitive control of motivation, and hypnosis.

Neal Miller and his associates at Rockefeller University (1969a, b) have recently demonstrated that the control over skeletal muscle responses through operant conditioning procedures can be extended to responses of the glands and viscera. Their work has generated the powerful conclusion that any discriminable response which is emitted by any part of the body can be learned if its occurrence is followed by reinforcement. "Learning" here refers to the change in frequency of making a specific response (such as cardiac acceleration or deceleration, or glandular secretion) when that change has as its consequence electrical stimulation in the pleasure center of the animal's hypothalamus. Miller believes that such results "force us to the radical reorientation of thinking of glandular visceral behavior, which ordinarily is concealed inside the body, in exactly the same way as we think of the externally more easily observable skeletal behavior." (Miller, 1969b, p. 11)

This conclusion is extended in the work of Zimbardo and his colleagues (1969a) which experimentally demonstrates that biological drives, as well as social motives, may be brought under the control of

cognitive variables such as choice and justification. Subjects modified the impact of a host of drive stimuli at subjective, behavioral, and physiological levels, in the process of resolving an "irrational," dissonant commitment (e.g., not to eat when hungry, or to expose oneself to a noxious stimulus without adequate justification for doing so). Thus a wide range of responses was controlled through the operation of "concealed" cognitive processes, in the absence of external reinforcers.

It appeared to us that hypnosis: a) is a state in which the effects of cognitive processes on bodily functioning are amplified; b) enables the subject to perceive the locus of causality for mind and body control as more internally centered and volitional; c) is often accompanied by a heightened sense of visual imagery; and d) can lead to intensive concentration and elimination of distractions. For these reasons, it should be possible for well-trained hypnotic subjects to gain control over regulation of their own skin temperature without either external reinforcement or even external feedback. While there have been a few scattered attempts to control temperature through hypnosis or other methods (McDowell, 1959; Chapman, Goodell, & Wolff, 1959; Green, Green, & Walters, 1970), they have often lacked adequate controls and tend to focus on a single aspect of temperature modification, such as unidirectional changes.

Our present study was exploratory in nature and attempted to demonstrate that hypnotic subjects would be able to achieve simultaneous alteration

of skin temperature in opposite directions in their two hands, while waking control subjects would not. The differential response of one hand getting hotter than normal, while the other gets colder, was chosen in order to rule out any simple notion of activation or prior learning and to control for any naturally occuring changes in skin temperature, such as cold hands gradually warming up over time. We also attempted to rule out other alternative explanations of changes in skin temperature by keeping environmental conditions constant and by minimizing overt skeletal responses on the part of the subjects.

Method

Three of our trained hypnotic subjects were tested in a specially designed room in the Laboratory of Dermatology Research at the Stanford Medical Center. The ambient temperature in this room was automatically regulated to maintain a constant level. Ten thermocouples of copper constantin were taped to identical sites on the ventral surface of the two hands and forearms of the subjects. Both room and skin temperatures were continuously monitored by a Honeywell recording system which printed them out directly in degrees Centigrade. The subjects lay on a bed with their arms resting comfortably at their sides and with open palms extended upward in exactly the same position. This posture was maintained throughout the session, and there was no overt body movement.

The instructions, which were delivered over an intercom, began with approximately ten minutes of hypnotic induction. After the subjects were deeply hypnotized (according to their self-reports), they were asked to

focus attention on their hands. They were then told to make an arbitrarily selected hand hotter, and the other colder, than normal. Accompanying this last, brief instruction were suggestions of several images which could be useful in producing this effect, and encouragement to generate personal imagery and commands which might be necessary to achieve the desired result. Typically, the subject lay in silence for the duration of the testing session (which averaged about ten minutes). In a few instances, the experimenter provided verbal feedback during the second half of the session when the subject appeared to have successfully differentiated the temperature of the two hands. The final instruction was to normalize the temperature in both hands by returning it to the initial baseline level.

Each of the subjects participated in two or three such sessions. In addition, one of the subjects (the senior author) completed two sessions utilizing auto-hypnosis. Communication between him and the experimenter occurred only to demarcate the various procedural stages being experienced.

Six waking control subjects also participated in each of two experimental sessions. The procedure was identical to that employed with the hypnotic subjects, except that they were not given any prior hypnotic training or the hypnotic induction during the experiment. The control group consisted of three male and three female undergraduate paid volunteers from the introductory psychology course at Stanford University. The hypnotized subjects, other than the senior author, were both coeds drawn from the same population.

Results

All of the hypnotic subjects demonstrated the ability to significantly alter localized skin temperature. Large differences (as much as 4° C) between identical skin sites on opposite hands appeared within two minutes of the verbal suggestion, were maintained for the entire testing period, and then were rapidly eliminated upon the suggestion to normalize skin temperature. Temperature decreases in the "cold" hand were generally much larger than the increases in the "hot" hand, the largest decrease being 7° C, while the largest increase was 2° C. In contrast, none of the waking control subjects were able to achieve such divergent changes in the temperature of their hands. The magnitude of the consistent changes produced by the hypnotic subjects was considerably greater than the slight fluctuations shown by the controls. The between-group differences illustrated in Figure 1 are highly reliable beyond the .001 level of significance (t= 14.27, df = 7).

Insert Figure 1 about here

When we examine the individual patterns of reaction in the hypnotized subjects, it becomes even more apparent that they were able to exert a considerable degree of control over the temperature of their two hands. The subject's data shown in Figure 2 reveals how, following the suggestion to make her left hand colder and right hand hotter (opposite to their relative baseline position), she rapidly "drove" them in the appropriate directions. After maintaining the separation for more than ten minutes, she re-established the initial baseline difference as soon as she was given

the instruction to normalize her skin temperature. Since there was no overlap in the temperature distributions of the two hands, the obtained differences from minute 4 to minute 16 were extremely significant ($p < .001$, within-subject $t = 20.18$, $df = 12$).

Figure 2 about here

The most impressive evidence for the hypnotic-cognitive control of this autonomic responding can be observed in the data for a subject under auto-suggestion (see Figure 3). After having induced a state of hypnotic relaxation, he signalled the experimenter as to which hand he would try to make hotter and which cooler. During the first minute thereafter, the left hand became hotter as the temperature in the right one dropped sharply. This divergence was also seen during the 5th to 6th minutes and again in the 10th to 11th minutes.

Figure 3 about here

When the experimenter provided information after seven minutes as to the subject's success, this feedback had a negative effect. A similar "loss" of the phenomenon occurred in both of the other hypnotic subjects immediately after being given verbal feedback from the experimenter. We believe that the intensive concentration required to achieve the unusual performance demanded in this study was disturbed by having to attend to and process the informational input from the experimenter. In a sense, the feedback, although supportive, operated as a distractor to attenuate the obtained differences in skin temperature. While non-verbal cues might be utilized to give the subject information as to performance adequacy, the comprehension required of

verbal feedback may always intrude upon and interfere with performance on such a complex task. However, we wish to underscore the fact that this subject was able to alter the skin temperature of his hands in opposite directions simultaneously without the aid of external demands, feedback, or extrinsic sources of reinforcement.

The specificity of this controlling process can be seen in Figure 4, where the subject was instructed to maintain the forearm at its normal temperature while making the right hand colder than normal. The forearm varied less than half a degree Centigrade, while at the same time, the temperature of the right index finger dropped 4° C.

Figure 4 about here

All of the hypnotic subjects reported great difficulty in performing this task due to the intensive concentration, extreme dissociation, and novel experience involved. Two of the subjects could not achieve a separation between the temperature of their two hands on the first day of testing, although they could vary both in conjunction. From analysis of the pattern of temperature changes and introspective reports, it appears that three different cognitive strategies were used to achieve these effects. The most frequent one was "unequal parallel shifts" -- the temperature in the two hands increased or decreased in a similar direction, but at a faster rate in one of the two hands. A "holding and spreading" approach was used to focus most attention on changing the temperature of one hand and, once changed, to hold it steady while driving the temperature in the other hand away. The technique which appeared to be most difficult, but was effectively used for at least

several minutes during each testing session, was "simultaneous divergence." Here the two hands seemed to act independently, with the arbitrarily chosen one getting hotter than normal, and the other becoming colder than normal. Different types of imagery were generated by the subjects during the sessions in order to help produce the desired effect. Some of the imagery involved realistic experiences, such as having one hand in a bucket of ice water while the other was under a heat lamp. Other imagery had a more symbolic or fantasy quality: the "hot" hand was getting red with anger over something the "cold" hand did, and the "cold" hand was getting white with fear over this angry reaction. However, it seems that at times the most dramatic divergences in skin temperature were produced by image-less commands given independently to each hand: "You become hot, you become cold". All of the waking control subjects reported trying hard to meet the experimental demand, and generating assorted imagery for that purpose. Several even believed they had done so effectively, although as we noted, the largest divergence was but a fraction of a degree.

Although we are not yet in a position to characterize the physiological mechanisms responsible for the control of skin temperature which we have shown, we believe that the role of hypnosis in the process is quite understandable. The research by Miller on visceral learning has stressed the important function served by curare in paralyzing the skeletal musculature of the animals. At first, this methodological control was thought to be necessary only to rule out possible influences of skeletal muscle responding on glandular and visceral responding. However, it now appears that curarizing the subjects may serve a more basic function:

> It is possible that curare may help to maintain a constant stimulus situation and/or to shift the animal's attention from distracting skeletal activities to the relevant visceral ones. (Miller, 1969b, p. 19)

We would argue that the effects of hypnosis are analagous to those of curare, since hypnosis provides a set of training conditions which permit a greater than normal degree of generalized relaxation, removal of distracting stimuli, and enhanced concentration upon a given, relevant dimension. Hypnotic training may also aid in the control of experiential, behavioral, and physiological processes by increasing the subject's confidence in his ability to exert such control, and by altering consciousness to the point that words and images can be more readily translated into a code language to which he is physiologically responsive.

While we feel this research demonstrates the fine degree of control it is possible for people to exert over one aspect of their autonomic nervous system, it is, nevertheless, a pilot study. The findings need to be replicated, additional measures must be introduced to discover how the instructional input yields the temperature difference output, and variations in type of feedback, imagery, and extent of practice should be incorporated into subsequent work.

To us, the significance of research in this area is less in understanding how hypnosis per se operates, but rather how human beings "naturally" learn to induce ulcers, tachycardia, excessive and uncontrolled sweating, and other forms of psychosomatic illness. Miller's work suggests that the intervention and modification of such reactions follow principles of operant conditioning. Our work adds the possibility that the sources of reinforcement in both producing and changing psychosomatic symptomatology

may be cognitive in nature. Therapeutic control may thus be best achieved by combining the precision of reinforcement contingencies with the power of a more pervasive cognitive approach to dealing with such mind-body interactions.

The Unobtrusive Control of Behavior by Temporal Factors

There is no construct of the human imagination which has a more pervasive, yet typically unacknowledged, effect upon our behavior as that of time. Because we tend to conceive of time as having a natural, physical reality of its own, we put it to service as a reliable yardstick against which to measure the speed of light, the pull of gravity, or the pathology of a heart beat.

However, time serves a much more fundamental role in our lives. We use it to establish continuity, duration, and history out of discrete, isolated, transient experiences. Time allows us to impose arbitrary boundaries upon the flow of events, parcelling them into past, present, and future. Such a temporal perspective makes possible the operation of expectancy (with its consequences experienced as hope, dread, achievement, or frustration) as well as the operations of obligation, commitment, and liability for our actions. To this sense of "time perspective" we add a sense of "time awareness" (Lehmann, 1967). We experience rhythm, excitement, and boredom as a function of our perception of whether time is passing rapidly or slowly. What aspects of our behavior and experience are independent of rate--of response emission, of reinforcement, of feedback, and of change? We would argue, none!

To understand better the influence which time exerts on behavior and human thought, psychologists have begun to study the effects upon the subjective experience of time of psychedelic drugs, variations in stimulus sequencing, and stimulus "overload" (cf. Ornstein, 1969). But a more direct technique of interfering with the naturally occurring experience of time is provided by hypnosis. Aldous Huxley's fictional description in his book Island (1962) extols the potential benefits of distorting time through hypnotic suggestion.

> And it's in very deep trance--and only in very deep trance--that a person can be taught how to distort time. . .One starts by learning how to experience twenty seconds as ten minutes, a minute as half an hour. In deep trance it's really very easy. You listen to the teacher's suggestions and you sit there quietly for a long, long time. Two full hours-- you'd be ready to take your oath on it. When you've been brought back, you look at your watch. Your experience of two hours was telescoped into exactly four minutes of clock time. . . . For example . . . here's a mathematical problem. In your normal state it might take you the best part of half an hour to solve. But now you distort time to the point where one minute is subjectively the equivalent of thirty minutes. Then you set to work on the problem. Thirty subjective minutes later it's solved. But thirty subjective minutes are one clock minute. . . You can imagine what happens when somebody with a genius IQ is also capable of time distortion. The results are fantastic. (pp. 210-211)

This enthusiasm may be premature, but not unwarranted. When deeply hypnotized subjects are told that either the past, present, or future no longer exists, or that it is expanded, dramatic changes in behavior result. In a provocative series of intensive core studies, subjects have been made to feel euphoric when in a state of expanded present, but schizophrenic-like when the present was removed through hypnotic suggestion (Aaronson, 1968a, b). States parallel to those produced by several psychedelic drugs have been reported by subjects in these studies. Unfortunately, the validity of these changes rests upon questionable evidence provided by clinical judgments, self-report personality tests, and interpretations of paintings made by the subjects during time distortion episodes.

Cooper and Erickson (1950) have attempted to manipulate time awareness, or tempo, in much the manner described above by Huxley. Hypnotic subjects were told that they would have a certain number of minutes of "special" time in which to execute some task. In actual clock time, they were given only several seconds, but many of the subjects reported experiencing the appropriate amount of time, indicating "that these periods of time were phenomenologically filled with many activities." However, again only subjective data were used, and studies which have measured performance increments have generally yielded negative findings (Barber and Calverley, 1964; Casey, 1966; Edmonston and Erbeck, 1967). The inherent difficulty of demonstrating that the subject is "really" experiencing time distortion is pointed up by Fischer (1967) who notes that it is possible to have "an increase in data content without proportionate increase in data processing."

In our research, to be described subsequently, we attempted to study the controlling effects of both time perspective and time awareness on a variety of behaviors. We have tried to modify these processes directly via suggestions to well-trained deeply hypnotized subjects. Incorporated into our research design were a number of methodological improvements in controls, objective measures, and non-reactive dependent variables.

