68-15,934

HUDESMAN, John Gerson, 1941-
A RELATIONSHIP BETWEEN SHARPENING AND LEVELING AND VISUAL COMPLEXITY.

The City University of New York, Ph.D., 1968
Psychology, clinical

University Microfilms, Inc., Ann Arbor, Michigan

A RELATIONSHIP BETWEEN SHARPENING AND LEVELING AND VISUAL COMPLEXITY

by

GERSON
JOHN HUDESMAN

A dissertation submitted to the Graduate Faculty in Psychology in partial fulfillment of the requirements for the degree of Doctor of Philosophy, The City University of New York

1968

This manuscript has been read and accepted for the University Committee in Psychology in satisfaction of the dissertation requirement for the degree of Doctor of Philosophy.

March 8, 1968 — Gertrude Schmeidler

date — **Chairman of Examining Committee**

March 5, 1968 — Howard Lesher

date — **Executive Officer**

Morton Bard, Ph. D.

Gertrude Schmeidler, Ph. D.

Charles Smith, Ph. D.

Supervisory Committee

The City University of New York

ACKNOWLEDGEMENTS

It is a real pleasure to acknowledge some of the people whose help was invaluable in putting together this dissertation.

First, I would like to thank Professor Gertrude Schmeidler who served as my advisor and friend. Dr. Schmeidler's help was not limited to assembling a thesis; rather her ideas also served as a model of what psychological research is all about.

I would also like to thank Professors Morton Bard and Charles Smith for their careful reading of the manuscript and for their theoretical and practical aid on various chapters.

Finally, I would like to thank Mr. Herman Collymore who gave his time and equipment so that I could get the dissertation underway.

To H. B.[1]

TABLE OF CONTENTS

Chapter		Page
I	BACKGROUND AND RELATED LITERATURE	1
	Sharpening and Leveling: A Description and Review.	4
	Reaction Time	18
II	SUMMARY PLAN OF THIS STUDY AND HYPOTHESES	24
III	PROCEDURE	26
	Session I: a. Klein Schematizing Test	26
	Session I: b. Intelligence Testing	29
	Selection of Subjects for Further Testing	29
	Simple and Intermediate Response Latency Conditions	30
	Session II: a. Simple Response Latency, Simple Designs: Repeated	30
	Session II: b. Simple Response Latency, Simple Designs: Varied	32
	Session II: c. Intermediate Response Latency, Dual Designs: Varied	33
	Session III: a. Complex Response Latency, Embedded Figures Test	33
	Session III: b. Taylor Manifest Anxiety Scale	34
IV	RESULTS	35
	Examination of Exploratory Groups	39
V	DISCUSSION	62
VI	OVERVIEW	72
APPENDIX		74
BIBLIOGRAPHY		82
AUTOBIOGRAPHICAL STATEMENT		87

LIST OF TABLES

TABLE		PAGE
I	Summary of Scores of Sharpeners and Levelers.........	45
II	Pearson Product Moment Correlations Between Indices of Sharpening--Leveling and Conditions of Visual Complexity (N=39).................................	46
III	Pearson Product Moment Correlations Between Indices of Sharpening--Leveling and Measures of Intellectual Functioning (N=39)................................	47
IV	Pearson Product Moment Correlation Between Response Latency at Three Levels of Visual Complexity and Measures of Intelligence (N=39)....................	48
V	Partial Correlations Between Indices of Sharpening--Leveling and Response Latencies with Intelligence Factors Held Constant (N=39)......................	49
VI	Summary Scores of Extreme Sharpeners and Extreme Levelers Assigned on the Criterion of Increment Error..	50
VII	Summary Scores of Extreme Sharpeners and Extreme Levelers Assigned on the Criterion of Rank Error....	51
VIII	Summary Scores of Extreme Sharpeners and Extreme Levelers Assigned on the Criterion of Index Error...	52
IX	Pearson Product Moment Correlations Between Extreme Sharpening and Extreme Leveling Increment Error Scores and Reciprocal Response Latencies for Four Levels of Visual Complexity.......................	53
X	Pearson Product Moment Correlations Between Extreme Sharpening and Extreme Leveling Rank Error Scores and Reciprocal Response Latencies for Four Levels of Visual Complexity.............................	54
XI	Pearson Product Moment Correlations Between Extreme Sharpening and Extreme Leveling Index Error Scores and Reciprocal Response Latencies for Four Levels of Visual Complexity.............................	55
XII	Pearson Product Moment Correlations Between Error Scores of Extreme Sharpeners and Extreme Levelers and Measures of Intellectual Functioning...........	56

