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Intensity of cross-modal meaning discrimination in academic achievers and underachievers.

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Intensity of Cross-Modal Meaning Discrimination in Academic Achievers and Under-achievers

A Dissertation Presented

by

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Intensity of Cross-Modal Meaning Discrimination

in Academic Achievers and Under-achievers

A Dissertation

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Table of Contents

List of Tables

List of Figures

ABSTRACT

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in Academic Achievers and Under-achievers

June 1970

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The study was designed to demonstrate the cross-modal generalization of a meaning discrimination difference between academic achievers and under-achievers observed by Drakeford and Snider (1970) with verbal stimuli. To this end 24 college achievers and 24 college under-achievers were compared on a meaning discrimination task using both auditory and visual stimuli.

In both the auditory and visual stimulus situations, significant differences were observed in the discrimination task in favor of the achievers. The data supported the Drakeford and Snider (1970) finding in the case of both stimulus modalities, although the effect was more pronounced with the auditory than with the visual stimuli.

The implications for a theory of under-achievement were analyzed and some practical applications of the results to current educational practice discussed.

Chapter I

Introduction

Multidimensional analyses of personality syndromes and family history profiles of under-achieving college students have long been fashionable areas of educational discourse and research. The ready availability of academic records and subjects have made the issue a favorite focus for dissertations in the areas of psychology and education. Such studies have done much to describe the under-achieving student, his background and his current plight in college.

The current study while similarly a dissertation on under-achievement, follows a very different strategy. The following pages describe a piece of basic research designed to elucidate an aspect of cognitive functioning thought relevant to the problem of under-achievement. The research described is basic to the extent that it utilizes isolated laboratory performance of the under-achiever on a somewhat molecular judgement task as the crucial variable, but it has applied implications, in that it pertains to the entire spectrum of stimulus input for the under-achiever.

One of the more interesting outcomes of the multidimensional approaches to college under-achievement is the inference that under-achievers may differ from achievers in some gross cognitive functioning variable which may be termed "cognitive rigidity." Davids (1963) has demonstrated that under-achievers "tend to be rigid and inflexible in their approach to new information and changes in their cognitive field"

In pursuing this notion of differing cognitive styles O'Donovan

(1965) suggests that such rigidity

> is best studied by measuring lack of differentiation between responses in two or more functionally dissimilar situations

This hint at the need for a more molecular approach was capitalized upon in a study by Drakeford and Snider (1970). This research concerned the possibility that the tendency on the part of academic under-achievers to respond in a cognitively rigid style was indicative of their failure to discriminate the uniquely meaningful aspects of their environment. Given two stimuli of differing levels of meaningfulness the achiever was found to display a finer degree of discrimination between the stimuli than did the under-achiever. This study suggests strongly that the critical issue of meaningfulness lies not with the stimuli per se but with the subject and his ability to discriminate between stimuli. This notion finds support in Campbell and Chapman (1967) who have pointed out that meaningfulness is not just a property of stimuli but rather it is "determined jointly by the stimuli and what is happening in the learner's head."

For Drakeford and Snider (1970) the variable "meaning discrimination" was considered an attribute of the individual. More specifically the interest of the study was in the ways achiever vs under-achievers discriminate stimuli which have been previously determined as being of high or low meaningfulness for others. The underlying assumption of this approach are that the individual must live and achieve in an environment dominated by the meanings of others and that a failure to discriminate meaning as do others may be fundamental to under-achievement.

This meaning discrimination difference, when viewed in the context

of the previous research is suggestive of the more general cognitive style variable referred to above. However the Drakeford and Snider (1970) study used verbal stimuli in a laboratory setting and before differences in meaning discrimination can be seriously related to a concept as molar as "rigidity of cognitive style" it would seem essential that such differences be tested for cross-modal generality. In other words if we are to realistically discuss a variable of cognitive style, the above meaning discrimination difference must first be demonstrated with a wider variety of stimulus input modalities than those pertaining merely to verbal material. The demonstration of just such a cross modal pervasiveness of the meaning discrimination effect is the focus of the present study.

Chapter II

Review of Literature

Under-achievement Educational psychologists have long been perplexed by the inferior academic performance on the part of students who otherwise evidence superior intellectual capacity. Unfortunately research on academic under-achievement has "typically been insignificant in its findings and inconsistent in its explanations" (Hummill and Sprinthall, 1965).

Investigations of the under-achievement problem have tended to focus on three areas (a) student personality (McCandless, 1947; McClelland, Atkinson, Clark and Lowell, 1953; Morgan 1952; Gough, 1964; Gill and Spilka, 1962 etc.) (b) parental attitudes to academic performance (Gough, 1953; Haggard, 1957; Sandefur and Bigge 1966; Kimball, 1953 etc.) and (c) socioeconomic correlates of academic achievement (Douvan, 1956; Milner, 1951; Gill and Spilka, 1962, Friedenburg, 1959; etc.).

Most of these studies have been multivariate analyses of multidimensional personality, attitude, interest and value scales. Typical of the conclusions of such studies is a summary statement made by Gough (1964)

> the personological basis for differential achievement at the high school level which seems indicated by our findings is one in which there is a sensitivity to and an acceptance of social values but with retention of individuality, a cathexes of constructive endeavor, and an initial advantage in talent (P 179).

Following a similar study with Mexican - American secondary school students Gill and Spilka (1962) concluded

> achievers manifested reliably less hostility and more social maturity, intellectual efficiency and conformity to rules (P 144)

Sandefur and Gigge (1966), in concluding an investigation of the Relationship between recognized problems of adolescents and school achievement, established that school achievement was inversely related to the number of school, home, family, social, and personal problems "sensed" by the student. In a study using the Mooney Problem Check List De Sena (1966) found that under-achievers showed less concern in the areas of finances, living conditions and employment than did over-achievers and in fact had fewer problems in social-psychological relations than did the over-achievers.

Papers such as these few cited are most typical of the area and they make clear why the words "inconsistent" and "insignificant" have been used to describe this area of educational research. The bulk of these studies are strictly correlational "fishing trips", quite devoid of a theoretical base. Their staple diet is student cumulative record cards and their product, for scientific behavior prediction, essentially nil.

Such a literature base provides, at best, a limited footing upon which to build a program of basic research. Consequently it is necessary to leave the formal under-achievement literature to pursue the genesis of the theoretical framework upon which the present study has been built.

Cognitively Rigidity As has been stated in the introduction the focus of the present study is on meaning discrimination and that interest in this variable is based upon its relationship to the more molar concept of rigidity of cognitive style.

The evolution of this relationship follows an indirect but interesting path. The present investigation can be traced to a series of

studies which were initially designed to investigate a cognitive-linguistic variable called "all-inclusive conceptualization." All-inclusive conceptualization is defined as a tendency to respond in terms of absolute or over-generalized language. It is the tendency to use such terms as "all," "always," "never," and "forever." As shall be seen, this notion of all-inclusive conceptualization was to become subsumed under the more molar concept of cognitive style following further analysis. However the process by which this occurred is directly revelant to the background of the present study and would seem an appropriate point at which to begin a literature review.

The impetus for the research into the all-inclusiveness variable has come from the area of general semantics. A number of investigators have argued for the importance of the linguistic content variable of all-inclusive conceptualization. Hayakawa (1943) has observed that the individual who is too all-inclusive, is likely to misjudge the environment, since he will not be flexible enough to change with a changing environment. Johnson (1946) suggested that such a tendency may lead to various personal maladjustments when he wrote:

> Previous mention has been made of allness terms, such as all, everyone, nobody, every, never, absolutely, etc. Language spoken during moments of anger or despair or other relatively profound affective states appears to be particularly characterized by such terms. They give to language a character which reflects what is usually referred to as digmatism, or stubborness, inflexibility, (P 515)

Another general-semanticist, Korzybski (1948) has argued that all-inclusive conceptualization is one of the major pitfalls of language which may

lead to very general misevaluations of reality. Unfortunately, the general-semanticists have been more inclined towards speculation than empirical study. Consequently, it is not surprising to find the principal experimental work in this area to have followed the language aspects of the variable.

In a study designed to analyze the various personality correlates of certain language behaviours, Brodsky (1964) measured all-inclusive conceptualization in the form of allness terms. These allness terms he defined as being extreme and polarized statements or words such as "always" and "none what-so-ever." The frequency of these allness terms Brodsky found to be significantly related to repression, a variable defined by Brodsky as the use of denial and avoidance as adaptation to stress.

This relationship of all-inclusiveness to stress was also upheld in a study by Osgood and Walker (1959) who analyzed the suicide notes of successful suicides. The investigators compared samples of written language of the successful suicides with the actual suicide notes written. It was hypothesized that due to the severe stress that precipitated the suicide, the suicide note should contain significantly more allness terms than language written at an earlier date. This hypothesis was upheld.

While the previously mentioned authors have shown passing interest in all-inclusive conceptualization, the only systematic attempt at its evaluation can be found in the work of J. G. Snider. He not only constructed instruments for its measurement, but also embarked upon a systematic study of its correlates.

Snider (1964b, 1964c) has constructed two instruments for measuring all-inclusiveness. The first of these was based on a hypothesis that a

tendency toward all-inclusive conceptualizing might be revealed by responses showing preferences for one word or the other, of pairs of words somewhat similar in meaning and yet where one of each pair is an all-inclusive term and the other is not. It is assumed that in this situation, the person who tends toward all-inclusive conceptualizing will show a preference for the all-inclusive terms. Such pairs as "seldom-never" and sometimes-always" are examples. The test consisted of forty items, twenty-five crucial items and fifteen distractor items. Snider found his test of all-inclusive conceptualization to yield reliability figures of 0.81 to 0.88. The validity of the test was established by correlating the total score on the test with word counts of all-inclusive terms found in samples of free writing of high school pupils. By such a method a moderate correlation coefficient of 0.42 was obtained.

The second test of all-inclusive conceptualization constructed by Snider consisted of 100 statements of the type "teachers are strict" or "ministers are good men" to which the subject is asked to respond true or false. The all-inclusiveness score is simply the total number of statements answered true, since it is assumed that in answering true to such general statements, the individual is acceding to all-inclusiveness or over-generalization. Reliability coefficients calculated for this test ranged from 0.93 to 0.94. Using the two above-mentioned tests, Snider (1964c) proceeded to investigate the relationship between all-inclusive conceptualization and stereotyping. The idea for the study arose from the observation that stereotypes (such statements as "Scotsmen are miserly") are usually stated in actual or implied all-inclusive-

terms. The general question of the study concerned whether or not those who tend toward an excessive use of all-inclusive terms, such as "all," "always," and "never" will also tend to stereotype more than usual. The subjects participating in the study were 292 randomly chosen tenth grade high school students of approximately similar socio-economic conditions, educational levels and age.

To these subjects, two instruments were administered. The Snider Test of All-Inclusive Conceptualization, involving the choice of pairs of all-inclusive words and secondly, the Stautland (1959) Test of Stereotyping. This latter test, constructed after the manner of Osgood's (1957) Semantic Differential, places the respondent in a situation of judging various concepts (Englishmen, Chinese, Americans, Mexicans, Norwegians) in regard to pairs of polar terms (practical--impractical, cruel--kind, intelligent--dumb, inferior--superior, happy--sad, dirty--clean, brave--cowardly, warlike--peace loving, honest--dishonest, and lazy--hardworking). The result upheld the hypothesis of a significant relationship between stereotyping and all-inclusive conceptualization. Of the results of this study, Snider states:

> While the results of the study suggest that the use of all-inclusive terms is a correlate of stereotyping, it is by no means clear whether or not there is any causal relationship between the two variables. Both the use of all-inclusive terms and the tendency to stereotype may be merely symptons of a more general 'tendency to be all-inclusive.' It may be, however, that the use of all-inclusive terms is a contributing factor in stereotyping. More experimental work needs to be done to answer such a question, but the results of the present study suggest that such an undertaking might be worthwhile. (Snider 1964c, p. 173)

In an effort to further elucidate the ways in which all-inclusive conceptualization can effect a person's view of the world, Snider (1966) conducted a study designed to analyze the relationship between all-inclusive conceptualization and intensity of meaningfulness. The rationale for the study inheres in the observation that the individual who overgeneralizes, is paying less attention than others to the unique, meaningful qualities of the environment. Hence it should follow that all-inclusive conceptualization is a correlate of meaningfulness.

To test this hypothesis, sixty-eight university students were presented with two tasks. Firstly they were asked to rate two "high meaningful" words (words to which there are a high number of associations) and two "low meaningful" words (words to which there are few associations) on three semantic differential scales. The second task was to choose a word from each of two lists of words. One list was judged to be all-inclusive (e.g. "all," "none," "always," "never") and the other flexible (e.g. "many," "some," "few," "often," "sometimes," "seldom,"). The words in the list were chosen so as to be equated for their frequency of use, since there is a high correlation between Noble's Meaningfulness Measure and frequency of use as shown in Thorndike-Lorge Word Count (1944). The control of word frequency was to ensure that choices of all-inclusive words were not based on frequency of word counts.

