SENSATION SEEKING: COGNITIVE AND PSYCHOPHYSICAL CORRELATES

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ABSTRACT

The large body of research on exploratory behaviour, early isolation, sensory deprivation, and sensory overload has suggested the hypothesis that organisms seek an optimal level of stimulation from their environment. Recently several attempts have been made to quantify individual differences with respect to stimulus needs as well as to provide constructs which might account for these differences. Zuckerman, Kolin, Price, and Zoob (1964) devised a Sensation Seeking Scale in an attempt to measure the construct "optimal stimulation level". In related research, Petrie and her colleagues (1967) have successfully used a psychophysical task, the kinesthetic aftereffects (KAE) task to differentiate between individuals who are high on stimulus need and low on stimulus need. Harvey, Hunt, and Schroder's (1961) construct of integrative complexity has also proven to be a valid method of differentiating individuals according to their stimulus input requirements. Until now few attempts have been made to relate these three different approaches.

This study was initiated to determine if performance on the KAE task could differentiate between high sensation seekers and low sensation seekers and also whether any relationship existed between sensation seeking and the construct of integrative complexity. The relationships among Barron-Welsh (BW) art scale performance, age, sensation seeking, augmentation-reduction, and integrative complexity

were also examined in the experiment. Twenty high sensation seeking subjects and twenty low sensation seeking subjects were administered the KAE task, the Interpersonal Topical Inventory measure of integrative complexity, and the BW art scales. Contrary to prediction, the KAE task did not differentiate high sensation seekers from low sensation seekers. Sensation seeking was found to be related to BW scale performance and inversely related to age. No relationship was observed between integrative complexity and any other variable.

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INTRODUCTION

A growing body of research within the last 25 years has been directed towards stimulus seeking behaviour in both animals and humans. The realization that the organism's behaviour is characterized not only by those activities related to its biological needs but also by those activities related to the seeking of optimal levels of stimulation has served as the main impetus to studies on exploratory behaviour, early isolation, sensory deprivation, and sensory overload. Drawing upon these studies several theorists have attempted to quantify individual differences in relation to measured needs for stimulation. At the same time, efforts have been made to suggest constructs which could account for these differences and to provide various descriptive models of information processing in the human organism. Consideration of these factors will comprise the basic subject matter of the following literature review.

Exploratory Behaviour

Early research into exploratory behaviour was originally directed towards spontaneous alternation in the rat, behaviour that was viewed as an attempt to seek stimulus variety (Dember & Fowler, 1958). Rats have shown preferences for the more complex portions of mazes (Montgomery, 1954; Dember, Earl, & Paradise, 1957), for the more novel of stimulus objects (Berlyne, 1950), and for the greater of two kinds of stimulus

changes (Dember & Milbrook, 1956). Several studies have also demonstrated that rats will learn to make instrumental responses for the rewards of stimulus change and the opportunity to engage in exploratory activities (Kish, 1955; Montgomery & Segall, 1955; Berlyne & Slater, 1957).

Experiments by Butler and Harlow (1954), Harlow (1950), and Welker (1956) have all centred upon exploratory activity in the behaviour of nonhuman primates. These studies have shown that monkeys will engage in exploratory and manipulative behaviour for prolonged and repetitive test sessions. Harlow (1953) demonstrated in several studies that monkeys could learn to solve mechanical puzzles when no motivation is provided other than the presence of the problem. Sufficient evidence has also been obtained to show that monkeys will learn to make instrumental responses for the opportunity to engage in exploratory behaviour and for visual, auditory, and manipulative incentives (Butler, 1953, 1957; Harlow & McClearn, 1954).

Studies with human subjects have supported the same general results found in animal research. Tarte and Klugh (1965) observed spontaneous alternation behaviour in humans using paper and pencil T-maze outlines. In a set of three experiments Berlyne (1957) found that his subjects responded more frequently to a symbol that had not been seen before than to a familiar symbol. Human infants from three to nine months of age showed definite preferences for more complex stimuli. A checkerboard pattern was more captivating than simple patterns (Berlyne, 1958). Fantz (1958) reported similar findings in

his studies of human infants. Ross (1972) observed that infants sought out more novel and complex stimulus objects and more novel environments in their exploratory activities even when they had to leave their mothers and move to distant sources of stimulation.

Much of the evidence derived from work in alternation behaviour, exploration, and curiosity would thus seem to confirm the suggestion that the organism's behaviour is directed toward increasing sensory stimulation and maintaining an adequate level of varied sensory input. Experiments on the effects of early isolation, deprived sensory environments and sensory restriction provide additional support for this proposition.

Reduced Stimulation During Development

It has been fairly well established that animals deprived of sensory stimulation during development may suffer physiological damage as well as behavioural decrements in perception and other areas. Numerous animal studies on gentling, handling, and enriched environments have demonstrated the beneficial effects of these treatments on learning, resistance to stressors and competitive behaviour (Suedfeld, 1969). The effects of isolation and confinement have been shown to be similar to those of stimulus reductions. Animals reared in isolation have demonstrated behavioural and emotional disturbances ranging from submissive behaviour in competitive situations to inadequate responsiveness to sexual clues (Suedfeld, 1969). Yarrow (1962) reviewed

the literature on maternal deprivation in humans and suggested that early tactile stimulation appeared to be necessary for normal human development. Hunt (1961) has emphasized the importance of adequate stimulus variability in childhood in the development of intelligence. Children raised in monotonous institutional environments have later shown signs of intellectual and emotional impoverishment (Goldfarb, 1955).

Sensory Deprivation

The large body of work on sensory deprivation in humans provides a mass of evidence for the deleterious effects of a lack of stimulus variations on many aspects of man's physiological, perceptual, cognitive, and affective functioning (Zubek, 1969). Some people cannot tolerate any length of time under sensory restriction. More severe behaviour effects occur with longer periods of confinement, with more severe types of confinement, and with the restriction of sensory input *per se*. Impairments increased as a function of the isolation experience (Schultz, 1965).

Sensory deprivation has been shown to induce motivation for meaningful sensory rewards such as taped propaganda lectures and segments of stock market reports (Myers, Murphy, & Smith, 1963; Smith & Myers, 1966) as well as for nonmeaningful sensory rewards such as variable light flashes (Jones, Wilkinson, & Braden, 1961). Rossi and Solomon (1964) showed that there was a wide range of individual

differences in responding when subjects were told they could press a button for "time-off" in a deprivation experiment. Some subjects pressed the button over 14,000 times while four subjects did not even press it at all. In summary, these studies seem to indicate that under conditions of sensory restriction individuals will actively seek to increase their level of stimulus variation.

Sensory Overload

Few studies have been done with the opposite extreme of sensory restriction--sensory overload. Extremely bright lights and loud noises or stimuli that are too novel elicit escape or withdrawal reactions in the organism. In a recent study on sensory overload (Ludwig, 1972) subjects experiencing extreme light and sound stimulation reported a variety of subjective psychedelic effects ranging from disturbances in sense of time to "otherworldly" feelings and to feelings of loss of control. The "spontaneous fears" exhibited by Hebb's monkeys to the sight of a clay model of a human head indicate the effect too great a perceptual incongruity may have (Hebb, 1955). Excess of stimulation whether because of suddenness, amount, or its unpredictable nature may precipitate stress reactions. Harvey (1963) noted that too varied a pattern of stimulation, too much complexity, or too high a level of arousal will lead to efforts by the organism to reduce the level of stimulation to more tolerable limits.

The "Optimum" Hypothesis

The fact that both deficits and extremes of stimulation are detrimental to the functioning of the organism suggest that there must be an optimal level of something involved in the organism's interaction with its environment. To account for the reinforcing consequences of both increases and decreases in sensory arousal the concept of an optimal level of stimulation was introduced in the mid-fifties. One of the main proponents of this theory was Leuba (1955). He suggested that organisms would learn those reactions producing an optimal level of stimulation, "...reactions which" he noted, "when overall stimulation is low are accompanied by increasing stimulation and when overall stimulation is high those which are accompanied by decreasing stimulation" (Leuba, 1955, p. 29). Activation theorists such as Schlosberg (1954), Malmo (1957), and Duffy (1962) have viewed arousal as a continuum varying from sleep to excited states. They have argued that behavioural efficiency is related to arousal by an inverted U-shaped function. With arousal at an intermediate magnitude behavioural efficiency was highest. At extremely low or extremely high arousal levels performance invariably declined (Cofer & Appley, 1964). Hebb implied that in affecting arousal, moderate levels of stimulation were preferred by the organism. In addition, depending upon the organism's current level of arousal the same stimulation could either attract or repel the organism. "Up to a certain point," Hebb (1955, p. 250) wrote, "threat and puzzle have positive motivating value, beyond that point,

negative value."

Schultz (1965) has suggested that exploration and curiosity were mechanisms by which the organism was able to maintain an optimal level of sensory variation. Fiske and Maddi (1961) talked in terms of the effect stimulation had upon the organism. The impact of stimulation they noted, depended upon its intensity, meaningfulness, and variation. Stimulation with either too high or too low an impact would result in optimum seeking behaviour. Hunt (1960) added that increases in stimulus variation, when the organism was below its optimum level were reinforcing. Decreases in sensory variation when the organism was above its optimum level were also seen as reinforcing. Dember and Earl (1957) have theorized as well, that each individual has a preferred or ideal stimulus complexity level. Glanzer (1958) viewed the organism as an information processing system, relating the notion of an optimum sought level to the flow of information from the environment. Each organism had its own experientially determined input requirements. Zuckerman (1969), as well as McReynolds (1956), McLelland and his colleagues (1953), Harvey (1963), and others have incorporated the optimum hypothesis into their thinking.

These theories together with the evidence provided by the studies described above have suggested that perhaps such a trait as "optimal stimulation" can be measured. Zuckerman, Kolin, Price, and Zoob (1964) attempted to do this through the development of a "sensation seeking scale".

Sensation Seeking Scale

The first form of the Sensation Seeking Scale (SSS) contained 54 forced choice items and was given to 268 male and 277 female undergraduates. Questionnaire items reflected preferences for varying kinds of sensory experiences, extremes of sensation, social stimulation, and thrill and adventure seeking. Subjects are asked to select one of a pair of responses from items such as the following:

A. I can't stand riding with a person who likes to speed.

B. I sometimes like to drive very fast because I find it exciting.

A. I find a certain pleasure in routine kinds of work.

B. Although it is sometimes necessary I usually dislike routine kinds of work.

The number of sensation seeking options chosen (response "B" in the examples above) represent the subjects' sensation seeking score.

Interest initially was in finding a general sensation seeking factor. Subjects' responses were intercorrelated and factor analysed. One large factor did emerge for both males and females. Subsequently, separate male and female general scales were formed as well as a general sensation seeking male-female subscale consisting of 22 items. These 22 items together with 12 other items scored either in the male or female direction comprised Form II of the SSS.

Satisfactory reliability coefficients (Pearson product moment correlations between .68 and .89) have been obtained in several samples (Zuckerman et al., 1964; Thorne, 1971). To date there have been

numerous studies of the construct validity of the general SSS. Using Form II of the SSS, Zuckerman and Link (1968) found positive correlations between sensation seeking and field independence measured on the Embedded Figures Test (Thurstone, 1944) and Witkin's Rod and Frame Test (Witkin, Lewis, Hertzman, & Machover, 1954), and between "breadth of categorization" on the Category Width Scale (Pettigrew, 1958) and sensation seeking. In the same study, sensation seeking correlated positively with autonomy, change, and exhibitionism on Edward's (1953) Personal Preference Schedule (PPS) and on Gough and Heilbrun's (1965) Adjective Check List (ACL). The SSS was also negatively correlated with Deference, Nurturance, Orderliness, and Affiliation on both these tests. Sensation seeking has also been found to correlate with the dominance, surgency, adventurous, bohemian, and radicalism scales of Cattell's, Saunders', and Stills' (1949) 16 PF (Gorman, 1970; Zuckerman, Bone, Neary, Mangelsdorff, and Brustman, 1972). Male stimulus seekers tend to be described as ascendant and non-conforming on Gough's (1968) California Personality Inventory (Kish, 1971). At the same time, they tend to be adaptable, changeable, and adventurous.

Volunteers for experiments in sensory deprivation or hypnosis have scored significantly higher than nonvolunteers on the SSS (Zuckerman, Schultz, & Hopkins, 1967) and high scorers on the SSS have demonstrated a higher response rate for visual stimulation in a short term deprivation situation than low sensation seekers (Lambert & Levy, 1972). The SSS has been correlated with extraversion (Bone &

Montgomery, 1970; Farley & Farley, 1967) and has also been correlated with scales such as Garlington and Shimota's (1964) Change Seeker Index (Farley, 1971), Pearson's (1970) External Sensation subscale of the Novelty Experience Scale, and Fitzgerald's (1966) "openness to experience" inventory (Zuckerman et al., 1972).

Several studies have suggested that high sensation seekers tend to be somewhat excitable and antisocial. MMPI scores for hypomania (reflecting impulsivity and hyperactivity) have been related to sensation seeking with male prisoners and female delinquents (Thorne, 1971) as well as with college students (Zuckerman et al., 1972). Zuckerman (1971) cites several studies which also demonstrate positive correlations between sensation seeking and hypomanic and asocial tendencies. He suggests that they are congruent with Quay's (1965) theory of psychopathic personality as pathological stimulation seeking. LeBlanc and Tolor (1972) found that prison inmates scored higher on the general sensation seeking factor than a group of controls while Farley and Farley (1972) observed that girls high on stimulus seeking had significantly more escape attempts and more frequent punishment for disobedience than girls low in stimulation seeking.

Other studies have indicated that psychiatric patients score lower than normals on the SSS (Brownfield, 1966; Kish, 1970) and that schizophrenic patients rated as most retarded in activity scored lowest on sensation seeking (Kish & Busse, 1968). Kish and Busse also noted that SSS scores decreased with age. Few studies have suggested any

correlation between the SSS and anxiety or neuroticism scales (Zuckerman, 1971; Bone & Montgomery, 1970).

In males the SSS has been found to positively correlate with scientific interests and negatively correlate with clerical interests. The SSS for females is positively correlated with the lawyer subscale on the Strong Vocational Interest Test (Strong, 1959) but negatively correlated with such interests as housewife, teacher, and dietician (Kish & Donnenwerth, 1969). Generally, sensation seeking is positively related to vocations emphasizing flexibility, change, novelty, and complexity while low sensation seeking is related to tasks characterized by interest in detail, order, routine, and structure.

The SSS has been correlated with preferences for spicy foods and nonauthoritarian as opposed to authoritarian attitudes as well (Zuckerman, 1971). High sensation seekers tend to perceive themselves as possessing liberal left orientations (Looft, 1972). Zuckerman, Neary, and Brustman (1970) found a positive correlation between high sensation seeking and use of psychedelic drugs and preference for varied forms of sexual experiences. They also found a relationship between sensation seeking and preference for complexity. High sensation seekers scored significantly higher than low scorers on the Barron-Welsh (BW) art scale of the Welsh Figure Preference Test (Welsh, 1959). In a later study (Zuckerman et al., 1972), it was observed that high sensation seekers tended to prefer complex, sketchy, or shaded figures on the Welsh Figure Preference test while low sensation seekers preferred

simple symmetrical geometric figures. Sensation seeking has also been positively related to the Obscure Figures Test (Acker & McReynolds, 1965) of "cognitive innovation" (Kish, 1970a). Kish and Donnenwerth (1972) examined sex differences between male and female sensation seekers and observed that in males stimulus seeking was related to intelligence and inversely related to authoritarianism and dogmatism. Female stimulus seekers were less likely to be intelligent, rebellious, or non-conformist, but as a group high sensation seekers were apparently more open to novel, changing, complex, or more intensive experiences than the low sensation seekers. Kish and Donnenwerth also observed a significant correlation between parents' scores on the SSS and stimulus seeking interests of their offsprings.

Taken together the studies cited above reveal a personality profile of the high sensation seeker. Basically, he is an outgoing, extraverted individual, oriented to internal body sensations and constantly in search of change and stimulation in his environment. He is adventurous and thrill-seeking and often a non-conformist who is unrestrained by social inhibitions. He is creative, continuously open to experience and easily bored by routine. His search for varied experience is manifested in activities involving speed and action, unconventional people and varieties of drug use and sexual experiences.

The Kinesthetic Aftereffects Task

In developments almost parallel to that of research into the

SSS, Asenath Petrie and her colleagues (1958) have proposed a uniquely different approach to the measurement of individual differences in relation to sensory stimulation. Petrie's work has involved the measurement of perceptual differences in individuals based upon their performance on the kinesthetic aftereffects (KAE) task. The task basically involves measuring changes in kinesthetically perceived size after stimulation with varying sized blocks of wood. The task was originally used by Klein and Krech (1952) in their studies of brain injured patients and used as well by Eysenck in his studies with introverts and extraverts (1955). The procedure involves recording changes over time in an individual's estimate of the size of a block of wood rubbed between finger and thumb. Petrie's work was stimulated by the early perceptual studies of Gibson (1933). Gibson found that when his subjects observed slightly curved lines for several minutes and were then presented with straight lines in the same location and orientation of the curves, these straight lines appeared curved in the opposite direction. Gibson demonstrated this phenomenon kinesthetically as well. Kohler and Wallach (1944) discussed figural aftereffects in terms of satiation of brain tissue. They observed in a large series of experiments that after prolonged inspection of an object in a given area figures presented afterwards in the same region are altered and appeared to recede from the area. In addition, figures that are in an oblique position relative to the satiated area turn as they recede from it. Kohler and Wallach (1944) believed that visual figures

had associated with them currents in the visual sector of the nervous system. With the activation of a cortical area by a visual stimulus a current flow was initiated which led to a polarization of tissue surfaces and surrounding areas. Figural aftereffects were the alterations which objects showed when their figure currents have passed through such a satiated region. As a consequence of the increased resistance in the satiated areas subsequently viewed objects are observed to be displaced from the affected region.

Wertheimer (1955) found that kinesthetic and visual aftereffects were correlated and also noted changes in visual and kinesthetic figural aftereffects after changes in metabolic rate. He and his colleagues hypothesized that large figural aftereffects reflected increased physiochemical modifiability and consequently a high metabolic efficiency. Kohler and Dinnerstein (1947) had suggested previously that both kinesthetic and visual aftereffects were phenomena of the same kind and that the kinesthetic effects of individuals could be measured. They found they could make quantitative measurements using varying size strips of beaverboard as their apparatus. Subjects were asked to rub the fingers of both hands along beaverboard strips of unequal width and then to rub their fingers along two other strips of equal widths. Subjects invariably reported the widths of these strips as unequal. Kohler and Dinnerstein observed large individual differences in applying this technique. They found as well that a narrower satiation object enlarged the test object and that a wider satiation object had the opposite effect.

