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THE UNIVERSITY OF OKLAHOMA

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THE EFFECTS OF SENSORY DEPRIVATION ON INTELLECTUAL EFFICIENCY AS A FUNCTION OF PERSONALITY

A DISSERTATION

SUBMITTED TO THE GRADUATE FACULTY

in partial fulfillment of the requirements for the

degree of

DOCTOR OF PHILOSOPHY

BY

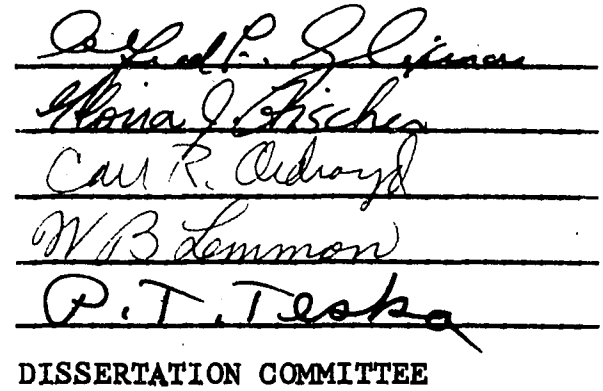
IRA GOLDBERG

Norman, Oklahoma

1961

THE EFFECTS OF SENSORY DEPRIVATION ON INTELLECTUAL EFFICIENCY AS A FUNCTION OF PERSONALITY

APPROVED BY



DISSERTATION COMMITTEE

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THE EFFECTS OF SENSORY DEPRIVATION ON INTELLECTUAL EFFICIENCY AS A FUNCTION OF PERSONALITY

CHAPTER I

INTRODUCTION

The major purpose of this study is to determine whether intellectual impairment which follows sensory deprivation depends on personality factors.

Despite the current interest in the area of sensory deprivation, it is interesting to note that prior to 1953 there were no reports concerning the effects of experimental sensory deprivation on healthy, "normal" individuals. Until that time, information was available only through autobiographical accounts by polar explorers, solitary sailors, lifeboat survivors, and by individuals who spent long periods of time in solitary confinement. Lilly (1956) has reviewed some of these accounts, and he reports that many of these individuals experienced unusual changes in perception, thinking, and feelings.

Currently a great deal of confusion and uncertainty exists concerning the effects of experimental sensory deprivation or isolation on intellectual efficiency. The results of some studies have indicated that sensory deprivation leads to in-

tellectual impairment while the results of other studies have suggested that this impairment does not exist. Two contrasting approaches to the problem have appeared. One approach attempts to study the effects of sensory deprivation with no attempt to take into account the influence of individual personality characteristics; a second approach has been concerned with the interrelationship among personality, sensory deprivation, and intellectual efficiency, considering the interaction the most fruitful area of exploration.

Review of the Experimental Literature

Studies which have not been concerned with the role of personality. Since 1953 a series of studies have been reported by experimental workers at McGill University (Bexton, Heron, & Scott, 1954; Doane, 1955; Heron, Bexton, & Hebb, 1953; Heron, Doane, & Scott, 1956; Scott, 1954). The impetus for these studies according to Heron (1957) stemmed from the occasional failure of radar operators on anti-submarine patrol to detect U-boats during World War II. These individuals worked in isolated northern bases and were exposed to an extremely monotonous environment for long periods of time. For practical reasons, therefore, in the McGill studies "the purpose was not to cut individuals off from any sensory stimulation whatever, but to remove all patterned or perceptual stimulation, so far as we could arrange it" (Heron, 1957, p. 53). The basic isolation conditions have remained essentially the same for all

these studies and has been referred to as the "McGill type" of isolation situation. Subjects were isolated by being placed on a comfortable bed in a lighted cubicle. Auditory perception was limited by the continuous hum of air-conditioning equipment and by means of a U-shaped pillow on which the subjects rested their heads. Their arms were placed in cardboard containers and cotton gloves extending beyond the fingertips were placed on their hands. Their eyes were covered with translucent ski goggles thus permitting some light stimulation in the partially lighted room but no patterned vision was possible. The subject's bed provided tactual stimulation, the light provided some visual stimulation, the hum of the airconditioner and the oral tests administered through the intercommunication system provided a high degree of auditory stimulation. The effects of these stimuli and of those that accompanied feeding and periodic urination and defecation are not clear. Suffice it to say that the normal input of sensory stimulation for each individual was drastically reduced.

The results of the McGill studies are consistent in indicating the effects of partial isolation on thinking, intellectual efficiency, emotionality, imagery, and on visual perception. Most subjects tended to spend the earlier part of the experiment in sleep; boredom set in after sleep lessened. "This boredom seemed to be partly due to deterioration in the capacity to think systematically and productively"

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(Bexton et al., 1954, p. 71). The experimental subjects became less efficient than control subjects in answering simple arithmetic problems, completing a group of number series, and in solving anagrams during isolation. They also did significantly poorer on a Kohs block test and a digit symbol test taken after emergence from isolation. Subjects also tended to become irritable toward the end of the experimental period, and some had marked mood swings. Fourteen subjects reported hallucinatory experiences consisting of simple geometric patterns, dark to light colors, or dots of light. Half of these subjects reported seeing isolated figures or objects without a background. Three subjects reported visions of integrated scenes, one reporting "a procession of squirrels with sacks over their shoulders marching 'purposefully' across a snowfield and out of the field of vision" (Bexton et al., 1954, p. 74). Some auditory hallucinations were also reported, and four subjects reported feelings of bodily strangeness, "otherness," and doubling of the body image (as if, for each subject, another body were lying along side him). Several subjects developed paranoid ideas, one had a seizure-like episode after five days in isolation, and several showed EEG changes normally exhibited in conditions of reduced consciousness. Heron (1957) also reports that, when subjects emerged after several days of isolation, the whole room appeared as if it were in motion. In addition, surfaces appeared curved and objects appeared to be changing their size and shape.

Investigating these visual phenomena further, Heron et al. (1956) exposed themselves to prolonged isolation in the "McGill type" of situation. They found extreme visual disturbances upon emerging from isolation. Fluctuation, drifting, and swirling of objects and surfaces in the visual field were reported. Shapes, lines, and edges appeared distorted and the position of objects seemed to change with head or eye movements.

Doane (1955) compared a small group of subjects who were isolated as described above with a comparable group who wore a translucent mask but no gloves or cuffs. This latter group was not confined to a cubicle and was encouraged to walk, listen to music, and converse. Significant changes for both groups were found on tests of figural after-effects, size constancy, autokinetic effect, color adaptation, and after-movement. It was concluded that specific visual isolation was the cause of the perceptual difficulties and that disturbances in perception may result "whenever patterned perception is held below an optimal level, regardless of whether the conditions interfering with perception are in the form of tissue damage or environmental restriction" (Doane, 1955, p. 54). This study tended to confirm the findings of Hochberg, Triebel, and Seaman (1951) who, while exploring the Ganzfeld effect noted that some subjects reported the appearance of hallucinatory shapes or objects during the course of visual adaptation. Several of these subjects were convinced that these shapes

had been introduced as part of the experimental procedure.

Using the "McGill type" of isolation situation for his 29 experimental subjects, Scott (1954) investigated the intellectual effects of perceptual isolation. He administered a battery of orally presented intellectual tasks at varying times during isolation and also administered a post-isolation test battery. It was found that all subjects reported subjective impressions of cognitive impairment and confusion in thinking. Some of these feelings lasted for several days. Scott also found a significant loss of efficiency on tests given immediately after completion of isolation. In the isolation situation, the average performance was poorer; however statistical significance appeared only on wordmaking and anagram tasks. Scott states, "The evidence is best summed up by saying there was a general disturbance in the relationship between the individual and surroundings. This was most marked when the subject was called upon for well-organized adaptive behavior" (Scott, 1954, p. 45). Scott also found evidence of hallucinatory activity and disturbance of the body image, incidental to his major findings. He concludes, "Without a range of stimuli to give variety to the sensory environment, adaptive, efficient behavior cannot be maintained. Without such variety, and its supportive, non-specific effects, a profound disturbance of behavior occurs, both cognitive and motivational" (Scott, 1954, p. 49).

In a series of studies at Princeton University, subjects were confined to a small room which was lightproof and in which there was an 80 decibel sound loss. In the first reported study (Vernon, 1956; Vernon & Hoffman, 1956), subjects received no light stimulation throughout the 48 hour period of isolation. A subject's ability to learn 12-item adjective lists by the anticipation method was determined prior to isolation, after 24 and 48 hours of confinement, and also 24 and 48 hours after emergence from isolation. The results indicated that there was improvement in learning the adjective lists with continued isolation. In contradistinction to the McGill studies, no hallucinatory experiences were reported, subjects did not report thinking or visual difficulties, and there were no reports of saturation of colors upon conclusion of isolation. Also there was no loss of three-dimensional perception and there was no increase in suggestibility as had been previously reported by Bexton et al. (1954) and Heron (1957). The authors suggest that differences in confinement conditions may have been responsible for these divergent results. All subjects were confined for 48 hours, while in the McGill studies confinement lasted up to 72 hours. Further, all subjects in the study by Vernon and Hoffman (1956) knew beforehand what the duration of confinement would be. Also, during the period of confinement subjects were allowed to move around. It is interesting to

note, however, that the lack of impairment on associative learning tasks is somewhat in agreement with the results of Scott's study (1954) in which no significant impairments were found in tests of associative learning, digit span, and analogies.

In a second study the Princeton group (Vernon, McGill, & Schiffman, 1958) attempted to discover the conditions of perceptual isolation under which different kinds (i.e. simple or complex) of hallucinations were most likely to occur. The incidence of hallucinations was determined by a post-isolation interview and judges who listened to recorded data independently decided on the existence of hallucinations for each subject. One group of subjects was confined to a "McGill type" of isolation situation except for the absence of any light stimulation during isolation. It was later discovered that all of these subjects reported light leaks through the blindfold which they wore when conducted by the experimenter to the toilet in another room. Because of this, a subsequent group of subjects remained in a dark cubicle during the entire confinement. They ate meals from a portable icebox and took care of their excretory needs by means of a chemical toilet within the cubicle. The results indicated that six out of nine subjects in the first group experienced hallucinations while only one of the 11 subjects in the second group reported an hallucination, and there was considerable doubt about this. There

were no complex hallucinatory experiences as reported by subjects in the McGill studies, and the authors feel that the shorter confinement of their subjects played some part in producing this difference. More important is the fact that the McGill subjects were confined in a lighted cubicle wearing translucent goggles which allowed perception of diffuse light. The authors agree with the findings previously cited (Hochberg et al., 1951) that diffuse light without the presence of patterned vision is sufficient to produce hallucinations. They conclude, "Confinement permitting a great deal of visual stimulation but not pattern vision, produces not only the greatest number but also the greatest variety of hallucinations" (Vernon et al., 1958, p. 34). Apparently the difference between the two groups had to do with light stimulation vs. absolute darkness as the crucial variables.

In their last reported experiment the Princeton group (Vernon, McGill, Gulick, & Candland, 1958) explored the effects of isolation on perceptual and motor skills. The isolation situation was again similar to the "McGill type" except for the absence of any kind of visual stimulation. Paid subjects were tested after 24, 48, and 72 hours of confinement, and their scores were then compared with the scores of a control group of subjects who did not undergo isolation. The results indicated that sensory deprivation had significant effects on tests of rotary pursuit ability, color perception, motor co-

ordination, mirror tracing, and on galvanic skin response. No impairments were noted on tests of depth perception, strength of grip, and delayed auditory feed-back.

Hebb, Heath, and Stuart (1954) explored the generalized effects of a sharp loss in hearing with no reduction in other areas of stimulation. Cotton impregnated with petroleum jelly was placed in the ears of six subjects who then carried on their usual routine. Subjects kept records of their activities over a three-day week-end. In addition, retrospective accounts were obtained. From the diaries and retrospective accounts it was found that, despite wide individual differences among subjects, some generalized effects were noted. Physical discomfort, an inability to speak with normal volume, and a temporary loss of motivation was noted in several subjects. In general, there were great individual differences in attitudes and emotions, varying from slight emotional effects to marked irritability. Seclusiveness, inferiority feelings, feelings of inadequacy, and anger were all found in varying degrees. The authors conclude that a "sudden lowering of normal auditory input has shown clear evidence in this experiment . . . of a disturbance in behaviour that does not directly require auditory acuity for its guidance. The degree of this effect, and its form, may vary greatly from subject to subject" (Hebb et al., 1954, pp. 155-156).

Solomon, Leiderman, Mendelson, and Wexler (1957) have reported on a study of a group of poliomyelitis patients who required treatment in a tank-type respirator. They report that after 24 to 48 hours some mental symptoms occurred which consisted of well-organized visual and auditory hallucinations and delusions. These symptoms lasted 10 to 15 days and recovery was spontaneous regardless of physical improvement or of continued existence in the respirator. The symptoms were worse at night and better during feeding, visiting, and psychotherapy. There were no febrile, anoxic, toxic, or metabolic disturbances which could account for these phenomena. The authors indicate that, under this condition of isolation, vision is restricted to a limited area, the patient lies in the same position, and the rhythmic sound of the tank motor and bellows provides the dominant auditory stimulation. "Thus the patient is restricted in terms of visual, auditory and kinesthetic sensation, and suffers a corresponding degree of perceptual deprivation" (Solomon et al., 1957, p. 362). Since the stimuli in this case were both unvarying and repetitive and there was no elimination of form and patterned stimuli, the authors characterize their situation as an "imposed structuring of stimuli" as compared to the McGill studies which reduced the patterning of stimuli.

Mendelson, Solomon, and Lindemann (1958) analyzed the content of transitory hallucinations and delusions experienced

by eight poliomyelitis patients confined to a tank-type respirator. They found visual, auditory, tactile, kinesthetic, and (in one case) olfactory and gustatory symptoms. In most cases these experiences were perceived as pleasant and "could be interpreted as a protective anticipatory device for supporting the ego in the stress situations which seemed likely to arise in the future" (Mendelson et al., 1958, p. 427). The authors also point out that the restriction of mobility is common to all sensory deprivation experiments and that this restriction may be as important in the production of mental symptoms as restriction of other senses.

Ormaston (1958) recently tested the hypothesis that compensatory reactions would be produced in individuals who were exposed to extremes of stimulation. Apparent movement thresholds were determined before and after periods of sensory deprivation, sensory bombardment, and waiting in a reception room. It was found that the readiness for stimulation increased under sensory deprivation and waiting in a reception room but decreased under sensory bombardment.

Several studies have recently reported on the influence of suggestion on sensory experiences under conditions of reduced sensory input (Kandel, Myers, & Murphy, 1958; Rosenbaum, Cohen, Dobie, & Gottleib, 1958). Kandel et al. (1958) instructed one group of normal subjects that it was normal to experience visual sensations in the absence of

light. After being exposed to ten minutes of sensory isolation, each subject was asked to describe his current visual sensations. The group that had been told that it was normal to experience visual sensations experienced significantly more sensations than did the other group. Rosenbaum et al. (1958) used a group of normal subjects and two groups of psychiatric patients. After informing them that they would perceive sensations which ordinarily were below conscious awareness, he exposed them to reduced visual, auditory, and tactual stimulation for one hour. Most subjects showed increased sensitivity and tendencies toward hallucinatory distortions of residual cues.

Studies which have been concerned with the interaction between sensory deprivation and personality. Taking note of body image disturbances and other signs of disorganization reported by Bexton et al., (1954), Azima and Cramer (1956) and Azima and Cramer-Azima (1956) investigated the effects of sensory isolation on a group of hospitalized mental patients of varying diagnoses. The authors held the opinion that a planned psychic disorganization in mental patients might have relatively organizing effects and beneficial results. The isolation situation was similar to the "McGill type" in addition to which there were twice per day interviews with a therapist lasting between twenty and thirty minutes. Patients were isolated from one to six days and psychodynamic changes

were investigated through dreams, fantasies, free associations, Rorschach responses, and figure-drawings done repeatedly. Their results indicated that 8 out of 15 patients exhibited symptoms of depersonalization accompanied with varying degrees of visual, auditory, and gustatory hallucinoses. A beneficial therapeutic effect was observed in five depressed cases, the effect lasting in two patients. Several individuals diagnosed as obsessive-compulsive neurotics became acutely psychotic and received electric shock treatments after which improvement of obsessional and paranoid symptoms was noted. The remaining cases showed a moderate increase in motivation, socialization, and self-assertiveness. Aggressive tendencies appeared in all subjects. "This aggression was either overtly expressed, or was surpressed and introverted. In all cases who showed alteration of body scheme, aggressive drives were found to be surpressed and introverted" (Azima & Cramer-Azima, 1956, p. 62). The results of this study are difficult to evaluate since it would appear extremely difficult to separate the effects of psychotherapy from those of sensory isolation.