The results were analyzed by dividing the subjects into two categories on the basis of the difference in their scores on the "high meaningful" and "low meaningful" words." This procedure assumed that those subjects who showed a smaller difference between their scores on the

"high meaningful" and "low meaningful" words were responding less intensely to meaning. According to the hypothesis, these subjects should show a greater preference for all-inclusive terms than the subjects who showed a more intense differentiation between "high meaningful" and "low meaningful" words. These latter subjects were considered to be exhibiting a greater intensity of response to meaningfulness and it was hypothesized that such subjects should show a preference for more flexible terms. These hypotheses were upheld by the data. The overall pattern indicated that all-inclusive conceptualization was related to the intensity of making a distinction between "high meaningful" and "low meaningful" material. In discussing these findings, Snider made some interesting comments.

He noted that while the causal relationship between all-inclusive conceptualization and meaningfulness were not clear from this initial study, it was reasonable to suppose:

> . . . that where there is little meaningfulness for the individual he begins to overgeneralize and to prefer all-inclusive conceptualization. Such might be the case where stimuli are ambiguous or where tasks are too difficult. (Snider 1966, p. 284)

Having established the relationship between all-inclusive conceptualization and intensity of meaningfulness, Snider and Drakeford (1967) embarked on a study aimed at relating all-inclusive conceptualization to the complex variable of scholastic under-achievement. Under-achievement was hypothesized as still one more of the correlates of all-inclusive conceptualization. It was reasoned that academic under-achievers would be more likely than academic achievers to be all-inclusive in conceptualizing since they are manifesting maladaptive responses which might well be partly a

function of such poor habits as the tendency to be all-inclusive and hence indiscriminant in their response to meaningfulness.

To test the hypothesis a measure of all-inclusive conceptualization was administered to seventy-two high school achievers and seventy-two high school under-achievers matched for intelligence, grade and sex. Achievement and under-achievement was determined by recording teacher grades and Otis Gamma IQ scores for all pupils, normalizing the distributions and then deriving 't' scores for both achievement and capacity. The individual was considered an under-achiever if his achievement score was more than one standard deviation below his capacity score. Comparison of the two groups on the test of all-inclusive conceptualization showed significant differences in the direction predicted. Once again the authors concluded that the causal relationships between the principal variables were unclear. The problem of whether all-inclusive conceptualization tends to produce under-achievement or the consequences of under-achievement are so threatening as to produce a defense of over-generalization, requires further elucidation.

Drakeford (1967) investigated the relationship between various "inclusiveness" tests, rigidity tests and the Snider All-inclusiveness scales by means of factor analysis. The resulting factor structure showed Snider scales loading on a common factor which was labeled "cognitive rigidity" due to the mutually high loadings of the Rokeach Dogmatism Scale, the C.P.I. Flexibility Scale, the "R" Scale of Acquiescence and the Rudin Response Set Scale.

As a result of the above factor analysis and the previously mentioned

studies on all-inclusive conceptualization Snider and Drakeford (1968) reconsidered the notion of "all-inclusive conceptualization". They decided their scales and hence their results to that point as pertaining to "a general unidimensional variable which is loaded in the direction of "rigidity" and which is cognitive in nature" (Snider and Drakeford, 1968). In other words it became apparent that all-inclusive conceptualization was one aspect of a more global concept of cognitive style.

Meaning Discrimination in Academic Achievers and Under-achievers In view of the change in orientation of the research, the relationship between academic achievement and all-inclusive conceptualization (Snider and Drakeford 1967) may be considered indicative of a tendency towards rigid cognitive style on the part of the under-achievers. Supporting evidence can be found in the work of Davids (1963) who demonstrated that under-achievers . . . "tend to be rigid and inflexible in their approach to new information and changes in their field." O'Donovan (1965) suggests that such rigidity

> is best studied by measuring lack of differentiation between responses in two or more functionally dissimilar situations.....In this discussion situations differing in meaningfulness have been stressed (P 362)

Just such a study was carried out by Drakeford and Snider (1970) and concerned the possibility that the tendency on the part of academic under-achievers to respond in terms of all-inclusive language, that is in a cognitively rigid style was indicative of their failure to discriminate the uniquely meaningful aspects of their environment. Given two stimuli of differing levels of meaningfulness the achiever was found to display a

finer degree of discrimination between the stimuli than did the under-achiever.

There is of course a much wider and more established line of research which emphasizes the importance of verbal meaningfulness to learning (Ausubel and Youssef 1963; Ausubel and Fitzgerald 1961, 1962; Ausubel 1963; Campbell and Chapman 1967; Samuels and Jeffrey 1966). However the Drakeford and Snider (1970) study shows that the critical issue of meaningfulness lies not with the stimuli per se but with the subject and his ability to discriminate between stimuli.

The variable "meaning discrimination" was considered as an attribute of the individual. More specifically, the interest of the study was in the ways achievers vs. under-achievers discriminate stimuli which have previously been determined as being of high or low meaningfulness for others. The underlying assumption of this approach is that the individual must live and achieve in an environment dominated by the meanings of others and that a failure to discriminate meaning as do others may be fundamental to under-achievement. To assess this predicted differential response to meaningfulness, verbal stimuli were presented according to the D4m technique outlined by Snider (1967). This method utilizes certain qualities of Nobles m scale (Noble 1952) and Osgood's D4 measure (Osgood, Suci and Tannenbaum 1957) and may be considered a measure of intensity of discrimination of relative levels of meaningfulness. $D4m = \Sigma D4\ Hm - \Sigma D4Lm$, where D4 Hm and D4 Lm are the D4 Evaluation, Potency, and Activity dimension coordinates for stimuli of high and low m. Thus, D4m is essentially a difference score and was calculated separately for each of the

FIGURE 1

ACHIEVEMENT X STIMULUS COMBINATION INTERACTION
(DRAKEFORD AND SNIDER, 1970)
PLOT OF MEANS

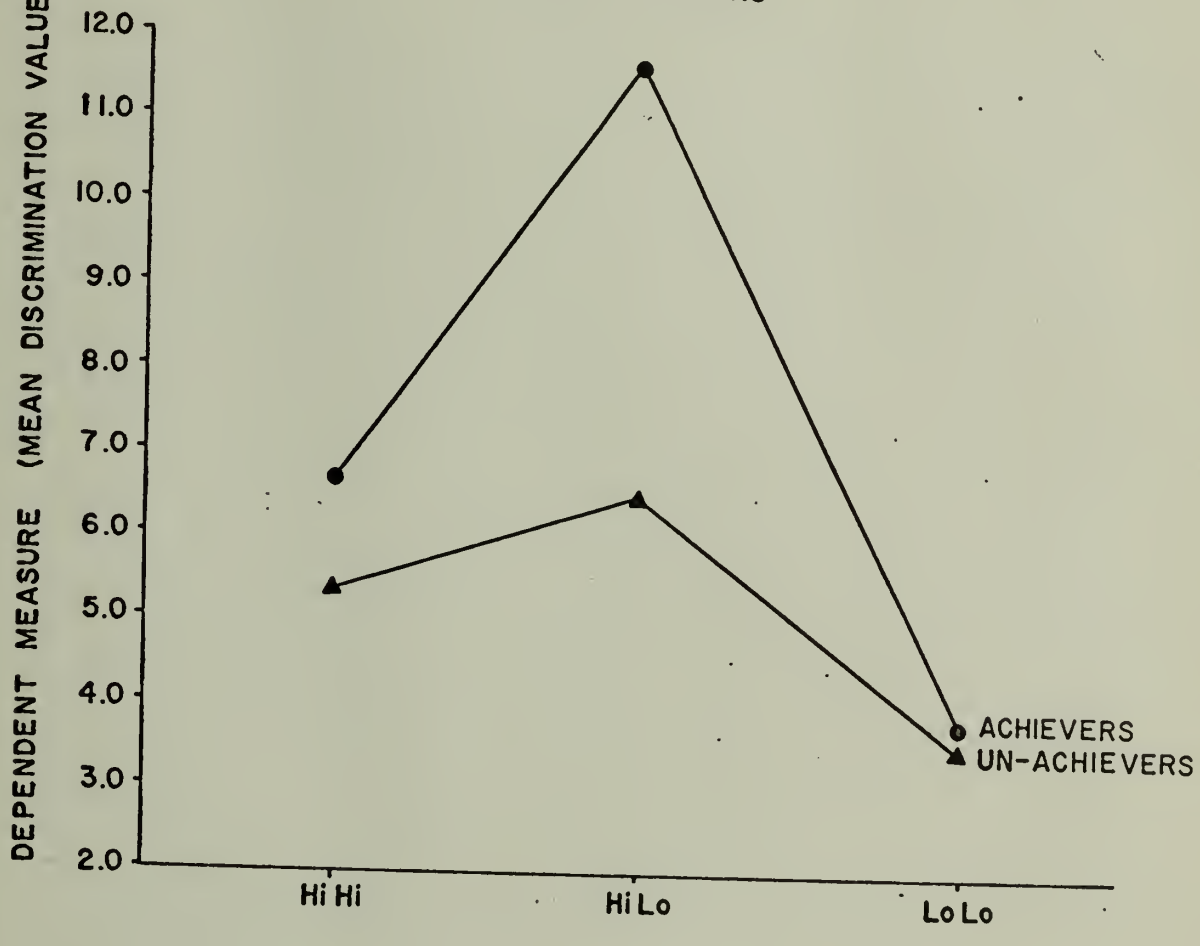

TABLE 1

MEANS FOR ACHIEVEMENT X STIMULUS COMBINATION INTERACTION (DRAKEFORD AND SNIDER, 1970)

	Hi Hi	Hi Lo	Lo Lo
ACHIEVERS	6.70	11.85	3.84
UN-ACHIEVERS	5.28	6.65	3.76

three above dimensions.

The general hypothesis of the study, namely that academic achievers would differ significantly from academic under-achievers in their discrimination between verbal stimuli of differing levels of meaningfulness was upheld. Further, it was found that such a difference was dependent on how the verbal stimuli differentiations were arranged (High-High, High-Low, and Low-Low) but not upon which semantic dimensions (Evaluation, Activity, Potency) were used to measure the discrimination. The nature of the key Achievement by Stimulus Combination Interaction can be seen in Figure 1 and Table 1. Firstly, the under-achievers not only seemed to discriminate less within a treatment condition, but they also discriminated poorly between treatment conditions when compared to the achievers. That is, significant differences between treatment means were found only between the HiLo and LoLo condition ($p<0.05$) in the under-achieving group while all possible orthogonal (a-1) comparisons yielded significant differences in the achieving group. This meant that only when a high m word was compared to a low m word was the resultant discrimination significantly different from when a low m word was compared to another low m word in the under-achieving group; while in the achieving group significantly different discriminations were made with each treatment combination.

Analogous results were obtained in a study by Wallach (1963) who found spelling achievement related to perceptual recognition accuracy in nonsense words, such that the achievers discriminated better than lesser achievers between nonsense words whose letters approximated the sequential

structure of English and nonsense words whose letters were arranged in random sequence. In a similarly analogous vein is the work of Baker and Madell (1965) who found college under-achievers significantly more distracted by extraneous noise than college achievers. It does not seem too unreasonable to interpret such distractability on the part of the under-achievers as indicative of "their incapacity to discriminate the uniquely meaningful aspects of their environment" (Drakeford and Snider, 1970, p. 2.) and hence related to the meaning discrimination differences observed by Drakeford and Snider (1970).

It would seem both from the results of the Drakeford and Snider (1970) study, in which groups differing in academic achievement have been shown to differ significantly in their discrimination between verbal stimuli and from the Snider and Drakeford (1967) study in which groups differing in academic achievement were found to differ significantly on a cognitive rigidity variable; rigidity of cognitive style should constitute a critical component in a theory of under-achievement. However, to adequately deal with a concept such as cognitive style, further evidence on the pervasiveness of the meaning discrimination deficiency is required.

A difference has been observed in the degree to which achievers and under-achievers discriminate verbal stimuli. A key question, and the one the current study will attempt to answer, concerns whether this meaning discrimination difference can be found using other modes of stimulus presentation or whether it is a phenomenon found only with written verbal material? Specifically, it is intended to use sounds and visual

images of high and low meaningfulness in a similar way as were used the verbal stimuli of the Drakeford and Snider (1970) study. An affirmitive answer to the above question will add crucial support and generalizability to the notion of a cognitively rigid style on the part of the under-achiever resulting from a failure to discriminate the uniquely meaningful aspects of the environment. Such a finding would support the notion of a deficiency in stimulus discrimination processing in all that the under-achiever sees, hears, and reads. There should be little doubt about the educational implications of such a finding, for instance, the current interest in Aptitude by Treatment Interaction, under-achievement prediction in early childhood and research in Sensitivity Training would all stand to benefit significantly from the outcomes of this study.