Klein and Krech (1952) worked with kinesthetic aftereffects in their studies with brain injured subjects. They saw neural conductivity as a basic personality dimension and suggested that differences in cortical integration and consequently in behaviour resulted from differences in transmission of excitatory patterns from individual to individual as a consequence of differential cortical conductivity. Klein and Krech suggested that an individual's "basal" level of cortical conductivity could be measured by satiability. People with high cortical conductivity would satiate more slowly, would not suffer a large drop in cortical conductivity, and would recover from satiation more quickly. Individuals with low cortical conductivity would demonstrate greater susceptibility to satiation. They used an adaptation of Kohler and Dinnerstein's (1947) KAE task as a measure of satiation. A decrease in judged width of a test object after stimulation with a wider stimulation object was viewed as evidence of satiation. The rationale underlying this approach was that satiation due to figure currents aroused by a stimulus object resulted in a displacement from the area previously occupied by the object. Klein and Krech's main findings were that figural aftereffects were much more strongly marked among brain injured patients than among normals. Eysenck (1955) suggested that in this respect there was a distinct similarity in the behaviour of the brain injured in Klein and Krech's study and the hysteric patients he studied in his own experiment. Eysenck had hypothesized that hysterics as prototypes of extraverted personality types would evidence stronger satiation and figural aftereffects than dysthymics (as

prototypes of introverted personality types) and that hysterics would develop more lasting satiation and figural aftereffects than did dysthymics. Working with groups of hysterics and dysthymics and applying the same apparatus and procedure used by Klein and Krech in their study, Eysenck found his results in line with expectation. Underlying Eysenck's work in this area was his postulation (drawing primarily from Hull's (1951) concept of reactive inhibition and to a lesser extent on Pavlov's (1927) work) that individuals differed with respect to which inhibition was aroused along cortical pathways by the passage of neural impulses. Individuals who developed strong reactive inhibitions quickly and in whom dissipation was slow would exhibit extraverted patterns of behaviour and would suffer hysterical disorders in the case of nervous disorders. Introverts on the other hand would develop weak reactive inhibition, would dissipate it quickly, and would tend towards dysthymic disorders. Eysenck predicted that extraverts would be differentiated from introverts in the speed of arousal, strength, and length of persistance of figural aftereffects. Eysenck (1955) demonstrated that extroverts tended towards greater reduction of apparent size on the kinesthetic aftereffects task using large block stimulation. In Eysenck's experiments an attempt was thus made to relate satiation theory with the personality concepts of introversion-extraversion. It should be pointed out, however, that there is still some disagreement about whether the concepts of reactive inhibition and satiation are manifestations of the same underlying

process (Becker, 1960).

Petrie's work with the KAE was initially an extension of the work done by Kohler and Wallach (1944), Klein and Krech (1952), and Eysenck (1955). In her earlier research on the effects of prefrontal surgery on pain she noted that patients suffering from incurable pain were not only less affected by the pain after the operation, but also exhibited notable changes in personality. Petrie (1952) found that following leucotomy operations, formerly introverted and passive patients became extroverted and outgoing. The fact that certain personality characteristics appeared to be related to pain tolerance and that individuals varied with respect to their tolerance for pain, combined with Klein and Krech's (1952) and Eysenck's (1955) findings, stimulated Petrie to use satiability of kinesthetic size as a measure of how individuals modulated their sensory experience. Her work led her to identify two kinds of individuals, "reducers" and "augmenters", who differed from each other in their ways of processing their sensory experiences. Reducers, Petrie suggested, tended to decrease stimulation impinging upon them from the environment, while augmenters typically increased stimulation impinging upon them.

In one study carried out, Petrie, Collins, and Solomon (1958) hypothesized that individuals who tolerated pain best would also be most susceptible to satiation. They found that those who showed the greatest tolerance for painful stimulation evidenced the greatest reduction on the KAE task, while those who were least tolerant of pain

were those who augmented or increased their size estimates on the task. Other research (Blitz, Dinnerstein, & Lowenthal, 1966; Dinnerstein, Lowenthal, Marion, & Olivo, 1962; Sweeney, 1966) has also suggested a relationship between pain tolerance and kinesthetic size judgements. In Petrie's study it was also found that reducers were least tolerant of a deprivation situation. Augmenters willingly remained longer in a tank type respirator than reducers. In such a situation it was hypothesized that reducers would be most handicapped because of their tendency to diminish what little environmental stimulation was available. Petrie suggested that augmenters in automatically amplifying their sensory input were more affected by pain than others because of a sensory excess. Reducers with their tendency to dampen down the intensity of sensory stimulation consequently experienced the same sensory event as less aversive. In relation to their base-line measures on the KAE task, reducers seemed to consistently reduce their estimation of a block of wood after the interpolated perception of a larger one. Conversely, augmenters consistently tended to increase their size estimation after stimulation.

While Petrie (1967) acknowledged that much of her work has been stimulated by the early perceptual studies of Gibson (1933), Kohler and Wallach (1944), Klein and Krech (1952), and Eysenck (1955), her findings have been directed to an entirely different area of research. In Petrie's work interest lies not in the aftereffect as such, which was the focus of interest in previous studies, but in what Petrie describes

as each person's "perceptual reactance" or the tendency for some individuals to "reduce" and others to "augment" impinging stimulation from the environment. Rather than attempting to relate the two approaches, Petrie has made her starting point the present concepts of reduction and augmentation.

Several studies have supported Petrie's original observations. Working with 60 normal female subjects, Solon (1967) found a significant negative correlation between the degree of reduction on the KAE task and high scores on the hypochrondriasis scale of the Minnesota Multiphasic Personality Inventory. These findings suggested that those who were most tolerant of pain were the least preoccupied with signs and symptoms of ill health. A study by Poser (1960) also confirmed Petrie's findings on pain sensitivity using a test of cutaneous pain tolerance. Ryan and Kovacic (1966) found that contact athletes such as football players showed a significantly higher tolerance for pain than nonathletes. In a further study (Ryan & Foster, 1967), it was demonstrated that contact athletes did in fact reduce on the kinesthetic aftereffects test while those who expressed a dislike for sports tended to enlarge estimates of width on the KAE task. In research conducted by Petrie, McCulloch, and Kazdin (1962) it was observed that there were significantly more reducers in a delinquent group than a control group. Additionally, controls were three times as likely as juvenile delinquents to be pronounced augmenters. In general, Petrie (1967) has suggested any given stimulation may be perceived as less intense by the reducer

and more intense by the augmenter. Tending more towards the reducing end of the perceptual modulation spectrum, delinquents would probably require a greater amount of sensory input to achieve an adequate level of perceptual modulation. That their activities seem to stress speed, action and excitement would be in line with expectations. This should then hold true for reducers in general. Activities such as smoking, drinking, and nail biting which may be interpreted as providing stimulation to the individual, have been related to augmentation-reduction by Petrie (1967). She has shown that reducers on the KAE task are more apt than augmenters to smoke, drink, and bite their nails. Sales (1971), in a series of studies, demonstrated that reducers preferred complex visual stimuli, were more likely than augmenters to provide their own stimulation in a dull environment, contributed greater verbal output in a group discussion than augmenters, and were more likely than augmenters to attend to highly complex dialogues. Finally, several recent neuropsychological studies have provided support of a different nature for the augmentation-reduction dimension. Using a modification of standard electroencephalographic procedures it has been possible to measure cortical evoked responses or patterns of electrical responses to sensory input which intervene between the subjective experience and the physical stimulus (Buchsbaum & Silverman, 1971). By presenting subjects with stimuli such as light flashes and by then summing the electroencephalograph activity for a brief time interval after each stimulus by means of a computer an averaged evoked pattern is produced.

Measurements of the averaged evoked response latencies and amplitudes provide an index of the strength of activity produced by a stimulus. In Buchsbaum and Silverman's (1971) experiment, augmenters showed increased response amplitudes with increased levels of light stimulation. Reducers, on the other hand, showed much smaller amplitudes with more intense stimulation and in some cases there was even an actual decrease in the cortical response. Thus, the experiment suggested that "reduction responsiveness" on the KAE was associated with reduced responsiveness to high intensity visual stimulation. Spilker and Callaway (1969) confirmed this result in a study of their own. They also found a high correlation between visually evoked responses and scores on the KAE. Reducers in their experiment also evidenced few increases and occasionally even decreases in evoked responses as stimulation intensity increased. Buchsbaum and Pfefferbaum (1971) have also observed reducing as a characteristic response at high stimulus intensities. The results of these experiments suggest the possibility of a central brain mechanism for processing information and provide additional support for Petrie's concept of augmentation-reduction.

The Abstract Concrete Dimension

Integrative complexity. A third line of approach to the question of individual differences in relation to stimulus needs has centred around the dimension of complexity-simplicity. The concept of cognitive

complexity was first discussed by Bieri (1961). He saw cognitive complexity as a tendency to view social situations in a multidimensional way so that cognitively complex individuals had more versatile systems for perceiving and interpreting the behaviour of others. The conceptual system of Harvey, Hunt, and Schroder (1961) classifies individuals along a continuum of cognitive complexity ranging from concrete to abstract. Harvey, Hunt, and Schroder (1961) and Schroder, Driver, and Streufert (1967) have proposed a personality system based upon the classification of individuals according to their level of conceptual structure. They viewed the individual's conceptual structure as a mediating link between stimulus input and response, a system of screening and evaluating impinging stimulation from the environment. Concrete functioning would be characteristic of the individual with a more fixed conceptual programme. Seen from a developmental approach, the individual progressing towards greater abstractness on the concrete-abstract dimension would be characterized by a more flexible programme. Less stimulus-bound than the concrete individual, he would possess a greater variety of schemata for coping with the same stimuli.

Harvey, Hunt, and Schroder (1961) attempted to classify individuals according to the degree of integrative complexity they had achieved. Those at the highest level of conceptual functioning have been designated by them as System IV individuals. Characterized by flexibility and autonomy, System IV people may be viewed as the reality-oriented, self-actualizing individuals. Processing information in a

complex fashion, they are open to experience and easily able to assimilate a variety of stimulus events within their conceptual structure. Those at the lowest level of integrative complexity have been designated as System I individuals. They are seen as conforming, rigid, and intolerant of ambiguity. A poorly differentiated structure provides them with a minimum of response alternatives. Functioning at intermediate levels of integrative complexity are the System II and System III individuals. More response alternatives are available to the System II individuals than to the System I individuals, while System II functioning is at an even higher level of integrative complexity. A variety of classification instruments including the Paragraph Completion Test, This I Believe Test, Impression Formation Test, and Interpersonal Topical Inventory have been used to measure integrative complexity (Wiggins, 1968). The tests are used interchangeably and while classification into four conceptual groups is possible, the usual procedure has been to dichotomize subjects into Abstract (System IV) and Concrete (System I) groups.

Several studies have provided construct validity for the concept of integrative complexity. In one study, subjects high on integrative complexity were able to track and integrate more information about stimulus events than those more integratively simple (Driver, 1962). Tuckman (1964) obtained similar results using a simulated stock market game. Seiber and Lanzetta (1964) exposed tachistoscopically presented slides to abstract and concrete subjects. One of their findings was

that abstract persons searched for more information (about a figure) and spent more time processing it than concrete subjects.

Suedfeld (1964a, b) investigated the relationship between the individual's conceptual structure and his responses in a deprivation situation. He hypothesized that abstract individuals would be more highly information oriented than concrete individuals and would consequently be more stressed by a low information sensory deprivation environment. This prediction was largely confirmed in one study (Suedfeld, 1964a). Suedfeld (1964b) also found that abstract subjects were less persuasible under a sensory deprivation situation than concrete subjects. More flexible than the concrete subjects, they appeared to integrate propaganda within their conceptual structure without the necessity of changing their attitudes while concrete subjects were more likely to be influenced by propaganda. Suedfeld and Vernon (1966) found that abstract subjects were also more inclined to comply with the demands of the experimental situation in order to receive information, but as in the previous study, were less persuasible than the concrete subjects.

Tuckman (1967) demonstrated that groups having a majority of System IV members performed more effectively on an abstract problem than groups having a majority of System I members. Karlins and Lamm (1967) found that integratively complex individuals actively sought out more information (asked more questions) in attacking a complex problem than integratively simple subjects. Finally, in one other study

(MacNeil & Rule, 1970), abstract subjects were observed to request a complex message more often than a simple message under sensory deprivation conditions. In addition, concrete subjects requested the simple message significantly more often than the complex message. These findings together with the findings outlined above support the idea that individuals differing in conceptual structure also differ in terms of their stimulus needs.

Barron-Welsh Art Scale. A further index of cognitive complexity that has found some usefulness in several studies is the Barron-Welsh (BW) art scale (Welsh, 1959). The scale, consisting of 62 black and white figures was derived by comparing the frequencies of responses of 37 artists and art students with those of 150 "non-artists" to a series of 400 drawings and designs. Subjects were asked to indicate whether they liked or disliked each of the drawings presented to them. By means of item analysis, a 62 item scale was developed which differentiated artists from non-artists in their preferences for the figures. A Revised Art (RA) scale was subsequently developed after scoring difficulties were encountered with the original BW scale. The scales are highly correlated with each other ($r = .85$) and satisfactory reliability coefficients have been obtained for both the BW (Barron, 1965) and RA scales (Moyles, Tuddenham, & Block, 1965). Both scales are presented in a booklet containing 86 figures and subjects are asked to indicate whether they like or dislike each of the drawings presented to them. Separate scores are obtained for each of the scales.

Barron and Welsh (1952) cross-validated the BW art scale on a group of 30 artists and 30 non-artists and obtained significant response differences between the two groups. In a study involving 40 graduate students (Barron, 1952), it was found that a group of paintings selected as most preferred by a group high on the BW scale were "least of all" liked by those low on the BW scale.

Barron (1952) viewed the test as a measure of complexity-simplicity related to artistic talent. Some individuals, he noted, would typically prefer perceiving and dealing with complexity while at the other extreme individuals preferred to perceive and deal with simplicity. Barron suggested that these preferences reflected themselves in many spheres of behaviour including interpersonal relations, attitudes, and related areas. In one study (Barron, 1952), high scorers on the BW scale more often checked items such as gloomy, unstable, emotional, and pleasure-seeking on the Gough Adjective Checklist (Gough & Heilbrun, 1965) while low scorers more frequently checked contented, gentle, conservative, patient, and peacable. Barron (1953) also noted that complexity as measured by the BW scale related positively to personal tempo, verbal fluency, impulsiveness, and expansiveness. High BW scores in the same study were also related positively to originality, artistic expression, breadth of interest, and expression of impulse. Complexity was negatively related to rigidity, social conformity, ethnocentrism, and political-economic conservatism. Persons who showed independence of judgement in an experimental social situation also preferred

complexity in drawing in contrast to "yielders'" preferences for simple drawings. Independents preferred complex figures to a greater extent than yielders (Barron, 1953). In a study by Rosen (1955) the BW scale clearly discriminated between artists and non-artists with artists averaging 40 on the scale and non-artists averaging 22 on the scale. Bieri, Bradburn, and Galinsky (1958) found a significant relationship between preference for complex drawings and field-independence for male subjects. No relationship was observed for female subjects.

A good deal of research has been done as well on the Revised Art (RA) scale. The 10 highest students on the RA scale in a class of 74 consistently checked off adventurous, aggressive, artistic, impulsive, unconventional, and rebellious on Gough's Adjective Check List (Gough & Heilbrun, 1965). The low scorers on the RA scale often checked conservative, conventional, easygoing, and preserving (Barron, 1965). The mean profiles of high RA scale scorers on Gough's (1957) California Psychological Inventory, in a class of 46 students, showed them to be high on dominance, sociability, and social presence, but low on responsibility, self-control, and socialization. The same students high on the RA scale were also higher on heterosexuality and aggression on Edwards Personal Preference Schedule (Edwards, 1953) and lower on abasement, deference, and order (Barron, 1965). In one other study, Cromwell (1969) found that preference for complexity on the Welsh Figure Preference Test (Welsh, 1959) was associated with high ego strength, self-confidence, and aesthetic value. In general, the research that has

been done on the BW and RA scales suggests that high scores on these tests are consistently related to such traits as criticalness, touchiness, liberal attitudes, and independence of judgement. Subjects scoring high on these scales appear to be typically outgoing, active, and creative individuals.

Summation and Hypotheses

It seems intuitively obvious on examining the work done on the SSS and on the KAE task that the high sensation seeker of Zuckerman might be the reducer described by Petrie. What also appears obvious is that there is some communality between the low sensation seeker on the SSS and the augmenter on the KAE. Both high sensation seekers and reducers appear to share a personality disposition that leads them to actively seek out stimulation and experience in their environment. Unlike other individuals they seem to require greater inputs of stimulus information to maintain themselves at optimum levels of arousal. Common to both low sensation seekers and augmenters on the other hand, is an apparent need for an environment free from sensory excess. More passive and withdrawn than other individuals, the low sensation seeker and augmenter would be attracted to situations and activities stressing low stimulus content.

The reducer with his tendency to diminish stimulation impinging upon him typically suffers from a sensory lack which is manifested in his seeking out increased stimulation from the environment. Sensation

seeking activities can consequently be seen as coping manoeuvers aimed at maintaining adequate levels of sensory input. At the other extreme, augmenters, by automatically amplifying the sensory information impinging upon them, may typically suffer from an excess of stimulation and may characteristically withdraw from it in order to satisfy their own "optimum" requirements. The augmenter thus becomes the low sensation seeker, content with an environment that is simple, predictable, and unchanging. Sales (1971) has suggested that individual differences in need for stimulation reflected themselves in a broad range of social situations. His study (Sales, 1971) indicated that kinesthetic aftereffects performance, as a measure of stimulation need, related to the individual's attitudes, social behaviour, level of activity, and stimulus preferences.

The existence of a relationship between sensation seeking and the augmentation-reduction dimension would serve to increase the validity of both constructs and of even greater importance would furnish some insight into the mechanisms that may be underlying the modulation of sensory experience in human beings. Petrie's theory of augmentation-reduction suggests a "volume control" mechanism in the brain that processes sensory intensity differently from individual to individual. In light of recent neurophysiological evidence supporting the augmentation-reduction dimension (Buchsbaum & Silverman, 1968; Spilker & Callaway, 1969) there is the possibility that Petrie's work may shed further light on the question of individual differences in sensation

seeking.

While the correlates of sensation seeking may reflect themselves in perceptual differences among individuals, it also seems possible that there may be some relationship between stimulus seeking and level of conceptual functioning. More specifically, Harvey, Hunt, and Schroder's (1961) concept of integrative complexity may provide an explanatory model at the cognitive level of how individuals process information differently and how these differences reflect themselves in behavioural terms. The concept of integrative complexity provides an added dimension for the examination of individual differences in need for stimulation.