The data collected from poliomyelitis patients has led researchers at Harvard University to use the tank-type respirator as an apparatus for investigating the effects of sensory deprivation. In the most recent study, Wexler, Mendelson, Leiderman, and Solomon (1958) placed healthy volunteer subjects

in a tank-type respirator. Subjects were paid by the hour for as long as they would remain in the respirator. They were unable to see any part of their body, and their arms and legs were enclosed in rigid cylinders. Although subjects breathed for themselves, the respirator motor provided a dull and repetitive noise. A battery of psychological tests including the Thematic Apperception Test (TAT), the Edwards Personal Preference Scale, the Rotter Sentence Completion Test, and the Minnesota Multiphasic Personality Inventory (MMPI) were given prior to isolation. The length of time for isolation ranged from one and one-half hours to 36 hours. The results indicated that most subjects experienced difficulty in concentration, particularly when dealing with abstract problems and mental arithmetic. Three subjects experienced hallucinations, and five individuals experienced illusions or misinterpretations of perceptual experiences. Five subjects experienced a depersonalizing reaction involving a feeling of change in bodily sensations. As for the test results, none of the possible 16 correlations on the MMPI was significantly related to the length of time spent in the respirator. On the Edwards Personal Preference Scale, it was found that need exhibitionism was negatively related to the length of time spent in the respirator while need affiliation and need nurturance were positively related to the length of time. Subjects who indicated a greater need for being with other people were

those who remained in the tank-type respirator for the longest period of time. Of additional interest is the finding that the greater the manifest anxiety as indicated on the MMPI, the lower was the rate of somatic complaints during isolation.

In one of the most carefully controlled studies presented so far, Goldberger (1958) and Goldberger and Holt (1958a; 1958b) attempted to explore the relationship between personality structure and isolation effects. Fourteen college students, motivated by financial reward, were placed individually in a "McGill type" of isolation situation. Halved ping-pong balls were glued over their eyes permitting a homogeneous visual field in the absence of patterned stimulation. A constant "white noise" produced consistent and unvarying auditory stimulation while masking all outside noises. All subjects were isolated for eight hours after which a post-isolation interview was obtained. The subjects' isolation behavior, verbalizations, and the results of the post-isolation interview were rated independently by two clinical judges along a number of dimensions. These ratings were compared with the individuals' tolerance for and method of handling primary process material on the Rorschach test according to a scoring procedure developed by Holt (1956; 1959). Each subject was given a pre-isolation battery of intellectual tasks consisting of logical deductions, arithmetic reasoning, story recall, and digit span. It was predicted that intellectual impair-

ment would be greatest for subjects who found isolation to be most threatening, disorganizing, and anxiety provoking. It was assumed further that since threat or anxiety stems from potential or actual emergence of the primary process, then successful control of the primary process on the Rorschach should be related to less impairment in test performance during isolation. On the other hand, individuals who exhibit poor control of the primary process on the Rorschach test should exhibit greater intellectual impairment.

The results indicated that the Rorschach measure of the amount of controlled primary process correlated positively with ratings of controlled primary process and pleasant affect and negatively with ratings of unpleasant affect during isolation. Of interest is the finding that of the seven test measures, only the story recall test was significantly related to the Rorschach. Individuals who exhibited a large amount of controlled primary process on the Rorschach correspondingly showed less impairment in reproducing a short, meaningful paragraph. Although all subjects reported difficulties in thinking, there was no general impairment on cognitive tasks. On three out of seven test measures, subjects obtained higher scores toward the conclusion of isolation as compared to their pre-isolation test scores. Significant impairment was found on the logical deductions test which was the only test administered immediately following isolation. This is consist-

ent with the results of the McGill studies where the most significant impairment was also found on post-isolation tasks. In general, subjects in this study had reactions similar to those reported in the McGill studies. Irritability, apathy, anxiety, and an inability to engage in normal, directed thinking were reported by all subjects. Some individuals reported the spontaneous occurrence of visual imagery ranging from simple hallucinatory experiences to fairly integrated scenes. Auditory imagery was reported by half of the subjects, and three individuals reported body image disturbances and feelings of depersonalization. Goldberger concluded:

> The data of this study seem, therefore, generally to support the psychoanalytically-derived hypothesis that continued contact with the structure of reality is necessary for a person to maintain secondary process thinking and to prevent the onslaught of drives, in the form of the primary process. The data further support the assumption that individuals differ significantly in their dependence on reality contact for maintaining secondary process thinking, in the degree to which they can tolerate primary process manifestations in consciousness, and in the effectiveness with which they handle, control, or use primary process material once it is conscious. Specifically, it is concluded that a person who is able to handle primary process intrusions successfully, is also able to deal more adaptively with a situation in which he is temporarily cut off from normal reality contact, than is a person who cannot tolerate or effectively handle the primary process (Goldberger, 1958, p. 66).

Studies which have attempted to reduce levels of stimulation to an absolute minimum. All of the studies reported, so far have attempted to reduce or change the patterning of external stimulation. For this reason, the "McGill type"

approach has been called a "partial isolation" condition. A second approach to the study of sensory deprivation was devised by Lilly (1956) and was later adopted by several other experimenters in the field (Camberari, 1958; Shurley, 1960). This approach involves immersion of the individual in water in an attempt to reduce the level of stimulation to an absolute minimum rather than to reduce the patterning of stimuli. In Lilly's study (1956), subjects were suspended in a large tank of tepid water at body temperature in a relatively soundproof room with all illumination absent. They were naked but wore a translucent latex mask covering the entire head. Breathing was accomplished through several tubes connected to flutter valves which allowed for fresh-air exchange and effortless breathing. Since Lilly used himself and an assistant as subjects, the published report of his experiences are limited for personal reasons. The longest exposure reported was three hours. It was found that for the first 45 minutes the day's residues were predominant. Gradually, relaxation and enjoyment of the experience occurred. During the second hour, tension developed which Lilly calls "stimulus-action hunger." This included hidden methods of self-stimulation. Later, attention was drawn to any residual stimuli such as the slight pressure of the mask. Next, there was a shift from a directed type of thinking to personal reveries and fantasies of an emotionally charged nature. The most dramatic result occurred

when Lilly experienced visual imagery after a two and one-half hour period. He describes this experience as follows:

> The black curtain in front of the eyes (such as one "sees" in a dark room with eyes closed) gradually opens out into a three-dimensional, dark, empty space in front of the body. This penomenon captures one's interest immediately, and one waits to find out what comes next. Gradually, forms of the type sometimes seen in hypnogogic states appear. In this case, they were small strangely shaped objects with self-luminous borders. A tunnel whose inside "space" seemed to be emitting a blue light then appeared straight ahead (Lilly, 1956, p. 7).

Camberari (1958) in a more recent study exposed twenty sophisticated graduate psychology students to a "Lilly type" sensory deprivation situation. Each subject completed a battery of tests of suggestibility. After voluntary termination of sensory deprivation, he was required to write an introspective report of his subjective experiences as well as to complete a questionnaire on his experience. Subjects were divided into two groups on the basis of the cumulative rank score on the tests of suggestibility. The subjects who achieved the ten highest ranks on the suggestibility tests were compared with the subjects who achieved the ten lowest ranks with respect to length of time voluntarily spent in the isolation tank, responses to the questionnaires, and introspective reports. Camberari reports that his subjects did not go through consistent progressive stages of the kind reported by Lilly (1956). On the other hand, they were quite "productive" in their experiencing of vivid numbers of hallucinations, fan-

tasies, and other unusual phenomena reported in other isolation studies. Camberari summarizes his tentative conclusions:

> 1. Suggestible subjects appear to be able to tolerate sensory isolation longer than non-suggestible subjects.
> 2. Suggestible subjects appear to be more productive of regressive phenomena (i.e., delusions, hallucinations, and fantasies) than non-suggestible subjects.
> 3. Suggestible subjects are more tolerant of regressive phenomena than are non-suggestible subjects.
> 4. Non-suggestible subjects tend to be more threatened by disturbances in "body-schema" than are suggestible subjects.
> 5. Non-suggestible subjects are more aware of and more defensive about their intellectual control in the absence of stimulation than are suggestible subjects.
> 6. Non-suggestible subjects are more acutely aware of, and reluctant to ignore, external factors that reinforce reality than are the suggestible subjects.
> 7. The suggestible subjects perceived the experiment as a sensory isolation experiment; the non-suggestible subjects perceived it more as a stress situation. (Camberari, 1958, pp. 105-106).

Shurley (1960) in a recent paper reported some preliminary results of sensory deprivation on ten male and two female subjects who were exposed, over several sessions, to a modified and improved "Lilly type" situation. Shurley states:

> At the physical level, we aimed at the provision of a constant environment allowing the maximum achievable reduction of ambient physical stimuli, plus the maintenance of a constant level of those inputs impossible to eliminate (Shurley, 1960, p. 2).

It was found that nine of the twelve subjects were able to remain in isolation for more than three hours, but none exceeded 6 hours, 40 minutes. Although subjects were not always able to report their experiences directly, Shurley indicates that simultaneous reports were richer in detail

than retrospective reports. There was a greater tendency to reveal deviations from usual feeling states, thought content, and imagery. Retrospective reports were limited by the utilization of repressive and other defensive measures. Post-isolation feeling states varied considerably among subjects. Shurley states:

> We saw marked calmness and extreme irritability, buoyancy and lethargy, vigilance and somnolence. Most frequently we observed a peculiar, mixed state characterized by calm, clear mental vigilance, coupled with lethargy, muscular relaxation and a decided disinclination for exercise but without any sense or sign of fatigue (Shurley, 1960, p. 11).

Lilly (1958) feels that, while similarities exist between his procedure and the "McGill type" condition, his situation makes stimuli more homogenous. He also believes that exposure to isolation conditions can train one to be more tolerant of internal activities. He states:

> In this way a mind in pure culture can see its own true nature, and have an opportunity to see if it can solve its own basic internal self-contained conflicts in order to have a try at changing the unsatisfying parts. Contrary to those who say such experiences in the tank or in the isolation bed are identical with mental illness or even psychosis, those healthy intact subjects who have been through such experiences know and feel this point of view to be wrong. For such subjects, the experiences can be quite interesting (Lilly, 1958, p. 503).

While he feels that personal integration can be speeded up, Lilly recognizes that the opposite effects may also be accelerated in some cases.

Evaluation of previous research. The problem of eval-

uating the reported experimental results is partly complicated by the variety of approaches which have been used to reduce environmental stimulation. It seems likely that in each experimental situation, various degrees of stimulation, monotony, and stress have been produced, thereby accounting for some of the divergent results. For example, in the McGill studies, subjects were able to remain in isolation for as long as six days; on the other hand, 36 hours was the longest period of time subjects were able to remain in a tank-type respirator; and in the "Lilly type" of condition, subjects could remain only six hours and forty minutes.

It is also difficult to evaluate properly the effects of sensory deprivation on intellectual efficiency. Firstly, differences in deprivation conditions, as indicated above, preclude direct comparisons of results. In addition, intellectual impairment has been found by some investigators but not by others. There is suggestive evidence indicating that tasks requiring organization and a high degree of mental effort are more likely to suffer impairment as a consequence of isolation. However, it is not entirely clear whether the crucial variable is really task complexity or whether it is the time at which these tasks are presented. It should be recalled that the greatest degree of intellectual impairment has been found on tests given after completion of isolation. However, this finding has to be regarded with caution since post-isolation tests

were in most instances different from the tests given during isolation. In the study reported by Goldberger (1958) and Goldberger and Holt (1958a; 1958b), a relationship was also found to exist between Rorschach productions and the degree of impairment on a story recall test. This suggests that in addition to the importance of task complexity and the time at which tests are given, the personality of the individual may play a vital role in determining whether intellectual impairment occurs as a consequence of sensory deprivation.

Theoretical Background

Autobiographical accounts of isolation experiences have been inherently interesting, informative, and of some practical value. However, these accounts did not generally stimulate much theoretical interest in the processes underlying social, sensory, and perceptual deprivation. With the advent of more organized and systematic experimental research, there arose greater interest in the theoretical aspects of isolation. At the present time, two distinct but by no means mutually exclusive theories are being applied to sensory deprivation data with increasing regularity.

A neuropsychological theory, consistent with recent studies of the reticular formation of the lower mid-brain, has been proposed by workers at McGill University (Hebb, 1949; Heron, 1957; Scott, 1954). On the other hand, a psychoanalytic

explanation of sensory deprivation phenomena has been offered by Goldberger (1958), Goldberger and Holt (1958a; 1958b), Lilly (1956; 1958), Rapaport (1958), and Shurley (1960). The investigators at Harvard University (Wexler et al., 1958) have tended to place their results within a psychoanalytic context.

Considering the neuropsychological position first, we find Heron expressing the view that normal functioning of the brain

> depends on a continuing arousal reaction generated in the reticular formation, which in turn depends on constant sensory bombardment. It appears that, aside from their specific functions, sensory stimuli have the general function of maintaining this arousal, and they rapidly lose their power to do so if they are restricted to the monotonously repeated stimulation of an unchanging environment. Under these circumstances the activity of the cortex may be impaired so that the brain behaves abnormally (Heron, 1957, p. 56).

This statement is consistent with the position of Hebb (1954) who believes that there are two distinct functions of a sensory event. Not only does it arouse or guide a specific response, but it also has the non-specific function of maintaining the kind of brain function which operates during the normal waking state. Hebb compares this function to the kind of machine which has to be continually warmed up and kept working by constantly varied input during its operation if it is to function effectively. He further believes that man continually seeks some optimal (as differentiated from maximal) degree of disturbing stimulation. However, when sensory input

is too varied, too unfamiliar, or too complicated, emotional breakdown may result.

Hebb's position is in agreement with that of Freeman (1948) who believes that those nervous centers which control total behavior adjustment seem to function most effectively over a limited range of excitation. In the middle range of energy levels, discharge of excitation and recovery are excellent.

> Beyond this further energy increment gives gradually diminishing returns until a point is reached where specifically integrated total behavior breaks down, overt reactions are of the generalized emotional type, and recovery is low (Freeman, 1948, p. 113).

Scott (1954) also believes that adaptive, efficient behavior cannot be maintained without a range of stimuli to give variety to the sensory environment. He considers the relationship between the central and peripheral processes, that is, between the arousal and cue function of a sensory event, to be an extremely important factor in explaining the reasons for reported thinking difficulties and impairment on cognitive tasks found in subjects undergoing isolation. He states:

> Without cues, mediated by the peripheral processes, there could be no behavior. Without centrally directed and organized selectivity, there could be no cues, properly defined, but only a medly of stimuli, dependent on their intensity or biological significance alone for their differential importance to the organism. But further: without the presence of other stimuli besides those selected the organism could not continue to make adaptive use of these key stimuli, its cues, from moment to moment. Extraneous stimulation provided by the peripheral processes exercise a general control over the activity of

> the central processes, upon which proper functioning of selectivity and thus adaptive behavior depends (Scott, 1954, p. 51).

It appears that neuropsychological theory offers an adequate account for changes in behavior under conditions of prolonged isolation since one may reasonably assume that every individual has an absolute threshold for tolerance of isolation. Confinement beyond this threshold would be expected to lead to some kind of behavioral disorganization. However, neuropsychological theory appears unable to explain satisfactorily why the absolute threshold or tolerance for isolation varies among individuals (the fact that one individual evinces disorganization more rapidly than another person although both have been isolated for the same length of time). In addition, this theory cannot adequately deal with the qualitative or idiosyncratic features which manifest themselves during the apparent disorganization. For example, several individuals may have hallucinatory experiences, but one of the individuals may consider this a pleasant experience, while the other person may consider it to be disturbing.

The McGill and Princeton University researchers appear to have focused their attention on the general effects of prolonged sensory isolation on groups of people. Consequently, they have tended to ignore the importance of individual differences and have made no attempt to relate these person-

ality differences to the data which they obtained. In a sense, they have treated the sensory isolation situation as if its stimulus value was the same for all subjects. In reality, it seems more likely that people differ markedly in their perception and reaction to this situation and that these in part influence the kinds of experiences which they have. This point of view gains support from Camberari's study (1958) where it was found that suggestible subjects perceived the sensory isolation situation as less stressful than did the non-suggestible subjects. In addition, Maslow (1954) points out that mere deprivation should be differentiated from threat to personality. He believes that one must define a situation of threat not only in terms of the basic needs of the species but also in terms of the individual organism facing his particular problem. That is, rather than defining frustration and conflict in terms of the external situation alone, the individual's internal reaction to or perception of the external situation must be taken into account.

It thus appears that the role of individual differences may be a crucial variable in determining the effects of sensory deprivation on people and, specifically, on their intellectual functioning. Since the neuropsychological position has made little attempt to deal with the influences of personality characteristics, we shall now consider what the psychoanalytic position has to offer.

From a psychoanalytic point of view, perception and cognition are processes under the control of the ego. Within this framework, then, the problem of sensory deprivation appears to be essentially an ego problem. Before going further, it might be well to offer a psychoanalytic definition of ego. Hartmann, one of the leading ego theorists, states:

> The ego organizes and controls motility and perception--perception of the outer world but probably also of the self . . . it also serves as a protective barrier against excessive external and, in a somewhat different sense, internal stimuli. The ego tests reality. . . . many aspects of the ego can be described as detour activities; they promote a more specific and safer form of adjustment by introducing a factor of growing independence from the immediate impact of present stimuli (Hartmann, 1950, p. 75).