The Behavioral Consequences of an "Expanded Present" Time Perspective

Could people be made to experience significant changes in their temporal perspective by simply instructing them that the present was expanded relative to a more remote past and future? Would hypnotic training enhance this effect? These questions initiated an exploration into the perceptual, judgmental, normative, and behavioral consequences of verbal time distortion instructions administered to hypnotic and non-hypnotic groups.

Method

Thirty undergraduate volunteer subjects were randomly assigned to one of four treatments: a hypnotic group, a hypnotic-simulation group, a neutral or non-simulating group given time distortion instructions, and a normal time control group. The twelve hypnotic subjects received the extensive training described earlier in the introduction; the six subjects in each of the other three groups did not receive any prior training.

The subjects in this study were tested in pairs, although for most tasks they were separated in adjacent cubicles. They were told that the

ostensible purpose of the experiment was "to study subjective reactions to various stimuli and situations under various conditions." Those in the hypnotic group were given a five-minute relaxation induction and told that they would remain in the hypnotic state throughout the session until instructed that the session was over. The simulators were told that throughout the experiment they were to act as if they were hypnotized and as they thought hypnotized subjects would respond.

All subjects then wrote a projective story about the theme of a given TAT picture. This was used as a baseline against which to compare the content of stories composed after the time distorting instruction. Subjects in the normal time condition were then told only to describe their conception of time, with no mention being made of time distortion. Subjects in the other three conditions were all given identical instructions to conceptualize time and then to allow the present to expand, while the past and future receded and became insignificant, until they were experiencing time almost totally in the present. After each subject reported being able to imagine such a change, a second TAT story was written. Five minutes was allowed for each of the two stories, and the order of the particular TAT picture was counterbalanced across subjects. It was expected that changes in time perspective would show up in before-after changes on such measures as use of present tense verbs, references to present events relative to past and future ones, etc.

Each of the next two tasks was preceded by a reminder of the alteration of time perspective (except for the normal time controls). The subjects were then put into an unexpected situation by having them listen to a

tape recording which, though humorous, was filled with vulgar obscenity. The recording was a pirated tape of five "takes" of a radio commercial by two well-known comedians for one of their old movies. After several bloopers, they begin to kid each other and become increasingly obscene with each successive failure to complete the commercial without a flaw. Would subjects in the expanded present be more able to respond to the humor and incongruity of listening to such material in a scientific laboratory setting than those not experiencing such a state? Could they overcome the implied normative prohibitions against letting themselves openly enjoy this kind of stimulus material? Their behavioral reactions while listening to the tape were recorded by two independent observers. In addition, they reported their personal reactions to various aspects of the experience on a questionnaire.

The final task was designed to get the subjects more directly involved with a sensory experience through physical actions. The subjects were told they had about five minutes to make something out of a large two-pound mound of clay which was on the floor in the front of the room. The subjects left their cubicles and proceeded to work either independently or together, as they chose. A stack of paper towels was available near the moist, sticky clay so that subjects could clean their hands, although this was not explicity suggested. At the end of five minutes, the experimenter entered the room and told the subjects to finish up and return to their cubicles to complete the questionnaire available there. It became evident that there was unanticipated variability in how long different subjects continued to work on the clay, ignoring the experimenter's request.

This then became an additional non-reactive measure of task involvement. Those few still continuing to play with the clay after the second five-minute time period were told they had to stop and go complete the final experimental questionnaire. Various features of the subjects' behavior were recorded by the observers, notably whether they cleaned their soiled hands on the towels or reacted in any negative way to the remains of the clay on their hands.

After instructing the appropriate subjects to allow their conception of time to return to normal, the experimenter described in detail the purpose and design of the study and answered all queries of the subjects.

Results

In general, the pattern of results obtained indicate that the manipulation of time perspective was successfully achieved in the hypnotic group. Across a variety of measures, hypnotized subjects given the present expanded suggestion showed a unique set of reactions to the diverse experimental tasks. Where the response measures were more obviously reactive--to the extent that one could readily ascertain how a hypnotic subject given the time distortion suggestion ought to react--simulating controls behaved like the hypnotic subjects, only more so. Where the relation of the task performance to an expanded present time sense was not so obvious, then the simulators were more comparable to non-hypnotized controls given the same time induction than they were to the hypnotized subjects.

Changes in verbal descriptions of events

The TAT pictures selected for this research rather clearly reflected time themes, since one showed an old woman and a young woman, and the other a farm with a farmer planting crops while a pregnant woman gazed upon the scene. The stories constructed by the subjects were each scored independently by two "blind" raters, with the average of their ratings being used for analysis. The primary categories analyzed were changes in the use of present tense verbs relative to total use of verbs, and changes in references to events which could be distinguished as taking place in the past, present or future.

These data, presented in Table 1, indicate that the hypnotic group changed their time perspective in accordance with an expanded present orientation. They used more present tense verbs, more references to present

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Table 1 about here

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events, fewer to future and no more than previously to the past. However, simulating controls "read" what was the appropriate way for hypnotized subjects to react and outdid the hypnosis group. They used an even greater percentage of present tense verbs, references to the present, and reduced concern for the past. The marked differences on each measure between simulators and the neutral group show that taking the role of simulator had an effect beyond simple exposure to the time distortion instructions. The neutral group behaved like control subjects given no suggestion to alter their time perspective. A comparison of the hypnotic and simulating

subjects versus the neutrals and controls reveals that the former showed a significantly greater use of present tense verbs ($p < .02$, $t = 2.54$, 28 d However, a similar comparison for changes in the percentage of references to present events fails to reach significance, although the means are in the right direction.

Perhaps even more revealing of the degree to which the simulators perceived what was expected of them is their consensus across the various measures. Every one of them increased their percentage of present tense verbs while 58% of the hypnotic group, 33% of the neutrals, and only 16% of the normal time group did so. The simulators thus differed significantly from each of the other three groups beyond the .01 level (by separate ratio analyses). In like manner, 83% of the simulators decreased their total references to past events and increased their references to present events. Only a third of the hypnosis subjects decreased their references to past events and a half of them increased their concern for present events. On the first measure, the hypnosis group differs from the simulators at the .01 level ($z = 3.52$) while on the second, the difference is at the .05 level ($z = 2.24$). The simulators also differ significantly from the other two groups on these measures, but the latter do not differ from the hypnosis group. None of the differences in references to the future were significant.

To smile or to laugh?

When the subjects were exposed to the humorous, obscene taped material, it was assumed that normative influences operating in the laboratory situation would prevent them from reacting strongly to it. However, if they had internalized an expanded present orientation, then they should have been less concerned about how they might be evaluated for their reaction than they were about experiencing and openly responding to the immediately present situation. This reasoning receives support when we compare the extent to which subjects in the different treatments responded to the comedy material by either smiling or laughing outright. It is evident from the data in Table 2 that the pattern of laughing or simply smiling distinguished the hypnosis group from each of the others.

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Table 2 about here

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These subjects were equally likely to react by openly laughing as by smiling. The simulators smiled as often as the hypnotic group, but they were not observed to react at the more intense level by laughing. Each of the other two groups behaved in a more socially appropriate manner, smiling more frequently, but laughing infrequently. In fact, they smiled significantly more than the hypnosis or simulation groups ($p < .025$, $F = 4.61$, $df = 3, 26$). The greater frequency of laughter of the hypnosis group, however, only approaches statistical significance. An analysis of the proportion of subjects in each group who gave an especially hearty laugh differentiated

hypnosis subjects from subjects who were merely simulating a reaction to the present expanded instructions. None of the simulators responded with laughs that were rated as "hearty"--whereas a quarter of the hypnotic subjects did.

This quantitative data is less convincing than some of our qualitative data of the basic changes in time sense and responsiveness to "stimulus immediacy" achieved in many of the hypnotic subjects. A more typical view of the nature of the unusual reactions generated by this alteration of time can be witnessed in the report of one of these subjects, written a minute after having heard the tape recording:

> I don't remember much about it now--all I remember was that it was funny and that I'd seen the movie the men were talking about. But actually I don't really care too much about the tape at all right now. I hate writing this. So I'm stopping. Right now. I feel like laughing. But I'd better stop writing this first. Right now.

Involvement in sensory experience

Our purpose for including the task of working with clay was to have a sensory task which might help detect differences in the experience of time perspective not apparent on the other, more cognitive tasks. We had expected the major difference to be revealed in what the subjects made; those with a sense of expanded present being less likely to plan ahead and thus merely work the clay without rendering it into a specific design or fixed shape. There was some evidence that several of the hypnotic

subjects did react in this way, and thus did not end up with a figure or a "thing," since they had made incomplete objects or changed the content of their modelling. However, the most compelling evidence for the greater involvement of the hypnotic subjects in the "here and now," and their lack of concern with appearance, comes from two rather subtle, non-obvious measures of change in temporal perspective.

If the subjects were truly engaged in the ongoing activity of deriving pleasure from manipulating the clay for its own sake (as we would predict for those experiencing an expanded present), then our test situation should elicit two characteristic behaviors. First, when the experimenter told the subjects to stop and return to their cubicles to complete the next questionnaire, those who were "stuck in the clay" should have ignored his command once he left. Secondly, the moist clay (which was chosen because it stuck to the hands) ought to be less disturbing to those with an expanded present orientaiton since they would continue to enjoy its sensory qualities and not have to worry about getting cleaned up before going on to the next task or leaving the experiment. The data strongly support both of these predictions in demonstrating significant differences between the hypnotic subjects and all others.

The total time each subject played with the clay after being told to stop is shown in Figure 5. The normal time subjects tended to complete the

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Figure 5 about here

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task shortly before the allotted five minutes time. The other subjects, given the present expanded instructions, worked at least a minute longer after the experimenter told them to stop. For the simulation and neutral groups, this time was usually spent in finishing up the figure they were making. In contrast, the hypnotic subjects continued to play with the clay for nearly 250 seconds, on the average. This mean would have been even higher if the experimenter had not insisted that those subjects who had not yet stopped after the five additional minutes do so immediately. The significant overall difference between groups ($p < .0001$, $F = 24.63$, $df = 3, 26$) is almost as strong ($p < .001$) for the difference between the hypnotic group and each of the others.

Observers recorded the subject's concern with the mess or being dirty by noting whether they used the readily available paper towels, wiped off their hands on the desk top or their clothing, or spent time looking at their hands. Two-thirds of the hypnotic group did not give any evidence at all of concern for the fact that their hands were coated with the residue of the clay. In sharp contrast was the almost universal reaction of all other subjects to clean up after the clay task was completed. Everyone of the normal time group did so, while all but one of the simulators and the neutral group showed unmistakable signs of concern for their appearance. The proportion of subjects revealing such concern was significantly less for the hypnotic group than the others ($p < .001$, $z = 3.52$). When subjects were asked how much they enjoyed playing with the clay, the simulators again gave responses comparable to those of the hypnosis subjects. Both groups reported having the most fun with the clay, significantly more

so than the normal time control ($p < .02$). The mean rating of enjoyment for the neutral group did not differ from any of the others. (On a 7-point scale, the mean ratings were: hypnosis, 6.5; simulators, 6.0; neutral 5.2; normal time, 3.8).

The experiential changes created by incorporating the present expanded time perspective into one's way of thinking and relating to environmental events clearly emerges in the self-reports of some hypnotic subjects. After the clay task, one subject, apparently still experiencing this altered time sense, wrote:

> I remember feeling very, very good. But that was clay and now this is pencil and paper. It's amazing how a pencil can make marks on a paper that other people can read and understand. . . I can't really think about working with the clay. These questions interrupt my thought process. That makes me angry But I don't care because it's all fantastically amazing. I can hear the blood in my ears . . . I didn't want to stop. But now I don't care because I'm writing this.

For another, "The clay was very soft and moist, it felt nice to dig my fingers into it. When I was working with it, the shape just kind of happened. There was very little effort involved. It just kind of worked itself out." No simulator or any other subject responded along similar dimensions.

The pattern of results obtained here point up the importance of using simulators to control for conclusions based upon compliance and expectation.

In addition, the need for non-reactive response measures which are less susceptible to experimental demand features is clearly important in distinguishing valid hypnotic phenomena from apparent manifestations of hypnotic suggestions.

More important to us is the encouragement which this preliminary study provides for inducing significant changes in time perspective via direct hypnotic intervention. Although the experimental behaviors shown to be affected by such changes in time sense have little practical significance, nevertheless the potential for influencing a wide range of meaningful behavior is vast. We plan to show in future research that if time perspective can be altered along the lines described in this report, then it will be possible to reduce anxiety or guilt reactions, to liberate anti-social behaviors from normative controls, and even to prolong life in geriatric patients who perceive only a contracted present and no future. The cognitive control of such "pathological" states represents one side of our basic interest; the other is to enable people simply to enjoy life more by having them experience its pleasures more immediately and totally.

Hypnotic Modification of Time Awareness or Tempo

Before Aldous Huxley's vision of an improved educational technology based upon controlled modification of time awareness can be realized, it is necessary to demonstrate that more than subjective experience is being changed by such procedures. If time is perceived as existing in a new relationship to the occurrence of certain events, then behavioral measures which are sensitive to rate of responding should reveal this altered perception.

If a reinforcing stimulus event is contingent upon the rate at which a given response is emitted, then altering the time base should affect frequency of responding. Thus, if two responses are required per second to turn on a signal light, doubling the time unit would require doubling response frequency (4/2 sec.) to maintain the same rate, and thus the same occurrence of reinforcement. But what would happen to such a system if subjective time were altered, while objective or "clock" time remained constant? Since the electronic relay circuits involved in such an apparatus operate on real time parameters, a person operating on a subjective time dimension which was out of synchrony with real time would not be able to obtain or maintain the reinforcing state.

Since many of the consequences of our behavior are a function of the rate at which we perform certain classes of responses, modification of time awareness--speeding up or slowing down of perceived tempo--should have a profound effect on our adjustment to important environmental

contingencies. The "lazy" person may differ from the energetic or ambitious one not so much in the amount of work that is done, but in performance per unit of time. Often the person perceived as behaving in a socially inappropriate manner is only guilty of not spacing his responses over time, of "coming on too fast." In many life situations, reinforcement comes only after long time-outs or waiting periods. Failure of children to sit still or to learn restraint may be related to perceived differences in the duration of the non-responding time-out periods. Similarly, the labelling of behavior as "impulsive" may represent the opposite side of this different temporal sense.

Because of considerations such as these, we decided that it was worthwhile to attempt to demonstrate that time awareness could be modified by direct hypnotic suggestion and its effects assessed with the precision and objectivity provided by the operant conditioning paradigm.

