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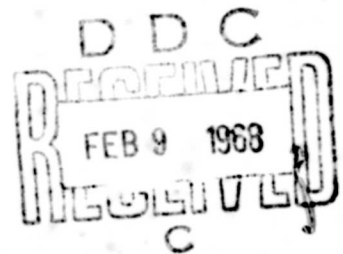


**MODIFICATION OF STRESS RESPONSES TO
COLD AND ELECTRIC SHOCK:
THE USE OF AUTOHYPNOTIC TECHNIQUES**

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OCTOBER 1967



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FOREWORD

This research was initiated by the Environmental Medicine Division, Biomedical Laboratory, Aerospace Medical Research Laboratories, Wright-Patterson Air Force Base, Ohio, with the University of Southern California. The research was conducted in support of Project 7222, "Biophysics of Flight," and Task 722205, "Biophysics of Flight: Environmental Physiology." This experiment was funded in part under National Institute of Mental Health Career Development Grant No. 1-K3-MH-31, 209-01. Perry London was principal investigator for the University of Southern California. V. H. Thaler, Major, USAF, BSC, Environmental Medical Division, was the original contract monitor and later Abbott T. Kissen, PhD of the Environmental Medical Division became contract monitor for the Aerospace Medical Research Laboratories. This experiment began in July, 1965 and was completed in August, 1966.

The authors are indebted to a number of consultants and assistants for their aid in the work reported here. Professor Martin Orne, University of Pennsylvania, assisted with the design of the experiment. Professor Norman Tiber, University of Southern California, helped in designing the study and the original vigilance task used in it. Mr. Robert Stewart, California State College at Los Angeles, helped design and construct much of the equipment used. Mr. Michael Davenport, Antioch College, Yellow Springs, Ohio, assisted in many phases of design and data collection. Mr. Norman Palley, Los Angeles County Department of Mental Health, managed the data analyses. Professor Patrick Meehan, University of Southern California, loaned us the equipment, Environmental Control Chamber, and technical assistance required for much of the work. Finally, we are deeply indebted to Drs. Kirk Klopp, Gilbert Steingart, Donald Schafer, and Alexander Zane, all of the Los Angeles Society of Clinical Hypnosis, who served as expert hypnotists and trained the experimental subjects used in the study.

This technical report has been reviewed and is approved.

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ABSTRACT

This project was undertaken to determine the usefulness of autohypnotic training for overcoming the debilitating effects of stress on performance and physiological processes. The experiment was performed on 64 male volunteers, one-half high in hypnotic susceptibility and one-half low. Each subject went through three experimental sessions, one without stress and two with stress, in each of which he was given two performance tasks and monitored on eight physiological measures. Cold (35°C) and electric shock (15 second average interval) were used as the stressors. After the non-stress and first stress sessions, the subjects in the experimental group received six hours of autohypnotic training, oriented toward enabling them to function optimally under stress without excessive discomfort.

Hypnotic susceptibility exercised a critical influence on most of the dependent measures. High and low hypnotic susceptibles are fundamentally different on a number of performance and physiological parameters, and susceptibility also frequently interacts with stress. Training was variably effective as a stress resistance technique; its efficacy was clear and pronounced on vigilance performance, independent of hypnotic susceptibility, but on rotary pursuit performance, training benefitted low-susceptibles significantly more than high ones. Training had comparably variable effects on physiological measures. Susceptibility often interacts significantly with training and itself produces some of the most powerful effects in the entire study, indicating clearly that future studies of hypnotic training should account for differences in subject susceptibility.

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SECTION I

INTRODUCTION

The experiment reported here originated in connection with a practical problem that is elementary and pervasive in the human struggle for control of the environment. It is the problem of how to maintain control over oneself, especially in the face of emergencies, so that one's energies can then be directed toward the solution of other problems. At the most elementary level, under the most primitive natural conditions, this usually refers to control of one's performance in the face of physical distress like the pain of wounds or the ravages of hunger, thirst, cold, or heat. Technically, such problems are said to be those of stress and stress resistance or tolerance.

The problems of stress resistance become apparent again under ideal technological conditions where bodily needs are specifically well cared for. In such situations, equipment malfunctions, human errors, or unforeseen "acts of God" may create emergencies where elementary dangers must be confronted by use of elementary skills. Aerospace exploration is one such situation, and this experiment is part of a broad program of studies by the United States Air Force to identify the behavioral and physiological variables that are critical for resisting environmental stresses.

THE DEFINITION OF STRESS

Stress and stress resistance is a fundamental and important problem in medicine, physiology, and psychology, but its investigation presents serious problems both of definition and operations. Contemporary definitions are exemplified by Coleman (1964, p. 671) who states that stress is "any conditions impinging on the organism which require adjustive reactions" and Selye (1965, p. 54) who defines it as the "state manifested by a specific syndrome which consists of all the nonspecifically induced changes within a biologic system." The difficulty of definition is suggested by the fact that some authors (e.g. Brady, 1957) conduct and report on stress research entirely in terms of their operations without ever attempting to define exactly what they mean by stress. This makes it understandable that there are wide differences in uses of the term.

Korchin (1964) states that:

"The use of the term 'stress' in behavioral and biological sciences derives from the physical sciences, where stress is a force which is exerted on some system in such fashion as to deform, alter or damage the structure of that system ... In our fields, there is no ready agreement on formal definition...(p. 247)."

Physiology and psychology are the two fields where stress is studied most extensively, and usage varies both within and between them,

referring in one or another context to environmental stimuli, physiological mechanisms, performance variables, and subjective feeling states. Lazarus (1966) tries to distinguish the broad categories of physiological and psychological stress by using the term "threat" for the latter, following Selye for the former. Appley & Trumbull (1967) similarly distinguish "Systemic stress" and "Psychological stress." They catalogue some currently popular uses of the concept.

"...as a substitute for what might otherwise have been called anxiety, conflict, emotional distress, extreme environmental conditions,...tension arousal, or by some other previously respectable terms...the use of the term suggested both apparent and real possibilities of correlating psychological events with physiological substrata...(p. 1)."

As might be expected in the face of such diversity, there are equally wide divergencies in the characteristic foci of researches on this subject, with definition following operation.

To begin with, investigators have employed a wide variety of stimulus conditions to induce stress. These have included such stressors as electric shock (Shor, 1962), continuous suggestion to highly motivated subjects that they were failing or doing poorly in their performance on various types of tasks (Dykman, Ackerman, Gallrecht, & Reese, 1963), and extreme thermal conditions (Kissen, Reifler, and Thaler, 1964). The different types of stressors can logically be subsumed in two operational categories:

1. The first may be designed as general debilitating stressors. These are stress conditions that are characteristically continuous over long periods of time and that tend to influence most measurable parameters of behavior and function. An example of this type would be thermal stress, such as cold, or prolonged extreme deprivation, such as starvation.
2. The second type may be designated as interference stress conditions. These are characteristically short in duration and tend to be task specific in their effects, as would a mild electric shock delivered to one hand, or a loud noise that interfered at random with one's ability to listen to instructions.

All such researches, focusing on the stimulus properties of stressors (Korchin, 1964), imply what Russ & Korchin call "Input definitions" of stress, that is definitions which "involve underloads or overloads of energy or information which produce stress within the system (1967, p. 297)."

There is also a great deal of variability evident in the type of measures that have been used to study the effects of stress. These too may be summarized operationally under two general headings:

1. Physiological reactions, such as heart rate, and basal skin resistance, and

2. Psychological reactions, such as performance decrements on psycho-motor coordination tasks, impairments in cognitive functions, and subjective distress.

Research which focuses on particular responses (Korchin, 1964) reflects what Ruff & Korchin call "Output definitions" of stress, that is those:

"...based upon variables which are displaced from equilibrium under stress. Performance tests are commonly used for this purpose, with a decrement beyond a certain level being taken as an index of stress (1967, p. 297)."

Though both input and output definitions have practical value for experimental purposes, there is general agreement that they do not comprehensively define the area. Nevertheless, as Korchin says,

"...a common sense emerges as to the phenomena under consideration...Perhaps the simplest way out of a definitional conflict is to assert that stress -- as noun -- described an organismic state. Those events which provoke it are stress situations: the resulting behavioral alterations which occur are stress reactions (1964, App. 247-248)."

Appley & Trumbull offer a similar definition of stress "as a state of the total organism under extenuating circumstances rather than as an event in the environment (1967, p. 11)," and this definition seems more or less to represent a consensus of current thinking in the area.

STRESS RESISTANCE: THE PROBLEM OF THIS RESEARCH

As stated thus far, the definition of stress, like the focus of most stress research, has been concerned with damaging or debilitating effects (Helmendach and Meehan, 1962). As they point out, however, "Probably the most demanding practical problem facing us is the selection and training of men for high stress tolerance (1967, p. 38)." Practical needs aside, moreover, Ruff and Korchin make clear that a proper scientific understanding of stress requires some study of the means for coping with it:

"The most complete definition of stress is given by the combined use of input, output, and adaptive considerations. First, the experimenter specifies which inputs are the stressors and describes as well as he can the mechanism by which they produce their effects. Next, he measures one or more output variables which fall within a specified range under ordinary conditions but cannot be maintained under stress conditions...Finally, indices of adaptive or compensatory processes are chosen (1967, p. 298)."

Nevertheless, there have been few controlled studies on the development of stress resistance. Most stress resistance reports have appeared in the form of clinical anecdotal studies of natural stress situations,

such as war, internment in concentration camps, and physiological trauma (Bettleheim, 1943, 1960; Biderman, 1967; Barber, 1959). Though these reports have much value in their own right, they do not offer the opportunities that laboratory experiments might for precise examination of the effects of stressful environmental stimuli and resistance efforts on the interactions of physiological mechanisms and psychological variables.

Among general environmental stressors, thermal stress offers an especially good medium for controlled laboratory research, as does electric shock among interference stressors, and hypnosis provides a promising technique for training and examining the processes of stress resistance. Thermal stress has long been the subject of intensive scientific and practical concern (see especially Sargent, 1964, and UNESCO, 1964), and a few controlled studies relating it and/or pain to hypnotic training have appeared in the literature. Kissen, Reifler, and Thaler (1964) studied the effectiveness of hypnosis as a stress resistance technique against a general debilitating stressor (cold). They monitored physiological measures including heart rate, basal skin resistance, and shivering rate, in addition to testing psychological performance using vigilance task for this purpose. Under hypnosis they found a general amelioration of the psychophysiological effects of the stress and improvement in vigilance task performance. Similarly, London, Ogle, and Unikel (In Press, 1967) found that both hypnosis and exhortation were effective stress resistance techniques which helped to improve performance on a rotary pursuit task under conditions of generally debilitating stress (heat). Shor (1962), using a task specific stressor (shock), also used hypnosis as a stress resistance technique and found it to be effective in relieving the subjective experience of pain. All three studies used an experimenter to induce hypnosis just before or during exposure to the stressor. No one, it seems, has studied the development of stress resistance to the simultaneous presentation of both general and interference types of stress stimuli, or used stress resistance techniques which were in the control of the subject throughout the experiment. The latter would provide a better parallel to natural situations in which an individual would have to rely upon his own resources and skills to resist stress and function effectively, and it would reduce the confounding of the interpersonal motive of responding to the suggestions of another person with whatever individual motives and capacities might operate when the distressed person cannot rely on somebody else's immediate encouragement or help. A self-controlled stress resistance technique, such as autohypnosis, would maximize the generality of the findings and more closely approximate natural conditions.

As Orne (1965) points out, there have been a few clinical studies using self hypnosis, but these did not provide appropriate controls (Shultz, 1932; Shultz and Luthe, 1959). Even so, they do suggest that autohypnosis may be an effective technique for stress resistance.

The main purpose of the present investigation was to study, in a controlled laboratory setting, the effects of a self-controlled

stress resistance technique (autohypnosis) on physiological and psychological functioning in the face of simultaneous presentation of both general and interference stressors.

Hypnosis and Pain Stress

Stress resistance may be studied by reference to the same criteria that have been used to denote the debilitating effects of stress, namely physiological mechanisms, performance measures, and subjective experiences. In this connection, Orne (1965) points out that it has long been recognized that a deeply hypnotized subject is able to undergo various types of painful procedures with very little objective indication of pain. This observation is supported by numerous accounts of hypnosis as an anesthetic agent (Esdaile, 1846; Winklestein, 1958; Moss, 1952) in procedures ranging from dental work to childbirth.

A number of similar reports have been published on autohypnosis. Shultz and Luthe (1959) state that there is a close relationship between traditional hypnosis and autohypnosis or, as Shultz calls it, "autogenic training." Shultz reports a number of cases in which individuals used autohypnosis for reducing the subjective experience of pain or distress, and also claims that individuals using autogenic techniques can be trained to slow their pulse and selectively increase circulation in various limbs.

In a thorough review of the literature on the physiological effects of painful stimulation during hypnosis, Shor (1962) also concludes that physiological responses to pain are less during hypnotic analgesia conditions than during waking conditions. He attributes these findings, however, to the effects that hypnosis has on minimizing the anxiety that ordinarily accompanies pain. His point is that most common physiological reactions to painful stimulation, or to stress, are attributable to a secondary psychological reaction (anxiety). By eliminating the anxiety component, hypnosis alters the usually observed physiological response. Shor's work generally supports the findings of other studies that hypnosis is effective in minimizing both subjective and physiological responses to stress (West, Neill, and Hardy, 1952; Miller and Keller, 1939).

Hypnosis and Thermal Stress

Painful stimulation is used in most experiments as an interference stressor. A number of studies have demonstrated how performance is adversely affected by general stress, such as extremes of temperature. In his review of the literature through 1963, Ogle lists several such studies (Ogle, 1963). Among these is that by Carpenter (1950), which found that performance on a pursuitmeter was adversely affected by heat. Carpenter found that error scores increased as effective temperature exceeded normal (70° Fahrenheit). Vitiles and Smith (1946) also observed that performance on the pursuitmeter shows a decrement when

the still air temperature is raised above the comfort range (70° Fahrenheit). Other investigators (Mackworth, 1946; Pepler, 1958; Weiner and Hutchinson, 1945), using a variety of tasks have all found a decrement in performance in a heated environment.

The studies cited above by London, Ogle, & Unikel and by Kissen, Reifler and Thaler, both indicate that hypnosis has some value for resisting thermal stress as well as pain.

One problem in studying resistance to heat, however, from a physiological point of view, is that it is not obvious how the body is supposed to resist. Its facilities for adapting to heat are very restricted and, in some sense oblique - like sweating, which does not cool directly but only if there is ambient air to produce evaporation. Cold stress is another matter, because the body is a natural heat producing factory, and for limited amounts of cold, its adaptive response is to produce more and more heat. From the point of view of performance deficit, essentially the same thing should be expected in both heat and cold stress resistance, but the advantage to physiological interests suggests that cold stress is a more useful method. Also, since the study by Kissen, et al., provided a precedent to studying the use of hypnosis as a training method for resisting cold, it was decided to use cold as a general stressor in this experiment.

Hypnotic Susceptibility and Stress Resistance

A final consideration in the design of the present study was that most previous studies on hypnosis and stress resistance had failed to consider the possible interactions of hypnotic susceptibility and training method. They have been restricted, by and large, to subjects who were very high in hypnotic susceptibility. Numerous studies have demonstrated, however, that the relationship between hypnotic susceptibility and hypnotic training effects is not easily predicted (London and Fuhrer, 1961; Rosenhan and London, 1963a; Slotnick and London, 1965) and, in some cases, that hypnotic training has significantly more effect on relatively unsusceptible people than on highly susceptible ones (Rosenhan and London, 1963b; London, Ogle, and Unikel, (In Press, 1967); London, Conant, and Davison, 1966). The heat stress study by London, Ogle, and Unikel, in fact, found consistent differences in rotary pursuit performance among people who differed in hypnotic susceptibility. It is clear that the study of hypnosis as a training method should always take hypnotic susceptibility into account, and this idea was incorporated within the design of the present experiment.

In summary, the intention of the present investigation was to study the relative efficacy of a self-controlled stress resistance technique (autohypnosis) in minimizing the combined debilitating effects of general and interference stressors on the performance, physiological responses, and subjective experience of discomfort among individuals who differ in their susceptibility to hypnosis. To this end, three specific hypotheses were tested:

1. Imposed stress adversely affects performance and heightens physiological reactions.
2. Autohypnotic training in stress resistance
 - (a) reduces performance deficit,
 - (b) lowers the level of physiological reaction to the stressors, and
 - (c) reduces subjective experiences of discomfort.
3. Autohypnotic training in stress resistance is more effective with subjects who are high in hypnotic susceptibility than with subjects of low susceptibility.

SECTION II

METHOD

SUBJECTS

The experiment was performed on 64 male subjects ranging in age from 18 to 28 years, all university students, and all in good health.

Subjects were selected from approximately 250 volunteers on the basis of their susceptibility to hypnosis. Half of them were high in susceptibility (T) and half were low (UT).¹

Most subjects were upper division undergraduates or graduate students. They were drawn chiefly from the ROTC programs at the University of Southern California and the University of California at Los Angeles. The volunteers were solicited during classes by the experimenter, whose appeal for subjects always followed a prepared text (see Appendix A). It stipulated that the experiment was connected with official aerospace research, that it involved training in stress resistance, and that it would require a total of 17 hours of time over several weeks for those volunteers who passed three separate screenings. For them, a \$25.00 fee would be paid at the end of the experiment, but nothing could be paid for participation in the screening sessions only.

No information was given the subjects about the hypnotic aspects of the experiment at this time in order to avoid whatever volunteer biases might have resulted from getting such information. At the beginning of their first screening session, however, the subjects were informed that the study involved training in autohypnosis. All their other questions during the solicitation were answered in detail except they were not told about the exact nature of the stressors to be used. This information was withheld in order to prevent people from developing any type of preparatory mental set about the stressors.