Until now, few attempts have been made to relate the various approaches described above. One study (Brodsky, 1970) did use the SSS and an adaptation of Petrie's KAE task, but only as part of a larger study investigating the relationship between psychopathy and stimulus seeking. The relationship between performance on the adapted KAE task (drawing 3" lines under blindfolded conditions) and performance on the SSS was not mentioned in the paper.

The present study was initiated to determine if performance on the kinesthetic aftereffects task could differentiate between high sensation seekers and low sensation seekers. A secondary purpose of this study was to determine as well whether any relationship existed between sensation seeking and the construct of integrative complexity. The BW art scale and the RA scale were introduced into the study

primarily to occupy subjects during the 45 minute hand resting period preceeding the administration of the KAE task. At the same time it was expected that the BW scales might also provide additional meaningful data related to sensation seeking and the concrete-abstract dimension. The relationship of age to sensation seeking performance was a further variable of interest in the present study.

METHOD

Materials and Apparatus

(1) Sensation Seeking Scale. Form II of the Sensation Seeking Scale (SSS) was employed in the selection of subjects. It is the most researched form to date and has been demonstrated to have both satisfactory reliability (Zuckerman, 1964) and validity (Zuckerman & Link, 1968). The scale contains 34 forced choice items reflecting preferences for varying kinds of sensory experiences. Only the 22 items of the general male-female sensation seeking scale were used in the scoring of the questionnaires. Scores consisted of the number of sensation seeking options chosen by subjects on the scale. Form II of the Sensation Seeking Scale is included in Appendix A.

(2) Kinesthetic Aftereffects Task. The apparatus used in the present study was identical to that used by Petrie (1967) in her own studies. The apparatus consisted of three wooden blocks, a 30 inch long ruled wedge shaped block increasing from 1/2 inch wide at its narrowest end to 4 inches at its widest end, a 2 1/2 inch rectangular stimulus block, and a 1 1/2 inch rectangular measuring block. A blindfold was included with the apparatus as well. In the large block stimulation test employed in this study, the 2 1/2 inch block was used for stimulation and the 1 1/2 inch block served as the measuring block. The measuring blocks were held between the fingers of the subject's right hand (unless he was lefthanded) and the tapered block was used

with the other hand to allow the subject to indicate to the tester the width of the block in his right hand. The changes in size estimates of the measuring block over time after the interpolated stimulation with the stimulation block served as the measures of reduction or augmentation in each of the subjects. The kinesthetic aftereffects (KAE) task has been demonstrated to have fairly high reliability (Eysenck, 1955; Spitz & Lipman, 1960; Petrie, 1967). Construct validity for the KAE has also been provided in several studies (Ryan & Foster, 1967; Petrie, 1967; Sales, 1971). Instructions for the administration of the KAE task are included within the general instructions in Appendix E. Detailed instructions for the administration of the KAE task have been outlined by Petrie (1967). Figure 1 contains a photograph of the apparatus.

(3) Interpersonal Topical Inventory. The Interpersonal Topical Inventory (ITI) was developed by Tuckman (1966) in an attempt to find a more reliably scored and more objective instrument than the Sentence Completion Test (SCT) (Schroder & Streufert, 1962) for abstract-concreteness. The Sentence Completion Test has been found to be a valid measure of integrative complexity in a number of studies (Driver, 1962; Tuckman, 1964; Suedfeld, 1964a, b). The ITI was evaluated by determining whether it could predict creative performance as well as the Sentence Completion measure of integrative complexity. Tuckman (1966) found that there was a strong relationship between creative performance and level of integrative complexity. As well, the ITI

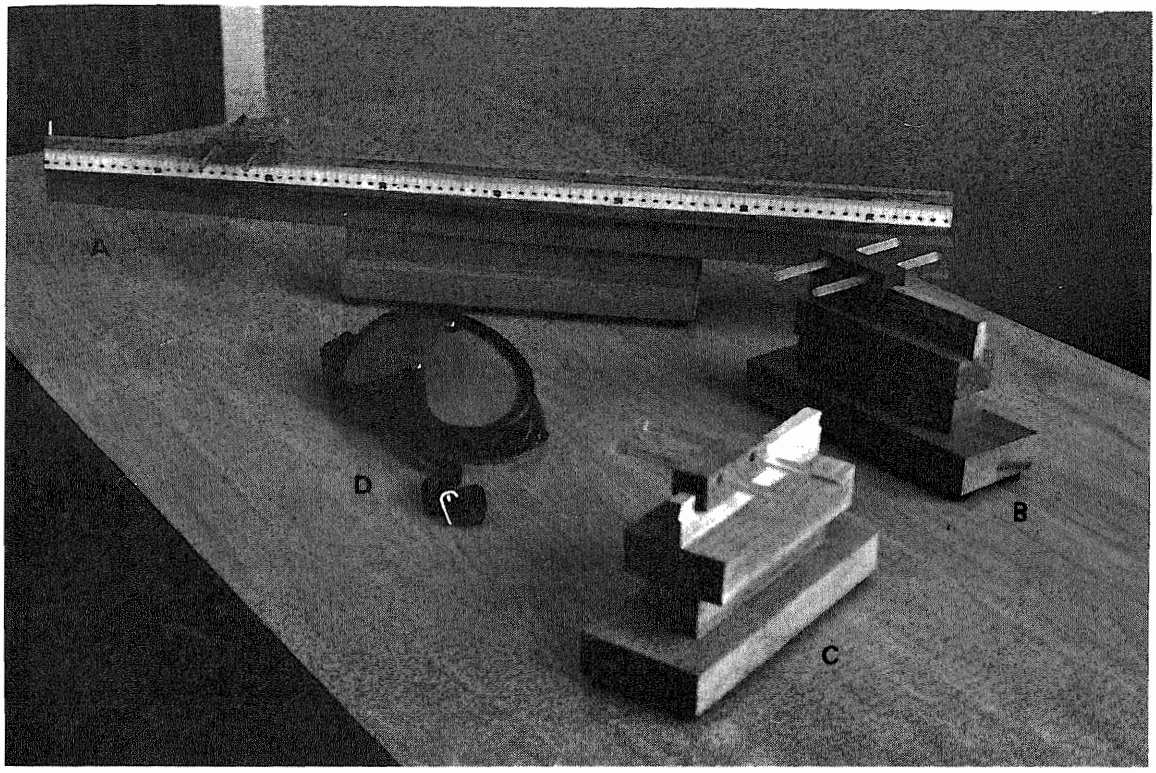

Figure 1. Kinesthetic figural aftereffect apparatus for measuring reduction and augmentation. A - tapered block, B - 1 1/2 inch measuring block, C - 2 1/2 inch stimulation block, D - blindfold.

discriminated between System I and System IV individuals as did the SCT. Tuckman (1966) concluded that the ITI could serve as a useful research instrument and potential substitute for the SCT as a measure of conceptual structure. McNeil and Rule (1971) recently used the ITI successfully to differentiate between abstract and concrete subjects.

The ITI is a 36 item forced choice instrument in which the subject is asked to choose one of two of a pair of items that best represents his feelings about interpersonal topics. These topics include beliefs about people in general, feelings about leaders, and rulers, and reactions to particular situations. Each member of a pair of items represents a typical response of a particular system. The subject is assigned to System I, II, III, or IV according to the pattern of his responses. The ITI is presented in Appendix B. The instructions for the administration of the ITI are included within the general instructions in Appendix E.

(4) Barron-Welsh Art Scale. The Barron-Welsh Art Scale (BW) and its revised from, the Revised Art (RA) scale, are presented in a booklet containing 86 figures. Subjects are asked to indicate whether they like or dislike each of the drawings presented to them and scores for the BW and RA scales are obtained by measuring the pattern of the subjects' responses. The BW scale was derived by comparing the frequencies of responses of artists and art students to non-artists on a figure preference task. Barron (1952) viewed the test as a measure of complexity-simplicity related to creative talent. Several studies

have supported Barron's interpretation of the test's meaning and have provided some validity for it (Barron, 1952; Barron & Welsh, 1952; Rosen, 1955). Barron (1965) reported an odd-even reliability of .96 and a test-retest reliability of .91 for 6 months for the BW. Test-retest reliabilities of .94 and .90 over one week for the RA have also been reported (Barron, 1965). The BW scales were included in the present study primarily to occupy subjects during the resting phase preceeding the administration of the KAE task and in the expectation that some meaningful data related to the dimension of abstractness-concreteness might be obtained. A copy of the Barron-Welsh scales is included in Appendix C.

Subjects

Subjects were drawn from a pool of 200 introductory psychology students (83 males and 117 females) who were required to participate in experiments as part of their course requirement. All students in the experimental pool were administered the SSS and subjects for the present study were selected from those students scoring in the top 15 per cent on the SSS and in the bottom 15 per cent on the SSS for each sex group. Twenty subjects (10 males and 10 females) selected from the bottom 15 per cent comprised the low sensation seeking group while 20 subjects (10 males and 10 females) drawn from the upper 15 per cent comprised the group of high sensation seekers. Subjects were contacted by phone and invited to participate in a psychology experiment for two credits. Of the 40 subjects selected, one refused to participate and

another could not be contacted. Two other subjects selected from the subject pool were contacted to replace them.

Procedure

All subjects were seen individually by the experimenter and through the use of a coding system for identification, the experimenter was blind as to each subject's sensation seeking score. The experimental procedure was carried out in two phases. Subjects were brought in to the experimental room and seated at a table. They were given brief descriptions of the KAE task and were also informed of the 45 minute hand resting period that was required before the administration of the task. Subjects were told to place both their hands over the arms of their chair so that they kept the tips of their index finger and thumb from touching each other while they sat through the rest period. To prevent fatigue, subjects were permitted to move their arms in different positions as long as they kept their fingers from touching each other. Following these instructions, the first phase of the experiment, the administration of the ITI and the BW art scales, was initiated.

A stand was placed on the table and the subject was informed that he would be given some situations and topics printed on cards which he was to respond to. Several examples were presented and then the test itself was administered. The procedure and instructions for the administration of the ITI were almost identical to those outlined

in the test instructions (Sandilands, 1969) except that the subject was asked to respond verbally to the response choices presented to him instead of using paper and pencil to indicate his choices. Subject responses were all recorded by the experimenter on a separate answer sheet.

Following the administration of the ITI the stand was removed from the table and the BW art scales were introduced. Following the instructions outlined in the test booklet (Welsh & Barron, 1963), subjects were told that they would be asked to indicate their preferences for a series of drawings. Subjects were asked to state verbally whether they liked or disliked each of the drawings presented to them and their responses were recorded by the experimenter. After completion of the test, subjects were presented with further figures from the Welsh Figure Preference test to respond to until the end of the 45 minute rest period.

Following the rest period, subjects were once again given a brief description of the KAE task. They were then blindfolded and the KAE apparatus was brought out from a box in which it had been placed out of view of the subject. The procedure for administering the KAE task followed that outlined by Petrie (1967) for the large block stimulation test. The subject was asked to grasp the 1 1/2 inch rectangular measuring block with one hand and to run his other hand up the ruled wedge-shaped block until the point where he felt the width of the wedge-shaped block appeared to be the same as the width of the block. This was repeated six times to obtain six baseline measurements. The

1 1/2 inch block was then replaced by the 2 1/2 inch block and the subject's left hand was withdrawn from the wedge-shaped block and rested on the table. The subject was then asked to rub the 2 1/2 inch stimulation block back and forth with his fingers and to concentrate on the width of the block. This continued for 90 seconds following which the subject's left hand was again placed on the tapered block and the right hand on the 1 1/2 inch measuring block. The subject again was asked to make size judgements of the measuring block. He was then instructed to rub the stimulation block as before for another 90 seconds. Size estimations were made again after stimulation, a 2 minute stimulation trial followed, and a final estimation trial concluded the task. In all cases, the finger guide on the measurement block was returned to the narrow end of the tapered block between measurements. Changes in size estimation of the 1 1/2 inch measuring block after interpolated stimulation were recorded for each subject and served as the measures of augmentation and reduction. After the final estimation trial, the block apparatus was returned to its box and the blindfold removed from the subject. Subjects were thanked for participating in the study and informed that they would receive an information sheet describing the purpose of the experiment and the results in the mail. A form letter describing the experiment was subsequently mailed to all participants. A copy of this is included in Appendix D.

RESULTS

Prediction and Overview

The major hypothesis of the present study was that there would be a difference in performance between high sensation seekers and low sensation seekers on the kinesthetic aftereffects (KAE) task. It was predicted that high sensation seeking subjects would show greater reduction on the KAE task than low sensation seeking subjects. A t-test for independent samples was used to test for significant differences in performance between the high sensation seeking and low sensation seeking groups.

In addition, it was hypothesized that there would be a relationship between sensation seeking and conceptual functioning. It was predicted that there would be a difference between the four integrative complexity System groupings in regard to sensation seeking. Individuals high on integrative complexity (System IV individuals) were expected to be high sensation seekers, while individuals low on integrative complexity (System I individuals) were expected to be low on sensation seeking. An analysis of variance across the groups was performed to test for these differences. Performance differences between the four integrative complexity groupings on augmentation-reduction and on the Barron-Welsh (BW) art scales were also examined to check for possible suggestive relationships. Analysis of variance for independent samples was used in these analyses. It was also

predicted that there would be significant performance differences between high sensation seekers and low sensation seekers on the BW scales. A t-test for independent samples was used to test for this difference. Intercorrelations between sensation seeking, kinesthetic aftereffects scores, BW and RA scales, and age were calculated as well to check for possible meaningful and/or suggestive relationships among them. Pearson's product moment correlation coefficients were employed for this purpose.

The findings of this study are presented under four separate headings: (1) sensation seeking and kinesthetic aftereffects performance, (2) sensation seeking and integrative complexity, (3) sensation seeking and BW and RA scale performance, and (4) correlational analysis. Sensation seeking was the major independent variable in the study while performance on the KAE and BW scales constituted the major dependent variables.

(1) Sensation Seeking and Kinesthetic Aftereffects Performance. The mean score for the 200 subjects administered the Sensation Seeking scale was 13.14. This compares with a mean score of 11.47 obtained by Farley (1971) and a mean score of 12.2 obtained by Zuckerman et al. (1964) for the 22 item scale. Scores ranged from 2 to 21 with a standard deviation of 4.07. The maximum score that could be obtained on the scale was 22, the minimum was 0. For females (n = 117), the mean score was

12.81 and the standard deviation 4.28 with scores ranging from 3 to 21. For males (n = 87), the mean score was 13.47 and the standard deviation 3.65 with scores ranging from 2 to 21. For the low sensation seeking group, the mean score and standard deviation were 6.20 and 1.98 respectively. The range was from 2 to 9. For the high sensation seeking group, the mean and standard deviation were 19.4 and 1.05 respectively. Scores ranged from 18 to 21.

Mean performance scores for both the low SS group and high SS group on the KAE are presented in Table 1. Because only the large block stimulation test was used in this study, interest was in the degree of augmentation or reduction shown in each subject rather than in the absolute classification of each subject as an augmenter or a reducer. Reduction was indicated by a negative (-) mean (indicating decreased estimates of the inspection block after interpolated stimulation) and augmentation by a positive (+) mean (indicating increased estimates of the inspection block after stimulation). For the low SS group KAE scores ranged from an augmentation score of +2.57

TABLE 1

Kinesthetic Aftereffects Scores (mm)	
Low Sensation Seekers n = 20	High Sensation Seekers n = 20
$\bar{X}$ = -3.40	$\bar{X}$ = -3.00
S = 3.40	S = 3.73

to a reducing score of -8.83. For the high SS group, scores ranged from +2.76 to -12.88.

Sensation seeking was the independent variable in this first analysis while performance on the KAE task served as the dependent variable. The major hypothesis of the present study was that there would be significant performance differences between high sensation seekers and low sensation seekers on the kinesthetic aftereffects test. A t-test for independent groups did not provide support for this hypothesis. No significant differences in performance between the low sensation seeking group and high sensation seeking group were observed on the KAE (t = .352, df = 38; n.s.). The present results do not provide any evidence of a relationship between sensation seeking and the concept of augmentation-reduction as measured by the KAE.

(2) Sensation Seeking and Integrative Complexity. A secondary hypothesis of the present study concerned the predicted relationship between sensation seeking and conceptual functioning. The hypothesis was tested by an analysis of variance of the sensation seeking scores obtained among the different System groupings on integrative complexity. Performance on the Interpersonal Topical Inventory (ITI) was the independent variable in this analysis while performance on the SSS served as the dependent variable.

It was possible to assign 26 of the 40 subjects to conceptual groupings on the ITI. Four subjects were classified as System II, five as System III, and sixteen as System IV. No subject fell within the

System I level of conceptual functioning. Fourteen subjects comprising 35 per cent of the sample were not predominant in any one of the systems and could not be classified. This percentage of non-classifiable subjects compares closely with the 38 per cent obtained by Sandilands (1969) and the 29.41 per cent of unclassifiable subjects obtained by Corfield (1967) in previous studies. An analysis of variance across the three System groups revealed no significant differences in sensation seeking scores (F = .78, df = 26; n.s.). Mean performance scores for the three different systems on the SSS are presented in Table 2. The results did not reveal any relationship between sensation seeking and the concept of integrative complexity.

TABLE 2

Sensation Seeking Scale Scores		
System II n = 4	System III n = 5	System IV n = 16
$\bar{X}$ = 17.25	$\bar{X}$ = 12.17	$\bar{X}$ = 12.63
S = 5.50	S = 7.57	S = 7.13

It was also expected that performance differences between the three integrative complexity groups on augmentation-reduction and on the BW Art Scales would be observed in the present study. Analysis of variance did not reveal any significant differences between the groups. Mean performance scores for the three system groupings on augmentation-reduction and on the BW and RA scales are presented in Tables 3, 4, and

5 respectively. Analysis of variance summaries for the above data are included in Appendix G.

TABLE 3

Augmentation-Reduction Scores (mm)		
System II n = 4	System III n = 5	System IV n = 16
$\bar{X}$ = -2.64	$\bar{X}$ = -3.01	$\bar{X}$ = -3.76
S = 1.91	S = 3.84	S = 3.82

TABLE 4

Barron-Welsh Art Scale Scores		
System II n = 4	System III n = 5	System IV n = 16
$\bar{X}$ = 39.00	$\bar{X}$ = 24.17	$\bar{X}$ = 27.94
S = 12.25	S = 19.32	S = 13.89

TABLE 5

Revised Art Scale Scores		
System II n = 4	System III n = 5	System IV n = 16
$\bar{X}$ = 44.75	$\bar{X}$ = 28.33	$\bar{X}$ = 31.75
S = 12.97	S = 20.56	S = 13.50

(3) Sensation Seeking and Barron-Welsh Art Scale Performance. A further prediction related to conceptual functioning was that performance on the BW scales would differentiate high sensation seekers from low sensation seekers. This prediction was born out in the present study. Sensation seeking was the independent variable while BW and RA scale performance constituted the dependent variables. A t-test for independent groups revealed differences in performance between high sensation seekers and low sensation seekers on the BW ($t = -2.39$, $df = 38$, $p < .01$) and RA ($t = -3.33$, $df = 38$, $p < .01$) scales. High sensation seekers achieved higher scores on the BW scales than low sensation seekers. Mean performance data for the scales are presented in Tables 6 and 7.

