THE EFFECT OF ISOPREL ON VISUAL RECOGNITION THRESHOLDS

Thesis for the Degree of Ph. D.
MICHIGAN STATE UNIVERSITY
William Francis Smith
1956

This is to certify that the

thesis entitled

The Effect of Isoprel on Visual Recognition Thresholds

presented by

William Francis Smith

has been accepted towards fulfillment of the requirements for

PH.D degree in Psychology

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Date Nov. 5, 1956

THE EFFECT OF ISOPREL ON VISUAL RECOGNITION THRESHOLDS

By

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A THESIS

Submitted to the School of Advanced Graduate Studies of Michigan State University of Agriculture and Applied Science in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

Department of Psychology

1956

ABSTRACT

The present investigation was designed to explore some physiological mechanism that may be involved during perceptual defense behavior and to lend support to the hypothesis that threshold alterations characteristic of the perceptual defense reaction are influenced by autonomic feedback loops. Since the present design could not demonstrate these directly, the interpretations are inferential ones.

Sixty-nine patients at Dearborn General Medical and Surgical Veterans Administration Hospital served as Ss. Only patients without records of previous or present neuropsychiatric disorders were used. Because a drug was employed, medical clearance was obtained for each of the patients prior to acceptance as a Subject. Ages of the Ss ranged from 20 to 45. Education of the members ranged from completion of the eighth grade through completion of seven years of college. All Ss had 20/20 or better vision.

Stimulus materials consisted of two practice lists of three five-letter words each, and two stimulus lists of twelve five-letter words each. The stimulus words were judged to be neutral in content for the V. A. population. All stimuli were typed in capitals on No. 3 gray graded art paper by means of an IBM electric typewriter, Executive Continental Model.

A Gerbrands mirror type tachistoscope and Gerbrands timer were employed to present the stimuli. The pre-exposure field was of the same material as the stimulus background. The size of the pre-exposure and exposure fields were 7 x 71/2 inches, with a rectangle of 1 x 31/2 inches, centered in the pre-exposure field. Since preliminary work indicated that the latencies for the stimuli were too rapid, six layers of clear acetate paper were placed over the aperture in front of the stimulus words. The resulting intensity of illumination at the aperture for the exposure field was 9 foot candles. The intensity of illumination of the pre-exposure field at the point of fixation was 16 foot candles.

Experiment I:

Twenty-one pairs of Ss matched on the basis of performance on List I were utilized in this study. Each S was run on two consecutive days. On the second day, each member of a pair received a coded package containing 10 mgm of Isoprel Hydrochloride or a placebo and List II. The manner of assignment of drug approximated the double blind procedure. Ss were not aware of the nature of the medicine, nor was E aware of which medicine was received by any one S. E, however, was aware that Ss were receiving a drug or a placebo.

The method of limits used in an ascending series of durations was employed to determine the thresholds for each word. Initial exposure was set at .01 seconds and increased in .01 second steps until the words were correctly identified on two successive exposures.

Experiment II:

A second experiment was designed to insure representativeness of sampling and to reduce the possibility of extraneous variables that may have operated in the matching procedure.

Twenty Ss were randomly assigned to the experimental conditions regardless of their performance on List I. The procedure was in all other respects identical to that of Experiment I.

The hypothesis tested was stated as follows: If sympathetic activity is provoked by a sympathomimetic drug, normal Ss will manifest significant alterations in recognition thresholds for neutrally affective (non-threat provoking) verbal stimuli.

Statistical analyses of the results of Experiment I and II were significant at the .05 and .03 levels respectively. A second finding was that of no significant psychological effect produced by taking a placebo under the guise of medicine. Nor could the obtained results be attributed to practice effects alone. The changes that did occur were in the direction of lowered thresholds.

These data are interpreted as supporting the hypothesis of this investigation and were seen consistent with the view that alterations characteristic of perceptual defense reactions are produced by feedback loops.

Approved November 12, 1956
by Alfred G. Dietze

ACKNOWLEDGMENTS

The author would like to express his appreciation to all who have contributed to this investigation.

My foremost intellectual and personal obligation is to Dr. Alfred G. Dietze, Chairman. I am indebted to him not only for his generous gift of time and wise counsel, but as well for conveying by action and deed the meaning and need for honesty and objectivity in human relationships and their value in scientific endeavor.

I should also like to thank Drs. M. Ray Denny, Carl Frost and Eugene Jacobson for their cogent, timely criticism and expressions of interest. Dr. Charles Hanley also contributed immeasurably to this investigation.

For their assistance, but more important for providing an atmosphere in which this research could be conceived and implemented, I am most grateful to Drs. John Brownfain, Herbert Malos, Helen Wardsworth, William Alexander, Mrs. Maime Gernay, and particularly Dr. Bernard Chodorkoff, members of the psychological staff at Dearborn Veterans Administration Hospital.

Among the medical staff I am most indebted to Dr. Milton C. Weed, Chief Medical Officer, who served as medical consultant; read and critically evaluated portions of this manuscript. Special thanks

also go to Drs. Nedwicki, Chornikoff and the many other physicians that were helpful.

I can but inadequately express my appreciation to Dr. William K. Knapp, Chief, Psychology Training Unit, who was instrumental in making the study possible, donated the services of his secretary, Miss Rosemary Szilagy, and offered encouragement at times of need.

I would also like to express my appreciation to the Lansing Bureau, International Business Machine Corporation, for their cooperation.

Finally, deep appreciation is also due to my constant motivators, my wife Barbara, and two sons, Bill and Keith.

This thesis I should like to dedicate to all of those above and the many unmentioned who were helpful and interested.

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INTRODUCTION

Within the past decade psychologists have shown considerable interest in perceptual defense. Such interest is shown in the increasing number of clinical and experimental studies dealing with perceptual phenomena, particularly perceptual recognition and identification of stimuli, and in controversies concerning methodological details, theoretical significance and interpretation. That this phenomenon, regardless of varying approaches and interpretations, merits careful consideration as part of our general body of psychological knowledge is demonstrated by the attention devoted to it in Floyd Allport's monumental work, Theories of Perception and the Concept of Structure (1).