Chapter III

Methodology

Study I - Norming the Sounds and Images The verbal stimuli of the Drakeford and Snider (1970) study were drawn from Nobles' (1952) list of 96 dysyllables. This list was ordered according to the number of associations that could be generated to the stimulus word in a unit time. The list has become a standard source of verbal stimuli of differing levels of meaningfulness.

In line with the aims of the present study it became necessary to find an equivalent source of visual and auditory stimuli. In particular, a set of sounds and images that had previously been empirically scaled for meaningfulness and which could be dichotomized on such meaningfulness, so as to comprise the High-High, High-Low, and Low-Low stimulus combination conditions. A review of the available literature showed that a source equivalent to Nobles' (1952) list of dysyllables was not readily available so it was decided to develop and scale a set of images and sounds particularly for the present study.

Considering that the stimuli used in the Drakeford and Snider (1970) study had been dichotomized on the basis of m association technique (Noble, 1952) it was thought desirable that this method also be used in scaling the images and sounds. Essentially this technique involves having subjects give as many associations as possible to the stimulus in a 60 second period. Mean members of associations are then calculated and these are considered as indices of meaningfulness. The technique is based on the notion that meaning is "a simple linear function of the number of S-mul-

tiple R connections aquired in an organism's history" (Noble, 1952). Speaking non-technically meanings are habits. As more habits accrue to a particular stimulus situation so increases the meaningfulness of that particular stimulus.

Previous research has produced association values for numbers (Battig and Spera, 1962) and for colors (Cochran, 1968) and of course, for verbal material. (Noble, 1952). Shulz and Hopkins (1968) have compared association values for verbal stimuli presented both visually and aurally. They found the commonality between the associations elicited in the two modes, directly related to m, with the frequency characteristics similar for both modes. Hence the use of the association technique with images and sounds seemed a feasible pursuit.

Another approach to the definition of meaningfulness has come from research on the Semantic Differential (Jenkins, 1960) involving the concept of polarization - the mean deviation of ratings from the neutral (center) position on semantic differential scales. The response to meaningful stimuli tends toward the extreme (polarize) while responses to meaningless stimuli tend toward the indifferent (depolarize).

Several studies (Staats 1959, Staats and Staats, 1959, Koen, 1962, and Zippel, 1967) have reported comparisons between m and the Semantic Differential. The degree of relationship ranges from .61 to .80 and the suggestion has been consistently made that the two measures are of related, but separate processes. The study by Koen (1962) explored the source of this differing process and concluded that there is a significant connection between m and polarization for neutral words (.61) but

that for words with an emotional connotation the relationship disappears (.02). The factor of emotionality produced no important changes in the m ratings, while polarization proved very sensitive to the presence of an affective factor in the stimuli.

In view of this apparent incapacity of the m technique to adequately deal with the affective components of the stimuli and because the Semantic Differential was to be used as the dependent measure in the major study, it was decided to dichotomize the images and sounds using the Semantic Differential as well as the m technique.

The Semantic Differential has been used in a great variety of situations and the literature seemed to suggest that its use with images and sounds was a realistic expectation. For instance, Solomon (1958) has used the technique in assessing the perception of sonar sounds with Navy sonarmen. Miron (1961) has used the Semantic Differential in studying cross-cultural phonetic symbols. Osgood and Hastorf (1961) found the technique useful in studying facial expressions, while Elliott and Tannenbaum (1963) had subjects assess the meaningfulness of various geometric shapes using the Semantic Differential.

The aim of this sub-study is to empirically arrange a series of images and sounds along a meaningfulness dimension using (a) Nobles' m association technique and (b) Osgood's Semantic Differential method.

Method

(i) Images - A series of twenty 35mm color slides were presented twice to a goup of 20 subjects. Each slide was presented for 10 secs. following which the subject was given 60 seconds to respond.

The subjects were divided into two groups of 10 subjects such that one group responded to the stimuli using the Semantic Differential, the other group using the association method. The slides were then repeated and the response mode reversed.

(ii) Sounds - A series of 20 five second pieces of sound were presented to a group of 20 subjects using a tape recorder. Before each sound there was a cue tone of 3 seconds followed by a 5 second sound, followed by a 60 second response period. As with the images the subjects were divided into two groups and the order of response mode counterbalanced.

Subjects The subjects consisted of two laboratory classes in Psychology 301[1] at the University of Massachusetts. One class was used for assessing the sounds, the other for assessing the images.

Materials

Stimuli The sounds were mostly pieces selected from "sound effects" recordings and ranged in "intuitive meaningfulness" from a piece of a Robert F. Kennedy speech to the sound of a body falling down stairs. A list of these sounds can be seen in the appendices. The sounds were transferred to a tape and arranged in random order.

The images were 35 min. color slides taken with a Pentax camera

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[1]The subjects (achievers and under-achievers) for the major study were taken from the same Psychology 301 course. The extreme shortage of such subjects resulting in one achiever being asked to leave the room during one of the testing sessions for the normative studies. However, it is the experimenter's opinion that this did not appreciably change the characteristics of the norming study sample.

using Agfacolor film. The objects photographed ranged from a knife, a teddy bear to a section of cut glass taken in close up. The easily distinguishable objects were photographed with a 50 mm lens on a plain backdrop, the more meaningless images were photographed with the aid of a set of Vivator lens extension rings in close up. More details of these images can be seen in the appendices.

Test booklets Test booklets were used to gather the responses of the subjects. The m association booklet had an instruction coversheet which used Noble's (1952) directions. Behind the coversheet were the response sheets each specifying the image or sound sequence number. The Semantic Differential booklet also had a standardized instruction coversheet. The subsequent pages specified the image or sound sequence number and provided three 7 point bipolar scales (good-bad, weak-strong, active-passive) on which to rate the stimulus.

Results

The analysis was accomplished by calculating the mean number of associations and the mean degree of polarization for each of the sounds and images. In the case of the Semantic Differential the absolute deviation of the response from the neutral point (midpoint) was summed over the three dimensions. The results are tabulated in the appendix.

From the total lists of stimuli six high and six low meaningful images and sounds were chosen. The criterion for this choice was essentially the Semantic Differential value, although some consideration was given the m values. These dichotomized stimuli can be seen in Tables 2 and 3.

Table 2

Norms For Sounds

	Sound No.	Name	Mean Assoc. Score	Mean Sem. Diff Score
	1	Telephone	10.55	5.80
	3	R. F. K.	11.30	6.55
High	4	Marching Feet	12.05	7.95
	11	Machine Gun	10.90	8.55
	9	Growling Animal	11.25	7.20
	6	Crying Baby	11.10	6.90
			$\bar{x}$ = 11.20	$\bar{x}$ = 7.20
	2	Turnstile	7.85	3.00
	8	Compressor	7.50	2.70
	7	Plastic Bag	7.15	3.35
Low	10	Card Reader	6.95	4.25
	5	Coke Bottles	6.70	1.95
	12	Falling Body	6.45	2.75
			$\bar{x}$ = 7.13	$\bar{x}$ = 3.00

Table 3

Norms For Images

	Image No.	Name	Mean Assoc. Score	Mean Sem. Diff Score
	9	Gun	12.20	8.15
	8	Prussian Helmet	10.90	6.25
High	5	Eye Glasses	10.60	5.50
	6	Orange	11.25	5.35
	1	Light Bulb	10.15	5.30
	12	Knife	10.10	4.95
			$\bar{x}$ = 10.87	$\bar{x}$ = 5.92
	3	Toweling	7.70	2.35
	4	Abstract	7.05	2.75
Low	11	Plastic	7.40	2.90
	10	Hair	6.80	3.05
	2	Spoons	7.40	3.05
	11	Green Plastic	6.15	3.70
			$\bar{x}$ = 7.08	$\bar{x}$ = 2.97

The results show that scaling the images and sound using these two techniques was quite successful and the degree of relationship between the two methods was sufficient to facilitate confidence in the dimensionalization of the stimuli in terms of meaningfulness.

Study II - Cross-Modal Meaning Discrimination (Major Study)

Aims

Essentially the present study is designed to demonstrate the cross-modal generalization of the meaning discrimination differences observed by Drakeford and Snider (1970) between academic achievers and under-achievers. Stated as a hypothesis this aim becomes that

(i) academic achievers will differ significantly from academic under-achievers in discrimination of visual and auditory stimuli of differing levels of meaningfulness as measured by a difference score derived from various stimulus comparisons.

Further it is predicted that

(ii) such differences will vary as a function of how the stimulus comparisons are arranged (High-High, High-Low, Low-Low) and which semantic dimension (Evaluation, Activity, Potency) is used to measure the discrimination

Subjects

Because of statistical artifacts such as regression towards the mean and errors of measurement inherent in much of the research done on under-achievement, particular care is necessary in defining subjects for such a study.

Thorndike (1963) has considered these problems sufficient to devote

an entire book The Concepts of Over-and Under-achievement to their discussion. In view of the points made by Thorndike the "concurrent comparison of contrasting groups" (Design IIc, Thorndike, 1963) was chosen for this study. Concerning the procedure for obtaining such groups Thorndike (1963) writes

> the appropriate method for assigning individuals to the contrasting achievement groups is on the basis of the difference between actual achievement and predicted achievement. A prediction can be made by a regression equation relating achievement to aptitude (and/or some other predictors that have been found to be related to achievement) (p 63).

This procedure was followed in the present study in that 48 subjects were selected from the Psychology 301 course at the University of Massachusetts according to a difference score between predicted grade point average (P.G.P.A.)[2] and current grade point average (G.P.A.). From Table 4 it can

Table 4

Achievement Means for Subjects (n=48)

	P.G.P.A.	G.P.A.	Mean Diff
Un-Achiev.	2.2	2.0	0.2 below
Achiev.	2.2	2.9	0.7 above

be seen that the achieving group has a mean G.P.A. of plus 0.70 grade points above their P.G.P.A. while the under-achievers has a G.P.A. minus 0.20 grade points below their P.G.P.A. All achievers had G.P.A.'s above

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[2]The P.G.P.A. is based on a regression equation used by the University of Massachusetts Admissions Office and utilizes both the high school rank and College Board Examination scores.

their P.G.P.A. while all under-achievers had G.P.A.'s below their P.G.P.A.[3]

In view of the academic dismissal policy of the Admissions Office, which restricts the degree to which a student can under-achieve, the under-achievers can be considered typical of the college under-achievement population[4] while the achieving group may be considered typical of "average" college achievers. Of this technique of comparing under-achievers with "average" or "normal" achievers Thorndike (1962) says it

> may be less efficient in bringing out differences between the two groups, but the differences that are established will be more clearly associated with "under-achievement" "per se." (p 61).

Procedure

The relative shortage of subjects who met the above criteria resulted in the same subjects being used for both the sounds and images sections of the study. To control for any order effects that might confound the outcome of the study, the subjects were divided into two groups. One group received the images testing before the sounds testing while for the other group the order was reversed. Twelve achievers and twelve under-achievers were assigned to each of these order groups. Hence within each achievement group half of the subjects were administered the sounds before the images and half was administered the images before the sounds.

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[3]The two groups were significantly different (p. .01) on their current G.P.A. but not significantly different on their P.G.P.A.

[4]Diener (1960) has used a similar G.P.A. of 2.0 as a criterion of current achievement.

The testing was carried out in groups of from 3 to 11 subjects drawn from regular laboratory sessions, care being taken to preserve the pre-arranged order of presentation of the images and sounds. The subjects were asked to take part in a study which would involve them judging "the meaningfulness of some sounds and images." The subjects were offered extra course credit for participating in the experiment. No subject refused.

At the beginning of each testing session the subjects were given a test booklet.[5] A cover sheet gave in detail an account of how to respond on the following Semantic Differential scales. The subsequent pages contained the stimulus number (e.g. Image 3) and a set of nine bipolar scales (good-bad, weak-strong, active-passive, stale-fresh, large-small, slow-fast, clean-dirty, rough-smooth, tense-relaxed). At the beginning of each booklet there was an example stimulus situation with which the subject rehersed and questions were answered.

The high and low meaningful stimuli (both images and sounds) as chosen in the norming study (Tables 2 and 3) were presented in random order. Each stimulus was presented for 5 secs. followed by a 30 sec. period during which the subject responded on the Semantic Differential scales. A five minute rest period was given between the testing on the sounds and the testing on the images.