Anna Freud (1946) indicates that the ego's function as a protective barrier against internal stimuli is extremely important because instinctual impulses are continually pressing for gratification by forcing their way into the ego and gaining access to the motor apparatus. From a psychoanalytic point of view, the interrelationship among the ego, id, and superego takes on major importance. Anna Freud states:

> In the id the so-called 'primary process' prevails; there is no synthesis of ideas, affects are liable to displacement, opposites are not mutually exclusive and may even coincide and condensation occurs as a matter of course. The sovereign principle which governs the psychic processes is that of obtaining pleasure. In the ego, on the contrary, the association of ideas is subject to strict conditions, to which we apply the term 'secondary process'; further, the instinctual impulses can no longer seek gratification without more ado--they are required to respect the demands of reality and, more than that, to conform to ethical and moral laws by which the superego seeks to control the behaviour of the ego (A. Freud, 1946, p. 7).

Under conditions of stress, deprivation, danger, and threat anxiety is likely to occur because the ego is more vulnerable to the invasion of instinctual impulses from the id. Sigmund Freud states:

> Since we have reduced the development of anxiety to a response to situations of danger, we shall prefer to say that symptoms are created in order to remove or rescue the ego from the situation of danger. . . . We can also say . . . that the development of anxiety, induces symptom formation . . . for if the ego did not forcibly arouse the pleasure-pain mechanism through the development of anxiety, it would not acquire the power to put a stop to the danger-threatening process elaborated in the id (S. Freud, 1936, pp. 85-86).

It is clear that anxiety as far as the psychoanalyst is concerned is directly related to break-throughs of instinctual impulses into consciousness. Federn (1952) suggests that break-throughs are more likely when there is a paucity of objects for cathexis.

As mentioned previously, Mendelson et al. (1958) believe that restriction of mobility may be an important contributing factor in the production of mental symptoms in isolation subjects. This belief gains some support from psychoanalytic theorists (Burlingham, 1953; Mittlemen, 1954) and from others (Angyal, 1941). Mittlemen, for example, believes that there is a motor urge or drive in the same sense that there are oral, anal, and genital drives. Angyal postulates a number of drives, one of which is a drive for action which includes "a drive to do things, to make things happen, without any ultimate purpose, but for the mere joy of action . . .

for the sake of experiencing oneself as the cause of changes" (Angyal, 1941, p. 218). Ausubel (1952) believes that an active exploratory orientation underlies much of human activity. Burlingham (1953) cites cases of individuals undergoing mechanical as well as voluntary restraint and mentions that the ego has to supply the restraining action in voluntary restraint since there is a normal impulse to move and to discharge tensions by means of the musculature. She feels that some compulsive activities, including biting or pulling of one's lips or hair, which are usually dismissed as expressions of boredom may well be "qualitatively reduced and displaced substitutes for the normal ways of motor discharge of affect" (Burlingham, 1953, p. 173). This point of view is supported by Lilly's observation (1956) that in the isolation tank there arose a strong need to use hidden methods of self-stimulation as a way of satisfying "stimulus-action hunger."

Schilder's work (1950) is also of particular interest because of the body-image distrubances and depersonalization phenomena reported in sensory deprivation studies. Schilder indicates that perception of our body is reduced when we are at rest and not moving around. However, perceptual clarity is increased when we move our bodies because in doing so, we obtain new sensations by means of contact with objects in the environment. He states:

> There is a tendency toward the dissolution of the body-image. When we close our eyes and remain as motionless as possible, the body-image tends toward dissolution. The body-image is the result of an effort and cannot be completely maintained when the effort ceases. The body-image is, to put it in a paradoxical way, never a complete structure; it is never static: there are always disrupting tendencies (Schilder, 1950, p. 287).

Szas states:

> The optimal state of ego-body integration in adult life obtains when awareness of the existence and functioning of the body remains just below the threshold of consciousness (Szas, 1957, p. 107).

The problem of sensory isolation has been characterized as a situation of boredom or monotony by Heron (1957). Fenichel (1953), too, has addressed himself to the problem of boredom from a psychoanalytic approach. Fenichel believes that the central problem of boredom is the concomitant inhibition of the urge to activity and at the same time a readiness to accept the longed for "incitatory stimuli." He believes that after the young child recognizes that outside objects can be used for instinctual gratification, there continues to be a longing for those objects which help bring about discharge of libido. If appropriate objects are not available, introversion, fantasy, and, finally, neurotic phenomena may result. Depersonalization and estrangement phenomena are viewed as ego disturbances which may result when discharge is prevented due to the unavailability of appropriate objects.

Concept of regression. It is clear at this point that perceptual or sensory deprivation constitutes a drastic cur-

tailment of reality contact between the ego and the world of external stimulation or reality. Rapaport (1958) emphasizes the relative autonomy of structures serving ego functions. These structures, he states,

> depend upon stimulation for their stability, or to use Piaget's terms, they require stimulation as nutriment for their maintenance. When such stimulus nutriment is not available, the effectiveness of these structures in controlling id impulses may be impaired, and some of the ego's autonomy from the id may be surrendered (Rapaport, 1958, pp. 19-20).

In other words, under conditions of a drastic reduction of external stimulation and structure, there may be a decrement in ego control over instinctual impulses in the id. Whenever the ego reduces its controlling function, this is termed an ego regression. Regression however, is not a simple affair. Within recent years it has been recognized that regression has survival value and other further positive and constructive effects. This is implicit in Kris's concept of "regression in the service of the ego" (1952).

There is considerable difference between an ego overwhelmed by regression and a "regression in the service of the ego." In the former, "the ego finds its supremacy curtailed whenever it is overwhelmed by affects, irrespective of whether an excess of affect or the ego's own weakness is to be held responsible for the process" (Kris, 1952, p. 177). Thus while, in psychosis, the ego is overwhelmed by the primary process in the id, Kris points out that the ego can make purposeful

use of the primary process in wit, aesthetic expression, caricature, and in the whole field of art and symbol formation. This kind of functional regression is what is meant by "regression in the service of the ego," that is, "a partial, temporary, 'inspiration' seeking shift to a more primitive level of psychic functioning than that typical of the individual's waking state" (Schafer, 1954, p. 80). The essence of this adaptive kind of regression appears to be that it remains essentially under ego control and tends to be an active rather than passive process of being overwhelmed by the primary process and the instinctual impulses in the id. Schafer states:

> This increased openness of consciousness requires relaxation of the defensive, regulatory and organizing ego attitudes that normally screen unconscious material seeking passage from the unconscious to the preconscious and from the preconscious to the conscious (Schafer, 1954, p. 80).

Apparently, though, not all preconscious material reaches consciousness with equal ease since the content may range from fantasy to purposeful reflection and from dream-like imagery to logical formulations. Kris believes that in fantasy as well as in dreaming, the processes of the ego are more in the service of the id than of the ego. He states:

> The ego . . . has two kinds of bound energy at its disposal: neutralized energy, and libido and aggression in their non-neutralized form. Fantastic, freely wandering thought processes tend to discharge more libido and aggression and less neutralized energy; purposeful reflection and solving problems, more neutralized energy. In

> fantasy, the processes of the ego are largely in the service of the id (Kris, 1952, p. 311).

Schur (1953) differentiates between more mature and more primitive ego defenses. He points out that in the conflict-free ego, there is a prevalence of "secondary processes," capacity for neutralization, ability to use controlled regression without anxiety, ability for sublimation, and a restriction of reaction to danger by having a thought-like awareness of it. In primitive defenses, however, there is a prevalence of primary processes, tenuous neutralization, and a tendency toward having regressive anxiety reactions accompanied by somatic symptoms. He states:

> The tendency to fall back, in certain areas and at certain occasions to operations on the level of primary processes constitutes a vulnerable link in the ego structure of the neurotic. As in other realms of pathology, this too is only an exaggeration of a condition prevailing to various degrees among all men. It is a triumph of adaptation when "unrealistic thinking" can be incorporated in the conflict-free area of the ego, or if it can be used for creative purposes. In the state of anxiety we see one of the pathological outcomes (Schur, 1953, p. 78).

Parenthetically, psychoanalysis has sometimes been called a "controlled psychosis" because of the amount of primary process data which comes into consciousness in the process of free association. This is the major reason why the technique of free association has remained such an integral part of psychoanalytic treatment. Kubie states:

> Free associations enable the psychological processes to roam through the mental highways and byways, unhampered

> by conscious restrictions, gathering up ideas and impressions, putting them together in varying combinations, until new relationships and new patterns come into view. Both in science and in the arts, free association is an essential tool in the process of creative search (Kubie, 1950, pp. 45-46).

Hartmann (1951) distinguishes between progressive and regressive adaptations, the former signifying adaptation in the direction of development. At the same time, he recognizes that successful adaptations may often use pathways of regression. Hartmann also indicates that while severe intellectual deficits occur only in psychoses, they can also occur in other forms of psychological illness to a milder degree. One may assume from this that whenever a maladaptive type of regression occurs, some intellectual impairment may be noted. Under intellectual function most likely to be disturbed, Hartmann includes selective control, thinking in terms of time, reality testing, abstraction, objectivation, and the ability to delay.

By way of summarizing the psychoanalytic viewpoints presented thus far, Schafer states:

> On the advanced levels of psychic functioning the reality principle and secondary process prevail over the pleasure principle and primary process; delay, indirectness and modulation of discharge of tension take precedence over immediate, direct, uncontrolled discharge; logic and reality testing overshadow autistic thought; and clarity and organization of subjective experience replace fluidity and diffuseness of experience, loss of "self," and minimal reflective and selective capacity (Schafer, 1954, p. 79).

From the discussion presented so far several inferences can be made. Firstly, it appears that, if secondary

process thinking is to be maintained, there must be continued contact between the individual and the world of reality and sensation. Secondly, when normal contact with the structure of reality is drastically reduced or cut off, some kind of ego regression occurs. For some individuals, regression may occur because of the anxiety which arises because of the threatened break-through of primary process material into consciousness. The unconscious material in this case is viewed as ego alien because its expression is potentially threatening and guilt-producing. When the ego is not strong enough to defend against such intrusions of threatening material, a breakdown of ego function is likely to occur leading to a major disruption of secondary process thinking. Such is the case in psychosis. At the opposite end of the regressive continuum is the individual with the rigid defensive system who prevents unacceptable material from reaching consciousness by means of a pervasive use of repression. However, the price the individual pays for maintaining this energy-consuming system is very high since there remains little available energy for secondary process functions. Somewhere in between these two extremes is the individual with the basically healthy ego who allows the ideational derivatives of the primary process to emerge into awareness in a controlled, modulated, and adaptive manner characteristic of the creative process. Schafer states:

> This creative regression . . . remains essentially under the control of the ego. It is primarily or largely an active process of taking imaginative liberties and not an altogether passive process of being overwhelmed by alien forces. Its active rather than passive nature is demonstrated by the fact that the creative regression is always accompanied or succeeded by critical, reality-oriented and communication-oriented evaluation and modification of the primary process material (Schafer, 1954, pp. 80-81).

The relationship between personality and adjustment to sensory deprivation. The position has been taken that the role of individual differences is a crucial one in determining the kind of adjustment one makes to the sensory deprivation situation. Our task now becomes that of determining the kinds of personality characteristics which influence the regressive-adjustive process. In addition, we need to ascertain whether there are appropriate personality measures by which one might differentiate between "good" and "poor" adjusters to sensory deprivation.

Until now, there have been only a few attempts to demonstrate a relationship between personality and adjustment to sensory deprivation. As mentioned previously Wexler et al. (1958) found that none of the 16 possible correlations on the MMPI were significantly related to the length of time spent in a respirator, which they considered one important criterion of adjustment. On the Edwards scale, need exhibitionism was negatively related while need affiliation and need nurturance were positively related to the length of time in the respirator.

In the most personality-oriented study reported on so far (Goldberger, 1958; Goldberger & Holt, 1958a; 1958b), a relationship was demonstrated between the manner of controlling primary process material on the Rorschach test and the manner of coping with the isolation situation. As a matter of fact, Holt's Rorschach Rating Scale for Primary Process Manifestations (1956; 1959) holds much future promise as an effective predictor of behavior in isolation. At this time, however, it is still in the process of revision and has an extremely complex scoring procedure, making it difficult to use unless one has been trained by its author.

There are suggestions from other sources which suggest that one's capacity to adapt adequately to a situation of minimal external structure is related to some very basic personality attributes. Maslow's description of the healthy and neurotic personalities and their relationships with and dependence on the environment are interesting in this regard. He states:

> The neurotic organism is one that lacks certain satisfactions that can come only from the environment. It is therefore more dependent on the environment and is less autonomous and self-determined, i.e., more shaped by the nature of the environment and less shaped by its own intrinsic nature. Such relative independence of environment as is found in the healthy person does not of course, mean lack of commerce with it; it means only that in these contacts, the person's ends are the primary determiners, and that the environment is no more than means to the person's self-actualizing ends. This is psychological, if not geographical freedom (Maslow, 1954, pp. 116-117).

Maslow's position gains strong support from a study by Witkin, Lewis, Hertzman, Machover, Meissner, and Wapner (1954) on the relationship between personality and perceptual behavior. In this study, there was an attempt to correlate the results from a number of personality measures with the individual's characteristic behavior in a variety of perceptual situations. Using normal men and women, hospitalized psychiatric patients, and children, clear-cut personality differences were found between field-dependent and non-field-dependent individuals. It was found that passivity was associated with field-dependent perceptual performance while activity was associated with independent or analytical perceptual performance. These dimensions of personality were functionally defined as follows:

> Passivity signifies inability to function independently of environmental support, an absence of initiating activity, and a readiness to submit to forces of authority. Activity, on the other hand, involves ability to function with relatively little support from the environment, a capacity for initiating and organizing and the power to struggle for mastery over social and other environmental forces (Witkin et al., 1954, p. 467).

In Witkin's study, such clinical tools as an interview, Rorschach test, TAT, and a figure-drawing test were used successfully. Since in this present study, only the Rorschach and figure-drawing test were used, the rationale behind their use and the results obtained with them will be discussed.

The rationale underlying the use of figure-drawings is clearly stated in the following passage:

> Each of us carries around with him some more or less crystallized view of a "person" that, in fact or in fantasy, represents himself and is the subtle product of experiences with himself and with others. Thus, the figure that is drawn on paper may be regarded as a rough representation of the subject's image of himself with relation to his environment. He projects himself by means of particular kinds of lines on a certain part of the page, in characteristic dimensions, proportions, and perspective, and with a peculiar configuration, all expressive of his temperament and self-view. The nature and distribution of his personal conflicts are represented in the organization of the pictured body, its clothing, accessories, and the symbols expressed; and a systematic analysis of these features, based upon the functional values of the body, helps establish the personality pattern of the person drawing (Witkin et al., 1954, p. 235).

Concerning their use of the figure-drawing test, Witkin et al. (1954) at first developed a long scale of graphic items which was related to a number of personality variables associated with different kinds of perceptual performance. An abbreviated list of graphic items was later developed which consisted of 40 items for men and 45 items for women. This list of graphic items was subdivided into three major categories, each representing a meaningful constellation of personality traits. The first category selected was lack of body confidence. Items in this category reflected a low evaluation of the body and a low level of narcissistic investment in it. Other items in this category reflected a lack of body esteem, uncontrolled or primitive expressions of anxiety, and lack of self-assurance. The second category chosen was lack of struggle for sexual identification. The

graphic items in this category reflected an identification with positive and self-enhancing traits of both sexes. The absence of cross-sex-identification trends suggested confusion with respect to the adult role and lack of confidence in managing such a role. It was felt that such individuals may have feelings of weakness and helplessness which they have not been able to compensate for in either a masculine or feminine manner. Such an individual may demonstrate childhood emotional and sexual patterns throughout his adult life. The authors relate the problem of sexual identification to the presence of castration anxiety. They state:

> It seems readily apparent that individuals who attempt to solve the problem of narcissistic injury by extracting from the environment whatever desirable traits they find available are thereby actively struggling to achieve sexual identification. Individuals whose solution lies along the lines of uncompensated inferiority and childish sexual preoccupation have "abdicated" and relinquished the struggle for sexual identification (Witkin et al., 1954, pp. 242-243).

The third category chosen represented items which reflected a lack of drive and drive modification. Strength of drive refers to the degree of activity or passivity characteristic of the individual. Related very closely to the activity-passivity dimension is the method which the individual uses to control or modify his drives and impulses. Passive individuals, when they express any open hostility and aggression at all, are more likely to show uncontrolled expressions of hostility and aggressiveness. Active individuals, on the other hand, are

more likely to impose their impulses on the environment in a manipulative and controlled manner.

In summarizing their results with the figure-drawing test, Witkin et al. state:

> Persons who are field dependent in their perception produce figure drawings reflecting a low evaluation of their bodies, infantile defenses against anxiety, lack of self-assurance, passivity coupled with uncontrolled expression of hostility, and difficulty in accepting an adult role. On the other hand, people who are not influenced by the prevailing field and who are capable of dealing with it in an active, analytical fashion produce drawings expressing a high degree of narcissistic investment in the body, sophisticated defenses against anxiety, self-assurance, identification with "desirable characteristics" of both sexes, strong drive, and manipulative tendencies in controlling their drives (Witkin et al., 1954, p. 254).