The concept of perceptual defense was developed to explain the finding that negatively valued verbal stimuli, e.g. taboo words, elicit elevated recognition thresholds in comparison with neutral verbal stimuli. The threatening, i.e. negatively valued stimuli in these investigations were thought to have been previously associated with anxiety-producing conditions which accounts for the resulting elevated thresholds. In accordance with this view are the experiments of McGuinnies (33, 34), Lazarus and McCleary (27), and the earlier explanations of Bruner and Postman (6). Subsequent investigators have invoked other explanations to similar findings: Frequency of occurrance

and usage of verbal stimuli (22), adequacy of personal adjustment of Ss (3, 10), and response suppression, i.e. reluctance to mention taboo words in the presence of E (23). In some of these studies the possibility that some physiological mechanism may be operating along with perceptual defense has been implied (7. 11, 27, 28).

In an earlier discussion of their views Bruner and Postman see the organism as having numerous response tendencies to presented stimuli. Veridical reporting was seen as one such response possibility together with other responses thought to be "largely affective in nature". In perceptual defense phenomena affective avoidance was seen as having a lower threshold than the veridical reporting response, thus accounting for differential recognition thresholds to threatening and non-threatening stimuli.

The finding of elevated PGR to threatening stimuli has been interpreted as evidence that subjects can discriminate stimuli before fully recognizing them. PGR has been recognized as an indication both of threat or anxiety on the one hand, and of sympathetic nervous system activity on the other. Threat and anxiety have been considered important in perceptual defense, and both of these have been traditionally conceptualized as end product changes of autonomic nervous system activity. Such implied physiological underlying reactions appear in the research of McGuinnies (32), Lazarus and McCleary (28), earlier views of Postman and Bruner (7), and more recently in assertions by Chodorkoff and Chodorkoff (11) in their attempt to integrate various research find-

ings.

Inasmuch as these studies and theoretical formulations suggest the possibility that physiological events are related to the perceptual defense reaction, the present study attempts to explore certain physiological mechanisms that may be involved in perceptual defense behavior.

Experimental and Theoretical Background

No attempt will be made here to give a complete coverage to studies attempting to demonstrate perceptual defense. Since comprehensive summaries may be found in the literature (1, 6) only relevant psychological and physiological studies and their results will be reported here.

Inasmuch as the McGuinnies, McCleary and Lazarus studies are most pertinent to the development of the present problem, they will be reported in some detail. In essence these studies tested the hypothesis that "Verbal stimuli that are emotionally disturbing or threatening to the individual tend to require longer recognition times than neutral words and/or tend to be so misperceived as to radically alter their form or meaning and tend to arouse their characteristic emotional responses even before they are recognized (1)".

McGuinnies (32) tested this notion by presenting a series of 18 words, comprising eleven neutral and seven taboo items, tachistoscopically to sixteen Ss. Using recognition thresholds as the dependent variable and Galvanic Skin response recordings as a measure of phys-

iological activity, McGuinnies found that thresholds for the taboo words were significantly greater than for neutral words and that PGR's for taboo words as compared with neutral words were heightened. Comparison of PGR's for pre-recognition thresholds of taboo and neutral words also revealed elevations for the former. Subsequent analysis further indicated that the neutral word guesses were structurally more similar than guesses for so-called critical stimuli. McGuinnies concluded that his findings demonstrate the existence of motivational factors operating in perception.

Howes and Solomon (23) later questioned the findings of McGuinnies. After demonstrating that an inverse relationship exists between familiarity with a stimulus word as measured by frequency of occurrence in samples of the English language, they asserted that such familiarity might be an important factor in explaining the threshold differences.

In a subsequent study McCleary and Lazarus (28) attempted to control for familiarity and other factors which others suggested might be operating in the McGuinnies study. In order to control for familiarity these authors used ten five-letter nonsense syllables instead of meaningful taboo and neutral words. In addition, to circumvent differences in threat-value to different Ss, five of the words were associated with electric shock to establish conditioned PGR's. Following the conditioning period each nonsense syllable was presented tachistoscopically. Galvanic Skin response measures were obtained subsequent to each presentation of a syllable and prior to the next presentation of a

syllable. The results of this procedure revealed that the syllables that had been previously associated with shock, although incorrectly perceived at sub-threshold levels, resulted in autonomic responses, i.e. PGR's, of greater magnitude than non-shock syllables. These authors concluded that "at tachistoscopic exposure speeds too rapid for correct recognition Ss were able to give discriminatory responses as measured by PGR's." The process by which some kind of discrimination is made when the S is unable to make a correct conscious discrimination was labeled subception.

In another attempt to attack the problem of McCleary and Lazarus, Bricker and Chapanis (4) used "guessed" responses to tachistoscopically presented nonsense words, but without shock-reinforcement. These workers found that, after the first wrong guesses, fewer trials were needed to perceive the stimulus correctly than would be expected by chance. Bricker and Chapanis interpreted these results to signify that "incorrectly perceived tachistoscopic stimuli convey some information." In turn, they rejected the subception-unconscious determination of behavior implied by McCleary and Lazarus in favor of the more parsimonious view that information conveyed prior to recognition comes from partial cues within the word. Although the findings of Bricker and Chapanis have been duplicated by Murdock (35), since no measure of conditioned PGR's were obtained they do not substantiate the case against "the subception hypothesis" and related autonomic involvement.

Although the above studies have been severely criticized by a number of workers, including the most recent article by Erickson (16), they nevertheless suggest the possibility that autonomic activity may be operating along with the perceptual mechanisms. The increased PGR's indicate specifically a functioning of the sympathetic segment. Thus far, however, there have been no attempts directly to invoke sympathetic nervous system activity to determine its effect on visual recognition thresholds. If sympathetic provocation could be shown to bring about alterations in visual thresholds, we would be in a better position to understand the relationships between the autonomic nervous system and perceptual thresholds.

Summary of Relevant Physiological Studies

Numerous studies (9,17,20,22,49) have appeared attempting to demonstrate relationships between physiological activity, overt behavior, and personality. For the most part these studies have received their impetus from rapid pharmacological advances. Summaries of this literature may be found in the various Annual Reviews (43,48), and more recently in Kempe's unpublished doctoral dissertation on Personality and Stress (24). The physiological studies selected for consideration here will be those that demonstrate autonomic nervous system changes in relation to psychological and perceptual functions.

