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Task PIONEER

Research Memorandum

Collected Papers Related to the Study of the Effects of Sensory Deprivation and Social Isolation

by

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FOREWORD

HumRRO's former Task ENDORSE (Now PIONEER VI) was directed toward experimental analysis of the effects of social isolation and sensory deprivation upon behavior. The research stemmed from an analysis of PW treatment during the Korean conflict and from pioneer studies of a limited perceptual environment - notably by Professor D. O. Hebb - which suggested that dramatic and important behavioral changes may occur when an individual experiences a tediously monotonous sensory environment. Sponsored by the Assistant Chief of Staff, Intelligence, Department of the Army, Task ENDORSE studies of a limited sensory environment focused upon those behavioral changes of particular implication for the potential coercion and exploitation of an individual in the captive situation.

This report is comprised of a collection of papers bringing together the results of a number of small, and not necessarily related studies that have been part of the ENDORSE research. Not being an interrelated series they treat diverse topics; e.g., the measurement of digit span, the study of attitude change, construction of a simple tracking apparatus. This collection of papers is meant to provide background and historical perspective for a series of formal HumRRO reports now in preparation. As a document providing temporal perspective to an extensive project in sensory deprivation and social isolation, it will be of interest primarily to researchers in this field.

LIST OF PAPERS

A Preliminary Study of the Effects of Controlled Isolation

The Reliability of a Modified Digit Span Procedure

Visual Sensations Experienced in the Dark as a Function of Instruction and Prior Verbalization

Some Basic Factors in Sensory Deprivation Research

Reported Visual Sensation During Brief Exposure to Reduced Sensory Input

A Technique for Studying Attitude Change

A Simple Tracking Apparatus for Classroom or Experimentation

Selected References to Research in Sensory Deprivation

A Preliminary Study of the Effects of Controlled Isolation

by

Thomas I. Myers
Lyman M. Forbes
Jack Arbit
Jack Hicks

This report provides a description of the initial ENDORSE exploratory study of isolation in a monotonous sensory environment, which formed the basis of a briefing to the military sponsor and of a Progress Report dated February 1957.

The exploratory research summarized in this report was one of the first studies to follow the pioneer Canadian experiments by Professor Hebb and his students, and the adventurous introspective observations by Dr. John C. Lilly of the National Institute of Health during his immersion in a tank of water. Because of the seemingly potent and dramatic effects obtained by these investigators, and the excitement and furor stimulated by journalists in accounts of these experiments, the HumRRO studies were undertaken with sober caution. Since the safety aspects of undertaking such experimentation with human subjects were little known, initial studies employed only volunteer research personnel as subjects. Each subject volunteered for four days of experimental confinement in a darkened cubicle with white noise present to mask external sounds. By providing the subject with ample food and his own chemical toilet, social isolation remained unbroken throughout the experiment. The initial study was carried out without adverse incident. Thus it represented an experience factor suggesting that such research could be carried out with human subjects without undue risk of their incurring enduring after-effects. Formal data collected in the study was necessarily inconclusive, since the research personnel used as subjects were quite familiar with the test instruments used.

A Preliminary Study Of The Effects Of Controlled Isolation

Background

The effects of controlled isolation upon the attitudes and behavior of human beings have been largely unexplored. In recent years attention has been focused on controlled isolation as a technique for influencing behavior because of the keen interest shown by the Communists in methods of coercing and exploiting political prisoners for propaganda purposes. Their apparent success is found in courtroom confessions of misdeeds known to be fictitious. Consequently, the Western World has been forced to appraise these methods soberly and to consider the extent to which an individual is able to defend himself against them.

A deceptively innocent aspect of any prisoner's confinement experience--the monotony of his surroundings--was experimentally examined by Professor D. O. Hebb and his colleagues at McGill University.[1] Their subjects were paid to do nothing. For as long as they were willing, their job was to lie on a cot, wearing frosted goggles, hearing nothing except the noise of a fan, with cardboard cuffs extending beyond their fingertips. The subjects were comfortable, rested, and fed upon request. The effects of such reduced stimulation were startling. The investigators reported:

(1) a surprising unwillingness of subjects to remain in the experiment,
(2) intellectual impairment, both during and immediately after experimental confinement,
(3) a desire for stimulation, even in inane forms,
(4) vivid visions or hallucinations.

Later exploratory work by Professor Jack Vernon of Princeton University does not confirm all the Canadian results. In fact, Vernon's "sensory deprivation" procedure, with the subjects remaining in a soundproof darkened room for 48 hours, has been reported to improve the learning of certain materials.[2]

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[1]Hebb, D. O. Drives and the conceptual nervous system, Psychol. Rev., 1955, 62, 243-254. Hebb, D. O., Heath, E. S. Stuart, E. A. Experimental deafness, Canad. J. Psychol., 1954, 8, 152-156. Bexton, W., Heron, W., and Scott, T. Effects of decreased variation in the sensory environment, Canad. J. Psychol., 1954, 8, 70-76.

[2]Vernon, J. and Hoffman, J. Effect of sensory deprivation on learning rate in human beings, Science, 1956, 123, 1074.

The existing research findings are, at once, few, puzzling, and indicative of important psychological effect--effects applicable not only to the political prisoner but directly relevant to every work-day situation involving boredom. Therefore, a research program known as Task ENDORSE has been undertaken at the U. S. Army Leadership Human Research Unit, Fort Ord, California. Its goal is the experimental study of the basis and effects of extreme boredom upon behavior. The present pages are intended as a summary of the first exploratory step in this program.

Objectives Of The Preliminary Study

The objectives of this preliminary step were necessarily limited. Specifically, caution surrounding the safety aspects of the experimental procedure has rightfully concerned both the military sponsors of the research and the researchers themselves. This initial study was accordingly planned to examine the effects of a moderately severe reduction of sensory experience. Only professional personnel of the unit were used as subjects in this exploratory phase. Thus, one of the objectives has been to determine if there is any risk for the experimental subject.

The self-imposed decision to use only researchers as subjects meant that the number of available subjects was too small to permit their use in pretesting. This study, therefore, had to perform that function. Thus, a second objective has been to pretest experimental procedures and measures of behavior.

Prepartion of Facilities

Three rooms of a barracks building were modified and equipped to permit the isolation of subjects for a period of four days and to provide a limited sensory environment. Rubber, canvas, and tape were applied to the doors, windows, and walls in an attempt to black out the rooms. Each room was equipped with a foam rubber bed, sheets, and blankets. At the head of each bed was a specially constructed head cradle designed to cradle the subject's head, to shield it from incoming sounds, to house microphone and speaker components of the intercom, and to provide a ventilating fan which insured air circulation and a masking sound.

In construction, the cradle consisted of a plasterboard box mounted on rubber within a larger box of the same material and was upholstered with foam rubber and terry cloth. Several thin foam pillows were provided as a means of varying pillow height in relation to the bed. A close-up view of the head cradle is shown in Figure 1.

In practice, the subject wore cotton gloves embedded in foam rubber and paraffin ear plugs. He was allowed to assume any position on the bed so long as his head remained in the cradle. See Figure 2.

To enable complete social isolation during experimental confinement, nutritional needs were met by using the Rockefeller liquid diet of dextrose, corn oil, and evaporated milk. This diet and water were both continuously available to the subject through latex tubes sheathed in hoses penetrating the wall, as shown in Figure 1. Both liquids were kept chilled and frequently renewed by the experimenters.

Elimination was effected by the subject without leaving his room. A vented chemical toilet was placed near the foot of the bed as shown in Figure 3. Room ventilation was provided by a light-baffled window fan. Additional supplies present were tissue, a basin of water, a towel, and disposable detergent washcloths.

An experimenter's control center, shown in Figure 4 was equipped to serve as a continuous monitoring post. Here communications controls were devised so that voice, records, and tapes could be played into any of the experimental rooms in conjunction with the testing program. Sounds could be monitored from all rooms and tape-recorded at will. Light signals indicated whether or not a subject had risen from his bed; records were kept as to how continually the subject kept his head in the cradle.

Subjects And Treatments

A total of sixteen civilian and military members of the professional staff of the U. S. Army Leadership Human Research Unit voluntarily participated in the experiment, nine as experimental subjects and seven as controls. Except when unforeseen events altered the schedule, subjects were assigned by chance to one of the two groups.

Confined or Experimental Group. The nine subjects in the experimental group were scheduled in advance for a 96-hour confinement. They were told they could bring pajamas, tooth brush, and dentrifice into their room. Before incarceration, each subject was shown all aspects of the cubicle, and was requested to keep his head in the cradle and his gloves on. He was also informed that he would be monitored continually, but was requested to talk only when necessary, that is, to report adverse conditions such as inadequate ventilation or extreme temperature changes. All experimental subjects were told that the door would never be locked, and that they could leave the cubicle before completing their four-day stint if they felt it to be necessary. Upon completing their period of isolation, subjects were asked to refrain from discussing the experiment and cubicle life until the remaining experimental subjects had been run.

Control Group. The seven subjects in the control group spent the four-day period in normal everyday pursuits but took the same tests, at the same spacing, and under identical conditions as the confined subjects. For example, control group subjects were administered their "confinement" tests in a darkened experimental room, just as were the experimental subjects.