In the research to be described, we attempted to modify one aspect of man's internal time machine, his awareness of tempo, or rate of movement of time, by means of hypnotic suggestion. The assumed changes in internal processes were measured "by analyzing the frequency, duration, and degree of their interference with a more easily measured process" (Lindsley, 1957, p. 1290). That more easily measured process was the rate of emission of a simple operant response, pressing a telegraph key. The operant response in turn, was part of a unique schedule of reinforcement -- conjugate reinforcement -- developed by Ogden Lindsley. Traditional reinforcement schedules are essentially "episodic"; trials are discrete events in which the subject works, obtains a reinforcement, consumes it, then resumes responding. The conjugate schedule more nearly approximates a dynamic interaction between behavior and

the environment: changes in behavior change some part of the environment, while these stimulus changes feed back on the subject's behavior to maintain, intensify or reduce it. For example, in the process of tuning in a favorite TV program which is out of focus, you turn a fine tuning dial until the desired level of clarity is reached, then stop fiddling with the controls and sit back to enjoy the program. But suppose TV sets were constructed so that once the image you wanted was clear (the reinforcing state of affairs) you had to continue to respond in order to keep it that way. Suppose you had to learn to press a lever at a given rate (presses/per unit time) to control the clarity of the stimulus. Pressing too fast or too slow would adversely affect stimulus presentation, and such changes in the stimulus would be cues to you that your rate of response was not appropriate. If the reinforcing state of affairs were desirable, you would learn to optimize the function relating how much work you would put out continuously for how much stimulus clarity you would find necessary. In fact, it would then be possible to measure just how desirable the reinforcement was in terms of this function.

Many interpersonal situations can be characterized as feedback loops of the kind illustrated in a conjugate reinforcement schedule. Our behavior changes some aspect of another person, and our perception of these changes (e.g., degree of attentiveness to what we are saying), feeds back to maintain our behavior (if the attentiveness is appropriate), intensify it (if boredom begins to show) or reduce it (if the reaction is too intense). In a responsive environment behavior is modulated according to feedback from changes in a target stimulus, and must remain in a state of continual modulation as long as the target stimulus continues to change. Thus while

behavior is under stimulus control, the stimulus is under behavioral control, and the relationship between them is established according to some temporal function relating response to reinforcement.

Zimbardo, Ebbesen and Fraser (1971) have developed an apparatus and technique which uses the rate of emission of a simple external response (key pressing) as an objective index of subjective states. They have demonstrated the validity of this approach to assessing preferences and attitudes as well as the impact of social and physical stimuli on behavior. In the present study, we have used this same approach to evaluate the impact of induced time distortion on behavior in a situation where behavior is related to stimulus feedback as a function of a (time-based) rate of responding.

Method

All subjects were trained to press a key at different rates in order to maintain illumination of one or another target light in a stimulus array. The first of five trials (each of 2 minutes duration) established a comfortable operant rate of responding during which the subject learned that the onset and offset of the lights was under the control of rate of key pressing. The remaining four trials were divided into baseline periods and experimental periods. On one of the baseline trials the subject was instructed merely to keep the red light on as long as possible, which required responding at the rate of 3 presses/second. On the other baseline trial, the task was to keep a blue light illuminated, requiring a faster rate of 6 presses/second. Pressing at a slower or faster rate than the target stimulus required lit a light other than the reinforced colored light. Obviously then, the subjects knew they

could satisfy the task demand by working to reach the appropriate level and then maintaining a consistent rate. But this necessitated an internalized temporal awareness which was synchronized to the time parameter electronically programmed into the apparatus.

Interspersed between the baseline trials and the experimental trials were the instructions designed to modify temporal awareness. Before one of the experimental trials, subjects were told about the difference between clock time and subjective time, and that they would experience time as slowing down:

> ...so that a second will seem like a minute, and a minute will seem like an hour. You will experience time slowing down now, getting slower and slower. When you have done this and your experience of time has changed, signal me [the experimenter] that the change has taken place.

Before the other experimental trial, each subject was told that time was speeding up:

> ...so that an hour will seem like a minute, a minute will seem like a second. You will experience time speeding up now, getting faster and faster. . .

Between the two tempo modification instructions, subjects were told to normalize their perception of time.

A variety of procedural controls were used to increase the generalizability of the findings and investigate some of the complex interactions between different experimental variables. Thus some subjects were given the instructions to slow time before speeding it up, while for others the sequence was reversed.

Some subjects were given the two baseline trials, then the two experimental trials, each with its appropriate instructions. Others were given one of the baseline trials, then an experimental trial, then the other baseline trial and the final experimental trial. In addition, two types of stimulus feedback conditions were used on the experimental trials: lights on (the target light and the stimulus array being illuminated by key pressing) or lights off (no stimulus lights lit). Thus in the lights-on condition, subjects were told to press at the rate that would keep the target light (either red or blue) illuminated. In the lights-off condition, they were told to press at the same rate they had previously used, "to press at a rate which would be sufficient to keep the target light on if the lights were on." The effects of internalized time distortion ought to be greater for the lights-off condition than the lights-on condition because there were no environmental cues to conflict with, and exert a corrective influence upon, the experience which was out of synchrony with the apparatus.

A cumulative recorder provided an on-going display of the subject's rate of responding and also a record of when the target rate was reached. An Esterline-Angus event recorder indicated the sequence and duration of which light level was being activated. A series of timers recorded the total time each light level was locked in by the relay circuity (dependent, of course, upon the subject's rate of response). The two major dependent variables to be reported are: 1) the percentage of total time available that key pressing rate corresponded to the rates associated with the target lights, and 2) the number of times that responding deviated from the target level to an off-target level.

Three groups of subjects were used for this study--hypnosis (N = 12), simulators (N = 6), and instructed controls (N = 12). During the experiment proper, the procedure was identical for every subject; the experimenter who delivered the instructions (via an intercom to a subject in an adjacent acoustic chamber) did not know to which of the three treatment conditions the subject had been randomly assigned. Thus all subjects were given the same tempo modification modification instructions. Prior to the first operant trial, however, one group of subjects, who had been extensively trained in hypnosis, were given an hypnotic induction by a second experimenter. The simulation group was told to simulate the reactions of an hypnotic subject or to behave as if they were hypnotized throughout the study. The control group was given no prior instructions.

Results

In order to simplify presentation of the mass of data and multiple comparisons made possible by the research design we have used, some data will be combined across conditions (which are not of primary interest) and only the light-off condition will be presented. As expected, the pattern of results for the light-on and light-off conditions was similar, but the treatment effects were significantly greater for the light-off condition. (Details of the comparisons not elaborated in this paper will be published separately.)

The data offer strong support for the conclusion that the subjective experience of time awareness can be experimentally modified, and this change has measurable consequences in behavior. The modification of subjective time sense (within a relatively brief procedure) would appear to require the

concentration, imaginative involvement, and suspension of usual modes of analytical thinking which characterize the hypnotic experience. Only those subjects previously trained in hypnosis and in a state of hypnotic relaxation were able to translate the verbal suggestion of a synchronicity between clock time and personal time into "reality." On each of the variety of ways of analyzing the data from this experiment, the operant behavior of the hypnosis group was significantly different from that of other non-hypnotized subjects given the same time distortion suggestions, regardless of whether they were simulators or merely instructed waking controls. This conclusion is based upon an analysis of change scores from a baseline level of responding to a post-suggestion level of responding. The specific nature of these induced changes is given in the following set of analyses.

Subjects in the three treatment conditions were generally equivalent in their baseline performance, pressing at a slow rate to keep one target light lit, or at a fast rate required to maintain the other light. Following the time distortion manipulation, all groups were off target more than they had been during the baseline period. However, only the mean change for the hypnosis group was significant ($p < .01$, $t = 6.46$, $df = 5$). The overall between-group differences in percent of time on target (noted in Table 3) were significant ($p < .05$, $F = 4.44$, $df = 2, 15$), as was the nearly four-fold

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Table 3 about here

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difference between the hypnosis group and the other two ($p < .01$, $t = 3.22$, $df = 18$).

Figure 6 about here

A similar pattern emerges when we examine the measure of percent of time responding at an off-target level in the specific direction suggested by the distortion instructions (reported in Figure 6). For each of the baseline levels, the percent of time a subject spent responding faster, slower or at the appropriate target rate was determined. The same trichotomy was also made for response rates following the distortion suggestions. The effectiveness of the experimental suggestions was determined by comparing percent of time faster than target rate before and after the fast-tempo manipulation, as well as percent of time slower than target rate before and after the slow-tempo manipulation. It is apparent from the figure that only the hypnosis group shows a substantial change on this measure of performance--over three times as great as the change of either simulators or waking controls. The overall between-group difference was significant ($p < .05$, $F = 4.26$, $df = 2, 15$), and this effect is attributable to the difference between the hypnosis and other two treatments ($p < .01$, $t = 3.05$, $df = 18$).

When the data are examined in terms of the mean extent of the deviation of the tempo suggested, once again the differences between groups is significant ($p < .025$, $F = 5.20$, $df = 2, 15$), the hypnosis group being at least twice as deviant from target level as the other two groups.

A more subtle measure of the efficacy of the hypnotically induced distortion of time awareness focuses upon patterns of response variability. In attempting to meet the experimental demand of maintaining a given operant rate of response during the baseline period, subjects would learn how to zero in on the target rate by pressing faster if a lower level light was on, and pressing slower if a higher level light was on. The number of shifts

from one response level to another were recorded on the event recorder for each baseline and experimental period. If the task demand to continue to press at the baseline target rate was more potent than the time distortion manipulation, then variations, or level shifts, should occur around the target level (e. g., from level 2 to 3 or 3 to 4, or 4 to 3, etc. for target level 3). However, for those subjects for whom time had "really" slowed down or speeded up, it would have been more difficult to satisfy the task demand of maintaining the target rate. We have seen that such subjects in the hypnosis group were more off target than those in the other groups. But in addition, their performance showed greater variation around off-target levels than around target levels, (e. g. from level 2 to 1 or 4 to 5 for target level 3). In Table 4, it can be seen that the total variation in

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Table 4 about here

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shifts from one target level to another is equally greater for all groups in the experimental periods than in the baseline periods . This is to be expected without the extrinsic feedback provided by the illuminated target light. But the simulation and control groups apparently had developed a relatively accurate sense of the appropriate target rate since when they were off target they were more likely to change their rate to return to the target level than to move to a further distant level. They show no greater variation around off-target levels during the experimental than the baseline periods. In sharp contrast, the hypnosis group seemed to be

responding to their new sense of time awareness, shifting less around the target level and very much more around the more remote levels. The hypnosis group differs significantly from both of the others on the measure of variation around the target ($p < .05$, $F = 4.85$, $df = 1, 15$), and even more so in variation around off-target levels ($p < .001$, $F = 20.15$, $df = 1, 15$).

Interviews with the subjects revealed that those in the simulation and instructed control groups tried to react as if time were speeding up or slowing down, but the demand to try to reproduce the previously appropriate level exerted a greater influence upon them. The subjects given the same time distortion instructions under hypnosis were apparently able to experience a change in time awareness. This changed perspective introduced an asynchrony between subjective time and the task-relevant clock time which in turn exerted a controlling influence on their behavior. Thus, they could not adequately relate (via rate of response behavior) to an environment programmed by objective time parameters.

Two different phenomenonal experiences were reported by these subjects. For some, their time-distorted behavior seemed to be different; they found themselves responding faster or slower than they had previously, although not trying to do so consciously. For others, they were not aware of physically moving their key-pressing finger faster or slower, but the time between responses seemed to become either very long (slow tempo) or very short (fast tempo). Finally, there were some subjects in the light-on condition who reported that their behavior did not change at all, but the feedback from the lights was altered; the lights seemed to take longer to change in response to their key-pressing, or they shifted too rapidly.

It seems to us that the combination provided by the power of hypnotic intervention in experience and the objective precision of the operant conditioning methodology has been effective in demonstrating the validity of inducing changes in time awareness. Our next step is to extend this approach to behaviors which are of more practical significance to the individual--such as problem-solving, anxiety reduction, and perhaps affecting heart rate by changing awareness of the rate at which events occur.

Unexplained Arousal: Emotional "Plasticity" or Emotional Pathology?

The experimental investigation of emotion has been given considerable impetus by the research of Schachter and Singer (1962) which specified the interacting components of emotional states as physiological arousal and an appropriate cognitive explanation of this arousal. They demonstrated that in the absence of an explanation for an arousal state, subjects will search the immediate environment for cognitive cues which can be used to make sense of and to label the arousal. Thus, starting with a common level of physiological activation, one subject will experience "anger" and another "euphoria" depending upon elements of the situation in which the activation occurs. These investigators used injections of epinephrine to induce the symptoms of arousal, and then either did or did not inform the subjects of this cause for their arousal.

In general, informed but aroused subjects did not react emotionally to the experimental situation, nor did unaroused subjects given placebo injections. However, uninformed arousal subjects tended to label their state as "happy" after exposure to a confederate who had acted euphoric, but as "angry" when the confederate had acted angry.

Such a finding has a variety of interesting implications: it links physiological processes to social psychology via cognitive search and labelling operations; it encourages an experimental-analytical approach in studying emotion and emotional development; it underscores the learned modifiability, or situationally-determined, "plasticity" of emotion; and finally, from our point of view, a major consequence of this research is the suggestion that emotional pathology may be understood as an "unsuccessful"

attempt by the individual to explain feelings of unexplained arousal or discontinuities in experience and behavior.

For these reasons, it seems obvious that independent replication of the Schachter & Singer study is necessary before we can accept the validity of its conclusions and extend them. Surprisingly, a review of the literature reveals no published attempts to do so. This may be due to the methodological complexity of the experiment, involving as it does a team of a medical doctor, observers, and a trained confederate for each subject. In addition, there is reluctance by many psychologists, and by college committees who pass on the use of human subjects, to sanction use of drugs in research with students. It is probable also that attempts at replication have not been carried out because psychologists of all persuasions would like to believe in, and accept as true, the conclusion and implications of this research.

Aside from the basic independent validation required to establish the acceptability of any conclusion, closer examination of the procedure and pattern of results of this study raises questions which can only be answered empirically. Briefly, some of these problems center around the action of epinephrine, the manipulation of the causal attribution for the arousal, the programmed activity of the confederate, some of the measures used, and weak or inconsistent between-treatment differences.

To illustrate some of these issues, it can be noted that the high level dosage used (.5 cc) would have a sudden, powerful onset usually within two minutes of the injection. Since little has occurred in the experiment between this experience and the always salient experience of receiving an

injection, it is likely that the two events will be perceived as related. The experimenter's attempt to break this causal link by simply instructing the subjects that the alleged vitamin supplement would have no side-effects or effects different from those experienced would seem to be weak relative to the more obvious temporal contiguity of unusual stimulus event and unusual reaction. Indeed, some subjects are reported to have made this association despite the instructions, and others may have also, but not reported doing so. Such a possibility helps account for the weak between-group effects found on some measures, which in part required an internal analysis of the data to yield statistical significance. Epinephrine also has a variable decay function for different individuals, so that for some it may wear off rapidly--before the confederate is in full-blown anger or euphoria--or slowly for others. With the only measure of arousal being pulse rate, taken after the entire session, and confounded by the subject's imitative activity of the confederate, one could not assess the on-going course of the physiological arousal.