SCREENING PROCEDURES

Each volunteer was screened initially on the Harvard Group Scale of Hypnotic Susceptibility (HGSS) (Shor and Orne, 1963), an adaptation of Form A of the Stanford Hypnotic Susceptibility Scale (Weitzenhoffer & Hilgard, 1959). The HGSS is constructed for group administration

1. T and UT are abbreviations of the terms "Tranceable" and "Untranceable," i.e., Susceptible or Unsusceptible to the phenomena that characterize the so-called hypnotic trance.

and scoring by self-report. Like the Stanford Scales, HGSS is a verbatim hypnotic induction procedure which is scored according to how similar the subject's responses are to the responses usually expected of hypnotic subjects. There are twelve different suggestions which can be scored objectively, and a subject's degree of susceptibility is considered to be the total number of suggestions to which he responded positively. The retest reliability of the Stanford Scales is generally of the order of .90, and the correlation between self-scoring and observer scoring on the HGSS is of the order of .85 (Hilgard, 1967).

This screening session was done in groups of two to twenty people, and in almost all cases by the same experimenter. The experimenter scored the Scales at the end of that session, and selected subjects for further screening on the basis of that score. Subjects whose scores fell in the upper or lower third of the scale range, that is above eight or below four, were scheduled for further screening and given individual appointments.

At the first individual session, each subject was given Form B of the Stanford Hypnotic Susceptibility Scale (Weitzenhoffer and Hilgard, 1959). If a subject's score fell in the middle third of the scale (five through seven inclusive) or was in the same range as it had been on the Harvard Group Scale, he was given an appointment for a third and final screening session. If his score on Form B was at the opposite end of the scale than it had been on the Group Scale, he was eliminated from the study. In the second individual screening, he received Form C of the Stanford Scale (Weitzenhoffer and Hilgard, 1962). As in the previous session, if the score on Form C was a reversal, he was eliminated. If not, then he qualified for the experiment.

In other words, subjects received three hypnotic susceptibility screenings. On at least two of the three, they had to score in either the upper or lower third of the scale to qualify for the experiment, and on none of the three could they score on the opposite end.

The subjects were given three separate screening sessions in order to obtain the most homogeneous possible samples of high- and low-susceptible subjects. Most of the previous research which divides subjects according to susceptibility did not make use of this practice, which provides a more reliable estimate of hypnotic susceptibility than any single measure could do (Evans and Orne, 1965).²

2. One additional screening device was used during the third and final screening session, but was not analyzed because it was introduced in the middle of the experiment and therefore performed by only about one-half the subjects. The technique, called "transcendance" by Orne (personal communication, October 31, 1965), is a measure (continued)

INSTRUMENTATION

Stressors

The experiment employed two kinds of stress: (1) General debilitators, and (2) Interference or task-specific stressors.

General debilitating stress conditions were defined as those that are characteristically continuous over long periods of time and that tend to influence most measurable parameters of behavior and functions. For our purposes, thermal stress (cold) operationally defined this category.

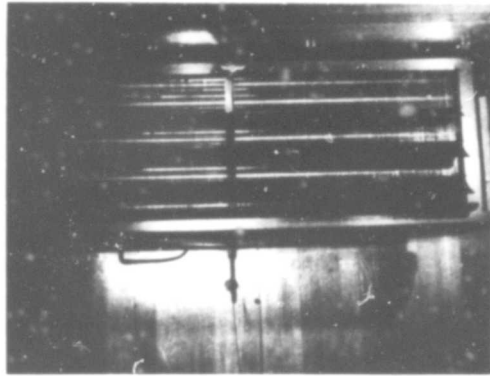
An environmental control chamber (cold box) was used, cooled to a mean temperature of 35° Fahrenheit \pm 2°. Each experimental session lasted about 85 minutes, including both hookup and operation time; hookup varied by four or five minutes, but operation was automated and, therefore, constant. The chamber was always cooled down to experimental level before the subjects entered it. Ambient air was circulated by blowers (exact speeds unknown) which further reduced the effective temperature (Figure 1).

Interference stress conditions were defined as those that are characteristically short in duration and tend to be task-specific, that is, to interfere with performance on some kinds of tasks without generally affecting performance on others. Painful shock was used for this purpose.

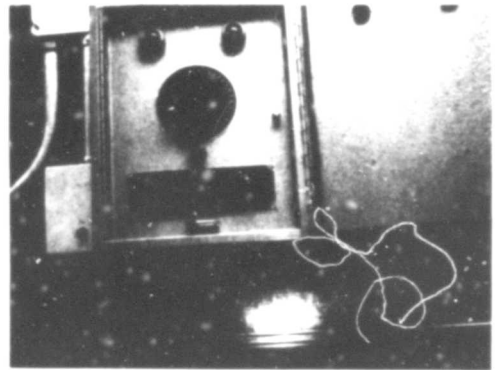
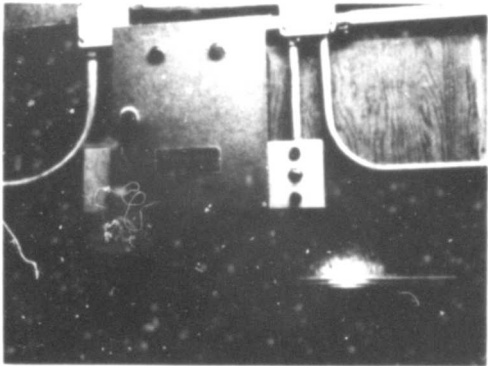
The shock apparatus consisted of a 64-volt battery, hooked into a capacitor that regulated the duration and thereby the intensity of the electric impulse delivered to the subject. The shock level was established individually for each subject at the beginning of his first stress session. He was told that he would first be shocked at a sub-threshold level (.5 milliseconds) and that small increments in the amount of shock would be added gradually. The subject was instructed

(Footnote 2 continued) of whether the subjects could exceed their normal hand grip strength when under hypnosis (Orne, 1964). No one was screened out of the experiment on the basis of this test, but it did yield information regarding the presence or absence of both objective transcendence and subjective feelings of it.

The instrument used was a hand dynamometer. Each subject got the test both awake and hypnotized, half in the order: Waking transcendence - Scale C - Hypnosis transcendence; and half in the order: Scale C - Hypnosis transcendence - Waking transcendence.



Blower in interior of cold box.



Temperature control unit for cold box.

Figure 1.

Cold Box Equipment

to report when he first became aware of any sensation of shock, which would ordinarily be experienced as nothing more than a tingle. At that point, he was told to continue observing his reactions, while smaller increments were added, and report again the point at which the shock was painful. This was the level of shock used throughout for that subject. Unless his report of the subjective experience of pain was substantiated by some appearance of distress, however, the level was raised to a point at which the behavioral indications were consistent with his subjective report. Increments in shock level were made in units of .5 milliseconds to a maximum of 10 milliseconds.

Shock was programmed to be administered at random intervals averaging every twenty seconds throughout the performance periods, so that the subject could not develop accurate expectations which might permit him to resist it (Figure 2). The mean interval between shock impulses was greater while the subject was performing on the vigilance task than when he was performing on the pursuit rotor task. The average shock rate on the vigilance task was one impulse every thirty seconds, while on the pursuit rotor it was one every ten seconds. The reason for using a different mean shock rate was that this stressor is more task specific for rotary pursuit than for vigilance. It was found in the pilot study reported below that the less frequent shock impulses during the vigilance task were sufficient to make it very difficult for the subject to concentrate and attend to the task, whereas it was necessary to use more frequent shocks on the pursuit rotor in order for this stressor to be sufficiently debilitating.

Pilot Study

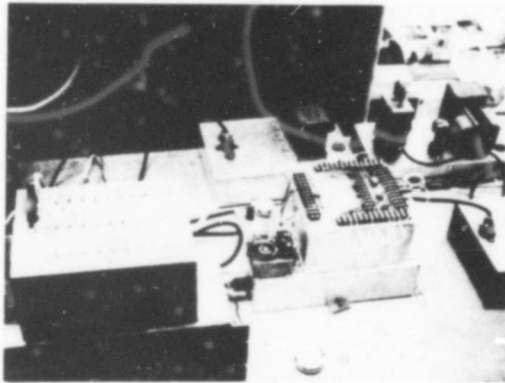
A pilot study was conducted before the main experiment began in order to determine:

(1) The levels of stress which would give optimal debilitating effects, i.e., sufficient impairment or decrement in performance so that it would be possible to measure resistance to debilitation, but not so severe that resistance would be impossible.

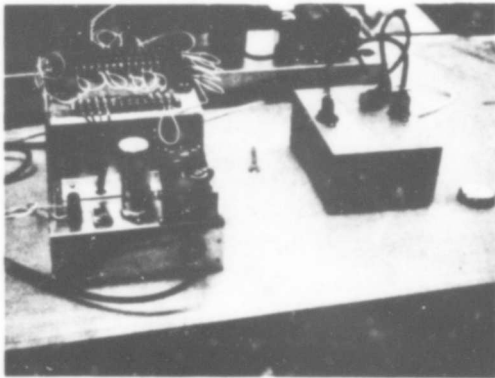
Constant cold was used for all subjects, but it was discovered that shock levels had to be adjusted individually, due to the wide range of individual variability in responsiveness to shock. Some subjects did not feel even very high levels of shock while others were hypersensitive and reported pain to extremely low shock levels.

(2) Most effective order of task presentation. The question involved here was whether to present the vigilance or pursuit rotor task first or whether to alternate their presentation in a counter-balanced manner.

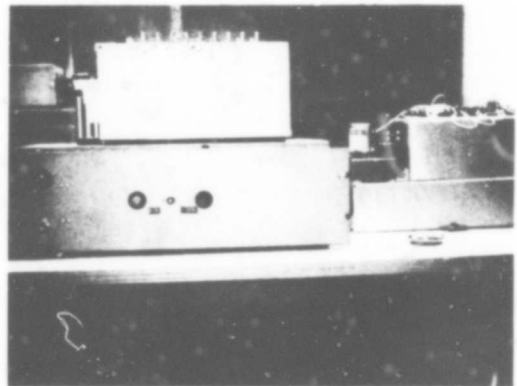
We found that both shock and cold stressors produced cumulative effects. Performance on the pursuit rotor task is more adversely affected by continued exposure to stress than is vigilance because of



Shock programmer (right foreground) and shock intensity regulator (left foreground).



Shock Programmer



Master Control Unit

Figure 2.

Electric Shock Control Apparatus

the fine hand control that is required for that task. Although cold interferes with ability to concentrate and pay attention, it interferes even more with controlled muscle movements of the extremities.

In other words, pilot subjects reported that they were bothered more by the cold when doing the rotary pursuit task than when doing the vigilance task, with the effect being even more pronounced when the pursuit rotor came after the vigilance task. Consequently, we used a fixed order for the experiment proper, with vigilance always preceding rotary pursuit.

(3) The pilot testing was also used to test equipment capabilities and functions.

DEPENDENT MEASURES

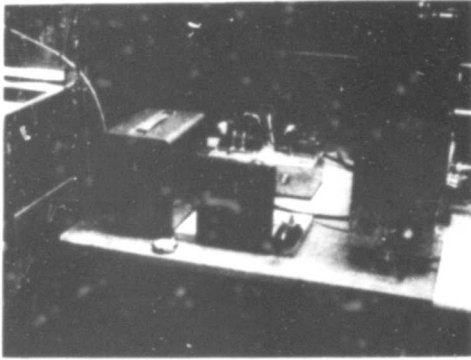
Performance Tasks

Pursuit rotor: A standard rotary pursuit apparatus was used, operated at one rotation per second and completely automated with respect to intervals (Figure 3).

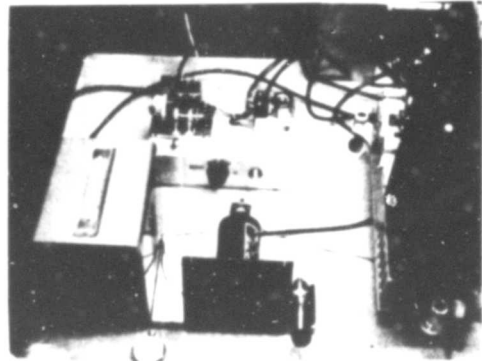
Vigilance: A special vigilance task was devised for this experiment. It is a task using both the visual and auditory modalities, requiring the integration of visual and auditory stimulus signals, paralleling an airplane pilot's task to some degree, especially in executing landings.

Subjects were required to memorize a five-digit number presented visually on a movie screen, and then to compare it with another five-digit number that appeared on the screen 3.5 seconds later. If any two digits in the numbers matched (i.e., if two or more numbers were repeated) and if a buzzer sounded while the second number was being observed, the subject was to respond by pressing a key. If the numbers matched but the buzzer did not sound, or if a buzzer sounded but there was not a match, the subject was not to press the key. Errors both of commission and omission thus could be recorded. What made this task especially difficult was that the subject is required to continuously compare any given number that he is looking at with whatever number immediately preceded it and must also memorize the number he is looking at so he can compare it in turn with the forthcoming number. As can readily be seen, the intrinsic difficulty here may be regulated rather closely by altering the time interval between presentations of the numbers. A number of non-participating students were piloted on this task under stress free conditions to determine the optimal time interval to use.

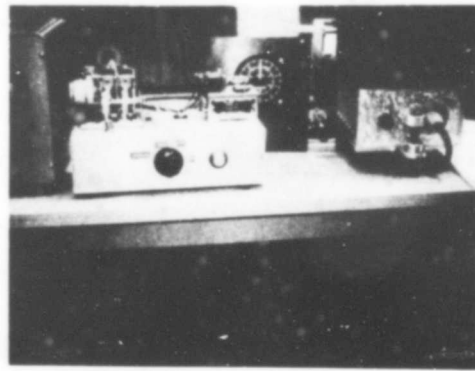
There were a total of 301 numbers on the vigilance task, so each run of the task required 300 comparisons to be made in a 25 minute period. One hundred and three matches occurred with the buzz, 75 matches without the buzz, and 75 buzzes without a corresponding match;



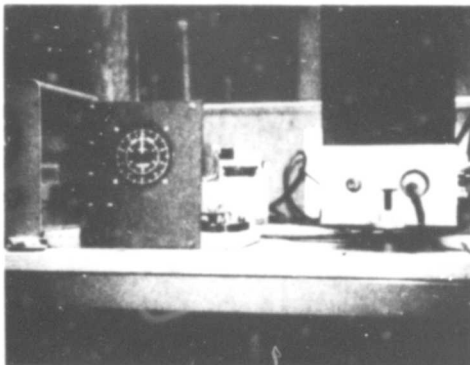
Pursuit Rotor Timers



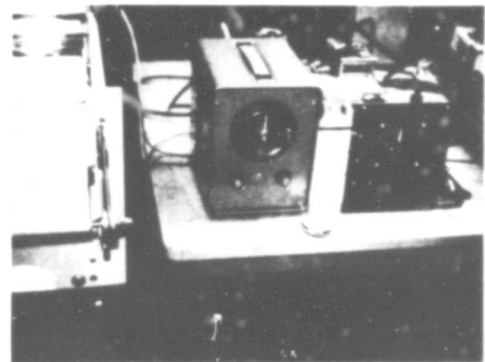
Timers and Pursuit Rotor Programmer



Pursuit Rotor Programmer



Elapsed Time Clock



Individual Run-timer (left)

Figure 3.

Pursuit Rotor Controls

the remaining 48 numbers were neither matched nor buzzed.

The commission error was inserted only as an inhibiting device. Without it, the subject could maximize his accuracy by pressing the key every time he heard the buzz without even looking at the numbers or every time he saw a match without even listening for the buzzer. Knowing in advance that commission errors are counted, and that he would have to attend to both signals, kept him from using this type of strategy. The instructions for the vigilance task were given to the subject prior to entering the cold box and he had to show that he fully understood the nature of the task and what would be required of him by explaining it back to the experimenter. The text of the instructions that were given the subject are as follows:

Instructions for Vigilance Tasks

A series of five-digit numbers will be projected on the screen in front of you. For example, one number may be 1 2 3 4 5. The number will be on the screen for a couple of seconds. Your task is to memorize the digits in the number. The order of the digits is not important, just memorize what they are. After a couple of seconds have passed, another five-digit number will appear on the screen. Your task is to determine whether or not two or more digits that appeared in the number on the screen also appeared in the preceding number. If this is the case, we call it a match.

Example:

Preceding number: 1 2 3 4 5
Number on the screen: 2 8 1 9 6

THIS IS A MATCH: The digits 2 and 1 were repeated. If two or more digits that appear in the number on the screen did not also appear in the preceding number, then it is not a match.

Example:

Preceding number: 1 2 3 4 5
Number on screen: 6 8 9 0 6

THIS IS NOT A MATCH

To further complicate the task, we have made it bimodal. There is a "son-alert" on the floor in the chamber. This "son-alert" makes a high-frequency buzz which is readily audible and distinguishable from other sounds in the room. Now, if you have determined that the number on the screen is a match (that two or more digits in it also appeared in the previous number) and you hear this buzz, we want you to press the response key on the table. If there is a match and no buzz, then do not press the response key. There will be matches with no buzz and there will be buzzes when there are no matches. We want you to press the response key only when there is a match and a buzz.

It is important to remember that you must always memorize the digits that appear in the number on the screen because you will be comparing that number to the next number that appears on the screen. You are always comparing the number that appears on the screen to the one preceding it.

Practice:

1. Preceding number: 1 2 3 4 5
2. Number on the screen: 2 8 1 8 6

THIS IS A MATCH: A 2 and a 1 appear in both numbers. If a buzz had accompanied the presentation of the second number you would press the key. Also note again that the order of the digits does not matter.