Tests And Testing Schedule

Measures of three basic aspects of behavior were pretested: visual perception, intellectual and learning performance. Indices of perceptual and intellectual functions were included since the findings of Hebb and Heron indicate that these functions may be adversely affected by monotony of

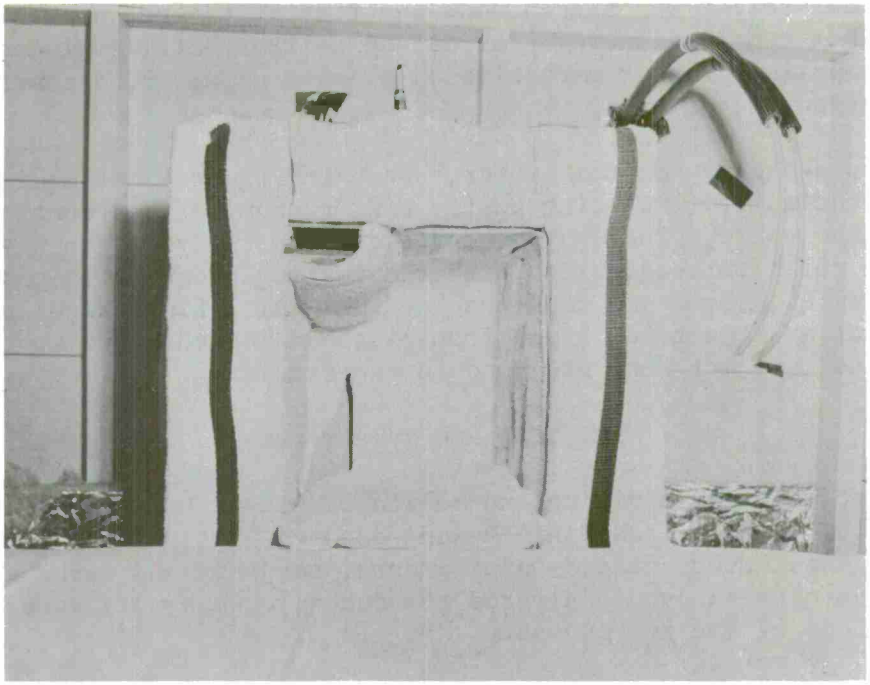

Figure One

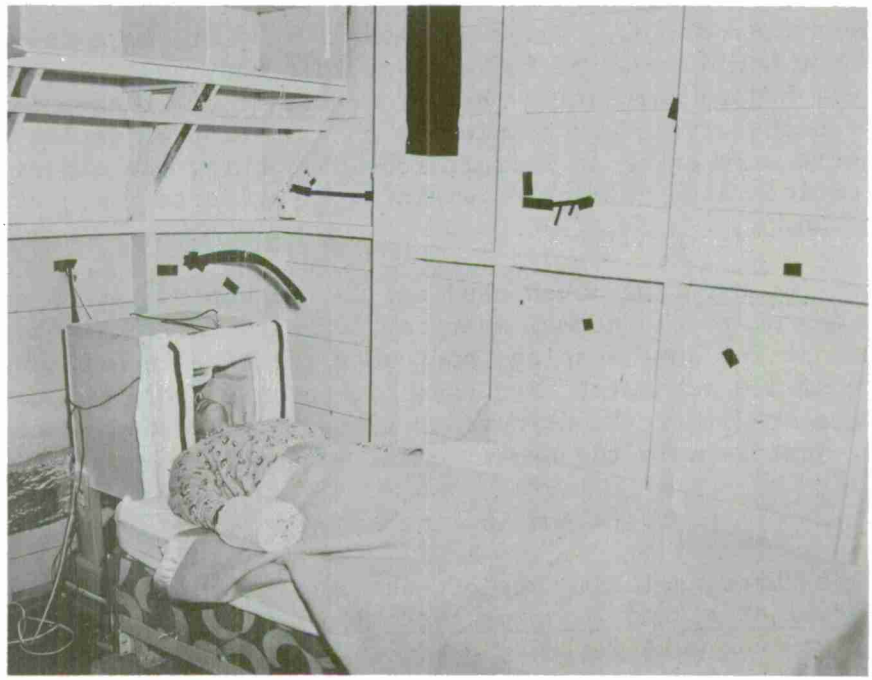

Figure Two

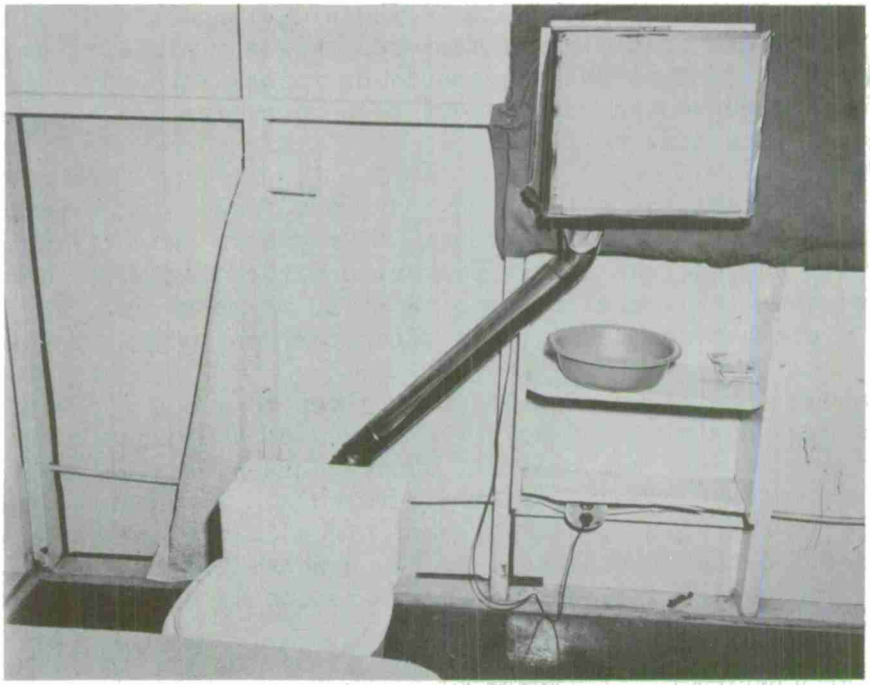

Figure Three

Figure Four

environment. Specifically, autokinetic movement, visuomotor coordination, and visually-determined intelligence measures were administered both before and after confinement. Tape-recorded tests of verbal fluency, numerical facility, inductive reasoning, and memory span were given to the subjects in the darkened room from time to time.

Several measures of the ability to learn were used since the results of Vernon suggest that a facilitative effect may occur in sensory isolation. Specifically, the subject was orally presented with nonsense syllable lists to be memorized and with verbal concept tasks to be mastered. These learning sessions took place before, during, and after the confinement period.

In all, about nine hours of tests were given to every subject. Two-hour batteries were administered at three stages of the experiment: just before the subject entered the cubicle, shortly after completion of his confinement, and three days or more after his release. One-hour test sessions were interposed at the 48, 72, and 96 hour points in the isolation period. In order to minimize the intrusions into the sensory isolation, the confinement tests were specially devised auditory versions as short as reliability needs permitted.

Preconfinement measures provided a set of normal "base-line" scores for each subject. The post-confinement test batteries were designed to tell whether sensory isolation had short-term effects upon behavior after release, and whether these effects were dissipated by the third day. The testing sessions during confinement permitted the study of both immediate and cumulative effects of various lengths of incarceration with reduced stimulation.

As unstructured, tape-recorded interview was held with each experimental subject immediately after the subject emerged from confinement so as to secure fresh, subjective, descriptive data. In addition to these tests, procedures relative to a motivational analysis of boredom were initiated. Specifically, modified operant conditioning techniques were developed in both psychomotor and verbal contexts.

Results

All experimental subjects became quite bored while in isolation. They cast about for things to do in an attempt to combat the feelings of being tense, on edge, and nervous. As long as they could remain occupied (symbolically, if not actively) the experience was quite tolerable.

Seven men completed the four-day confinement; two did not. Both men who emerged prematurely did so only after discussing their decision with the monitor on duty at the time. One, reporting that he was becoming quite nervous, left after two days of confinement. The other left within the first hour after stating that he was afraid he would, if he remained, dwell too closely on personal problems. Since confinement under present conditions was endurable to nearly all, there was not opportunity to compare experimentally the activities and adjustments of those who were relatively more successful in coping with the monotony with those who were relatively less successful.

Typically, the subject was able to sleep through a large part of the first day or so. We learned that many subjects had deliberately burned the candle at both ends, in regard to sleep, on the weekend preceding, correctly anticipating that sleep would prove to be the perfect prophylactic against the boredom of isolation. It is interesting to note that the subject who broke isolation after 48 hours had been sick and confined to bed through much of the preceding days. The value of sleep as an "activity" for the confined group was further indicated by the rituals and calisthenics sometimes performed for the explicit purpose of becoming fatigued and able to sleep.

By and large, experimental subjects reported that they were able to refrain from gross activities, such as pacing the room, as requested. Most men did sing, explore the head cradle with their arms, and fidget at times. Feelings of hostility toward the experimenters seemed to be expressed by shouting expletives occasionally and by blasting the microphone with direct whistling or physical blows.

All subjects were able to gauge time with considerable accuracy by observing time-correlated cues which leaked in from the "outside." The sound of trucks and aircraft meant daytime, and a noticeably cooler temperature signalled the hours after sundown. To some, minute pinholes of light served as a true sundial. Every subject reported that the watching for these cues, computing the percent of the four days elapsed, and the like, were of great value in "passing the time." Moreover, the temporal frame-of-reference which the time cues made possible seemed to be important, in its own right, in permitting the subjects to pace and condition their reactions over the interval of confinement. The half-way point usually had to be passed before the subject felt well into the session. Time dragged almost interminably on the final day and release was eagerly anticipated and elaborately planned for by all subjects.

Most subjects had decided upon definite matters to think over while in isolation. In some, abstract intellectual activities such as research problems were to be attacked; in others, a "taking stock" of themselves and their interpersonal relationships was intended. Typically, the subjects reported that these deliberations did not meet with much success. A number of the subjects experienced difficulty in "holding in mind" those necessary elements--facts and premises--vital to logical inference. Furthermore, many found that even matters of some urgency came to seem inconsequential or irrelevant as the confinement period progressed. Several subjects began to feel a pervading sense of "remoteness," of "aloneness," of "being insulated." In no case was the feeling frightening or even discomforting: rather, apathy was the dominant feeling tone.

Passive daydreams and reverie occupied much of the wakeful periods following the initial period of extended sleep. In many, this lapsing into reverie was correlated with the weakening sense of urgency associated with the more intellectual tasks planned. The imagery in these daydreams was vivid and often indistinguishable from sleep dreams. As in twilight states preceding sleep, names and faces of acquaintances of long ago were frequently recalled. Many subjects reported that sexual themes were recurrent in the reveries, with contexts of reminiscences, fantasies, and admixtures of the two.