Most pertinent to the present discussion is the Calloway and Thompson (8) endeavor to relate personality and physiological stress reactions. These authors studied the effect of endogenous sympathetic

activity on the perception of size and distance. Using both a cold-pressor procedure and amyl nitrate inhalations as methods of inducing sympathetic activity, these investigators found that if adequate cues for distance were established and sympathetic activity provoked a decrease in apparent size of a distant subject was obtained. To explain their results Calloway and Thompson made use of a negative feedback hypothesis. The negative feedback hypothesis as it applies here can be stated as follows: Most biological systems have a feedback, and this may be negative in sign; that is, if a receiving system drives an output system some of that output is fed back into the receiving line in such a way that the threshold of the receiving system will be raised (1, 8).

Calloway and Thompson consider such a governing device to be part of the organisms homeostatic mechanism. Thus, a hypothesized negative feedback loop from the autonomic system should result in a decrease in exteroceptive input. In essence this is what is demonstrated in the Calloway and Thompson study. This would suggest that when threat is present the feedback system can act to prevent panic by reducing the magnitude of the perceived threat, i.e. sympathetic activity is provoked and the deviation in size constancy is interpreted as due to decreased exteroceptive input or a narrowing of awareness.

Calloway and Thompson argue that support for a negative feedback hypothesis resulting in decreased exteroceptive input, i.e. narrowing of awareness and reactivity, is found in the work of Lindeman and Finesinger (30), Krakov (25), and others.

Lindeman and Finesinger observed patients after adrenalin and mecholyn, a parasympathetic stimulant, were administered. They found that adrenalin was followed by a decrease in speech output, an increased preoccupation with self, and a general decrease in exteroceptive activity particularly in Ss for whom adrenalin produced an anxiety attack. In contrast, mecholyn provoked increased speech and environmental interest. Funkenstein (20), working with schizophrenics, also found similar results from mecholyn. Krakov (25) found that the administration of adrenalin and anodal stimulation produced increased sensitivity to blue-green light, while the administration of pilocarpine, a parasympathetic stimulant, and cathodal stimulation produced increased orange-red sensitivity.

In many respects the interpretation of a negative feedback loop and the resulting decreased awareness of reactivity to threatening stimuli seems to correspond to the primary emphasis which perceptual defense research has placed on the avoidance reaction to threatening stimuli. Other studies, however, have suggested a positive feedback loop (14, 17, 47) between autonomic discharge and perception. These findings have been abandoned by Calloway and Thompson. However, it may be premature to do so since the finding of positive feedback loops would seem to parallel those perceptual studies in which sensitization appears (10, 26, 41, 42), sensitization and positive feedback both implying increased awareness and reactivity to threatening stimuli.

These results and considerations can be viewed together, enabling

us to arrive at an understanding of possible mechanisms that may operate in perceptual defense behavior. Here we essentially follow the theoretical formulations of Chodorkoff and Chodorkoff (11).

Threatening stimuli may be discriminated by the individual before he fully recognizes them because the affective reaction of fear or anxiety and its physiology precede recognition. Alterations in recognition thresholds are thus affected as a consequence of the affective reaction and are mediated by feedback loops. Such a feedback loop would then operate between autonomic discharge and perception to either raise or lower recognition thresholds so that there will be decreased or increased awareness of threatening stimuli and corresponding change in reaction to such stimuli.

The developmental basis for this can be understood within the psychoanalytic framework. Here it is assumed that preconscious perception is an early stage of the perceptual process ontogenetically speaking, and that with growth and maturation this early stage of perception, originally operating under the pleasure principle, may become inhibited in the sense that it is relegated to the control of the ego process and reality demands. Thus, in the course of ego development and its characteristic modes of adaptation, the ego develops a more selective function and becomes capable of delaying or suppressing percepts.

Prior to maturation the organism responds more readily in terms of autonomic reactions than in terms of the higher nervous system effects. This would mean that threatening stimuli would lead to rela-

tively diffuse, gross, and overwhelming kinds of responses.

In the course of development, then, we would expect that these autonomic reactions are gradually incorporated into the services of the higher centers so that what is threatening at first no longer produces overwhelming responses later. Feedback between autonomic nervous and the various exteroceptive systems is a probable mechanism by which the autonomic nervous system remains in the service of the higher centers, which in turn maintain the organism's integrity. The result of such feedback is threshold alteration of the exteroceptive system. Whether the alteration in threshold is in terms of an increase or decrease in thresholds probably depends upon the stimulus situation, the nature of the stimuli, learning experiences, and constitutional factors.

Statement of the Problem

The purpose of this study is to lend support to the hypothesis that the threshold alterations characteristic of the perceptual defense reaction are influenced by autonomic feedback loops. That is, we assume that an affective reaction yielding a lower threshold precedes recognition and an ensuing feedback alters visual recognition thresholds. Since this cannot be demonstrated directly at this time, our experimental results will lead to inferential interpretations.

This study will take its starting point just prior to where feedback presumably occurs, i.e. sympathetic provocation. Ss under the

influence of sympathetic nervous system provocation will be subjected to visual recognition threshold procedures using neutral stimuli. If thresholds are different when we compare results obtained under sympathetic provocation with results obtained under neutral conditions, we shall infer that these threshold alterations are produced by feedback loops. Such findings of threshold alterations would parallel perceptual defense findings, a result that would be consistent with the hypothesis that the perceptual reaction is based on such mechanisms as have been discussed.

The hypothesis to be tested may be stated specifically as follows:

If sympathetic nervous system activity is provoked by the administration of a sympathomimetic drug, normal Ss will manifest a significant alteration in recognition thresholds for affectively neutral (non-threat provoking) verbal stimuli. The sympathomimetic drug to be investigated is Isoprel.

METHOD

Subjects

Sixty-nine patients at Dearborn General Medical and Surgical Veterans Hospital served as subjects in the two phases of this investigation. Forty-nine served in Experiment I and twenty in Experiment II. Their ages ranged from twenty to forty-five. Education of the various members ranged from completion of the eighth grade through completion of seven years of college. Mean estimated intelligence, based on Wechsler Adult Intelligence, Vocabulary Scale, was 107. Only patients without records of previous or present neuropsychiatric disorders were used. Medical clearance was obtained for each patient prior to acceptance as a subject in this investigation. All subjects had 20/20 or better vision. Patients wearing glasses had vision corrected to 20/20. A summary of the characteristics of the subjects may be found in Table A.