3. Number on the screen: 3 7 8 4 4

(THIS NUMBER IS COMPARED TO THE PRECEDING ONE, in this case 2 8 1 8 6; THIS IS NOT A MATCH)

4. Number on the screen: 4 1 9 4 5

(THIS NUMBER IS COMPARED TO THE PRECEDING NUMBER, in this case, 3 7 8 4 4; THIS IS A MATCH -- a 4 and a 4 appear in both numbers).

These instructions were repeated with the subject until it was certain that he fully understood the nature of the task.

The vigilance task apparatus is shown in Figures 4a and 4b.

Physiological Measures

The following measures were taken:

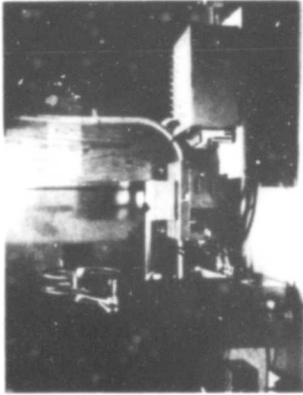
- (1) Heart rate (EKG), recorded continuously on a Sanborn 4-channel polygraph (Figure 5).
- (2) Basal Skin Resistance, taken from the sole of each foot by two silver electrodes, and similarly recording on the Sanborn polygraph.
- (3) Shiver and Related Arm Movements

This variable was measured by a piece of equipment designed and constructed for that specific purpose (Figure 6). In brief, it consisted of a suspended piece of plywood upon which the subject rested his unused arm. Movement was detected by use of photocells and was then transmitted into a Sanborn amplifier-recorder.

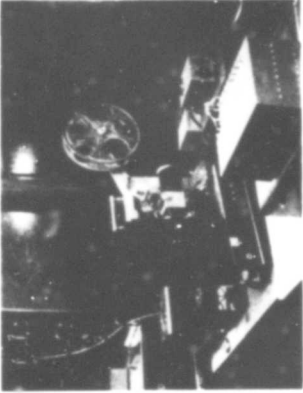
The instrument was originally intended to measure shiver only, but the stress sessions produced sufficient arm and body movement that shivering could not be distinguished from somewhat larger movements with a high degree of reliability. Neither kind of movement, however,

Figure 4a.

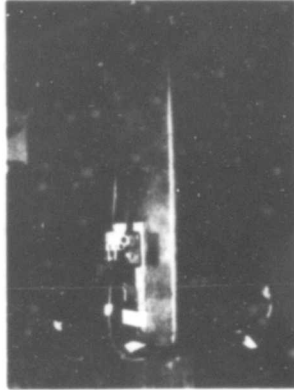
Vigilance Apparatus



Projector and Vigilance Error Recorder



Projector (side view)



Vigilance Response Key

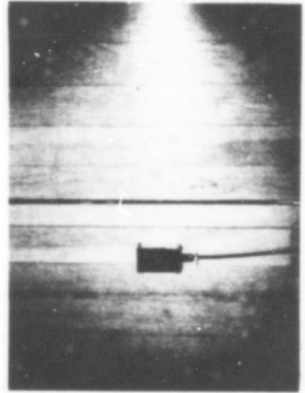
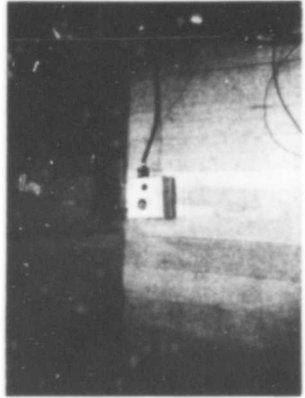
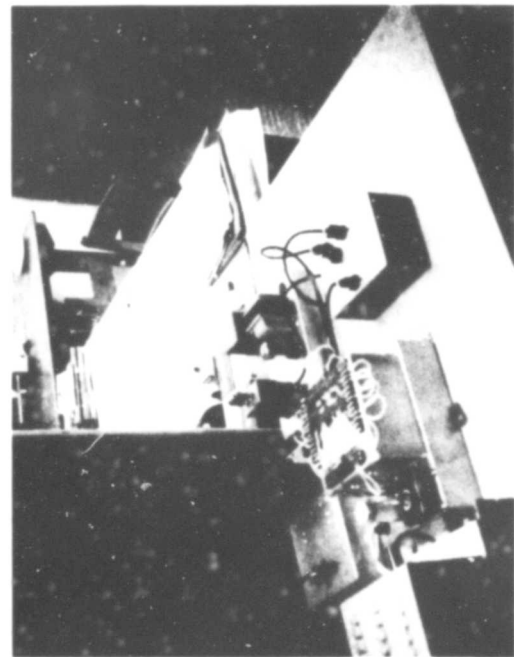


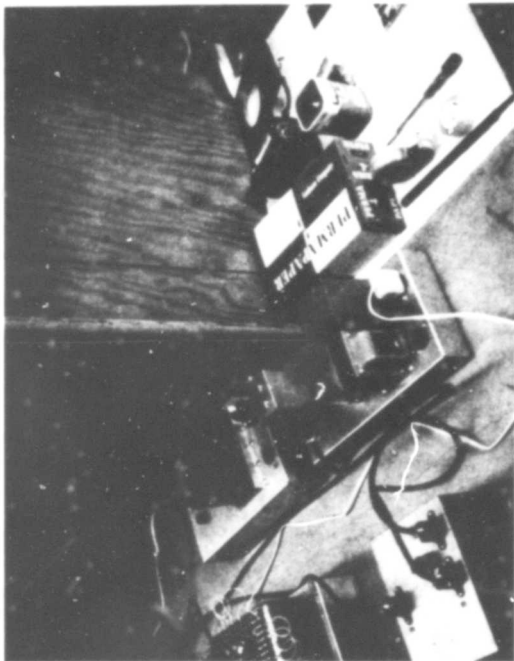
Photo electric cell in cold box for triggering "sonalert".



"Sonalert" on floor of cold box.

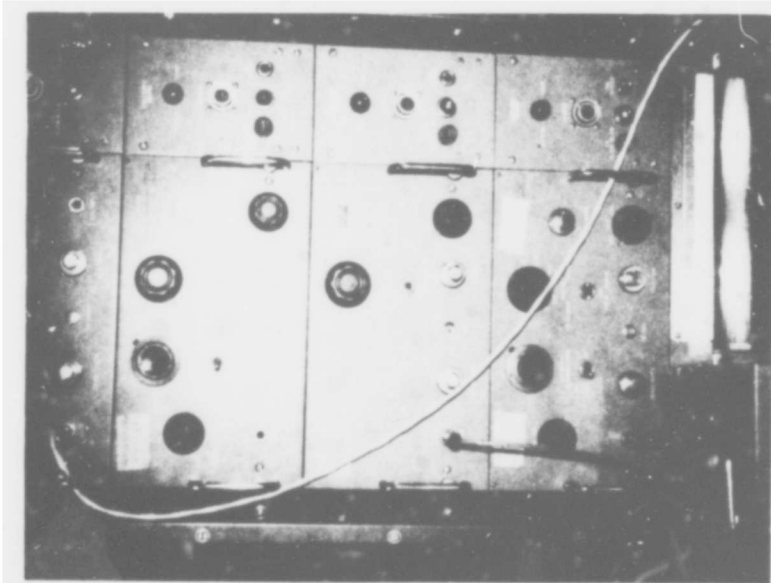


Right foreground, "sonalert" intensity and duration regulator; left background, constant current power supply; right background, power transformer.

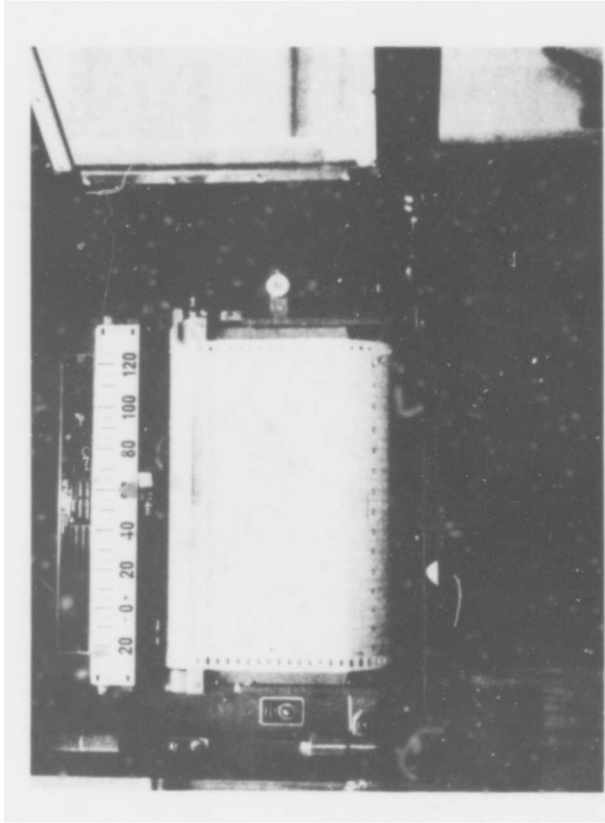


Left foreground, "sonalert" intensity and duration regulator; right foreground, power transformer; background, constant current power supply.

Figure 4b.
Vigilance Apparatus (cont.)



Sanborn Polygraph



Honeywell Temperature Recorder

Figure 5.
Data Recording Apparatus

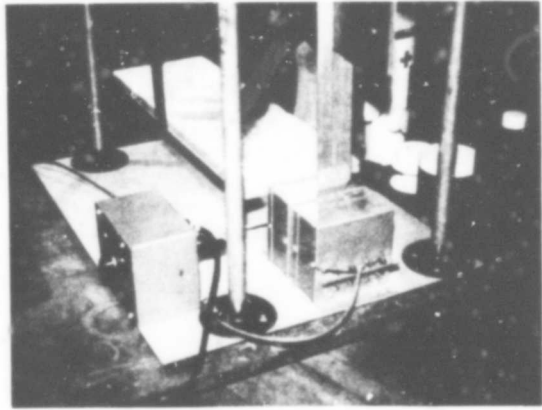
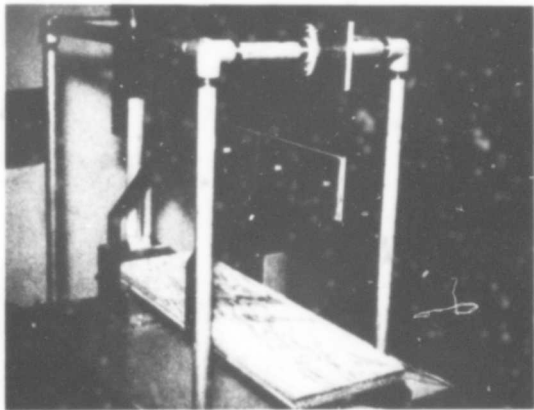
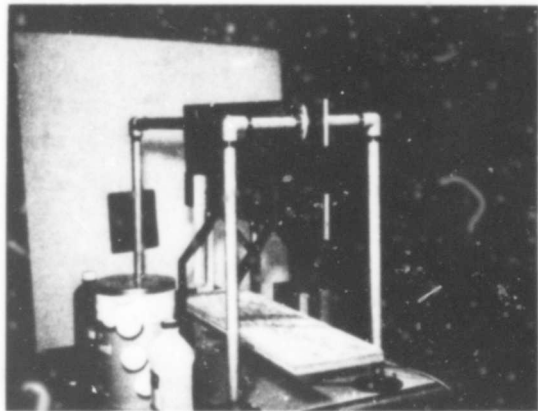


Figure 6.
Shiverometer

occurred during nonstress sessions, so that the measure is a direct result of the stress, though not in terms of shivering alone.

During pursuit rotor trials, it was not possible to accurately take a shivering measure because of artifacts related to moving the stylus around the turntable with the other arm and hand. During this task, therefore, shivering was measured only during the 2-minute rest periods between each block of trials; then, the 1-minute segment closest to the preceding trial block was taken as the time sample unit of measurement. It was scored as a percentage of the minute that we sampled (Figure 7).

(4) Temperature

Four points of skin temperature were recorded, including the top of the inactive hand (i.e., the hand in the shiverometer sling), top of the foot, chest, and back.

One point of core temperature was taken, in the armpit.

Temperatures were all measured continuously on a Honeywell Temperature Recorder (Figure 5).

Exterior views of the control chamber and apparatus are presented in Figure 8. Schematic diagrams of the equipment are presented in Appendix B.

EXPERIMENTAL PROCEDURES (See table 34, appendix C.)

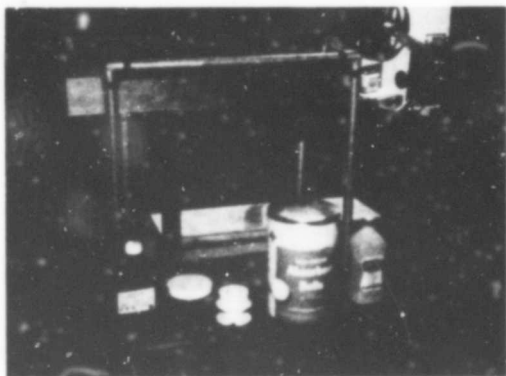
After completing the screening sessions, half the subjects in each susceptibility group were randomly assigned to either experimental or control groups and were then scheduled for training on the pursuit rotor. They did not receive any training on the vigilance task, which is not a learning task.

Training to asymptote on pursuit rotor required 1 hour. The procedure during training was identical with that used on the pursuit rotor during the experiment. This consisted of eight blocks of trials, each block consisting of five runs of 30 seconds on and 10 seconds off (30/10 data), which is the standard method of pursuit rotor training.

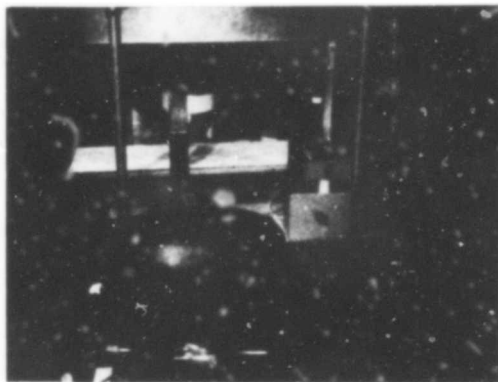
Two minutes rest were allowed between each block of trials and after the eighth trial block, a 5-minute rest period occurred. This was followed with a single continuous run for 5 minutes (30/30 data).

Base Rate Sessions

There were three sessions in the environmental control chamber, two base rate sessions and one experimental session. In all sessions,



Shiverometer



Vigilance task response key pursuit rotor and shiverometer. (side view)

Figure 7.

Performance Equipment and Shiverometer

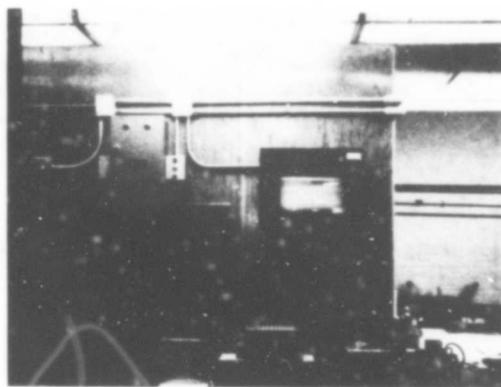


Figure 8.

Exterior views of cold box and equipment.

the subjects were clothed only in undershorts, barefoot and bare chested (Figure 9). The first base rate session was stressed for half the subjects in each susceptibility group and unstressed for the other half. The sequence for each session was as follows:

- (1) Subject is given instructions on the vigilance task.
- (2) Subject disrobes to shorts, enters chamber and is seated, then the necessary electrodes are attached.
- (3) In stress sessions, the shock level is next established (the same shock level was used for a subject in both his stress sessions).
- (4) The vigilance task is started and lasts for 25 minutes.
- (5) The subject is given a 5-minute practice run on the pursuit rotor, following the same pursuit rotor procedures as in the training session. The task then proceeds for 45 minutes longer.

Following the first experimental session, there was an interim of 1 day to 1 week before the second base rate session. The average interim period was 4 days. After the second base rate session, there was an interim of from 1 to 2 weeks before the final session.

Autogenic Training

Subjects in the experimental groups received 6 hours of autogenic training between the second base-rate session and the single experimental session. Control subjects received no special training or instructions during this period. None of the subjects were told which group they were assigned to until after the second base-rate session.

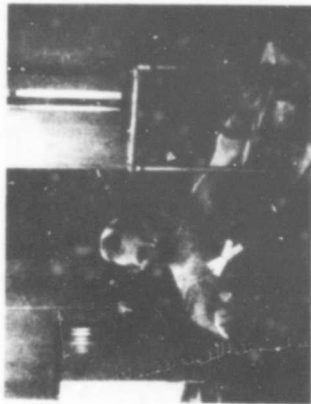
Autogenic training was conducted by four expert hypnotists, all members of the Los Angeles Society of Clinical Hypnotists. Each expert met with the subjects in groups of five to twelve for three 2-hour training sessions on each of three alternate evenings of the same week. Training was conducted in group meetings in order to permit the hypnotist to capitalize on the well known tendency of subjects to positively reinforce each other's experience of hypnosis.

Prior to initiating training, the hypnotists were given a demonstration of a stress session to fully apprise them of all relevant details of it. They were themselves put in the cold box for 15 minutes. They were thus better equipped to orient the groups towards the tasks at hand and towards resisting the stressors.

The experimenters carefully briefed the hypnotists on the content of training before any of the training sessions began but did not interfere with the individual techniques which the experts actually used in the training sessions. Some limitations were imposed, however, as follows:

Figure 9.