No full blown hallucinations were reported. Most of the subjects did experience a flashing of lights, in black and white, described by one as similar to "a projector on the blink." Any vivid and colorful imagery reported by the subjects was ascribed by them to their daydreams or sleep-dreams rather than to hallucinations.

Test scores failed to show any striking changes in intellectual or learning performance, either for the subjects themselves or in comparison to the performances of the control subjects. These results were corroborated subjectively by the majority of the experimental subjects who felt that they had done no better or worse on the tests while in confinement. While the tests were generally looked forward to as a diversion, the tedium and effort involved in answering the problems was also mentioned. For the small number of cases in this study, no obvious consistent changes were seen in capacity to perform on intellectual tasks or to learn verbal materials after two, three, or four days in sensory isolation chambers.

Summary

Volunteer subjects, all professional members of the research unit, were confined for four days to experimental rooms contrived so as to permit unbroken social isolation in a moderately reduced sensory environment. For the most part, the subject simply remained on a cot in almost total darkness and heard little beyond the masking sounds of ventilating fans. Nutrition and elimination needs were satisfied without moving more than a few feet within the room.

The impressions of these subjects were studied; objective behavior measures were devised for pretest. Furthermore, the visual, intellectual, and learning performances of these confined subjects were compared before, during, and after confinement to the performances of a control group of subjects tested under identical circumstances but without the experience of prolonged confinement.

Experimental subjects were provided with the safety valve of voluntary withdrawal and, in fact, two subjects did emerge prematurely from isolation. However, no evidence was obtained that either these or the "full-term" subjects suffered from the experiment. By the very nature of things one cannot generalize this result to as yet unexplored experimental conditions. However, if caution is conscientiously exercised in future research, it is almost certain that any deleterious effects upon the subjects may be avoided.

In general, the isolation techniques used have produced not detectable changes in performance. A number of possible factors that might account for this suggest themselves: (1) the number of subjects used in this study was small and the results therefore lack sensitivity to other than the most marked changes of behavior; (2) the subjects serving in the study were psychologically sophisticated and perhaps under a considerable implicit group pressure to stand impervious to the anticipated stress of isolation; (3) paramount, perhaps, was the factor of the subject's successful time orientation, which was not eradicable with present facilities for control of sensory environment. It is expected that future facilities and further research will clarify the roles of some of these factors.

Concluding Remarks

This study has served its two exploratory objectives. First of all it is concluded that there need be no risk to subjects under the particular conditions employed. With suitable caution, it is very probable that harm can be avoided to the subjects of even more drastic isolation.

Second, the study has served to pretest and refine procedural measures and has provided an extremely valuable first-hand experience with the problems inherent in such research. This experience is indispensable to economical execution of full-scale experimentation.

The Reliability of a Modified Digit Span Procedure

by

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One finding of the original studies of a limited perceptual world was a tendency for the experimentally confined subject to show impairment in basic intellectual functions, both curing and immediately following confinement. However, since this trend toward impairment was by no means overwhelming in consistency and magnitude, the researcher is inclined to examine the measuring instruments for signs of unreliability, etc. which might account for the relatively weaker outcomes on particular scales. The traditional manner of testing memory span, a subtest of standard intellectual test batteries, does, in fact, give a somewhat unstable index of an individual's performance. This paper summarizes Task ENDORSE efforts to develop a suitably reliable research instrument for measuring memory span, as one of several test developments undertaken preparatory to experiments on intellectual functioning during monotonous experimental isolation.

The Reliability of a Modified Digit Span Procedure

Background

Interest in the digit span stems from its use as a subtest in the various Wechsler Intelligence Scales, its interpretation as a measure of attention, and the opinion held by some (Kay, Kirschner, and Mandler, 1957; Moldawsky and Moldawsky, 1952) that it is a good barometer of anxiety in subjects. Unfortunately, studies of digit span have generally yielded low reliability coefficients as illustrated by the Derner, Abon, and Canter summary (1950) of seven studies done with neuropsychiatric patients in which the coefficients ranged from .59 to .77 with a median value of .65. Their own study with 158 normal subjects yielded a coefficient of .67.

In an effort to obtain higher reliability, Blackburn and Benton (1957) modified the administration and scoring of the Wechsler Digit Span subtest. Their modified version yielded a satisfactory test-retest reliability coefficient of .81 with a group of 50 college students. The modifications were such that the test's traditionally short administration time, ease of scoring, and usefulness as a clinical instrument were not impaired.

Despite this improvement, the need persisted for a digit span procedure which would be suitable for experimental studies. In addition to high reliability, such a procedure would have to provide: (a) a constant amount of test material for every subject, (b) a standardized procedure for administering the test, and (c) an instrument which could be used for group testing as well as individual administration. The purpose of this study was to provide such a digit span test.

The modified test reported here used only forward digit presentations and consisted of six blocks of six items each, with item length ranging from 5 to 10 digits. Administration time was approximately 10 minutes, somewhat longer than that for the Standard Wechsler. Instead of the traditional presentation of items in ascending order of length, the six items in each block were presented in scrambled sequence. This modification raised a secondary problem. Because some subjects would be confronted with digit material beyond their capacity, it might be hypothesized that their subsequent performance on material within their capacity would be adversely affected by deterioration in motivation. Thus, in addition to establishing the reliability and validity of this new method, a test for its possible depressing effect upon mean performance had to be undertaken.

Procedure

Subjects were 114 Army inductees with scores of 110 or above on an Army Classification Battery subtest which corresponds to a general intelligence measure and whose ages ranged from 17 to 26. The first 54 subjects

were tested in a group; the instructions and digit items had been recorded on magnetic tape and the interval between items was controlled by the experimenter to permit sufficient time for response. Subjects wrote their answers on a prepared test blank. To prevent writing during presentation of a digit series, the subjects were asked to hold their pencils in the air until the digit series had been completely presented.

For sixty subjects the modified digit span (MDS) was individually administered by tape recording and the oral responses of each subject were recorded on tape by the experimenter. Half of this group received the forward digits of the Wechsler-Bellevue Form I, administered individually according to standard procedure, followed after a thirty minute interval by administration of the MDS. The other half received the same two tests in reverse sequence.

Scoring of individual records. The MDS scoring method was borrowed from the psychophysical method of Constant Stimuli (Guilford, 1936). Raw data for each subject consisted of the number of items correct (out of six possible) for each item length from 5 through 10 digits. An individual's overall score was the linearly extrapolated point of item length corresponding to a .50 probability of correct recall. With this method of scoring a relatively stable threshold value for each subject was anticipated. Also, a greater number of scoring categories than would be provided by traditional scoring methods seemed possible. This appeared desirable, particularly in view of the restricted ability range of our sample.

Scoring for test analysis. For reliability estimates, the test was broken into odd (1, 3, 5) blocks of items and even (2, 4, 6) blocks of items for each subject, and the psychophysical scoring method applied separately to each group of items. Split-half reliability coefficients, using the Spearman-Brown formula, were computed.

Results

The reliability coefficient of .86 was obtained for group administration of the MDS (N=54). Since the individually tested subjects also received the Wechsler digit span subtest, separate reliability coefficients were computed, based on whether the MDS administration preceded or followed the Wechsler subtest. These coefficients were .86 (N=30) and .79 (N=30), respectively. For all three groups the split-half correlations were greater than zero at the .01 level. The magnitude of these reliability coefficients is greater than those generally reported for standard digit span procedures.

The validity of the MDS scores in relation to orthodox Wechsler-Bellevue subtest performance was established by the product-moment correlation between these two forms. Separate correlations were computed for the two sequences of test presentation. The resulting correlations were .64 with the Wechsler first, and .69 with MDS first. For the 30 cases in each sequence, both correlations were greater than zero at the .01 level. Considering the imperfect reliability of the MDS and particularly of the Wechsler digit span subtest, the validity coefficients were as high as could be expected. Thus, the MDS appears to tap the same variance as does the Wechsler digit span subtest.

Table 1

Analysis of Variance

Source of Variation	df	MS	F
Between Subjects	59	2.27	
Interaction	1	4.60	2.06
Error	58	2.23	
Within subjects	60	.45	
Method	1	.12	.33
Order	1	1.51	4.19*
Error	58	.36	
Total	119	1.35	

*Significant at .05 level

Table 1 presents the analysis of variance of performance level as a function of method (MDS and Wechsler), order of tests, and test interaction. This analysis was of particular interest considering the expectation that the MDS procedure, by exposing subjects to more failure experiences, might reduce their motivation. If this were the case, then we might anticipate either of two effects: (a) MDS performance might be poorer on the average than the Wechsler, as would be shown in the method's main effect; (b) administration of MDS first might destroy task motivation for the Wechsler sufficiently to produce a significant interaction effect. In fact, however, neither of these outcomes was realized. Thus, there was no discernible evidence that abandonment of the traditional ascending order of digit span presentation adversely affected motivation. The only test approaching significance was that of order: the second test taken, regardless of method, resulted in lower scores.

Summary and Conclusions

It was found that a modified digit span procedure qualified for research purposes when testing time is not at a premium. The reliability of the method was higher than usually reported in the literature for digit span tests, and correlated to the point of saturation with the customary clinical instrument using ascending order of presentation.

There were no indications in the data to support the hypothesis that scrambled order of presentation with respect to length of digit items, or repeated experience of failure by some subjects, would have adverse motivational effects. In addition to the important feature of providing a similar test experience for all subjects, the modified digit span procedure had the further advantage of permitting administration individually or to a group by means of tape recording.

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Visual Sensations Experienced in the Dark as a Function of Instructions and Prior Verbalization

by

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A major finding of the original studies of an experimentally limited perceptual world was the occurrence of visual experiences of striking complexity and compelling realism (sometimes termed 'hallucinations'). To view these visual events as a product of prolonged perceptual isolation, per se, implies their rarer occurrence under "normal" baseline conditions, e.g., only brief exposure to the experimental setting. This paper summarizes an experiment conducted as part of the development by Task ENDORSE of such a technique for assessing the visual sensations reported under both experimental and baseline control conditions. In this study, the reported visual sensations (RVS) technique described was designed to be administrable under a variety of conditions and was found to possess the simplifying property of cumulative scaleability. Moreover, the RVS technique proved to be a sensitive barometer of variations in instructional set, which thus appears to be an important determiner of the extent of visual phenomena to be obtained in any given experimental setting.