TABLE 6

Barron-Welsh Art Scale Scores	
High Sensation Seeking Group n = 20	Low Sensation Seeking Group n = 20
$\bar{X} = 35.20$	$\bar{X} = 25.25$
$S = 13.71$	$S = 12.58$

TABLE 7

Revised Art Scale Scores	
High Sensation Seeking Group n = 20	Low Sensation Seeking Group n = 20
$\bar{X}$ = 41.35	$\bar{X}$ = 27.30
S = 13.24	S = 13.10

(4) Correlational Analysis. Pearson product moment correlation coefficients between sensation seeking, KAE, BW and RA scale performance, and age revealed several interesting findings. The correlational matrix is presented in Table 8. Sensation seeking

TABLE 8

	Sensation Seeking Scale (1)	Kinesthetic Aftereffects Task (2)	Barron-Welsh Art Scale (3)	Revised Art Scale (4)	Age (5)
(1)					
(2)	0.06 N.S.				
(3)	0.40*	0.18 N.S.			
(4)	0.51**	-0.00 N.S.	0.94**		
(5)	-0.44**	-0.10 N.S.	-0.09 N.S.	-0.18 N.S.	

* $p < .05$
** $p < .01$

was found to correlate positively with both the BW scale (r = .40, df = 39, $p < .05$) and the RA scale (r = .51, df = 39, $p < .01$). Sensation seeking was found to correlate negatively as well with age (r = -.44, df = 39, $p < .01$). The mean age of the high sensation seeking group was 20.35 and for the low sensation seeking group, 23.55. A further analysis of the age factor revealed a significant difference in age between the two groups. No relationship was observed between augmentation-reduction and any of the other variables. A high correlation (r = .94, df = 39, $p < .01$) was observed between the BW and RA scales. This compares with an r of .85 noted in a previous study by Welsh (1959).

DISCUSSION

The major finding of the present study was that the kinesthetic aftereffects (KAE) task did not discriminate between high sensation seekers and low sensation seekers. Inspection of the data reveals that the tendency towards reduction was equally as great in the low sensation seeking (LSS) group as in the high sensation seeking (HSS) group. Only three subjects in the LSS group demonstrated augmentation on the KAE while only four augmented in the HSS group. The results suggest that there is no relationship between sensation seeking and augmentation-reduction. The results may be viewed in two ways. They may be discussed in terms of the validity of the instruments employed and the method of administration of the tasks or they may be interpreted as giving evidence of a lack of any relationship between the two instruments and the theoretical constructs underlying them. The author favours the latter point of view but both views will be examined in the following discussion.

The construct validity of the Sensation Seeking Scale (SSS) has been firmly established in numerous studies (Zuckerman & Link, 1968; Zuckerman et al., 1972). The evidence from these and other studies suggests that the Sensation Seeking Scale is in fact measuring a relevant aspect of personality, one that is related to stimulus preferences and need for certain varieties of experience in the environment. In the present study, performance on the Barron-

Welsh (BW) Art Scales differentiated high sensation seekers from low sensation seekers. These results substantiate a previous finding using the same instruments (Zuckerman, Neary, & Brustman, 1970) and suggest that the LSS and HSS groups in this study were in fact two different groups differentiated according to their sensation seeking scale performance. The further evidence obtained in this study that high sensation seekers, as a group, were significantly younger than low sensation seekers, results that were also obtained by Kish and Busse (1968), Thorne (1971), and others, provide further support for the sensation seeking differences between the two groups in this study.

The KAE task has been employed in numerous studies and while some recent research with it has yielded a number of conflicting results, the validity of the augmentation-reduction dimension has been generally borne out. Morgan and Hilgard (1972) have added a note of caution about the KAE task by suggesting that the split half reliability of .97 reported by Petrie (1967) for the KAE task, was high only because it was based on scores derived from width estimates made within the same time and condition. This measure thus ignored the reliability of an individual's tendency to "reduce" or "augment" over different testing sessions. Morgan and Hilgard (1972) noted that Eysenck (1955) and Spitz and Lipman (1960) also reported high correlations but again these were taken within short intervals. In their own study, Morgan and Hilgard (1972) actually noted a reversal in sign from one day to the next so that those who augmented more on

day one reduced more on the next day. Augmenters did augment more with small block stimulation and reduced less with large block stimulation while reducers augmented less with small block stimulation and reduced more on large block stimulation. Their results were so marginal though that the authors concluded that further work was necessary before any definite deductions could be drawn from their study. In an earlier study, Morgan, Lezar, Prytulak, and Hilgard (1970) found that subjects appeared to respond to contrast effects either augmenting or reducing according to whether the standard block was large or small, rather than responding consistently in one direction as predicted by Petrie (1967). A further finding was that augmenters and reducers did not differ in their responsiveness to the pain of immersing their hands into cold water. Thus, they were also unable to replicate Petrie's findings with relation to individual differences in tolerance for pain. Conflicting results with the KAE task were obtained by Maier (1961) in one other study. He failed to corroborate Eysenck's (1955) findings that the KAE task could differentiate dysthymics from hysterics. What is more, the results were not in the direction predicted by Eysenck with dysthymics showing larger and more persistent kinesthetic aftereffects than hysterics.

Wetheimer and Herring (1968) surveyed over ten years of work in the area of figural aftereffects and concluded that while a large number of correlations between figural aftereffects and other perceptual and cognitive indices have been in the expected direction, most of the

correlations have been disappointingly low. In addition, results across studies have been variable, inconsistent, and often not replicable. Small differences in apparatus, procedure, or instructions often made major differences in measured individual differences. Wertheimer and Skeets (1968), for example, discovered that measured size of the KAE can be substantially affected by the set, suggestion, or orientation induced by the instructions. Phenomenological instructions such as "Report what it feels like" yielded mean KAEs which were numerically twice as large as the mean KAE produced under physicalistic instructions such as "Report what it is really like". Individual differences in the amount of finger pressure applied on the blocks during comparison and stimulation trials may be another variable of importance. Differences in apparatus and technique may thus account for some of the conflicting results obtained in KAE research. Any work investigating the augmentation-reduction dimension must be viewed in light of this variance in apparatus and procedure. The method of administration of the KAE in the present study followed that outlined by Petrie (1967). The procedure was followed as accurately as possible and consequently the results of the present study are best interpreted in light of Petrie's methodology and theory.

Because only large block stimulation was used in the present study, traditional kinesthetic aftereffects theory would predict that all subjects would reduce on the KAE task. Petrie, however, has claimed that the augmentation-reduction effect is so strong that

extreme augmenters would still augment with large block stimulation. Ryan and Foster (1967), for example, found that about 30 per cent of a group of non-athletes, compared to 0 per cent in a group of athletes, did in fact augment on the large block test. While only seven subjects augmented in the present study, Petrie's theory would still predict that reducers would reduce more on large block stimulation than augmenters because of their strong tendency to diminish impinging stimulation. This has been borne out in a number of previous studies (Petrie, 1967; Ryan & Foster, 1967; Morgan & Hilgard, 1972). High sensation seekers therefore would be expected to have significantly higher reducing scores on the large block stimulation task than low sensation seekers as previously predicted. The lack of any differences between the two groups, however, suggests that there is in fact no relationship between performance on the KAE task and sensation seeking. Both tasks appear to reflect different aspects of human functioning that are independent of each other. A number of other studies that have attempted to relate these two kinds of variables, KAE task performance, and other personality measures have also yielded generally disappointing results.

Rechtschaffen and Bookbinder (1960) reported insignificant correlations between KAE performance and introversion-extraversion, thus failing to corroborate Eysenck's (1955) earlier results. Satinder (1964b) also failed to corroborate Eysenck's findings. Phelan, Brocks, and Brashears (1970) found no relationship between KAE performance and

a number of personality variables that included scores from the Embedded Figures Test (Witkin, 1950), the Masculinity-Femininity Scale of the Guilford Zimmerman Temperament Survey (Guilford & Zimmerman, 1949), the Rotter Internal External Control State (Rotter, 1966), and the Combined Self Actualization Scales of Shostrom's Personal Orientation Inventory (Shostrom, 1966). Kidd and Beere (1968) gave five personality measures to 50 subjects and attempted to correlate them with KAE performance. These measures included Eysenck's Personality Inventory (Eysenck & Eysenck, 1963), the Sanford Gough Rigidity Scale (Rokeach, 1960), the short form of the Taylor MAS (Bendig, 1956), and the Ego Strength Scale of the MMPI (Barron, 1953), and the short form of the Embedded Figures Test (Jackson, 1956) of field dependence. In general, the results they obtained were insignificant and they concluded that there may be no real relationship between personality measures and the KAE. Drawing from her own findings, Petrie (1967) speculated that the differences in sensitivity between the augmenter and reducer would reflect themselves in other areas of personality. The reducer would be more active and outgoing while the augmenter would be more socially withdrawn and introverted. Work by Dean Ryan and his associates (Ryan & Kovacic, 1966; Ryan & Foster, 1967) demonstrated that tolerance for pain and the degree of perceptual reduction was greatest among contact athletes and least among non-athletic students. Petrie (1967) reported several suggestive findings that reducers are more active in sports than augmenters. Other researchers investigating neurophysiological

differences between individuals have also hypothesized that these differences would be reflected in personality and behaviour (Nebylitsyn & Gray, 1972). While there is some evidence for this in certain cases such as in Eysenck's (1957) introversion-extroversion dimension, the weight of the evidence from the present study and the studies discussed above suggests that the dimension of augmentation-reduction may not be associated with other areas of personality functioning. In the present study, augmentation-reduction has not been shown to be a correlate of sensation seeking as was hypothesized and the two, do in fact, appear to be independent processes. Augmentation-reduction has been related to certain perceptual experiences such as the tolerance for pain (Petrie, 1967) but it is apparently not related to higher levels of cognitive functioning. At the same time, one could speculate that the preference for variety and experience measured by the SSS is more a reflection of past experience and socialization than of any physiological differences between individuals.

There has been little work attempting to relate sensation seeking to physiological measures or to perceptual tasks such as Petrie's KAE task based on hypothesized neurophysiological differences. Most of the work with the SSS has related it to personality variables or to preferences for varying kinds of sensory experiences. The little evidence to date including the evidence from the present experiment suggests that sensation seeking may not have any physiological correlates and that it is largely a cognitive personality trait measure as suggested

above. Lambert and Levy (1972), for example, found that high scorers on the SSS demonstrated higher response rate for visual stimulation in a brief deprivation situation than low scorers but they failed to find any relationship between stimulus-seeking and skin resistance function. The authors proposed that their findings could be attributed to a distinction between stimulus-seeking and isolation discomfort, the latter being measured by the GSR function and standing independent of sensation seeking. Further research to clarify these results is still required.

Because there is virtually no research relating sensation seeking to physiological measures, it would seem appropriate to increase the scope of research in this area. The lack of significant findings in the present study and the findings of Lambert and Levy's (1972) study with respect to SSS performance and galvanic skin response function only suggests the direction other research in this area may take. It is still possible that sensation seeking, as a measure of optimal stimulus seeking, can be related to a number of physiological measures. The evidence against this possibility is still only minimal.

A secondary finding of the present study was that sensation-seeking was not related to integrative complexity as measured on the Interpersonal Topical Inventory (ITI). Because of the small number of subjects that could be classified into system groupings, the present results can only be seen as suggestive. Further research should involve administering the ITI to a large number of individuals establishing four separate system groupings and administering the

sensation seeking scale to each of the groups. An analysis of variance of the results would yield more definitive conclusions about the two measures than the data from the present experiment.

The results of this study can be discussed in terms of what the SSS and the ITI are measuring. Integrative complexity relates to an individual's total value orientation dealing with internal schemata that mediate the individual's responses to others in a large number of situations. These determine how the individual structures and interprets his environment, how he views himself and others, and to what extent he apprehends alternatives in his thinking. Integrative complexity is thus a measure of how an individual would typically cope with particular situations. It may even be solely a measure of social complexity unrelated to other kinds of complexity (Vannoy, 1965). What the SSS appears to be measuring, on the other hand, is what kinds of situations the individual will choose to cope with, whether they are situations with high stimulus value or situations with low stimulus value. The ITI thus relates to how an individual perceives his world and the SSS to what the individual perceives. It was hypothesized that the high sensation seeker would be the counterpart of the System IV individual who processed information from his environment in a complex, flexible manner while the low sensation seeker would be the System I individual processing information in a simple, rigid categorical manner. The results suggest that the method by which an individual processed information from his environment, as measured by the ITI, may be

unrelated to the quantity of information processed. In other words, a high sensation seeker may require a great deal of stimulation and variety in his environment, but his personality style may still be the rigid inflexible style of the System I individual. He could seek out experience and excitement at the level of sensation, yet still be rigid and inflexible in his interpersonal relations or in other areas of his cognitive functioning. As Harvey, Hunt, and Schroder (1961) have pointed out, individuals may be more abstract and open in some areas of their life but at the same time may possess concepts that are closed and isolated from other parts of their experience. What is suggested is a distinction between what may be an underlying cognitive structure (integrative complexity) and what may be a more surface personality trait related to dispositional tendencies for certain varieties of experience. While an individual's cognitive structure would be expected to influence his choice of experiences other factors such as motivational states may be just as important in determining what kinds of stimuli the individual will attend to. Thus, Bieri (1961) has pointed out that the person's tendency to respond to certain stimuli must be seen in relationship to the "stimulus" value of these cues for the organism. This may be in terms of the organism's past experience with particular stimuli or in relation to the individual's needs at the particular time. In sensory deprivation situations, for example, individuals will attend to stimuli that in ordinary situations they would find extremely boring due to the lack of variability in the

deprivation situation (Smith & Myers, 1966). Personal interest and preferences must also be considered as influencing the individual's choice of stimulation (Maddi, 1961). Some individuals may seek variation in one area, for example, in their vocational or leisure time pursuits, but not seek variation in other areas such as in the sphere of social relations. It should also be noted that while most of the items in the ITI relate to interpersonal topics and situations, the SSS places a greater emphasis on concrete situations related to preferences for external sensation such as speed, physical activity, and visual experiences.

In the present study, integrative complexity was not found to be related to augmentation-reduction nor to performance on the BW art scales. Once again, the small number of subjects in some of the system groupings does not allow for clear-cut conclusions to be drawn from the results. As previously noted though, few studies have been able to relate augmentation-reduction to personality variables and the present findings also underline the fact that higher level processes are not easily linked with physiological processes. The step from physiological differences to difference in conceptual style are apparently too large to allow the augmentation-reduction to serve as an explanatory concept for higher level processes.

It would be less surprising to find a relationship between integrative complexity and performance on the BW art scales, as both are measures of cognitive complexity. The fact that no relationship

was apparent in the present study may be due to the poor distribution of integrative complexity scores in the study. For example, no subjects could be classified under the System I grouping on integrative complexity. Ideally, subjects on each of the four systems should be selected from a large population on the basis of ITI scores. It is also possible that the ITI and BW art scales are measuring different aspects of cognitive complexity. Vannoy (1965) obtained intercorrelations among 20 widely used measures of "cognitive complexity" in a sample of 113 college males and females and found no single factor of cognitive complexity. He also found a low correlation between Schroder's measure of cognitive complexity and a modified form of the BW art scale. Vannoy (1965) suggested that cognitive complexity may consist of a number of distinct possibly independent tendencies, some of which may not have been measured by the instruments in his study. Scott (1963) has contended that there is no unitary trait of complexity-simplicity that typified an individual in all aspects of his life and that cognitive complexity is not a general personality trait. The ITI and BW scales may thus be measuring two independent traits related to complexity-simplicity, the ITI measuring complexity at the level of interpersonal relationships and the BW scales measuring complexity at the simpler perceptual level.

As predicted, performance on the BW scales differentiated individuals according to their performance on the SSS. The results obtained substantiate previous findings that the BW scales differentiate high sensation seekers from low sensation seekers (Zuckerman et al., 1970).

Pearson and Maddi (1966) have suggested that there are two active forms of stimulus seeking, the "exteroceptive" or the seeking of external sources of stimulational variety and the "interoceptive" or the seeking of stimulational variety on the cognitive level. Pearson (1970) noted that the SSS as a global measure of sensation seeking did not appear to measure either the cognitive or interoceptive aspects of novelty experience. Kish (1970b) noted that the SSS is more of a measure of the need to seek exteroceptive stimulation. If the SSS is seen then as an exteroceptive measure of the need for variety, it becomes easier to see why it can be related to BW art scale performance--another exteroceptive measure--and why it is apparently unrelated to integrative complexity. Novelty seeking at the interoceptive level would be related to integrative complexity and to cognitive processes that are not tapped by the SSS with its emphasis upon external sources of stimulation.

As anticipated from the results of previous studies, sensation seeking was found to correlate with the BW art scales. The possible reasons for this relationship have been discussed above. No relationship was observed between BW art scale performance and age. A further finding that sensation seeking was inversely correlated with age has been found previously in a number of other studies (Thorne, 1971; Blackburn, 1969; Kish & Busse, 1968; Brownfield, 1966). What the data suggests is that sensation seeking is more of a trait that is related to situational and environmental variables. While sensation seeking, particularly physical sensation seeking, is an

activity that individuals participate in all their lives, it is in youth that it is engaged in most rigorously. Children begin playing and exploring from the time of birth and continue to seek out varieties of experience from their environment throughout adolescence and beyond. With age there is typically a gradual drop in such activity and an increased interest in more stable and secure pursuits. It is not unexpected therefore that sensation seeking scores would decrease with age. What this suggests is that motivational variables play a significant role in the determination of sensation seeking preferences and that sensation seeking is not a fixed unchanging aspect of personality. It is also possible that as individuals age, their sensation seeking activities are directed into other areas of interest. While an individual may no longer seek stimulation through physical activity such as sports, he may seek out variation in more cognitive or passive pursuits such as in reading, hobbies, or other leisure time pursuits. These latter activities may be more subtle sensation seeking activities that are not tapped by the sensation seeking scale.

The extent to which individuals seek out stimulation would seem to depend upon their past experiences and upon their current needs. Kish and Donnenwerth (1972) found a significant correlation between parent's scores on the SSS and sensation seeking interest of their offspring. While further research is needed in this area the results do suggest that stimulus-seeking interests may be acquired through the family or through the kind of environments and experiences parents

provide for their children. The question of genetic influences on sensation seeking in humans is still an unexplored area.