TABLE		PAGE
XIII	Extreme Sharpening and Extreme Leveling Increment Error Scores: Pearson Product Moment Correlations for Response Latency at Three Levels of Visual Complexity and Measures of Intelligence..............	57
XIV	Extreme Sharpening and Extreme Leveling Rank Error Scores: Pearson Product Moment Correlations for Response Latency at Three Levels of Visual Complexity and Measures of Intelligence..............	58
XV	Extreme Sharpening and Extreme Leveling Index Error Scores: Pearson Product Moment Correlations for Response Latency at Three Levels of Visual Complexity and Measures of Intelligence..............	59
XVI	Partial Correlations Between Error Scores of Extreme Sharpeners and Response Latencies with Intelligence Factors Held Constant (N^1=10).......................	60
XVII	Partial Correlations Between Error Scores of Extreme Levelers and Response Latencies with Intelligence Factors Held Constant (N^1=10).......................	61

CHAPTER I

BACKGROUND AND RELATED LITERATURE

At different times in the past, the study of perception has emphasized the mathematical model, as in the case of psychophysics, and at other times the description of stimulus configurations, as in the Gestalt Psychology movement. Generally, it was not until the 1930's that the academic study of perception became of interest to the personality theorist and clinician.

With the emergence of the "New Look," there came into perception a theory that the recognition of a stimulus in an ambiguous environment might well be based on the value of that stimulus to the individual. These variables might be physiological, as in Sanford's (1937) work on hunger, or sometimes being purely psychological as in the case of Bruner and Postman (1948). In either event the individual was thought to be guided by stimuli that were congruent with his needs and/or values.

The idea of a "need" operating solely on a person's perceptions has been criticized by Klein (1949) and Klein and Schlesinger (1949). These papers set forth the thesis that one must examine the perceiver rather than just the need. Klein (1949) maintained that there were consistent differences between individuals in the perceptual process which in turn led to different reactions. It was only by pursuing these differences on all levels of functioning that it was possible to formulate a theory of individual differences. Klein and Schlesinger (1949) in a further explanation of their position proposed that these differences, which they call adaptive properties, provided the ego categories through which perception took place.

It is with this type of orientation that Klein _et al_ (1951) set about to redo the Bruner and Postman (1948) study. Bruner and Postman presented subjects with three equal size standard disks; one with a dollar sign, a second with a swastika, and a third with no markings on it. They were asked to judge a variable disk so that it would be equal in size to that of the standard disk. The results showed that the variable disks corresponding to the two value stimuli were judged larger in size than was the blank disk. Bruner and Postman concluded that the acquired need caused the individual to see the value disks as more important and therefore larger in physical size. Klein's group found that the original significant results held only for optimum viewing conditions, and then, only for some subjects. Also of interest was that some people tended to consistently overestimate or to underestimate the size of the disks, regardless of the particular value attached to a condition. Gardner _et al_ (1959) supported these findings by demonstrating that levelers tended to overestimate a variable stimulus disk, while sharpeners tended to underestimate one.

With reference to experimentally induced physiological need states studies by Sanford (1937), the work of Levine _et al_ (1942) and McClelland _et al_ (1948) can be cited as indications of the role of physiological need in perception. Here again Klein's group would predict that given subjects with known perceptually adaptive categories, it would be possible to predict their reactions to food and water deprivation.

With this in mind, Klein and Salomon (1952) preselected subjects on the basis of the Stroop Color Word Test. This test requires that the subject read color names. However, the color names are printed in contradictary colors, e.g. the word green is printed in blue. No color is printed in its own color. The subject is faced with an incongruity which he must resolve before he can effectively "color name." Subjects can be divided into high and low interference groups, depending on how much the incongruity affects their naming speed and accuracy. One-half of the subjects in each group were then made thirsty by a dry meal. All subjects were then tested on a size estimation task involving adjustments of variable disks to standards on which were pasted pictures of either "need" or "neutral" stimuli. An example of a need stimulus would be a coke bottle or ice water pitcher. It was found that "low interference" individuals overestimated the size of both categories of disks, while "high interference" individuals underestimated both categories of disks. It is again to be concluded that needs do not have a uniform effect on everyone's perception, but rather that perception might also be determined by perceptual categories or "Anschauung" that transcend specific need variables under investigation.