Visual Sensations Experienced in the Dark as a Function of Instructions and Prior Verbalization

Background

Experiments by Bexton, Heron, and Scott (1954); Lilly (1956); Vernon, McGill, and Gulick (1957a, 1957b); and Wexler, Mendelson, Leiderman, and Solomon (1957) have led to widespread interest in the effects of sensory monotony and social isolation. In these experiments, where the period of confinement ranged from 3 to 72 hours, Ss reported visual sensations which could not be explained in terms of external light sources. The authors interpreted these reports as evidence of hallucinatory or illusional phenomena resulting from the experimental conditions. However, to attribute these sensations with confidence to the effects of sensory monotony and social isolation, the incidence of reported visual sensations under control conditions, e.g., a brief period in the dark, is needed. An additional consideration is that the instructions in some of the experiments ("report any visual images which occur") may have augmented the frequency with which visual sensations were reported.

This research was undertaken in preparation for a research program on sensory deprivation and social isolation. The purpose was to investigate the frequency and complexity of visual sensations reported by Ss after a brief period in the dark as a function of instructions and prior verbalization in a perceptual task.

Method

Subjects

Ss were 80 basic trainees from Fort Ord, California, whose scores on an Army Classification Battery subtest, which corresponds to a measure of general intelligence, were at least one-half standard deviation above the mean. They averaged 21 years of age and had completed one year of college.

Treatment Combinations

In order to investigate the effects of prior verbalization, Ss were given a pretest, ostensibly as part of another experiment, consisting of cards VIII, IX and X of the Rorschach (Ror) on half of the testing days. On the remaining days Ss had no pretest Rorschach experience (NRor). Ss within each of the two prior verbalization conditions were randomly assigned to either a positive (Pos) or negative (Neg) instruction condition. There were, then, four experimental groups of 20 Ss each: PosRor, PosNRor, NegRor, NegNRor.

Procedure

During the testing period, Ss were segregated to avoid intersubject

contamination and were drawn from a population pool where the opportunity to contaminate potential Ss was kept to a minimum.

Rorschach Treatments S was seated at an office desk and instructed as follows:

"Almost all people see things in inkblots. We've found that what they see generally falls into these categories: colored blobs, inaninimate objects, animals -- including man. The color or shade may suggest texture or give a three-dimensional effect. The cards may be considered as a whole or in part. There are no right or wrong answers, so you may see things other than are mentioned above. Here is the first card. Tell me all of the things you see."

If S did not spontaneously verbalize percepts in each of the predetermined categories, he was encouraged and instructed until he reported seeing them. After the completion of the Rorschach pretest, S was told he would participate in another experiment.

Instruction Treatments. Each S was brought into a semi-lightproofed office and told to sit on the edge of a bed. The positive instructions groups were told:

"We are interested in certain visual sensations which occur after being in the dark for some time with your eyes open. In order for your eyes to become accustomed to the dark, I will leave you here lying on the bed. I also want you to wear these goggles. (S given opaque goggles.) Note that you can open your eyes even with them on. Please keep the goggles on for the remainder of this task.

"As you know, objects cannot be seen in a very dark room. However, the human eye is so constructed that people normally become aware of visual sensations when lying in the dark with their eyes open. These visual sensations are due to the physiology of the eye and are experienced by all people. (E turned off light.)

"Right now, for example, you are not experiencing total blackness but, rather, varying shades of darkness. As you lie here in the dark these sensations will become more pronounced and others will occur. Normally, you, as most people, are unaware of these sensations because you have learned to ignore them. In this task I'd like you to describe all the visual sensations you experience while lying in the dark with your eyes open. However, I want you to describe only visual sensations. Please do not describe thoughts or memories which you are only thinking about but not actually seeing.

"Do you understand what you're to do? Now you'll lie in the dark for 10 minutes to get used to the conditions of the experiment."

The negative instruction groups were instructed as follows:

"We are interested in certain visual sensations which psychiatric patients report seeing in the dark. As you know, objects cannot be seen in a very dark room. However, these psychiatric cases claim to experience visual sensations while lying in the dark with their eyes open. In this task I'd like to know if you experience these visual sensations while lying

in the dark with your eyes open. Please do not describe thoughts or memories which you are thinking about but not actually seeing. Be sure to describe only those visual sensations which actually seem to appear in front of your eyes. I also want you to wear these goggles. Note that you can open your eyes even with them on. Please keep the goggles on for the remainder of the task. Don't take them off until I tell you to. Now you'll lie in the dark for 10 minutes to get used to the conditions of the experiment."

After the 10 minute period E, who was seated in an adjoining room connected to the experimental room by an inter-com system, asked S to describe all of the visual sensations that he was actually experiencing. If after one minute S had said nothing, E repeated the request. If S had been talking during the first minute, E said, "You're doing fine." All Ss were allowed a 15 minute reporting period; however, if S remained silent for 4 consecutive minutes, the reporting period was discontinued. Upon completion of the reporting period, Ss were questioned concerning their experiences.

All Ss' responses during the experiment were tape recorded and protocols were typed from the tapes.

Scoring

The protocols were keyed and scored by a technical assistant. A second assistant scored 36 of the protocols independently. Scoring was done according to the following instructions: first, bracket the word groups which report the occurrence of a visual sensation, (verbal material was scored only if S used the present tense in reporting) and, second, assign one of the four content categories below to each bracketed group of words.

1. Light or contrast in shade of darkness (e.g., lines, dots, amorphous shapes, color).
2. Any geometric object (e.g., patterns, triangles, squares).
3. Isolated or single objects (e.g., table, chair, man, car); groups of repeated objects (e.g., tables which are alike, chairs which are alike, cars which are alike); or objects which are modified by no more than one adjective (e.g., large chair, red table, new car).
4. Integrated scenes involving a detailed description of one object or a group of objects; a combination of various objects forming an integrated unit(e.g., a red-haired man at a desk dialing a phone, or a statement of relationship between objects); or a three-dimensional vista effect containing objects.

Results

The results were analyzed both in terms of the number of visual sensations reported and the complexity (scale scores) of the verbal reports.

Table 1 presents the mean number of reported visual sensations for each of the four treatment combinations. The instructions' main effect, as shown in Table 2, was significant ($p < .01$), with the positive instruction groups reporting a significantly greater number of visual sensations than the negative groups. Neither prior verbalization nor the interaction of instructions with prior verbalization was significant.

Scorer reliability for the occurrence of visual sensations was .81 as determined on the 36 records scored independently by two individuals.

Examination of the frequency with which Ss reported visual sensations in each of these content categories suggested the possibility of a scaleable complexity-of-report dimension. For example, it was found that if S reported a visual sensation in category four, it was highly probably that he reported sensations in categories, three, two, and one. Similarly, if S reported a sensation in category three, he was likely to have reported sensations in categories two and one as well. This pattern of scores suggested that a Guttman scaling procedure (Stouffer, Guttman, Suchman, Lazerfeld, Star, and Clausen, 1950) might be suitable for assigning to each S a single score based on the complexity of his verbal report. Thus, if a protocol contained reports of visual sensations scored for all four content categories, S was assigned a scale of four. If he reported sensations scored for the first three categories, his score was three, etc. The coefficient of reproducibility for this scale was .937 which, we felt confident, was above the mean chance value for this statistic. The scale scores for each S based on the two independent scorings of 36 protocols were in agreement for 78% of the cases.

The mean scale scores for the treatment combinations are presented in Table 1. As shown in Table 2, the scale scores for each S were used to evaluate the effects of the experimental variables. The instruction effect proved to be significant ($p < .025$), with the scale scores for the positive instructions groups greater than for the negative instructions groups. The interaction and prior verbalization mean squares were not significant.

Following the report period, the 80 Ss of the experiment proper were questioned about their experiences. The questions asked and the frequency of responses for all groups combined are presented in Table 3. The "?" category was used when S failed to answer or his answer was qualified and could not be categorized as either "Yes" or "No".

Table 3

Responses to Post-Experiment Questions

Questions	Response: Yes	?	No
1. Did the objects appear to be outside of you?	55	16	9
2. Did they seem to be real rather than imagined?	42	23	15
3. Did any of these visual sensations have a dream-like quality, a feeling of unreality?	37	17	26
4. Have you ever noticed such visual sensations before, perhaps before going to sleep?	44	18	18
5. Did the visual sensations seem to be three-dimensional?	35	16	29
6. Did you feel compelled to say you saw something?	14	18	48
7. Did the instructions I gave you at the start lead you to expect that you would have visual sensations?	43	12	25

Discussion

Following 10 minutes in the dark, a group of 80 Ss reported "seeing" a variety of visual sensations. Reports of visual sensations, during a brief period in the dark appear to be relatively frequent phenomena.

The positive instructions tended not only to significantly increase the total frequency of verbal reports, but also to increase the complexity. Whether the positive instructions resulted in an increase in visual sensations actually "seen," or simply in more complex verbal behavior, cannot, of course, be determined. However, in view of the effects of instructions, it might be anticipated that other experimental conditions may also affect the frequency or complexity of the verbal report. Cautious examination of the role of instructions and other conditions determining experimental set is, therefore, of value in examining the relationship of reported visual events to sensory deprivation.

Ss reported frequent occurrences of visual sensations even under negative instructions. Whether the visual sensations were so compelling that Ss reported them despite the negative instructions, or whether the instructions were not really negative, could not be determined. Some support for the latter contention is offered by the answers to the question, "Did the instructions I gave you at the start lead you to expect that you would have visual sensations?" Of the 40 Ss in the negative instruction groups, 19 answered "yes" to this question. Thus, it may be that such factors as E's nonverbal behavior, as well as the social obligations inherent in the testing process, particularly experimenter-induced sets, attitudes, or expectancies, may have led to surprisingly frequent reports of visual sensations despite instructional materials intended to minimize them.