From the high and low meaningfulness images and sounds the three stimulus combination conditions (High-High, High-Low, Low-Low) were arranged. The stimuli were chosen at random while still maintaining the stimulus

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[5] An example of the test materials appear in the appendices.

combination conditions. These stimuli can be seen arranged in Table 5. From this arrangement 27 scores were initially obtained for each subject. The scores were made up of a difference score for each dimension of meaning (Evaluation, Potency, Activity) under each stimulus combination condition (High-High, High-Low, Low-Low). There were three stimulus combination "trials" under each condition. For the purpose of the analysis the scores were summed over trials within Dimensions of meaning x Stimulus Combination blocks yielding 3 x 3 scores per subject. Thus the dependent measure was the difference score summed over 3 trials for each Dimension x Stimulus Combination cell.

Table 5

Comparison of Stimuli

Hi-Hi	Hi-Lo	Lo-Lo
Sound 3 - Sound 4	Sound 4 - Sound 5	Sound 7 - Sound 5
Sound 11- Sound 9	Sound 3 - Sound 2	Sound 10- Sound 8
Sound 6 - Sound 1	Sound 9 - Sound 12	Sound 12- Sound 2
Image 8 - Image 9	Image 9 - Image 4	Image 10- Image 2
Image 5 - Image 1	Image 8 - Image 11	Image 4 - Image 11
Image 12- Image 6	Image 5 - Image 11	Image 7 - Image 3

Chapter IV

Analysis of Results

The analysis utilized the Analysis of Variance technique and was based on a design involving two between subjects variables (Achievement A, and Order of presentation of the Stimuli, O.) and two within subjects variables (Combination of stimuli C and Dimensions of meaning D.) There were two levels of A x 2 levels of O x 3 levels of C x 3 levels of D. A separate analysis was computed for the sounds and images. A p value of .05 was chosen as representing an appropriate significance level for all statistical tests.

Sounds The sources of variance and corresponding F values are to be seen in Table 6. From this table it is apparent that the general hypothesis of the study has been upheld, namely the main effect of achievement suggests that academic achievers ($\bar{X}$ = 6.05) differ significantly from academic under-achievers ($\bar{X}$ = 5.44) on the meaning of sounds discrimination task. Averaging over stimulus combination levels and dimensions of meaning, the achievers appear to make more polarized discriminations than do the under-achievers.

Similarly significant is the main effect of stimulus combination (C). This indicates that averaging over levels of achievement and dimensions of meaning, the three stimulus combination arrangements (Hi-Hi, Hi-Lo, Lo-Lo) differ significantly from one another on the difference score they elicit.

The main effect of dimension of mean (D) is also significant and indicates that averaging over levels of achievement and stimulus combination

Table 6

Analysis of Variance for Sounds.*

Source	DF	MS	F	P
Between S's				
A (Achievement)	1	40.33	4.36	.05
O (Order)	1	3.70		
OA	1	53.48	5.79	.025
S/OA	44	9.24		
Within S's				
C (Combination)	2	157.09	17.34	.001
CA	2	130.75	14.43	.001
CO	2	.84		
COA	2	13.82		
SC/OA	88	9.05		
D (Dimension)	2	39.39	5.11	.01
DA	2	35.39	4.54	.05
DO	2	11.83		
DOA	2	2.94		
SD/OA	88	7.70		
CD	4	9.69		
CDA	4	2.65		
CDO	4	7.14		
CDOA	4	5.45		
SCD/OA	176	4.65		

*Only F values significant at the 5% level of confidence or better are included.

arrangements there is a significant difference in the polarization difference score elicited by the scales quantifying the meaning dimensions of Evaluation, Potency and Activity.

Table 7
Cell Means for Dimensions (Sounds)

Evaluation	Potency	Activity
6.19	5.88	5.17

The higher mean value for Evaluation provides support to the literature stressed importance of the evaluative dimension in the measurement of meaning (Osgood and Suci, 1955). It would seem that sounds, like most verbal material are also highly dependent upon evaluative judgements for their meaningfulness.

Achievement (A) by Stimulus Combination (C) Interaction The most important outcome of the sounds analysis is the significance of the Achievement by Combination interaction. This indicates that averaging over dimensions of meaning measurement, differences between achievers and under-achievers on the dependent measure are a function of the stimulus combination level considered. The source of this interaction can be seen in Figure 2 and Table 8.

To further elucidate this interaction, a posteriori comparison of means was computed using the Newman - Kuels technique (Winer, 1962). This method keeps the level of significance equal to alpha for all ordered pairs, no matter how many steps apart the means may be. However, the

FIGURE 2

ACHIEVEMENT X COMBINATION INTERACTION (SOUNDS)

PLOT OF MEANS

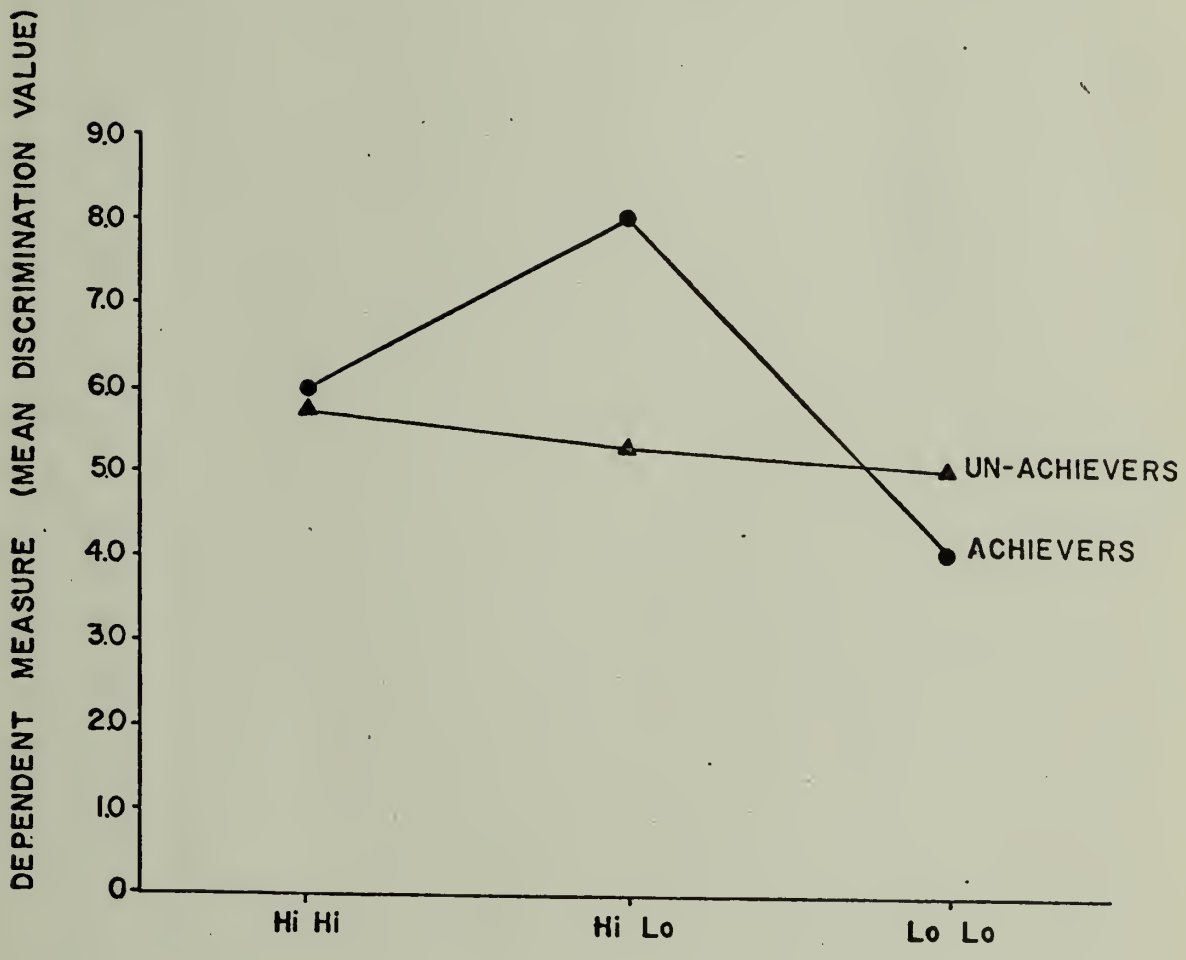

TABLE 8

CELL MEANS FOR ACHIEVEMENT X COMBINATION INTERACTION (SOUNDS)

	Hi Hi	Hi Lo	Lo Lo
ACHIEVERS	6.01	8.05	4.09
UN-ACHIEVERS	5.75	5.38	5.19

level of significance with respect to the collection of all tests made, considered as a single test, is considerably lower than alpha.

The comparison of means supports the effect apparent in Table 8 namely that there are no significant differences for the under-achievers between the stimulus combination conditions. The achievers, on the other hand, performed significantly differently on each of the stimulus combination conditions. That is, the means for the achieving group were significantly different from one another at each level of C. ($p<.05$ for all comparisons of means at the achiever level of A.)

Also significant was the difference between the achievers and under-achievers in the Hi-Lo stimulus combination condition. When faced with two stimuli of quite different levels of meaningfulness the achieving group discriminated (averaging over meaning dimensions) significantly more than did the under-achieving group. Apparently the differences between the stimuli in this condition were considered greater by the achievers than by the under-achievers. The differences were not significant between the achievers and under-achievers in the Hi-Hi condition.

An interesting result of the comparison of means was the significant simple effect of achievement in the Lo-Lo condition. The achievers seemed to find the differences between two stimuli of low meaningfulness very small while the under-achievers made discriminations not unlike those they had made in both the other stimulus combination conditions. It is as if for the achievers, two times nothing is nothing while for the under-achievers two times nothing might just be something.

This achievement by stimulus combination interaction is the crux

of the experiment. It is apparent that the achievement by stimulus combination interaction found significant by Drakeford and Snider (1970) with verbal material has been replicated with complex auditory material.

Achievement (A) by Dimension of Meaning (D) Interaction. The analysis of variance source table (table 6) shows the Achievement by Dimension of Meaning interaction to be significant at the 5% level. This indicates that averaging over stimulus combination conditions (levels of C) the achievers differ significantly from the under-achievers as a function of the dimension of meaning. Figure 3 shows that this interaction is, in large part the result of the simple effect of achievement at the Activity dimension level of D. In fact the comparison of means shows there to be a significant difference between achievers and under-achievers on the Activity dimension. The Newman-Kuels procedure also shows that the means for achievers on the three dimensions are not significantly different, while for the under-achievers the means at each level of D are all significantly different from one another.

At first glance this A x D interaction appears important in that it suggests that under-achievers are responding in some differential manner on the Activity dimension. However at the conceptual level, the absence of a significant A x C x D interaction must be considered. The highly significant main effect of C (stimulus combination) ($p<.001$) shows a significant difference among the means of each level of C. Consequently in view of the A x D interaction being independent of, or averaged over levels of C. consideration of such an interaction would seem less meaningful than usual, particularly when it is observed that, when the con-

FIGURE 3

ACHIEVEMENT X DIMENSION INTERACTION (SOUNDS)