The conclusion is that the concept of cognitive or adaptive controls— has implications beyond the immediate task. For example, Klein (1958) discusses how the cognitive control of the leveling individual tends to provide him with relatively few perceptual categories to check situations with which he comes into contact. This in turn might well lead to an over-simplified view of the world. Perhaps the most comprehensive work in the area of the consequences of cognitive controls can be found in the relationships described by Witkin et al (1962). These investigators worked with the dimension of field dependence/field independence, and found associations with intelligence and general adjustment.

In support of the stability of cognitive controls, work reported by Witkin et al (1962) can be cited. One such reference is to the work of Bauman (1951). He investigated test-retest correlations on field independence/dependence measures. These correlations were found to range from the .70's to .90's over a period of a year.

Further evidence of stability is given by Fliegel's (1955) test-retest of high school students over three years. He found coefficients of stability for field dependence/field independence of .80 and .85 for women and men respectively. In another study Pollack et al (1960) tested field dependent/independent measures under drugs and found test-retest correlations in the middle to high .80's. In a more general study Gardner and Long (1960) retested subjects on a wide variety of cognitive control tests after an average of thirty-six months. On the whole, test-retest correlations were high and all were minimally significant at the .05 level. This is all the more important as most of the subjects had undergone major life changes since the initial testing.

Sharpening and Leveling: A Description and Review

The focus of this study will be with the cognitive control of sharpening-leveling. This measure is one of the first cognitive controls developed by Klein (1949,1951), and has also been one of the most productive. The dimension is best defined by a modification of the Schematizing Test developed by Hollingworth (1913). Subjects are told that they will see squares projected onto a screen and that they must judge the size of such squares in inches. Anchor slides of one inch and eighteen inches are shown to the subjects. These anchors are beyond the actual limits of the squares to be shown. Subjects are then presented with five squares singly and in ascending size order (1.2, 1.6, 2.0, 2.4, 2.8 inches). These squares are then presented two more times in the size rank patterns: 3,2,5,1,4 and 1,5,3,4,2 respectively. In the fourth series, slide number 20, a new square (3.2 inches), is substituted for the smallest square then in the series (i.e., the 1.2 inch square). After this initial size rank pattern, the second and third rank patterns are also repeated. The procedure continues until the subject has made 150 size judgements, i.e., nine substitutive procedures.

The measures to be derived from this type of technique are of two general types. First there is a measure of each subject's ranking accuracy. Ranking accuracy is defined by Gardner <u>et al</u> (1959) as the number of correct size placements within each series of 5 judgements. For convenience, this writer has decided to use the term rank error in this paper. Rank error is the percentage of incorrect rankings. Holzman and Klein (1954) advise that the possibility of error for a square changes depending upon its relative size in a given series of five square sizes. This decrease in accuracy, although expected in both levelers and sharpeners, appears as a 5-25% loss in accuracy in sharpeners and a loss of between 30 and 50% accuracy in levelers. This loss in ranking accuracy is also referred to in the literature as loss in intraseries accuracy.

The other measure derived from the Schematizing Test is the increment error score. Involved in this computation is a comparison of the objective shift of the standard squares, i.e., those projected onto the screen, and the way in which the subject shifts his estimates as the physical size of the squares increases. The difference between the actual percentage shift and subject's percentage shift is known as increment error.

Apparently the first tests involving the Schematizing Test employed only variations of the increment error score. In this connection, Klein and Schlesinger (1949) reported that three categories of increment error resulting from the Schematising Test were used. The first category included those subjects who progressively underestimated the size of the squares. This result Klein referred to as adaptive lag. A second response pattern began with a period of adaptive lag but then shifted to a more accurate reference level. The third was demonstrated by subjects who consistently and flexibly shifted their own reference levels, in accordance with the demands of the shifting squares. Those individuals with the greatest adaptive lag were called levelers, and those who shifted most accurately were called sharpeners. Modifications of this score are reported by Kratwohl and Cronbach (1956), Gardner et al (1959), and Gardner and Long (1960). This study will employ the Gardner et al (1959) version of increment error. Neither Klein nor other investigators have stated the numerical increment and rank error scores that define sharpening and leveling across a wide variety of subjects. It is quite probable that the sharpening subject in one experiment would qualify as a leveling subject in another investigation.

Another problem concerns a recent study, Holzman and Gardner (1960). In this investigation only ranking error was employed. In this case the resulting dimension has been labeled leveling and sharpening as though both measures had been calculated.

Kauffman (1962) has noted the differential effectiveness of the increment error and the ranking error scores in subject's performance in several laboratory tasks. If this differentiation holds, then two conclusions are possible:

1. Although useable in its complex form (i.e., with both ranking error and increment error considered) sharpening and leveling can also be subdivided into components for the prediction of certain types of functionings.