Stimulus Materials and Apparatus

Stimulus materials for this investigation consisted of two practice lists of three five-letter words each, and two stimulus lists consisting of twelve five-letter words each. All words were neutral in content as determined by judgments of experts. The lists were constructed in the following manner: One hundred five-letter words

selected from the Thorndike-Lorge Word Count List (44) were presented to four judges[1] with instructions to select words that in their judgment would be neutral for a Veterans Administration population. Thirty words judged to be neutral were randomly assigned to two lists. Three words were designated as practice words for List I, and three were designated as practice words for List II.

Apparatus

A Gerbrands Mirror-Type Tachistoscope and Gerbrands Timer were used to present the stimuli. All stimuli were typed in capitals on No. 3 gray graded art paper by means of an IBM electric typewriter, Executive Continental Model. The timer was calibrated in one-hundredths of a second and allowed for variation from one-hundredth of a second to one second.

The pre-exposure background was of the same material as the material on which the stimuli appeared. The size of the pre-exposure field was 7 x 71/2 in. with the fixation point, a cross of 1/2 in. x 1/2 in., within a rectangle of 1 in. x 31/2 in. centered in the pre-exposure field. The intensity of illumination of the pre-exposure field at the fixation point was 16 ft. candles.

The size of the exposure field was 71/2 in. x 71/2 in., with the stimulus words exposed through an aperture 1 in. x 31/2 in. Prelimi-

[1] Judges were advanced clinical trainees and staff members. All judges had been at the installation for more than ten months.

nary experimentation seemed to indicate that the unobstructed presentation of the stimuli resulted in too easy recognition with insufficient spread of latencies. In order to make the task more difficult six layers of clear acetate paper were placed over the aperture in front of the stimulus words, thus reducing clarity. The resulting intensity of illumination of the exposure field measured at the aperture was 9.7 ft. candles. The distance of the exposure aperture from S's eye was approximately 23 inches. All illumination intensity measures were made with a Photovolt-Corporation Light Meter 200m.

The Medicine-Independent Variable

Ten milligram tablets of Isoprel Hydrochloride served as a sympathetic provocator. Control group subjects received a sugar coated placebo tablet. Placebo and drug were taken sublingually. Both "medicines" were in sealed coded packages. The method of administration of the medicine in this study was similar to but no identical with a double blind procedure. Subjects were not aware of the nature of the medicine nor was E aware of which medicine was obtained by any one S. E did know that Ss were receiving either a drug or a placebo.

The drug Isoprel Hydrochloride was selected under medical advice. Isoprel is a close congener of epinephrine and is classified among those sympathomimetic amines having adrenergic releasing properties (38). Chemically Isoprel or Isopropylaternol Hydrochloride is

$C_{11}H_{17}NO_3HCL$. Its most prominent actions are on the cardial vascular system and on the smooth muscles of the bronchial tree. Very small dosages cause an increase in heart rate, stroke volume and work per beat. The combined effects of the cardiac and peripheral actions in man result in a marked increase in cardiac output, variable effects on systolic pressure and a fall of diastolic pressure. The powerful bronchiodilator properties make it useful in the treatment of asthmatics. Over dosages may lead to headache, nauseau, nervousness, tremor, dizziness, weakness, sweating and vomiting (21, 36). The drug is administered sublingually, the time elapsing before such administration producing some effect on the body 30 to 60 seconds or sooner. Its duration of action is dependent upon the condition of the patient and may vary from 1 up to 4 hours, that is an asthmatic may have relief of his symptoms with one tablet up to four hours. The effect on a normal person may wear off in an hour or so. Ten milligrams, like any potent drug, is sufficient to produce effects on normal people (39). Because no literature was available on the effect of this drug on the eye mechanism a preliminary investigation was carried out.[2] With an N of 5 no consistent differences were found under drug and non drug conditions on pupillary changes, accomodation or visual acuity (Table B).

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[2] The measurements were made by the Staff Ophthalmologist at Dearborn Veterans Administration Hospital.

Experiment I

Experimental Design:

Twenty-one pairs of subjects matched on the basis of performance on List I were utilized in this investigation. Seven subjects who had no matches were eliminated. Each subject was tested on two consecutive days. On the second day, each member of a pair received either a drug or a placebo, and then was tested on List II. Mean ages, years of education, and estimated intelligence for the subjects, according to their experimental treatment, are summarized in Table A.

The general experimental situation is depicted in Figure 1. The experiment was conducted in a room equipped with dark shades. The shades were drawn and the room was illuminated by two 100 watt overhead bulbs. Figure 2 illustrates the placement of the lighting relative to the subject and the apparatus.

Session I:

At the beginning of the first session, all subjects were tested for visual acuity using the Snellen Eye Chart. Following this, each subject was seated in front of the tachistoscope and given the following instructions:

> I am going to show you some words at varying rates of speed with this instrument.[3] Your task is to tell me what you see each time they are shown. You may not be able to see them clearly at first, but I would like you to report what you see

[3] Subjects referred to the tachistoscope as... the eye blinker or peep box.