The activity of the confederates was selected to represent the extremes of an emotion continuum, anger versus euphoria, but appears rather to represent a common point of agitation on an activity dimension and "bizarrness" or unusualness on a situational-expectation dimension. Would the same conclusion hold for passive emotions such as sorrow and joy? Perhaps not, if the mechanism for labelling is the association of one's internally agitated state with the comparably agitated behavior of the confederate. Then too, the question is raised of the less standardized interaction between confederate and subject in the euphoria than in the anger condition, since the former involved greater interaction with and participation by the subject. It also follows that direct participation by the subject in "emotional activity" may

be what produces the experience and labelling of emotion through self-observation, and not a cognitive appraisal of the confederate's mood as a likely explanation for one's arousal. If instead the latter process operates in this situation, then one would predict that emotional comparison would not be initiated if the confederate was noncomparable on other dimensions. Finally, it should be pointed out that there was no reported assessment by the subject of the confederate's mood, and more importantly, the major dependent measure is a relative index of emotion obtained by subtracting self-ratings of anger from happiness. In some experimental conditions, subjects are described as reacting with the emotion of happiness, when in fact they are only less angry than other subjects. Obviously, emotions are scaled relatively, but there is also a categorical aspect of emotions; an experience of mild anger is not functionally equivalent to one of slight happiness.

In attempting to reproduce the previous results, while modifying the procedure to improve upon some of its questionable features and perhaps strengthen the basic manipulation of not having an explanation for one's arousal, we took advantage of the utility of hypnosis.

Martin Orne (1967) has pointed out what is both a defining characteristic of hypnosis and the key to using hypnosis as a method for studying the phenomenon of unexplained arousal and discontinuities in experience and behavior:

> What is impressive about the hypnotized subject's behavior is that he appears capable of ignoring reality, responding instead to a reality

> constructed in part by the hypnotist's words. In addition, he may have amnesia for the experience and may manifest the effects of hypnosis at a much later time in response to predetermined cues. Again, what impresses one about the posthypnotic suggestion is not so much that the subject carries out the behavior, but that he does not appear cognizant of the reason for doing so. (p. 210)

Thus, it should be possible to produce marked physiological changes hypnotically (as shown by Crasilneck & Hall, 1959, and Sarbin, 1956) and then induce amnesia for the cause of these changes by posthypnotic suggestion. The use of hypnosis in place of epinephrine even allows for a better degree of experimental control over the nature of the onset of the arousal. The arousal symptoms can be hypnotically conditioned to a specific situational cue, and introduced at the appropriate time during the procedure. In addition to this major methodological change, we included several other modifications: physiological recording of GSR and heart rate to assess the hypnotically induced arousal; ratings of the confederate's mood; a more standardized, more believable set of activities engaged in by the confederate in both anger and happy conditions; and a battery of emotion scales.

It was expected that these changes would strengthen the treatment differences found by Schachter and Singer, and provide a more viable methodology for further exploration of the dynamics of emotional experience.

Method

The experimental session was divided into two parts. The purpose of Part I was to establish an arousal response to a particular cue and to demonstrate, through physiological recording, that this arousal involved actual

physiological changes. In Part II, this arousal response was either elicited or not in the presence of a confederate who was behaving happily or angrily. Several dependent measures then assessed whether or not the arousal was interpreted in terms of the emotion displayed by the confederate. A summary diagram of the experimental procedure is shown in Figure 7.

Figure 7 about here

Thirty six subjects were used in this study (21 males and 15 females from the introductory psychology subject pool). Twenty-four received hypnotic training, while twelve did not. Half of the hypnosis group was not given the cue for arousal during Part II of the experiment, while the other half, and all controls, did receive the cue. Each of these groups and the waking control group was divided into subgroups of six subjects who were then exposed to a (same-sex) confederate acting happy or angry.

Part I--Physiological Arousal. When each subject arrived for this study, he was greated by one of the experimenters and asked to sign a "subject sheet," indicating voluntary participation in the experiment. The signature of the confederate was already on the sheet (as though he had arrived previously). The subject was told that the "other subject" was in the acoustic chamber, having his physiological responses recorded. He was then ushered past this room, where he could see the other experimenter busily engrossed with the recording machine. The first experimenter took him to another room and asked him to fill out a brief questionnaire. Soon after the subject completed this task, the second experimenter brought in the confederate and asked him to fill out a questionnaire. She then told the subject that it was his turn to be recorded and took him back to the acoustic chamber.

After recording electrodes were applied to the subject's arms, he was told to lean back comfortably in his chair and to follow the instructions that he would hear over the intercom. For the remainder of the period in the sound chamber, the subject's heart rate and GSR responses were continuously recorded on an Offner Type R Dynograph. The instructions were prerecorded on tape and thus were identical for all subjects.

The instructions began with a brief introduction followed by an hypnotic induction for the hypnosis subjects (this was eliminated for the unhypnotized group). All subjects then heard the following instructions:

> In this session, the following reactions will occur whenever you see the word 'start.' When you see the word 'start,' your heart will beat faster, your breathing will increase, there will be a sinking feeling in your stomach, and your hands will get moist and cold. You will feel all of these sensations as soon as you see the word 'start,' and they will last until I say to you, 'that's all for now.' When I say 'that's all for now,' you will return to your normal, comfortable state and feel relaxed and good. However, when you see the word 'start' and experience these reactions, you will not know why you are feeling the way you are, or remember my telling you anything about it.

All subjects were then asked to describe how they felt at the moment, using a Mood-Adjective Checklist. When they had finished, one of the experimenters removed the completed form from the sound chamber.

At this point, subjects were told that their physiological responses to several visual stimuli were going to be recorded. They were instructed to

look straight ahead and to remain sitting quietly in the dark. A series of stimulus lights was then individually illuminated. Each light was on for five seconds, followed by a twenty-five second period of darkness (this period was extended to eighty-five seconds for the last cue light). The first light was a red one, the second a white one, the third was labelled "stop," and then the fourth, cue signal was given, "start." At the end of the last darkness period, the subject was instructed to fill out a second Mood-Adjective Checklist, describing his feelings at that moment.

The subject was then given the cue for the disappearance of any symptoms he was experiencing and for the return to his normal physiological state and a relaxed psychological state. The suggestion about the symptoms and the word "start" (as well as the amnesia for it) was repeated, and hypnotic subjects were brought out of their hypnotic state. This concluded Part I; the electrodes were removed and the subject was brought out of the sound chamber.

Part II -- Emotional Cues. The experimenter took the subject back to the first room where the confederate was waiting. As they entered the room, the confederate asked the experimenter if they were going to begin the next part of the study. The experimenter then introduced the subject and confederate to each other, and asked them to sit down at a table, which, though divided in half by a wooden partition, still enabled them to easily see each other. Before each of them was a memory drum, a learning test sheet, a folder containing bogus test materials (i.e. TAT pictures, a color-word test, pieces of a puzzle, etc.), and some pencils. The experimenters were able to observe the subject and the confederate through a two-way mirror. An intercom system allowed the experimenters to give prerecorded instructions and to monitor the verbal interaction.

A learning task was then introduced in order to have a non-obvious way of presenting the arousal cue without either the confederate or observer's being aware of the manipulation. Two 15-word lists were presented on the memory drum with a recall test after each one. The final word on the second list was either the arousal word "start" or a neutral word "speedy." Half of the hypnotic subjects got the arousal cue, the others the neutral cue. Thus with training, conditioning and post-hypnotic expectations in the two groups held constant, we could better assess the effects of the arousal cue on the behavior of the hypnotized subjects. One indication of the success of the arousal manipulation comes from an analysis of the type of errors made on the recall test. Although there were no between group differences in overall performance, the aroused-hypnotized subjects made more errors of omission than of commission while this pattern was reversed for subjects in the other two groups. It would be predicted that a subject performing under the distracting influence of intense arousal would be less motivated to search his memory for words which may have been on the list and come up with commission errors by recalling "new" words. Rather, it is likely they will write down only the words they have stored in readily accessible memory and stop -- leading to more errors of omission. The difference in the ratio of commissions to omissions for the hypnotic versus the other two groups approaches significance ($p < .10$, $F = 3.33$, $df = 1.34$).

After the subject and the confederate had finished the recall test, they were told that the next part of the experiment would take a few minutes to be set up. It was suggested that they look through the materials in the folder while waiting for the next part to begin. They were then left alone for four minutes. During this period, the confederate went through a prearranged series of behaviors that were either angry or happy.

The confederate's behavior followed the same pattern in both the Angry and Happy conditions, although the content was different. During the first minute, he worked with the folder materials and made a few comments to himself about them, while in the second minute period he talked a little more about the experiment, school, etc. During the third minute, he directed some questions at the subject, and during the fourth minute, he finished working with the materials and "accidentally" dropped them on the floor. In both conditions, his mood was mild at first, and then became more intense over time.

Thus, the "angry" confederate began by expressing some annoyance with the experiment and fumbling around with the folder materials. Gradually, his irritation began to build up, and he became more agitated (e.g., scribbling on the pictures, crumpling up sheets of paper, moving back and forth in his chair). By the fourth minute, he had become quite angry and "blew up" when his folder "accidentally" spilled all over the floor. In the Happy condition, the confederate began by expressing interest in the folder materials and by humming a tune to himself. Gradually, he began to laugh and joke about the experiment and to clown around with the materials (e.g. drawing a mustache on a picture, making an airplane or hat out of the puzzle pieces). By the fourth minute, he was very happy and exuberant, and laughed uproariously when the folder "accidentally" spilled on the floor.

At the end of the four-minute period, one of the experimenters entered the room and asked the confederate to leave and go to another room for the next part of the experiment. The subject was told that another experimenter would join him in a minute, but before that, he should complete several questionnaires. One of these focused on the subject's present emotional feelings and physiological state, while the other assessed his reaction to the confederate. When this was

completed, the experimenter entered and gave the cue for the disappearance of the physiological symptoms. All subjects were then questioned about their reactions to various aspects of the study. Those in the arousal condition were made to relax and every effort was made to return them to the normal, pre-experimental condition. All subjects were asked not to talk about the experiment and were later given an elaborate debriefing session when the study was completed.

Summary of Design. This study is a 2 x 2 factorial design (two levels of arousal and two levels of confederate emotion) with the addition of two unhypnotized groups. Six subjects were run in each of the six cells. In terms of the Schachter & Singer model, the experimental conditions of most interest are the two Aroused groups, in which the subjects were both physiologically aroused and exposed to a happy or angry person. The arousal was produced by a combination of two factors: training in hypnosis and an arousal stimulus. The other experimental conditions lacked either one or the other of these two factors and thus represent two different types of control groups. The Unaroused subjects received the identical treatment as the Aroused condition except that they were not given the arousal stimulus. Similarly, the Control condition was identical to the Aroused groups except that these subjects had not been hypnotized.

Results

Presentation of the results will be organized around five issues: 1) effectiveness of the physiological arousal manipulation; 2) evaluation of the confederate's mood; 3) behavioral differences between treatments; 4) experienced emotional differences between treatments, and 5) attribution of arousal and emotion.

Overview of Results. In general, it can be said that the use of hypnotic training and the conditioning procedure utilized did produce a strong, persistent level of physiological arousal. Hypnotized subjects given an amnesia suggestion for the cause of their arousal were unaware of why they felt as they did. Differences between the angry and the happy confederate were perceived veridically by subjects in all conditions. These differences in the model's behavior were reflected in differences in the subjects' overt behavior. A happy model elicited much more pro-social behavior than an angry model and more observation by the subject. However, despite all of these apparently ideal conditions for replicating the finding of emotional plasticity, such a result did not occur. Aroused subjects reacted negatively across a range of self-reported items of emotion regardless of whether they had been exposed to the angry or happy model. Control subjects, not experiencing a comparable state of unexplained arousal, either did not react with emotion, or reacted positively.

Physiological Arousal

The physiological data from the first part of the experiment clearly show that the hypnotized subjects experienced a state of arousal upon seeing the word "start." In contrast, the unhypnotized subjects did not

demonstrate such extreme physiological changes, even though they heard the identical instructions. Figure 8 shows the pattern of mean changes in heart rate for both groups. The difference between the highest heart rate

Insert Figure 8 about here

recorded after the arousal stimulus and the highest heart rate following the three neutral stimuli is significantly greater for hypnotic subjects than for non-hypnotic ones ($p<.001$, $t = 5.16$, $df = 23$). Analysis of GSR responses also reveals differences in arousal. Hypnotic subjects displayed a significantly greater number of GSR responses during the minute following the arousal stimulus than did the unhypnotized group ($p<.05$, $F = 5.36$, $df = 1/34$).

How did the subjects feel emotionally while they were experiencing this arousal? Before and immediately after the arousal stimulus, subjects filled out a Mood-Adjective Checklist, in which they rated each of forty-four adjectives on a four-point scale (ranging from "not feeling this emotion at all" to "definitely experiencing this emotion"). Some of the adjectives described negative emotions (e.g., angry, clutched up), some were positive (e.g., overjoyed, pleased), some were active (e.g., bold, energetic), and some were passive (e.g., calm, still). The difference scores between the subjects' pre- and post-ratings indicate the shift in mood that resulted from the physiological arousal. As shown in Figure 9, hypnotic subjects became more negative and active in their mood, and less positive

Insert Figure 9 about here

and passive. Their ratings were significantly more extreme than the unhypnotized subjects ($p < .001$, $F = 17.15$, $df = 1/34$).

Because hypnotic subjects responded physiologically to the arousal stimulus in the acoustic sound chamber, it was assumed that they would respond in the same way if they saw this stimulus during the learning task. Unfortunately, because we lacked telemetry equipment, it was not possible to record the subjects' physiological responses while they were with the confederate and thus check on the validity of this assumption. However, two indirect measures of arousal were used. The effect of arousal on recall has been reported earlier. On a second measure, subjects reported which of a battery of physiological symptoms they were experiencing. From 92 to 100 percent of the aroused subjects reported experiencing each of the four suggested symptoms, while only 26 to 52 percent of the unaroused subjects reported having one of the set of symptoms. The difference between preportions for each of the four symptoms computed separately is beyond the .001 level.

Perception of Confederate.