2. Klein's (1949) criticism concerning the use of complex indicators is now turned back on him. Klein maintained that if the indicator used was too complex in nature,

> i.e., could be broken down into component parts, subjects inconsistent in the various parts of the complex dimension would cancel each other out. The results of this cancellation would appear as insignificant difference scores between the two groups of subjects.

Other evidence concerning inconsistencies in error scores is found in the study of Holzman and Klein (1954). It was reported that about 25% of the subjects had to be disregarded because of differences in direction in their error scores. Taken in conjunction with the above conclusions, the importance of reporting Schematizing measures becomes obvious. A subject who is high in ranking accuracy and low in increment error will not perform identically with someone who has high ranking accuracy and high increment error. For example, Gardner et al (1959) (1960) and Kauffman (1962) report Pearson correlations of -.41 (N=30), -.40 (N=63), and -.26 (N=50) respectively between increment error and ranking accuracy for female subjects. Increment and rank error have thus been two separate defining criteria of the cognitive control of sharpening-leveling. In the present study, an additional composite score, the index error, will be employed. It consists of a combination of increment and rank error scores obtained through the use of centiles and z deviates.

The effectiveness of a cognitive control can best be seen in its relation to other performance. Among the earliest reports of such relations was a study in which Holzman and Klein (1950) divided subjects according to increment error. They then tested subjects on a Q sort compiled from Murray's definition of needs. Using Klein's original three categories it was found that the perceptual attitude of leveling was linked to the personality qualities of self-inwardness, retreat from objects, avoidance of competitive situations, exaggerated needs for succor and nurturance, self-abasement and passive drifting. It was concluded that

"The patterns of psychophysical response, gotten via the Schematizing Test, express stable perceptual attitudes and are predictive of personality tendencies"(p. 312).

Next Holzman and Klein (1954) attempted to anchor the perceptual dimension of sharpening-leveling in the Gestalt based trace system. The investigators felt that since there were differences in the degree to which new material was "assimilated" with older material, there would also be corresponding differences in the organization of the trace systems. It was proposed by Holzman and Klein (1954) and Holzman (1954) that the degree of time error could be predicted from knowledge of whether the individual was a leveler or a sharpener. The rationale followed from Lowenstein's (1933) explanation of the trace system. He postulated that the traces of a standard stimulus tended to assimilate with other processes simultaneously active in the brain field. Holzman and Klein (1954) selected subjects on the basis of consistent leveling or sharpening behavior on the Schematizing Test. Subjects were then tested for three conditions of time error: (1) No interpolated stimulus; (2) Visual stimulus between the standard and comparison stimuli; and (3) A brighter interpolated stimulus and then a dimmer interpolated stimulus between the standard and variable stimuli. As expected, the <u>direction</u> of the time error was the same for both groups, i.e., negative for conditions one and three, positive for condition two. However, in all three conditions levelers were shown to have greater degrees of time error than sharpeners. The authors concluded that:

> "Leveling may occur in a neural field where traces are weakly bound so that communication and fusion among the traces occurs easily. Sharpening, on the other hand, occurs in a brain field where the neural system has less permeable boundaries. It is further formulated that the autochthonous or self-distributive processes of the brain field which the Gestaltists

> have assumed to be unvarying may themselves vary according to the regulating principles of a different and more superordinate level than set, need, etc. Such an over all system would constitute one aspect of the hierarchy of regulatory principles implied by the concept of personality." (p. 120)

In an extension of this work, Holzman (1954) examined individual assimilation tendencies in the visual, auditory, and kinesthetic modalities. Both measures of sharpening-leveling were used, with both males and females. Levelers showed a significantly greater time error assimilation effect than did sharpeners. Furthermore, there was a positive tendency for the same people to respond with the same degree of assimilation in visual, auditory, and kinesthetic modalities. These results are consistent with a theory that cognitive attitudes are general dispositions of personality guiding a wide variety of behavior situations.

Other physiological theories have been proposed. For example, Kauffman (1962) suggests that assimilation may account for rank error, but that increment error is due to set (i.e., to the shutting out of new information rather than its assimilation with older material). On a physiological level he suggests that a hyperpolarization of the neurons occurs. It is this hyperpolarization that prevents new information from being processed.

The present writer feels that if the concept of hyperpolarization were valid one would find a negative correlation between increment error (hyperpolarization) and rank error (assimilation). However, most investigators report positive relations between these two indicators.