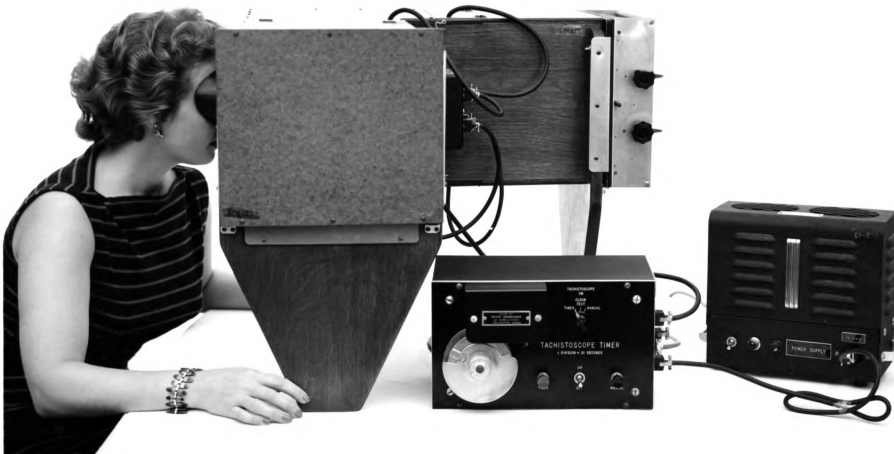
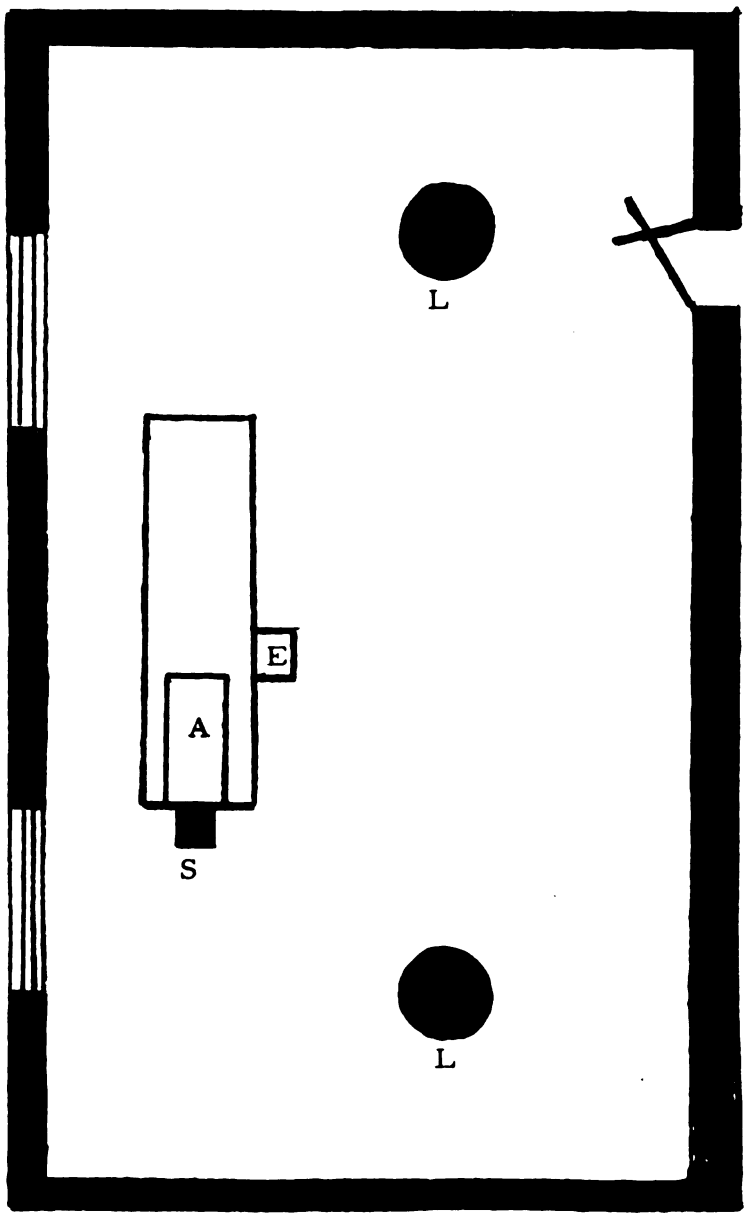

TACHISTOSCOPE TIMER
POWER SUPPLY

Photo by
Medical Illustration Dept.
Dearborn Veteran's Hospital

PLACEMENT OF LIGHTING RELATIVE TO
SUBJECT AND APPARATUS



S - Subject
A - Apparatus
E - Experimenter
L - Overhead Lighting

each time they are shown. You may guess if you like. Are there any questions?

Next, each subject received practice List I to familiarize him with the visual recognition procedure. After the practice list was administered, each subject was tested with the twelve stimulus words of List I.

The method of limits, used in an ascending series of duration was employed to determine the thresholds for each word. The initial exposure was set at .01 seconds and increased in .01 second steps until the word had been correctly identified on two successive exposures. Threshold values for each word were recorded, and mean threshold values on the twelve words were used to obtain the matched pairs for the experimental session.

Session II:

At the beginning of the second session, each member of a pair received a coded package containing either 10 mgm of Isoprel or a placebo, along with the following instructions:

> This time we would like to see what effect this medicine will have on the various procedures we have here... The medicine is one that is commonly used in the hospital, and is not harmful. You do not swallow it, you merely place it under your tongue... As you know, we have checked with your doctor and he has consented to its use. We hope that this procedure will give us some information about each of you, and that it will be of some value in understanding future patients as they enter the hospital...
>
> Now let us turn to the task... As you remember in yesterday's session, I am going to show you some words at varying rates of speed with this instrument. Your task is to tell me what you see each time they are shown. You may not be able to

> see them clearly at first, but I would like you to tell me what you see each time they are shown... You may guess if you like... Are there any questions?

Relatively few subjects asked questions about the nature of the medicine. Those who did were told that the experimenter did not know. There were no refusals.

Approximately 30 seconds after sublingual administration of drug or placebo, each subject received the three practice words for List II. Immediately following the practice words, List II was administered.

As in Session I, the method of limits used in an ascending series was employed to determine the thresholds for each word. The initial exposure was set at .01 seconds and increased in .01 second steps until the word had been correctly identified on two successive exposures. Recognition thresholds and pre-recognition hypotheses were recorded.

In order to insure representativeness of sampling and to reduce possibility of extraneous variables that may have operated in a matching procedure a second experiment was run.

Experiment II

Twenty subjects randomly assigned to either drug or placebo in the experimental condition, regardless of their performance on List I were used in the second study. As in Experiment I, all subjects were run on two consecutive days. Mean ages, years of education, and estimated intelligence for the subjects are summarized in Table A.

The general experimental situation and procedure was essentially the same as in Experiment I. As already noted, the subjects in this experiment received drug or placebo regardless of their performance on List I*. Drug and placebos had been previously randomly placed in packages by a colleague and coded. Code numbers were recorded by E.

*Ten Ss received placebo and ten Ss received isoprel and List II.

RESULTS

Experiment I:

Mean recognition thresholds for the two stimulus lists for matched subjects served as the basic data in this investigation. Table I summarizes the mean recognition thresholds for List I and List II for each subject according to the experimental conditions. Since the subjects were not exact matches, difference scores for each member of a pair were calculated. Mean recognition threshold values on List I and List II were used to calculate the difference scores. Table 2 summarizes the difference scores for each member of a pair according to his designation in the experimental condition.

To obtain matched pairs and therefore matched groups, subjects were paired on the basis of their performance on List I. A statistical test (45) of the assumption of matched groups was then carried out by means of a t ratio. The resulting t ratio of .03 for 40 degrees of freedom was found not significant. The two groups may, therefore, be considered as randomly selected from a single population.