To check on the effectiveness of the confederate manipulation, subjects were asked to make ratings of the confederate. On scale items which described the confederate's mood (e.g., angry - peaceful), subjects in the Happy condition rated the confederate's mood as positive, while Angry subjects reported it as negative. As seen in Figure 10, the difference

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Insert Figure 10 about here

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between the two groups is extremely significant ($p<.001$, $F = 68.58$, $df = 1/32$), which testifies to the success of this manipulation. The remaining scale items focused on the subject's personal evaluation of the confederate (e.g., rude - polite). Subjects in the Anger condition were more negative in their evaluation than subjects in the Happy condition ($p<.025$, $F = 6.61$, $df = 1/32$).

Overt "Emotional" Behavior.

The overt behavior of the subjects varied as a function of the confederate's mood. As shown in Table 5 subjects who were with the happy

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Table 5 about here

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confederate exhibited a significantly higher amount of positive social behaviors than did subjects who were with the angry confederate. This was true for both verbal behaviors, such as agreeing with the confederate ($p<.001$, $F = 20.97$, $df = 1/30$) and non-verbal behaviors, such as smiling, nodding one's head, etc. ($p<.001$, $F = 44.80$, $df = 1/30$). Furthermore, subjects in the Aroused condition spent more time looking at the confederate when he was happy than when he was angry ($p<.025$, $F = 9.90$, $df = 1/10$).

Reported "Emotional" Experience.

Although the confederate's mood had an effect on subjects' overt behavior, it did not exert the expected influence on their reported emotional state. Rather, their felt emotion was a function of whether or not they were experiencing unexplained arousal. Two of the questionnaire items on emotion were the identical ones used by Schachter & Singer which asked subjects to rate on a five-point scale just how happy and how angry

they were. Following their procedure, an analysis of the difference scores (happy - angry) shows that both of the Aroused conditions were experiencing a more negative emotional state than the conditions experiencing no arousal ($p < .01$, $F = 8.13$, $df = 1/32$) (See Figure 11). Analyses of both

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Insert Figure 11 about here

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the happy and the angry ratings separately provide even stronger evidence of the difference in emotional reactions between the Aroused groups and the other groups without arousal. Aroused subjects were significantly more angry ($p < .005$, $F = 12.89$, $df = 1/32$) and less happy ($p < .001$, $F = 16.34$, $df = 1/32$) than the subjects in the Unaroused and the Control groups. In all cases, there was no difference in patterns of emotion between subjects exposed to the happy and to the angry confederate, which indicates the lack of influence of this model.

The questionnaire also included a series of seven-point scale items on emotional feelings, such as "happy - sad," "anxious - calm," etc. The subjects' mean ratings on these eight combined emotion items is shown in Figure 12. Aroused subjects reported a generally negative emotional state, which was significantly different from the emotional ratings of the

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Insert Figure 12 about here

Unaroused and Control groups ($p < .001$, $F = 25.88$, $df = 1/32$). While the Unaroused groups rated themselves as feeling a positive emotional state

(the mean of 6.08 is different from zero at the .05 level, $t = 2.321$, $df = 11$), the Control groups were neutral in their emotions, as their scores did not differ significantly from zero. Apparently, the Unaroused subjects were responding to the post-hypnotic suggestion that they would feel relaxed and good when they came out of hypnosis, while the Control subjects were unable to do so. The positive feelings of the Unaroused group make even more dramatic the negative reaction of the Aroused subjects, who had also received the same post-hypnotic suggestion. Again there was no difference between the pattern of emotion ratings displayed by the Happy condition and that of the Angry condition.

Subjects were also asked to describe previous situations in which they had felt as they now did. These open-ended responses were rated by judges who were "blind" to both the purpose of the experiment and the condition of the subject. Aroused subjects described situations which were more negative (e.g., waiting to take an exam, waiting to see the dentist, hearing bad news, etc.) than those described by subjects in both non-arousal conditions ($p<.001$, $F = 21.84$, $df = 1/30$). Subjects who were not aroused described more passive situations than did the Aroused group, and this was more true of the Happy condition than of the Angry condition ($p<.025$, $F = 6.44$, $df = 1/30$).

Attribution of Causality.

In another questionnaire item, subjects were asked if they knew why they felt as they did and, if so, to state the reason. These responses were also scored by "blind" judges. One of these scores reflected the degree of similarity between the subject's stated reason for his feelings and the reasons given by the confederate for his emotional state

(e.g., "I'm very upset because I also don't like this experiment"). A significant interaction was found ($p<.025$, $F = 8.25$, $df = 1/30$), in which the Aroused subjects (who were experiencing a negative emotional state) were more similar to the confederate when he was angry than when he was happy. On the other hand, the two conditions with no arousal (who reported positive or neutral emotions) were more similar to the confederate when he was happy than when he was angry. The judges also rated the extent to which the subject said his emotional state was the result of the confederate's behavior (e.g., "I'm feeling upset because that other guy was bothering me and getting on my nerves"). The analysis again reveals a significant interaction ($p<.001$, $F = 11.06$, $df = 2/16$); subjects were more likely to attribute their emotion to the confederate's behavior when they were aroused than when they were not, but only in the anger condition.

It is possible that the post-hypnotic suggestion had the effect of blocking any search for an explanation of the experienced arousal. This does not seem to be the case since 67 percent of the arousal subjects did state they thought they knew why they felt as they did. However, in no case was their stated reason related to the experimentally induced cause. In the unaroused hypnotic group 50 percent of the subjects stated they knew the cause of their current feelings, while 67 percent of the controls also did. Thus there is no difference between groups in the likelihood that subjects will generate an explanation for their experienced state. The important difference appears to be that this state is a more negative one for the aroused subjects and the explanations they propose do not adequately explain or reduce their level of arousal.

Conclusion and Discussion

The following conclusions seem warranted by the available data. Hypnosis is effective in eliciting a specific syndrome of measurable physiological symptoms and in creating amnesia as to its cause. Emotional reaction can be differentiated into overt, behavioral, and subjective experiental components, which in this study were not correlated. Subjects can laugh at the joke of a confederate but still be upset by their arousal state, or conversely, show distressed concern over the anger of a confederate, yet personally feel good. This finding in fact, removes a source of ambiguity from interpretation of the data from experiments such as these. We can answer in the negative the question: is the experience of emotion anymore than self-labelling which follows from observing oneself overtly acting in a particular "emotional" way. In addition, subjects can clearly separate their evaluation of another person's mood from their own. Aroused subjects made comments as, "She was a very nice, bouncy, and talkative person, but I just don't feel bouncy and talkative right now."

The failure to find the "plasticity" effect of Schachter and Singer (1962) requires that we try a more direct replication of their study, using epinephrine and their original conditions, which we have begun. We hope to discover through a systematic program of research the variables which are responsible for the result they found. One of our studies will administer epinephrine to hypnotized subjects, while instructing them that they will feel whatever they happen to be feeling whenever a particular cue is presented (in the post-hypnotic, test situation). Thus, we bring the onset of arousal under more precise experimental control without adding the questionable aspect of verbally providing the set of symptoms the

subjects should be feeling -- the symptoms thus remain partly their own private experience.

Most exciting to us is the possibility that unexplained arousal is the key to emotional pathology. If the need to explain discontinuities in behavior and experience leads to a cognitive search of the external and/or internal environment, then failure to come up with adequate causal explanation makes one's behavior "irrational." If it also appears that others in the same situation are not reacting similarly, then one's behavior becomes not "normal." To be different from others, to behave idiosyncratically and not know why, are the basic elements in our cultural definition of madness. We are in the process of developing a general model which we believe will explain the development of particular types of defensive mechanisms as well as neurotic and psychotic symptomatology. Such pathology is viewed as the end products of what begins as a rational search for understanding chronic, unexplained arousal. It may be that the Schachter-Singer model holds for the development of the emotional labelling process, but that by the time we become adults the experience of a masked discontinuity in state is always perceived negatively, and the search for an explanation is thus biased and motivated by the concern that failure to come up with an adequate explanation has pathological consequences in terms of loss of self-control. And it often does.

CONCLUSIONS

The studies reported in this paper represent only a preliminary attempt to use hypnosis as a means to explore a variety of basic psychological phenomena. We are encouraged enough by the overall pattern of significant findings to recommend that psychologists consider hypnosis as a valuable addition to their set of research tools. By doing so, they may gain in being better able to study certain complex problems such as those described here -- autonomic control, time distortion, and emotion -- as well as more traditional ones related to memory and learning. In turn, the study of hypnosis will also gain by having new research-oriented blood infused into its substance. We anticipate that the next decade will see this reciprocal relationship flourish to the mutual benefit of hypnosis and psychology.

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TABLE 1

Changes in TAT responses
from before to after
induction of time distortion

TREATMENT	MEAN % PRESENT TENSE VERBS TO TOTAL VERBS	MEAN % TOTAL REFERENCES TO: PAST	PRESENT	FUTURE
Present expanded Hypnosis	+8.5	0	+3.3	-3.2
Simulation	+12.4	-10,1	+11.3	-1.3
Neutral	-14.6	-1.2	-8.3	+9.6
Normal Time	-20.7	+5.9	-8.8	+2.9

TABLE 2

Mean number of observed smiles or laughs in response to obscene, comedy material.

TREATMENT	SMILES	LAUGHS
Hypnosis	3.0	3.0
Simulation	3.7	.2
Neutral	5.2	1.0
Normal Time	6.7	.7

Table 3

Percent of time on target
(for each two-minute period)

Treatment	Baseline (A)	Slow tempo	change	Baseline (B)	Fast tempo	change
Hypnosis (N = 6)	74%	36%	-38%	68%	28%	-40%
Simulation (N = 3)	86%	77%	- 9%	69%	66%	- 3%
Control (N = 9)	78%	66%	-12%	71%	60%	-11%

Table 4

Patterns of response variability (mean number of shifts to and away from target level compared to shifts within off-target levels, subtracted from baseline shifts).

Treatment	Total variation	Variation around target level	Variation around off-target levels
Hypnosis	+17.8	-13.2	+31.0
Simulation	+16.3	+18.0	-1.7
Control	+19.0	+19.2	-0.2

TABLE 5

Mean Number of Pro-Social Behaviors

Verbal

Confederate's mood	Arousal condition		
	Aroused	Unaroused	Control
Happy	4.42	4.33	2.50
Angry	.67	.42	.92

Non-Verbal

Confederate's mood	Arousal condition		
	Aroused	Unaroused	Control
Happy	10.50	8.17	6.00
Angry	.83	.42	1.58

Figure Captions

Figure 1--Mean change in skin temperature in suggested direction (no change being the baseline level, negative scores for changes opposite to suggestion, positive scores for appropriate changes).

Figure 2--Simultaneous modification of skin temperature in opposite directions in the right and left hands (omitted minutes 8 - 12 are no different from the rest of the modification period).

Figure 3--Divergent skin temperature modification in a subject responding to self-induced relaxation, concentration, and temperature change suggestions.

Figure 4--Response specificity shown by hand decreases in temperature with constantly maintained forearm temperature.

Figure 5--Mean time spent continuing to play with clay after being told to stop.

Figure 6--Mean percent of time responding at off-target rates in direction of distortion suggestion.

Figure 7--Summary diagram of experiment.

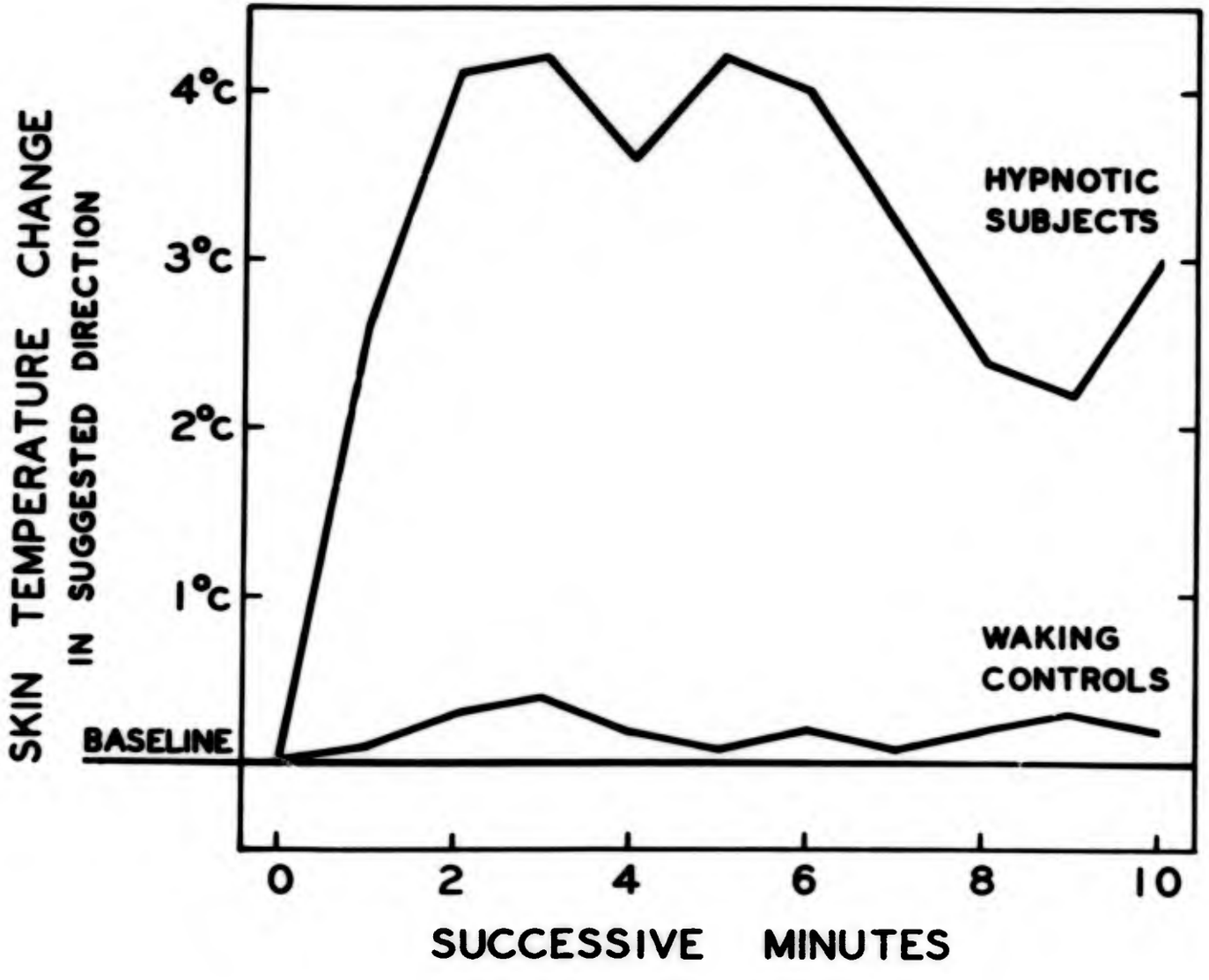
Figure 8--Mean changes in heart rate to irrelevant and hypnotically conditioned stimuli.