PLOT OF MEANS

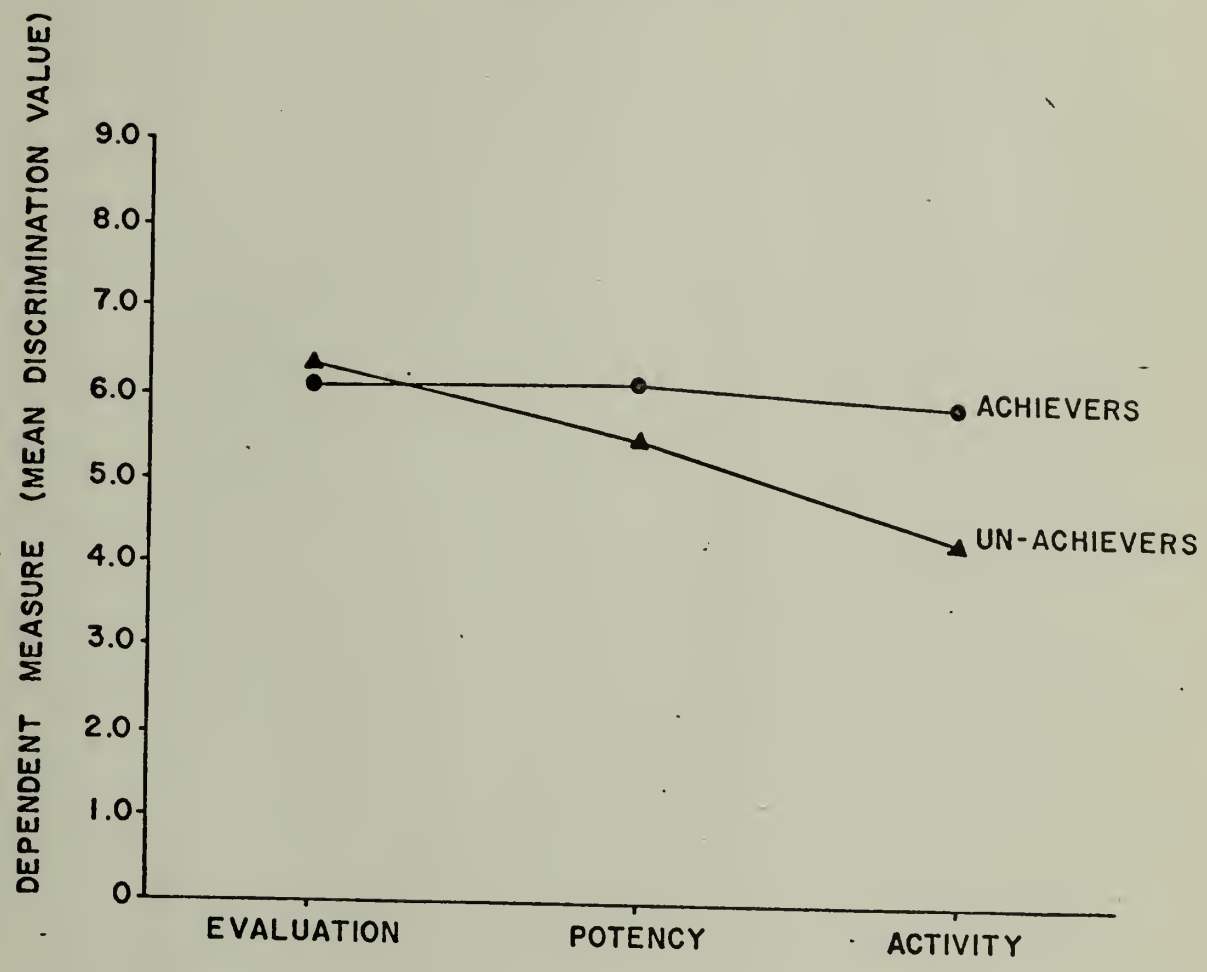

TABLE 9

CELL MEANS FOR ACHIEVEMENT X DIMENSION INTERACTION (SOUNDS)

	EVALUTION	POTENCY	ACTIVITY
ACHIEVERS	6.05	6.09	6.01
UN-ACHIEVERS	6.33	5.66	4.33

tribution of C is assessed, as in the A x C x D effect, the result is not significant. Thus in view of the experimental procedure, it makes little sense to speculate on why under-achievers might utilize the Activity dimension less than achievers. We can say, however, that in view of the absence of a significant A x C x D interaction, the crucial A x C interaction is not dependent upon the dimension of meaning on which it is being measured.

Achievement (A) by Order of Stimulus Presentation Interaction (O).

The variable of order of stimulus presentation was introduced into the design because the experimental situation required that the same group of subjects be used for both the sounds and images measurements.

As can be seen from Table 6 there was no significant effect of Order, however the interaction of Order with Achievement is significant at better than the 5% level. Figure 4 and Table 10 shows that this interaction is due to a simple effect of achievement at Order 1. It would seem that Order 1, presenting the images before the sounds resulted in a higher mean discrimination, averaged over stimulus combinations and dimensions of meaning, in the achievers than in the under-achievers.

Using the Newman-Kuels procedure, comparisons of the means of Table 10 shows that there is a significant difference ($p < .05$) between achievers and under-achievers, when the images were presented first. This effect was not predicted and no logical explanation seems apparent. The non-significant A x C x O effect suggests that the crucial A x C interaction is not uniquely due to the order of stimulus presentation, which after all was the reason for the inclusion of Order as a variable in the design.

FIGURE 4
ACHIEVEMENT X ORDER INTERACTION (SOUNDS)
PLOT OF MEANS

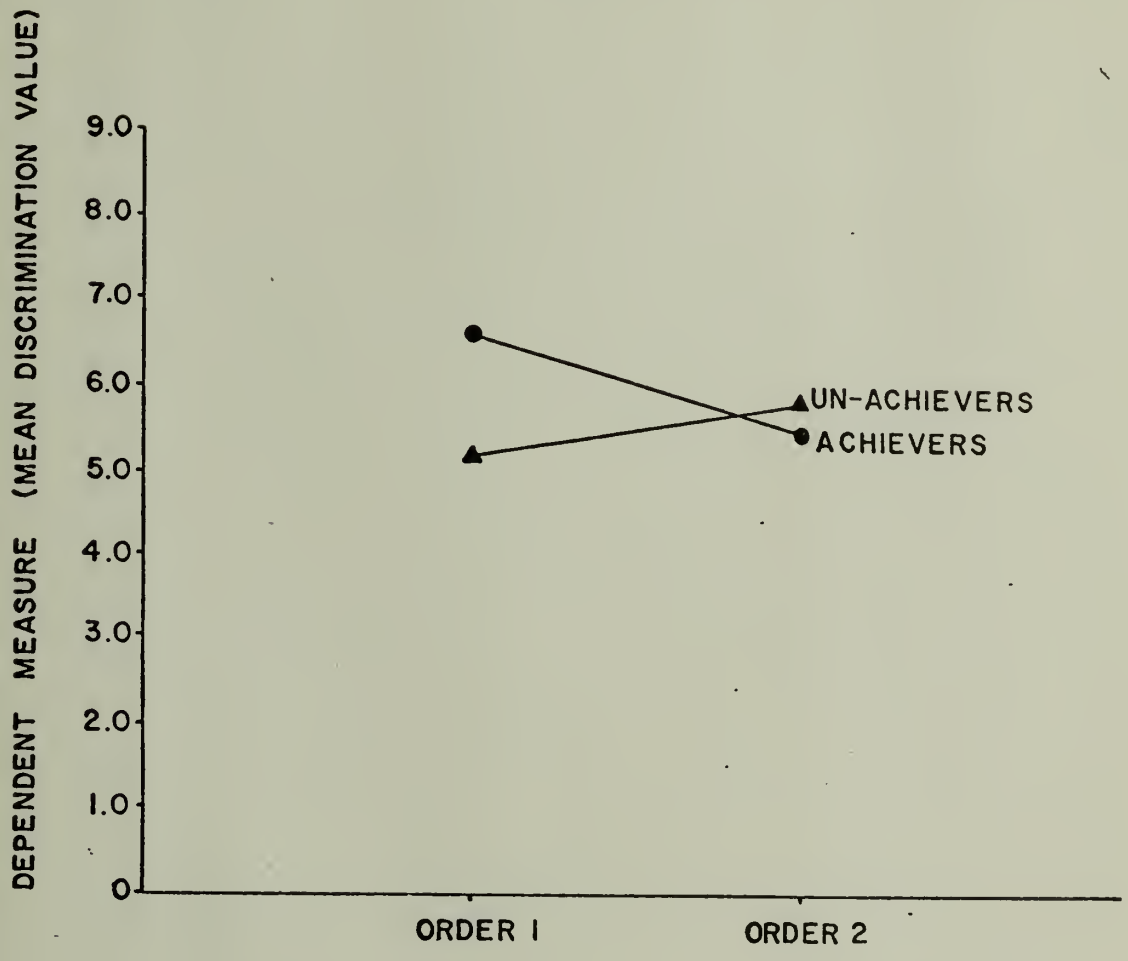

TABLE 10
CELL MEANS FOR ACHIEVEMENT X ORDER INTERACTION (SOUNDS)

	ORDER 1	ORDER 2
ACHIEVERS	6.50	5.61
UN-ACHIEVERS	5.18	5.70

Thus, order effects are interpreted as sampling effects and measurement unreliability.

Images As has been previously mentioned the analysis for the images was carried out separately. The the most part the results of the images analysis follow closely the results of the sounds analysis. It is intended here to discuss mainly the points of divergence.

Like the sounds analysis it is apparent (from Table 12) that the main effects of Achievement (A), Stimulus Combination (C) and Dimension of the Meaning Measurement (D) are all significant. The achievers have a higher mean discrimination value; the Hi-Lo stimulus combination condition produces a significantly higher mean discrimination value than either the Hi-Hi or Lo-Lo conditions (per Newman-Kuels); and the dimensions of meaning measurement produce significantly different means.

On this latter point there is an interesting divergence from the sounds results.

Table 11

Means for Dimension of Meaning (Images)

Evaluation	Potency	Activity
5.95	5.11	5.93

From Table 11 it can be seen that the mean discrimination score averaged over achievement and stimulus combinations is lowest on the Potency dimension. In fact the Newman-Kuels procedure shows the Potency dimension to be significantly ($p<.05$) lower than either the Evaluation or Activity

Table 12

Analysis of Variance for Images*

Source	D.F.	MS	F.	P.
Between S's				
A (Achievement)	1	126.75	7.56	.01
O (Order)	1	32.23		
OA	1	29.03		
S/OA	44	16.75		
Within S's				
C (Combination)	2	83.04	8.02	.01
CA	2	31.09	3.00	.05
CO	2	8.75		
COA	2	17.46		
SC/OA	88	10.36		
D (Dimension)	2	33.34	4.27	.025
DA	2	2.50		
DO	2	14.21		
DOA	2	.46		
SD/OA	88	7.80		
CD	4	24.05	4.63	.005
CDA	4	11.53		
CDO	4	10.16		
CDOA	4	4.88		
SCD/OA	176	5.20		

*Only F values significant at the 5% level of confidence or better are included.

FIGURE 5

ACHIEVEMENT X STIMULUS COMBINATION INTERACTION (IMAGES) PLOT OF MEANS

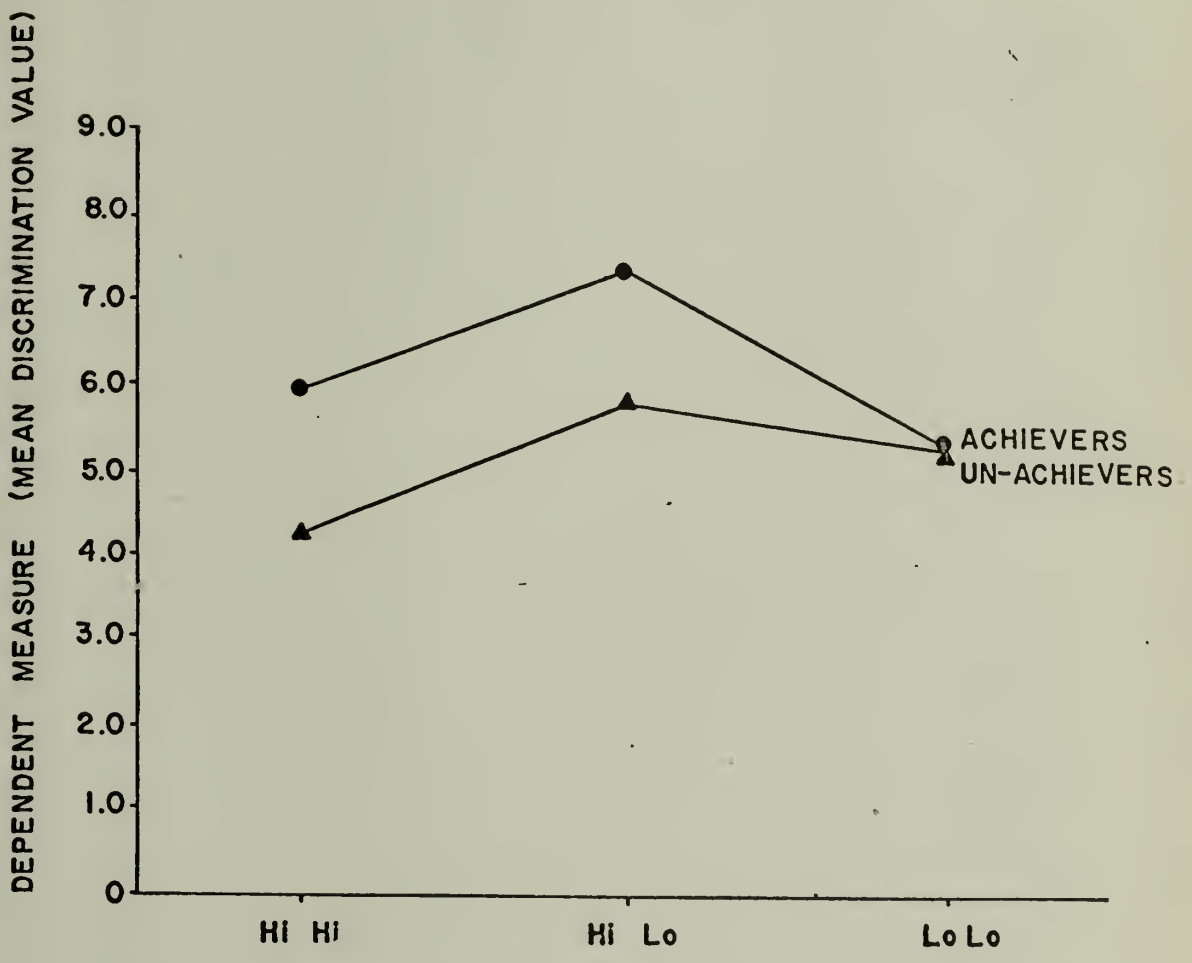

TABLE 13

CELL MEANS FOR ACHIEVEMENT X STIMULUS COMBINATION INTERACTION (IMAGES)

	Hi Hi	Hi Lo	Lo Lo
ACHIEVERS	5.97	7.30	5.34
UN-ACHIEVERS	4.27	5.76	5.33

dimensions. For sounds the Activity demension was found to have the lowest mean value.