A t test was also computed between the mean recognition threshold values of the placebo group on List I and List II. This was done to test the possibility that the mere receiving of something in the guise of medicine may have produced changes. The resulting t ratio of .36 for 20 degrees of freedom was not significant. The mere taking of a substance into the mouth may, therefore, be considered as having no significant effect on thresholds.

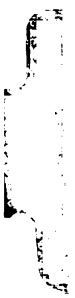


TABLE 1.

MEAN RECOGNITION THRESHOLDS OF 21 SUBJECTS BEFORE AND AFTER ADMINISTRATION OF ISOPREL AS COMPARED WITH CORRESPONDING VALUES OF 21 COMPARISON SUBJECTS RECEIVING PLACEBOS

Experimental		Control	
List I	List II	List I	List II
No Drug	Isoprel	No Drug	Placebo
14.58	10.66	14.58	14.33
19.17	23.83	19.92	14.83
7.58	6.75	7.75	9.08
10.08	6.75	10.83	10.08
8.25	6.42	8.17	8.00
8.91	8.00	8.92	7.83
13.08	11.08	13.33	13.08
13.58	14.92	13.50	16.75
13.58	22.25	13.75	20.25
6.75	5.17	7.08	8.67
10.75	10.83	11.42	15.58
36.42	8.75	36.42	31.83
6.33	5.33	6.66	6.75
9.67	6.08	9.92	9.83
23.83	21.08	24.41	24.92
15.50	11.00	15.25	12.08
5.25	5.33	5.42	5.67
17.08	12.16	17.02	14.00
10.67	8.08	10.83	8.25
6.50	8.17	6.00	6.33
11.91	6.58	11.50	9.91
269.39	219.22	272.68	268.05

TABLE 2.

DIFFERENCE SCORES FOR EACH SUBJECT ACCORDING TO THE EXPERIMENTAL CONDITIONS IN EXPERIMENT I

Experimental Group (Isoprel)	Control Group (Placebo)
3.92	.25
4.66	5.09
6.75	1.33
3.33	.75
1.83	.17
.91	1.09
2.00	.25
1.34	3.25
8.67	6.50
1.50	1.59
.08	4.16
27.67	4.59
1.00	.09
3.59	.09
2.75	.51
4.50	3.17
.08	.25
4.92	3.02
2.59	2.58
1.67	.33
5.33	1.59
80.25	40.65

A t test for matched pairs utilizing the calculated difference scores was used to test the major hypothesis of this investigation. The resultant t ratio of 2.11 for 20 degrees of freedom was found significant at beyond the .05 level of confidence. Thus, the null hypothesis of no effect may confidently be rejected.

Experiment II:

Mean threshold values for the subjects on List I, the initial measure, and for List II under the experimental conditions are summarized in Table 3. The results were subjected to an analysis of covariance (13).

An analysis of variance was first computed between the mean recognition threshold values for the two experimental groups on List I. The resultant F of .00052 (Table 4) for 1 and 18 degrees of freedom was not significant.

TABLE 4.

ANALYSIS OF VARIANCE OF MEAN THRESHOLD VALUES FOR THE DRUG AND PLACEBO GROUP ON LIST I

Source of Variation	Sum of Squares	df	Mean Squares	F
Between groups	.01	1	.01	.00052
Within groups	348.33	18	19.35	
Total	348.34	19		

A second analysis of variance was computed between the two experimental groups for List II. The resultant F of .05 (Table 5) was not significant.

TABLE 3.

SUMMARY OF MEAN THRESHOLD VALUES FOR THE SUBJECTS ACCORDING TO THEIR EXPERIMENTAL DESIGNATION ON LIS T I AND LIST II IN EXPERIMENT II

Experimental Group		Control Group	
No Drug	Isoprel	No Drug	Placebo
List I	List II	List I	List II
17.67	14.00	8.92	7.17
12.75	10.42	10.33	9.50
11.33	7.67	10.58	8.25
11.67	11.58	16.08	15.50
13.75	13.42	25.17	22.25
12.25	9.42	9.08	9.08
9.25	6.17	6.67	6.42
8.42	5.83	9.00	10.42
9.08	8.42	15.92	16.42
16.08	14.00	10.67	9.17
122.25	100.93	122.42	114.18

TABLE 5.

ANALYSIS OF VARIANCE OF MEAN THRESHOLD VALUES ON LIST II FOR THE DRUG AND PLACEBO GROUPS

Source of Variation	Sum of Squares	df	Mean Squares	F
Between groups	8.78	1	8.78	.05
Within groups	313.91	18	17.44	
Total	322.69	19		

A summary of the analysis of the total sum of cross products may be found in Table 6.

TABLE 6.

SUM OF SQUARES AND CROSS PRODUCTS FOR THE TWO GROUPS OF SUBJECTS ON LIST I AND FOR LIST II UNDER THE EXPERIMENTAL CONDITIONS

Source of Variation	df	Sum List I	Sum (List I) (List II)	Sum List II
Between groups	1	.01	.11	8.78
Within groups	18	348.33	315.22	313.91
Total	19	348.34	315.33	322.69

From the data of Table 6 the total sums of squares of estimate (37.24) and the sums of squares of errors of estimate within groups (28.64) were computed and used to obtain the adjusted sum of squares between groups (8.60).

A summary of the analysis of covariance may be found in Table 7.

TABLE 7.

ANALYSIS OF COVARIANCE OF MEAN THRESHOLD VALUES FOR THE PLACEBO AND DRUG GROUPS

Source of Variation	Sums of Squares of Errors of Estimate	df	Mean Square	F
Total	37.24	18		
Within groups	28.64	17	1.68	
Adjusted means	8.60	1	8.60	5.12

The obtained F value of 5.12 for 1 and 17 degrees of freedom was found to be significant at beyond the .03 level of confidence.

The correlation within and between groups were found to be .95 and .13 respectively.

In summary, an analysis of variance was computed between the performance of the drug and placebo subjects on List I. The variation between the two groups was found not significant. Thus, it would appear that differences between the mean threshold values may be accounted for on the basis of chance variations and that the groups are random samples from a common population.

The results of an analysis of variance between the same two groups for List II under the experimental condition also was not significant. Accordingly, the hypothesis that the groups are random samples from a common population must be considered tenable.

The results of the analysis of covariance procedure yielded an F value of 5.12 for 1 and 17 degrees of freedom. This value has a

probability of less than .03, and is significant. Accordingly it would appear that the differences in the means of the two experimental groups with List II cannot be accounted for by differences in mean level of initial ability as measured by List I since the means of the groups on List II have been adjusted by the analysis to a common mean initial level of performance on List I.