Figure 9--Mean change in mood ratings before to after unexplained arousal in Part I of experiment.

Figure 10--Perception of model's mood.

Figure 11--Mean self-ratings on Schachter & Singer emotion scales.

Figure 12--Mean self-ratings on eight emotion scales.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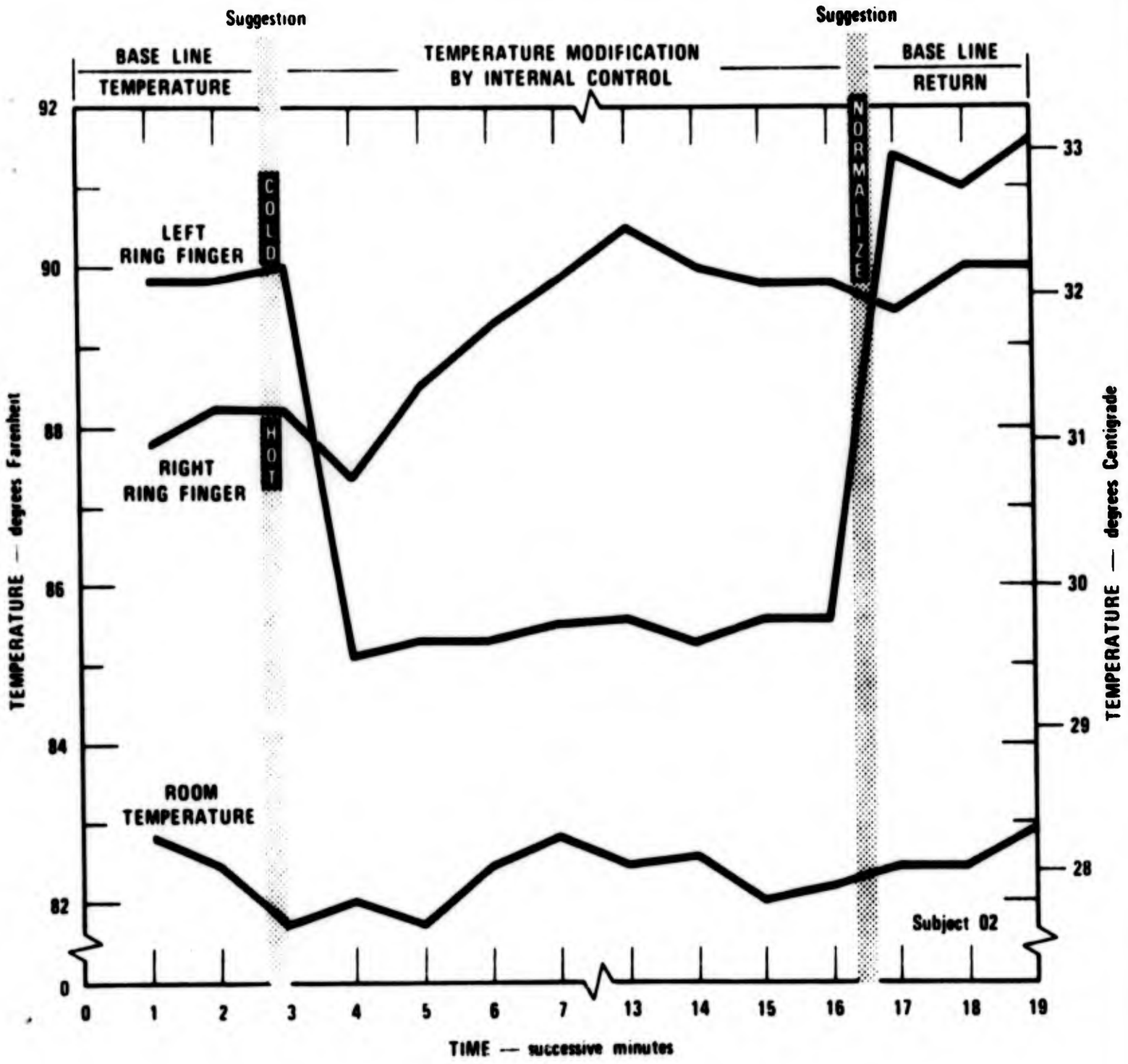
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TEMPERATURE — degrees Farenheit
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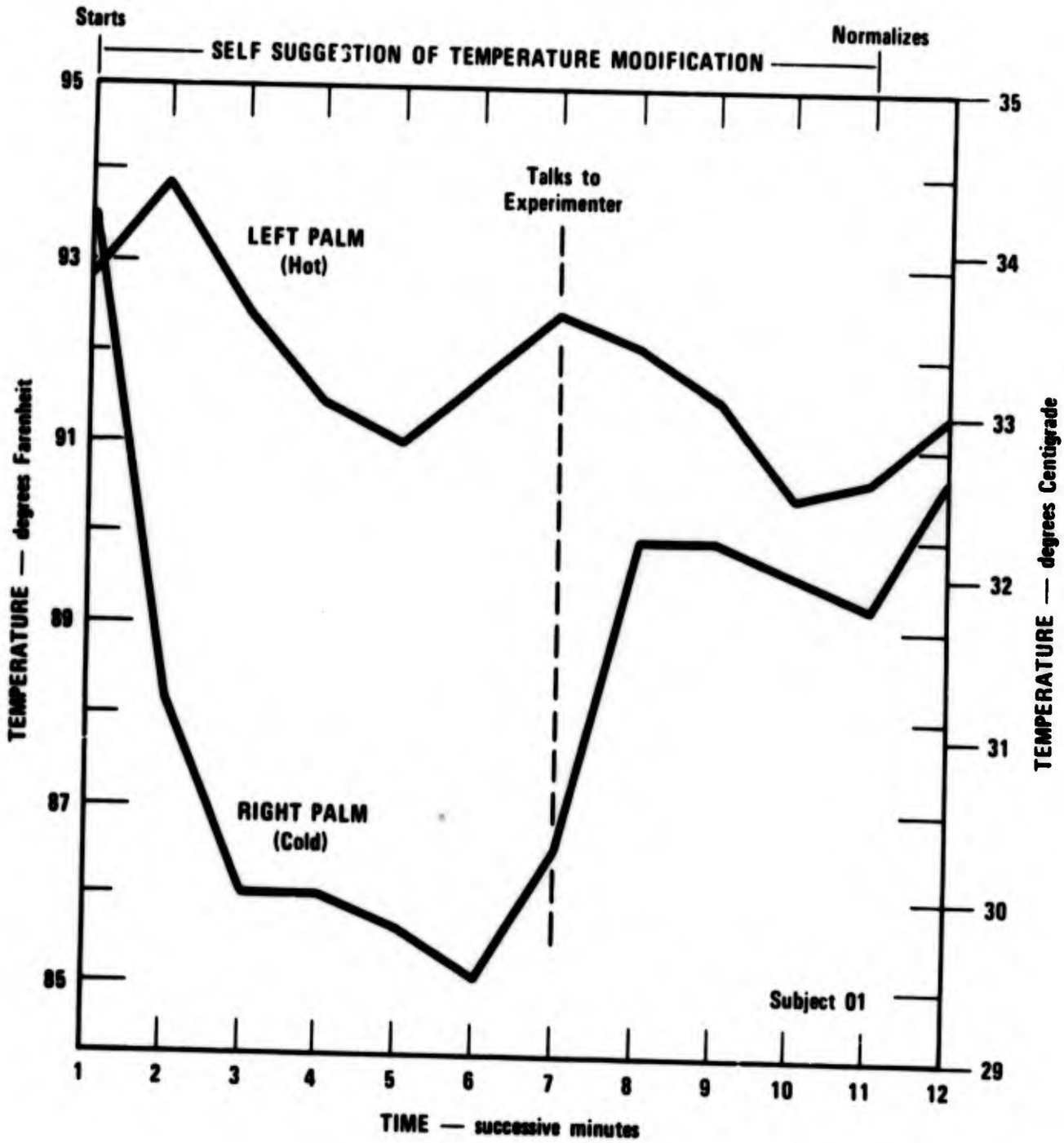
Starts