In another physiologically oriented theory of the sharpening-leveling process, Isreal (1966) attempted to relate this cognitive control and the orienting reflex. Her discussion views sharpening-leveling in terms of attention. She sees sharpening (hyperattentiveness) in terms of disrupted assimilation. If a subject could no longer discriminate between the novel and familiar), the adaptive physiological response would be attentiveness to more detail concerning stimuli that impinge on him. Isreal uses the term "adaptive" to imply that hyperattention need not be equated with anxiety. She views leveling as the manifestation of chronic damping differences due to depression of the reticular formation by cortical inhibitory systems.

This system does not seem at variance with Klein's original conceptual trace system. However, Hudesman's (1965) experiment, to be discussed later, does not support this relationship between sharpening-leveling and attention.

Klein and Smith (1953) and Klein (1958) extend the thesis of cognitive style. The expansion takes the form of a new integrative unit called the goal set. This is the goal or aim which serves to connect the units of behavior. However, the orientation of the subject in attaining this aim still manifests itself within the framework of his cognitive controls. Klein describes these controls as the action and transaction which determine what will be the adequately perceived result, be it in the judgement of squares or the search for food when one is hungry. Klein stresses that "effective perception does not mean uniform perception among people; conversely, individual differences in perception do not necessarily imply a distorting mechanism per se. They are merely adequate ways of taking hold of reality and providing a 'workable fit'" (1958, p. 99).

Perhaps the most complete work on cognitive controls in general has been that of Gardner _et al_ (1959). Sixty paid volunteers were employed, but the investigators did not control for such variables as age and education. In their report, the cognitive controls of sharpening-leveling; tolerance for unrealistic experience; equivalence range; focusing; constricted-flexible control; and field independence/dependence are examined individually and then are factor analyzed. The results for the dimension of sharpening-leveling are reported here.

The sharpening-leveling factor appeared for female and not for male subjects. However, the authors write that the sample size and other factors modify the importance of the sex differences. This disclaimer is supported by the research of Holzman (1954) and Holzman and Klein (1954), who employed both sexes and got positive results.

Levelers experienced greater degrees of kinesthetic time error. They also took longer to experience tilt as a result of using aniseikonic lenses. Performance on the Stroop Color Word Test was poorer for levelers. On a modified free association test, where a core word is given, levelers produced fewer numbers of ideas than sharpeners. The authors suggest that their associations, drawn from memory schemata, were organized in a rather global and undifferentiated manner. The content of leveler's associations was also relatively undifferentiated from the stimulus word. This was reflected in fewer distant associations to the stimulus word.

Sharpeners tended to have opposite results on the tasks cited. The authors caution that sharpening may not merely be the opposite of leveling. Evidence supporting their point will be presented when this discussion deals with the relationship between leveling-sharpening and the defense mechanisms.

The general conclusion based on the study is that sharpening-leveling manifests itself best in the organization of sequences of stimuli. The trace system of the leveling subject is relatively global, and tends to blur differences between incoming stimuli. The trace system of the sharpening subject is relatively more distinct and tends to accentuate differences between the incoming stimuli.

This differential processing of sequential stimuli prompted Hudesman (1965) to explore the relationship between sharpening-leveling and reaction time to simple consecutively presented auditory stimuli. The results showed levelers to have faster reaction times than sharpeners. This was taken as evidence that the relatively global trace system of the leveler is better suited for efficiently processing repetitive simple stimuli. It was also found that the within series variation for the sharpeners tended to be greater than that for levelers. This could be interpreted as representing a more homogeneous system for the leveler, which allowed for a more uniform and efficient response. On the basis of Holzman's (1954) findings, the assumption is made that Hudesman's findings in the auditory modality will also be operative in the visual modality to be used in this study.

Sharpening-leveling theory seems to lead to the prediction that as the stimuli become more complex the homogeneous trace system of the leveler will become progressively less efficient in coping with the increasingly complex task, and the distinct trace system of the sharpener will be more effective.

Another area that has been explored is the relationship between cognitive controls and the defense mechanisms. The door to much investigations was opened by Hartmann (1939) and other ego psychologists such as Klein (1958).