Prior experience in "seeing" things, as on the Rorschach, appeared not to have an effect.

The post-report-period questions provided information that for a majority of the Ss, the reported visual sensations appeared to lie outside themselves, to be three-dimensional, and to be real rather than imagined, although for many Ss the sensations possessed a dreamlike quality. These findings indicated that the subjects were actually "seeing" things and not reporting thoughts or memories, and that the visual sensations had many of the realistic attributes of the sensations reported to occur in sustained deprivation studies. Many Ss reported having noticed such sensations on prior occasions, which further suggests that this phenomenon occurs frequently under normal conditions.

Previous studies have reported the occurrence of visual sensations during the period when Ss experienced sensory monotony and social isolation. In general, in these studies information from control groups was not obtained on this measure. The occurrence of the visual experiences was attributed to experimental isolation because it was presumed, evidently, that control Ss would not report "seeing" things. The measure of reported visual experiences used in this study indicates that with at least one type of control condition, i.e., a brief period in the dark, Ss report visual experiences frequently and of considerable complexity. Although comparison is difficult, due in part to methods of measuring visual experiences, the present study suggests that the complexity of visual sensations occurring after only ten minutes in the dark is comparable to the visual

experience of Ss in isolation studies. Table 4 presents the number of Ss reporting visual sensations in each of the four scoring categories, and for comparison purposes, the published data from other sensory deprivation experiments were categorized according to this scheme. The results of this study do not rule out the possibility of an increase in frequency or complexity of visual sensations under prolonged isolation; however, they do suggest caution in making inferences about the occurrences of visual experiences in sustained isolation studies until such time as data from control groups are obtained.

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Some Basic Factors in Sensory Deprivation Research

by

Thomas I. Myers

This report is designed to elaborate some elementary methodological distinctions deemed pertinent to the research area of sensory deprivation which appear as pertinent now as they did at the time the statements were originally made. The phenomena of experimental isolation and sensory deprivation have excited the interest of scientists and layman alike - to whom these distinctions may be obvious or unnecessary - and the various gradations in between. The material in this report was taken verbatim from a paper presented by the author at the Symposium on Isolation and Sensory Deprivation at the American Psychological Association meetings in Washington, D. C. on 3 September 1958.

Some Basic Factors in Sensory Deprivation Research

The scientific study of social isolation and sensory deprivation is a relatively recent undertaking. The dramatic pioneer studies have been widely publicized and their results are well known. Another index of the unusual interest accorded the research is the diversity of specialized research interests of the scientists themselves who are becoming involved in doing the research. It is rare that an area seems to promise so much to specialists of so many persuasions and viewpoints. This curious heterogeneity of background has a number of implications. The fact of specialized vocabulary and conceptual framework clearly augers a potential of Babel. To avoid misinterpretation and animosity, extraordinary effort toward clear and explicit communication is in order. The recent Office of Naval Research sponsored Symposium on Sensory Deprivation served admirably this cause of effective communication. That scientists of varying backrounds are mutually interested in a common set of behavioral phenomena offers, in principle, some hope that conceptual coordination might occur on a basis more fundamental than mere linguistic agreement legislated by desire for semantic conformity. This noteworthy variability of interest should also prove conducive to efficient discovery and elaboration of findings.

Granted the freedom of caricature, one can illustrate the promise of sensory deprivation research as it might appear to a number of hypothetical extremist points of view.

The clinical psychiatrist and psychologist might view the deprivation condition as one in which a patient will reveal himself to an unusual degree. In undergoing sensory deprivation, a person is automatically deprived of many of the cues to external adjustment and thrown upon inner resources, as it were. In a sense, he is forced into a repressed state of dependency with but limited possibility for acting upon the world about him. By experimentally altering the balance of behavioral adjustments, the clinician may gain insight into the forces in balance and may even have a situation conducive to therapeutic manipulation.

The student of personality theory finds sensory deprivation experiments of potential value in learning how different kinds of people react to the stress of isolation. An individual's ability to endure sensory monotony, and the particular ways he finds to tolerate it, can serve as valuable tests of generalized concepts of personality dynamics.

The physiologically oriented researcher views sensory deprivation as a state of reduced sensory input in some, if not all, modalities. Continuous measures of physiological processes interest him, and he finds experimental deprivation a potentially useful technique to test implications of brain-function models. A good example of this is the concept of arousal and the ascending reticular formation.

An experimental psychologist might tend to view sensory deprivation as an artificially extreme environment and to question how this strangely invariant setting would affect normal response capabilities. Are there

systematic changes in the average person's ability to differentiate stimuli, to maintain alertness and attention, to perceive normally, to think and communicate, to recall previously acquired material and to learn new materials, to exercise independence of judgment and attitude, and so on.

The social psychologist, too, can find particular aspects of interest in sensory deprivation research. By comparing individuals deprived of human company and experiencing a limited perceptual environment with individuals only deprived of human company, useful information can be gained about the strength and conditions of social affiliation, and the relative contribution of the social isolation component to the typical behavioral pattern in the sensory deprivation setting. Of possible interest, too, is the possibility of prior classification and validation of measures of social need, not to mention a whole host of possible experimental manipulations--of recruitment procedure, the nature of the subject's experimental commitment, etc.

Admittedly, these are caricatures to illustrate how different training and interests might direct the researcher to focus upon different aspects of the total problem. Since the classification is so sketchy, I have not attempted to assign individuals to any one category. It is clear that these approaches are not mutually exclusive. Most behavior scientists are interested in all such questions, although to varying degrees. In practice, sensory deprivation research is relatively difficult and costly. An artificial environment must be contrived, subjects must be recruited, and the experiments monitored--not to mention the unique problem that the stimulation involved in data collection may violate the deprivation itself. These practical difficulties tend to limit the rate of study and necessitate assigning priority to aspects of particular interest.

So far, we've seen that many specialists can find promising aspects in the research operations possible in the sensory deprivation experiment. I think it is obvious that they can all lead to valuable research. Our knowledge is still limited in all respects, and it would take a bravely opinionated, if not omniscient, person to argue their respective merits.

Not only are many scientists becoming interested in the phenomena of sensory deprivation research, but a number of practical goals appear to be served by a systematic elaboration of findings. Material and moral support for much of the existent and contemplated research has come from military and governmental agencies motivated to solve practical problems. If deprivation research proves even slightly useful to mental health theory and practice, its contribution will have been very great indeed. Individuals and agencies concerned with penal policy and quasi-prison situations may benefit greatly from the knowledge accrued. It is suspected that performance degradation in vocations such as that of the jet pilot results from such features as homogeneity of sensory environment. Projected plans of manned space vehicles foresee the possibility of a cramped and perceptually monotonous capsule for the space traveler, in addition to such dramatic factors as weightlessness. Assurance of adequate human performance in such settings is of no little value.

Application not only generates research needs, but also guides its strategy. To the degree possible, one attempts to simulate the environment to which one wishes to generalize, as well as the performance features that are critical. For some applications simulation is very difficult, and the research goal becomes the discovery of laws or principles to bridge the applicational gap.

Disregarding classification of research interests and research goals, it is helpful to examine three types of research design occurring in the literature. These are the single-case method, the single-group method, and the multiple-group method.

The single-case method simply involves exposure of an observer, subject, or patient to a deliberately impoverished sensory environment. Characteristic data are obtained in the form of verbal report of the observer or by observations of the subject. Although a straightforward and direct method for achieving descriptive materials, this method is a tricky one for purposes of discovering the behavioral effects of a limited perceptual environment. To illustrate this point with a ludicrously improbable example, let us suppose that one notes a marked tendency to laugh while in sensory deprivation. Described to an onlooker as such, this information is not problematic. John Doe tended to laugh while in deprivation. To state that deprivation caused increased tendency to laugh, however, requires another element--some baseline or standard of comparison. We might need to know how much John Doe laughs ordinarily under other-than-deprivation conditions. For the most part, the distinction between the descriptive and causal statement does not raise difficulty. If behavior reported by the single-case method seems to be extreme, surprising, or bizarre, then the reader is reasonably safe in assuming that the author has made the judgmental reference comparison and is reporting a causal linkage. In the case of subtler manifestations, the reader may find it more difficult to discern whether a causal linkage is intended or to make his own appraisal of its status. My remarks about inference ambiguity of the single-case method are meant only as a caution and not as a rejection of this fundamental exploratory method.

The second method in the literature might be termed the single-group method. It differs from the single-case method in that several persons, rather than a single individual, are exposed to sensory deprivation conditions. The goal of the single-group study is usually a statement or prediction about individual differences or relative behavior under sensory deprivation conditions. One may be interested in determining what kind of person will respond to deprivation with the greatest endurance or tolerance, with the greatest tendency to laugh, or so on. I think it is obvious here that the reader of a single-group study must depend upon the author for cues or must make his own judgment as to any causal relation to deprivation conditions. The single-group method is well suited to its goal of exploring relative behavior during deprivation and has already produced some provocative findings.

The third (multiple-group) method typically designates at least one treatment or condition to serve as a control to the experimental sensory deprivation treatment, using either the same individuals or separate

groups of subjects. The typical use of this approach is to employ a group of subjects to take tests in the same temporal schedule as isolated subjects, but who otherwise pursue a normal schedule of living. In effect, this method defines sensory deprivation experimentally as the difference between experimental and control treatments and evaluates its effect upon behavior. This experimental method is directly suited to causal inference about the effects of the sensory environment. Such inference must, of course, be limited to those dependent variables, tests, or observations which can be secured from BOTH groups of subjects. Additional observations of subjects in isolation can be of value; but the point here is to distinguish between the descriptive accounts whose dependence upon the deprivation regimen must be judged, and the behavioral criteria which experimentally distinguish the groups. For example, what kind of control condition would suffice if one wanted to use endurance of isolation conditions as a criterion?

It goes without saying that the methods can be combined. It is also possible that a variable which correlates well with a single-group criterion, such as isolation tolerance, may not be related to other criteria in the multiple-group method.