An individual who has experienced high levels of stimulation during his development will have stronger stimulus needs than someone who has not experienced a great deal of early stimulation. Thus, Maddi (1967) noted that "the adult exposed to a relatively great degree of variation in childhood may have a higher normal activation level than the person who has been more restricted in this regard. The first adult will require more variation than the second in order to maintain normal activation in the absence of strong specific motivation". The evidence does suggest that a more stimulating environment will produce an adult organism that is alert and flexible and more adaptable to changing stimulation in his environment (Thompson & Schaefer, 1967).

Dember and Earl (1957) proposed that each individual has an "ideal" stimulation level. The "ideal" was the maximum amount of complexity in a stimulus that the individual could comfortably cope with. The ideal varied from stimulus attribute to attribute and changed as well over time through the individual's interaction with a class of stimuli called "pacers". Pacers with complexity values just above the individual's current ideal represented optimum levels of stimulation for the individual. Because of the need to seek stimulus variety, individuals would spend a great deal of time responding to pacers. Continual contact with a pacer would subsequently lead to an

increase in the individual's ideal and a new pacer would be found to replace the old one. In applying this theory to the present discussion, high sensation seekers can be seen as individuals who have always been confronted with numerous pacers in their environment and who consequently have achieved higher "ideals" of stimulation than those who have experienced fewer pacers in their environment. Thus, what is presently optimal for an individual is largely dependent upon the types of experiences his environment has provided him earlier in his development. Consequently, each individual would have different "optimum" requirements. In measuring these "optimum" needs, the SSS is thus measuring a changing aspect of personality that is inextricably linked to environmental conditions and socialization experiences. With age, the value of pacers decreases and the individual's "ideal" may become stabilized at a fixed level. Stimulus seeking decreases therefore as the interaction with pacers gradually diminishes. It is the process of moving from a stimulus ideal to a stimulus pacer that can be viewed as the sensation seeking activity.

What the above discussion has implied and what the results of the present study imply generally is that while sensation-seeking is a pervasive and fairly well defined personality trait, it is not a fixed immutable aspect of personality. Running parallel to this is the suggestion that neither is sensation seeking linked to any physiological differences between individuals. Sensation seeking, as a trait, describes interests and preferences that grow out of past

socialization experiences. Because of variations in developmental histories, individuals have different optimum stimulus requirements: some individuals require quite passive activities and others are constantly seeking out variety and novelty in their environment. That physiological differences underly these differences in behaviour is a tenuous proposition that still requires further research.

In recent years interest has begun to focus on the properties of the nervous system as the possible basis for individual differences in behaviour. The search, as has been noted previously in this paper, has been for physiological differences that manifest themselves in behaviour. Eysenck's (1955) work with introversion-extroversion was an early approach to this and Petrie's work has run parallel to it. Pavlov (Gray, 1964) talked about individual differences in "strength" of the nervous system in animals and Teplov (Gray, 1964) attempted to apply this hypothetical neural entity to human functioning. The weaker the nervous system, Teplov (Gray, 1964) suggested, the more intense was the excitatory process which was set up by a given physical stimulus. In the stronger nervous system, there was a greater strength of cortical cells or a greater working capacity which allowed the organism to respond to higher intensities and greater frequencies of stimulation before an inhibitory process took place to protect the cells from excess stimulation. In the weak nervous system, there was a lower threshold before which the inhibitory process occurred. The "strength" of the nervous system therefore, lay in the ability of

the organism to tolerate greater intensities of stimulation than could be borne by an organism with a weak nervous system. Several studies have provided support for these theories (Nebylitsyn & Gray, 1972). Although most of these have been undertaken in the Soviet Union, there has been an increased interest in these theories in the West. It is obvious that there are some strong similarities between the work of Teplov (Gray, 1964) and that of Petrie (1967) and her co-workers. The reducer characterized by a strong nervous system may respond to stimuli of higher intensity than the augmenter. In the reducer, the nervous system would act as if it damped down stimulation while in the augmenter, the nervous system would act as if it amplified it. A profitable line of research would be to attempt to relate KAE performance with measures of nervous system strength. Teplov (Gray, 1964) used a conditioning paradigm as one such measure testing the magnitude of a photochemical conditioned reflex over a series of rapid elicitations. Buchsbaum and Silverman's (1971) findings that "reduction responsiveness" on the KAE was associated with reduced responsiveness to high intensity visual stimulation as measured by modified electroencephalographic procedures point out another direction future research could take. It is predicted that there would, in fact, be a relationship between KAE performance and nervous system strength. Reducers would demonstrate greater nervous system strength, being able to handle greater intensities of stimulation than augmenters. Weak individuals, or augmenters, would characteristically exhibit high

levels of arousal and would demonstrate preferences for an environment low in stimulus value. Strong individuals would have higher optimum requirements functioning better at higher levels of arousal.

Another line of research could examine if there is a relationship between sensation seeking and nervous system strength and measures such as those used by Buchsbaum and Silverman (1971) in their experiments with augmenters and reducers. Sales, Guydosh, and Iacono (1973) observed that strong individuals (those with high auditory thresholds) were more likely to respond to complex stimuli than to simple stimuli, were more likely than weak individuals to use a stimulant (coffee), and were more likely to have been born and raised in urban environments. These strong individuals thus appear to share some of the traits of the high sensation seeker. A profitable line of research could involve the administration of the Sensation Seeking Scale to subjects selected on the basis of their auditory thresholds. The theory would predict that those with high auditory thresholds would have the higher scores on the Sensation Seeking Scale as compared with those having low auditory thresholds. The evidence from such a study could provide further information about possible physiological correlates of sensation seeking. Zuckerman et al., (1970) have suggested that attempts could also be made to relate sensation seeking with measures of autonomic habituation rates and C.N.S. satiation measures. Further research could also examine the relationship of KAE performance with these same physiological measures.

What the present study has pointed out is the difficulty of relating physiological variables to personality variables and the difficulty of relating different measures of cognitive functioning to each other. This was suggested in the first instance by the inability of the KAE to differentiate high sensation seekers from low sensation seekers, and secondly, by the lack of any relationship between sensation seeking and integrative complexity and BW art scale performance. In the future, further work on the KAE must begin emphasizing standardization of apparatus and technique. The KAE is slightly unwieldly and difficult to administer as a clinical and diagnostic tool and efforts may even be made to find a more easily administered and simplified method of quantifying augmentation-reduction. Satinder (1964a), for example, has designed an apparatus consisting of parallel sliding aluminum strips that appears to be a more reliable measure of kinesthetic aftereffects than the wedge-shaped comparison scale used by Petrie (1967). The SSS could also be associated with other measures of creativity aside from the BW scales. Research is also required into the etiology of the sensation seeking trait. Longitudinal and twin studies may be profitable in determining the familial influences on sensation seeking. The possibility of genetic factors assuming a role in sensation seeking has not been explored at all. Cross-cultural studies might also yield valuable information about the pervasiveness of sensation seeking as a personality trait.

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*This manual is available from the author and contains an excellent review of the research done with the Sensation Seeking Scale up to April 1972.

APPENDIX A

SENSATION SEEKING SCALE

(FORM II)

The following is an interest test being administered to all Introductory Psychology students. It is important that you fill it out honestly and accurately. We are interested not in how you as an individual respond to it, but in how different groups of people vary according to their interests. You may be contacted for a further study at some later date.

DIRECTIONS

1. All answers are to be recorded on the separate answer sheet.

   Make no marks or answers on the questionnaire booklet.

2. Provide the following information on your answer sheet:

   a) Print your name, age, and faculty.
   b) Place an "X" in the box indicating your sex.
   c) Write your telephone number in the space provided.

INTEREST AND PREFERENCE TEST

DIRECTIONS: Each of the items below contains two choices, A and B. Please indicate on your answer sheet, by making an "X" in the box beside A or B, which of the choices most describes your likes or the way you feel. In some cases you may find items in which both choices describe your likes or feelings. Please choose the one which best describes your likes or feelings. In some cases you may find items in which you do not like either choice. In these cases mark the choice you dislike least. Do not leave any items blank.

It is important you respond to all items with only one choice, A or B. We are interested only in your likes or feelings, not in how others feel about these things or how one is supposed to feel. There are no right or wrong answers as in other kinds of tests. Be frank and give your honest appraisal of yourself.

1. A. I would like a job which would require a lot of travelling.
   B. I would prefer a job in one location.

2. A. I am invigorated by a brisk, cold day.
   B. I can't wait to get into the indoors on a cold day.

3. A. I find a certain pleasure in routine kinds of work.
   B. Although It is sometimes necessary I usually dislike routine kinds of work.

4. A. I often wish I could be a mountain climber.
   B. I can't understand people who risk their necks climbing mountains.

5. A. I dislike all body odours.
   B. I like some of the earthy body smells.

6. A. I get bored seeing the same old faces.
   B. I like the comfortable familiarity of everyday friends.

7. A. I like to explore a strange city or section of town by myself, even if it means getting lost.
   B. I prefer a guide when I am in a place I don't know well.

8. A. I find the quickest and easiest route to a place and stick to it.
   B. I sometimes take different routes to a place I often go, just for variety's sake.

9. A. I would not like to try any drug which might produce strange and dangerous effects on me.
   B. I would like to try some of the new drugs that produce hallucinations.

10. A. I would prefer living in an ideal society where everyone is safe, secure, and happy.
    B. I would have preferred living in the unsettled days in our history.

11. A. I sometimes like to do things that are a little frightening.
    B. A sensible person avoids activities that are dangerous.

12. A. I order the dishes with which I am familiar, so as to avoid disappointment and unpleasantness.

13. A. I can't stand riding with a person who likes to speed.
    B. I sometimes like to drive very fast because I find it exciting.

14. A. If I were a salesman I would prefer a straight salary, rather than the risk of making little or nothing on a commission basis.
    B. If I were a salesman I would prefer working on a commission if I had a chance to make more money than I could on a salary.

15. A. I would like to take up the sport of water skiing.
    B. I would not like to take up water skiing.

16. A. I don't like to argue with people whose beliefs are sharply divergent from mine, since such arguments are never resolved.
    B. I find people that disagree with my beliefs more stimulating than people who agree with me.

17. A. When I go on a trip I like to plan my route and timetable fairly carefully.
    B. I would like to take off on a trip with no preplanned or definite routes, or timetables.

18. A. I enjoy the thrills of watching car races.
    B. I find car races unpleasant.

19. A. Most people spend entirely too much money on life insurance.
    B. Life insurance is something that no man can afford to be without.

20. A. I would like to learn to fly an airplane.
    B. I would not like to learn to fly an airplane.

21. A. I would not like to be hypnotized.
    B. I would like to have the experience of being hypnotized.

22. A. The most important goal of life is to live it to the fullest and experience as much of it as you can.
    B. The most important goal of life is to find peace and happiness.

23. A. I would like to try parachute jumping.
    B. I would never want to try junping out of a plane, with or without a parachute.

24. A. I enter cold water gradually giving myself time to get used to it.
    B. I like to dive or jump right into the ocean or a cold pool.

25. A. I do not like the irregularity and discord of most modern music.
    B. I like to listen to new and unusual kinds of music.

26. A. I prefer friends who are excitingly unpredictable.
    B. I prefer friends who are reliable and predictable.

27. A. When I go on a vacation I prefer the comfort of a good room.
    B. When I go on a vacation I would prefer the change of camping out.

28. A. The essence of good art is in its clarity, symmetry of form, and harmony of colour.
    B. I often find beauty in the "clashing" colours and irregular forms of modern paintings.

29. A. The worst social sin is to be rude.
    B. The worst social sin is to be a bore.

30. A. I look forward to a good night of rest after a long day.
    B. I wish I didn't have to waste so much of a day sleeping.

31. A. I prefer people who are emotionally expressive even if they are a bit unstable.
    B. I prefer people who are calm and even tempered.

32. A. A good painting should shock or jolt the senses.
    B. A good painting should give one a feeling of peace and serenity.

33. A. When I feel discouraged I recover by relaxing and having some soothing diversion.
    B. When I feel discouraged I recover by going out and doing something new and exciting.

34. A. People who ride motorcycles must have some kind of an unconscious need to hurt themselves.
    B. I would like to drive or ride on a motorcycle.

ANSWER SHEET

INTEREST AND PREFERENCE TEST

NAME _____

AGE _____

FACULTY _____ TELEPHONE NUMBER _____

1.	A ☐ B ☐	11.	A ☐ B ☐	21.	A ☐ B ☐	31.	A ☐ B ☐
2.	A ☐ B ☐	12.	A ☐ B ☐	22.	A ☐ B ☐	32.	A ☐ B ☐
3.	A ☐ B ☐	13.	A ☐ B ☐	23.	A ☐ B ☐	33.	A ☐ B ☐
4.	A ☐ B ☐	14.	A ☐ B ☐	24.	A ☐ B ☐	34.	A ☐ B ☐
5.	A ☐ B ☐	15.	A ☐ B ☐	25.	A ☐ B ☐		
6.	A ☐ B ☐	16.	A ☐ B ☐	26.	A ☐ B ☐		
7.	A ☐ B ☐	17.	A ☐ B ☐	27.	A ☐ B ☐		
8.	A ☐ B ☐	18.	A ☐ B ☐	28.	A ☐ B ☐		
9.	A ☐ B ☐	19.	A ☐ B ☐	29.	A ☐ B ☐		
10.	A ☐ B ☐	20.	A ☐ B ☐	30.	A ☐ B ☐		

NOTE: IT IS IMPORTANT YOU RESPOND TO ALL ITEMS WITH ONLY ONE CHOICE, A OR B.

PLEASE CHECK THAT YOU HAVE ANSWERED ALL THE ITEMS.

SENSATION SEEKING SCALE

SCORING KEY

(General male-female SSS scale - 22 Items)

SCORE:		
	1A	20A
	2A	21B
	4A	22A
	5B	23A
	6A	24B
	7A	26A
	9B	27B
	10B	28B
	11A	31A
	15A	32A
	17B	34B

APPENDIX B

INDIVIDUAL-TOPICAL INVENTORY

FORM A

1. Imagine that someone has criticized you. Choose the response from each pair that comes closest to your feelings about such criticism. Indicate your choice by circling either "A" or "B".

When I am criticized...

Pair No.	A	B
(1)	I try to take the criticism, think about it, and value it for what it is worth. Unjustified criticism is as helpful as justified criticism in discovering what other people's standards are.	I try to accept the criticism, but often find that it is not justified. People are too quick to criticize something because it doesn't fit their standards.
(2)	I try to determine whether I was right or wrong. I examine my behaviour to see if it was abnormal. Criticism usually indicates that I have acted badly and tends to make me aware of my own bad points.	It could possibly be that there is some misunderstanding about something I did or said. After we both explain our viewpoints, we probably reach some sort of compromise.
(3)	I listen to what the person says and try to accept it. At any rate, I will compare it to my own way of thinking and try to understand what it means.	I feel that either I'm not right, or the person who is criticizing me is not right. I have a talk with that person to see what's right or wrong.
(4)	I usually do not take it with good humour. Although, at times, constructive criticism is very good, I don't always think that the criticizer knows what he is talking about.	At first I feel that it is unfair and that I know that I am doing but later I realize that the person criticizing me was right and I am thankful for his advice. I realize that he is just trying to better my actions.

Pair No.		
A	(5)	B
I try to ask myself what advantages this viewpoint has over mine. Sometimes both views have their advantages and it is better to combine them. Criticism usually helps me to learn better ways of dealing with others.		I am very thankful. Often I can't see my own errors because I am too engrossed in my work at the time. An outsider can judge and help me correct the errors. Criticism in everyday life usually hurts my feelings, but I know it is for my own good.
A	(6)	B
It often has little or no effect on me. I don't mind constructive criticism too much, but I dislike destructive criticism. Destructive criticism should be ignored.		I try to accept and consider the criticism. Sometimes it has caused me to change myself; at other times I have felt that the criticism didn't really make much sense.

2. Imagine that you are in doubt. Choose the response from each pair that comes closest to your feelings about such doubt. Indicate your choice by circling either "A" or "B".

When I am in doubt...

Pair No.		
A	(7)	B
I become uncomfortable. Doubt can cause confusion and make me do a poor job. When one is in doubt he should ask and be sure of himself.		I find myself wanting to remove the doubt, but this often takes time. I may ask for help or advise if I feel that my questions won't bother the other person.
A	(8)	B
I don't get too upset about it. I don't like to ask someone else unless I have to. It's better to discover the correct answer on your own.		I usually go to someone who knows the correct answer to my question. Sometimes I go to a book which will set me straight by removing the doubt.

Pair No.		
A	(9)	B
I first try to reason things out and check over the facts. Often I approach others to get ideas that will provide a solution.		I think things over, ask questions, and see what I can come up with. Often several answers are reasonable and it may be difficult to settle on one.
A	(10)	B
I realize that I'll have to decide on the correct answer on my own. Others try to be helpful, but often do not give me the right advice.		I usually try to find out what others think, especially my friends. They may not know the answer, but they often give me some good ideas.
A	(11)	B
I look over the problem and try to see why ther is a doubt. I try to figure things out. Sometimes I just have to wait while for an answer to come to me.		I try to get some definite information as soon as possible. Doubt can be bad if it lasts too long. It's better to be sure of yourself.
A	(12)	B
I consider what is best in the given situation. Although one should not rush himself when in doubt, he should certainly try to discover the right answer.		I act according to the situation. Sometimes doubt can be more serious than at other times and many of our serious doubts must go unanswered.

3. Imagine that a friend has acted differently toward you. Choose the response from each pair that comes closest to your feelings about such an action. Indicate your choice by circling either "A" or "B".

When a friend acts differently toward me...

Pair No.		
A	(13)	B
I am not terribly surprised because people can act in many different ways. We are different people and I can't expect to understand all his reasons for acting in different ways		I am usually somewhat surprised but it doesn't bother me very much. I usually act the way I feel towards others. People worry too much about others' actions and reactions.

Pair No. (14)	
A	B
I find out why. If I have done something wrong I will try to straighten out the situation. If I think he's wrong, I expect him to clear things up.	I feel that I may have caused him to act in a different way. Of course, he may have other reasons for acting differently which would come out in time.
(15)	
A	B
I first wonder what the trouble is. I try to look at it from his viewpoint and see if I might be doing something to make him act differently toward me.	It is probably because he has had a bad day, which would explain this different behaviour; in other cases he may just be a changeable kind of person.
(16)	
A	B
It is probably just because something is bothering him. I might try to cheer him up or to help him out. If these things didn't work I would just wait for him to get over it.	I try to understand what his different actions mean. I can learn more about my friend if I try to figure out why he does things. Sometimes the reasons may not be very clear.
(17)	
A	B
There has to be a definite reason. I try to find out this reason, and then act accordingly. If I'm right I'll let him know it. If he's wrong he should apologize.	I usually let him go his way and I go mine. If a friend wants to act differently that's his business, but it's my business if I don't want to be around when he's that way.
(18)	
A	B
I don't get excited. People change and this may cause differences. It is important to have friends, but you can't expect them to always be the same.	I like to get things back to normal as soon as possible. It isn't right for friends to have differences between them. Who ever is at fault should straighten himself out.