In attempting to relate Rorschach productions to perceptual performance, Witkin et al. (1954) were led to expect that such personality variables as strength of organizing ability, capacity to integrate, degree of awareness of bodily sensations, and the extent of self-acceptance and self-trust would be of prime importance. It was found that six major categories (whole responses, human movement responses, human figure responses, color responses, popular responses, and form responses) and one minor category (anatomy responses) were significantly related to perceptual performance. The WPC group (whole, popular and color responses) was thought to reflect the degree of effectiveness in dealing with one's own needs and the environment. The quality of the whole response,

they state,

> is an indication . . . of the force and effectiveness of his integrative drive and ability. It reflects the extent to which he can overcome potential sources of distraction, such as anxiety, compulsiveness, or dependence, and maintain an active attitude toward the stimulus material (Witkin et al., 1954, p. 207).

The number of popular responses were considered to reflect the degree of adequacy in dealing with the environment and also an indication of whether inner conflicts might prevent the individual from dealing effectively with commonplace reality. Color responses indicated the characteristic way in which the individual dealt with his emotional impulses and reactions to the outside environment. The MHFA group (human movement, human figures, form, and anatomy responses) was considered to be an introspective category since it provided an index of constriction, the amount of self-trust, and the degree of richness or impoverishment of inner life or fantasy. Human movement responses were viewed as reflections of introspective trends, one's capacity for self-reflection, and the degree of self-awareness. The human figure responses provided an index of the degree of self-acceptance. Form responses provided an index of constriction and suggested the manner in which the individual coped with the environment. Anatomy responses reflected the degree to which the individual was preoccupied with his body.

While both groups of measures were found to be empirically related to perceptual scores, the WPC or coping group

was more closely related to perceptual functioning than the MHFA or introspective group. In general, field-dependent individuals exhibited a great deal of inadequacy in both coping and introspective areas, demonstrating a lack of self-awareness, self-acceptance, and an inability to take action in relation to the external world. Witkin et al. state:

> The factors that seem to be most important in maintaining independence of the field are the ability to act, to assert oneself, to organize, to make use of relevant factors in the field, and to control distruptive forces in oneself when following a goal--all in some manner reflected in the group of coping scores (Witkin et al., 1954, p. 234).

To summarize our position thus far, it appears that the Rorschach and the figure-drawing test as used by Witkin et al. (1954) can effectively distinguish personality differences among people. There is reason to believe that these personality differences may profoundly influence the manner in which an individual adapts to sensory deprivation and the degree of intellectual efficiency which he is able to maintain. One would expect individuals who tend to be passive in dealing with the environment, who are relatively unfamiliar with and afraid of their own impulses together with poor control over them, and who have primitive, undifferentiated body-images, and low self-esteem, to experience considerable anxiety accompanied by intellectual impairment under sensory deprivation conditions. On the other hand, individuals who demonstrate a high degree of activity and independence in relation to the

environment, greater self-awareness, good control over impulses, high self esteem, and more differentiated and mature body images, should experience less anxiety and consequently less intellectual impairment when deprived of external stimulation.

CHAPTER II

PROBLEM

The general purpose of this study is to investigate the effects of sensory deprivation on intellectual efficiency as a function of personality. Secondary purposes are to determine the relationship between personality characteristics and the manner of adjustment to sensory deprivation and the relationship between manner of adjustment to sensory deprivation and subsequent intellectual efficiency.

A line of reasoning has been presented which assumes that basic personality characteristics may be crucially related to the kinds of ego regression which take place when contact with external reality is drastically curtailed. An adjustive regression which takes place "in the service of the ego," permits a non-anxiety and non-guilt-producing awareness of material which formerly remained out of consciousness. A non-adjustive regression, however, is characterized by a real or threatened break-through into awareness of unconscious material accompanied by anxiety, unpleasant affect, and perhaps desperate attempts to maintain a reality orientation through stimulus-bound and obsessional thinking.

According to this formulation, the adequacy of ad-

justment to sensory deprivation seems to be directly related to some very central personality characteristics which the Rorschach and the figure-drawing test measure. It is expected that a more inadequate adjustment to sensory deprivation, as determined by The Rating Scale of Deprivation Adjustment (see Appendix I), will be made by those individuals who evince poor introspective and coping skills, low bodily evaluation, primitive defenses against anxiety, a low degree of self-assurance and acceptance of the adult role, and a passive orientation toward the world with poor control over their drives. On the other hand, it is expected that a more satisfactory adjustment to sensory deprivation will be made by those individuals, who on the Rorschach and the figure-drawing test, demonstrate high introspective and coping skills, high bodily evaluation, mature defenses against anxiety, a high degree of self assurance and acceptance of the adult role, and an active orientation toward the world with strong but well-controlled drives.

There is further theoretical support for the view that a maladjustive type of regression, accompanied by increased anxiety, unpleasant affect, and perhaps obsessional and stimulus-bound thinking, leads to an impairment of secondary process functioning both during the deprivation period and for a period of time afterwards. Therefore, it is expected that individuals who demonstrate the greatest degree of maladjust-

ment to sensory deprivation, as measured by The Rating Scale of Deprivation Adjustment, will correspondingly suffer the greatest degree of impairment on a subsequent series of intellectual tasks. Conversely, those individuals who show good adaptation to sensory deprivation are expected to maintain, or to reestablish immediately, the kind of secondary process thinking necessary for dealing effectively with intellectual tasks.

It further follows from the line of thinking presented above that the basic personality characteristics discussed may also be intimately related to the degree of intellectual impairment which occurs subsequent to sensory deprivation. One would expect greater intellectual impairment to be found in those individuals, who, on the Rorschach and the figure-drawing test, manifest the greatest degree of poor introspective and coping skills, low bodily evaluation, primitive defenses against anxiety, a low degree of self-assurance and acceptance of the adult role, and a passive orientation toward the world with poor control over their drives. Conversely, less intellectual impairment should occur in individuals who manifest more positive characteristics on the personality measures.

The specific purposes of this study are to test the following predictions:

1. A positive relationship will be found between the adequacy of introspective-coping skills and attitudes toward

the self (as indicated by combined Rorschach and figure-drawing scores) and the degree of intellectual efficiency (as measured by a series of intellectual tasks).

2. A positive relationship will be found between the adequacy of introspective-coping skills and attitudes toward the self (as indicated by combined Rorschach and figure-drawing scores) and adaptation to sensory deprivation (as measured by The Rating Scale of Deprivation Adjustment).

3. A positive relationship will be found between the degree of adaptation to sensory deprivation (as measured by The Rating Scale of Deprivation Adjustment) and the degree of intellectual efficiency (as measured by a series of intellectual tasks).

CHAPTER III

METHOD

Overall Plan

Volunteers for this study were solicited from the junior and senior class of medical students at the University of Oklahoma School of Medicine. The Rorschach and the figure-drawing test were administered to each subject on an individual basis. From the pool of 29 volunteers, 16 individuals were selected as subjects for the experiment. Eight of these individuals received the highest weighted combination scores on the Rorschach and figure-drawings; the remaining eight individuals received the lowest weighted combination scores on these same measures. The eight high scorers (Group H) and the eight low scorers (Group L) were assigned randomly to either the control or experimental group in such a way that each of the latter contained four high scorers and four low scorers.

Subjects in the experimental group received a battery of intellectual tasks immediately prior to undergoing sensory deprivation. Sensory deprivation was achieved by allowing the subject to float in a large circular tank filled with warm water in a sound-proof and light-proof room. Breathing

was provided by means of a rubber head mask connected to hoses which allowed air-conditioned respiration. Although the experimental subjects were instructed to remain in the isolation tank for as long as possible, they were asked to come out of the tank after two hours had passed. An alternate battery of intellectual tasks was then administered. After completing these tests, each experimental subject completed The Rating Scale of Deprivation Adjustment. Finally, he orally recorded a retrospective account of his experiences in sensory deprivation after which the experimenter conducted a brief interview.

The subjects in the control group completed a battery of intellectual tasks followed by approximately two hours of relaxation under moderate stimulation. The alternate battery of tests was then given.

Subjects

Selection. Subjects for this study were junior and senior medical students at the University of Oklahoma School of Medicine. The Chief of the Neuropsychiatric Service at the Veterans Administration Hospital, who is also a Professor of Psychiatry at the University School of Medicine, informed the assembled junior and senior class that volunteer subjects were needed for an experiment in sensory deprivation. They were told that they would be paid by the hour for their services. A total of 33 students volunteered to be subjects but

four of these students later found that they could not spare the necessary time.

Each volunteer was contacted by telephone or mail and appointments were made for the administration of the figure-drawing test and the Rorschach test, both of which were given by the investigator.

Assignments to groups. Since the scores on the figure-drawing test ranged from 7.33 to 25.66 and those on the Rorschach from zero to five, the total scores on each test were converted to standard scores. Following this conversion, the scores on both tests for each individual were added together. A product-moment correlation between the Rorschach and the figure-drawing test was .36, with $P = .05$. A group of 16 subjects were selected out of the total of 29 volunteers. Of the 29 volunteers, the 8 who had the highest weighted combination of scores were selected for Group H (high scores), and the 8 who had the lowest weighted combination of scores were selected for Group L (low scores). One individual among the eight lowest scorers had to be discarded as a subject because of physical disability. Strictly speaking therefore, Group L was selected from among the nine lowest scorers (the distribution of scores appears in Table 7 in Appendix E). Four subjects from each personality group were randomly designated as members of the control group, the other four as members of the experimental group.

The Sensory Deprivation Condition

The physical situation. The isolation room is a light-proof and virtually sound-proof room located directly beneath the animal laboratory at the Veterans Administration Hospital in Oklahoma City. In the center of the isolation room is a circular steel tank measuring 8 ft. deep and 7 ft. in diameter. The tank is set on a concrete saucer foundation, which rests on layers of gravel, sand, and earth. The 5 ft. of tank which is beneath the level of the floor is surrounded by a layer of cork in order to minimize the effects of external vibration. The tank was filled with warm water at a temperature of approximately 92-93° F. This water did not vary more than one degree during the two hours of deprivation. The temperature of the water minimized the subject's sensations of heat or cold.

While in the isolation tank, the subject wore a complete one-piece head and face mask which was just tight enough around the neck to prevent water from seeping in. The mask was made of latex and had a fibre-glass front-piece imbedded in rubber to provide a rigid support for breathing tubes and to prevent the front of the mask from collapsing during respiration. The eyes, nose, and mouth of the subject did not come in contact with the front of the mask. A threaded lucite ring in the front of the mask was connected to a Y-shaped lucite tube which was further connected to two flexible hoses.

One of the hoses was attached to an additional plastic hose which was connected to an air-conditioning duct leading to the animal laboratory which was directly above. In this way, the subject was provided with cool, filtered air without any accompanying compressor noises. The other flexible hose allowed the subject to exhale directly into the isolation room. Flutter valves, which were incorporated into the Y-shaped lucite tube, permitted only a one-directional flow of air into and out of the mask. Adjacent to the isolation room and separated from it by an industrial-type refrigerator door was an ante-chamber which was equipped with water volume and temperature controls, tape recording equipment, a two-way intercommunication system, and with a rheostat which controlled the voltage and the amount of light which emanated from the four 100 watt bulbs in the isolation room.

The sensory deprivation procedure and instructions to subjects. On the morning of the experiment, immediately prior to entering the tank of water, each experimental subject completed one form of the battery of intellectual tasks. The subject was seated on a comfortable lawn chair in the isolation room, dim lighting was provided, and he wore a set of small earphones. A microphone which was suspended over the tank allowed the investigator in the ante-chamber to hear the subject's responses as they were channeled through a tape recorder. During sensory deprivation this microphone was

placed directly in front of the exhaling tube of the subject's mask, thus permitting simultaneous recording of the subject's comments. Upon completing the intellectual tasks, bright lights were turned on and the experimenter inquired whether the subject wished to use the toilet facilities in an adjacent building. After returning to the laboratory within three to six minutes, the subject was instructed to undress behind a screen and put on the bathing suit which he had brought with him. The tank cover was then removed and the subject was permitted to swim in the tank for a few minutes in order to accustom himself to the water temperature. He was then introduced to the buoyancy material and to the rubber head and face mask. In addition, the function of the breathing tubes and the mechanics of the respiration system were explained. When the subject had no further questions concerning the apparatus, the buoyancy material was placed around his waist and the mask was placed over his head. In addition, a U-shaped rubber tube was placed around his neck in order to provide support for the neck and head while in the water. The subject was then helped into the water where he spent between five and ten minutes in finding a position which he felt could be maintained over a period of time. In all cases this entailed adding to or reducing the amount of buoyancy material or changing its position on the body. When the buoyancy material was worn around the chest, the subject

would invariably assume a vertical position in the water. As the material was moved down toward the waist, a more supine position was achieved. Floating on one's back was the most preferred position for almost all subjects. After the subject assured the investigator that he was quite comfortable, the lighting was reduced and the subject was instructed to remove his bathing suit. The investigator placed the bathing suit on the platform which was adjacent to the tank, and the subject was then told that the experimenter would be leaving the room, that the lights would be turned off, and that he would be given further instructions over the intercommunication system. The experimenter left the room, turned the lights off completely, and gave the following instructions in an informal manner over the two-way loud-speaker system:

> The purpose of this study is to investigate some of the reactions of people when they are alone and have a limited amount of external stimulation. The kapok material around your body will keep you afloat and the rubber mask which you are wearing will allow you to breathe comfortably, as you have already discovered. Once you are in a comfortable position, try to inhibit your movements as much as possible. Although, I shall be able to hear you at all times or when I choose to do so, I shall not talk to you unless I have a specific reason for doing so. I should like you to report any experiences, feelings, sensations, and thoughts at any time, whenever you feel like doing so. Everything you say will be recorded on the tape recorder. I should like you to remain in the tank for as long as you can. At the same time, you have complete freedom to leave the tank whenever you wish to. Once out of the tank, however, you will not have an opportunity to go back in today. It is also important that you also let me know of your intention before you actually come out of the water so that I may assist you. Do you have any questions? (pause) If there are no ques-

tions, then from this time on I will not be talking to you. I am signing off.

During the period of sensory deprivation, the experimenter monitored the subject's verbalizations as they were recorded on tape. Although subjects in the experimental group were instructed to remain in the isolation tank for as long as possible, they were required to come out of the tank after two hours. After the subject estimated the length of time he thought had passed, he was instructed to take off the rubber mask and buoyancy materials. With the lights turned up to a dim level, the subject dried himself with a towel and put on a laboratory coat. He was then instructed to seat himself in the lawn chair and to put on the ear phones which he had worn previously. Under lighting and communication conditions identical to pre-deprivation testing conditions, the alternate form of intellectual tasks was administered. When these tasks were completed, the subject entered the ante-chamber and completed The Rating Scale of Deprivation Adjustment. Following completion of this scale, each subject was required to dictate a spontaneous, oral account of his experiences in isolation to a recording machine. The experimenter then conducted an interview which attempted to clarify the subject's spontaneous account and to elicit any further information.

Intellectual tasks were administered to subjects in the control group under conditions identical to those of the experimental group. During the two hour period of time between the

administration of the first and second series of tasks, control subjects were left by themselves in the isolation room but had complete freedom of movement. In addition, the lights remained on, the door separating the tank room from the ante-chamber was left open, and each subject had access to magazines and a portable radio. At the end of two hours, the alternate battery of tasks was administered under conditions identical to the first series of tasks.

The Figure-Drawing Test

Rationale. Drawings of the human figure have been used for many years because of the intimate relationship which has been found to exist between the figure drawn and the personality of the individual who creates the drawing. The figure drawn may be considered to roughly represent one's self-image in relation to the environment. The individual projects his temperament and self-view by means of the lines drawn and the dimensions, proportions, and perspective of the whole body and body parts. The nature of the individual's conflicts are represented in the organization of the body, the clothing, accessories, and symbols which are depicted in the drawings.

The Short Scale of Graphic Items as used by Witkin et al. (1954) contains forty items each of which is related to a specific aspect of personality. The list of graphic items is subdivided into three major categories. Items in the lack of body confidence category reflect a low evaluation of the body,

lack of body esteem, uncontrolled or primitive expressions of anxiety, and lack of self-assurance. The second category, lack of struggle for sexual identification, reflects the lack of cross-sex-identification trends which suggests confusion with respect to the adult role and lack of confidence in managing such a role. The third category, lack of drive and drive modification, refers to the degree of activity or passivity characteristic of the individual and the adequacy of his defenses against anxiety and impulsive expression.

Administration. The figure-drawing test was administered individually to the 29 volunteer subjects. Each subject was required to draw a person on a blank sheet of white paper. In addition, he was asked to draw a whole person. After completing the first drawing, he was asked to draw a person of the opposite sex from that which he had already drawn.