The correlation within groups of .95 indicates that there is a decided tendency for Ss who were high in initial performance on List I also to be high when tested under the experimental conditions. The between group correlation of .13, on the other hand, would indicate that there is no decided tendency for groups with higher initial means on List I to have a higher mean under the experimental condition with List II.

The results of the analysis of covariance procedure yielded a level of significance such that the null hypothesis of no effect could be rejected.

Inspection of the data revealed that the alterations were in the direction of lowered thresholds.

DISCUSSION

The results of the two experiments of this investigation are viewed as supporting the hypothesis that "if sympathetic activity is provoked by the administration of a sympathetico-active drug, normal Ss will manifest significant alterations in recognition thresholds for neutral (non-threat provoking) verbal stimuli." Thus a comparison of the control and experimental groups of the two experiments of this investigation indicated that the introduction of 10 mgm of Isoprel, the main independent variable, resulted in significant effects on recognition thresholds. While control subjects tended to improve, i.e. obtain lowered thresholds on List II, this tendency was not significant, whereas experimental Ss obtained significantly lowered threshold values.

In this study, then, it has been demonstrated that when a sympathomimetic drug is administered Ss manifest significant alterations in recognition thresholds for neutral stimuli. In general, the alteration seems to be in the direction of decreased thresholds.

These results are seen as consistent with the view that threshold alterations characteristic of perceptual defense reactions are resultants of autonomic feedback loops. This study took its starting point just prior to where feedback was presumed to occur, that is sympathetic provocation. Under drug conditions threshold change

appeared and it was assumed that these changes were related to feedback loops.

The sympathomimetic drug employed in this investigation was presumed to produce physiological changes which are similar to the components of anxiety. In perceptual defense studies where Ss respond to taboo or threatening stimuli, anxiety is also assumed to be evoked. In these cases anxiety may occur prior to recognition since the threshold for affective reaction, anxiety included, is lower than those for recognition (7, 11, 27, 28). The physical changes of anxiety that is produced in response to taboo or personally threatening words we assume to be relatively similar to those that are produced by an artificial sympathetic provocator.

In this study the threshold alterations produced were in the direction of decreasing recognition thresholds. Such results appear similar to "sensitization" as it occurs in more traditional perceptual defense studies. However, it should be made clear that responses to threat of so called sensitizers and of the Ss in the present study may be quite different. In those studies where sensitizers and avoiders are reported, it is presumed that Ss were responding to stimuli that have been previously associated with threatening situations. Such an assumption is not tenable here.

Calloway and Thompson have shown that when sympathetic activity is provoked a significant decrease in apparent size of distant objects is obtained. These investigators interpret their findings as

support for a negative feedback hypothesis. The finding of lowered thresholds under the level of drug administered in the present investigation are, as already noted, consistent with a hypothesized positive feedback loop between autonomic discharge and the perceptual mechanism. Positive feedback seems to suggest increased exteroceptive input, and increased awareness.

It is not clear why the results of the present study do not support the interpretation of Calloway and Thompson. There are several possible explanations, one of which is differences in drug level. In the Calloway and Thompson study Ss were instructed to breathe the fumes of a broken amyl nitrite vial "until they felt uneasy." Such a procedure does not provide for control over concentrations of drug from individual to individual.

In the present investigation experimental Ss received identical dosages--10 mgm sublingual tablets of Isoprel. If the concentrations of the drug in the Calloway and Thompson study were greater than in the present study, it is not unlikely that still larger dosages of Isoprel would lead to greater discomfort and possibly elevated thresholds. Such findings would be similar to avoidant behavior in perceptual defense studies. In this case a negative feedback hypothesis might be invoked. Only one of the Ss of the present study was reported to have had severe side effects, although several Ss reported some discomfort. Inspection of the code No. of this case revealed that he had received the drug and that his thresholds on List II were higher.

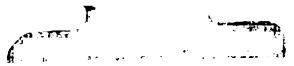
Other factors of importance leading to different interpretation in the two experiments may have been the greater subjectivity of distance judgments, individual reaction sensitivities and difference in the pharmacological properties of the drugs employed.

One serious criticism of the Calloway and Thompson study was their choice of drug (46). Although amyl nitrite does stimulate the heart and has vasodilation properties it is not a sympathomimetic. As such one cannot assume that it mimics the sympathetic nervous system in its adrenergic releasing properties as these occur under physiological conditions of stress and anxiety.

Further, Calloway and Thompson have not convincingly demonstrated that their results were not explainable in terms of pupillary changes produced by the drug. This too is a failing of the present experiment. A preliminary study of changes in pupillary sizes, accommodation, and visual acuity with an N of five under drug and non-drug conditions revealed no consistent differences.

Although no physiological or psychological measures of threat or anxiety were included in this study, it should be noted that the finding of lowered thresholds for the experimental Ss are consistent with numerous other studies (12, 31, 34) that have suggested that under certain conditions moderate threat and anxiety may be facilitating.

One factor commonly overlooked in experimental studies is the meaning of the task to the subjects. Although no quantitative data was accumulated here the spontaneous comments of the subjects, ward and

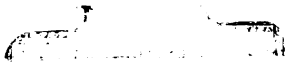


medical personnel, all indicated that the Ss viewed the procedure as a test of mental alertness, reaction time, and visual acuity. Viewed in this light one might conjecture that Ss were set to respond rapidly and accurately. The effect of Isoprel then may have produced physiological components of set. Such an explanation of the data would be consonant with Freeman's views of the organism responding in his environment (18, 19).

Research which is suggested by this study would involve the incorporation of additional variables in a much larger design. It was previously suggested that a different drug level might have yielded elevated thresholds. An examination of this possibility seems imperative if we are to arrive at a fuller understanding of some of the mechanisms operating in perceptual defense.

The present study involved the use of neutral verbal stimuli. Other investigations could be designed to include comparisons of neutral and personally-relevant, threatening stimuli under drug and non-drug conditions.

Finally, efforts should not be limited to studies of vision. Other sensory modalities and psychological functions are equally in need of investigation.