Is is also worth noting that, with the images as with the sounds the Evaluation dimension has the highest mean value, however for the images this mean is significantly higher than only the Potency dimension. It would seem that in judging sounds and images the Evaluation dimension is the most important. With verbal material Evaluation dimension has been shown to contribute some 68% of the common variance, as compared with 12% for the Potency dimension and 3% for the Activity dimension. (Osgood and Suci, 1955). For these latter two dimensions the picture seems less clear, with sounds the Potency dimension seems more important, while for images the Activity dimension plays a greater role.

Table 12 shows that the crucial Achievement by Stimulus Combination interaction is significant ($p = .05$). Using images the effect is not as strong, but still it is clear that the effect supports the similar result found with sounds and with verbal material (Drakeford and Snider, 1970).

While providing general support for the cross-modal generality of the meaning discrimination effect, perusul of the means in Table 13 and the plot of those means in Figure 5 shows that considerable differences are to be seen when the data is compared to the means for sounds.

As with sounds there is a significant difference between achievers and under-achievers under the Hi-Lo stimulus combination condition, the achievers making a considerably greater distinction between high and low meaningful images than do the under-achievers.

FIGURE .6

STIMULUS COMBINATION X DIMENSION OF MEANING INTERACTION (IMAGES)

PLOT OF MEANS

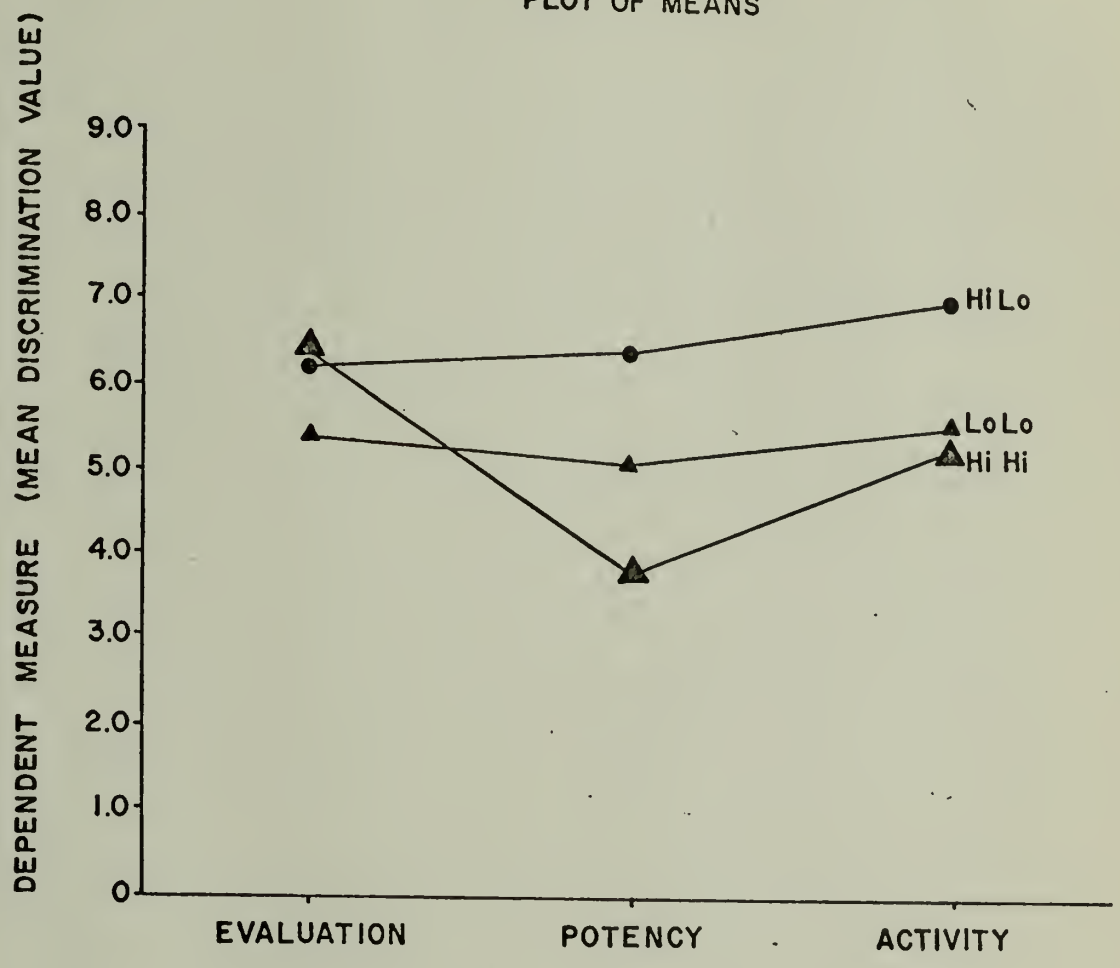

TABLE 14

CELL MEANS FOR STIMULUS COMBINATION X DIMENSION OF MEANING INTERACTION (IMAGES)

	EVALUATION	POTENCY	ACTIVITY
Hi Hi	6.25	3.85	5.27
Hi Lo	6.22	6.29	7.08
Lo Lo	5.37	5.18	5.45

Unlike the situation with sounds there is also a significant difference under the Hi-Hi stimulus combination condition (p .05). This would indicate that the achievers are making more polarized, or finer discriminations between the images than do the under-achievers. With sounds, it will be recalled that this situation was observed not under the Hi-Hi condition but rather under the Lo-Lo condition and in that case it was the under-achievers who made the more polarized discriminations.

In summary, it appears that when achievers are faced with responding to highly meaningful visual and auditory stimuli and lowly meaningful visual and auditory stimuli the achievers make significantly more polarized discriminations than do the under-achievers. When the stimuli are arranged to provide high with high and low with low comparisons the picture becomes less clear and seems to be somewhat dependent upon the stimulus modality involved.

The other main point of divergence between the sounds analysis and images analysis is the significant (p .005) interaction of stimulus combination and dimension of meaning found with the images. Figure 6 and Table 14 show that averaging over achievement levels it is only in the Hi-Hi stimulus combination condition that the Evaluation dimension takes on a significantly more important role in the meaning discrimination process than either the Potency or Activity dimensions. That is, the Newman-Kuels shows that only in the Hi-Hi condition are the differences between meaning dimensions significant.

A possible explanation of this effect is that with images, only when highly meaningful stimuli are being compared is the dominance of the

Evaluation dimension able to exercise its presence. When one or both of the visual stimuli are essentially meaningless the question of "goodness" is no more critical a question than "roughness" or "quickness."

Chapter V

Discussion and Conclusions

Toward a Theory of Under-achievement

It is clear from the analysis of results that the hypotheses have been supported and the general aim of the study accomplished. A difference has been observed in the degree to which academic achievers and under-achievers discriminate not only verbal stimuli but also auditory and visual stimuli of differing levels of meaningfulness. The meaning discrimination difference has been shown to generalize across other modalities of stimulus input and would seem to support the notion of a stimulus discrimination processing deficiency, quite pervasive in nature.

The results of the present study and the results of the Drakeford and Snider (1970) paper have shown that groups differing in academic achievement differ significantly in their ability to discriminate between environmental stimuli. These findings when coupled with the results of the Snider and Drakeford (1967) study in which groups differing in academic achievement were found to differ significantly on a cognitive rigidity variable are strongly suggestive of the role flexibility and rigidity of cognitive style should play in a theory of under-achievement. The under-achievers discriminate less well and respond to differing verbal, auditory and visual stimuli in a basically similar, and hence rigid fashion.

Such conclusions have theoretical implications outside the scope of this study, however the literature shows them not to be without support.

The first such implication is that there do exist reliable individual differences in cognitive rigidity. Such an assumption does not go unchallenged for in the past considerable doubt and misgivings have arisen concerning the unidimensionality of rigidity. The research has lead to statements such as

> that the various existing tests of rigidity do in fact measure quite different things and that rigidity as a trait or unidimensional variable is a figment (Jenkins and Lykken, 1957)

However the same literature has led Brengelmann (1960) to conclude that such statements merely reflect the present research situation and should not be taken as indicative of a final verdict on rigidity.

In fact, Brengelmann has been responsible for perhaps the most extensive set of studies on questionnaire measures of rigidity. In his 1960 (a and b) studies he worked with five questionnaire measures of rigidity; a revision of the Nigniewitzky (1955) rigidity scale, a revision of Gough's (1952) California Psychological inventory of rigidity, a revision of the Rokeach (1953) dogmatism scale, a revision of the Nigniewitzky intolerance of ambiguity scale and a questionnaire measure of extreme response set. These five scales he found to intercorrelate significantly. Brengelmann considered his results consistent with Nigniewitzky's (1956) general factor found on French subjects and Rokeach and Fruchter's (1956) general factor found with American subjects. The findings of Drakeford (1967) based on the Gough scale, the 'F' scale, the Rokeach dogmatism scale, and two "all-inclusiveness' scales, when compared to the findings of Brengelmann would seem sufficient to verify the existency of a cognitive style variable which we might call "cogni-

tive rigidity."

The second theoretical question raised by the present series of studies asks, do people (other than under-achievers) who exhibit aspects of a rigid cognitive style, show discrimination differences analogous to those of the present study? The answer is clearly yes, there are several studies which show groups who, on many of the previously discussed measures, might be considered cognitively rigid, displaying inabilities and lesser capacities on tasks clearly involving stimulus discrimination.

For instance, Feather (1967) in a study of religious beliefs found a significant negative relationship between intolerance of ambiguity, (a consistent correlate of rigidity) and critical ability which was measured by the individuals' capacity to identify logically correct syllogisms. The subjects who were high on intolerance of ambiguity made more errors in discriminating among the premises and thus in answering the syllogisms. Rokeach (1960) reports evidence to suggest that subjects low on dogmatism are better able to synthesize new beliefs than subjects high on dogmatism. In so far as synthesizing new beliefs involves first discriminating among them, Rokeach's data supports the notion of a rigid cognitive style, stimulus discrimination relationship. Similar results were found by Mouw (1969) who demonstrated a significant difference between high and low digmatic subjects not only in Synthesis but also in Analysis, a variable measuring "those behaviors which emphasize the breakdown of material into its constituent parts and the detection of the relationships of the parts and the way they are organized." (p 367).

Powell (1962), based on Rokeach's (1960) distinction between open

and closed belief-disbelief systems found support for the hypothesis that a person with an open belief system would be more able to distinguish between the message content and the message source and to judge each on its intrinsic merits. Similar inappropriate discrimination of source and content is suggested by Wright and Harvey (1965) who found authoritarianism and opinion change positively correlated when the source had high status but negatively correlated when the source had low status.

Hence there is some justification to the assumption that poor stimulus discrimination and rigidity of cognitive style are related. Certainly at the intuitive level it is not difficult to imagine how a history of inappropriate or inaccurate discrimination of stimulus situations could result in a cognitive style, the attributes of which might be described as dogmatic, rigid, authoritarian, pertaining to closed belief systems and intolerant of ambiguity.

To summarize the current theoretical situation, there appears to be a relationship between under-achievement and stimulus situation discrimination differences (Drakeford and Snider 1970; present study). These meaning discriminations differences seem related to cognitive rigidity (Feather 1967; Rokeach 1960; Powell 1962; Wright and Harvey, 1965; and Snider, 1966). Cognitive rigidity seems related to under-achievement (Davids 1963; Snider and Drakeford, 1967). Given this tri-partite relationship the causal sequence is still unclear. Do meaning discrimination incapacities produce a rigid cognitive style which in turn affects under-achievement? Or does the rigid cognitive style produce meaning discrimination differences (maybe as a defense against ambiguity) which

cause poor achievement? Or does an established history of under-achievement cause the adoption of a cognitively rigid style, the maintainance of which is dependent upon ignoring discriminations among stimulus situations?