Subject Performing



Top left: Front view of subject operating pursuit rotor. Skin temperature on right hand and chest. Left arm in Shiverometer.



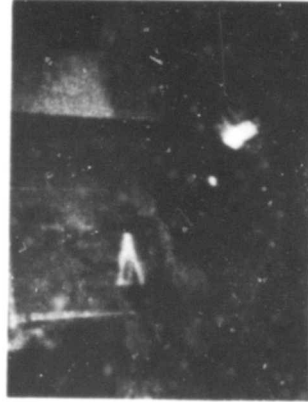
Top right: Side view of subject. Left arm in Shiverometer and EKG electrode on side.



Center: Side view of subject operating pursuit rotor. Left arm in shiverometer and EKG electrode under right arm. Skin temperature on right hand and chest.



Bottom left: Experimenter's view of subject operating pursuit rotor.



Bottom right: Experimenter's view of subject during vigilance task.

- (1) Training would specifically give the subjects self-control over induction and termination of hypnosis under real stress conditions.
- (2) Training would emphasize the subjects' ability to perform with eyes open while under hypnosis.
- (3) Training would specify the kinds of stress to which the subjects would be exposed and the kinds of tasks on which they would have to perform.

It was mutually agreed that expert hypnotists would provide the best training if they were free to follow their own predilections and utilize whatever hypnotic training techniques they felt would be most valuable. Therefore, no further operational restrictions were imposed on their activities other than those indicated above. The training sessions were tape recorded in order to permit us to examine the differences between their styles of operation.³

Experimental Session

After completing autogenic training, each experimental subject received his second and final session. This session was identical with the first stress session in all respects except that the subjects in the experimental group were allowed 5 minutes before entering the control chamber to put themselves into a hypnotic trance.

Postexperimental Reports

Upon finishing this final session, each subject was asked to write a report of his subjective experiences in the two stress sessions, comparing them with regard to (1) which stress session was worse and in what way; (2) which of the two stressors was worse in each session and at what point; and (3) for experimental subjects, to discuss whether or not the training was helpful and, if so, in what way.⁴

3. This data is kept on file, but was not analyzed for the purposes of this report, since differences in training techniques among hypnotists were not germane to our hypotheses.

4. The data on subjective experiences has not been incorporated into this report because preliminary analyses of the subjective experience reports revealed that the information in them is not readily amenable to any reliable scoring system.

Scoring Methods

Appropriate scoring systems were devised for both performance and physiological measures for purposes of data analysis.

The physiological measures were monitored continuously during each session from the time the subject was completely hooked up to the various electrodes, thermocouples, and the shivering apparatus, until the session was completed.

Among the various ways in which the data could most meaningfully be recorded and coded, it was concluded, a time sampling would be most suitable. It was decided, therefore, to record a 1-minute reading of each continuous measure and a single reading of each discrete measure at the beginning of each session and another such reading every 15 minutes thereafter. Six readings were thus taken during each session and used as the data for each dependent measure, the first readings immediately after hookup, and subsequently after 15 minutes, 30 minutes, 45 minutes, 60 minutes, and 75 minutes.

The heart rate measure (HRG) typified the continuously recorded measures. The position on the written record was determined for each of the prescribed time periods, and the number of heart beats during the 1-minute time period immediately following that point was the score recorded. Essentially the same procedure was followed for each of the other continuous measures.

The temperature data typified the discrete recordings. It was collected by a Honeywell temperature recorder. The temperature at each of the points monitored (Core, chest, back, foot, and hand) was printed onto the chart at least once every minute. It was thus possible to get a measure of the temperature reading at almost exactly the end of each 15-minute time period.

Performance data were generally easier to score than were physiological measures. Vigilance was automatically recorded in three error scores, Omission Errors, Commission Errors, and Total Errors. Pursuit rotor 30/10 data was recorded as the number of seconds on target for each 30-second trial, so the mean number of seconds on target for each block of five trials was used as the scoring unit for these data. Performance during the continuous 5-minute run (30/30 data) was also recorded in 30-second units and, for most purposes of the analysis, the score for the entire period consisted of the mean number of seconds on target over all 10-second segments.

SECTION III

RESULTS

STRATEGY OF DATA ANALYSIS

The design of the experiment made it evident that analysis of variance was the most suitable statistical technique for testing its hypotheses. Since the hypotheses were directed primarily towards differences between sessions and between groups rather than within sessions, it was decided for purposes of analysis to reduce the multiple scores on the eleven dependent variables to a single overall score on each measure for each session. In addition to making the results more manageable and presumably interpretable, this would also have the effect of providing a more reliable index per session for each variable than would be provided by using the multiple scores per session that were available. For the physiological data, this means that the score reported for each variable in a session is the mean of the six scores taken for it within that session. For the vigilance data, the Total Errors alone were used as the session score, since these included both Omission and Commission Errors. For the rotary pursuit data, the session score reported for trial blocks (30'30) is the same as indicated above, namely the mean number of seconds on target over all ten 30-second segments. Tables 1 to 11 inclusive present the mean scores of all subjects in all experimental conditions and sessions on all eleven dependent variables.

Several analyses of variance were performed on all the data of the study in order to permit exhaustive tests of the hypotheses in terms of main effects, simple effects, and interactions between dimensions. There were two Between-subjects variables, namely experimental versus control groups and High Susceptible (T) versus Low Susceptible (UT) groups, and one Within-subjects variable, namely the three sessions on which all subjects were tested. The main analyses were, therefore (1) a three-way analysis of variance for two Between-subjects variables and one twice repeated Within-subjects variable, to obtain main effects and interactions for all groups and sessions, and (2) a two-way analysis of variance of the Between-subjects dimensions for each individual session to provide the equivalent of simple effects tests.

In addition, however, it was recognized that the hypothesized effects of stress could be tested separately by comparing the two base rate sessions (the room temperature session and the first stress session) and the hypothesized effects of training could be tested by the separate comparison of the two stress sessions, so three-way analyses of variance for both Between-subjects dimensions and a repeated Within-subjects dimension were conducted separately to compare the two base rate sessions and again to compare the two stress sessions.

TABLE 1

MEAN HEART RATE SCORES FOR ALL EXPERIMENTAL CONDITIONS

Subject Group	Session		
	Room Temperature	Stress 1	Stress 2
Control			
T (N = 16)	79.71	80.78	79.90
UT (N = 16)	75.82	79.17	77.26
Total (N = 32)	77.77	79.97	78.59
Experimental			
T (N = 16)	82.91	81.46	83.18
UT (N = 16)	78.01	79.69	75.94
Total (N = 32)	80.46	80.57	79.56
Susceptibility (N = 64)			
T (N = 32)	81.31	81.12	81.54
UT (N = 32)	76.92	79.42	76.60
All Subjects (N = 64)	79.11	80.27	79.07

Dimension Means

Tranceable	= 81.32	Experimental	= 80.20
Untranceable	= 77.65	Control	= 78.78

TABLE 2
 MEAN SHIVERING RATE SCORES FOR ALL EXPERIMENTAL CONDITIONS

Subject Group	Session		
	Room Temperature	Stress 1	Stress 2
Control			
T (N = 16)	0.280	0.843	0.996
UT (N = 16)	0.370	1.131	1.143
Total (N = 32)	0.325	0.987	1.070
Experimental			
T (N = 16)	0.192	0.998	0.734
UT (N = 16)	0.428	0.991	1.043
Total (N = 32)	0.310	0.995	0.889
Susceptibility (N = 64)			
T (N = 32)	0.236	0.921	0.865
UT (N = 32)	0.399	1.061	1.093
All Subjects (N = 64)	0.317	0.991	0.979

Dimension Means

Tranceable = 0.674	Experimental = 0.731
Untranceable = 0.851	Control = 0.794

TABLE 3
 MEAN BASAL SKIN RESISTANCE SCORES FOR ALL
 EXPERIMENTAL CONDITIONS

Subject Group	Session		
	Room Temperature	Stress 1	Stress 2
Control			
T (N = 16)	22.22	15.37	14.50
UT (N = 16)	13.97	15.36	11.91
Total (N = 32)	18.09	15.36	13.20
Experimental			
T (N = 16)	19.54	11.51	16.58
UT (N = 16)	18.58	11.46	12.04
Total (N = 32)	19.06	11.49	14.31
Susceptibility (N = 64)			
T (N = 32)	20.88	13.44	15.54
UT (N = 32)	16.28	13.41	11.97
All Subjects (N = 64)	18.58	13.42	13.76

Dimension Means

Tranceable = 16.62	Experimental = 14.95
Untranceable = 13.89	Control = 15.55

TABLE 4
 MEAN CORE TEMPERATURE SCORES FOR ALL
 EXPERIMENTAL CONDITIONS

Subject Group	Session		
	Room Temperature	Stress 1	Stress 2
Control			
T (N = 16)	91.09	78.11	79.77
UT (N = 16)	90.93	81.18	82.55
Total (N = 32)	91.01	79.64	81.16
Experimental			
T (N = 16)	90.20	80.17	80.30
UT (N = 16)	91.88	81.01	80.96
Total (N = 32)	91.04	80.59	80.63
Susceptibility (N = 64)			
T (N = 32)	90.64	79.14	80.03
UT (N = 32)	91.41	81.09	81.75
All Subjects (N = 64)	91.03	80.12	80.89

Dimension Means

Tranceable = 83.27	Experimental = 84.09
Untranceable = 84.75	Control = 83.94

TABLE 5
 MEAN CHEST TEMPERATURE SCORES FOR ALL
 EXPERIMENTAL CONDITIONS

Subject Group	Session		
	Room Temperature	Stress 1	Stress 2
Control			
T (N = 16)	87.90	72.77	72.81
UT (N = 16)	88.92	75.14	74.93
Total (N = 32)	88.41	73.95	73.87
Experimental			
T (N = 16)	86.88	73.53	72.14
UT (N = 16)	87.84	74.33	74.42
Total (N = 32)	87.36	73.93	73.28
Susceptibility (N = 64)			
T (N = 32)	87.39	73.15	72.47
UT (N = 32)	88.38	74.73	74.67
All Subjects (N = 64)	87.88	73.94	73.57

Dimension Means

Tranceable = 77.67	Experimental = 78.19
Untranceable = 79.26	Control = 78.74

TABLE 6

MEAN BACK TEMPERATURE SCORES FOR ALL
EXPERIMENTAL CONDITIONS

Subject Group	Session		
	Room Temperature	Stress 1	Stress 2
Control			
T (N = 16)	88.99	70.36	70.15
UT (N = 16)	89.46	75.19	72.72
Total (N = 32)	89.23	72.78	71.44
Experimental			
T (N = 16)	89.29	72.21	69.29
UT (N = 16)	89.56	74.29	70.30
Total (N = 32)	89.43	73.25	69.79
Susceptibility (N = 64)			
T (N = 32)	89.14	71.28	69.72
UT (N = 32)	89.51	74.74	71.51
All Subjects (N = 64)	89.33	73.01	70.62

Dimension Means

Tranceable	= 76.71	Experimental	= 77.49
Untranceable	= 78.59	Control	= 77.81

TABLE 7

MEAN FOOT TEMPERATURE SCORES FOR ALL
EXPERIMENTAL CONDITIONS

Subject Group	Session		
	Room Temperature	Stress 1	Stress 2
Control			
T (N = 16)	82.45	60.65	65.74
UT (N = 16)	83.52	64.08	65.80
Total (N = 32)	82.98	62.37	65.77
Experimental			
T (N = 16)	83.15	60.96	62.63
UT (N = 16)	83.31	64.36	64.59
Total (N = 32)	83.23	62.66	63.61
Susceptibility (N = 64)			
T (N = 32)	82.80	60.81	64.19
UT (N = 32)	83.42	64.22	65.20
All Subjects (N = 64)	83.11	62.51	64.69

Dimension Means

Tranceable = 69.27	Experimental = 69.84
Untranceable = 70.95	Control = 70.38

TABLE 8
MEAN HAND TEMPERATURE SCORES FOR ALL
EXPERIMENTAL CONDITIONS

Subject Group	Session		
	Room Temperature	Stress 1	Stress 2
Control			
T (N = 16)	85.44	62.58	61.53
UT (N = 16)	86.28	55.88	58.18
Total (N = 32)	85.87	59.24	59.86
Experimental			
T (N = 16)	86.53	60.34	60.93
UT (N = 16)	85.27	60.60	58.39
Total (N = 32)	85.91	60.48	59.67
Susceptibility (N = 64)			
T (N = 32)	85.99	61.46	61.23
UT (N = 32)	85.78	59.24	58.28
All Subjects (N = 64)	85.88	59.85	59.76

Dimension Means

Tranceable = 69.56	Experimental = 68.68
Untranceable = 67.44	Control = 68.32

TABLE 9
 MEAN VIGILANCE (TOTAL ERRORS) SCORES FOR ALL
 EXPERIMENTAL CONDITIONS

Subject Group	Session		
	Room Temperature	Stress 1	Stress 2
Control			
T (N = 16)	25.56	37.44	30.00
UT (N = 16)	29.62	40.75	32.06
Total (N = 32)	27.59	39.09	31.03
Experimental			
T (N = 16)	22.62	36.93	24.25
UT (N = 16)	26.50	39.09	23.12
Total (N = 32)	24.56	38.01	23.68
Susceptibility (N = 64)			
T (N = 32)	24.09	37.19	27.12
UT (N = 32)	28.06	39.92	27.59
All Subjects (N = 64)	26.07	38.55	27.35

Dimension Means

Tranceable = 29.47	Experimental = 28.76
Untranceable = 31.86	Control = 32.57

TABLE 10

MEAN PURSUIT ROTOR (BLOCKS) SCORES FOR ALL
EXPERIMENTAL CONDITIONS

Subject Group	Session		
	Room Temperature	Stress 1	Stress 2
Control			
T (N = 16)	23.05	21.59	23.54
UT (N = 16)	25.40	20.43	24.16
Total (N = 32)	24.23	21.02	23.85
Experimental			
T (N = 16)	23.54	21.05	23.49
UT (N = 16)	25.21	22.75	29.90
Total (N = 32)	24.38	21.91	24.70
Susceptibility (N = 64)			
T (N = 32)	23.29	21.32	23.51
UT (N = 32)	25.31	21.59	25.03
All Subjects (N = 64)	24.30	21.46	24.27

Dimension Means

Tranceable = 22.71 Experimental = 23.66
 Untranceable = 23.98 Control = 23.03

TABLE 11

MEAN PURSUIT ROTOR (FIVE-MINUTE) SCORES FOR ALL
EXPERIMENTAL CONDITIONS

Subject Group	Session		
	Room Temperature	Stress 1	Stress 2
Control			
T (N = 16)	23.22	22.58	24.01
UT (N = 16)	25.05	20.50	22.84
Total (N = 32)	24.14	21.54	23.42
Experimental			
T (N = 16)	24.41	21.94	23.91
UT (N = 16)	24.91	22.82	26.17
Total (N = 32)	24.66	22.38	25.04
Susceptibility (N = 64)			
T (N = 32)	23.82	22.26	23.96
UT (N = 32)	24.98	21.66	24.51
All Subjects (N = 64)	24.40	21.96	24.23

Dimension Means

Tranceable	= 23.35	Experimental	= 24.03
Untranceable	= 23.72	Control	= 23.03

Since the most comprehensive analyses are those referred to in (1) above, only those are presented in detail in Tables 12 to 22 inclusive.

Finally, it was decided that the importance of counterbalancing the order of administration of the room temperature and the first stress sessions, as had been done, should be investigated by comparing the relative effects of session order on performance in the second stress session. For this purpose, (4) a Between-subjects analysis was conducted for the final stress session with subjects divided according to the order of base rate session administration. Mean scores on the final stress session by order of base rate sessions are presented in Tables 23 to 33 inclusive.

The massiveness and complexity of the results makes it difficult to present them comprehensively and clearly. The presentation will, therefore, focus strictly on the hypotheses of the study and examine the results of all the variables separately for each hypothesis, generally in the order of an introductory summary statement, followed by main effects, simple effects, and interactions, and finally by a statement which qualifies the conclusions. First we shall consider stress effects as in Hypothesis 1, then training effects, as in Hypothesis 2. Since Hypothesis 3 is a prediction of interactions of susceptibility with stress and training, its results will be incorporated chiefly in the presentations of the other two. The susceptibility effects which were not hypothesized will be presented separately. Finally, we shall discuss order effects which, though not the subject of any hypothesis in this study, are the most important potential source of contaminated results and, therefore, must be examined in order to qualify all conclusions from the hypotheses.

HYPOTHESIS 1: STRESS EFFECTS

The first hypothesis of this study, on which the relevance of any training effects depended, was that the stress of cold and electric shock would impair performance and increase physiological reactivity. This occurred without exception on all of the eleven variables under study, and the effects were statistically significant on ten of the eleven.

Physiological Reactions

All the physiological measures except heart rate showed significant changes in the expected direction from the room temperature to the stress sessions. Both on the overall analysis of variance of all sessions and on the analysis which compared room temperature and stress base rate sessions only, the changes which resulted from stress were typically significant at probability levels on the order of .005.