Now let me summarize some of the points resulting from the classifications and distinctions which have been advanced.

The fact that the students of sensory deprivation hold many viewpoints is encouraging because of the manifold research attack generated. The results pictured to date are sparse and somewhat puzzling, but there is little danger of injurious overlap of effort. The sensory deprivation experiment holds promise in the direction of clarifying personality concepts, and it may shed light on the basis of social affiliation, the function of the nervous system, and upon the precise character of man's dependence upon a varied environment as a necessary condition for acceptable performance. It may prove valuable as an individual therapy technique and as a basis for assessing and changing man's performance in situations characterized by homogeneity of sensory experience--aircraft, space capsules and prisons.

The way will not be easy. Different conceptual terminologies are used by investigators of specialized interests. The different research methods used necessitate alert discrimination and appraisal of the logical status of the inference permitted. Is any given report a descriptive fact denoting the product of a particular's experience in sensory deprivation, or is it a fact denoting some significant behavioral change attributable to the contrived environment itself? Some of our current studies present descriptive accounts of adventurous explorations of unusual environments. Others deal with the handling of individual differences in reaction to the stress of a perceptually limited environment. Still others seek measures of performance which are experimentally affected by a drastic, as opposed to a limited, decrease in the variety of sensory stimulation.

These many differences in interest, technique, experimental design, and research goal render difficult the task of synthesizing the findings as they emerge. I believe that these differences must be clearly recognized, however, as a basis for determining the type and extent of synthesis that is possible.

Reported Visual Sensation During Brief Exposure to Reduced Sensory Input

by

Thomas I. Myers

Donald B. Murphy

This report comprises the verbatim text of a paper presented by the senior author at the Symposium on Hallucinations held under the joint sponsorship of the Committee on Research of the American Psychiatric Association and the American Association for the Advancement of Science in Washington, D.C., on 27 December 1958. The material presented consists of initial research results employing a technique for objectively measuring the complexity of reported visual sensations.

Reported Visual Sensation During Brief Exposure to Reduced Sensory Input

The Human Resources Research Office, under contract with the Department of the Army, is currently engaged in research on sensory deprivation in Monterey, California. Like many working in this area, we were greatly stimulated by the provocative findings of researchers such as the McGill University group.

Of the many behavioral changes noted by these researchers, the occurrence of the hallucinatory phenomena was, perhaps, the most dramatic. Therefore, it was only natural that we, too, would be most curious about such phenomena and intensely interested in discovering whether we would reproduce them under somewhat different experimental conditions.

Two years ago, and again this fall, we conducted exploratory studies under "dark cell" conditions similar to those made famous by Dr. Jack Vernon of Princeton University. A total of 15 subjects experienced this limited sensory environment, some for as long as four days. A like number of subjects served in a control condition so that test performance changes could be better evaluated. Since we used professional personnel as subjects, they were necessarily somewhat sophisticated and knew of the findings in this research area.

Insofar as the hallucinatory experiences were concerned, the net results of these studies, which involved a sizeable number of man-days, were somewhat disappointing. Reports of light and dark flashes were fairly frequent. One subject described them as similar to a "projector on the blink." However, only a few subjects experienced complex visual sensations or colorful panoramic vistas. No subject ascribed reality status to any of the visual phenomena either during the experiment or later. The images, they said, were similar to those of dreams, but were typically more saturated in hue.

Clearly, we had not obtained the hallucination of classic definition. Colorful dreams and fantasies were reported, but none of our subjects found them compellingly "real." Comparison of our observations to those of the McGill and Princeton studies is most tenuous.

Since none of our subjects reported visual experiences which seemed as gripping and disturbing as the famous marching eyeglasses scene from the McGill study, we believe that our visual experiences were, perhaps, less intense. Roughly, they seemed comparable to the findings of Vernon at Princeton.

If it is true that there are differences between studies in degree of reported visual sensations, then speculation as to reasons for this draw upon a confusing welter of variables. The condition of darkness, as opposed to diffuse brightness, may have accounted for the varying reports. To check this idea, a few of us put on frosted goggles, but again, we did not experience compelling effects.

Other differences between the studies included a host of varying conditions, such as the population sampled, the subjects' sophistication and motivation, the terms of recruitment, the conditions limiting the perceptual experience itself, and the relationship and degree of dependence upon the experimenter during the experiment.

Since we did not experience the compelling, unusually vivid experiences reported by other experimenters, we considered the possibility that idiosyncratic visual experiences may be more common than normally anticipated. In particular, we became interested in the procedures for eliciting and interpreting verbal reports of visual sensations. It may be that in twilight states preceding sleep, or in the unusual circumstances of sensory deprivation studies, visual sensations become noteworthy, even dominating, even though one normally ignores or just doesn't notice them. Certainly it is reasonable to believe that expectancies, biases, and sets on the part of the subject might predetermine the likelihood of his experiencing--or at least of his reporting--the visual events. Among such set factors one might mention the subject's willingness to cooperate in the experiment, his eagerness to conform to what he thinks is expected of him, and his expectancies regarding the deprivation experience itself--as influenced by rumor and by facts and attitudes communicated to him during his recruitment and orientation.

We decided to evaluate some of these factors. The major contribution to this work has been Dr. Donald B. Murphy, assisted by Mr. Ed Kandel and myself. The research was designed so that we could examine the influence of certain "set" variables upon the number and complexity of reported visual sensations. Specifically, the variables were prior verbalization and instructions. Also it should be pointed out that none of the studies reporting hallucinations under sensory deprivation conditions provided any comparison data as to the incidence of such experiences under normal or minimal deprivation conditions. To be sure, it is difficult in some cases even to conceive of a relevant control experience; but unless some baseline is used, we must be content with descriptive statements as to "occurrence of visual experiences," rather than to conclusions of the order, "sensory deprivation conditions produce a greater incidence of hallucinatory effects."

This methodological point generated two considerations regarding this research. First of all, we planned to place subjects under minimal deprivation conditions, so that we could get at least a crude indication of baseline frequency of visual events. Secondly, our strong bias toward experimental analysis of sensory deprivation has forced us to seek a technique which might be just as applicable to control group subjects as to experimental subjects undergoing sustained deprivation.

The first experimental variable, prior verbalization, was defined as individual practice in "seeing things" on a projective test and describing them to an experimenter. For the second variable, two sets of instructions were used. One was designed to produce a positive expectancy

of visual sensations, while the other was intended to produce negative expectancy with respect to visual events.

The research was conducted upon 80 psychiatrically normal Army basic trainees who were in their early 20's and who had above-average ACB scores. One-half of the sample, 40 men, was given a pretest, ostensibly a part of another experiment. This pretest consisted of Rorschach cards VIII, IX, and X, and the subjects were encouraged to verbalize freely about what they saw in the cards. The other half of the sample had no pretest Rorschach experience.

The Ror group and the Non-Ror group were then divided into positive or negative expectation groups. Thus, there were four groups of 80 men each. The positive instruction groups were told that it is normal to experience visual sensations in the absence of external light, and that the experimenter wished the subject to attend to and describe his visual sensations. The negative instruction groups were told that only psychiatric patients reported seeing things in the absence of external light.

Subsequently, the subject put on a pair of opaque goggles and lay on a bed in a semi-lightproofed room. After leaving him alone under these conditions for 10 minutes, the experimenter asked the subject, by means of an intercom system, several questions to assure that he was awake. The subject was then asked to describe the visual sensations he was actually experiencing. If, after one minute the subject had said nothing, the request was repeated. If the subject had been talking during the first minute, the experimenter said, "You're doing fine." If the subject was silent for four consecutive minutes, this phase of the subject's participation was concluded, otherwise he was allowed a 15-minute reporting period.

Protocols were typed from the tape recorded reports, and then keyed. A technical assistant scored the protocols by first bracketing the word groups which reported the occurrence of a visual sensation, and second by assigning one of four content categories to each bracketed area.

The content categories were chosen on the basis of other deprivation experiments and by examination of the sensations reported by our subjects. The categories can be differentiated on the basis of complexity. From least complex to most complex, they are: (1) lines, dots, and diffuse light; (2) geometrical designs; (3) isolated objects; and (4) integrated scenes.

In evaluating our results, we first considered the number of visual sensations reported and then their complexity. The total number of sensations reported for each of the four treatment combinations and the results of the statistical analyses are shown in Table 1.

More than twice as many visual sensations were reported by the positive instruction groups as by the negative instruction groups ($P < .01$).

Table 1

Number of Visual Sensations Reported
in Each Treatment-Combination

Instructions	Prior Verbalization: Non-Ror	Prior Verbalization: Ror
Pos.	N = 20 ΣX = 340 M = 17.0	N = 20 ΣX = 297 M = 14.8
Neg.	N = 20 ΣX = 162 M = 8.1	N = 20 ΣX = 146 = 7.3

Analysis of Variance

Source of Variation	df	MS	F	P
Instruction	1	1353.01	7.61	< .01
Prior Verbalization	1	43.51	--	
Instr. x Prior Verb.	1	9.12	--	
Within cells (error)	76	177.77		
Total	79			

However, prior verbalization on the Rorschach had no significant effect on the number of sensations reported.

Further examination of our data suggested that if a subject reported a Category 4 sensation, he also reported sensations in the less complex categories; i.e., Categories 3, 2, and 1. Similarly, if a subject reported visual sensations in Category 3, he also reported visual sensations in Categories 2 and 1. This observation suggested that the categories formed a Guttman-type cumulative scale having to do with the complexity of the verbal report. Analysis showed, using Guttman's technique, that the coefficient of reproducibility was .94. This level of reproducibility seemed to warrant the use of a scaling procedure in which each subject was assigned a complexity-of-report score. Consequently, we assigned "scale scores": 4 to subjects who reported sensations in all four categories; 3 to subjects who reported sensations in the first three categories; and so forth.

The scale scores for the four treatment combinations and the results of the statistical analyses are shown in Table 2.