Although beyond the scope of this study the answer to the above entanglement is probably to be found within the learning paradigm. It is not difficult to imagine how poor meaning discrimination could negatively affect learning, there being, of course, a considerable accumulation of data on the role of discrimination of stimuli and responses in, and for, a theory of learning. However, usually, meaning discrimination as a variable is examined and controlled for in the stimulus dimension, it being assumed that if generally meaningful v's meaningless stimuli are presented, proper control of this variable will have been ensured. However, it should be noted that various groups do not respond appropriately to the above controls and if it can be assumed that present theory, research and practice is presenting learning materials in generally meaningful ways, the problem must lie, at least in part, with the student rather than with the stimuli. The possibility that such a group might well be under-achievers, who inspite of adequate intellect fail to maximize their learning experiences, could be tested by directly manipulating the learning variable.

Such an experiment might involve a comparison of academic achievers and under-achievers on a paired associate learning task in which the independent variable is stimulus meaningfulness and appropriate isolation of the effect is accomplished. If under-achievers do possess a meaning discrimination deficit and it is influential in the learning process,

group differences should be apparent. An affirmative answer to this possibility would infer that meaning discrimination differences are the source of the problem and that academic under-achievement and rigid cognitive style are both manifestations of the more fundamental stimulus processing dificiency.

Such an outcome is given plausibility when the results of a study by Whipple and Kodman (1969) are considered. The investigation concerned the learning abilities of two groups differing in reading achievement but matched for age, sex, grade placement and intellectual level. The groups were tested on two learning tasks; discrimination learning where the stimuli were presented both simultaneously and successively and perceptual learning tasks. The under-achieving readers differed significantly on all learning tasks in the direction of poorer performance. In so far as under-achieving readers are concerned stimulus discrimination differences would seem to play a critical part in the learning process. Further analysis of learning processes with under-achievers would appear the next logical step in elucidating the meaning discrimination, cognitive style, under-achievement issue.

Educational Implications

However educational intervention is not necessarily dependent upon a resolution of this problem. The current study carries with it some implications of immediate practical importance.

The results of the present series of studies have clearly shown that certain groups of students possess significantly different abilities on a variable (meaning discrimination) closely related to academic

achievement. That such groups differ in aptitudes, interests and personality traits has long been recognized, however educational practice "has traditionally viewed these differences as something of an inconvenience and has only recently recognized the potential advantages of individualized instruction" (Tallmadge 1968, p. 32).

Educational research has paid much attention to differences in ability level as seen in the development of such techniques as branching auto-instructional programs, self-paced learning and classroom grouping. Only recently (Tallmadge, 1968; Cronbach and Snow, 1969; Berliner, 1970; Bush, Gregg Smith and McBride, 1965.) has due consideration been paid to the importance of ability or aptitude type in classroom learning. The interaction of aptitude and instructional technique is considered by some (Berliner 1970) as potentially the most significant single source of variance in classroom learning differences.

The results of such investigations have to date been equivocal. Edgerton (1968), Bush Gregg Smith and McBride (1965) Cronbach (1969) and Berliner (1970) have found positive results in favor of such an interaction. Tallmadge (1968) in a study specifically aimed at investigating the aptitude x treatment interaction, rather than the main effects of the treatment conditions, found negative results. Such results are attributed by the author to other interactions "perhaps between the materials to be learned and the training methods employed, which acted in such a way as to obscure the interaction of interest." (Tallmadge, 1968. P 35).

In so far as meaning discrimination differences represent an ap-

titude relevant to academic achievement, the results of the present study have obvious ramifications for differential instructional techniques. Under-achievement is often taken as the product of historical environmental factors (dominant mothers, negative reinforcement etc) which if corrected would correct the under-achievement, or it is taken as an attribute of the individual (personality syndrome), a characteristic that somehow can be changed. It seems more likely that under-achievement, as with so many other behaviors is a result of the interaction of the individual with the environment. This means that while some of the etiology of the problem is manipulable via the environment and some via the individual the most opportune place for manipulation is via the interaction of the individual in the environment. Thus research on just how the observed meaning discrimination differences may best be instructionally optimized seems imperative and need not await a resolution to the causal relations previously discussed.

Another practical implication of the present results is the possibility that the observed differences be utilized in the construction of a diagnostic test instrument that might be used to detect meaning discrimination deficiencies early in a child's educational career.

While the current results have come from college students, the testing technique, especially with the verbal material is most appropriate for the construction of a diagnostic device. The data on the images might also be used by reproducing the 35 mm slides as color plates. The Semantic Differential response situation is an easily reproduced format, although some changes in the format would be necessary for younger

children.

The development of a research tool and the replication of the present study at various age levels would seem a worth-while pursuit, and one which should be developed alongside a project designed to use the aptitude by treatment interaction notion, as diagnosis of aptitudes must be an integral part of any differential treatment program.

Such a diagnostic tool would shed light on the developmental aspects of academic achievement, an area of study which has resulted in the conclusion that under-achievers have consistently been under-achieving from grade one and underachievement is thus essentially chronic in nature (Shaw and McCuen, 1960). Similarly pessimistic is Shaw and Grubb's (1958) summary

> under-achievement among bright students is not a problem that has its genesis within the educational framework, but rather one which the under-achiever brings with him, at least in embryo form, when he enters school.

Finally it is worth noting that many of the aims and objectives of "sensitivity training" appear to be appropriate for persons apparently performing poorly in discriminating the uniquely meaningful aspects of their environment. Such training, especially if it develops a more solid theoretical base and researched set of techniques, may well be of great value to under-achievement problems, especially in the college setting.

Summary

The study was designed to demonstrate the cross-modal generalization of a meaning discrimination difference between academic achievers and under-achievers observed by Drakeford and Snider (1970) with verbal stimuli. To this end 24 college achievers and 24 college under-achievers were compared on a meaning discrimination task using both auditory and visual stimuli.

In both the auditory and visual stimulus situations, significant differences were observed in the discrimination task in favor of the achievers. The data supported the Drakeford and Snider (1970) finding in the case of both stimulus modalities, although the effect was more pronounced with the auditory than with the visual stimuli.

The implications for a theory of under-achievement were analyzed and some practical applications of the results to current educational practice discussed.

REFERENCES

AUSUBEL, D. P. The Psychology of Meaningful Verbal Learning. New York Greene and Stratton, 1963.

_____ and FITZGERALD, D. The role of discriminability in meaningful verbal learning and retention. J. Educ. Psychol. 1961, 52, 266-274.

_____ and _____. Organizer, general background and antecedent variables in sequential verbal learning. J. Educ. Psychol. 1962, 53, 243-249.

_____ and YOUSSEF, M. Role of discriminability in meaningful parallel learning. J. Educ. Psychol. 1963, 54, 331-336.

BAKER, R. W. and MADELL, T. O. A continued investigation of susceptability to distraction in academically underachieving and achieving male college students. J. Educ. Psychol. 1965, 56, 254-258.

BATTIG, W. F. and SPERA, A. J. Rated association values of numbers from 0-100. J. Verbal Learning and Verbal Behavior 1962, 1, 200-202.

BERLINER, D. Aptitude X Treatment Interaction. Presentation to graduate seminar Univ. of Massachusetts 1970.

BRENGELMANN, J. C. "Extreme response set, drive level and abnormality in questionnaire rigidity," J. Ment. Sci., 1960, 106, 171-186. (a)

_____. "A note on questionnaire rigidity and extreme response set," J. Ment. Sci., 1960, 106, 187-191. (b)

BRODSKY, S. L. "Language patterns of repressors and sensitizers in personal and impersonal description." Unpublished Ph.D. thesis, University of Florida, 1964.

BUSH, W. J., GREGG, D. K., SMITH, E. A., and McBRIDE, C. B. Some interactions between individual differences and modes of instruction. Report No AMRL-TR-65-228, Wright-Patterson A.F.B. Ohio Aerospace Medical Research Labortories 1965.

CAMPBELL, V. N. and CHAPMAN, M. A. Learner control v's program control of instruction. Psychol. in Schools 1967, 4, 121-130.

COCHRAN, S. W. Rated association values for 251 colors. J. Verbal Learning and Verbal Behavior, 1968, 7, 14-15.

CRONBACH, L. J. and SNOW, R. E. Final report: Individual differences in learning ability as function of instructional variables. Contract No OEC-4-6-061269-1217 U.S.O.E. School of Education Stanford, 1969.

DAVIDS, A. Cognitive rigidity and intolerance of ambiguity in future scientists and in underachieving high school students. Unpublished paper presented at meeting of the California State Psychological Assoc. San Francisco, December, 1963.

DE SENA, P. A. Problems of consistent over, under, and normal achieving college students as identified by the Mooney problem check list J. Educ. Res. 1966, 59, 351-355.

DIENER, C. L. Similarities and differences between overachieving and underachieving students. Personnel & Guid. J. 1960, 38, 396-400.

DRAKEFORD, G. C. and SNIDER, J. G. Intensity of meaning discrimination in academic achievers and underachievers. Paper presented at 1970 Annual Convention A.E.R.A. Minneapolis, 1970.

DOUVAN, E. Social status and successive strivings J. abnorm. soc. Psychol. 1956, 52, 219-223.

EDGERTON, H. A. The relationship of method of instruction to trainee aptitude pattern. New York: Richardson, Bellows, Henry 1958.

ELLIOTT, L. L. and TANNENBAUM, P. H. Factor structure of semantic differential responses to visual forms and predictions of factor scores from structural characteristics of stimulus shapes Amer. J. Psychol. 1963, 76, 589-587.

FEATHER, N. T. Evaluation of religeous and neutral arguments in religeous and atheist student groups Austral. J. Psychol., 1967, 19, 3-12.

FRIEDENBERG, E. Z. The vanishing adolescent Boston: Beacon 1958.

GILL, L. J. and SPILKS, B. Some nonintellectual correlates of academic achievement among Mexican-American secondary school students. J. Educ. Psychol. 1962, 53, 144-149.

GOUGH, H. G. What determines the academic achievement of high school students. J. educ. Res. 1953, 46, 321-333.

_____. Academic achievement in high school as predicted from the California Psychological Inventory. J. Educ. Psychol. 1964, 55, 174-180.

HAGGARD, E. A. Socialization, personality, and academic achievement in gifted children. Sch. Rev. 1957, 65, 388-414.

HAYAKAWA, S. I. Language in Action. New York: Harcourt Brace, 1943.

HUMMEL, R. and SPRINTHALL, N. Underachievement related to interests attitudes and values. The Personnel and Guidance Journal, 1965, 44, 388-395.

JENKINS, J. J. Degree of polarization and scores on the principal factors for concepts in the semantic atlas. Amer. J. Psychol. 1960, 63, 274-279.

_____ and LYKKEN, D. T. "Individual differences." Annu. Rev. Psychol., 1959, 8, 79-112.

JOHNSON, W. People in Quandries. New York: Harpers, 1946.

KIMBALL, B. Case studies in educational failure during adolescence. Amer. J. Orthopsychiat., 1953, 23, 406-415.

KOEN, F. Polarization, m and emotionality in words J. Verbal Learning and Verbal Behavior 1962, 1, 183-187.

KORZYBSKI, A. Science and Sanity. Lakeville, Conn.: The Institute of General Semantics, 1948.

O'DONOVAN, D. Rating extremity. Pathology of meaningfulness? Psychol. Rev. 1965, 72, 358-372.

OSGOOD, C. E. and SUCI, G. J. Factor analysis of meaning. J. exp. Psychol. 1955, 50, 325-338.

_____, _____ and TANNENBAUM, P. H. The measurement of meaning. Urbana: University of Illinois, 1957.

_____ and WALKER, E. E. "Motivation and language behavior: a content analysis of suicide notes," J. abnorm. soc. Psychol., 1959, 59, 58-67.

_____ and HASTORF, A. A semantic structure of facial communication. Unpublished study, 1961.

McCANDLESS, B. The Rorschach as a differential predictor of academic success for matched groups of highly superior men. Amer. Psychologist 1947, 2, 414-415.

McCLELLAND, D. C., ATKINSON, J., CLARK, R., and LOWELL, E. The achievement motive. New York: Appleton-Century-Crofts, 1953.

MILNER, E. A study of the relationship between reading readiness in grade one school children and patterns of parent-child interaction. Child Development, 1951, 22, 95-112.

MIRON, M. S. A cross-linguistic investigation of phonetic symbolism. J. Abnorm. Soc. Psychol. 1961, 62, 623-630.

MORGAN, H. H. A psychosomatic comparison of achieving and non-achieving college students of high ability. J. consult. Psychol. 1952, 16, 292-298.

MOUW, J. T. Effect of dogmatism on levels of cognitive processes. J. Educ. Psychol. 1969, 60, 365-369.