SUMMARY

The present investigation was designed to test the hypothesis that so-called perceptual defense phenomena may be influenced by autonomic feedback loops. On the assumption that a sympathomimetic drug activates segments of the autonomic system in a manner similar to that which is widely assumed to be the case under conditions of anxiety, two experiments were conducted on two groups of adult subjects to determine whether perceptual changes similar to perceptual defense phenomena would occur under drug conditions as compared with no drug. In Experiment I experimental and control subjects were paired on initial performances in a tachistoscopic word recognition situation, the words used being emotionally neutral. In a second session experimental subjects received 10 mgm of the drug Isoprel, whereas controls received placebos prior to the recognition test on any second set of verbal stimuli. Statistical analysis revealed no significant change from situation 1 to situation 2, whereas the change in the case of experimental subjects could not have occurred by chance. Correspondingly, the difference between control and experimental groups on the second recognition test could not have occurred by chance. It is concluded that Isoprel significantly affects the recognition

threshold of normal subjects. The direction of the change appears to be in the direction of lowered threshold and seems to agree with the hypothesis of positive feedback in perceptual defense studies.

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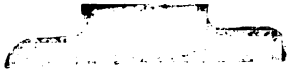

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APPENDIX

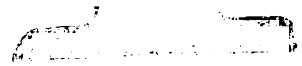

TABLE A

SUMMARY OF CHARACTERISTICS OF PATIENT POPULATION
EXPERIMENT I

Drug				Placebo			
Age	I.Q.	Education	Occupation	Age	I.Q.	Education	Occupation
21	-*	10	Truck Driver Helper in	27	99	10	Self-emp. Gardner
36	118	10	Power plant	36	112	14	Bookkeeper
24	-	14	Bartender	28	99	14	Student
41	94	8	Factory wk.	26	150	16	Chem. eng.
31	120	19	Optometrist	25	112	12	Utility wk.
20	106	10	Student	22	118	13	Floor planner
24	-	13	Student	27	105	12	Inspect.
23	106	12	Student	30	-	10	Steel Mill
24	106	12	Tool maker	25	105	15	Student
29	107	11		45	120	13	Printer
44	88	12	Grocery	31	-	12	Soldier
28	99	9	Machine opr.	25	117	12	Mechanic
32	93	12	Dept. Sales Mg	28	87	11	Shoe repair
31	93	8	Ins. Agent	37	129	12	Supervisor
33	106	10	Salesman	45	96		
39	123	14	Cost. Accnt.	20	95	9	Radio opr.
24	112	12	Const. insp.	26	106	13	Clerk
26	89	12	Student	23	94	12	None
23	106	9	Const. work	26	111	12	Student
33	103	13	Carpenter	32	111	12	None
24	95	9	Factory wk.	21	106	11	Laborer
Mean: 29	104	12		29	108	12	

* Those subjects without estimate I.Q. had been discharged prior to testing.

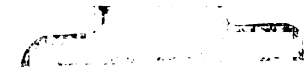

TABLE A

SUMMARY OF CHARACTERISTICS OF PATIENT POPULATION
EXPERIMENT II

Drug				Placebo			
Age	I.Q.	Education	Occupation	Age	I.Q.	Education	Occupation
39	106	11th	Polisher	26	105	14	Student
27	117	14	Student	26	105	11	Semi-skilled laborer
23	101	12	None	24	-	17	B.S. 24 hr. stu. Cred. mast.
25	-*	12	Coal	31	99	12	Press Opr.
29	99	11	Clerk	24	101	10	Groc. Clerk
38	106	16	Mechanic	27	129	12	Bus Opr.
23	106	8	Cook	26	117	16	B.A. Teacher
28	-	10	Mechanic	23	101	12	None
27	123	16	Adv. Dir. of Publishing	23	106	11	Student
38	106	9	Inspect. motion picture plant	24	95	11	Factory wk.
Mean Values							
29.7	108	11.9		25.4	106	12.6	

* Those subjects without estimate I.Q. had been discharged prior to testing.

Total Mean Values

I.Q.	107
Yrs. of Educ.	11.9
Age	28.5

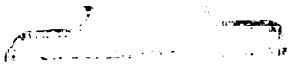

TABLE B

INDIVIDUAL DATA MEASUREMENTS OF VISUAL ACUITY, PUPILLIARY SIZE AND ACCOMMODATION UNDER DRUG AND NON DRUG CONDITIONS

Subjects	Best Visual Acuity		Pupil Size	Accommodation
1	Before	O.D 20/20	2.5mm	8.5 diopters
		O.S 20/20-4	2.5	9.0
	After	O.D 20/30-1	2.5	8.0
		O.S 20/30-1	2.5	8.5
2	Before	O.D 20/20	3.0	10.0
		O.S 20/30-2	3.0	11.0
	After	O.D 20/20	3.0	10.0
		O.S 20/20-2	3.0	11.0
3	Before	O.D 20/20-2	2.5	7.0
		O.S 20/20-2	2.5	6.0
	After	O.D 20/20-2	3.0	6.0
		O.S 20/20-2	3.0	7.0
4	Before	O.D 20/20-2	2.0	6.0
		O.S 20/20-2	2.0	5.0
	After	O.D 20/20-1	2.0	5.0
		O.S 20/20-2	2.0	4.5
5	Before	O.D 20/20-1	3.0	6.25
		O.S 20/20-1	3.0	6.75
	After	O.D 20/20-1	3.0	6.25
		O.S 20/20-1	3.0	7.25

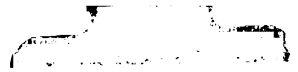

TABLE C

PRACTICE AND STIMULUS WORDS

List I	List II
Practice	Practice
1. CHAIR	1. PAPER
2. PLAIN	2. MONTH
3. SHADE	3. SHADE
Stimulus	Stimulus
1. EVENT	1. CHESS
2. DERBY	2. WINDY
3. SLEET	3. DOZEN
4. PLAID	4. TREND
5. FOGGY	5. VOCAL
6. SEDAN	6. FLINT
7. VOWEL	7. ERASE
8. TALLY	8. NORTH
9. PECAN	9. PEDAL
10. MOOSE	10. SYRUP
11. BEGIN	11. MURAL
12. SCALE	12. LEVER

Medic ne Code -umber_____ Ward

IQ_____ Hospital Diagnosis_____

N-me_____

Educ tion_____

Occupation_____

Age_____ Vision_____

Practice Words	Log Values	Practice Words	Log Values
1.		1.	
2.		2.	
3.		3.	
Mean		Mean	

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

13._____

to solve