Scoring. The scoring procedure was identical to the one used by Witkin et al. (1954). The criteria for scoring each item appear in Appendix A. Since all subjects were males, forty items made up The Short Scale of Graphic Items. They included 21 lack-of-body-confidence items, 8 absence-of-struggle-for sexual-identification items, and 11 lack-of-drive and drive-modification items. Each item was scored plus if present and minus if absent. Each subject received a single score which represented the total number of graphic

items found in his drawings. High scores suggested a lack of body confidence, a lack of struggle for sexual identification, and lack of drive and drive modification, all of which were viewed as negative personality traits. Low scores indicated the presence of body confidence, cross-sex-identification trends, and an active orientation toward the world with good control over drives.

Reliability of scoring. In order to establish a reliable scoring procedure, five sets of drawings, chosen at random from the patients' files in the Psychology Department at the Veterans Administration Hospital, were independently scored by the investigator and two experienced clinical psychologists who held positions at the hospital. The scores for each patient were then compared and a conference was held among the judges to discuss scoring differences and problems in scoring which arose. There was an attempt to decide on consistent scoring procedures. The judges then independently scored the figure-drawings produced by the 29 individuals in the volunteer group. The final score for each subject was obtained by taking the mean of the three judges' scores on each set of drawings. The distribution of judges' scores and the final mean score for each subject can be seen on Table 5 in Appendix B. Product-moment correlations between pairs of judges for total scores were .86, .92, and .87.

The Rorschach Test

Rationale. It was felt that a number of central personality characteristics might be crucially related to sensory deprivation adjustment. Among these characteristics were strength of organizing ability, capacity to integrate experiences, degree of awareness of bodily sensations, introspective ability, control over impulses and emotional reactions, and the degree of self-acceptance and self-trust. Among the many possible Rorschach categories, seven were found to be intimately related to these personality traits (Witkin et al., 1954). According to the authors, whole responses indicate the force and effectiveness of integrative drive and ability. Popular responses reflect the degree of adequacy in dealing with the environment and ordinary reality. Color responses suggest the manner in which individuals deal with their emotional reactions. Human movement responses indicate the degree of introspective ability and self-awareness. The presence of human-figure responses suggests the extent of self-acceptance. Form responses provide an index of constriction and anatomy responses usually reflect the degree of bodily preoccupation.

In the study by Witkin et al. (1954), two groups of responses were differentiated. The WPC group (whole, popular, and color responses) was considered to be a coping category since it basically reflected the degree of effectiveness in

dealing with one's needs and the environment. The absence of integrated and well-organized whole responses, together with a low number of popular responses and an excessive amount of uncontrolled color reactions, suggested poor coping ability. The MHFA group (human movement, human figure, form, and anatomy responses), or introspective category, provided an index of constriction. The absence of human figure responses, together with a high percentage of form and anatomy responses, suggested impoverishment and constriction of creative fantasy, a low degree of self-awareness and self-trust, and bodily preoccupations.

Administration. This test was individually administered by the investigator immediately after each subject completed the figure-drawing test. Instructions to the subject were given in the following informal manner:

> If you take a fountain pen and drop some ink on a piece of paper, fold the paper in half, and smear the ink, you will see symmetrical designs on each half the paper. Children sometimes play this game and call it blottos. I have ten cards with ink-blots on them, and these same cards are used all over the world. People see all sorts of things in these ink-blots, so there are no right or wrong answers, and this is not a test of intelligence. I am going to show you these cards one at a time, and I want you to tell me everything you see or what they remind you of. After you have seen all there is to see, turn the card over and I'll give you the next one. Do you have any questions?

After the subject responded to the ten cards, an inquiry was held to determine the location, the determinants used, and the

content for each response.

Scoring. The Rorschach protocols were scored according to the procedure used by Klopfer and Kelley (1942) with the additional refinements used by Witkin et al. (1954). Among these refinements were the use of twenty popular responses and the judging of each form-determined whole response according to Beck's tables of form levels (1944). After each record was completely scored, calculations of the seven Rorschach categories took place. These included the presence of a specific number of whole responses, human movement responses, human detail responses, popular responses, form responses, color responses, and anatomy responses. The individual's total score reflected the number of categories present in his record with the exception that the anatomy score, when present, was subtracted from the sum of the other scores, following the procedure of Witkin et al. (1954). A high score on the Rorschach test denoted poor introspective and coping skills, a low score indicated good introspective and coping skills.

Reliability of scoring. In attempting to establish reliability of scoring, each Rorschach protocol was independently scored by the investigator and one other clinical psychologist at the Veterans Administration Hospital. After scoring each record, a total score based on the seven categories was calculated. Since both judges were very familiar with the scoring system (Klopfer & Kelley, 1942), there were only few

disagreements between them. Once the protocols were scored, calculations of the seven categories proved to be fairly automatic. Using a product-moment correlation, agreement between the two judges was found to be .95. After calculating the mean of the two judges' scores in each category, the presence or absence of a category score was determined by referring to the criteria in Witkin et al. (1954). The total Rorschach score was composed of the total number of categories in the record.

The Intellectual Tasks

Description and rationale. Items for the two series of intellectual tasks were obtained from a larger number of test items administered to freshmen medical students at the University of Oklahoma School of Medicine during the 1959 spring semester. Each item was scored and ranked for difficulty on the standardizing group. A description of these tests and the manner of administration appears in Appendix F. From the original pool of test items, and based on the results with the standardizing group, test batteries A and B were devised.

Several factors influenced the original and final selection of the intellectual tasks. Firstly, all test items had to be of such a nature that they could be presented and answered orally. Secondly, there was a need to use both relatively simple and difficult tasks. Simple tasks were considered

to be those which could be answered correctly with only a minimal amount of reflection, organization, and effort. Difficult tasks, on the other hand, were viewed as those skills which would require good organizing ability, a high degree of mental effort, and a fair amount of concentration. On the basis of clinical experience, it appeared that information, digit span, associative learning, and analogy items could be considered as relatively simple tasks. On the other hand, sentence building, logical deductions, and proverb interpretation items appeared to be inherently more demanding.

The final test batteries were made up of seven subtests. Mean scores for each subtest in each battery appear on Table 8 in Appendix F. Each test battery consists of the following tasks: twenty information questions, seven sentence building items, a digit span series through nine digits forward, seven logical deduction items, ten associative learning items, and twenty analogy items.

Administration. While it seemed likely that the two batteries of tasks were equated for difficulty, the following order of administration was used to minimize the effects of systematic differences in difficulty between the two sets of tasks. As the first series of tasks, test battery A was administered to a randomly selected half of Group H (high weighted combination scores on the Rorschach and the figure-drawing test) and half of Group L (low weighted combination

scores on the Rorschach and the figure-drawing test) in both the experimental and control groups. Test battery B was administered first to the remaining subjects in the control and experimental groups. This procedure was reversed at the end of the experiment. Subjects who initially took test battery A were then required to take test battery B; those who were given test battery B at first were required to take test battery A as the alternate battery. The investigator, who was stationed in the ante-chamber, wrote down the subject's responses as they were given from the isolation room. This was accomplished by means of an intercommunication system which was channeled through a tape recorder. The conditions under which both batteries of tests were given were identical for the experimental and control groups. A description of these conditions was presented on pp. 55-59.

Scoring. The total score for each test battery was obtained by summating the scores of the seven subtests, which were scored in the following manner:

1. Information: One point for each correct response (total score: twenty points).

2. Sentence building: One point for each correct response (total score: seven points).

3. Digit span: The highest number of digits repeated correctly (total score: nine points).

4. Logical deductions: One point for each correct response (total score: seven points).

5. Associative learning: One point for each easy item recalled and two points for each difficult item (total score: fourteen points).

6. Proverb interpretation: Two points for each abstract verbalization; one point if the response was a specific instance but not quite equivalent generalization. No credit was given if there was no recognition that the statement was a proverb or if the response represented a distortion or a wrong interpretation (total score: twenty points).

7. Analogies: One point for each correct response (total score: twenty points).

Reliability of scoring. Since most of the items on the intellectual tasks were part of routinely administered intelligence, aptitude, and achievement tests, not much difficulty in scoring occurred. Proverb interpretation and, to a lesser extent, sentence building were the only tests which required subjective scoring methods. The investigator and the two other clinical psychologists who scored the figure-drawings independently scored all of the intellectual tasks. Produce moment correlations between pairs of judges for total scores were .97, .95, and .97. The final score of each subtest for every subject was obtained by calculating the mean of the three judges' scores on that subtest. The total score on each test battery

was obtained by summing the mean scores of the seven subtests.

The Rating Scale of Deprivation Adjustment

Description and rationale. This scale consists of 37 items all of which are related to negative or maladaptive aspects of sensory deprivation. The areas covered by the scale include thoughts, feelings, reactions, behavior, preoccupations, bodily sensations, perceptual phenomena, and attitudes during and immediately after sensory deprivation. The scale is self administering and was presented to each experimental subject immediately after he completed the second set or final set of intellectual tests. The scale, to some extent, also provided a framework for a subsequent interview.

Scoring. Since it was important to determine not only whether the subject was uncomfortable, for example, but also to determine the degree of discomfort in the sensory deprivation situation, the subject rated each item on the rating scale as follows: 0 (no), 1 (very little), 2 (some), 3 (much), and 4 (very much). The total score for each experimental subject could theoretically have ranged from 0 (excellent adaptation) to 148 (very poor adaptation). In this study, the scores ranged from a low score of 15 to a high score of 61. The distribution of scores appears on Table 3, page 74. The entire Rating Scale of Deprivation Adjustment appears in Appendix I.

CHAPTER IV

RESULTS

Before proceeding with the analysis of data concerning the predictions made on pages 49 and 50, it might be fruitful to review briefly the method used in scoring the personality tests and some of the results obtained from the 29 volunteer subjects.

The figure-drawing test. The scoring procedure for this test was presented on page 60. Each of the three judges independently scored each set of drawings. The final mean score for each subject was obtained by computing the mean of the three judges' scores. The mean score for the total group was 16.58. For the distribution of figure-drawing scores, see Table 5 in Appendix B.

The Rorschach test. The scoring procedure for this test appeared on page 64. Two judges independently scored the Rorschach protocols and the means of the judges' scores for each category were then calculated. The presence of any of the seven Rorschach categories was determined by comparing the obtained means with the criteria in Witkin et al. (1954). The distribution of Rorschach scores appears in Table 6 in Appendix D. The total Rorschach score was obtained by taking

the sum of the number of categories found in the protocol (with the exception of the anatomy score which was subtracted from the sum of the other scores). The mean score for the total group of volunteers was 1.55.

Combined Rorschach and figure-drawing scores. The Rorschach and figure-drawing scores were converted to z-scores to which a constant of five was added. The sum of the standard scores then was computed for each subject. The subject with the lowest score was ranked one and the highest scoring individual was ranked 29. These ranks serve to identify each subject throughout this dissertation. The combined scores for the total volunteer group ranged from 7.15 to 13.14. The distribution of Rorschach, figure-drawing, and standard scores appears in Table 7 in Appendix E.

Analysis of Data in Regard to Predictions

Prediction 1. It was predicted that a positive relationship would be found between the adequacy of introspective-coping skills and attitudes toward the self (as indicated by combined Rorschach and figure-drawing scores) and the degree of intellectual efficiency (as measured by a series of intellectual tasks). Table 1 presents the basic experimental design from which an evaluation of this prediction was made. The major variables are: condition (experimental, control), personality (high, low), ordinality (pretest, posttest), test (form A, form B), and sequence of test administration (AB, BA).

The design may be considered as consisting of a second-order Latin square (test x ordinality x sequence) with two individuals in each sequence. This Latin square is replicated over four (condition x personality) groups. Each individual has two scores: pretest and posttest (and, hence, forms A and B). A significance level of .05 will be used to evaluate the statistical tests of all three predictions.

Table 1

Distribution of Mean Intellectual Test Scores over Condition, Personality, Sequence, and Ordinality

(N= 16)

Condition	Personality	Sequence	Ordinality: Mean pretest scores	Ordinality: Mean posttest scores
Experimental	High	1. A, B	52.50	54.66
		2. B, A	68.16	63.83
	Low	1. A, B	68.83	73.17
		2. B, A	66.83	71.50
Control	High	1. A, B	65.00	63.66
		2. B, A	60.16	63.17
	Low	1. A, B	61.33	66.96
		2. B, A	72.00	73.33

The scores on the intellectual tasks were submitted to an analysis of variance, the summary of which is presented in Table 2.

Table 2

Analysis of Variance of Intellectual Test Scores over Condition, Personality, Sequence, and Ordinality

Source of Variation	Sum of Squares	df	Mean Square	F	P
Total	24,579.50	31			
Between Subjects	22,367.50	15			
Condition (C)	50.00	1	50.00		
Personality (P)	4,371.13	1	4,371.13	2.63	>.05
Sequence (S)	1,250.00	1	1,250.00		
C x P	406.13	1	406.13		
C x S	112.50	1	112.50		
P x S	36.13	1	36.13		
C x S x P	2,820.13	1	2,820.13	1.69	>.05
Ss within C x P x S	13,321.50	8	1,665.19		
Within Subjects	2,212.00	16			
Ordinality (O)	288.00	1	288.00	1.93	>.05
Test (T)	50.00	1	50.00		
O x C	2.00	1	2.00		
O x P	325.03	1	325.03	2.18	>.05
O x C x P	45.23	1	45.23		
T x C	50.00	1	50.00		
T x P	6.13	1	6.13		
T x C x P	253.13	1	253.13	1.70	>.05
O x Ss within C x P x S	1,192.50	8	149.06		

The results in Table 2 indicate that none of the effects were significant; therefore, the prediction that personality test

scores would be positively related to intellectual efficiency scores is not supported by the evidence.

Prediction 2. This prediction stated that a positive relationship would be found between the adequacy of introspective-coping skills and attitudes toward the self (as indicated by combined Rorschach and figure-drawing scores) and adaptation to sensory deprivation (as measured by The Rating Scale of Deprivation Adjustment). Table 3 shows the scores obtained by each experimental subject on the rating scale.

Table 3

Comparisons of Rating Scale Scores for the Two Personality Groups

(N= 8)

Group H S	Rating scale score	Group L S	Rating scale score
23	27	1	23
24	61	7	19
27	49	8	29
29	42	9	15
Mean Score	44.8		21.5

Mean Difference = 23.3

$t = 3.02$

$P < .05$

The mean score for subjects in Group H was 44.8 while for subjects in Group L the mean score was 21.5. This difference yielded a $P < .05$. Therefore, prediction 2 is supported by the evidence.

Prediction 3. This prediction stated that a positive relationship would be found between the degree of adaptation to sensory deprivation (as measured by The Rating Scale of Deprivation Adjustment) and the degree of intellectual efficiency (as measured by a series of intellectual tasks). Table 4 presents a comparison of rating scale and intellectual efficiency scores for each subject in the experimental group.

Table 4

Comparisons of Intellectual Efficiency Scores and Rating Scale Scores for Experimental Subjects

($N = 8$)

Group H			Group L		
S	Rating scale score	Efficiency score	S	Rating scale score	Efficiency score
23	27	-1.34	1	23	+11.01
24	61	-2.34	7	19	- 1.33
27	49	-7.33	8	29	+ 2.33
29	42	+6.67	9	15	+ 7.00

$r = -.51$, $t = 1.46$, $P > .05$

It can be seen in Table 4 that, although the correlation coefficient is in the expected direction, the level of significance is above .05. Therefore, the prediction that a positive relationship would be found between sensory deprivation adjustment and intellectual efficiency is not supported by the evidence.

CHAPTER V

DISCUSSION

The Effects of Sensory Deprivation on Intellectual Efficiency as a Function of Personality

The prediction that a positive relationship would be found between the personality groups (Group H and Group L) and the degree of intellectual efficiency was not supported by the results.

It should be noted that in addition to examining the overall relationship between personality characteristics and intellectual efficiency, the relationship between personality characteristics and adjustment to isolation and the relationship between adjustment to isolation and intellectual efficiency also were examined. It also should be noted that only the relationship between personality characteristics and adjustment to deprivation was significant.

First, then, it is clear that personality structure does affect adjustment to sensory deprivation. Subjects in Group H obtained a significantly higher score on The Rating Scale of Deprivation Adjustment than did subjects in Group L. The results on the rating scale indicate that individuals who

demonstrate inadequate introspective-coping skills and negative attitudes toward themselves experienced greater boredom, restlessness, tiredness, discomfort, agitation, and tension. As might be expected, they spent a greater amount of time ruminating about the experimental situation, in worrying about their breathing, and in showing concern over parts of their body. They also expressed a greater desire to move their bodies and did so more frequently than did subjects in Group L. These individuals also had the subjective impression that time had gone by slowly, although all but one of the subjects underestimated the length of time they had been in the tank. The highest scoring individual on the rating scale was the only subject who estimated the amount of elapsed time correctly. Estimates by other subjects in both groups ranged from one to one and a half hours.