4. Think about the topic of people in general. Choose the response from each pair that comes closest to your thoughts about people. Indicate your choice by circling either "A" or "B".

This I believe about people...

Pair No.		
A	(19)	B
Whatever differences may exist between persons, they can usually get along if they really want to. Although their ideas may not agree, they probably still have something in common.		People can learn from those who have different ideas. Other people usually have some information or have had some experience which is interesting and can add to one's knowledge.
A	(20)	B
People can act in all sorts of ways. No single way is always best, although at certain times a particular action might be wiser than others.		Each person should be able to decide the correct thing for himself. There are always a few choices to be made and the individual himself is in the best position to pick the right one.
A	(21)	B
Some people think they know what's best for others and try to give advice. These people shouldn't make suggestions unless asked for help.		There are certain definite ways in which people should act. Some don't know what the standards are and therefore need to be straightened out.
A	(22)	B
I can tell if I am going to get along with a person very soon after meeting him. Most people act either one way or another and usually it is not difficult to say what they are like.		It's hard for me to say what a person is like until I've known him a long time. People are not easy to understand and often act in unpredictable ways.
A	(23)	B
People have an outside appearance that usually isn't anything like what can be found on the inside, if you search long and hard enough.		Each person is an individual. Although some people have more good or bad points than others, no one has the right to change them.

Pair No.		
A	(24)	B
People can be put into categories on the basis of what they're really like. Knowing the way a person really is helps you to get along with him better.		People are unlike one another in many respects. You can get along with people better, and better understand them if you are aware of the differences.

5. Think about the general topic of leaders. Choose the response from each pair that comes closest to your thoughts about leaders. Indicate your choice by circling either "A" or "B".

Leaders...

Pair No.		
A	(25)	B
Leaders do not always make the right decisions, In such cases, it is wise for a man to look out for his own welfare.		Leaders are necessary in all cases. If a leader cannot make the right decisions another should be found who can.
A	(26)	B
Leaders cannot provide all the answers. They are like other people--they have to try to figure out what action is necessary and learn from their mistake.		Leaders make decisions sometimes without being sure of themselves. We should try to understand this and think of ways to help them out.
A	(27)	B
I like a leader who is aware of how the group feels about things. Such a leader would not lead any two groups in exactly the same way.		A person should be able to put his confidence in a leader and feel that the leader can make the right decision in a difficult situation.
A	(28)	B
There are times when a leader shouldn't make decisions for those under him. The leader has the power to decide things, but each man has certain rights also.		A leader should give those under him some opportunity to make decisions, when possible. At times the leader is not the best judge of a situation and should be willing to accept what others have to say.

Pair No.		
A	(29)	B
Some leaders are good, others are quite poor. Good leaders are those who know what is right for the men under them. These leaders deserve the respect of every man.		Leaders cannot be judged easily. Many things go to make up good leadership. Most people fall short in some way or another, but that is to be expected.
A	(30)	B
Leaders are needed more at certain times than at others. Even though people can work out many of their own problems, a leader can sometimes give valuable advice.		Some people need leaders to make their decisions. I prefer to be an individual and decide for myself, when possible. Most leaders won't let you do this.

6. Imagine that someone has found fault with you. Choose the response from each pair that comes closest to your feelings about such a situation. Indicate your choice by circling either "A" or "B".

When other people find fault with me...

Pair No.		
A	(31)	B
It means that someone dislikes something I'm doing. People who find fault with others are not always correct. Each person has his own ideas about what's right.		It means that someone has noticed something and feels he must speak out. It may be that we don't agree about a certain thing. Although we both have our own ideas, we can talk about it.
A	(32)	B
I first wonder if they are serious and why they have found fault with me. I then try to consider what they've said and make changes if it will help.		If enough people point out the same fault, there must be something to it. I try to rid myself of the fault, especially if the criticizers are people "in-the-know".
A	(33)	B
They have noticed something about me which I an not aware. Although criticism may be hard to take, it is often helpful.		They are telling me something they feel is correct. Often they may have a good point which can help me in my own thinking. At least it's worthwhile to consider it.

Pair No. (34)	
A	B
I may accept what is said or I may not. It depends upon who is pointing out the fault. Sometimes it's best to just stay out of sight.	I accept what is said if it is worthwhile, but sometimes I don't feel like changing anything. I usually question the person.

(35)	
A	B
I like to find out what it means; since people are different from one another, it could mean almost anything. A few people just like to find fault with others but there's usually something to be learned.	There is something to be changed. Either I am doing something wrong or else they don't like what I'm doing. Whoever is at fault should be informed so that the situation can be set straight.

(36)	
A	B
I don't mind if their remarks are meant to be helpful, but there are too many people who find fault just to give you a hard time.	It often means that they're trying to be disagreeable. People get this way when they've had a bad day. I try to examine their remarks in terms of what's behind them.

Individual Topical Inventory Scoring Key

Pair No.	System		Pair No.	System	
	A	B		A	B
1	3	2	19	3	4
2	1	4	20	4	2
3	3	1	21	2	1
4	2	1	22	1	4
5	4	3	23	3	2
6	2	4	24	1	3
7	1	3	25	2	1
8	2	1	26	4	3
9	3	4	27	3	1
10	2	3	28	2	4
11	4	1	29	1	4
12	2	4	30	3	2
13	4	2	31	2	4
14	1	3	32	3	1
15	3	2	33	3	4
16	3	4	34	1	2
17	1	2	35	4	1
18	4	1	36	2	3

Norms For Individual Topical Inventory

(Obtained from 461 Naval Trainees - Tuckman)

Decile	I	II	III	IV
10	13+	12+	12+	13+
9	12	11	11	12
8	11	10	10	11
7	10-11	9	9-10	10-11
6	9-	8-	8-	9-

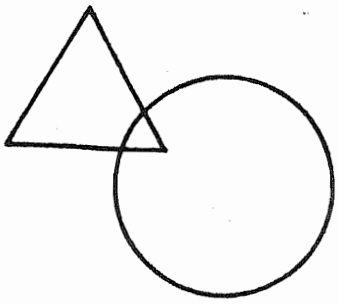
System Scoring:

If S scores 9th or 10th Decile in one system and 8th or lower in all others, classify him in his highest system.

If necessary, Ss who score 8th Decile in one system and 6th or lower in all others may also be classified in highest scoring system.

APPENDIX C

BARRON-WELSH ART SCALE



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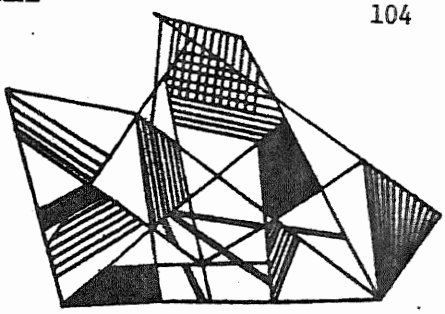

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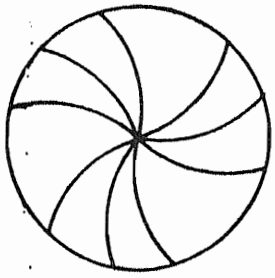

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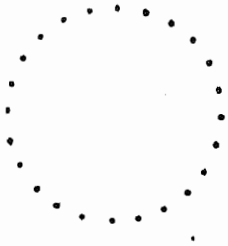

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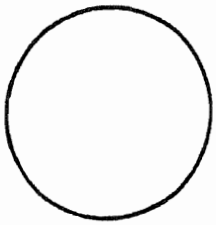

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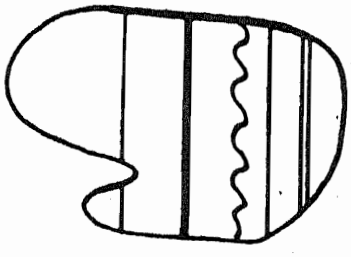

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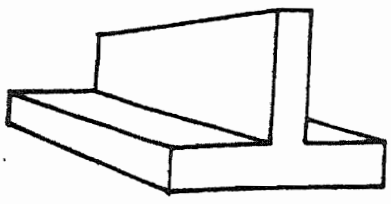

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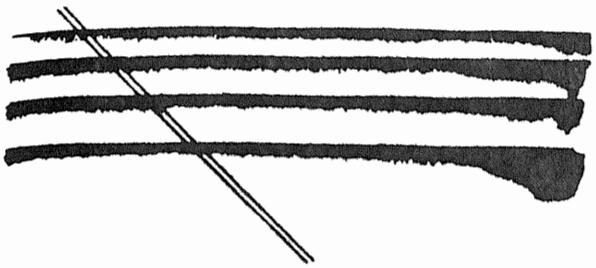

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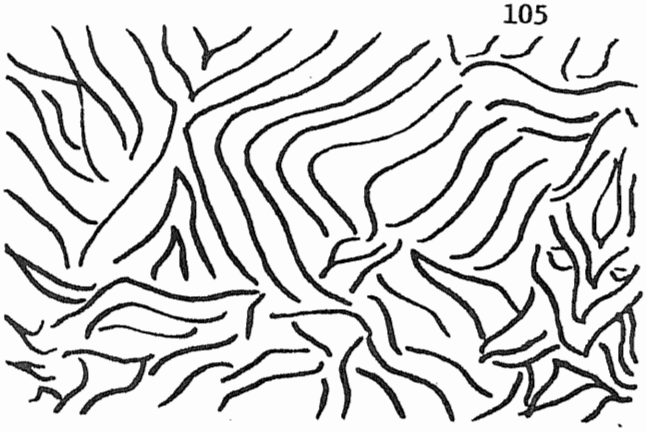

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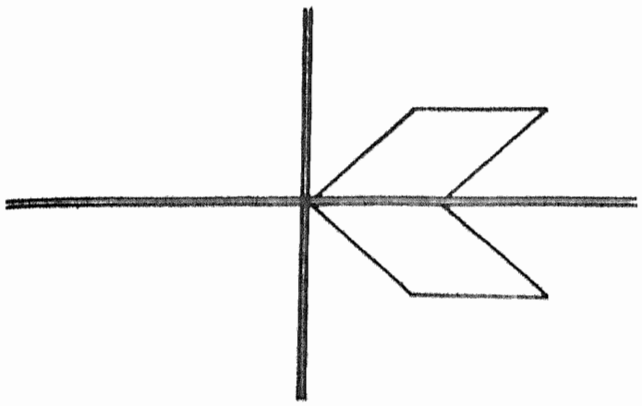

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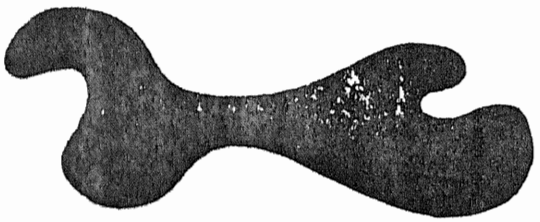

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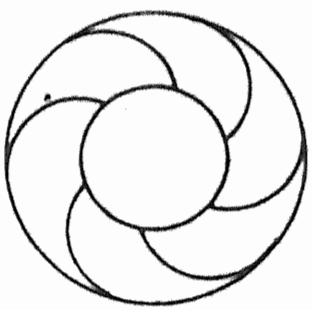

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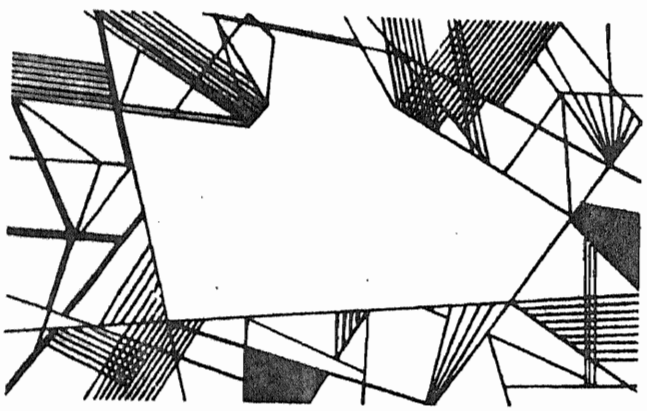

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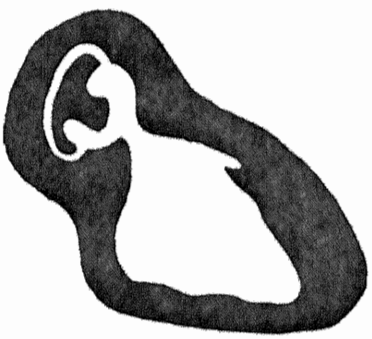

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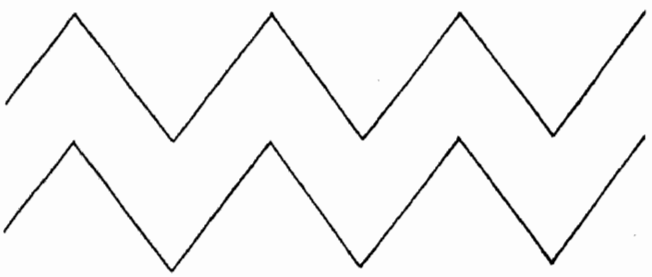

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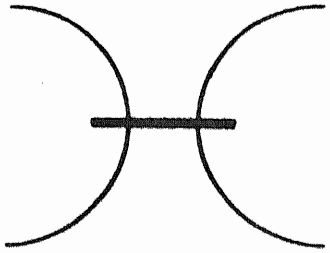

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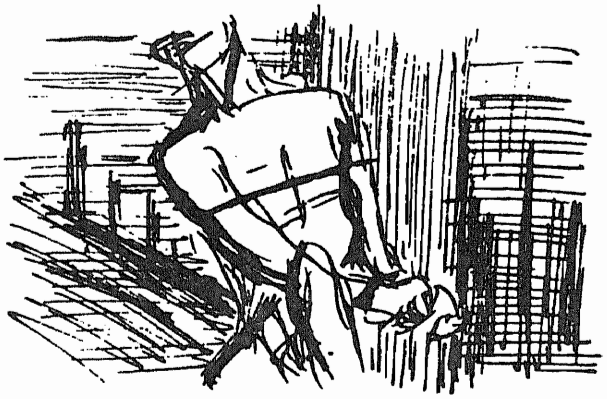

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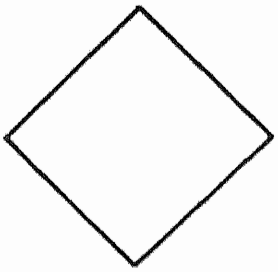

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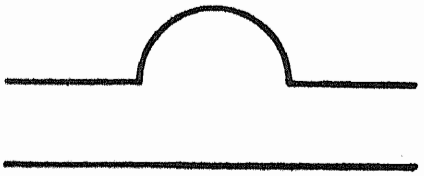

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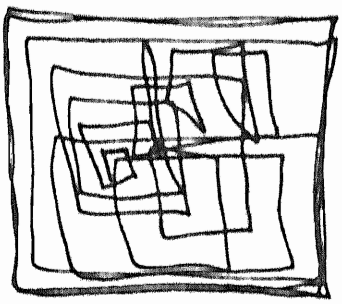

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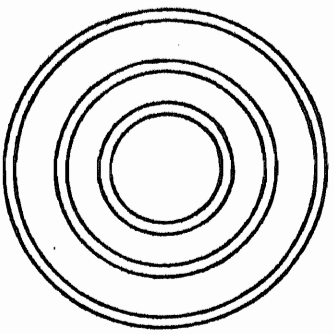

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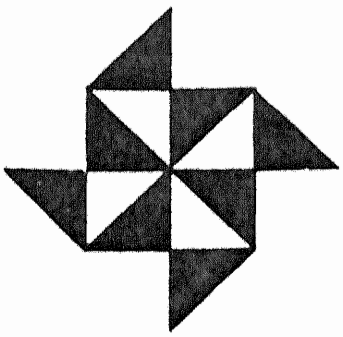

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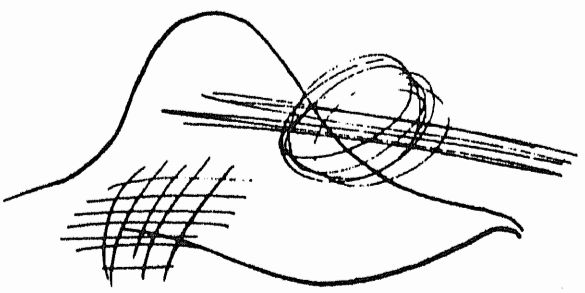

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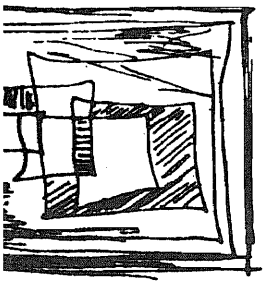

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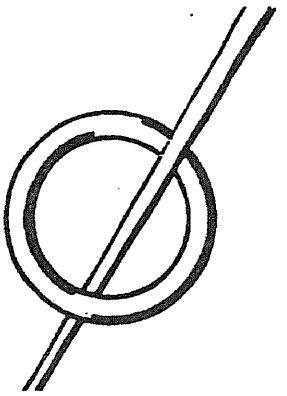

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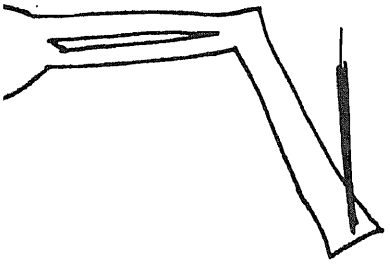

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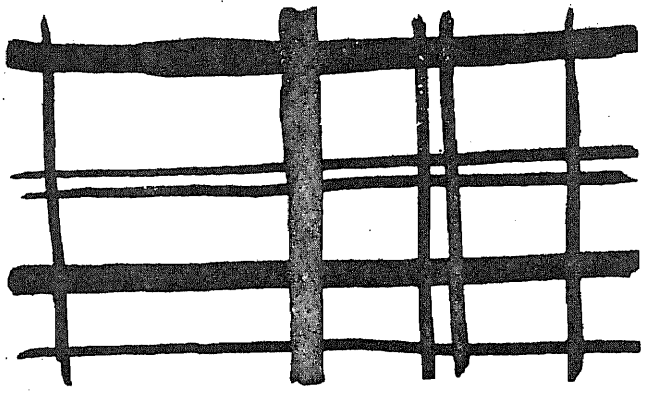