Concerning the relationship between cognitive controls and the defense mechanisms, there are several separate studies to be reported. The similarity between leveling and repression led Gardner <u>et al</u> (1959) to administer Rorschachs in order to determine predominant defenses. Eight of thirty male volunteers in the sample were judged to rely on repression as their principal defense. Of these eight, six were levelers, as indicated by scores in the upper half of the distribution of the sharpening-leveling scores. In the female example, repression was a predominant defense in eleven of the thirty women. Nine of these eleven were levelers. It is also important that neither the eight men nor eleven women repressors formed a significant proportion of those in the upper or lower halves of distributions for any of the other control principles listed earlier (p. 132). Similar results were obtained by Holzman and Gardner (1959) in a study which showed a similar relationship between six extreme repressors and extreme leveling ($p < .02$).

It is important to point out that the tendency is unidirectional. That is, while extreme repressors tended to be levelers, the converse was not true. An extreme leveler might or might not be unusually repressive. The unidirectionality of these relationships offers support for the hypothesis that cognitive controls provide preconditions for the emergence of defenses. In this view, repressors would emerge against the background of a general tendency towards maximal assimilation between present and past experiences and this would lead to a relatively undifferentiated memory organization. Therefore, repression may be a more likely defense in extreme levelers than in sharpeners. Although other conditions are necessary for the actual occurrence of repression, the tendency towards assimilation (leveling) seems to be a necessary antecedent condition.

In the area of learning and memory, Holzman and Gardner (1960) used a modified sharpening-leveling technique, intra-series ranking, to study memory scores. Subjects (16 levelers and 25 sharpeners) were each asked to write the story of the Pied Piper from memory. It was assumed they had once, long ago, learned the story but had not consciously committed it to memory. The rating was done quantitatively on the basis of breaking the original story into 11 thematic units and then determining how many of these units the subject used in the reproduction of his story. Results showed that sharpeners had a mean of 5.6 story units remembered while levelers averaged 3.3 units ($p < .02$). Sharpeners' reproductions of the Pied Piper story were half again as long as those of the levelers.

In a similar investigation, Gardner and Long (1960) presented five levelers and five sharpeners with a telephone type game. It involved the serial repetition of a folk tale through the respective groups. The story, Bartlett's "The Son Who Tried to Outwit His Father", was read to sharpener number 1 and leveler number 1. Each then passed the story onto the next member of his group. The results of such sequential transmission were related to the following criteria: (1) total number of themes; (2) number of correct themes; (3) number of new themes introduced; (4) number of transposed themes. The results showed sharpeners obtained higher scores for criteria 1, 2 and 4. There was no difference in the third criterion. Kauffman (1962) has questioned these results based on the small sample and statistics used in the evaluation.

In another study on learning, Gardner and Long (1960) had subjects learn two lists containing eight words each. The words had both high intra and interlist similarity. All words started with the letter "p", contained two syllables, and ended in "ed" (e.g., painted, patted, printed). The two lists, A and B, were presented eight times each via a memory drum. Subjects were then asked to reproduce both lists. The similarity of words as well as the brief time factor were intended to maximize the possible interaction between the lists. Results indicated that levelers tended to remember the words as well as sharpeners, but that they were less able to locate the words accurately within each list. The authors maintain that the lack of a significant difference is due to the rote nature of the task. They felt it was: "likely that assimilation phenomena may be more closely observed in learning situations which correspond more closely to the ordinary conditions of learning in everyday life", (p. 194).

The present writer feels that the evidence does not support such a conclusion. From these data, it is just as possible that no difference in intellectual activity actually exists in the leveling--sharpening differentiation. If so, this would make it different from field independence/dependence, since the latter has shown high correlations to certain measures of intellectual functioning. In contrast, most studies show that leveling--sharpening is primarily operative in the perceptual area. It has not, as would be true of a true cognitive control, been shown to be operative across various levels of functioning. Support for this is found in the work of Kauffman (1962), who finds the explanation offered by Gardner and Long (1960) "ad hoc". He makes the point: "if assimilation proneness is a characteristic of levelers, then these tasks should have elicited differences between levelers and sharpeners. These differences should have held despite the type of material used in the story, i.e., words or nonsense syllables" p. 15. The problem demands investigation; and the research to be reported will examine it.

Perhaps the most extensive investigation involving the relationship between sharpening--leveling and learning is to be found in the Gardner <u>et al</u> (1960) study of Personality Organization in Cognitive Control and Intellectual Abilities. Subjects, who were tested on major cognitive controls, were also given those tasks in French's (1954) "kit". This included tests of closure, flexibility, spatial ability, verbal knowledge, reasoning, ideational fluency, associative memory, induction and deduction. It was supposed that sharpening--leveling factors would be most operative where associative memory was also a factor. This was not borne out in the results. This prompted the authors to conclude that sharpening--leveling is largely unrelated to intellectual functioning (1960, p. 123). In the present study this hypothesis will be tested both by intelligence test scores and by finding whether as the visual stimuli become increasingly complex, and therefore correlated with intelligence, the cognitive control of sharpening--leveling will no longer be operative.