These findings corroborate those of Goldberger (1958) and of Goldberger and Holt (1958a; 1958b). Camberari's results (1959) also suggest that personality, in the form of suggestibility, is related to adjustment in sensory deprivation; however, his data were not evaluated statistically and it is difficult to judge the degree of confidence to place in them. For what it is worth, the direction of his results contradicts the direction of the current results; i.e., if we equate field dependency with suggestibility, the two sets of data do not agree.

Despite the finding that personality was related to deprivation adjustment, the comparability of the deprivation experiences in this study to others should be examined. Although the period of deprivation in this study was considerably shorter than in others, subjects in this sensory deprivation situation experienced many of the phenomena found in other studies. These phenomena included visual imagery, auditory and olfactory sensations, body dissociation, loss of orientation in space and time, sleep, subjective impressions of thought disturbances, "stimulus-action hunger," and a variety of affective reactions during and immediately after sensory deprivation. All of these phenomena have been reported previously (Bexton et al., 1954; Camberari, 1959; Goldberger, 1958; Goldberger & Holt, 1958a; 1958b; Lilly, 1956; Scott, 1954; Shurley, 1960; Wexler et al., 1958).

The personality classification in this study was based on results from two tests, Rorschach and figure-drawing. In an attempt to discover which of these is a more efficient predictor of deprivation-tank behavior (as measured by The Rating Scale of Deprivation Adjustment), correlations between each of the personality tests and the rating scale were obtained. For the relationship between Rorschach and the rating scale, $r = .90$, $P < .01$. For the relationship between figure-drawing and the rating scale, $r = .34$, $P > .05$. (These values should be compared with the correlation coefficient for combined

Rorschach and figure-drawings with the rating scale: r = .74, P <.05). These results suggest that the Rorschach test is the better predictor of deprivation adjustment. Goldberger (1958) and Goldberger and Holt (1958a; 1958b) used a different scale based on Rorschach responses (Holt, 1956; 1959). They found that under conditions of isolation their Rorschach scores correlated positively with controlled primary process, and positively with pleasant affect, and negatively with unpleasant affect. Thus the current findings agree with those reported by others.

While no correlations were calculated between specific Rorschach categories and the rating scale, cursory examination of the data suggests that the whole and popular responses in the coping category and the human movement responses in the introspective category were the most relevant ones. Translated into personality terms, this means that the most adaptive behavior in sensory deprivation was exhibited by those individuals who had good integrative capacities, were able to deal effectively with commonplace reality, and who were capable of using introspective, self-reflective thinking in a productive way. The impression that the whole and popular categories may bear an important relationship to sensory deprivation adjustment is interesting in the light of other findings. Witkin et al. (1954) found that the highest correlation for both men and women occurred between whole and popular

categories and the orientation index (considered by the authors to be the most comprehensive perceptual score). The correlations were about as high for these two categories as those obtained with the total Rorschach score based on seven categories. The authors state:

> The suggestion is that subjects who are unable to resist the visual field in our orientation test situations tend also to be unable to organize Rorschach stimulus material and to make use of its more obvious and relevant components. It is noteworthy that the W score which most closely corresponds conceptually to the "activity-passivity" interview variable, should correspond to this variable in showing the highest and most consistent correlations with perceptual performance (Witkin et al., 1954, p. 220).

Just as it is clear that personality is related to sensory deprivation adjustment, so is it equally clear that (so far as the data in this research are concerned) adjustment to sensory deprivation does not affect intellectual efficiency ($r = -.51$, $P > .05$). Examination of the possible reasons for the lack of relationship may be fruitful for future research.

First, of course, there may be no relationship between deprivation experiences and intellectual efficiency. It may also be true, however, that the length of deprivation in this study was long enough to produce negative reactions to deprivation but not long enough to produce intellectual impairment. Had sensory deprivation been continued for a longer period, intellectual impairment might have become manifest (Bexton et al., 1954).

Another factor which may have influenced the results

was the mode of coping with the deprivation situation. On the rating scale, high scorers indicated that they had moved twice as much as had low scoring individuals. In the retrospective accounts, some subjects indicated they had moved almost continuously. In addition, subjects who obtained high scores on the rating scale also had focused their thinking on the experimental situation and had remained fixated on residual stimuli. For example, they would dwell on their breathing or the slight bobbing in the water (which increased as they took deep breaths or moved around). One subject stated, "I needed to move. I just wanted to occupy my mind with something to do." When asked if he had experienced unpleasant thoughts, he said, "Well you could shut those out. I wouldn't think much about those." Another high scoring subject, when asked whether he did any daydreaming or thought about personal things, stated, "I considered the time I nearly drowned last summer." Later in the interview this subject said, "I was distracted from thinking about personal things by the breathing, buoyancy, muscular aching, and I was somewhat preoccupied with experimental factors." In contrast to these statements, a low scoring subject stated, "This experience reminded me of a picture I saw of a large man floating on his back in a salt lake. He was very relaxed, like taking a Sunday afternoon nap. It was just like I'd feel after a large meal and stretching out and not going to sleep." Another low

scoring subject stated, "I began devising things in order to pass time. I tried to invent a story but found that I couldn't keep my mind on it. Other things would break in continually. It's hard to remember what they were. It seems like most of them were commonplace."

In short, individuals who obtained high scores on the rating scale (poor adjustment) tended to maintain their reality orientation, and they avoided self-reflective thinking by focusing on aspects of the experimental situation which they felt were either disturbing, distracting, or causing them to feel uncomfortable. They resorted to ruminative and, at times, obsessional thinking and, instead of experiencing anxiety as such, they turned it to discomfort and pain, somewhat like the behavior of individuals who undergo conversion reactions. Subjects who achieved low scores on the rating scale freely admitted difficulties in secondary process thinking but invariably associated these difficulties with intrusions by intervening thoughts rather than with distractions in the experimental situation.

In the light of the above reactions, it appears that the manner of coping demonstrated by the high scoring individuals served the purpose of warding off anxiety and thereby of limiting the debilitating effects of regression. Vernon and Hoffman (1956) found that, when subjects were isolated in a darkened room and allowed to move around, there was no de-

crease in associative learning ability. Mendelson et al. (1958) have also pointed out that the restriction of mobility in sensory deprivation studies may be as important in producing mental symptoms as the restriction of other senses. High-scoring individuals may have succeeded in binding their anxiety into symptoms. The consequence of the anxiety binding may have been the prevention of deterioration of intellectual functioning (Schafer, 1948).

The test itself may have contained a set of factors which influenced the obtained results. In the first place, the tests took approximately 45-60 minutes. This period of time may be long enough to permit the dissipation of the deprivation effects. Secondly, there may be an interaction effect which involves the kind of task and the order of presentation. It may be that complex tasks are affected in a way which is different from the way simple tasks are affected. Goldberger and Holt state:

> Probably any task that can be done satisfactorily in a single brief effort by the use of highly overlearned sets of operations (as in simple arithmetic problems), and any learning or memory performance requiring passive receptivity (cf. digit span, rote learning) rather than active reflection and manipulation of ideas (cf. logical reasoning) would be least interfered with by moderate amounts of isolation (Goldberger & Holt, 1958b, p. 109).

If sensory deprivation has differential effects on simple as opposed to complex skills, perhaps the best way to reveal these effects would be to give all the complex tasks

at the beginning of the test. The procedure followed in this study alternated simple and complex tasks. It is possible that this procedure permitted the dissipation of sensory-deprivation effects on intellectual efficiency.

By way of summary, it may be stated that conclusive evidence of a relationship between personality factors and the effects of sensory deprivation upon intellectual efficiency still does not exist. While some investigators have found impairment in post-deprivation tasks (Bexton et al., 1954; Goldberger, 1958; Goldberger & Holt, 1958a; 1958b; Scott, 1954), other investigators have not demonstrated the existence of any impairment (Vernon & Hoffman, 1956).

The current study must be included in the list of those which do not find that sensory deprivation leads to intellectual impairment. In addition, this study did not find a relationship between personality factors and the effects of sensory deprivation on intellectual efficiency. At the same time, the results of this study tend to support previous findings (Goldberger, 1958; Goldberger & Holt, 1958a; 1958b) concerning the relationship between personality and adaptation to sensory deprivation.

A number of possible reasons for the lack of relationship between adjustment to deprivation and intellectual efficiency have been mentioned. There is, however, one other factor which affects the overall results that has not yet

been taken into consideration: It may be that subjects in the High personality group came to the experiment with an anxiety level high enough to depress their initial scores to the point where further depression was unlikely. If this were true, then any of the deprivation effects on intellectual efficiency would have been masked.

Suggestions for future research. In evaluating this research and in comparing it with other studies, several variables emerge which warrant further study. The results of this study suggest that a two hour period of deprivation, using the immersion technique, may not be a long enough period of time to produce intellectual impairment. Additional research is needed to determine the relationship between various functions and length of time in deprivation.

The kinds of tasks which would be most sensitive to intellectual impairment is another variable that needs further exploration. The results of other studies suggest that tasks which require complex manipulation of ideas would be most suitable. In addition, the length of test batteries needs to be explored since we have little information about the recovery rate in individuals who have been exposed to sensory deprivation. A fruitful way of exploring this area might be to give an equated series of tasks before, during, and immediately after deprivation. However, the introduction of tasks during deprivation, may, because of its stimulating

effects, influence the subject's reactions to an unknown degree.

The initial reaction of subjects is another area that needs further study. The very fact that individuals with particular personality structures are about to take part in a sensory deprivation experiment can arouse a high degree of situational anxiety which may be reflected in lowered scores on pre-deprivation testing thereby masking the results on posttests.

One last comment should be made about the personality measures used in this study and their application for future research. Although the combined personality measures (Rorschach and figure-drawing test scores) effectively predicted deprivation behavior, the Rorschach test seemed to be more successful. It might be worthwhile, therefore, to explore the possibility of integrating the scoring systems of Witkin et al. (1954) and that of Holt (1956; 1959) in order to make predictions of sensory deprivation adjustment even more effective.

CHAPTER VI

SUMMARY

Previous studies have not been able to demonstrate conclusively the presence of intellectual impairment in individuals who have been exposed to sensory deprivation.

The purpose of this study was to investigate the effects of sensory deprivation on intellectual efficiency as a function of personality.

A line of reasoning was presented which assumed that basic personality characteristics might be crucially related to the kinds of ego regression which take place when contact with the external environment is drastically curtailed. According to psychoanalytic theorists, two kinds of regression are possible: an adjustive regression which takes place in the "service of the ego" and which permits a non-anxiety and non-guilt-producing awareness of material which formerly remained out of awareness; a non-adjustive regression which is characterized by a real or threatened break-through into awareness of unconscious material, accompanied by anxiety, unpleasant affect, and by attempts to maintain a reality

orientation through stimulus-bound and obsessional thinking.

According to this formulation, the adequacy of adjustment to sensory deprivation seemed to be directly related to basic personality characteristics which the Rorschach and the figure-drawing test measure.

The specific purposes of this study were to test the following predictions:

1. There is a positive relationship between the adequacy of introspective-coping skills and attitudes toward the self (as indicated by combined Rorschach and figure-drawing scores) and the degree of intellectual efficiency (as measured by a series of intellectual tasks).

2. There is a positive relationship between the adequacy of introspective-coping skills and attitudes toward the self (as indicated by combined Rorschach and figure-drawing scores) and adaptation to sensory deprivation (as measured by The Rating Scale of Deprivation Adjustment).

3. There is a positive relationship between the degree of adaptation to sensory deprivation (as measured by The Rating Scale of Deprivation Adjustment) and the degree of intellectual efficiency (as measured by a series of intellectual tasks).

Subjects in this study were junior and senior medical students at the University of Oklahoma School of Medicine. From an initial group of 29 volunteers, 16 individuals were

selected as subjects. The 8 individuals who had the highest weighted combination of scores on the Rorschach and figure-drawings were selected for Group H (high scores), and the 8 individuals who had the lowest weighted combination of scores were selected for Group L (low scores). Four subjects from each personality group were assigned randomly to either the control or experimental group. Subjects in the experimental group received a battery of intellectual tasks immediately prior to undergoing two hours of sensory deprivation. Sensory deprivation was achieved by allowing the subject to float in a large circular tank filled with warm water in a sound-proof and light-proof room. After sensory deprivation, an alternate battery of intellectual tasks was administered. Each experimental subject then completed The Rating Scale of Deprivation Adjustment. Finally, he recorded a retrospective account of his experiences in sensory deprivation and was interviewed briefly.

Subjects in the control group completed a battery of tests followed by two hours of relaxation under moderate stimulation. The alternate test battery was then given.

The scores on the intellectual tests were submitted to an analysis of variance which indicated that none of the effects were significant. Therefore the prediction that personality test scores would be positively related to intellectual efficiency was not supported by the evidence.

A positive relationship was found between the personality test scores and adaptation to sensory deprivation. Individuals who demonstrated poor coping-introspective skills and negative self-attitudes on the personality tests demonstrated poorer adjustment to sensory deprivation on the basis of rating scale scores.

A positive relationship was not found between the degree of adaptation to sensory deprivation and the degree of intellectual efficiency on post-deprivation tests.

On the basis of results in this study, it was concluded that while personality appears to be related to deprivation adjustment, there is no evidence to support the view that personality is related to intellectual impairment which results from sensory deprivation. Indeed, in this study, there is no evidence that such impairment occurs. Some of the possible reasons for these results were discussed and suggestions for future research were offered.

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APPENDIXES

APPENDIX A

Short Scale of Figure-Drawing Items

The following scale is identical to that used by Witkin et al. (1954) except for the fact that the numerical designations for each item have been changed and only the forty items applicable to male subjects have been included. A particular item is scored plus (+) if it appears in one of four ways.

1. On either figure regardless of sex.
2. On the self-sex figure.
3. On the opposite-sex figure.
4. On both figures.

Below you will find when each specific item is scored. For example, weak body posture is scored only on the self-sex figure. The opposite-sex figure is ignored when scoring this particular item.

Criteria for Scoring

1.	Weak body posture	(Scored on self-figure) Global impression of weakness, depletion, collapse, or "falling apart" in content or structure.
2.	Marked disproportion	(Scored on either figure) Global impression concerning adequacy of proportion in size and placement of major body parts. Specific disproportion of hands and feet are not included.
3.	Skill rating of 5 or less on a 9-point scale	(Scored on either figure)

4. Excessive erasures	(Scored on either figure) Scored if either figure has three or more erasures, or if the head is erased.
5. Transparency	(Scored on either figure) Scored when any part of the figure "shows through" a superimposed part or through clothing.
6. Vertical midline not indicated or off-axis	(Scored on either figure) Midline refers to explicit indications of the body axis. In "simple" drawings it may be represented by a vertical line in the center of the trunk, in more "sophisticated" ones by sufficient details (such as a row of buttons, elaborate zipper, long tie, etc.) to represent the midline. The midline is off-axis if it is not parallel to the body. It may be moved to the side in profile drawings.
7. Continuous line	(Scored on either figure) The line is essentially continuous, as if the pencil had rarely been lifted from the paper in the process of drawing outlines for each of the major body parts.
8. Reinforcements absent or rare	(Scored on either figure) Reinforcement is defined as going over a line, usually with heavier pressure.
9. Consistency rating of 5 or less on a 9-point scale	(Scored on either figure) Consistency within a single figure refers to consistency in quality, skill, amount, and balance of detailing in various areas, freedom from a combination of childish or animal-like elements with mature elements. Consistency of mood or action is included in the score, but variation in line quality is not.

10.	Excessive mouth disturbance	(Scored on either figure) Deviations such as unusual size or shape, persistent erasures, uncontrolled shading, or omission of the mouth when the eyes and nose are present.
11.	Large head	(Scored on self figure only) Scored if the length of the head is approximately one-seventh of the figure.
12.	Large eyes	(Scored on self-figure only) Scored on the basis of the relationship of size of eyes to the rest of the face.
13.	No sensuous mouth	(Scored on self-figure only) A sensuous mouth is heavily shaded, full-lipped, and very curved.
14.	Ear emphasis	(Scored only when present in both drawings) Ear may be very large, displaced, distorted, detailed, incorporated in head outline, heavily reinforced, erased, or shaded.
15.	Peculiar or circle head	(Scored on either figure) The head is misshapen or is a crude circle.
16.	Self-sex figure pleasanter	(Scored on self-figure only) Ordinarily scored on the basis of facial expression. If facial features are omitted in either or both drawings, the score is based on the basis of the mood expressed in the total figure.
17.	Opposite sex more hostile	(Scored on other sex only) Absence of features is also taken as an expression of hostility.
18.	Hostile or fearful expression	(Scored on either figure) Scored on the basis of facial expression. Absence of facial features on either figure is also taken as expression of hostility.
19.	Arms relatively weak or omitted	(Scored on self-sex only) Impression may be conveyed by faint lines, amorphous shape, etc.