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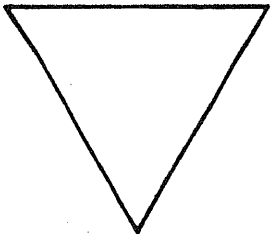

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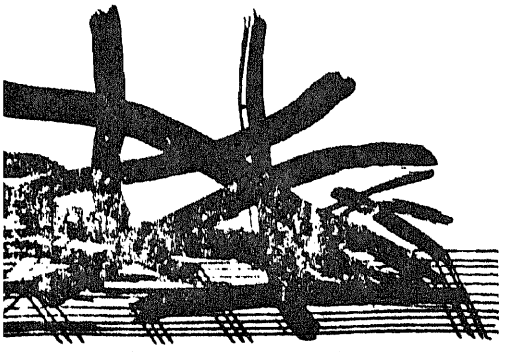

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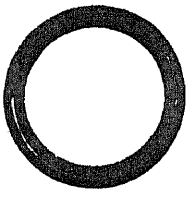

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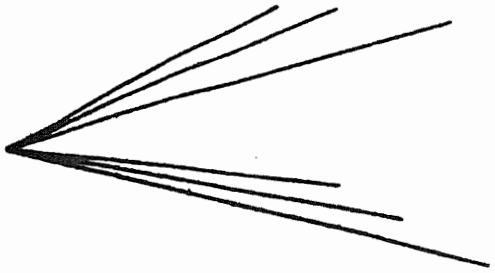

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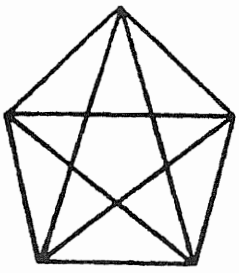

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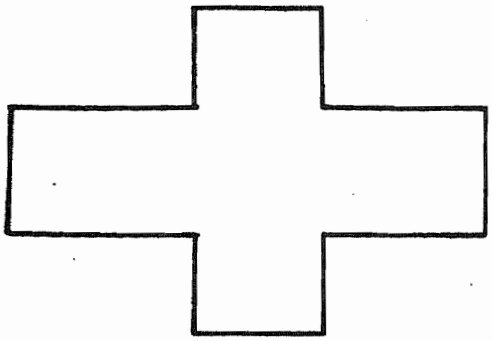

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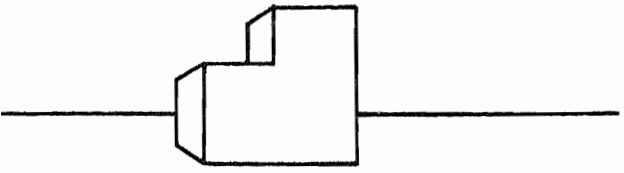

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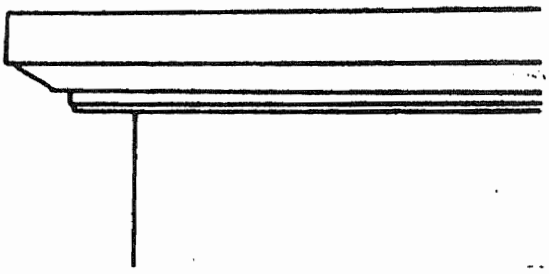

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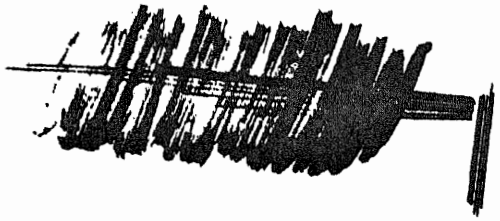

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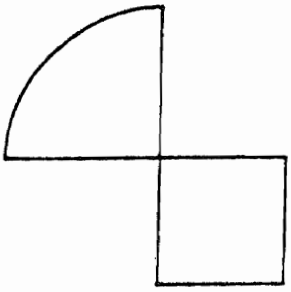

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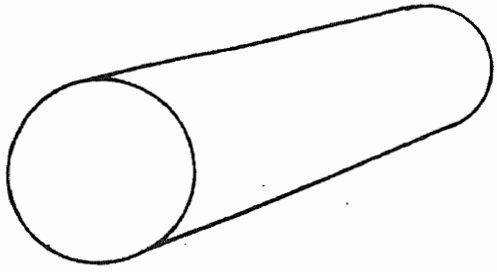

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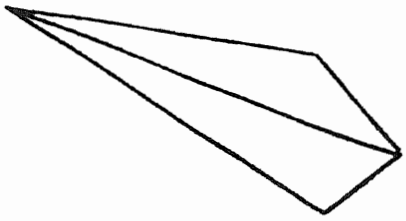

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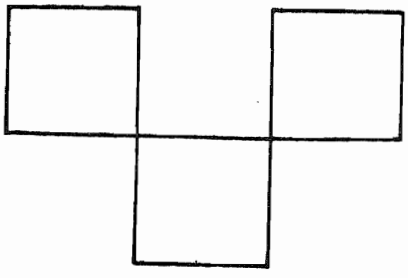

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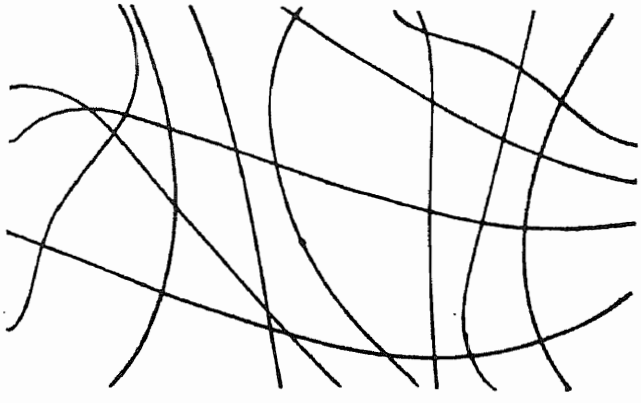

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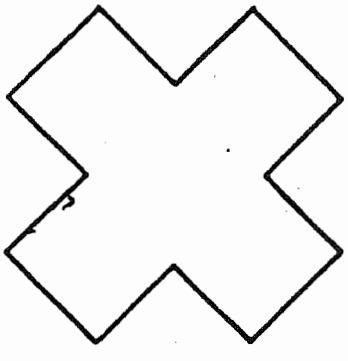

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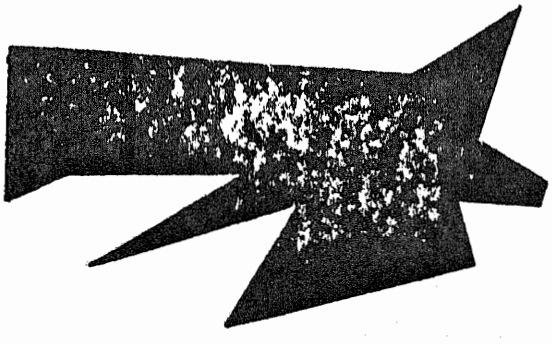

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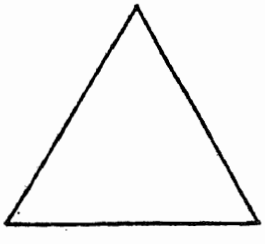

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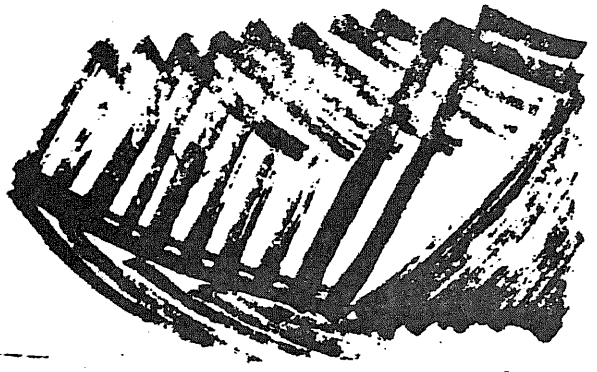

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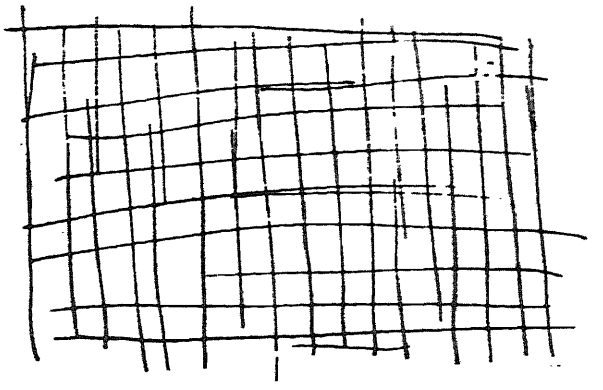

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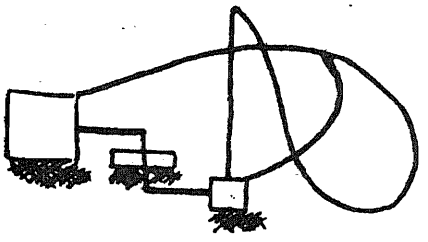

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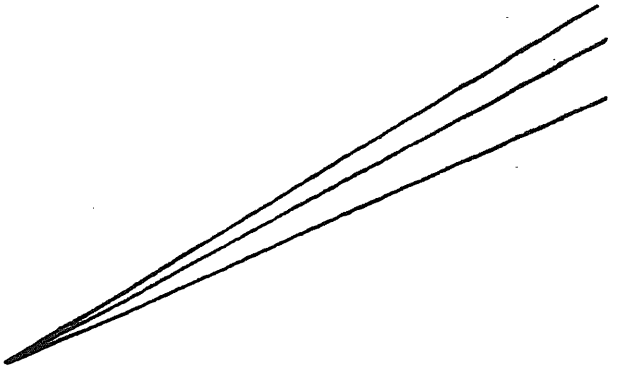

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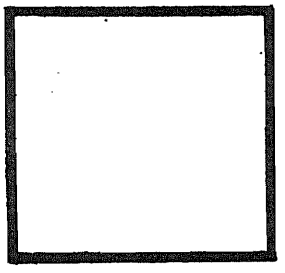

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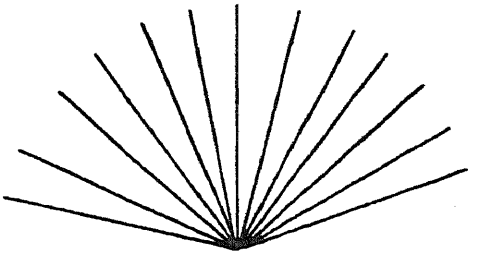

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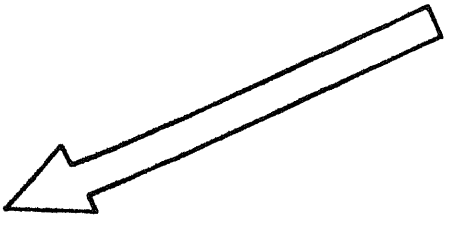

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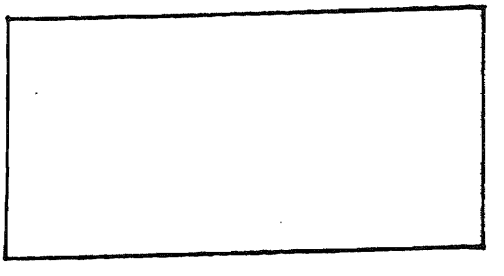

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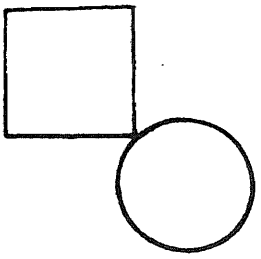

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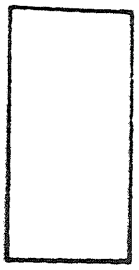

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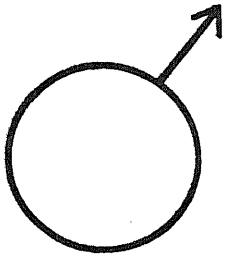

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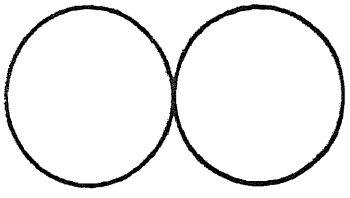

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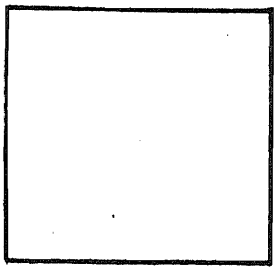

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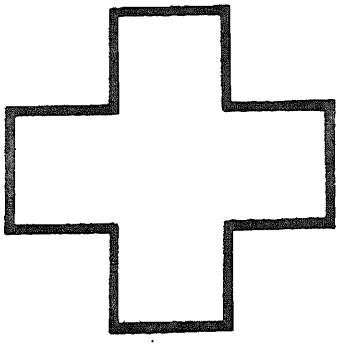

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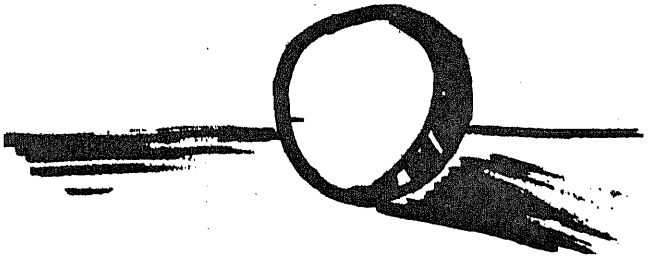

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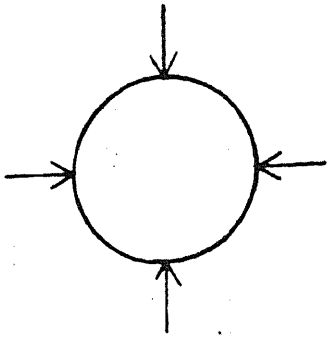

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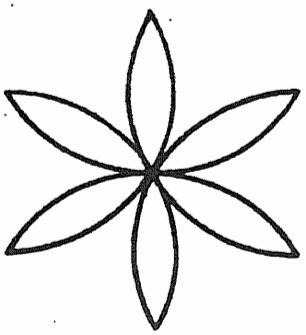

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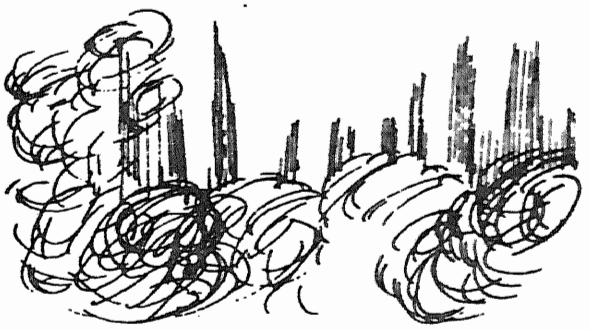

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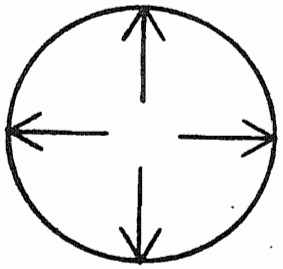

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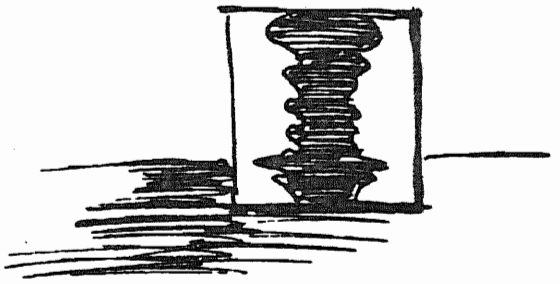

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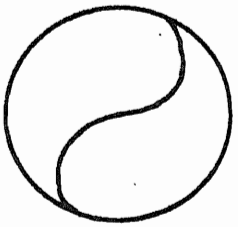

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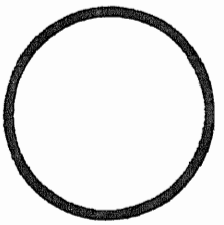

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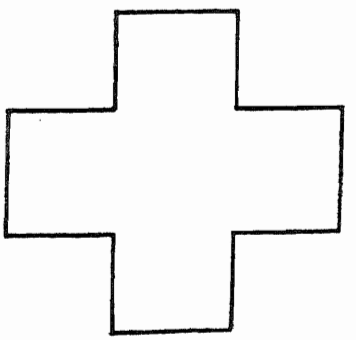

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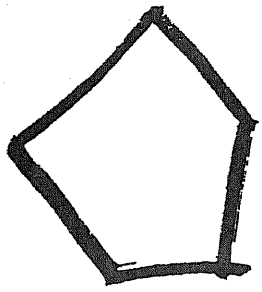

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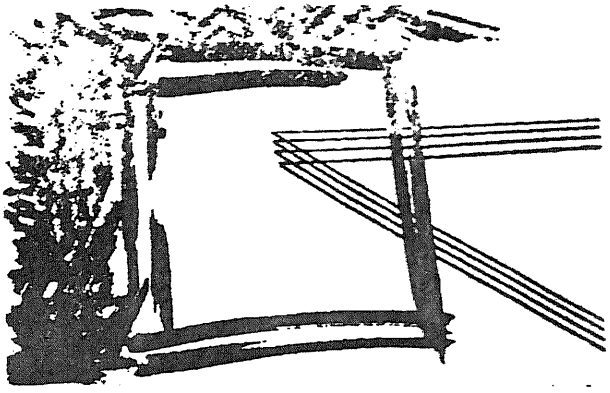

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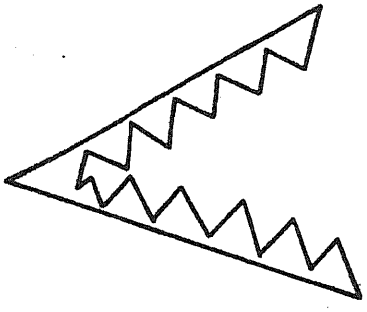

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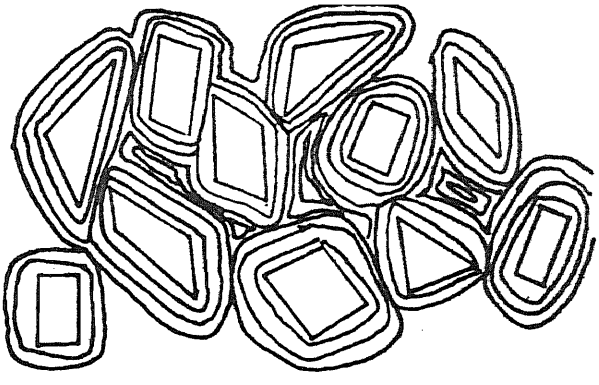