TABLE 12

ANALYSIS OF VARIANCE OF HEART RATE SCORES FOR ALL
SESSIONS BY SUSCEPTIBILITY (T-UT) AND
TRAINING (E-C) GROUPS

Source	df	Mean Square	F
(E) Training	1	96.94	.40
(T) Susceptibility	1	648.76	2.66
(S) Session	2	29.74	.49
E X T	1	44.39	.18
E X S	2	19.97	.33
T X S	2	48.38	.80
E X T X S	2	22.22	.37
Error Between	60	243.77	
Error Within	120	60.47	

TABLE 13

ANALYSIS OF VARIANCE OF SHIVER SCORES FOR ALL
SESSIONS BY SUSCEPTIBILITY (T-UT) AND
TRAINING (E-C) GROUPS

Source	df	Mean Square	F
(E) Training	1	0.1875	.88
(T) Susceptibility	1	1.5087	7.11
(S) Session	2	9.5118	63.97
E X T	1	0.0003	.00
E X S	2	0.1703	1.14
T X S	2	0.0335	.22
E X T X S	2	0.2684	1.80
Error Between	60	0.2122	
Error Within	120	0.1487	

TABLE 14

ANALYSIS OF VARIANCE OF BASAL SKIN RESISTANCE SCORES
FOR ALL SESSIONS BY SUSCEPTIBILITY (T-UT) AND
TRAINING (E-C) GROUPS

Source	df	Mean Square	F
(E) Training	1	17.39	.12
(T) Susceptibility	1	358.39	2.47
(S) Session	2	532.46	5.13
E X T	1	37.49	.26
E X S	2	128.66	1.24
T X S	2	91.97	.89
E X T X S	2	94.87	.91
Error Between	60	145.23	
Error Within	120	103.72	

TABLE 15

ANALYSIS OF VARIANCE OF CORE TEMPERATURE SCORES
FOR ALL SESSIONS BY SUSCEPTIBILITY (T-UT) AND
TRAINING (E-C) GROUPS

Source	df	Mean Square	F
(E) Training	1	1.05	.02
(T) Susceptibility	1	105.20	2.39
(S) Session	2	2371.24	107.62
E X T	1	8.47	.19
E X S	2	9.01	.41
T X S	2	6.46	.29
E X T X S	2	21.43	.97
Error Between	60	43.99	
Error Within	120	.22.03	

TABLE 16

ANALYSIS OF VARIANCE OF CHEST TEMPERATURE SCORES
FOR ALL SESSIONS BY SUSCEPTIBILITY (T-UT) AND
TRAINING (E-C) GROUPS

Source	df	Mean Square	F
(E) Training	1	14.62	.41
(T) Susceptibility	1	121.57	3.41
(S) Session	2	4259.72	194.17
E X T	1	2.93	.08
E X S	2	4.33	.20
T X S	2	5.97	.27
E X T X S	2	3.47	.16
Error Between	60	35.62	
Error Within	120	21.94	

TABLE 17

ANALYSIS OF VARIANCE OF BACK TEMPERATURE SCORES
 FOR ALL SESSIONS BY SUSCEPTIBILITY (T-UT) AND
 TRAINING (E-C) GROUPS

Source	df	Mean Square	F
(E) Training	1	4.98	.18
(T) Susceptibility	1	168.50	6.01
(S) Session	2	6634.95	330.70
E X T	1	27.11	.97
E X S	2	21.34	1.06
T X S	2	38.44	1.91
E X T X S	2	6.33	.32
Error Between	60	28.02	
Error Within	120	20.06	

TABLE 18

ANALYSIS OF VARIANCE OF HAND TEMPERATURE SCORES
FOR ALL SESSIONS BY SUSCEPTIBILITY (T-UT) AND
TRAINING (E-C) GROUPS

Source	df	Mean Square	F
(E) Training	1	6.28	.36
(T) Susceptibility	1	216.69	12.58
(S) Session	2	14508.03	1382.52
E X T	1	42.67	2.48
E X S	2	9.78	.93
T X S	2	44.66	4.26
E X T X S	2	85.46	8.14
Error Between	60	17.22	
Error Within	120	10.49	

TABLE 19

ANALYSIS OF VARIANCE OF FOOT TEMPERATURE SCORES
FOR ALL SESSIONS BY SUSCEPTIBILITY (T-UT) AND
TRAINING (E-C) GROUPS

Source	df	Mean Square	F
(E) Training	1	14.01	.73
(T) Susceptibility	1	135.42	7.07
(S) Session	2	8191.09	567.70
E X T	1	1.28	.07
E X S	2	31.81	2.20
T X S	2	36.87	2.56
E X T X S	2	7.99	.55
Error Between	60	19.17	
Error Within	120	14.43	

TABLE 20
 ANALYSIS OF VARIANCE OF VIGILANCE SCORES FOR ALL
 SESSIONS OF SUSCEPTIBILITY (T-UT) AND
 TRAINING (E-C) GROUPS

Source	df	Mean Square	F
(E) Training	1	699.82	1.93
(T) Susceptibility	1	274.18	.76
(S) Session	2	3016.25	27.84
E X T	1	27.24	.08
E X S	2	164.37	1.52
T X S	2	50.41	.46
E X T X S	2	9.39	.09
Error Between	60	362.12	
Error Within	120	108.36	

TABLE 21

ANALYSIS OF VARIANCE OF PURSUIT ROTOR (MEAN OF TRIAL
BLOCKS) SCORES FOR ALL SESSIONS BY SUSCEPTIBILITY
(T-UT) AND TRAINING (E-C) GROUPS

Source	df	Mean Square	F
(E) Training	1	19.03	.87
(T) Susceptibility	1	76.88	3.51
(S) Session	2	170.75	30.18
E X T	1	20.94	.97
E X S	2	2.75	.48
T X S	2	12.96	2.29
E X T X S	2	13.20	2.33
Error Between	60	21.87	
Error Within	120	5.66	

TABLE 22

ANALYSIS OF VARIANCE OF PURSUIT ROTOR (FIVE-MINUTE
CONTINUOUS) SCORES FOR ALL SESSIONS BY SUSCEPTIBILITY
(T-UT) AND TRAINING (E-C) GROUPS

Source	df	Mean Square	F
(E) Training	1	47.60	1.89
(T) Susceptibility	1	6.58	.26
(S) Session	2	118.56	12.74
E X T	1	34.02	1.35
E X S	2	5.08	.55
T X S	2	12.86	1.38
E X T X S	2	27.57	2.96
Error Between	60	25.20	
Error Within	120	9.31	

TABLE 23
MEANS OF HEART RATE SCORES OF ALL SUBJECT GROUPS IN SECOND STRESS SESSION
BY ORDER OF BASE RATE SESSIONS

Assigned Condition	Order					
	Room Temperature First			Stress Session First		
	T	UT	Total	T	UT	Total
Control	78.56	77.04	77.80	81.25	77.49	79.37
Experimental	82.08	76.25	79.17	84.27	75.62	79.95
Total	80.32	76.65	78.48	82.76	76.56	79.66

TABLE 24
 MEANS OF SHIVER SCORES OF ALL SUBJECT GROUPS IN SECOND STRESS SESSION
 BY ORDER OF BASE RATE SESSIONS

Assigned Condition	Order					
	Room Temperature First			Stress Session First		
	T	UT	Total	T	UT	Total
Control	1.088	1.089	1.088	0.905	1.199	1.052
Experimental	0.665	1.070	0.868	0.804	1.018	0.911
Total	0.876	1.079	0.978	0.854	1.108	0.981

TABLE 25
 MEANS OF BASAL SKIN RESISTANCE SCORES OF ALL SUBJECT GROUPS IN SECOND
 STRESS SESSION BY ORDER OF BASE RATE SESSIONS

Assigned Condition	Order					
	Room Temperature First			Stress Session First		
	T	UT	Total	T	UT	Total
Control	13.73	14.07	13.90	15.29	9.752	12.52
Experimental	15.61	11.38	13.49	17.56	12.71	15.13
Total	14.67	12.72	13.70	16.42	11.23	13.83

TABLE 26

MEANS OF CORE TEMPERATURE SCORES OF ALL SUBJECT GROUPS IN SECOND STRESS
SESSION BY ORDER OF BASE RATE SESSIONS

Assigned Condition	Order					
	Room Temperature First			Stress Session First		
	T	UT	Total	T	UT	Total
Control	80.06	82.33	81.20	79.48	82.78	81.13
Experimental	79.31	78.78	79.05	81.29	83.15	82.22
Total	79.69	80.55	80.12	80.38	82.96	81.67

TABLE 27

MEANS OF CHEST TEMPERATURE SCORES OF ALL SUBJECT GROUPS IN SECOND STRESS
SESSION BY ORDER OF BASE RATE SESSIONS

Assigned Condition	Order					
	Room Temperature First			Stress Session First		
	T	UT	Total	T	UT	Total
Control	72.29	74.50	73.40	73.33	75.36	74.35
Experimental	72.79	72.88	72.83	71.50	75.98	73.74
Total	72.54	73.69	73.12	72.42	75.67	74.04

TABLE 28

MEANS OF BACK TEMPERATURE SCORES OF ALL SUBJECT GROUPS IN SECOND STRESS
SESSION BY ORDER OF BASE RATE SESSIONS

Assigned Condition	Order					
	Room Temperature First			Stress Session First		
	T	UT	Total	T	UT	Total
Control	66.85	73.17	70.01	73.46	72.28	72.87
Experimental	70.92	59.70	70.31	67.67	70.92	69.29
Total	68.88	71.43	70.16	70.56	71.60	71.08

TABLE 29
 MEANS OF HAND TEMPERATURE SCORES OF ALL SUBJECT GROUPS IN SECOND STRESS
 SESSION BY ORDER OF BASE RATE SESSIONS

Assigned Condition	Order					
	Room Temperature First			Stress Session First		
	T	UT	Total	T	UT	Total
Control	63.07	57.66	60.36	59.99	58.71	59.35
Experimental	61.62	58.06	59.84	60.26	58.72	59.49
Total	62.35	57.86	60.10	60.12	58.72	59.42

TABLE 30

MEANS OF FOOT TEMPERATURE SCORES OF ALL SUBJECT GROUPS IN SECOND STRESS
SESSION BY ORDER OF BASE RATE SESSIONS

Assigned Condition	Order					
	Room Temperature First			Stress Session First		
	T	UT	Total	T	UT	Total
Control	66.79	67.83	67.31	64.71	63.78	64.24
Experimental	62.19	64.64	63.41	63.08	64.56	63.82
Total	64.49	66.24	65.36	63.90	64.17	64.03

TABLE 31
 MEANS OF VIGILANCE SCORES OF ALL SUBJECT GROUPS IN SECOND STRESS SESSION
 BY ORDER OF BASE RATE SESSIONS

Assigned Condition	Order					
	Room Temperature First	Stress Session First	Total	Total		
	T	UT	T	UT		
Control	34.50(16.8)	30.12(9.4)	32.31(13.3)	25.50(10.4)	34.00(24.0)	29.75(18.4)
Experimental	23.87(12.7)	19.37(8.2)	21.62(10.6)	24.62(15.6)	26.87(11.1)	25.75(13.2)
Total	29.18(15.4)	24.75(10.2)	26.97(13.0)	25.06(12.8)	30.43(18.4)	27.75(15.9)

TABLE 32

MEANS OF PURSUIT ROTOR (TRIAL BLOCKS) SCORES OF ALL SUBJECT GROUPS IN SECOND STRESS SESSION BY ORDER OF BASE RATE SESSIONS

Assigned Condition	Order					
	Room Temperature First		Stress Session First		Total	
	T	UT	T	UT	T	Total
Control	24.18(1.9)	24.06(3.07)	24.12(2.5)	22.90(3.8)	24.26(3.3)	23.58(3.5)
Experimental	21.98(5.0)	25.57(2.8)	23.66(4.4)	24.46(3.0)	25.91(1.8)	25.23(2.5)
Total	23.08(3.8)	24.75(2.9)	23.90(3.5)	23.63(3.4)	25.08(2.7)	24.38(3.1)

TABLE 33

MEANS OF PURSUIT ROTOR (FIVE-MINUTE CONTINUOUS) SCORES
OF ALL SUBJECT GROUPS IN SECOND STRESS SESSION
BY ORDER OF BASE RATE SESSIONS

Assigned Condition	Order					
	Room Temperature First	Stress Session First				
	T	UT	Total	T		
				UT		
				Total		
Control	24.75(2.0)	22.11(4.5)	23.43(3.6)	23.27(3.80)	23.57(4.1)	23.42(3.8)
Experi- mental	22.35(5.0)	26.42(3.2)	24.38(4.6)	25.48(2.9)	25.93(1.8)	25.70(2.3)
Total	23.55(3.9)	24.26(4.3)	23.91(4.1)	24.37(3.4)	24.75(3.3)	24.56(3.3)

One-tailed tests were used, since the hypothesis was unidirectional. Though heart rate overall barely changed from the room temperature to the first stress session (Table 1, All Subjects), shivering rate more than tripled (Table 2, All Subjects), basal skin resistance dropped almost a third, from 18.58 k to 13.42 k, (Table 3), core temperature dropped from 91.03° to 80.12° (Fahrenheit) (Table 4), chest temperature from 87.88° to 73.94° (Table 5), back temperature from 89.33° to 73.01° (Table 6), foot temperature from 83.11° to 62.51° (Table 7), and hand temperature from 85.88° to 59.85° (Table 8).

Performance Changes

Changes on the performance measures, while sometimes not as dramatic as the physiological changes, were nevertheless all highly significant. On the vigilance task, Total Errors increased from 26.07 to 38.55 (Table 9). On the rotary pursuit task, where subjects were performing much closer to asymptote to begin with, mean time on target dropped, for the trial blocks, from 24.30 to 21.46 seconds (Table 10), and for the continuous run, from 24.40 to 21.96 seconds (Table 11).

Interactions With Susceptibility

The effects of stress were not always independent of the hypnotic susceptibility of the subjects and occasionally interacted significantly with both susceptibility and training group. In no case, however, were there any significant interactions between the base rate sessions and training group alone. This means that the differences which might later be seen between the experimental and control groups in the final stress session could not be attributed entirely to base rate differences in their reactions.

Although there were no hypotheses about any relationship between hypnotic susceptibility and base rate reactions, the significant interactions which were observed in this connection seem too important to omit mention of them here. Four physiological measures and one performance measure showed such interactions. For the former, UT subjects tend to have higher shivering rates than do T's in the room temperature session (.399 vs. .236), and react with generally more shivering in the first stress session as well. The stress reaction is more pronounced among UT's in the control group than among experimental group UT's, and it is only the triple interaction (susceptibility, training group, and stress) which approaches significance ($p < .10$, 2-tailed test). There are more pronounced interactions between susceptibility and stress reactions for back, foot, and hand temperatures, among the physiological measures, and for the trial-block scores on rotary pursuit, among the performance measures. For both back and foot temperatures, T's and UT's have about the same means during the room temperature session, but T's drop relatively more in the first stress session (Back temp., $p < .10$, foot temp., $p < .05$, both tests 2-tailed). Precisely the opposite happens to hand temperature under stress; UT's drop significantly more ($p < .05$, for susceptibility x session interaction, 2-tailed test), especially in the control group ($p < .01$ for triple

interaction, 2-tailed test). On rotary pursuit, however, the differences seem to have more to do with base rate performance under room temperatures than under stress. UT's start with a higher mean performance and, under stress, decline to about the same level as the T group ($p < .10$, 2-tailed test).

Summary of Hypothesis 1.

In summary, it is very clear that the evidence supports the first hypothesis strongly but with some qualifications. In other words, it is clear that the stressors had the effects predicted on all groups and almost all measures, but these effects sometimes differed systematically among all the affected groups. Evidently, there are some fundamental differences between people who are high and low in hypnotic susceptibility which dispose them to respond with different degrees of impairment to the same amounts of stress.

HYPOTHESES 2 AND 3: TRAINING EFFECTS AND INTERACTIONS OF TRAINING AND SUSCEPTIBILITY

The second and third hypotheses of this study were that training and self-hypnosis would reduce the performance decrements and physiological reactivity which resulted from the stress, especially among High Susceptibles (T's). These hypotheses were supported in part, but the results in connection with them are considerably more equivocal and complex than was the case with the first hypothesis. Some measures showed a training effect, some did not, and some showed the reverse of the expected effect, both independently and in connection with susceptibility.

Physiological Reactions

Among the physiological measures, heart rate, chest temperature, and core temperature showed virtually no mean changes from the first to the second stress sessions among either experimental or control groups. Shivering shows a slight mean increase among control subjects from first to second stress sessions, and a slight decrease among experimental subjects, but it is not possible to attribute this result with much confidence to training. The differences are not statistically significant and, as we have seen, the influences of hypnotic susceptibility and stress on shivering are both so massive that it is difficult for any training effect that might have occurred to be clearly seen. Nevertheless, it is worth noting that the observed increases and decreases in shivering rate are attributable almost entirely to T's in the control and experimental groups respectively. UT's in both groups stay the same.

Basal skin resistance seems to show more of a training effect than shivering, but this result must also be considered somewhat

unreliable. The mean BSR of control and experimental subjects is almost identical at room temperature, but drops 7.5 points for the experimental group and only about 2.5 for the control group during the first stress session, a difference significant between the .05 and .10 levels ($F = 3.57$). After training, the experimental group rises a little less than three points and the control group declines a little more than two points, a difference again significant between the .05 and .10 levels ($F = 3.64$).

Back temperature scores drop significantly overall from first to second stress sessions ($F = 6.66$) by 3 degrees. Peculiarly, the back temperatures of experimental subjects drop a mean 3.5 degrees after training, from one session to the other, while those of controls drop less than 1.5, but these differences are not significant. Foot temperatures, on the other hand, rise significantly from first to second stress sessions by more than 2 degrees ($F = 10.27$, $p < .01$), but they rise more than 3 degrees among control subjects and barely 1 degree among experimentals, and the difference of more than 2 degrees between groups in the final session ($F = 4.82$, $p < .05$) clearly favors control subjects, precisely contrary to Hypothesis 2.