SELF SUGGESTION OF TEMPERATURE MODIFICATION
Normalizes
Talks to Experimenter
LEFT PALM (Hot)
RIGHT PALM (Cold)
Subject 01
TEMPERATURE — degrees Farenheit
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TIME — successive minutes
95
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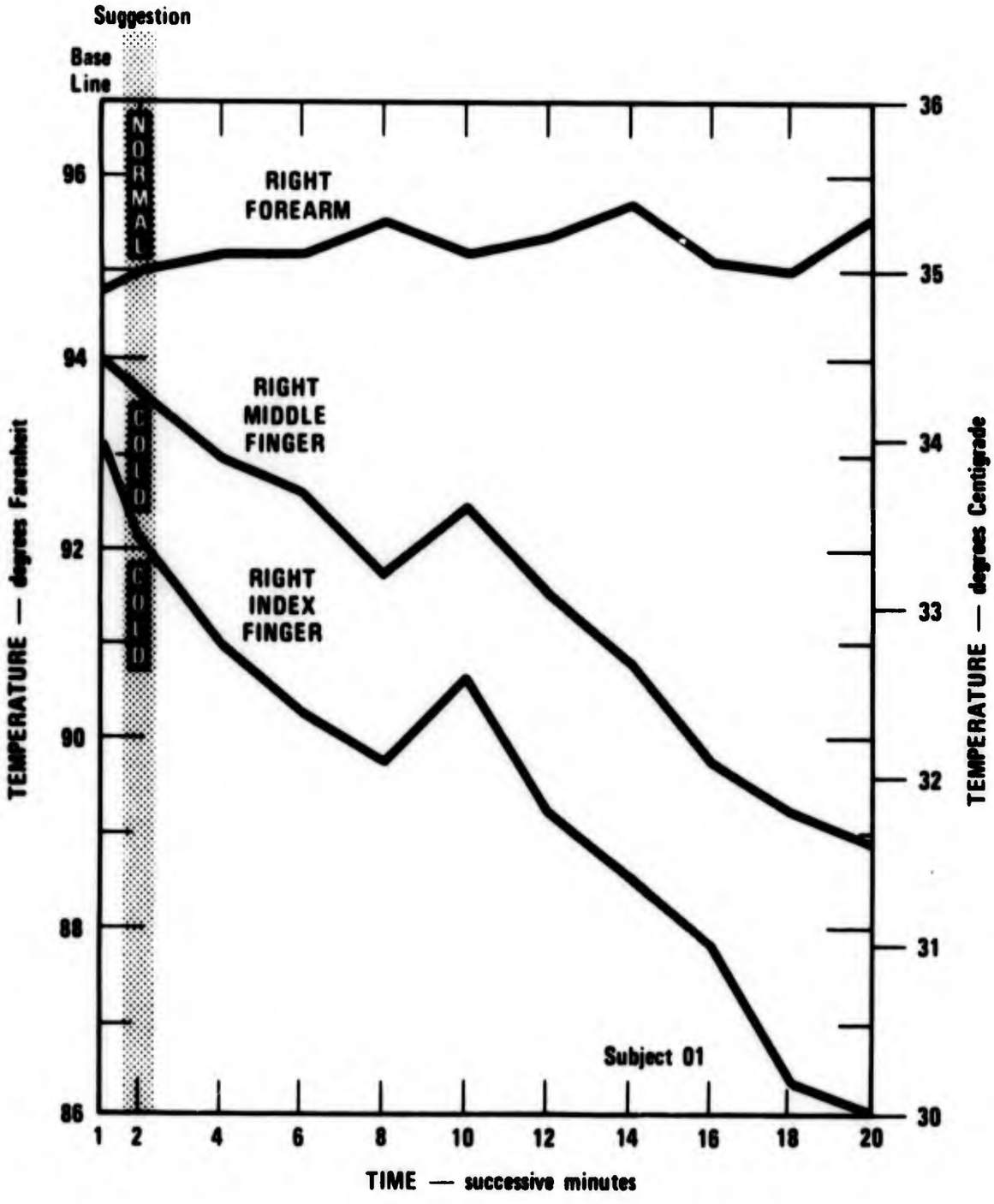
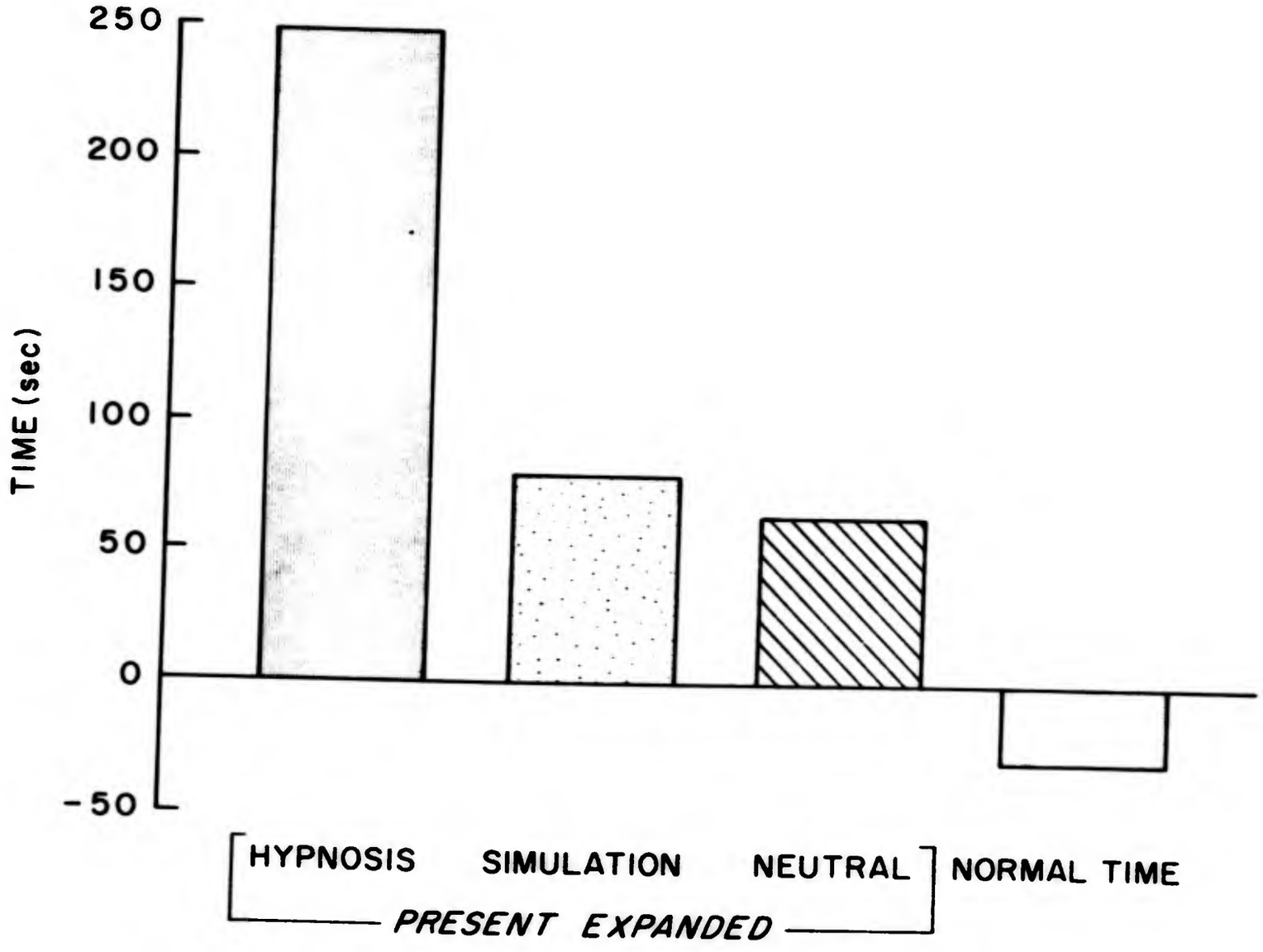
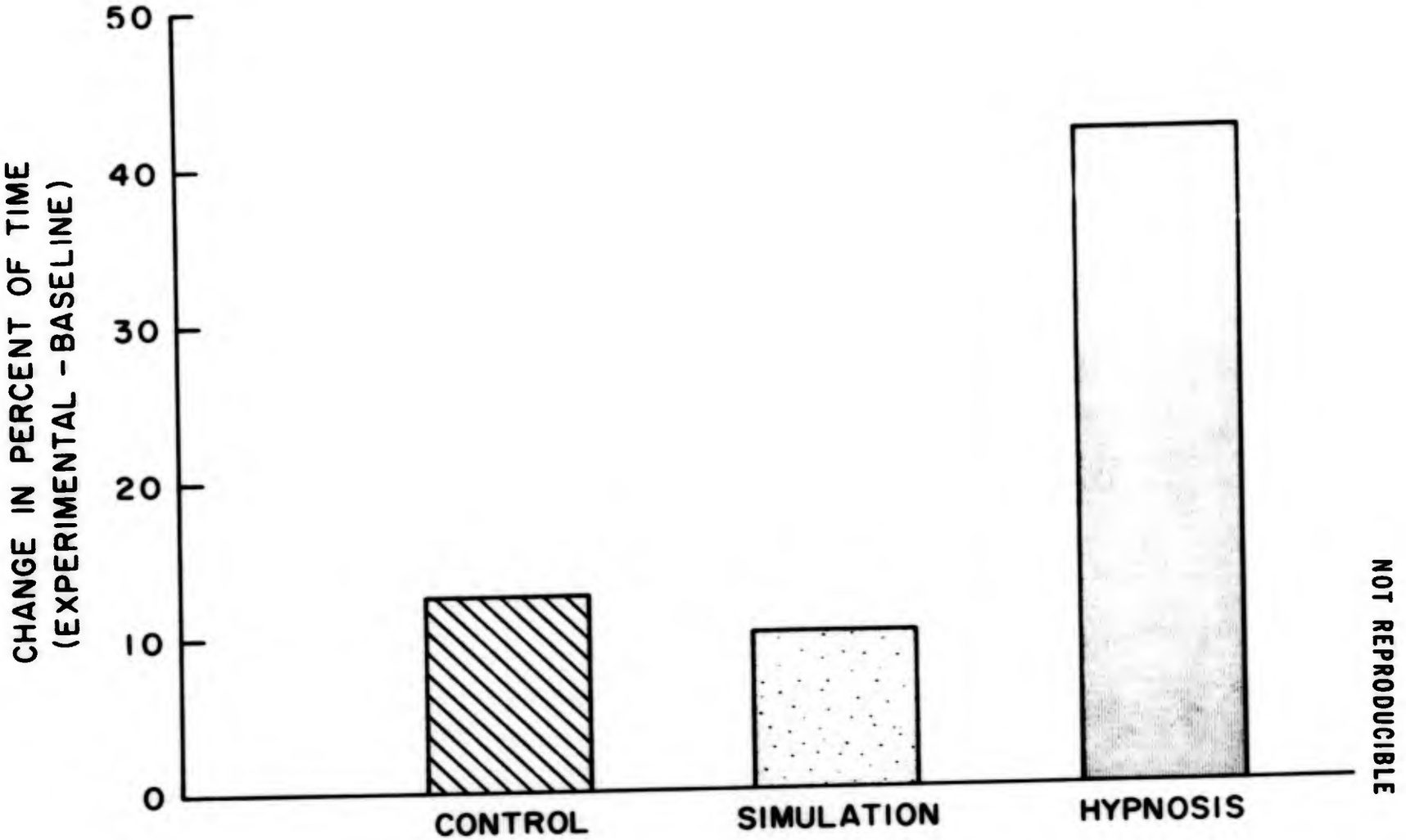
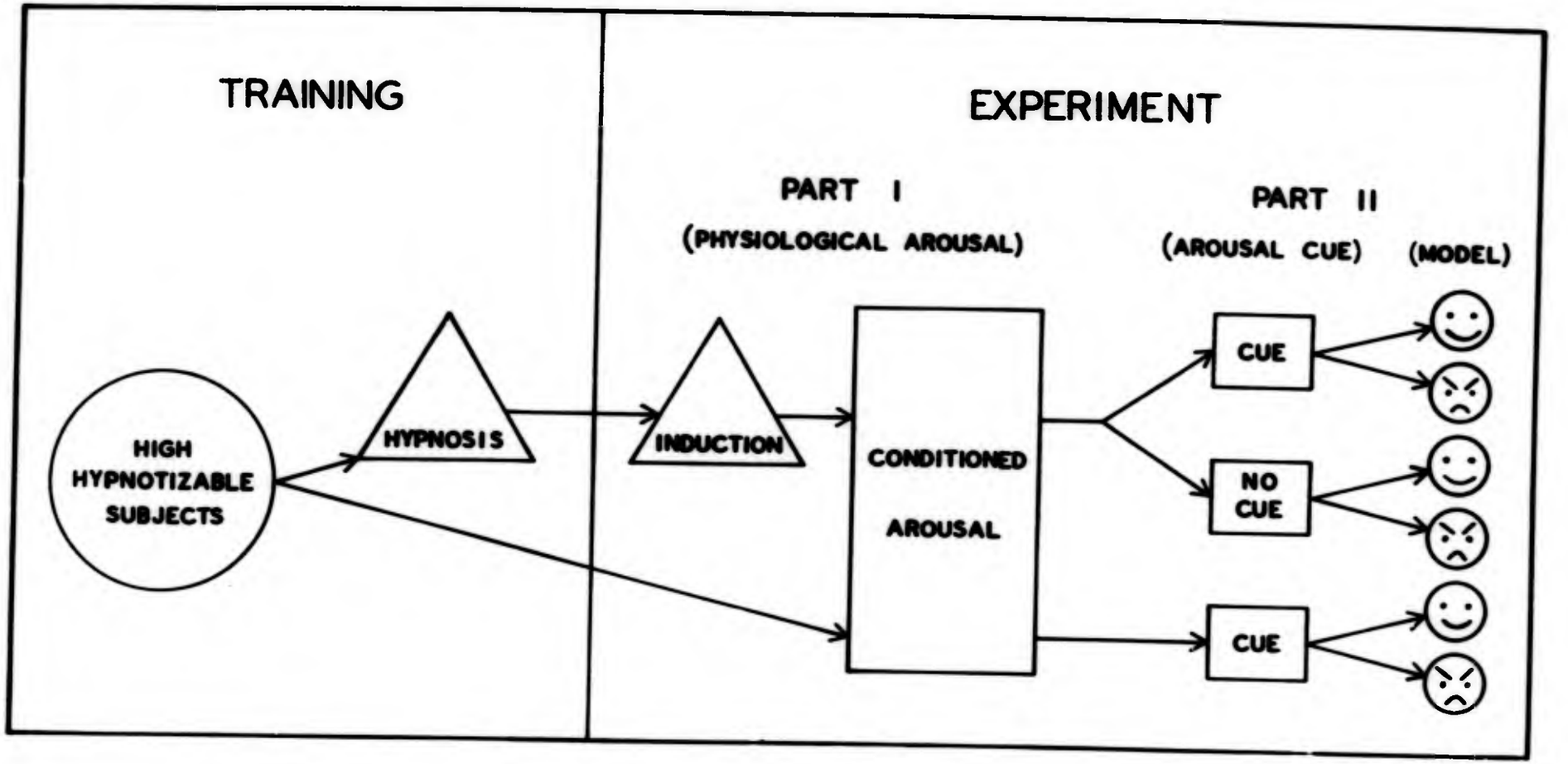
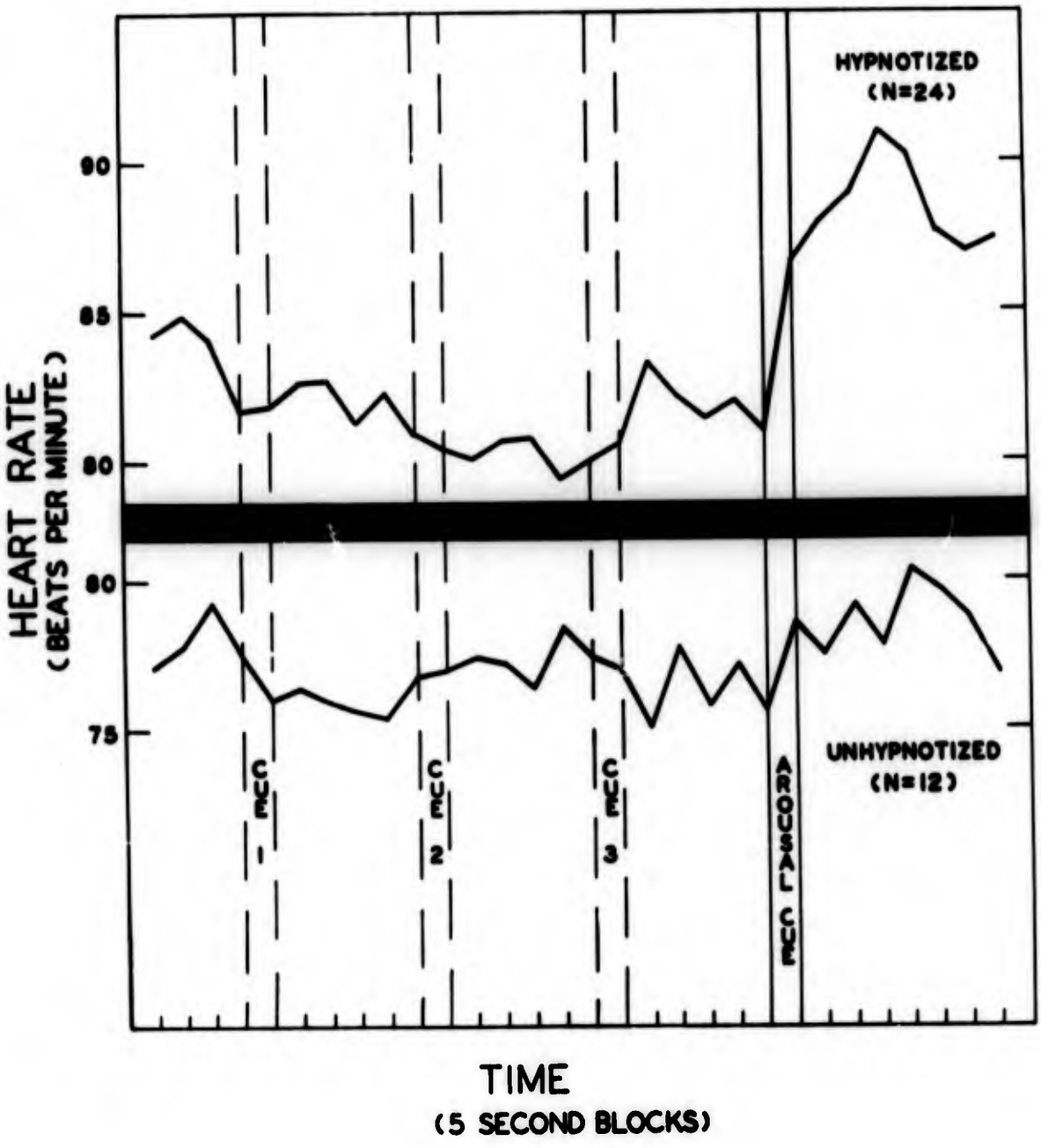
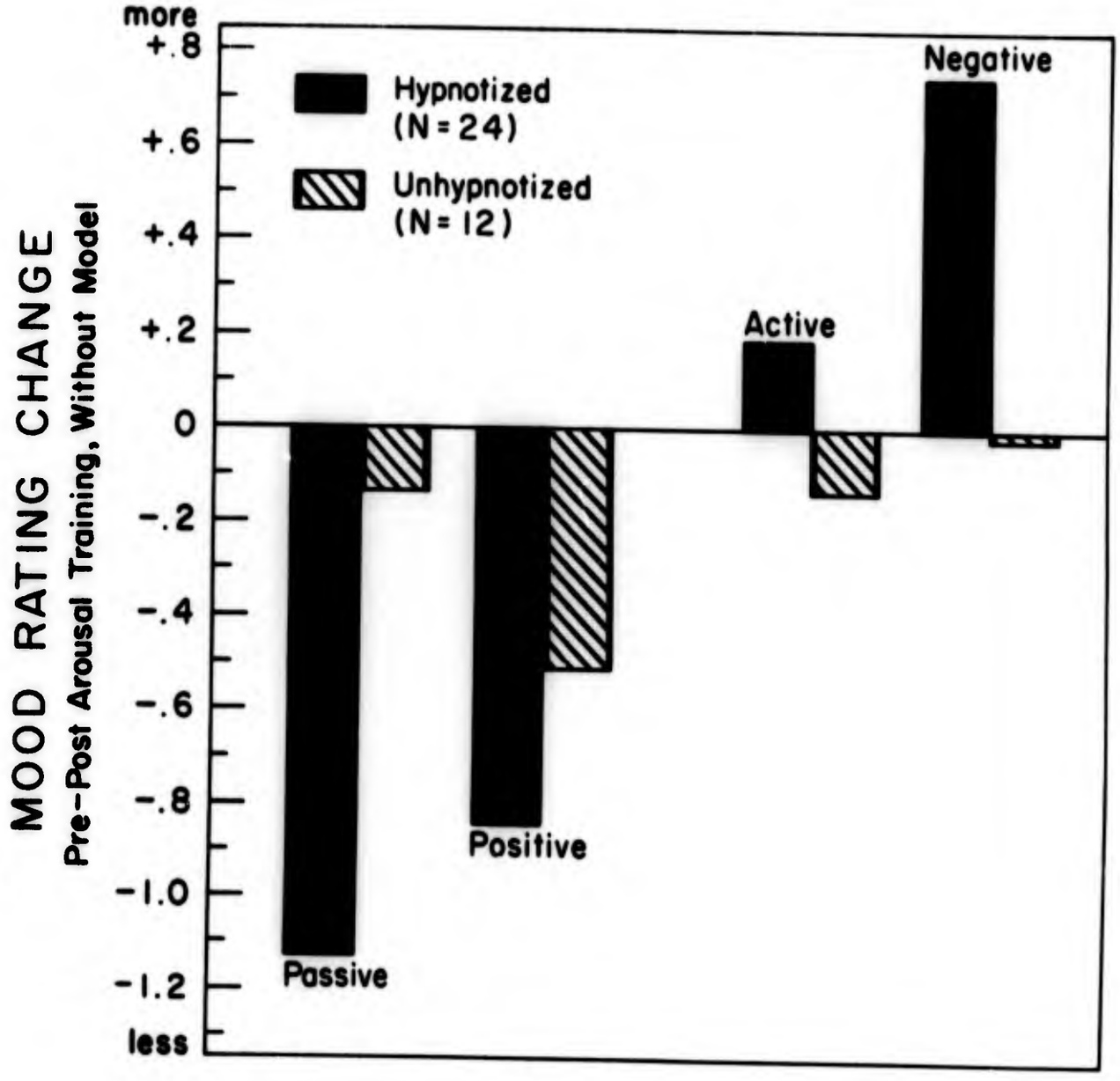