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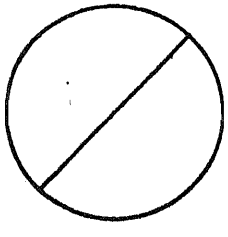

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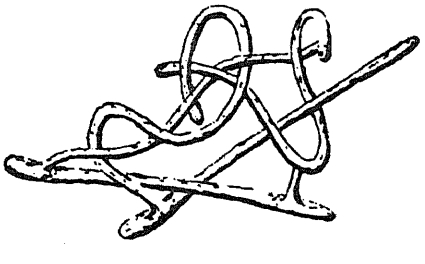

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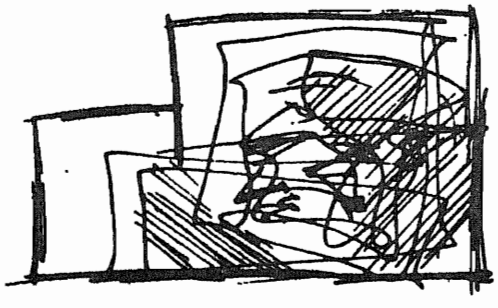

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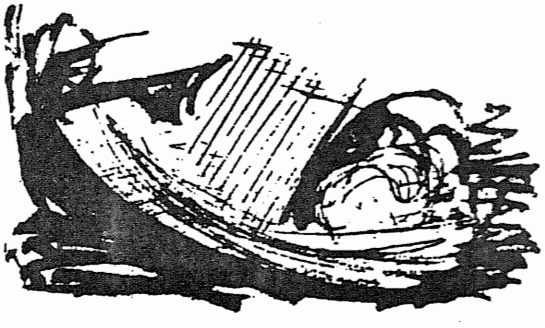

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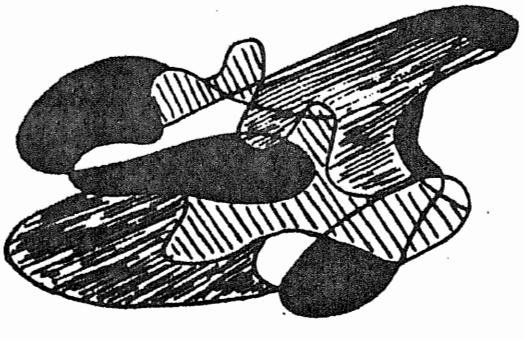

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BARRON-WELSH ART SCALE

SCORING KEY

BW (Barron-Welsh Art Scale)

LIKE (24)	DISLIKE (36)	
6	1	52
9	2	54
12	3	55
19	7	56
25	8	57
26	10	58
28	11	62
30	16	65
31	17	66
36	20	67
44	22	71
46	23	72
49	29	74
50	32	81
53	33	
68	34	
73	35	
77	37	
78	39	
79	41	
82	42	
83	45	
84	47	
85	51	

RA (Revised Art Scale)

LIKE (30)		DISLIKE (30)	
4	76	2	64
5	77	3	65
6	80	7	66
9	83	11	71
12	84	16	75
13	85	18	81
14		22	
15		23	
21		27	
24		37	
25		38	
28		39	
30		40	
31		41	
36		42	
43		48	
44		51	
46		52	
49		55	
50		56	
60		59	
68		61	
69		62	
70		63	

APPENDIX D

LETTER TO PARTICIPANTS

January 10, 1973

TO: ALL PARTICIPANTS IN EXPERIMENT "BLOCKS"

SUBJECT: THE FOLLOWING IS AN EXPLANATION OF THE EXPERIMENT YOU PARTICIPATED IN LAST OCTOBER.

Experiment "Blocks" was concerned with the differences between people who are "high sensation seekers" and "low sensation seekers". Sensation seeking is a trait similar to extraversion but it has more to do with the need to seek stimulation and variety in your environment. People who are high on this need tend to enjoy excitement, action, and new experiences. People low on sensation seeking are less out-going and more interested in simpler, more familiar pursuits and experiences. A scale to measure "sensation seeking" was developed by Dr. Marvin Zuckerman in 1964. This scale has been very successful in differentiating between people who are high on sensation seeking and people who are low on sensation seeking.

A similar line of research has been carried out by Asenath Petrie in Boston. She found that a perceptual task known as the Kinesthetic After-Effects (KAE) task tended to differentiate between people who had a low tolerance for pain and people who had a high tolerance for pain. People with a low tolerance for pain seemed to be more passive, withdrawn individuals while those who stood pain better were more outgoing people who actively sought out stimulation and excitement. Low tolerance individuals were often "augmenters" on the KAE (the blocks test) and high tolerance individuals were often reducers on the same task. While augmenters characteristically increased the perceived magnitude of a given stimulus reducers would decrease the perceived magnitude of the same stimulus. In simple terms, an augmenter would magnify a painful stimulus (and thus would experience it as more painful) while a reducer would decrease the magnitude of the same stimulus and experience it as less painful. Because augmenters experienced stimuli more intensely than others they would be more passive individuals who characteristically avoided

Continued on page 2...

excessive stimulation. On the other hand because reducers diminished the perceived magnitude of stimuli in their environment they would require more stimulation than others simply to maintain themselves at an optimal level of stimulation. They would get bored fairly easily and consequently they needed to seek more stimulation from the environment.

On the blocks test you were given two different sized blocks to feel in your right hand. First, you were given a 1 1/2" wide block to feel, then you were asked to rub a 2 1/2" block for several minutes and finally you were given the 1 1/2" block again. This was done several times. Augmenters would experience the 1 1/2" block as LARGER after stimulation on the 2 1/2" block (they augmented or increased their perceived stimulation) while reducers would experience the 1 1/2" block as smaller (they reduced) after the interpolated stimulation.

Because there seemed to be many similarities between the personalities of the reducer and the high sensation seeker, experiment "BLOCKS" was conceived to investigate whether this was in fact true. Another line of research that was incorporated into this experiment was the fact that in previous studies researchers have found that high sensation seekers tended to be more abstract-thinking individuals and less concrete in their thinking than others.

Abstract thinking might be described as being opposite to one-track thinking where the individual is very stimulus bound and often blind to the different aspects of an issue or situation. An abstract individual would be more independent and less rigid in a particular situation as opposed to a concrete-thinking individual who might typically view the world in black and white terms. You were given two different test of abstractness-concreteness. One was the card questionnaire known as the Interpersonal Topical Inventory and the other was a test known as the Barron-Welsh Art Scale. Both gave scores in terms of how abstract or concrete you were.

Subjects for this study were selected on the basis of the Sensation Seeking Scale which was administered to you at the beginning of the year. You were asked to decide whether you liked such things as water-skiing, mountain climbing, speed, risk-taking, and similar sensation seeking activities. Two hundred people wrote the test and the top 20 scorers were chosen as the high sensation seeking group and the bottom 20 scorers (those with the lowest sensation seeking scores) were chosen for the low sensation seeking group. You were administered the Interpersonal Topical Inventory, the Barron-Welsh Art Scale and finally the KAE, or block test.

An anlysis of the data after the study was completed revealed the following results:

1. There were no significant differences between high sensation seekers and low sensation seekers on the KAE. In other words the blocks test did not differentiate between the two groups and this suggests that there is no relationship between the concepts of sensation seeking and augmentation-reduction.

2. The Interpersonal Topical Inventory did not differentiate between the two groups.

3. There was a significant difference between the two groups on the Barron-Welsh Art Scale. High sensation seekers as a group had higher abstractness scores than low sensation seekers.

4. There was an inverse correlation between sensation seeking and age. In other words, with increasing age, there was a decrease in sensation seeking scores.

5. There was a positive correlation between sensation seeking and Barron-Welsh Art Scale scores. As sensation seeking scores increased Art Scale scores increased as well.

Using introspection you can probably judge yourself whether you are a high sensation seeker or a low sensation seeker. If you happen to have any questions about the study you are welcome to drop in to Room MB 2008B to discuss it further.

Thank you again for participating in the experiment.

Sincerely yours,

Arieh Bonder

APPENDIX E

GENERAL INSTRUCTIONS

The experiment I am working on here is concerned with personality and perception. There are going to be two separate parts to this study. In the first part I will be asking you to respond to a series of statements and to indicate your preferences for a series of drawings. In the second part of the study I will be exploring your sense of touch in these two fingers in each hand.

Now there are no right or wrong answers in this experiment. We are interested in the way in which you experience things. The only right answers are what you feel. The whole experiment will take about an hour.

O.K. Now before we go on with the first part of the experiment I will just tell you a little bit about what we are going to do later on.

We are going to place your right hand on a horizontal wooden block of a certain width and then while you are still holding this block we are going to place your left hand on a horizontal block that tapers from a small width at the bottom to a greater width at the top. I will ask you to find a place on the tapered block that feels just as wide as the block in your right hand. Because the sense of touch is influenced by what you have been doing with your other hand, you must rest these two fingers of both hands before we can use the blocks.

Nothing should touch them while they rest. You can cross your arms or put them in any position you like so long as you keep your fingers from touching each other.

While you are resting your fingers, I am going to get some information from you and we will proceed with the first part of the study. Do you have any questions so far?

You will now be given some situations and topics to which I would like you to respond. The responses are given in pairs and printed on cards which I will be presenting to you on this stand. You are to choose the response that most closely fits your opinion or feelings and indicate your choice verbally by letting me know whether you are choosing response A or response B. Always choose one member of each pair. If you agree with both choose the one you agree with most strongly. If you do not agree with either, choose the one you find the least disagreeable of the two.

Here is an example of the way the questions will be presented and the way they should be answered. I will first present you with a statement such as this one, and I will then present you with a pair of responses. You should read both responses and then decide which response you agree with most. Then tell me which response you have chosen by calling out the letter, either A or B, corresponding to your response.

Thus, if in comparing the first pair of responses you agree with the statement, "I try to find a solution and end the confusion" more

than the statement, "I completely ignore the fact that I am confused" you would call out the letter "A" corresponding to the statement you agree with.

After you have chosen a response from the first pair of statements I will then continue to present you with further pairs of responses. In considering this second pair, for example, you may find that you agree more with the statement "I remain calm at all times" than with the statement "I break out into a nervous sweat". In this case you would call out "B" to me.

There are going to be 36 different pairs of responses and you are to select one response from each pair, the one that more accurately shows your opinion or feeling. I would like you to be as frank as possible and to indicate in each case your true feeling or opinion or the reaction which you would actually make in the situation. Do not indicate how you should feel or act, rather indicate how you do feel and act. Make sure that you are aware of the situation or topic that each pair of responses refers to. In each case you will find the situation or topic above each pair of responses on the stand.

Remember, you are still resting your fingers so be careful not to let the tips of your index finger or thumb touch each other or anything else.

ITI

O.K. Now I will just let you rest for a minute or two while I put these materials away and get the next set of materials ready. Remember, you are still resting your fingers.

BW ART SCALE

Now this booklet contains a series of drawings which I am now going to show you. I am going to ask you to decide whether you like or do not like each of the drawings on the following pages. Record your response by simply saying yes, if you like the drawing and no, if you do not like it. If you cannot decide, guess.

I told you something about the blocks we are going to use before. Well, we are ready for them now. Let me tell you what we will do. We will place your right hand on a horizontal block of a certain width and your left hand on the longer block that feels just as wide as the block in your right hand. We will do this a few times and then place your right hand on a different size block and ask you to rub it with these two fingers. Remember, there are no right or wrong answers --the only right answer is what you feel. Because it is essential that you judge by what you feel and not by what you see, we must cover your eyes. This part of the testing will take only a few minutes. While your eyes are covered I am going to have on this table only this stopwatch, this pad and pen, and the blocks.

(PUT ON BLINDFOLD) "Does that seen comfortable? Can you see anything through the blindfold? (place blocks in position for measuring). "Let's put the two fingers of your right hand on a block; you can feel that the top slides and the block is the same width all along. Now let's put your other two fingers on another block; you can feel again that the top slides, but this block gets wider and wider. Feel it?" (guide hand up block, but not beyond 8" mark, return hand to bottom)

Now show me a spot on the tapered block which feels just as wide as the block in your other hand. Find it as quickly and as accurately as you can. Say "here" when you have found it and wait a moment until I say "all right" (record numbers on tapered block). All right.

Now please return your hand to the bottom of the tapered block and show me again a place on the tapered block which feels just as wide as the block in your other hand. Remember to say "here" and wait a moment until I say "all right".

-Return your hand to the bottom again. Now show me again a place on the tapered block which feels just as wide as the block in your other hand.

-Return to the bottom. Now show me again.

-Back to the bottom. Now show me again.

-Back to the bottom. Now show me again.

-(Remove left hand from block)

Now you may rest just this hand, but be careful not to let the tips of your index fingers or thumb touch each other or anything else.

90 SEC. STIMULATION

Now we are going to pick up this right-hand block together and put it down there. Hold it lightly here for a moment. Now we will let go of this block, and put your fingers on a different block. When I say "go ahead", would you please rub this block along its length, back and forth at whatever rate you like. Go ahead now. I want you to concentrate on the width of the block so I am not going to talk to you about anything else until you finish. Continue rubbing until I tell you to stop. Please concentrate on the width of the block. Just a few more seconds to go.

Now we are going to pick up this right block together once more and put it down here. Hold it lightly here for a moment. Now I am going to put these fingers onto another block and I will again put the fingers of your left hand on the tapered block.

Now show me a spot on the tapered block which feels just as wide as the block in your other hand. Find it as quickly and as accurately as you can. Say "here" when you have found it and wait a moment until I say "all right".

-All right, return your hand to the bottom and show me again a spot on the tapered block which feels just as wide as the block in your other hand.

-All right, back to the bottom, Show me again.

-Back to the bottom. Show me again.

-(Remove left hand)

Now you may rest just this hand again but be careful not to let the tips of your index finger and thumb touch each other or anything else.

90 SEC. STIMULATION

Now we are going to pick up this right-hand block together and put it down here. Now we will let go of this block and put your fingers on a different block. When I say "go ahead" would you please rub this block along its length back and forth at whatever rate you like. Go ahead. I want you to concentrate on the width of the block so I'm not going to talk to you about anything else until you finish rubbing. Keep rubbing until I tell you to stop. Concentrate on the width of the block. Just a few more seconds to go.

Now we are going to pick up this right hand block together and put it down here. Hold it lightly here for a moment. Now I am going to put these fingers onto another block and I will again put the fingers of your left hand on the tapered block.

-Now show me a spot on the tapered block which feels just as wide as the block in your other hand.

-All right, back to the bottom. Show me again.

-and again

-and again

Now you may rest this hand again but be careful not to let the tips of your index finger or thumb touch each other or anything else.

120 SEC. STIMULATION

Now we are going to pick up this right-hand block together and put it down here. Now we will let go of this block and put your fingers on a different block. When I say "go ahead" would you please rub this block along its length back and forth at whatever rate you like. Go ahead. I want you to concentrate on the width of the block so I am not going to talk to you about anything else until you finish rubbing. Keep rubbing until I tell you to stop. Concentrate on the width of the block. Just a few more seconds to go.

Now we are going to pick up this right-hand block together and put it down here. Hold it lightly here for a moment. Now I am going to put these fingers onto another block and I will again put the fingers of your left hand on the tapered block.

-Now show me a spot on the tapered block which feels just as wide as the block in your other hand.

-All right, back to the bottom. Show me again.

-and again

-and again

Now we are going to pick up this right-hand block together and put it here. Hold it lightly here for a moment. Now I am going to

put these fingers onto another block and I will again put the fingers of your left hand on the tapered block.

-Now show me a spot on the tapered block which feels just as wide as the block in your other hand.

-All right, and again

-and again

-and again

Now you may relax both hands. We are finished with the experiment and I will take off your blindfold as soon as I put away the apparatus.

Thank you for your participation in the experiment. You will receive two credits for participating in it. I cannot discuss the study now, but when it is completed, I will be sending you a letter describing what it was all about. Thanks again.

APPENDIX F

RAW SCORES

SUBJECT	SSS	AUG - RED(mm)	BW	RA	AGE
1	2	-5.76	7	7	41
2	3	-6.51	37	33	34
3	4	-0.92	29	34	29
4	4	-8.82	7	12	25
5	5	+2.57	6	8	21
6	5	+1.12	38	41	19
7	5	-2.07	31	29	21
8	5	-3.34	17	17	19
9	6	+2.41	36	40	32
10	6	-0.90	24	23	25
11	7	-0.64	7	9	19
12	7	-6.16	10	9	20
13	7	-6.73	25	36	19
14	7	-8.83	33	36	21
15	8	-1.95	24	29	20
16	8	-2.43	33	31	21
17	8	-3.56	46	50	25
18	8	-6.41	43	44	20
19	9	-4.30	25	27	21
20	9	-4.75	27	35	19
21	18	+0.31	5	9	21
22	18	-2.15	18	23	19
23	18	-2.94	38	48	19
24	18	-3.89	43	46	26
25	18	-4.20	46	50	17
26	19	+1.23	36	48	19

SUBJECT	SSS	AUG - RED (mm)	BW	RA	AGE
27	19	-1.67	46	51	25
28	19	-2.68	40	45	18
29	19	-9.95	8	17	21
30	19	-12.88	35	43	22
31	20	+0.53	39	44	18
32	20	-0.34	42	44	20
33	20	-0.98	52	57	22
34	20	-1.00	33	44	19
35	20	-4.30	46	51	21
36	20	-4.31	39	46	21
37	20	-7.12	35	45	20
38	21	+2.76	11	18	18
39	21	-1.97	46	48	23
40	21	-4.50	46	50	18

APPENDIX G

SUMMARIES OF ANALYSES OF VARIANCE

TABLE 1

ITI Scores and Performance on the SSS

Source of Variation	Sum of Squares	df	Mean Square	F	P
Between groups	77.28	2	38.64	.78	N.S.
Within groups	1139.33	23	49.54		
Total	1216.61	25			

TABLE 2

ITI Scores and Performance on the KAE

Source of Variation	Sum of Squares	df	Mean Square	F	P
Between groups	5.29	2	2.64	.20	N.S.
Within groups	303.15	23	13.18		
Total	308.44	25			

TABLE 3

ITI Scores and Performance on the BW Scale

Source of Variation	Sum of Squares	df	Mean Square	F	P
Between groups	556.84	2	278.42	1.23	N.S.
Within groups	5209.77	23	226.51		
Total	5766.61	25			

TABLE 4

ITI Scores and Performance on the RA Scale

Source of Variation	Sum of Squares	df	Mean Square	F	P
Between groups	707.87	2	353.94	1.23	N.S.
Within groups	5353.08	23	232.74		
Total	6060.95	25			

TABLE 5

ITI Scores and Age

Source of Variation	Sum of Squares	df	Mean Square	F	P
Between groups	14.21	2	7.10	.48	N.S.
Within groups	341.33	23	14.84		
Total	355.54	25			