Hand temperature presents even more peculiar results in that the mean differences are very slight and very significant at the same time. Experimental and control group differ in mean hand temperature by barely more than 1 degree in the first stress session, but this 1 degree of greater warmth in the experimental group is significant at the .005 level ($F = 13.65$). In addition, while training does not have any independent effect, as it inversely did with foot temperature, it interacts significantly if slightly with susceptibility ($F = 6.30$, $p < .025$), as per the third hypothesis. As predicted, experimental subjects of high susceptibility rose in mean hand temperature by .6 degrees from first to second stress sessions. Unexpectedly, however, though the mean hand temperatures of experimental Low Susceptibles and control High Susceptibles dropped, that of control Low Susceptibles actually rose by more than 2 degrees. The latter may be a chance fluctuation in the results, however, and the hypothesis must, in general, be considered supported by the hand temperature data.

Performance Changes

The effects of training on the performance measures are a little easier to describe than were the physiological measures. On all three performance tests, scores increased significantly overall from the first to the second stress sessions (pursuit rotor trial blocks, $F = 39.47$; PR continuous, $F = 18.18$; vigilance Total Errors, $F = 32.98$, all $p < .001$).

On the vigilance task, there is a clearly significant training effect per Hypotheses 2: experimental subjects return to the performance level of their room temperature session after an increase of almost 14 errors in the first stress session. Control subjects also

improve noticeably from the first stress session, but still make considerably more errors than they originally did and average a significant 7.5 more errors than experimentals in the final stress session ($F = 4.25, p < .05$). Contrary to the third hypothesis, however, the T subjects are not more affected by training than the UT's. If anything, the latter group improves very slightly more than the former.

On the pursuit rotor trial blocks, there is no evidence for any training effect. Control and experimental subjects both improve an average of almost 3 seconds from the first to the second stress sessions. The continuous rotary pursuit data, on the other hand, does show a significant interaction between training and susceptibility ($F = 4.33, p < .05$) from the first to the second stress session, but it is precisely the opposite of that which was predicted by the third hypothesis. Experimental subjects do tend to improve more than controls, but within those groups, it is clearly the UT's who improve most in the experimental group, outperforming all other groups in the second stress session.

Summary of Hypotheses 2 and 3

In summary, the hypothesized effects of training and interactions between training and susceptibility were not so much wrong as grossly oversimplified statements of what is really the case. Training does have some effects, indeed, but not easily predictable ones. It shows no effects on heart rate, chest temperature, and core temperatures, and its evident effects on shivering and basal skin resistance, though tending in the direction of the hypothesis, are not very dependable. Back temperatures and foot temperature, to the contrary, seem to be affected negatively by training, the latter reliably so, and none of the training effects indicated thus far interact with susceptibility at all, contrary to Hypothesis 3.

Hand temperature results do support the third hypothesis, though there is no independent training effect in evidence on this measure and the differences between groups, though significant, are very small. Vigilance, on the other hand, shows a very clear training effect, as per the second hypothesis, but no interaction with susceptibility, as per the third. Finally, continuous rotary pursuit data show a training effect interacting with susceptibility, but it is low susceptibility that benefits from training, not high - and rotary pursuit trial blocks show no significant effects at all.

ADDITIONAL RESULTS: HYPNOTIC SUSCEPTIBILITY

In formulating the hypotheses of this study, it was assumed that susceptibility to hypnosis would be a pertinent factor in benefiting from autohypnotic training, but that T and UT subjects would be essentially the same with respect to everything other than training effects.

As we have seen, this was not the case. Not only did susceptibility interact with the base rate measures, as discussed in connection with Hypothesis 1, but it frequently showed significant independent effects, often among the most powerful ones in the entire study.

Analysis of variance of all groups and sessions combined shows that hypnotic susceptibility is independently and significantly influential on at least four of the eleven measures studied and tends to have some effects in connection with another five. Overall, T subjects have lower shivering rates than UT's ($F = 7.11, p < .025$, 2-tailed test), lower back temperatures ($F = 6.01, p < .05$, 2-tailed), lower foot temperatures ($F = 7.07, p < .05$, 2-tailed test), and higher hand temperatures ($F = 12.58, p < .01$, 2-tailed test). Their chest and core temperatures also tend to be lower than those of UT's, but not reliably so ($F_s = 3.41$ and 2.39 respectively). In addition, the mean heart rate of High Susceptibles is 3.5 beats per minute faster than that of Low Susceptibles and their mean basal skin resistance almost 3 k higher, but neither of these differences are significant ($F_s = 2.66$ and 2.47 respectively). Finally, they tend to perform more poorly on rotary pursuit than do Low Susceptibles ($F = 3.51, p < .10$, 2-tailed test), but this difference is seen only on trial blocks, not on continuous performance.

Analysis of the individual sessions generally confirms the overall results and sometimes sheds more light on them. Differences in shivering rate, for example, are seen most clearly during the room temperature session, where T's have a mean score of .24 and UT's of .40 ($F = 12.60, p < .01$, 2-tailed). Differences among the two susceptibility groups in back temperature and foot temperatures are most pronounced in reaction to the first stress session ($F_s = 5.49$ and 11.19 respectively), but are almost identical in the room temperature session. Differences in hand temperature also are virtually nil in the room temperature session, are most pronounced in the first stress session ($F = 11.65$), but are still clearly significant in the second stress session, quite apart from any training effects ($F = 9.08$). Finally, the differences in rotary pursuit trial blocks are greater during the room temperature session than at any other time ($F = 6.68, p < .05$, 2-tailed test), virtually disappear under the impact of the first stress session, and tend to recur during the second stress session ($F = 3.45$).

ADDITIONAL RESULTS: ORDER EFFECTS

Since it was anticipated that the stress and room temperature base rate sessions would elicit markedly different reactions from subjects which in turn might affect their responses to training, the order of administration of these two sessions was counterbalanced; half the subjects in each group received the room temperature session first and half the stress session first. Although the tests of hypotheses were safeguarded from contamination by order effects in this way, it was decided nevertheless to examine the possible influence which order of base rate session administration may have had on performance in

the second stress session. Subjects were, therefore, divided into two groups according to the order in which they had received the base rate sessions and their responses in the second stress session were subjected to analyses of variance with three Between-subjects variables: T-UT, experimental-control, and order of base rate session.

Session order was not independently significant on any measure, nor was it significant in single interactions with either of the other dimensions on any measure. The only significant effect was a triple interaction on back temperature scores ($F = 5.50, p < .05$). Among subjects who had the room temperature session first, control T's had lower back temperatures than control UT's, while experimental T's had higher back temperatures than experimental UT's. Precisely the opposite effect obtained among subjects who had the stress session first. These effects obviously were cancelled out by the counterbalancing procedure.

Means of all groups on all measures in the second stress session are presented by order of base rate sessions in Tables 23 to 33.

SECTION IV

DISCUSSION

The principal purpose of this study was to examine the effectiveness of autohypnotic training as a stress resistance technique; the first and third hypotheses, regarding stress and susceptibility, while important, were formulated primarily in order to gain a more sophisticated understanding of the effects of such training. Consequently, it is more meaningful to discuss the results from the perspective of training effects per se.

The results relating to training effects were more ambiguous than were the very clear-cut disabling effects of the stressors and the different influences of susceptibility on different measures. Certainly training did have a strong positive effect on vigilance task performance, which from a practical point of view is probably the most important measure in the entire experiment, but the effect of training on all the other measures is more puzzling. It seems to benefit continuous rotary pursuit, but only among unsusceptible subjects. Seven of the physiological measures are either unaffected by training or so variably affected that the results are not reliable. And on one of the temperature measures, training effects appear to be reliably backwards - subjects' foot temperatures rise after being trained in how to resist cold, but other subjects' foot temperatures rise even more if they receive no training at all.

In considering these effects, it is important to note that the influence of training is inevitably limited by the magnitude of the stress effects. Considering that stress has a very profound effect on the reactions of most subjects, it is not surprising that the limited amount of training in stress resistance provided in this study does not unequivocally reduce the functional decrements.

Two additional factors which contributed to variation in training effects must also be taken into consideration. These are: a. Variations in the performance of the expert hypnotists, and b. Differences in response dispositions resulting from susceptibility.

Expert Hypnotists

The design of the study was such that, within fairly broad limits, the expert hypnotists were free to use whatever techniques they thought would be most effective both in training people to hypnotize themselves and in making suggestions for resisting the stress effects. The experts did indeed take advantage of this latitude and differed from each other in their approaches to the subjects and in the kinds of suggestions they made. Though all of them were very experienced in the clinical use of hypnosis, it is well known that clinical techniques differ rather widely, not so much in induction "patter" as in connection

with the concrete suggestions for producing special effects. The considerable differences among the expert hypnotists inevitably contributed an unknown quantum of variation to the subsequent reactions of the subjects.

No effort was made to analyze formally the differences between the hypnotists for two reasons: (a) The dimensional complexity of the study was already so great that it would have been impossible to provide a meaningful analysis of variance design that incorporated both hypnotist differences and the other main effects in which we were interested, and (b) It was recognized that the most critical hypotheses to be scrutinized in this experiment concerned whether any autohypnotic training would be effective, and not whether stylistic differences in training methods would make a difference.

It may be asserted, for that matter, that the design of this experiment actually tested only whether training mattered, not whether autohypnotic training as such was important. To test the latter, it would be necessary to have two comparison groups, one which received no training at all and one which received some specific, but not hypnotic training. The economic limitations of the study made it more critical at this juncture to test whether autohypnotic training worked better than no training at all rather than whether it was relatively more effective than other types of training. Certainly the results are clear enough to indicate that it is effective, as expected, and future research could now legitimately be concerned with the question of type and style of training, comparing different training methods as well as differential effectiveness of different individuals using the same method.

Response Dispositions and Susceptibility

Differences in response dispositions related to hypnotic susceptibility were also a major factor in blurring the effects of training. In fact, it is clear that, next to the debilitating effects of the stress situation, susceptibility differences were the most powerful and reliable findings of this study. With respect to performance variables, these findings reconfirm a large number of quite unexpected and still unexplained performance differences between high and low susceptible subjects. The most interesting finding in this connection is the rotary pursuit performance difference -- the relatively better performance of UT's both in base rate and stress sessions essentially replicates the earlier finding of London, Ogle, and Unikel (In Press, 1967). But their results were obtained under conditions of severe heat stress, whereas the present study used cold stress. Evidently, whatever dispositions of the subjects are reflected in high or low susceptibility produce similar response patterns to hot and cold thermal stressors, even though heat and cold may produce dissimilar physiological reactions. At all events, it seems reasonable to conclude that

the similarity of relative performances under these different circumstances reflects a reaction to the common feelings of discomfort which different kinds of thermal stress produce whether or not there are different physical reactions involved (Waybrew, 1967, p. 336).

Of even greater interest and perhaps importance is the fact that there are significant physiological differences between High and Low Susceptibles, both in base rate performance under room temperature conditions and in response to the impact of stress. The differences which we had hypothesized in physical reaction were all straightforward derivatives of the assumption that High and Low Susceptibles are fundamentally the same kinds of people in all respects except their susceptibility of hypnosis, so that differences between them could be expected to occur only in connection with their differential abilities to make use of hypnotic suggestions.

Apparently, this notion is far from accurate. The physiological evidence of this study, whether taken alone or pooled with the peculiar performance differences that have been observed in so many previous experiments, seems to indicate overwhelmingly that T's and UT's are in some critical respects fundamentally different people and that these differences, reflected so strikingly on tests of hypnotic susceptibility, are not fundamentally related to hypnotic experiences, but to a wide variety of life experiences towards which these people respond in subtly but measurably different ways.

Whether or not this will prove to be the case in future research, it is quite clear that reactions to hypnotic training cannot be predicted merely from knowing hypnotic susceptibility. Failure to distinguish subjects in terms of this variable, on the other hand, may actually obscure training effects. Without a doubt, all research on hypnotic effects should take individual differences among subjects into careful account and should evaluate hypothesized effects in terms both of high and low hypnotic susceptibility.

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APPENDIX A

VOLUNTEER SOLICITATION TEXT

My purpose in being here today is to solicit volunteer subjects for a research project that is being conducted by the Psychological Research Center at the University of Southern California. The research project was undertaken at the request of and is being supported by the United States Aerospace Research Program; the results may be used in the nation's astronaut program. The research program involves the development and evaluation of psychological training techniques which can be used to improve and sustain performance in stressful situations.

The total time commitment for each volunteer would be approximately 17 hours which would be spread over a period of 2 to 3 weeks. It will rarely be necessary for an individual to come in on any given day for more than one or two hours.

We will make every effort to schedule your appointments to suit your convenience so that they will not interfere with your schedules in any way.

For those individuals that are selected to participate in all phases of the study we will be able to pay the sum of \$25.00. This selection will be made on the basis of three separate screening sessions. Unfortunately, because of a limited budget, we will not be able to compensate all individuals that go through the screening sessions; only those that are selected to continue on and that complete all phases of the project. The screening sessions are not designed to be stressful and I can assure you that you will find them to be interesting. (Ask for questions at this point. If anyone asks about a more detailed discussion of the stressors, the training, etc., tell them that they will be more fully informed of all relevant details at the time of their screening session.)

APPENDIX B
EQUIPMENT SCHEMATICS

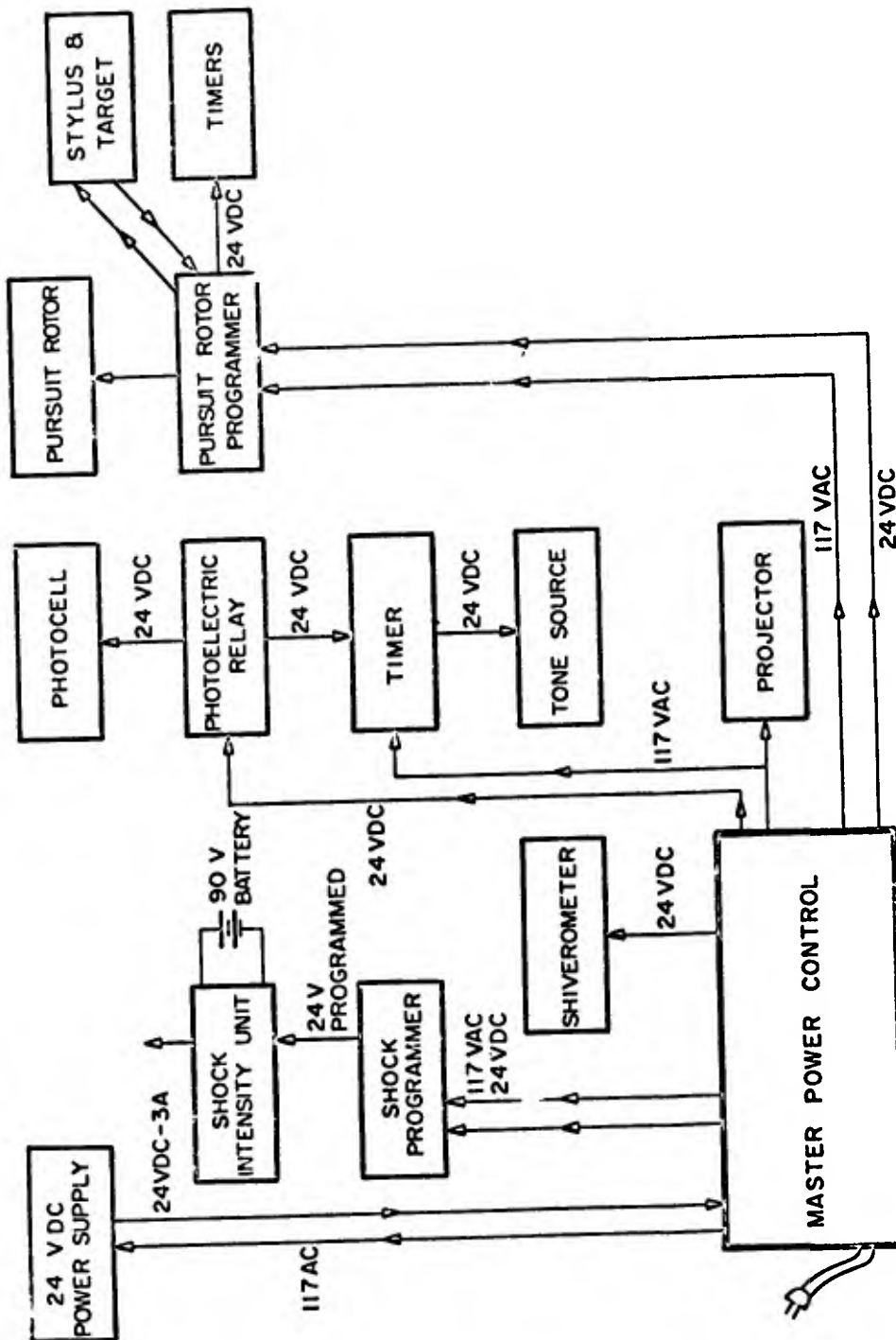
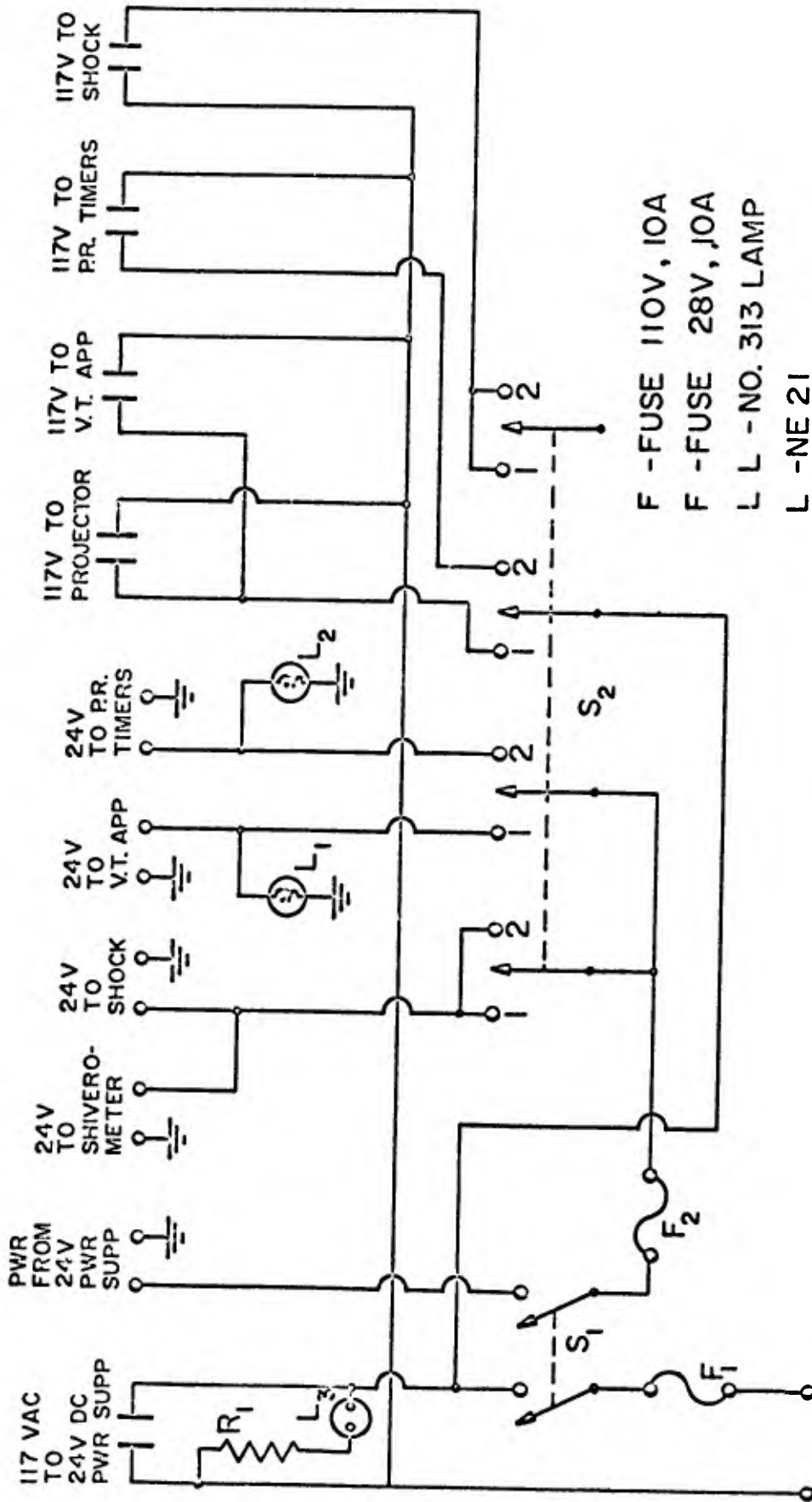