20.	Short arms	(Scored on self-sex only) Normal arm is roughly two-fifths of the length of the figure. Short arms are defined as less than one-third of the figure.
21.	Arm or arms out or at side	(Scored on either figure)
22.	Hand or hands not pointing toward the body	(Scored on self-figure only) Scored on the basis of the direction of the arm even if the hands are omitted.
23.	Foot blurring, peculiarity or omission	(Scored on either figure) Feet blurred, unrealistically shaped, or distorted.
24.	No tight stance	(Scored on either figure) Tight stance is defined as legs pressed close together.
25.	Crude clothing	(Scored on either figure) Clothing indicated by belt or buttons at most. Does not refer to realistically drawn nudes.
26.	No tie	(Scored on male drawings only) Scored only when a shirt is buttoned up, a hat is indicated, or a business suit is drawn.
27.	Accessories emphasized more than essential details	(Scored on either figure) The figure is too "fussy", contains too many ideas or special items, at the expense of essential parts of the figure and clothing.
28.	No dressing to neckline, no sport clothing, no nudes	(Scored on self-sex only) No dress of the figure to the neck, no sport attire or bathing suit, no nudes.

29.	Meager sex characteristics	(Scored on either figure) Basis of judgment is the absence or minimization of sex characteristics. For drawings of the male figure, broad shoulders, appropriate hair treatment, and clothing, and accessories are considered indicators of masculinity. For drawings of the female figure, breasts, hips, buttocks, as well as coiffure, clothing, and accessories are considered indicators of femininity.
30.	Meager male-figure differentiation	(Scored when both figures look "alike").
31.	Hair shading uncontrolled	(Scored on either figure) Scored when the shading is disorderly, lacking in structure, not encased, without coiffure lines.
32.	Body shading uncontrolled	(Scored on either figure)
33.	Absence of usual indicators of masturbatory guilt	(Scored on self-sex only) Absence of such features as: hand or hands in pocket or in genital area; rigid, conspicuous, or deformed fingers; swelling or reinforcement of hand or hands; pipe or cigarette, pencil, baseball bat, etc.
34.	Absence of soft hair on female figure	(Scored on female figure only) Meager, severe, harshly scribbled hair, or complete absence of hair.
35.	Female has higher drive	(Scored if the numerical rating assigned to the female is higher than the rating assigned to the male figure) Drive is derived from a global impression of all aspects of the drawing and scored on a nine-point scale. This item refers mainly to energy level.
36.	No effeminacy on male	(Scored on self-sex only) Absence of effeminate features such as small feet, small hands, large hips, rouged mouth, fancy hairdo, shoe heels.

37.	Opposite-sex drawing equal in size to or smaller than self-sex	(Both drawings need to be taken into account)
38.	Female in profile	(Scored on opposite sex only)
39.	Absence of margins and encasements	(Scored on either figure) Margins refer, e.g., to cuffs on shirt-sleeves or trousers. Encasements may consist of a line around the fingers, toes, or around the hair.
40.	Neck very long or absent	(Scored on either figure) Neck is considered long if its length is 10 per cent or more of the length of the total figure.

APPENDIX B

Table 5

Figure-Drawing Scores for Each Subject in the Volunteer Group

(N= 29)

S number	Judge H	Judge B	Judge I	Mean score
1	7	6	9	7.33
2	8	8	10	8.66
3	10	12	12	11.33
4	13	10	15	12.66
5	15	10	14	13.00
6	13	9	12	11.33
7	13	17	15	15.00
8	8	8	10	8.66
9	11	11	14	12.00
10	10	11	17	12.66
11	18	14	16	16.00
12	18	17	18	17.66
13	21	16	17	18.00
14	14	14	11	13.00
15	20	14	20	18.00
16	22	21	22	21.66
17	19	18	21	19.33
18	12	15	14	13.66
19	23	15	22	20.00
20	19	15	18	17.33
21	17	20	16	17.66
22	28	26	23	25.66
23	21	24	23	22.66
24	13	13	15	13.66

(Table 5 continued on next page)

Table 5 -- Continued

S number	Judge H	Judge B	Judge I	Mean score
25	25	22	25	24.00
26	24	21	24	23.00
27	22	19	22	21.00
28	24	26	25	25.00
29	21	21	21	21.00
Mean score	16.80	15.60	17.30	16.58

APPENDIX C

The Rorschach Scoring System

Description. The initial scoring of the Rorschach protocols is based primarily on the scoring system of Klopfer and Kelley (1942) with some additional refinements used by Witkin et al. (1954). In accordance with Klopfer's method, each response receives only one main determinant score; other determinants are scored as additional only and are not included in tabulating ratios and percentages (except for human movement and color responses, both of which are used in the calculation of the F per cent).

In the Rorschach scoring system devised by Witkin et al. (1954), differences between field-dependent and non-field-dependent perceivers were found to exist in a number of categories. These categories were whole responses (W), human movement responses (M), human-figure responses (H), popular responses (P), form responses (F), color responses (C), and anatomy responses (A). These seven categories were divided into two main groups. The WPC (whole, popular, and color responses) were believed to reflect organizing and coping ability, activity level, and control over impulses. The MHFA (human movement, human figure, form, and anatomy responses)

reflected inner life, self-awareness, and the degree of constriction, and self-acceptance. The scoring system was devised in such a way that the presence of scores in all categories (except anatomy) was found to be associated with field-dependent perceptual behavior. The absence of scores was associated with analytical perceptual performance. Since the anatomy score (A) was found to be associated with the performance of the latter group, it was subtracted from the sum of the other scores. The total scores may therefore range from zero to six without the presence of an anatomy score and zero to five if there is an anatomy score.

Criteria for Determining WPC (Coping) Scores

The whole response (W). Both whole and cut-off wholes are used in determining the W score. The popular response to Card III (two people) is scored W in this case. Two criteria are used for assigning a W score:

> 1. When no more than three adequate whole responses are present in the record no matter how many or how few other kinds of whole responses are present. The adequacy of a whole response depends on whether the response contains a well-articulated form and represents an adequate use of the blot's structural features.
>
> 2. If 50 per cent or more of the whole responses are inadequate (F minus) or blot-determined. Blot-determined responses are those that represent little organizing activity but rather represent a passive acceptance of the compelling structural features of the blot (i.e., crude and vague whole responses and those determined primarily

by shading or color, with the form element absent, or playing a minor role.

The W score is assigned therefore either for a small number of adequate whole responses or for a large proportion of inadequate or blot-determined responses. The form level tables in Beck (1944) are used to determine the critical form level of whole responses. The major deviations are as follows: cloud responses on Card VII are treated as blot-determined; anatomy charts in the colored cards are considered to be blot-determined if the form element is minor; collection responses (i.e. "a lot of insects" on Card X) are not used in determining the W score unless the form elements are clear.

The popular response (P). The list of popular responses enumerated below consists of the ten popular responses published by Klopfer et al. (1942) and all of the twenty responses listed by Beck (1944) that are not on Klopfer's list. Twenty responses are therefore used as a basis for assigning the P score. A P score is given when the Rorschach record contains five or fewer of the popular responses listed below.

Card I

1. Any W or cut-off W indicating a creature with the body in the center and wings at the sides (e.g., bat, butterfly, moth).

2. The center D area as a human form.

Card II

3. In the black D area, any animal or part of an animal of the dog, bear, rabbit, bull, or rhinoceros variety. Usually the center-top detail is the head region.

4. The whole blot as two humans but not necessarily in movement.

5. The lower D area as a butterfly or moth. Modifications of this basic form are P (e.g., swallowtail butterfly). Other winged forms are not P.

Card III

6. The large side D areas as human figures as long as the legs are in the lower side D area. Representations of humans are P (e.g., dolls, statues). Calling just one side human still justifies as P score.

7. The center D area as a bow-tie, hair ribbon, butterfly, or moth. No other winged creature is P.

Card IV

8. The whole blot as any variation of animal skin. A human dressed in an animal skin is also given a P score since the credit is for the skin, not the human.

9. The side D area as a foot, shoe, or boot. The lower side D alone as a boot, foot, or shoe is not P.

Card V

10. Any W or cut-off W given as a winged creature with the body in the center and wings at the sides. This also applies with the card held up-side down.

11. The outer D projection as a human or animal leg. This also applies to variations such as drumstick or chicken leg. The basic form is a leg filled out by muscle development.

Card VI

12. The whole card or the large D as an animal hide, pelt, skin, or rug. The basic animal skin form must be perceived although specific animals may vary.

Card VII

13. The large detail (below the projection on top) as human heads or faces, nearly always of women. The response may embrace the whole side, as a whole person, or include the whole card, each lateral half being a person. The content may vary in being busts or statues. All these are P if the female head form is the nucleus of the response.

Card VIII

14. The side D areas as any kind of four-legged animal in any kind of motion. The only animals not included are those considered to be F minus in Beck's tables (1944).

15. The upper white space as a skeletal form. These may be ribs, bones, thorax, spinal column, fish backbone, etc.

Card IX

16. The lower pink area as a head or face, nearly always of men. Well-known people may be named and the card may be held in any position.

17. The top orange detail as a human figure. These may include such things as clown, dwarf, ghost, witch, etc. Seeing the basic human form is the important thing.

Card X

18. The outer blue area as any many legged animal such as spider, crab, or octopus. Variations for crab include lobster and crustacean.

19. The lower light green area as the head of an animal with long ears or horns (e.g., rabbit, donkey, goat).

20. The darker green area in the lower center as any elongated, green animal such as caterpiller, garden snake, or tobacco worm.

The color response (C). The C score is determined on the basis of the relative frequency of responses indicating

controlled emotional reactions (FC) and responses showing predominantly uncontrolled features (CF, C, but not Csym.). Two criteria for assigning the C score are used:

1. When there is only one form-color response (FC) and two or more uncontrolled color responses (CF or C). If there are no form-color responses but at least one uncontrolled color response, a C score is given.

2. If two or more FC responses are produced but there are more than twice as many CF and/or C responses. The C score is not assigned where there is a complete absence of color.

Criteria for Determining MHFA (Introspective) Scores

The human-movement response (M). Individual human-movement responses are judged according to the criteria laid down by Klopfer and Kelley (1942). Some indication of motor activity or clearly expressed movement in parts of human figures is necessary to receive an M score. Marginal responses are scored as movement tendencies but are not included in the final determination of the M score. Responses that attribute to animals human-like actions that are unusual for these particular animals, are scored as human-movements. The total M score is assigned if the record contains two or fewer human-movement responses.

The human-figure response (H). The total H score is based on the ratio of human detail responses to all responses scored as having human content (Hd/ H + Hd). The H score is given whenever the ratio is 50 per cent or greater.

The form response (F). Form responses are scored according to the criteria offered by Klopfer et al. (1942). The accuracy of the form level (F+ or F-) is not taken into account except in the case of whole responses. Animals in movement are scored FM rather than being scored for form alone. In responses that are primarily form-determined with other determinants subordinate to form, the form determinant alone is used in estimating the proportion of form responses. Two criteria are used in assigning a total F score:

1. Where form responses constitute 60 per cent or more of the total responses.

2. Where the F per cent is less than 60 per cent and the sum of human movement and color responses of any kind is five or less. Color responses that are used as additional determinants are included in computing the F score.

The anatomy response (A). These responses usually involve internal organs, bone structure, or anatomical charts. Responses such as skeleton which refer to the human figure are not scored as anatomy. Two criteria for assigning the A score are used:

1. The presence of three or more anatomy responses in records where the total number of responses is less than 35.

2. The presence of four or more anatomy responses in records with more than 35 responses.

APPENDIX D

Table 6

Mean Rorschach Scores for Each Subject in the Volunteer Group

(N= 29)

S	R	Poor W%	P	FC	CF	C	M	Hd%	F%	A	Group	Total
1	57	0	9	3	5	0	4	75	42	5	HA	0
2	39	40	8	2.5	3.5	0	5	50	56	6	HA	0
3	57	35.5	13	3	2	1	7.5	44	46.5	2	None	0
4	17	18	7	1	1	0	5.5	0	18	1	None	0
5	23	14	9	1	0 (1)[a]	0	4	37.5	36.5	0	None	0
6	77	0	11	2.5	1.5	0	13	61	36	1	H	1
7	28	25	8	1	0	0	4	40	41	4	FA	0
8	37	57	6	0	4	0	5	57	57.5	5	WCHA	2
9	20	33	6	0	3 (0.5)[a]	0	2.5	16.5	42.5	1	C	1
10	27	14	7	1 (1)[a]	0	0	4	50	48	2	H	1
11	35	38.5	9	2	0	0	5	60	49.5	5	HA	0
12	13	43	9	2 (2)[a]	1 (1.5)[a]	0	4	0	11.5	0	None	0

[a]Numbers enclosed in parentheses represent additional determinants.

(Table 6 continued on next page)

Table 6 -- Continued

S	R	Poor W%	P	FC	CF	C	M	Hd%	F%	A	Group	Total
13	29	55	8	3	4 (0.5)[a]	0	4	17	37	3	WA	0
14	79	62	11	8 (0.5)[a]	7 (1)[a]	0	8	64	38	0	WH	2
15	50	59	8.5	4	7.5 (1)[a]	0	7	37	31	2	W	1
16	25	41	6	0	1	0	5	33	33	4	CA	0
17	15	20	10	0	0	0	4	33	26	1	F	1
18	24	36	5	0 (2)[a]	1 (0.5)[a]	0	2	0	56	3	PCMFA	3
19	21	0	7	1	0	0	2	50	47.5	3	MHFA	2
20	83	77	8	1	4	0	4.5	94	67	8	WCHFA	3
21	14	14	7	0 (0.5)[a]	1 (0.5)[a]	0	2	33	39.5	2	CMF	3
22	17	27	7	1	2 (1)[a]	0	3	25	41	2	C	1
23	39	62	3	0	12 (1)[a]	0	3	25	43	8	WPCA	2
24	10	90	3	0	4	0	1	0	0	0	WPCMF	5
25	33	50	5	2 (2)[a]	3	0	6	0	43.5	2.5	WP	2
26	18	38.5	8	0	1	0	2	33	52.5	1	CMF	3
27	10	60	2	0.5	0.5	0	0	100	70	3	WPMHFA	4
28	23	60.5	4	0	0	0	0	0	74	3	WPMFA	3
29	12	58	4	0	2	0	0	0	50	2	WPCMF	5

[a]Numbers in parentheses represent additional determinants.

APPENDIX E

Table 7

Figure-Drawing and Rorschach Standard Scores for Each Subject in the Volunteer Group

(N= 29)

S number	Total score	Figure-Drawing score	Rorschach score
1[a]	7.15	3.17	3.98
2[a]	7.41	3.43	3.98
3[b]	7.94	3.96	3.98
4[a]	8.21	4.23	3.98
5[a]	8.27	4.29	3.98
6[a]	8.60	3.96	4.64
7[a]	8.67	4.69	3.98
8[a]	8.73	3.43	5.30
9[a]	8.73	4.09	4.64
10	8.87	4.23	4.64
11	8.87	4.89	3.98
12	9.19	5.21	3.98
13	9.26	5.28	3.98
14	9.59	4.29	5.30
15	9.92	5.28	4.64
16	9.98	6.00	3.98
17	10.18	5.54	4.64
18	10.37	4.42	5.95
19	10.98	5.68	5.30
20	11.10	5.15	5.95
21	11.16	5.21	5.95

[a]S assigned to Group L

[b]This individual suffered from a physical disability which precluded his participation as a subject.

(Table 7 continued on next page)

Table 7 -- Continued

S number	Total score	Figure-Drawing score	Rorschach score
22[c]	11.43	6.79	4.64
23[c]	11.50	6.20	5.30
24[c]	11.69	4.42	7.27
25[c]	11.77	6.47	5.30
26[c]	12.22	6.27	5.95
27[c]	12.48	5.87	6.61
28[c]	12.61	6.66	5.95
29[c]	13.14	5.87	7.27

[c]S assigned to Group H.

APPENDIX F

Intellectual Tasks Administered to the Standardizing Group

Subjects. The standardizing group consisted of freshmen medical students at the University of Oklahoma School of Medicine. The group was composed of male students with only one exception. Eighty-three students were present for the first testing session. Three of these students were absent for the second session while eight new students were present. The remaining series of tasks were therefore administered to a total of 87 students.

Description of the Tests

Information. This test consisted of sixty items taken from the Vocational Aptitude Examination (Cleeton & Mason, 1946) and the Iowa High School Content Examination (Stuit, Greene, & Ruch, 1943). These items covered material in the historical, scientific, economic, literary, and governmental areas.

Digit span. Two sets of digits, ranging from four through nine digit numbers, were used. These digits were taken from the Wechsler-Bellevue Intelligence Scale, Form I (Wechsler, 1944) and the Wechsler-Bellevue Intelligence

Scale, Form II (Wechsler, 1946).

Logical deductions. The 16 items for this test were adopted from the Watson-Glaser Critical Thinking Appraisal, Form Am (Watson & Glaser, 1952), and the New California Short-Form Test of Mental Maturity (Sullivan, Clark, & Tiegs, 1947). Subjects were presented with a statement followed by three possible conclusions for each statement. The subjects were required to select the conclusion which logically followed from the given statement.