One such visually complex instrument is the Witkin (1950) Embedded Figures Test (E.F.T.). This test has been correlated with a wide variety of intellectual measures. Among these Witkin (1962) reports work done with the WISC, WAIS and Guilford's adaptive flexibility factor. Witkin reports an unpublished study by Woenerand and Levine (1950). Using field independent/dependent indices on a sample of 12 year old males, the authors report correlations of $r = .71$ and $r = .60$ between the field dependent/independent measures and the performance and verbal scales of the W.I.S.C. ($p < .01$).

In terms of adult scores, Witkin reports correlations of EFT scores with various W.A.I.S. performance indices. For Block Design and Picture Completion, he obtained correlations of $r = .80$ and $r = .72$ respectively. Both scores are significant ($p < .01$).

In the area of verbal factors, Witkin reports a correlation of $r = .39$ ($p < .05$) between the EFT performance and the W.A.I.S. comprehension score.

In terms of Duncker's insight problems, the results are very impressive. Using extreme scorers on the E.F.T., it was found that there was almost no overlap between field independence/dependence and solution of two insight problems (the box problem and the pliers problem) ($p < .01$).

In another study by Gardner et al (1960), parallel results were obtained. They found the E.F.T. to be related to a variety of verbal and non-verbal tasks. Significant results were obtained on tests of spatial relations, as well as vocabulary, associative memory and induction ($p < .05$). Here again the factors accounting for field independence seemed responsible for superior performance on a wide variety of test materials.

In another investigation, Bieri, Bradburn and Galinsky (1958) used a short form of the E.F.T. They found a significant relationship between E.F.T. performance and the mathematics portion of the Scholastic Aptitude Test. These authors found no significant relationship between the E.F.T. and the verbal portion of the test. In the present study, the Jackson (1956) abbreviated version of the E.F.T. will be employed. Jackson's results indicate that results on the abbreviated form correlated about .95 with results on the entire Witkin E.F.T.

In summarizing some of the above information, Witkin arrives, via factor analysis, at three basic elements or factors in intelligence tests: a verbal comprehension factor, an attention-concentration factor and an analytic field approach factor. It is this third factor that Witkin ties in with field dependence/independence. This is also the area into which fall those portions of intelligence tests which require the overcoming of embedding contexts, e.g., the WAIS Block Design subtest.

The picture is not altogether clear. A modification of the E.F.T., the C.H.E.F., was found to have a loading on the attention-concentration factor. Witkin writes in summary: "In the absence of more conclusive evidence, we are inclined to think that E.F.T. performance (also) requires some kind of attention-concentration ability" (1962, p. 67).

It is also possible that the results reported above are indicative of a wider trend. It has already been reported that the field dependent/ independent measures are correlated with a large variety of nonlanguage scores. These correlations have also been shown with respect to predominantly verbal areas of functioning.

There are several explanations for these results. The first involves the assumption of a g theory of intelligence. It would then follow that while the E.F.T. is heavily weighted on Witkin's analytic field approach it is also weighted on the g factor of intelligence. This could explain the highly consistent and significant results obtained between the E.F.T. and certain tests heavily weighted on this factor; e.g., the WAIS Block Design test. It could also account for the variability of findings in relating the E.F.T. to other areas of functioning, e.g., the significant relation between the E.F.T. and the Wide Range Vocabulary test (Gardner et al, 1960) vs. the nonsignificant relation between E.F.T. performance and the WAIS Vocabulary test (Witkin, 1962).

Another explanation would lie in the relationship between field independence and test taking behavior in general. Field independent individuals tend to show superior performance in those tests requiring a novel response to a situation, e.g., the insight problems of Duncker. It is possible that these people, by virtue of their development, have learned to trust their own judgement more and hence are able to bring forth a greater number of possibly relevant solutions in the testing situation. Field independent individuals would display more effective test taking behavior. This is in contrast to the field dependent subjects who find it difficult to come up with more than the standard solutions. This could explain the superior performance of field independent subjects in a performance situation.