Figure 10. Overall Equipment Schematic



- F - FUSE 110V, 10A
- F - FUSE 28V, 10A
- L L - NO. 313 LAMP
- L - NE 21
- R - 50K 1/2W
- S - MASTER PWR DPST
- S - FUNCTION SWITCH
- 4PDT - CENTER OFF

Figure 11.

MASTER CONTROL UNIT

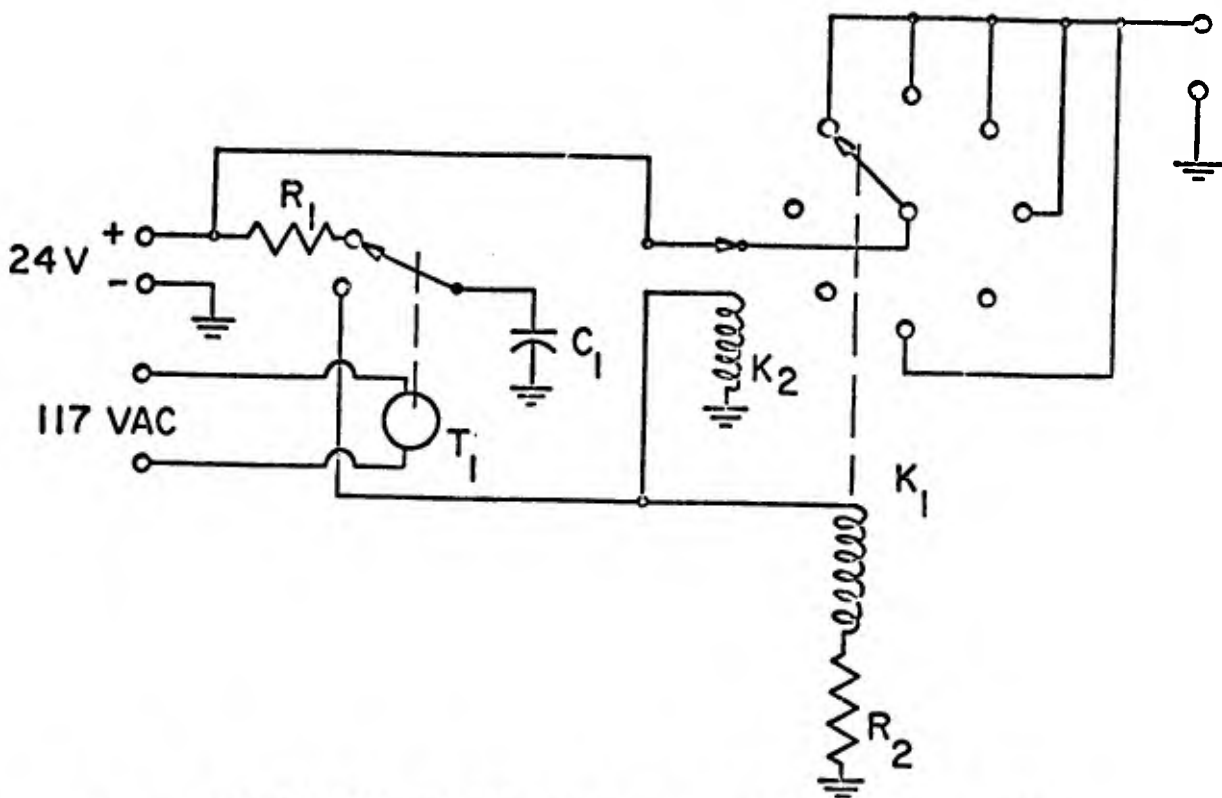


Figure 12. SHOCK RANDOMIZING PROGRAMMER

- C_1 - 1000 MFD 75V ELECTROLYTIC CAPACITOR
 K_1 - 50 POINT BRIDGING-ROTARY STEPPING SWITCH
 12V, 4 OHM COIL - 25 POINTS CONNECTED
 RANDOMLY
 K_2 - SERIES INTERRUPTING RELAY 24V SPST
 R_1 - SURGPROTECTING RESISTOR 10 OHM 20W
 R_2 - SERIES DROPPING RESISTOR 5 OHM 50W
 T - CAM TIMER WITH GEAR $\left\{ \begin{array}{l} = 6 \text{ REV / MIN} \\ \text{B-12} = 3 \text{ REV / MIN} \end{array} \right.$

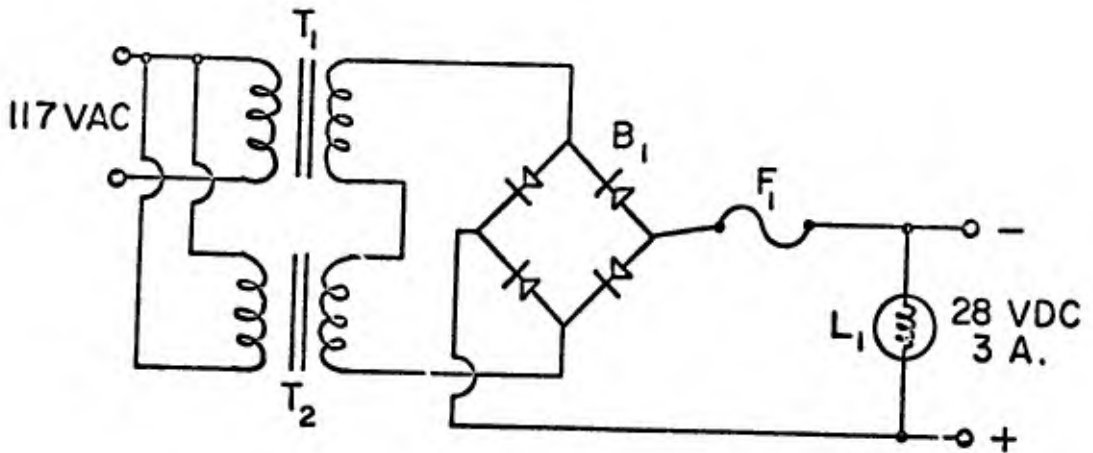


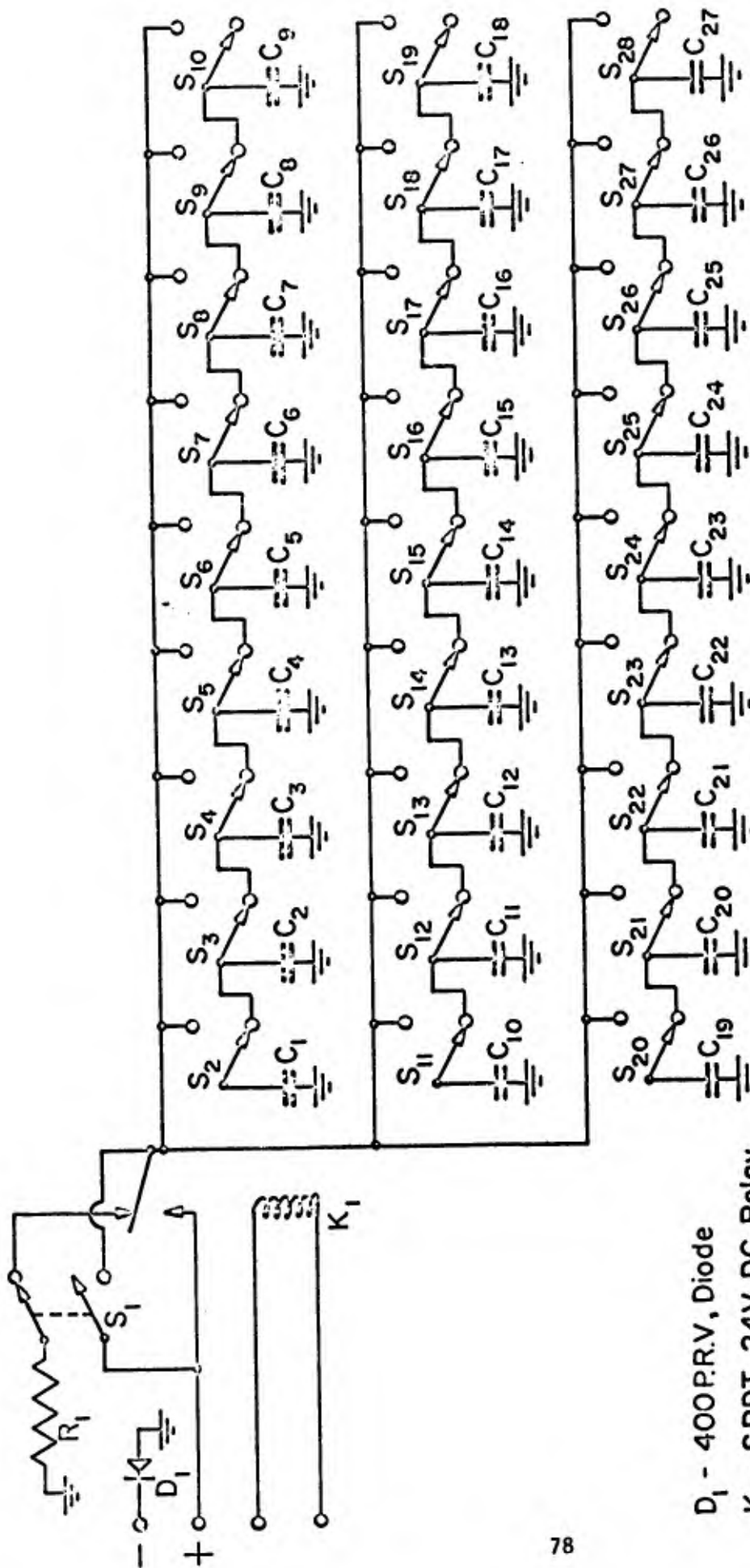
Figure 13. 24 VOLT POWER SUPPLY

B_1 - 10-A 35V RMS BRIDGE , INT. RECT.

F_1 - 10A FUSE

L_1 - 24V LIGHT NO. 313

$T_1 - T_2$ - 14V-3A TRANSFORMERS



- D₁ - 400 P.R.V. Diode
- K₁ - S.P.D.T. 24V DC Relay
- R₁ - 200 Ohm - 1/2 watt
- S₁ - D.P.S.T. MOM. Contact push-button switch
- S₂ - S₂₈ - S.P.S.T. Toggle Switch
- C₁ - C₉ - 1 μfd 600V Capacitor
- C₁₀ - C₁₈ - 0.1 μfd 600V Capacitor
- C₁₉ - C₂₇ - 0.01 μfd 600V Capacitor

Figure 14. SHOCK INTENSITY REGULATOR

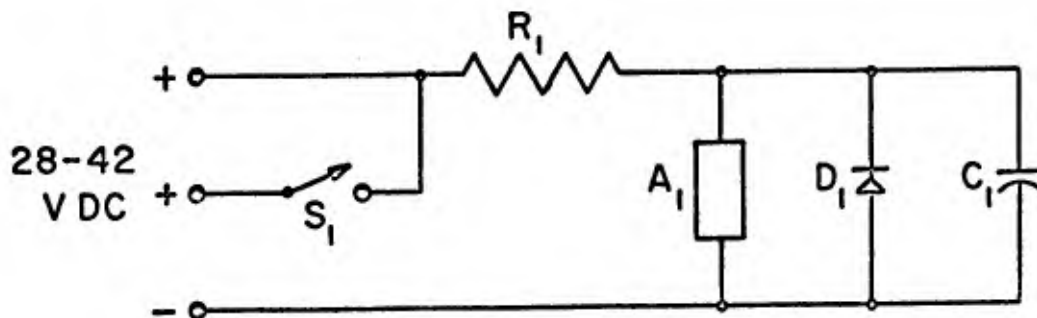


Figure 15. AUDIO GENERATOR

A₁ - "SONALERT" AUDIO TRANSDUCER
28VDC, 2.5KC at 80DB

C₁ - ELECTROLYTIC CAPACITOR
8MFD 100WVDC

D₁ - ZENER DIODE 28V 1-WATT

R₁ - 250 5-W WIRE WOUND RESISTOR

S₁ - PUSH BUTTON SWITCH, MOM. CONTACT
NORMALLY OPEN S.P.S.T.

C₁ - 20 MFD 450 VDC
 C₂ - 5 MFD 600V Oil filled
 C₃ - 10 MFD 600V Oil filled
 C₄ - 15 MFD 600V Oil filled
 K₁ - Sensitive relay S.P.D.T.
 5,000 ohm 2MA pull-in
 K₂ - 24VDC S.P.S.T. Relay
 R₁ - 20K 25W Wire wound resistor
 R_{2,3} 100K 2W Resistors
 R₄ - 200ohm 1W Resistor
 L₁ - 10H 200MA 150ohm Choke
 S₁ - 3pos. S.P. Switch

T₁ - Power transformer 350-0-350V
 at 125MA, 5V at 2A, 6.3V at 2A,
 Primary 117 V AC

V₁ - 5Y3 Rect.