Associative learning. Three associative learning tasks, each consisting of six easy and four difficult word associations were orally presented to the subjects. The first two series of tasks were identical to those used in the Wechsler Memory Scale, Form I (Wechsler, 1945), and the Wechsler Memory Scale, Form II (Wechsler & Stone, 1946). The third series of associations were originated by the investigator, following a pattern similar to the first two series of tasks.

Sentence building. Items for this test were adopted from the Stanford-Binet Intelligence Scale, Forms L and M (Terman & Merrill, 1937). Original items were also included in the test. The subjects were presented with 15 sets of three abstract words and were required to use the three words in a sensible sentence.

Analogies. Forty-five items from the Terman-McNemar Test of Mental Ability, Forms C and D (Terman & McNemar, 1941)

were used. After hearing the first analogy, subjects were required to complete the second one.

Proverb interpretation. Twenty-five proverbs were orally presented and the subjects were required to write down the meaning of each.

Water-jar problems. These problems were similar to those used by Luchins (1942) and Rokeach (1948). Although this test was administered to the standardizing group, the items proved to be inappropriate for group administration, and therefore the test was not included in the final batteries of tests selected.

Administration of the Tests

The following general instructions were read to the group at the beginning of the first session after the test booklets had been passed around:

> The tests which you are taking today will be an important part of a research study being conducted at the Veterans Administration Hospital. We are interested in group results rather than individual scores and shall be comparing the scores made by this group with the scores obtained by other medical students. You will be taking a number of tests today and next week at the same time. It is very important that you return next week to complete the tests. Since the time allowed is brief, you will have to work rapidly and yet write legibly. Now before we begin, please print your full name on the top of the first page. Any questions?

These instructions, with the exception of minor appropriate deletions, were repeated the following week at the beginning of the second session.

Scoring of the Tests

Every response was judged by the investigator to be either correct or incorrect according to the scoring criteria. After all items on every subtest were scored for all subjects, each item was ranked for difficulty according to the number of correct responses to the item. The raw score was then converted to a percentage score which indicated the per cent of correct responses for each item. Items were then assigned to test batteries A and B on the basis of the per cent correct responses for each item. As a result, each item on every subtest in test battery A was matched with an equivalent test item in test battery B. It can be seen in Table 8 that the total mean scores for the subtests in each test battery are identical.

Table 8

Comparisons of Mean Scores for Each Subtest in Test Batteries A and B

Subtests	N	Test battery A	Test battery B
Information	83	37.4	37.5
Digit span	83(87)[a]	63.9	64.0
Logical deductions	83	68.7	68.9
Associative learning	83(87)[a]	85.7	85.8
Sentence building	83	79.2	79.0
Analogies	87	82.2	81.9
Proverb interpretation	87	78.1	78.1
Total Mean score		70.7	70.7

[a]Equal numbers of subjects were not present for both testing sessions when alternate forms of these tests were administered. The numbers in parentheses represent the number of students present for the second testing session.

APPENDIX G

Test Battery A

General instructions. I have a series of different tasks for you to do. Some of them will be easy and others will be more difficult. At any rate, do not expect to answer every question correctly. Just do the best you can. Any questions?

Information

Instructions. Please try and answer the following questions.

1. What is the speed of light per second?
2. A beam of light striking a mirror at an angle of thirty degrees is reflected at what angle?
3. Who wrote, The Call of the Wild?
4. What is a caucus?
5. What was the name of the first transcontinental railroad?
6. What does the ore known as pitchblende yield?
7. Which was the first state to secede from the Union?
8. What is an injunction?
9. A sonnet consists of how many lines?
10. The open-door policy is associated with what country?
11. What do we call the policy of, "let well enough alone?"
12. On weather maps, what do we call the lines connecting the places having the same barometric pressures?
13. What is a referendum?
14. Whitman's "O Captain, My Captain" commemorates what famous person?
15. What do we call a poem that tells of country or farm life?
16. In Shakespeare's Hamlet, who killed King Claudius?
17. What do we call a poem with symbolic characters?
18. Who wrote, The Wreck of the Hesperus?
19. What do we call the tubes within an insect through which air passes?
20. Who wrote, The Emperor Jones?

Sentence Building

Instructions. I am going to read a group of words, three at a time. Make up a sensible sentence using all three words.

1. failure, business, incompetant
2. dictatorial, philosophical, against
3. benefactor, institution, contribution
4. catastrophe, responsibility, poverty
5. society, sophistication, civilization
6. language, familiarity, ambiguous
7. civility, requirement, contribution

Digit Span

Instructions. I am going to say some numbers. Listen carefully and when I am through, say them after me. For example, if I were to say, "one, two, three" then you would say, "one, two, three." Do you understand?

4)	2861 5394
5)	85164 75836
6)	842751 392487
7)	8396152 7482591
8)	58192647 37294158
9)	275862584 594827316

Logical Deductions

Instructions. I am going to read a series of statements one at a time. For each statement, I will read three possible conclusions. After hearing each conclusion, decide whether it logically follows from the preceding statement. Indicate your choice by saying yes or no after

hearing each conclusion. Do not depend on your general knowledge to determine whether the conclusion is true or not. The important thing to consider is whether the conclusion is warranted on the basis of the given statement. Do you have any questions? Remember, say yes or no after hearing each conclusion.

1. Elm street is parallel to Oak Street. Oak Street is parallel to Palm Avenue. Therefore:

   a. Elm Street crosses Palm Avenue.
   b. Palm Street is longer than Elm Street.
   c. Elm Street is parallel to Palm Avenue.

2. If the students are in error, your refusal to listen to their side is unreasonable. If they are not in error, your refusal is unjust. But the students are in error or they are not. Therefore:

   a. Your refusal is justifiable.
   b. Your refusal is either unreasonable or it is unjust.
   c. Your refusal may be reconsidered later.

3. If he is to complete his highschool course, he must avoid wasting his energy and money. But he will not avoid wasting his money. Therefore:

   a. He will not complete his highschool course.
   b. He will be sorry some day.
   c. He should be criticized for not doing better.

4. Some cannibals are sincere idealists. All cannibals are fanatic. Therefore:

   a. Some sincere idealists are fanatics.
   b. No fanatics are sincere idealists.
   c. All fanatics are cannibals.

5. If he were loyal he would not speak unkindly of his family in earnest. If he were wise, he would not speak unkindly of them in jest. Either he speaks unkindly in earnest or jest. Therefore:

   a. He is either not loyal or not wise.
   b. He is unkind.
   c. If he were wise, he would say unkind things in jest.

6. All Jews feel friendly toward the State of Israel. David feels friendly toward the State of Israel. Therefore:

   a. David is not friendly toward the Arabs.
   b. David is Jewish.
   c. Some non-Jews also feel friendly toward the State of Israel.

7. If a person is superstitious, he believes fortunetellers. Some people do not believe fortunetellers. Therefore:

   a. No superstitious person doubts fortunetellers.
   b. If a person is not superstitious, he will not believe fortunetellers.
   c. If a person believes fortunetellers, he is superstitious.

Associative Learning

Instructions. I am going to read a list of words, two at a time. Listen carefully, because after I am through, I'll want you to try and remember the words that go together. For example, if the words were east-west; gold-silver; then when I say the word, east, you would answer west. When I say the word, gold, you would answer silver. Do you understand?

	Order of Presentation	Order of Recall
1.	metal-iron	window-
2.	baby-cries	fruit-
3.	lamp-box	obey-
4.	chair-table	up-
5.	obey-inch	school-
6.	window-glass	chair-
7.	up-down	baby-
8.	dig-guilty	lamp-
9.	fruit-apple	metal-
10.	school-grocery	dig-

Proverb Interpretation

Instructions. I am going to say some proverbs, one at a time, and I want you to tell me what each one means. Any questions?

1. It is a sad house when the hen crows louder than the cock.

2. Necessity is the mother of invention.
3. A good salad may be the prologue to a bad supper.
4. He's a wise man that leads passion by the bridle.
5. A fox should not be of the jury at a goose's trial.
6. He that's cheated twice by the same man is an accomplice with the cheater.
7. A coward's fear may make a coward valient.
8. It is a foolish sheep that makes the wolf his confessor.
9. A broad hat does not always cover a venerable head.
10. A civil denial is better than a rude grant.

Analogies

Instructions. Sugar is to sweet as lemon is to_? The thing that comes to mind is sour, of course. Now I have some others for you to complete. In each case, I will say the first part of the analogy and you are to tell me the word which completes it. Any questions?

1. Food is to hunger as water is to_
2. Add is to subtract as multiply is to_
3. Tell is to told as speak is to_
4. Linoleum is to floor as sheet is to_
5. Army is to general as navy is to_
6. Pro is to con as for is to_
7. Salmon is to fish as goose is to_
8. Success is to joy as failure is to_
9. Poison is to death as food is to_
10. Square is to cube as circle is to_
11. B is to D as second is to_
12. City is to mayor as army is to_
13. Round is to shape as large is to_
14. Cub is to bear as gosling is to_
15. Day is to 365 as week is to_
16. Subject is to predicate as noun is to_
17. Liberty is to freedom as bondage is to_
18. Shell is to nut as skin is to_
19. Introduction is to conclusion as overture is to_
20. Bad is to worse as worse is to_

APPENDIX H

Test Battery B

General instructions. I have a series of different tasks for you to do. Some of them will be easy and others will be more difficult. At any rate, do not expect to answer every question correctly. Just do the best you can. Any questions?

Information

Instructions. Please try and answer the following questions.

1. What is entomology?
2. What do we call crystals that absorb moisture?
3. Who wrote, The Last of the Mohicans?
4. What is a person with predominantly external interests called?
5. According to Greek mythology, who was the father of the Gods?
6. Who was the founder of the Democratic party?
7. Name the poem that begins with this line, "Once upon a midnight dreary."
8. Which planet is nearest the sun?
9. What is the diameter of the earth?
10. What does the 18th amendment to the Constitution deal with?
11. In parlimentary law, how many times can a main motion be amended?
12. What kind of tax is most commonly used by local governments?
13. What is a ring-shaped island of coral called?
14. What do we call trees which shed their leaves in the fall?
15. Who is considered to be the most brilliant writer in France during the 18th century?
16. What is the name of the woman we most connect with Hull House?
17. Who was the British Prime Minister in 1918?
18. What is the best known work of Coleridge?
19. Fort Dearborn was the beginning of what present-day city?
20. Who commanded the French during the battle of Quebec?

Sentence Building

Instructions. I am going to read a group of words, three at a time. Make up a sensible sentence using all three words.

1. feasible, success, perseverence
2. ceremonial, dignity, impression
3. attainment, fortune, misery
4. individual, validity, evaluation
5. elementary, primitive, mature
6. baffle, cunning, pursuit
7. measurement, modality, objectivity

Digit Span

Instructions. I am going to say some numbers. Listen carefully and when I am through, say them after me. For example, if I were to say, "one, two, three" then you would say, "one, two, three." Do you understand?

4)	6439 7286
5)	42731 74296
6)	729536 619473
7)	4179386 5917423
8)	38295174 26958371
9)	429386175 713942568

Logical Deductions

Instructions. I am going to read a series of statements one at a time. For each statement, I will read three possible conclusions. After hearing each conclusion, decide whether it logically follows from the preceding statement. Indicate your choice by saying yes or no after hearing each conclusion. Do not depend on your

general knowledge to determine whether the conclusion is true or not. The important thing to consider is whether the conclusion is warranted on the basis of the given statement. Do you have any questions? Remember, say yes or no after hearing each conclusion.

1. All circles are round figures. The figure is not round. Therefore:

   a. The figure is oval.
   b. It is either a square or a triangle.
   c. It is not a circle.

2. George Washington was a skillful general. George Washington was President of the United States. Therefore:

   a. Skillful generals make good presidents.
   b. A President of the United States was a skillful general.
   c. Good presidents make skillful generals.

3. X is younger than Y. Y is younger than Z. Therefore:

   a. Y is younger than X.
   b. X is younger than Z.
   c. Z is younger than both X and Y.

4. If the wind changes it will either grow warmer or it will storm. The wind does not change. Therefore:

   a. It will probably grow warmer.
   b. It will not grow warmer nor will it storm.
   c. It will probably storm.

5. No Republican is a Democrat. All Democrats favor prosperity. Therefore:

   a. No Republican opposes prosperity.
   b. No Democrat opposes prosperity.
   c. No Republican favors prosperity.

6. If an adult has the ability to give love to others, he must have received love as a child. Some adults did not receive love when they were children. Therefore:

   a. Some adults do not have the ability to give love to others.
   b. If an adult received love as a child, he has the ability to give love to others.
   c. All adults love children.

7. No jockey is a heavyweight boxer. All heavyweight boxers are large men. Therefore:

   a. No jockey is a small man.
   b. No heavyweight boxer is a small man.
   c. Jockeys are small men.

Associative Learning

Instructions. I am going to read a list of words, two at a time. Listen carefully, because after I am through, I'll want you to try and remember the words that go together. For example, if the words were east-west; gold-silver; then when I say the word east, you would answer west. When I say the word gold, you would answer silver. Do you understand?

	Order of Presentation	Order of Recall
1.	rug-floor	rose-
2.	book-read	many-
3.	crush-dark	cabbage-
4.	north-south	cold-
5.	cabbage-pen	envelope-
6.	rose-flower	north-
7.	cold-hot	book-
8.	in-although	crush-
9.	many-few	rug-
10.	envelope-leg	in-

Proverb Interpretation

Instructions. I am going to say some proverbs, one at a time, and I want you to tell me what each one means. Any questions?

1. A fair face may be a foul bargain.
2. A careless watch invites a vigilent foe.
3. A horse that will not carry a saddle must have no oats.
4. A servent is known by his master's absence.
5. One swallow doesn't make a summer.
6. A man apt to promise is apt to forget.
7. A bold fellow is the jest of wise men, and the idol of fools.
8. Take a hair of the same dog that bit you.
9. A courageous foe is better than a cowardly friend.
10. He who peeps through a hole may see what will vex him.

Analogies

Instructions. Sugar is to sweet as lemon is to _? The thing that comes to mind is sour, of course. Now I have some others for you to complete. In each case, I will say the first part of the analogy and you are to tell me the word which completes it. Any questions?

1. Zoo is to animal as aquarium is to_
2. You is to yours as me is to_
3. Lead is to heavy as cork is to_
4. Author is to book as artist is to_
5. Sextet is to six as octet is to_
6. 1 is to 3 as 9 is to_
7. Wolf is to sheep as cat is to_
8. String is to kitten as rattle is to_
9. Past is to present as yesterday is to_
10. Complex is to simple as hard is to_
11. Tree is to forest as person is to_
12. 4 is to 36 as 6 is to
13. Brick is to clay as glass is to_
14. Peach is to tree as cucumber is to_
15. Singing is to opera as dancing is to_
16. Seldom is to never as little is to_
17. Dog is to hair as trout is to_
18. Bread is to mold as tree is to_
19. Imitate is to copy as invent is to_
20. Thermometer is to temperature as metronome is to_

APPENDIX I

The Rating Scale of Deprivation Adjustment

Instructions. Below are a list of questions which may be related to your experiences in sensory deprivation. Each question should be answered by placing a rating number in the space provided to the left of the question. Every question should be answered. The criteria for each numerical rating are as follows:

No----------0

Very little------1

Some----------2

Much----------3

Very much--------4

Rating number

1. Did you feel anxious and tense?
2. Did you feel bored?
3. Did you feel restless?
4. Did you feel angry?
5. Did you feel disgusted?
6. Did you feel depressed?
7. Did you feel tired or fatigued?
8. Did you spend any time thinking about the experimental situation?
9. Did you worry about your breathing?
10. Did you think about being alone?

Rating number

11. Did being alone bother you?

12. Did you feel uncomfortable?

13. Did you have unpleasant, mixed-up thoughts?

14. Did you have unpleasant sexual thoughts?

15a. Did you have the experience of hearing sounds or voices or of seeing forms, objects, animals or people? (Write yes or no)

15b. If your answer was yes to the above question, indicate by means of a rating number if you were confused or unsure whether the sounds or visions were real or imagined.

16. Were the visions or sounds unpleasant or disturbing experiences?

17. Did you feel at any time that the experimenter was trying to "put something over" on you or fool you in some way?

18. Did you at any time develop angry feelings toward the experimenter?

19. Did you desire to move your hands and/or fingers?

20. Did you desire to move your feet and/or legs?

21. Did you desire to move some other part of your body?

22. Did you itch at all?

23. Were you unable to inhibit movement of some kind?

24. Did you feel at any time that unpleasant or disturbing things were happening to your body?

Rating number

25. Did you feel particular concern for any part of your body?

26. Did you feel "closed-in" or trapped?

27. Did you worry about drowning or suffocating?

28. Did you at any time feel the desire to rip off the mask and get out of the tank?

29. Did time go by slowly?

30. Did you think about quitting?

31. Were you relieved and glad when the experimenter requested that you come out of the tank?

32. Do you feel uncomfortable at this time?

33. Do you feel apathetic, as if you don't much care about anything right now?

34. Do you feel agitated, restless, or tense?

35. Are you having difficulty in thinking straight at this time?

36. Do things seem confused and unreal right now?

37. Do you feel as if you would like to go to sleep?