According to statistical analysis, positive instructions were found to produce more complex reports than negative instructions ($P \leqslant .025$), whereas prior verbalization had no significant effect on the complexity of the verbal report.

In order to learn more about the instruction variable, we ran additional subjects under a neutral, non-Rorschach condition, where subjects were merely told to describe any visual sensations they might experience in the dark. We found that the mean number of sensations, as well as the mean scale scores for this group, fell midway between the means for the positive and negative instruction groups.

Two assistants independently scored the protocols and agreed 80% of the time on the number of reported visual sensations; and 78% of the time on scale scores.

The results of this experiment indicate that when non-psychiatric subjects are isolated in the dark for 10 minutes, they report "seeing" a variety of visual sensations. Reports of visual sensations, even when the effects of deprivation can be assumed to be very minimal, appear to be relatively normal phenomena and do not appear to be solely the result of sustained sensory deprivation.

It was shown that the type of instruction given the subjects significantly influenced the frequency and complexity of reported visual sensations. Whether the positive instructions resulted in an increase in visual sensations actually "seen," or simply in an increased readiness to report, could not be determined. In view of these results, we are inclined to take the position that, in addition to potential sensory deprivation effects, implicit or explicit sets associated with experimental conditions may markedly affect the frequency and/or complexity of the

verbal report of visual sensations. It is interesting to note that even under the most prohibitive conditions--negative instructions--the subjects reported an average of 7.7 visual sensations during the reporting period.

For the prior verbalization variable, "seeing" things on the Rorschach appeared to have no significant effect on the number or complexity of reported visual sensations. This negative finding may be of some consequence to those anticipating testing subjects prior to a deprivation experience.

In summary, then, it may be said that these findings suggest caution in ascribing reported visual sensations to the stress of sustained deprivation alone, and that attitudinal or "set" variable of instructions affected the number and complexity of reported visual sensations under conditions of minimal sensory deprivation. However, none of the visual sensations reported by the subjects used in this study had the characteristics of the hallucinatory behavior of the mentally ill; that is, there was no indication that subjects acted upon, or accepted as reality, the sense data of the visual sensations.

Table 2

Scale Scores of Ss in Each Treatment Combination

Instructions	Prior Verbalization: Non-Ror	Prior Verbalization: Ror
Pos.	N = 20 ΣX = 44 M = 2.20	N = 20 ΣX = 54 M = 2.70
Neg.	N = 20 ΣX = 30 M = 1.50	N = 20 ΣX = 37 M = 1.85

Analysis of Variance

Source of Variation	df	MS	F	P
Instruction	1	12.01	6.13	$<.025$
Prior Verbalization	1	3.61	--	
Inst. x Prior Verb.	1	.12	--	
Within cells (error)	76	1.96		
Total	79			

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A Technique for Studying Attitude Change

by

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A major finding of the original studies of a limited perceptual world was the willingness of confined subjects to expose themselves to and to be influenced by recordings advocating the existence of ghosts, poltergeists and similar phenomena. This finding of heightened influence of propaganda is of such import and relevance to the mission of Task ENDORSE that follow-up and extension studies have been planned of the effects of propaganda upon attitudes of subjects in a sensory-reduced as opposed to a normal sensory environment. Efficient conduct of these studies required propoganda material and attitude measurement techniques of demonstrable sensitivity.

This report describes propaganda materials and attitude change measures whose sensitivity has been experimentally validated. As such, its main value will be to other research personnel who may have need for similar techniques. The present experiment was conducted as one of the Task ENDORSE pilot studies aimed at appraising the effects of sensory deprivation. The study was planned and data collected in the summer of 1960. The text is taken from a paper read to the Western Psychological Association in 1961.

A Technique for Studying Attitude Change

This is a report on the development of a technique for studying attitude change. The need for such a technique was derived from a project at the U.S. Army Leadership Human Research Unit (HumRRO), Presidio of Monterey, California, involving the assessment of the effects of a limited sensory environment, i.e., an environment marked by a dearth of sensory stimulation and by the absence of human companionship. As part of this project we wanted to examine the potency of propaganda materials in bringing about a change in attitude in experimental Ss confined in dark, quiet cubicles for several days as compared with control Ss living a normally active life. Since an available technique would have saved us several months of examining and testing the feasibility of several attitude change techniques, one of which is reported here, I hope this information may prove to be useful to others facing a similar need.

Initially, in our search, it appeared that the most desirable topic for propaganda purposes would be one on which Ss expressed relatively homogeneous and extreme attitudes, and which, for obvious reasons, would not conflict with or offend religious, social or governmental agencies. With such a topic a single propaganda script could be pitched at a point some distance from the initial attitudes of all Ss and the effects of the propaganda treatment estimated. However, upon examination, a preponderance of suitable topics appeared likely to elicit attitudes ranging from strongly favorable to strongly unfavorable and, more importantly, there was no way of knowing in advance the distribution of attitude scores. For example, on one topic given a trial run, we found that the initial position of 50% of the Ss coincided with the bias of the propaganda, thus ruling out, for this subsample, any possible change in attitude due to propaganda. Thus, in order to utilize maximally the scores of all Ss, we were interested in preparing <u>both</u> positive and negative propaganda scripts of similar potency, i.e., propaganda which would produce significant changes in attitude when compared to a no propaganda control group. Each script could then be directed at the sub-group most likely to be affected by it, i.e., Ss initially favorable would get the negative propaganda and those initially unfavorable would get positive propaganda.

Another feature required of the technique was a measure of attitude, to be administered both prior to and following exposure to propaganda, which would reflect a shift in attitude resulting from the propaganda. A requirement specific to the deprivation study was for propaganda materials which could be tape recorded and presented over an intercom system, and an attitude change measure amenable to a standardized auditory presentation.

A study to evaluate a technique developed to meet the above requirements was conducted as follows.

The Ss were 97 male Army inductees at Ft. Ord, California who had scores on a subtest of the Army Classification Battery which placed them in the upper 40% of the Army in intelligence. The Ss participated in a multiple-test project during their 8 hours at the HumRRO unit, but always took part in the attitude change study prior to any other study. Precautions were taken such that it was highly unlikely that Ss within a day's run could contaminate as yet untested Ss, or that Ss on a given day's run could communicate with Ss arriving on subsequent days.

Ss were first given a pre-propaganda test of their attitudes toward a number of national groups, e.g., Spaniards and Armenians, in addition to the national group selected as the propaganda target, in this case, the people of Turkey, or Turks. The measure of attitude was a paper and pencil form of Osgood's Semantic Differential in which scales for the evaluative, potency and activity dimensions were used. The three scales for each dimension were selected on the basis of Osgood's data and were chosen from those having high factor loadings on the dimension. The propaganda scripts used adjectives, adverbs and verbs aligned as much as possible with the evaluative dimension and our intent was to have a change in attitude reflected in the evaluative dimension rather than in the other two. For the evaluative dimension with which we were concerned, the scales used were good-bad, pleasant-unpleasant, and clean-dirty. Scores on the three scales ranged from a high score of 21, indicating a strongly unfavorable attitude towards the Turks to a low score of 3, suggesting a very favorable attitude towards the Turks.

Following the pre-propaganda attitude measure Ss were taken in groups of eight and placed in individual rooms where they heard propaganda recording over the intercom system. Of the Ss who were initially unfavorable towards the Turks, a random selection listened to 12 taped repetitions, randomly distributed throughout a 75 minute listening period, of a three minute pro-Turkey recording. The remaining Ss unfavorable to the Turks spent 75 minutes in the individual rooms but heard no recordings. In a similar manner, a random selection of Ss initially favorable toward the Turks listened to 12 repetitions over a period of 75 minutes, of a 3 minute anti-Turkey recording. The remaining Ss who were initially favorable spent 75 minutes in the rooms but heard no recordings.

Thus, there were four treatment groups. Ss who were initially unfavorable comprized two groups, one of which received pro-Turk-propaganda and the other received no propaganda. Of the Ss initially favorable there were also two treatment groups, one of which received anti-Turk propaganda and the other no propaganda.

Following the recordings Ss were instructed, by means of a recording played over the intercom system, to rate each of a number of national groups. This post-propaganda test was essentially an auditory form of the earlier test, and contained the same national groups and semantic differential scales. The Ss indicated their judgment by pulling the lever of a Lindsley manipulandum from 1 to 7 times.

Subsequent to the post-propaganda test, the two groups hearing the recordings were given a test of verbatim recall of the prose material.

The pre-propaganda attitude scores for the four groups can be found in Tables 1 and 2. The pre-propaganda scores for the two groups initially favorable to the Turks did not differ significantly. The same was true for

the two groups initially unfavorable to the Turks. The statistical analysis was performed on the data in these two tables and the results are presented in Table 3. Essentially, the interaction term in each analysis may be interpreted as indicating that the groups receiving propaganda showed a significantly greater shift in attitude (probability was less than .001) in the intended direction than did the groups without the propaganda.

Table 1

Pre and Post Attitude Means for the Two Treatment Groups Composed of Ss Initially Unfavorable to "Turks"

	Attitude Score*	
	Pre	Post
Pro-Turk Prop. Grp.	14.11	8.36
No Prop. Grp.	14.04	12.77

Table 2

Pre and Post Attitude Means for the Two Treatment Groups Composed of Ss Initially Favorable to "Turks"

	Attitude Score*	
	Pre	Post
Anti-Turk Prop. Grp.	8.27	13.40
No Prop. Grp.	8.43	8.93

* High Score - unfavorable attitude
Low score - favorable attitude

Table 3

Analysis of Variance of Attitude Data in Tables 1 and 2

Source	Table 1			Table 2		
	df	Mean Square	F	df	Mean Square	F
Between Ss	53			42		
Prop-No Prop	1	127.2	10.54*	1	90.70	8.14*
error (b)	52	12.07		41	11.14	
Within Ss	54			43		
Pre-Post	1	348.5	52.80**	1	96.3	16.57**
Interactinn	1	135.3	20.50**	1	104.9	18.06**
error (w)	52	6.6		41	5.81	

*Denotes significance at <.01 level; ** at <.001 level.