Suggestion
Base Line
NORMAL
COOL
COLD
RIGHT FOREARM
RIGHT MIDDLE FINGER
RIGHT INDEX FINGER
Subject 01
TEMPERATURE — degrees Farenheit
TEMPERATURE — degrees Centigrade
TIME — successive minutes
96
94
92
90
88
86
36
35
34
33
32
31
30
1
2
4
6
8
10
12
14
16
18
20

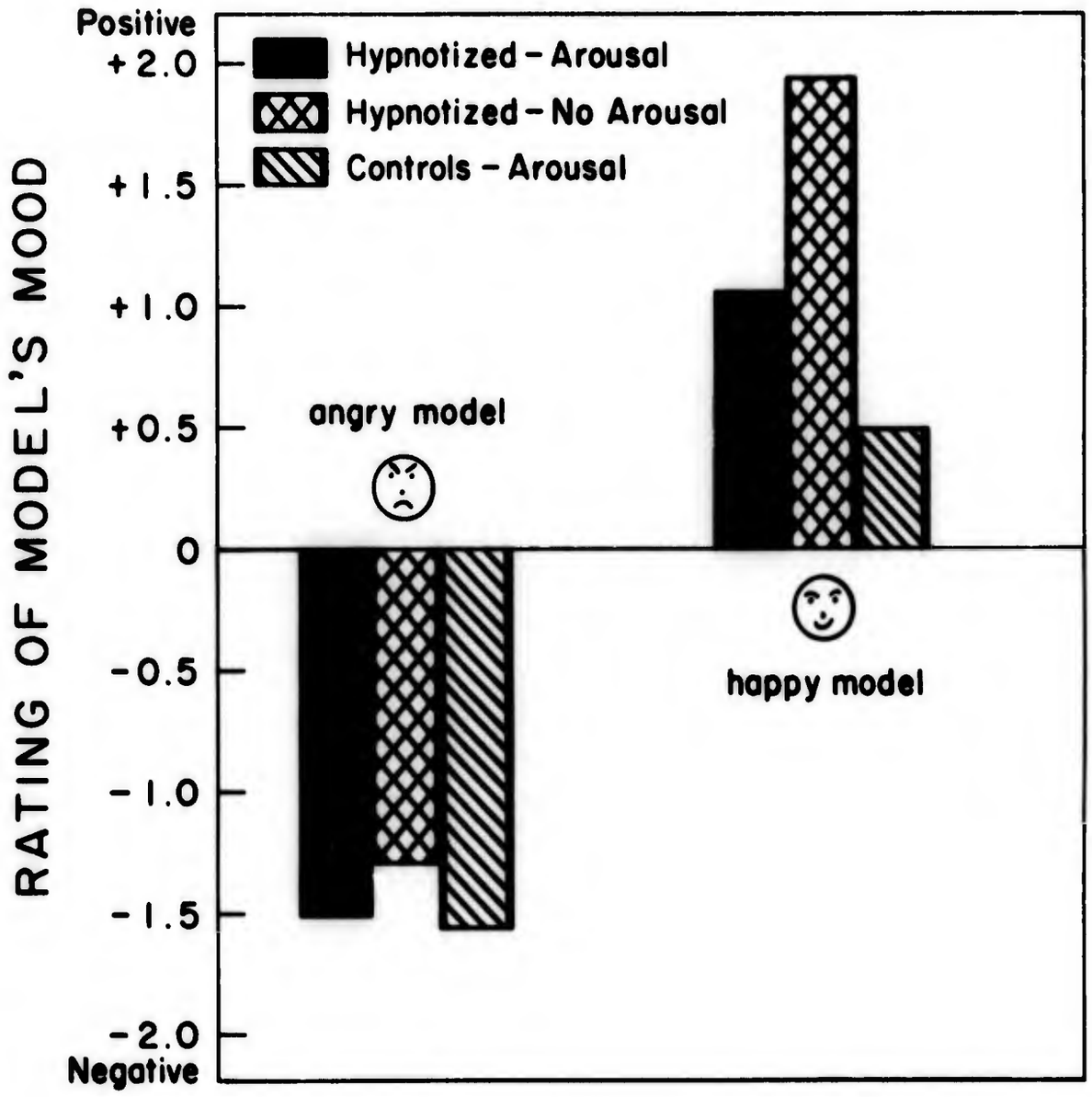


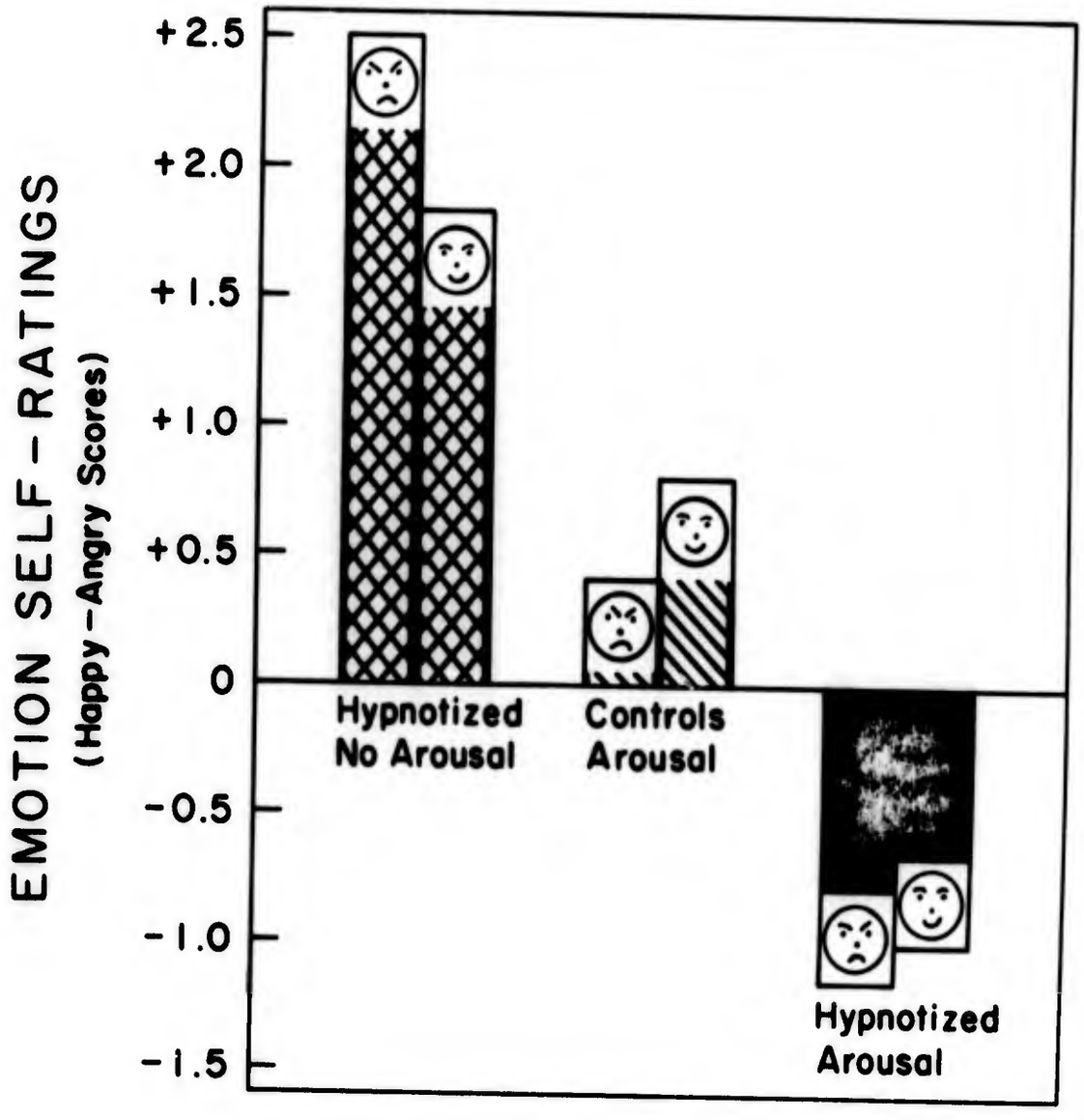


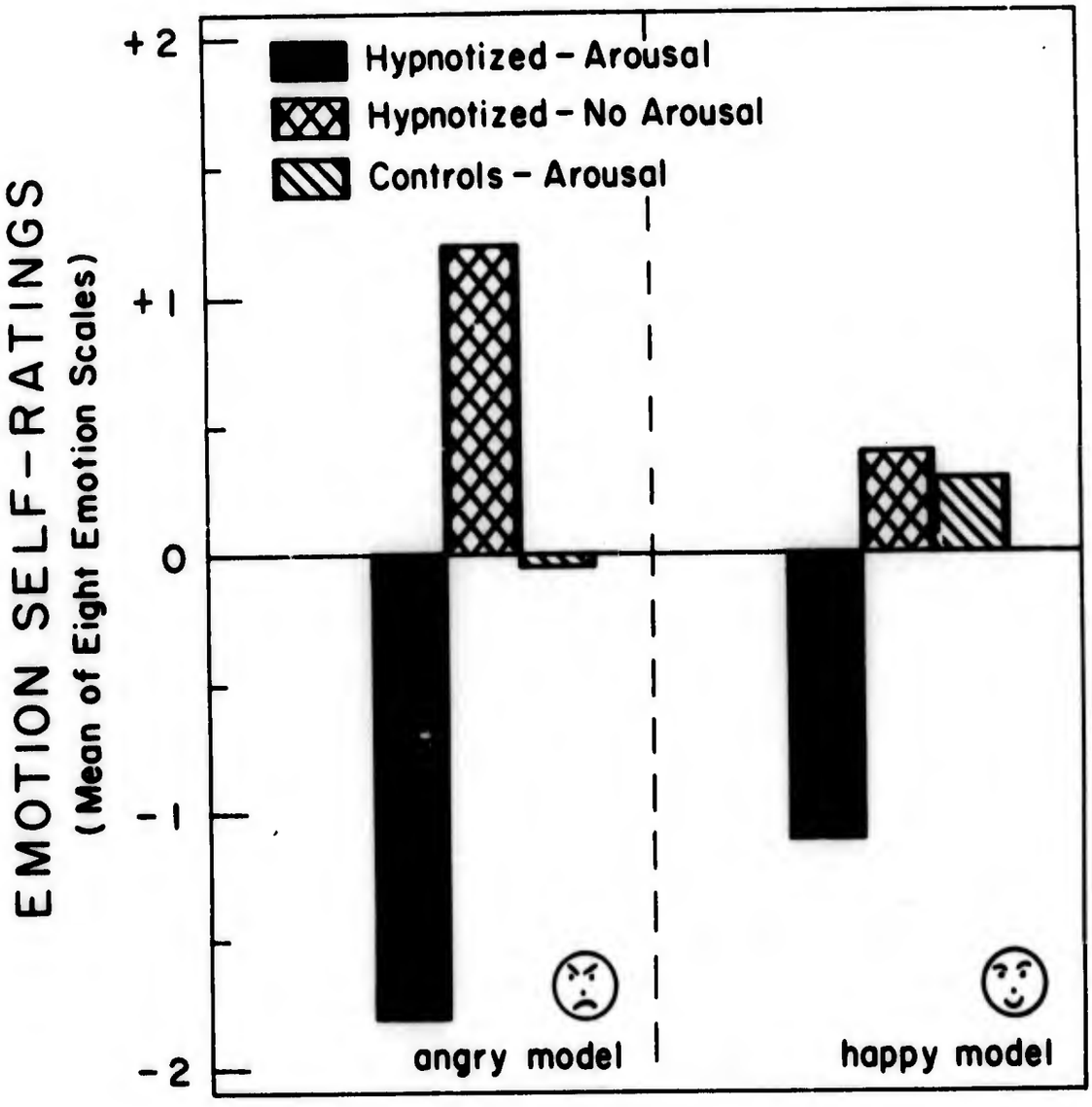

TRAINING
EXPERIMENT
PART I
(PHYSIOLOGICAL AROUSAL)
PART II
(AROUSAL CUE)
(MODEL)
HIGH HYPNOTIZABLE SUBJECTS
HYPNOSIS
INDUCTION
CONDITIONED AROUSAL
CUE
NO CUE
CUE











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Professor P. G. Zimbardo
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13. ABSTRACT

Four experiments are reported which study various aspects of cognitive and behavioral control processes. They each employ hypnosis as a methodological tool to induce alterations in states of awareness or to change self-attributions of causality. The first study demonstrates the control over autonomic function--skin temperature--which is possible with hypnotic training. The next two studies explore the relationship between time perspective, time awareness and a variety of behavioral measures. The final study is the first in a systematic program investigating the nature of emotional arousal and emotional plasticity. Hypnosis is used to help induce a state of physiological arousal while simultaneously creating amnesia for the cause of the arousal. The resulting condition of "unexplained emotional arousal" is assumed to be the basic dynamic in a search for a rational explanation and the mechanism by which irrational explorations may be generated.

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