NIGNIEWITSKY, R. D. "A statistical study of rigidity as a personality variable," M. A. thesis, University of London, 1955.

NOBLE, C. E. An analysis of meaning. Psychol. Rev., 1952, 59, 421-430.

PETERSON, J. The researcher and the underachiever; never the twain shall meet. Phi Delta Kappan 1963, 44, 379-381.

POWELL, F. A. Open and closed-mindedness and the ability to differentiate source and message. J. abnorm. soc. Psychol. 1962, 65, 61-64.

ROKEACH, M. The Open and Closed Mind. New York: Basic Books, 1960.

_____ and FRUCHTER, B. "A factorial study of dogmatism and related concepts," J. abnorm. soc. Psychol., 1956, 53, 356-360.

SAMUELS, S. J. and JEFFREY, W. E. Discriminability of words and letter cues used in learning to read. J. Educ. Psychol., 1966, 57, 337-340.

SANDEFUR, J. T. and BIGGE, J. An investigation of the relationship between recognized problems of adolescents and school achievement. J. Educ. Res. 1966, 59, 473-474.

SCHULZ, R. W. and HOPKINS, R. H. Free-association responses to verbal stimuli of varying meaningfulness as a function of presentation mode. J. Verbal Learning and Verbal Behavior 1968, 7, 737-741.

SHAW, M. C. and GRUBB, J. Hostility and able high school underachievers. J. Counsel Psychol. 1958, 5, 263-266.

_____ and McCUEN, J. T. The onset of academic underachievement in bright children. J. Educ. Psychol. 1960, 51, 103-108.

SNIDER, J. G. "The linguistic content variable in school counseling," Personnel and Guidance Journal, 1964, 42, 577-580. (a)

_____. "Some correlates of all-inclusive conceptualization in high school pupils." Unpublished Doctoral dissertation, 1964, Stanford University. (b)

_____. "Stereotyping and h use of all-inclusive terms," Alberta J. Educ. Res., 1964, 10, 170-174. (c)

_____. "A comparison of all-inclusive conceptualization in the delinquent and non-delinquent," Canadian J. of Corrections, 1965, 7, 411-413.

_____. "All-inclusive conceptualization and intensity of meaningfulness: a research note," Alberta J. Educ. Res., 1966, 4, 281-284.

_____. The D4m measure. Psychol. Reports, 1967, 21, 843-844.

_____ and DRAKEFORD, G. C. "All-inclusive conceptualization in academic achievers and underachievers," Psychology in the Schools, 1967, 4, 172-173.

_____ and _____. Two scales to measure cognitive rigidity. J. Psychol. 1968, 68, 223-226.

SOLOMON, L. N. Semantic approach to the perception of complex sounds. J. acoust. Soc. Amer. 1958, 30, 421-425.

STAATS, A. W. and STAATS, C. K. Meaning and m: Correlated but separate. Psychol. Rev. 1959, 66, 136-144.

_____. Meaning and word associations: Separate processes. Tech. Rep. No 12. Contract Nonv 2794 (02) Arizona State Univ. 1959.

STAUTLAND, S. "Some correlates and determinants of national stereotyping." Unpublished Doctoral dissertation. Stanford University, 1959.

TALLMADGE G. K. Relationships between training methods and learner characteristics. J. Educ. Psychol. 1968, 59, 32-36.

THORNDIKE, E. L. and LORGE, I. The Teacher's Word Book of 30,000 Words. New York: Bureau of Publications Teachers' College, Columbia University, 1944.

THORNDIKE, R. L. The concepts of over and under achievement. Teacher's College Columbia University, New York, 1963.

WALLACH, M. A. Perceptual recognition of approximations to English in relation to spelling achievement. J. Educ. Psychol. 1961, 54, 57-62.

WHIPPLE, C. I. and KODMAN, F. A study of discrimination and perceptual learning with retarded readers. J. Educ. Psychol. 1969, 60, 1-5.

WINER, B. J. Statistical principles in experimental design. New York: McGraw-Hill, 1962.

WRIGHT, J. M. and HARVEY, O. J. Attitude change as a function of authoritarianism and punitiveness. J. pers. soc. Psychol. 1965, 1, 177-181.

ZIPPEL, B. Semantic differential measures of meaningfulness and agreement of meaning. J. Verbal Learning and Verbal Behavior 1967, 6, 22-225.

APPENDIX A

Meaningfulness Values for Sounds (Norming Study)

Meaningfulness Values for Sounds (Norming Study)

No	Sound Name	Mean Assoc Value	Mean Polarization Value
1	telephone	10.55	5.80
2	machine gun	10.90	8.55
3	Hey Jude (Beatles)	9.85	6.50
4	card reader	6.95	4.25
5	President Johnson	8.70	4.65
6	baby crying	11.10	6.90
7	growling elephant	11.25	7.20
8	shower	9.55	4.25
9	turnstile	7.85	3.00
10	plastic rustling	7.15	3.35
11	car race	10.15	7.20
12	marching men	12.05	7.95
13	compressor	7.50	2.70
14	Robert F. Kennedy	11.30	6.55
15	Missile	9.30	7.35
16	Body falling	6.45	2.75
17	Coke bottles	6.70	1.95
18	washing machine	12.05	2.75
19	ping pong	12.10	4.95
20	ocean	15.70	5.60

APPENDIX B

Meaningfulness Values for Images (Norming Study)

Meaningfulness Values for Images (Norming Study)

No	Image Name	Mean Assoc Value	Mean Polarization Value
1	Gun	12.20	8.15
2	Black abstract	7.05	2.75
3	orange	11.25	5.35
4	cut glass	7.90	3.80
5	ribbon	7.30	3.90
6	knife	10.10	4.95
7	hair	6.80	3.05
8	Blue abstract	7.90	4.55
9	plastic	7.40	2.90
10	light bulb	10.15	5.30
11	spoons	7.40	3.05
12	towelling	7.70	2.35
13	eye glasses	10.60	5.50
14	cut glass	8.00	3.55
15	cork	9.60	4.15
16	feathers	7.75	3.65
17	Helmet	10.90	6.25
18	wicker	8.05	5.15
19	green plastic	6.15	3.70
20	Tissues	7.65	4.45

APPENDIX C

TEST MATERIALS

INSTRUCTIONS

Booklet No. _____

The purpose of this study is to measure the meanings of certain images to various people. You are to judge the image given on a series of two-word scales. In doing this, please make your judgments on the basis of what these images mean to you. Some of the images may be very meaningful to you, and others may be meaningless. On each page of this booklet you will find a set of two-word scales. You are to rate the image on each of these scales in order.

Here is how you are to use these scales: If you feel that the image referred to at the top of the page is very closely related to one end of the scale, you should place your check mark as follows:

fair (X) ( ) ( ) ( ) ( ) ( ) ( ) unfair

or

fair ( ) ( ) ( ) ( ) ( ) ( ) (X) unfair

If you feel that the image is quite closely related to one or the other end of the scale (but not extremely), you should place your check-mark as follows:

safe ( ) (X) ( ) ( ) ( ) ( ) ( ) dangerous

or

safe ( ) ( ) ( ) ( ) ( ) (X) ( ) dangerous

If the image seems only slightly related to one side as opposed to the other (but is not really neutral), then you should check as follows:

soft ( ) ( ) (X) ( ) ( ) ( ) ( ) hard

or

soft ( ) ( ) ( ) ( ) (X) ( ) ( ) hard

The direction toward which you check depends upon which of the two ends of the scale seem to you most related to the image you are judging.

If you consider the image to be related to neither end of the scale, or if both sides of the scale are equally related to the image, or if the scale is completely irrelevant to the image, than you should place your check-mark in the middle space:

hot ( ) ( ) ( ) (X) ( ) ( ) ( ) cold

IMPORTANT

1) Place your check-mark in the middle of spaces

			This		Not This	
( )	( )	( )	(X)	( )	( ) X	( )

2) Be sure you check every scale for every image.

3) Never put more than one check-mark for a scale.

As you go through the scales do not look back and forth through them. Make each scale a separate and independent judgment. Work at a fairly high speed. Do not worry or puzzle over your judgments, it is your first impression that is wanted. On the other hand, do not be careless. We want your true impressions.

IMAGE A

good	(___)	(___)	(___)	(___)	(___)	(___)	(___)	bad
weak	(___)	(___)	(___)	(___)	(___)	(___)	(___)	strong
active	(___)	(___)	(___)	(___)	(___)	(___)	(___)	passive
stale	(___)	(___)	(___)	(___)	(___)	(___)	(___)	fresh
large	(___)	(___)	(___)	(___)	(___)	(___)	(___)	small
slow	(___)	(___)	(___)	(___)	(___)	(___)	(___)	fast
clean	(___)	(___)	(___)	(___)	(___)	(___)	(___)	dirty
rough	(___)	(___)	(___)	(___)	(___)	(___)	(___)	smooth
tense	(___)	(___)	(___)	(___)	(___)	(___)	(___)	relaxed

APPENDIX D

Print-Out of
Analysis of Variance Source
Table (Bio-Med 08V) for Sounds

ANALYSIS OF VARIANCE FOR DEPENDENT VARIABLE 1

	SOURCE	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARE	EXPECTED MEAN SQUARE	
1	MEAN	14283.0000	1	14283.0000	432.000 (1)	9.000(12)
2	A	40.3333	1	40.3333	216.000 (2)	9.000(12)
3	O	3.7037	1	3.7037	216.000 (3)	9.000(12)
4	C	314.1806	2	157.0903	144.000 (4)	3.000(17)
5	D	78.7917	2	39.3958	144.000 (5)	3.000(18)
6	AO	53.4815	1	53.4815	108.000 (6)	9.000(12)
7	AC	261.5139	2	130.7569	72.000 (7)	3.000(17)
8	OC	1.6991	2	0.8495	72.000 (8)	3.000(17)
9	AD	70.7917	2	35.3958	72.000 (9)	3.000(18)
10	OD	23.6713	2	11.8356	72.000(10)	3.000(18)
11	CD	38.7778	4	9.6944	48.000(11)	1.000(20)
12	S(AO)	406.5926	44	9.2407	9.000(12)	
13	ACC	27.6435	2	13.8218	36.000(13)	3.000(17)
14	ACD	5.8935	2	2.9468	36.000(14)	3.000(18)
15	ACD	10.6111	4	2.6528	24.000(15)	1.000(20)
16	OCD	28.5926	4	7.1481	24.000(16)	1.000(20)
17	SC(AO)	797.1852	88	9.0589	3.000(17)	
18	SD(AO)	678.4074	88	7.7092	3.000(18)	
19	ACCD	21.8148	4	5.4537	12.000(19)	1.000(20)
20	SCD(AO)	819.3148	176	4.6552	1.000(20)	

MEAN 5.75000

CELL MEANS

A =	1	2
	6.05556	5.44444

O =	1	2

APPENDIX E

Print-Out of
Analysis of Variance Source
Table (Bio-Med 08V) for Images

ANALYSIS OF VARIANCE FOR DEPENDENT VARIABLE 1

	SOURCE	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARE	EXPECTED M AN SQUARE	
1	MEAN	13872.0000	1	13872.0000	432.000 (1)	9.000(12)
2	A	126.7500	1	126.7500	216.000 (2)	9.000(12)
3	C	32.2315	1	32.2315	216.000 (3)	9.000(12)
4	C	166.0972	2	83.0486	144.000 (4)	3.000(17)
5	D	66.6806	2	33.3403	144.000 (5)	3.000(18)
6	AC	29.0370	1	29.0370	108.000 (6)	9.000(12)
7	AC	62.1806	2	31.0903	72.000 (7)	3.000(17)
8	CC	17.5046	2	8.7523	72.000 (8)	3.000(17)
9	AD	5.0139	2	2.5069	72.000 (9)	3.000(18)
10	CD	28.4213	2	14.2106	72.000(10)	3.000(18)
11	CD	96.2222	4	24.0556	48.000(11)	1.000(20)
12	S(AC)	737.3148	44	16.7572	9.000(12)	
13	ACC	34.9213	2	17.4606	36.000(13)	3.000(17)
14	ACD	0.9213	2	0.4606	36.000(14)	3.000(18)
15	ACD	46.1389	4	11.5347	24.000(15)	1.000(20)
16	CCD	40.6759	4	10.1690	24.000(16)	1.000(20)
17	SC(AC)	911.9630	88	10.3632	3.000(17)	
18	SD(AC)	686.9630	88	7.8064	3.000(18)	
19	ACCD	19.5370	4	4.8843	12.000(19)	1.000(20)
20	SCD(AC)	915.4259	176	5.2013	1.000(20)	

MEAN 5.66067

CELL-MEANS

A = 1 2

6.20833 5.12500

C = 1 2