(The authors will be pleased to provide test instructions, sample test materials, and propaganda scripts upon request.)

Additional information was available to assist in interpreting attitude change as obtained by this technique. We were interested, for example, in whether the change in attitude was specific to "Turks" or whether the Ss getting the propaganda also shifted systematically on their ratings of other national groups. The pre-propaganda distribution of attitudes towards the Armenians, another national group in the list, was similar to that for the Turks. However, the propaganda groups did not show a significant differential shift in attitude with respect to Armenians when compared with the control groups. Since the propaganda had been tailored to produce changes in the evaluative dimension primarily, we were also interested in whether the changes in attitude were specific to this dimension or whether they were reflected in the other two dimensions as well. Consistent significant differences in attitude shifts between the propaganda and the no propaganda groups were restricted to the evaluative dimension, although there was some evidence of change on the activity dimension.

Since there was an element of forced indoctrination in this study, i.e., the propaganda material was repeated 12 times, we were interested in finding out if a similar shift in attitude would occur if the Ss were permitted to request the same propaganda materials as often as they liked during the 75 minute period. Essentially the same experimental design used in the first study was carried out and highly similar outcomes (both in terms of direction and level of significance) with respect to attitude change were obtained.

In the forced propaganda study we found a small positive correlation between the verbatim recall scores and attitude change. In the free choice study there was a small positive correlation between the number of times the material was selected and attitude change. Both findings suggest that although attitude change is related to frequency of repetition and to recall of the material, these measures do not account for a substantial portion of the observed shifts in attitude.

In summary, then, a technique for studying attitude change was developed and tested. The essential elements of the technique are: (1) positive and negative propaganda material of similar potency in producing a change in attitude; and (2) a test for measuring attitude both prior to and following exposure to propaganda.

A Simple Tracking Apparatus for Classroom or Experimentation

by

Seward Smith
Paul M. Haas

A Simple Tracking Apparatus for Classroom or Experimentation

An inexpensive and easily constructed apparatus for use in investigating perceptual-motor performance has been developed as a part of Task ENDORSE, a research project investigating sensory deprivation and social isolation. It was designed to evaluate the ability of Ss undergoing a several day period of voluntary isolation to perform, in comparison with a control group, a relatively simple one-dimensional following tracking task and a simultaneous, competing task requiring the turning off of a frequently presented tone. However, programmed in a simple fashion, the tracking apparatus could provide an interesting addition to equipment used in experimental laboratory courses. In a more elaborate form the apparatus could furnish an inexpensive means for investigating various aspects of perceptual-motor skills.

The tracking apparatus is housed in a masonite box. The display is pr - vided by two non-optical devices, one projecting the image of a circle, and the other a cross hair, onto the white wall at the back of the box. The circle is moved up and down by a lever and cam arrangement which is driven by a two RPM motor. The cross hair is connected to a small control stick by which it can be moved up and down. The task requires S to attempt to keep the cross hair centered on the circle. See Figure 1 for a general view of the apparatus.

A scoring zone is provided using a transistorized photocell circuit operating a scoring relay. The photocell senses the relative positions of the concentric shafts upon which the two display units are mounted. See Figure 2 for the relationship among the components.

The images are created by placing cardboard, punched with the appropriate geometric figure, at the front end of a short tube which has been painted flat black inside. Light is furnished by a bulb with a single strand filament. The bulb is mounted at the other end of the tube and is oriented so that the filament is parallel to the sides of the tube. When this is accomplished, the image can be projected to a distance of several feet with clarity and minimal stray light. See Figure 3 for details of a projector unit.

Because the tracking device was designed to be used in a dark room, a low intensity light source was used. In order to use the device in a well lighted room some sort of shield and/or brighter bulbs would probably be necessary.

The devices used in this research program were automatically programmed by means of a 35mm punched tape. At the beginning of a trial the display lights (the circle and the cross hair) were turned on. After the target circle remained motionless for a moment (to allow S to get on target), the program cam mechanism began to move the circle, and the scoring circuit was activated. At the end of the trial the display darkened again and remained dark for the duration of a short rest period, after which the cycle began again.

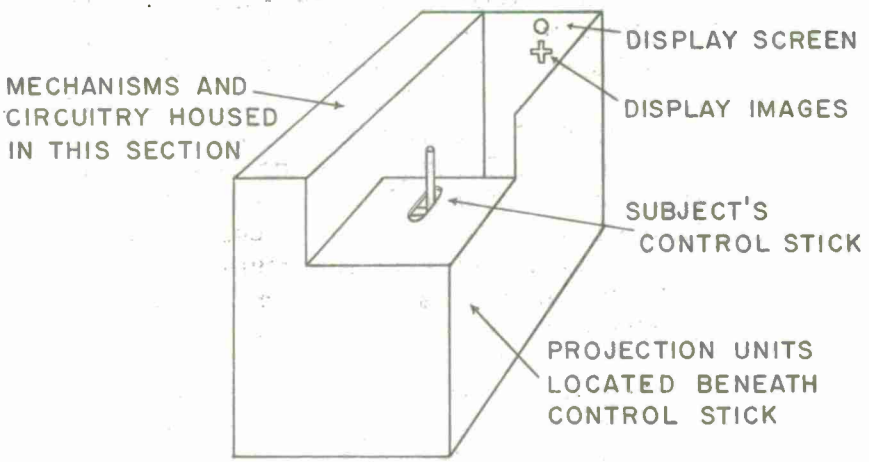

FIGURE 1

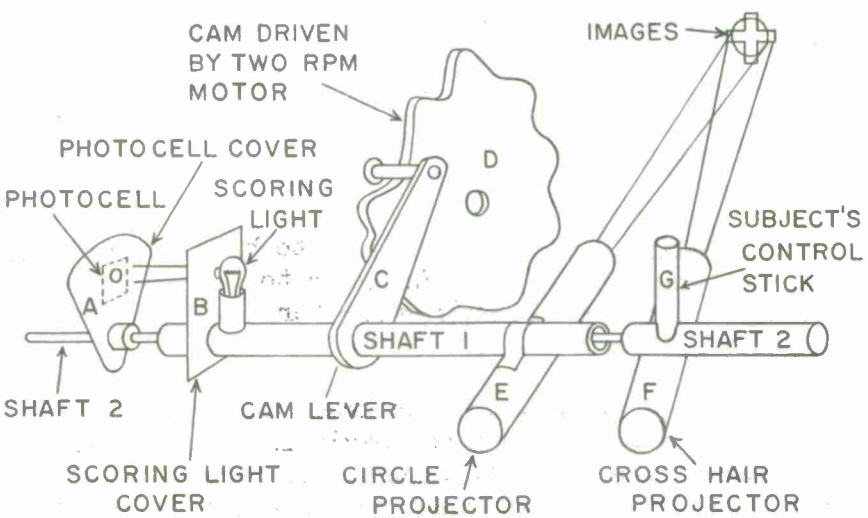

FIGURE 2

The competing task was designed to increase the complexity of both the perceptual and the motor performance components required. Using another channel of the punched tape, the onset of a 500 cps tone to S's room was programmed. By pressing a switch mounted on the left side of the box, S tried to turn off the tone as quickly as he could each time it appeared. Once it was turned on by the punched tape, the tone was kept on by a holding relay which could be de-energized by depressing S's switch.

Three scores were recorded at the end of each trial; time on target in the tracking task, time the tone was off, and the time that both of these conditions were simultaneously met. Scoring proceeded automatically using print-out counters receiving their counting impulses from a multi-vibrator set to provide ten impulses per second. Scores thus accumulated at a rate of ten impulses per second that S was, for example, on target in tracking.

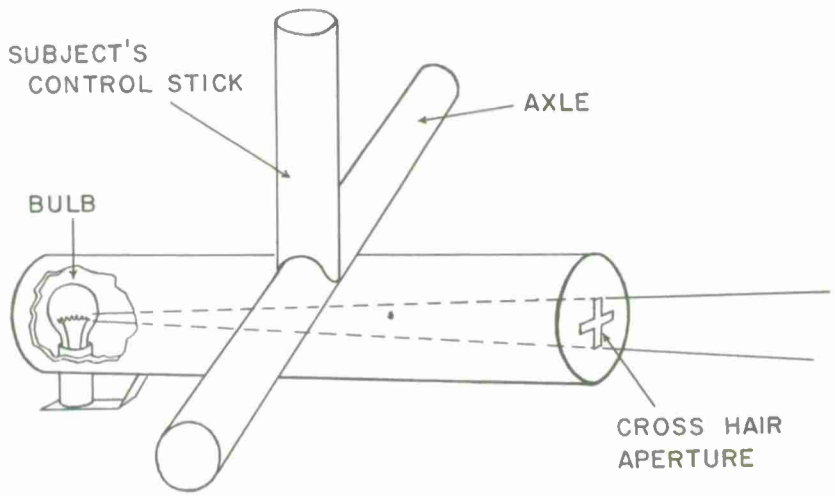

FIGURE 3

The tracking task could be very simply programmed for use in the classroom. For example, a single on-off switch could be provided which would control the display lights, the cam motor, and the scoring circuit. Performance could be scored by connecting a standard electric timer to the scoring relay. Satisfactory photocell circuits to operate the scoring relay can be found in nearly any book of circuit diagrams, e.g., Gardner, 1956.[1] Other scoring systems, such as a wiper switch arrangement which makes contact only when S is on target, could be substituted if preferred.

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[1]Gardner, L. E., Transistor Circuit Handbook. Chicago: Coyne, 1956.

Although many factors determine the difficulty of the task, it should be easy to develop a moderately difficult tracking program which will lead to a stable level of performance in a few trials. For example, using such a program with twenty-second trials and ten-second rest periods, pilot study data indicate that it is possible to gather stable performance measures in as few as sixteen to twenty trials.

By requiring simultaneous performance on the task of turning off the tone, a considerably more complex total task could be derived. In pilot studies to date, performance on the tracking task was significantly reduced by the addition of the competing task. A variable complexity device such as this might prove to be valuable in the study of such problems as the potential breakdown of perceptual-motor performance under increasing levels of stress.

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by

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