V_{2,3} - 6AUG

TERMINALS

1 - Off during timed interval

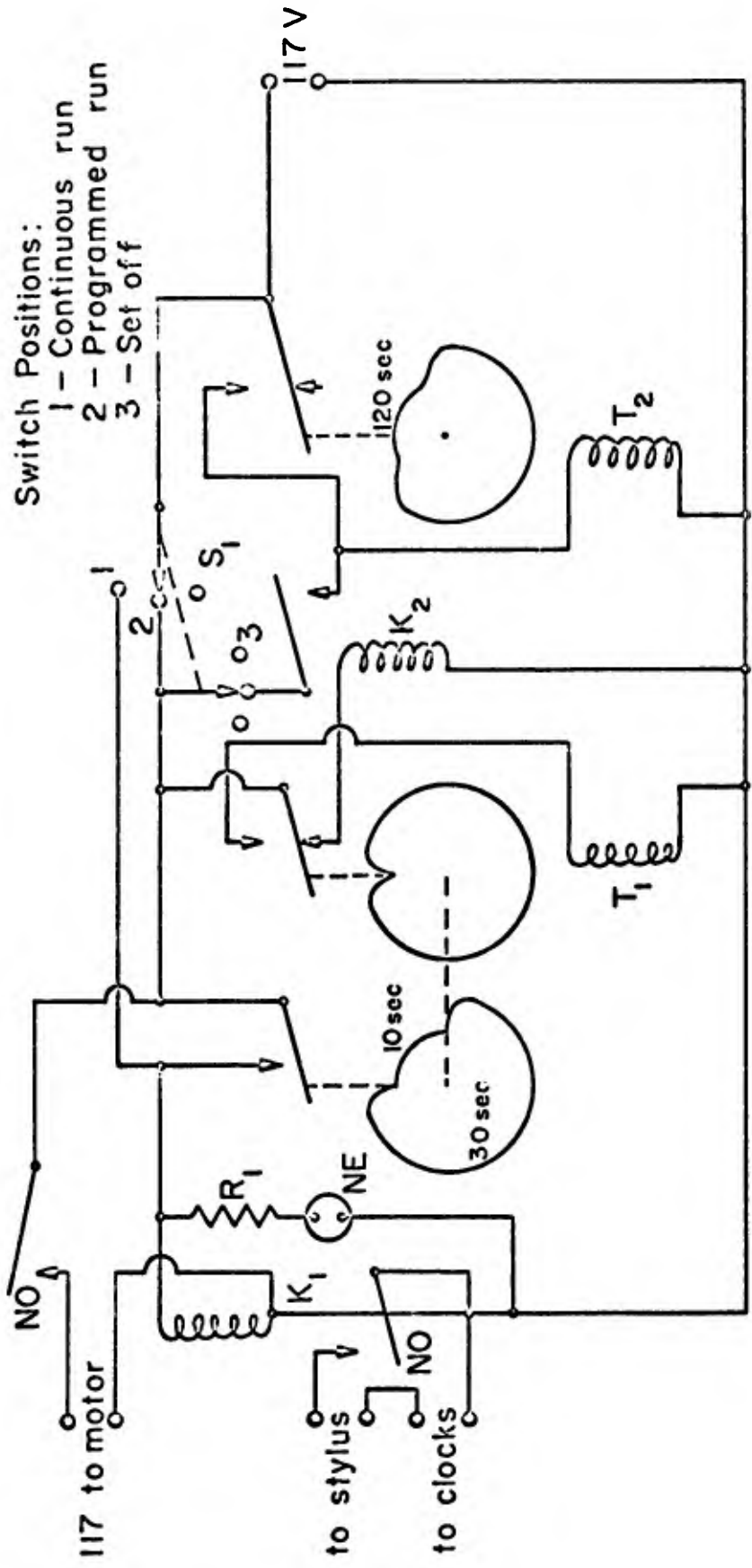
3 - On during timed interval

2 - Common to both

4,5 - 24V Input to initiate and hold
 relay during timed interval

6 - 24V - Power in

Figure 17. AUDIO TIMING UNIT COMPONENTS



Switch Positions:
 1 - Continuous run
 2 - Programmed run
 3 - Set off

Figure 18. PURSUIT ROTOR PROGRAMMER

- K₁ - 117V AC D.P.D.T. Relay
- K₂ - 117V AC S.P.S.T. Relay
- NE - NE 51
- R₁ - 50K
- S₁ - 2P 3Position
- T₁ - Timer - Industrial timer control no. MC4 - E12 GEAR
- T₂ - Timer - Industrial timer control no. CM4 - A 30 GEAR

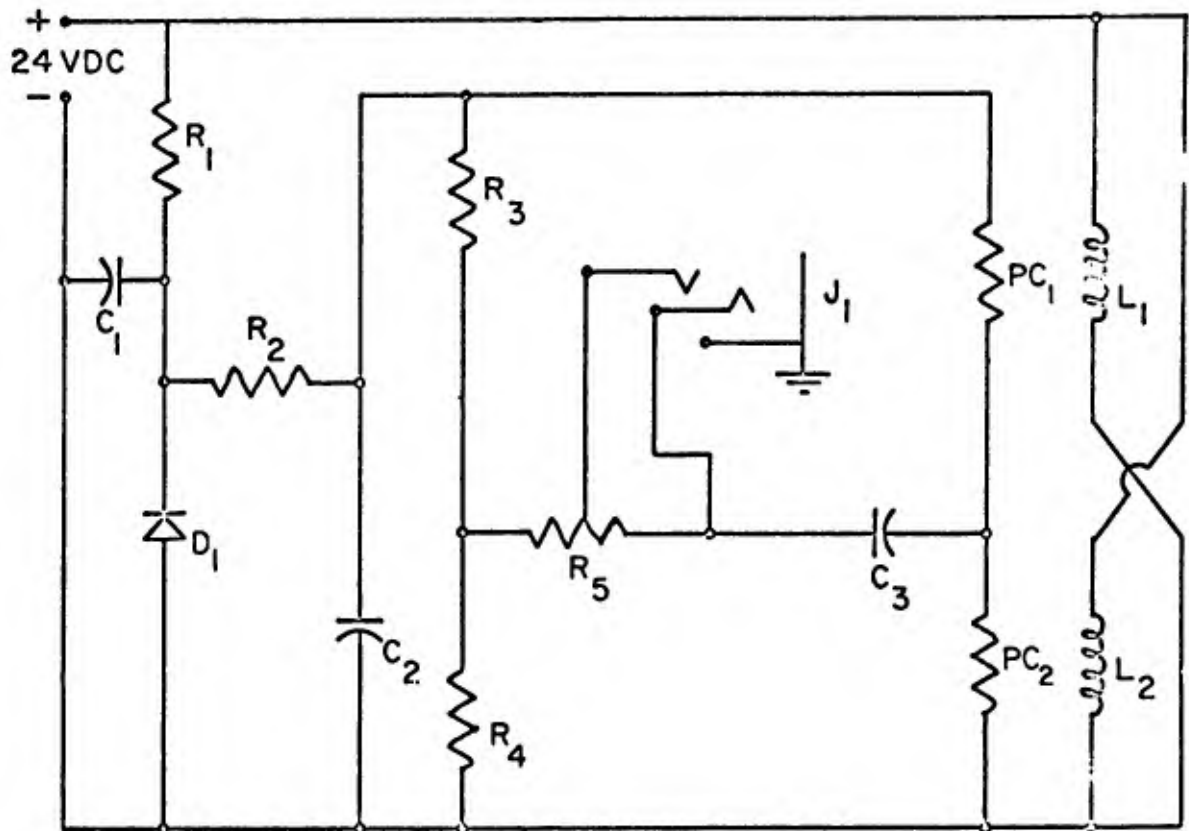


Figure 19. SHIVEROMETER

C_1, C_2 - 5 MFD 15V

C_3 - .05 MFD 600V

D_1 - ZENER DIODE 10V 1WATT

J_1 - OUTPUT JACK

L_1, L_2 - 24V LAMP NO. 313

R_1, R_2 - 2.2K 1W

R_3, R_4 - 1K 1W

R_5 - 1MEG. POT.

PC_1, PC_2 - PHOTO CELLS

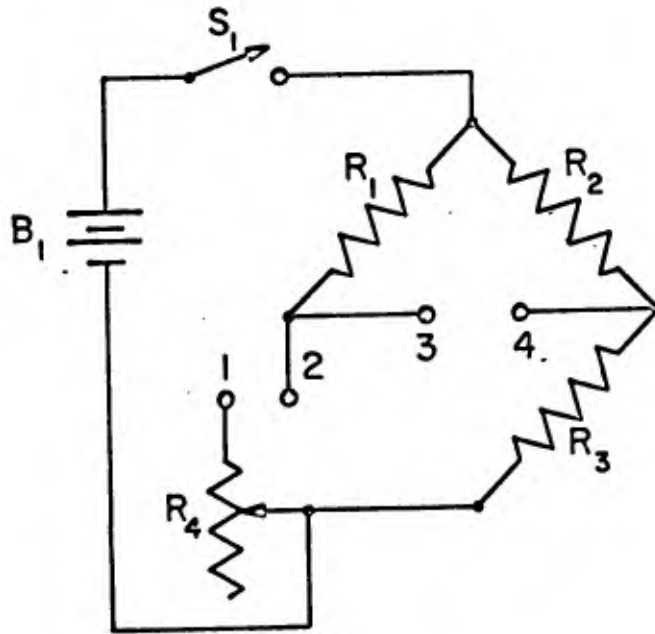


Figure 20. G. S. R. BRIDGE

B_1 - 2 - 1 1/2 V "D" CELLS

R_1, R_2, R_3 - 100K 1% RESISTORS 1/2W

R_4 - 10-TURN 100K POT. WITH TURNS COUNTING DIAL

S_1 - OFF-ON SWITCH S.P.S.T.

TERMINALS

NOS. 1 & 2 - TO ELECTRODES

NOS. 3 & 4 - OUTPUT TO GRAPHIC RECORDER

APPENDIX C

TABLE 34

DESIGN OF THE EXPERIMENT

TABLE 34

DESIGN OF THE EXPERIMENT: All Groups and Conditions

Subject Group	Hypnotic Susceptibility	Session*			
		Training	Room Temperature (Base Rate 1)	Stress 1 (Base Rate 2)	Stress 2
Control	High (T) N = 16	All Subjects: 1 hour Pursuit Rotor training.	All Subjects: A. Vigilance B. Pursuit Rotor	All Subjects: Same tasks as Room Temperature, but with: A. Cold and B. Shock	All Subjects: Same as Stress 1.
	Low (UT) N = 16				
Experimental	High (T) N = 16				No Training, time lapse of approximately 5-7 days.
	Low (UT) N = 16				
					3 Sessions, 2 hours each, over 5 days.

* Room temperature and stress first sessions were counterbalanced, so half the subjects in each subgroup got one first, half got the other first.

REFERENCES

1. Appley, M. H., & Trumbull, R. "On the concept of psychological stress." In Appley, M. H. & Trumbull, R. (Eds.), Psychological Stress: Issues in Research. N.Y.: Appleton, 1967.
2. Ax, A. F. Discussion of Lacey, J. I. "Somatic response patterning and stress." In Appley, M. H. & Trumbull, R. (Eds.), Psychological Stress: Issues in Research. N.Y.: Appleton, 1967.
3. Barber, T. X. "Toward a theory of pain: Relief of chronic pain by prefrontal leucotomy, opiates, placebos, and hypnosis." Psychological Bulletin, 1959, 56, 430-460.
4. Bettelheim, B. "Individual and mass behavior in extreme situations." Journal of Abnormal and Social Psychology, 1943, 38, 417-452.
5. Bettelheim, B. The Informed Heart - Autonomy in a Mass Age. N.Y.: Free Press, 1960.
6. Biderman, A. D. "Life and death in extreme captivity situations." In Appley, M. H. & Trumbull, R. (Eds.), Psychological Stress: Issues In Research. N.Y.: Appleton, 1967.
7. Brady, J. V. "Psychophysiology of emotional behavior. In Bachrach, A. J. (Ed.): Experimental Foundations of Clinical Psychology. N.Y.: Basic Books, Inc., 1962, 343-385.
8. Carpenter, A. A. "A comparison of the influence of handle load and of unfavorable atmospheric conditions on a tracking task." Quarterly Journal of Experimental Psychology, 1950, 2, 1-6.
9. Coleman, J. C. Abnormal Psychology and Modern Life. Third Edition. Chicago: Scott, Foresman, & Co., 1964.
10. Dykman, R. A., Ackerman, Peggy T., Galbrecht, C. R., & Reese, W. G. "Physiological reactivity to different stressors and methods of evaluation. Psychosomatic Medicine, 1963, 31, 37-59.
11. Erikson, M. H. "Special techniques of brief psychotherapy." Journal of Clinical and Experimental Hypnosis, 1954, 2, 109-129.
12. Esdaile, J. Mesmerism in India and its Practical Application in Surgery and Medicine. N.Y.: The Julian Press, Inc., 1957.
13. Evans, F. T., & Orne, M. T. "Motivation, performance, and hypnosis." Journal of Clinical and Experimental Hypnosis, 1965, 13, 103-116.

14. Helmendach, R. H., & Meehan, J. P. "Thermoregulatory responses of dogs after alteration of peripheral sensitivity." American Journal of Physiology, 1962, 203, 1237-1240.
15. Hilgard, E. R. "Individual differences in hypnotizability." In Gordon, J. E. (Ed.), Handbook of Clinical and Experimental Hypnosis. N.Y.: Macmillan, 1967.
16. Kissen, A. T., Reifler, C. B., & Thaler, V. H. "Modification of thermoregulatory responses to cold by hypnosis." Journal of Applied Physiology, 1954, 19, 1043-1060.
17. Korchin, S. J. "Some psychological determinants of stress behavior." In Grosser, G. H., Wechsler, H., & Greenblatt, M. (Eds.): The Threat of Impending Disaster: Contribution to the Psychology of Stress. Cambridge: MIT Press, 1964.
18. Lazarus, R. S. Psychological Stress and the Coping Process. N. Y.: McGraw-Hill, 1966.
19. London, P., & Fuhrer, M. "Hypnosis, motivation, and performance." Journal of Personality, 1961, 29, 321-333.
20. London, P., Conant, M., & Davison, G. "More hypnosis in the unhypnotizable: Effects of hypnosis and exhortation on rote learning." Journal of Personality, 1966, 34, 71-79.
21. London, P., Ogle, M. E., & Unikel, I. P. "The effects of hypnosis and motivation on resistance to heat stress." Journal of Abnormal Psychology, 1967, In Press.
22. Miller, W. R., Doupe, J., & Keller, W. K. "Vasomotor reactions in the hypnotic state." Journal of Neurology and Psychiatry, 1939, 2, 97-106.
23. Moss, A. A. Hypnodontics: Hypnosis in Dentistry. N.Y.: Dental Items of Interest Publishing Company, 1952.
24. Orne, M. T. Final Report of Work Carried Out Under Contract Nonr 3952 (00), Office of Naval Research, 1964.
25. Orne, M. T. "Psychological factors maximizing resistance to stress: With special reference to hypnosis." In Klausner, S. Z. (Ed.), The Quest for Self-control. N.Y.: Free Press, 1965.
26. Rosenhan, D., & London, P. "Hypnosis in the unhypnotizable: A study in rote learning." Journal of Experimental Psychology, 1963a, 65, 30-34.
27. Rosenhan, D., & London, P. "Hypnosis: Expectation, susceptibility, and performance." Journal of Abnormal and Social Psychology, 1963b, 66, 77-81.

28. Roff, G. E., & Korchin, S. J. "Adaptive stress behavior." In Appley, M. H. & Trumbull, R., (Eds.), Psychological Stress: Issues in Research. N.Y.: Appleton, 1967.
29. Sargent, F., II. "Tropical neurasthenia: giant or windmill?" In UNESCO, Environmental Physiology and Psychology in Arid Conditions. N.Y.: UNESCO Publications, Volume XXII, 1964.
30. Selye, H. The Stress of Life. N.Y.: McGraw-Hill, 1956.
31. Shor, R. E., & Orne, Emily C. Harvard Group Scale of Hypnotic Susceptibility, Form A: An adaptation for group administration with self report scoring of the Stanford hypnotic susceptibility scale, Form A. Palo Alto, California: Consulting Psychologists Press, 1963.
32. Shor, R. E. "On the physiological effects of painful stimulation during hypnotic analgesia: Basic issues for further research." In G. H. Estabrooks (Ed.): Hypnosis: Current Problems. N.Y.: Harper & Row, 1962.
33. Shultz, J. H. Das Autogenic Training. Stuttgart: G. T. Theme, 1932. As reported in: Orne, M. T. Psychological Factors Maximizing Resistance to Stress: With Special Reference to Hypnosis. N.Y.: Free Press, 1965.
34. Shultz, J. H., & Luthe, W. Autogenic Training. N.Y.: Grune and Stratton, 1959.
35. Slotnick, R., & London, P. "Influence of instructions on hypnotic and nonhypnotic performance." Journal of Abnormal Psychology, 1965, 70, 39-46.
36. UNESCO Environmental Physiology and Psychology in Arid Conditions: Proceedings of the Lucknow Symposium. Volume XXIV. N.Y.: UNESCO Publications, 1964.
37. Vitiles, H. S., & Smith, K. R. "An experimental investigation of the effects of change in atmospheric conditions and noise upon performance." Heating, Ventilation, Air Conditioning, 1946, 18, 107-112.
38. Weitzenhoffer, A. M., & Hilgard, E. R. Stanford Hypnotic Susceptibility Scale, Forms A and B. Palo Alto, California: Consulting Psychologists Press, 1959.
39. Weitzenhoffer, A. M., & Hilgard, E. R. Stanford Hypnotic Susceptibility Scale, Form C. Palo Alto, California: Consulting Psychologists Press, 1962.

40. West, L. J., Neill, K., & Hardy, J. D. "Effects of hypnotic suggestions on pain perception and galvanic skin response." Archives of Neurology and Psychiatry, 1952, 68, 549-560.
41. Weybrew, B. B. "Patterns of psychophysiological response to military stress." In Appley, M. H., & Trumbull, R. (Eds.), Psychological Stress: Issues in Research. N.Y.: Appleton, 1967.
42. Winklestein, L. B. "Routine hypnosis for obstetrical delivery: An evaluation of hypnosuggestion in 200 consecutive cases." American Journal of Obstetrics and Gynecology, 1958, 76, 152-160.

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13. ABSTRACT This project was undertaken to determine the usefulness of autohypnotic training for overcoming the debilitating effects of stress on performance and physiological processes. The experiment was performed on 64 male volunteers, one-half high in hypnotic susceptibility and one-half low. Each subject then went through three experimental sessions, one without stress and two with stress, in each of which he was given two performance tasks and monitored on eight physiological measures. Cold (35°C) and electric shock (15 second average interval) were used as the stressors. After the non-stress and first stress sessions, the subjects in the experimental group received 6 hours of autohypnotic training, oriented toward enabling them to function optimally under stress without excessive discomfort. Hypnotic susceptibility exercised a critical influence on most of the dependent measures. High and low hypnotic susceptibles are fundamentally different on a number of performance and physiological parameters, and susceptibility also frequently interacts with stress. Training was variably effective as a stress resistance technique; its efficacy was clear and pronounced on vigilance performance, independent of hypnotic susceptibility, but on rotary pursuit performance, training benefitted low-susceptibles significantly more than high ones. Training had comparably variable effects on physiological measures. Susceptibility often interacts significantly with training and itself produces some of the most powerful effects in the entire study, indicating clearly that future studies of hypnotic training should account for differences in subject susceptibility.			

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