In the present study subjects will be screened on the California Test of Mental Maturity short form level 5 1963 revision. This test consists of seven timed subtests in the areas of opposites, similarities, analogies, numerical values, number problems, verbal concepts and memory. These tests have been factor analyzed into four factors: logical reasoning, numerical reasoning, verbal concepts and memory. Based on the above evidence, one might expect superior performance by field independent subjects on total I.Q. scores. According to Witkin, the bulk of the superior performance should occur with the nonlanguage tests, opposites, similarities, numerical values and number problems. These correspond to factors 1 and 2: logical reasoning and numerical reasoning. Subjects in leveling--sharpening groups will be matched on the basis of their nonlanguage scores. Another reason for this is that the other tasks to be used in this study, i.e., reaction time and E.F.T., are basically performance tests.

Reaction Time

The measurement of the dependent variable to be employed in this study, reaction time, is itself complex. Therefore, it is necessary to examine those elements of the reaction time process that have a bearing on a person's ability to respond to a signal.

Most investigators maintain that individual readiness to respond is influenced by the foreperiod: i.e., the time between the ready signal and the reaction time signal. If the foreperiod is too short, the subject does not have enough time to get ready; if too long, the readiness fades away. The general question then is: what is the foreperiod at which subjects will respond optimally?

Using an auditory stimulus, Telford (1931) tested foreperiods of .5, 1.0, 2.0, and 4.0 seconds. His results indicated reliably shorter reaction times at 1.0 and 2.0 second foreperiods presentations. Similarly, Woodrow (1914) found the optimum foreperiod to be around 2.0 seconds.

In contrast, Teichner's (1954) review concludes that the optimum foreperiod might be anywhere from 1.5 seconds to 8.0 seconds for reaction time. To add to this controversy, Karlin (1959), using an auditory reaction time stimulus, has found the optimum, i.e., shortest reaction time, to vary inversely as a function of the foreperiod.

As previously mentioned, Hudesman attempted to fit reaction time performance into a cognitive control framework. He performed the following experiment. From an original sample of [redacted] subjects, he took the 20 most extreme male leveling and sharpening Ss (10 leveling and 10 sharpening subjects). These individuals were then tested on a reaction time procedure employing consecutively presented auditory stimuli. A wide range of foreperiods was employed: .5, 2-3, 5, and 8 seconds. Results indicated that there was a difference in foreperiods with results supportive of Karlin's (1959) findings.

Also relevant is that reaction time has been found indicative of certain physiological indices. In an investigation by Botvinick and Thompson (1966), reaction time was fractionated into premotor and motor components. This was based on the difference between EMG and finger lift responses. The EMGs were recorded from the extensor muscles of the recording forearm during measures of simple auditory reaction time. The premotor time was that period from the presentation of the stimulus to the appearance of increased muscle firing. The motor time was from this change in action potential to the finger lift response. Results showed that premotor time and reaction time were highly correlated. Motor time was poorly correlated with reaction time. It was concluded that set must be a premotor response.

This kind of evidence fits in with the present investigation, which theorizes that there is a relationship between the different "trace systems" of levelers and sharpeners with respect to reaction time. This thinking is based on Holzman and Klein's (1954) postulations previously described.

Further support for this line of reasoning derives from a summary work of Calloway (1962). He reviews several of his studies concerning the relationship between alpha activity and visual reaction time. Evidence is presented to indicate that for a given subject there is an enduring tendency for particular phases of the alpha cycle to be associated with the fastest or slowest reaction times. Again, this is indicative of the involvement of a relatively stable CNS influence on the reaction time process.

In another study, Umanskii and Shapiro (1965) investigated reaction time from the standpoint of stimuli, and the probability of presentation. Their dependent variable was the reaction time required to move a lever to one of four different positions dependent on stimulus type. Preliminary conclusions were that information transmission behavior is not only a function of the informational aspects of the task but also of the personality type. The personality type is seen by the authors in terms of speed and strength of the nervous system.

Another related area is the relationship between reaction time performance and personality characteristics. For example, one might expect that an anxious person would react faster than one who is not so anxious. In one investigation, Wenar (1954) found this to be the case. Anxious individuals did react faster to a buzzer than nonanxious subjects. The author then placed these results within the framework of Hullian theory, i.e., the thesis that if the habit factor is held constant, increases in drive level will lead to increases in response strength. There have been attempts to replicate these results, e.g., Farber and Spence (1956). The authors investigated several variables via a visual reaction time test. The dependent measure was the speed with which the subject pressed one of two keys 6" from the starting point. Results showed that four main effects were significant: men were consistently faster than women; reactions to brighter light were faster than to dimmer signals; choice reaction times exceeded simple reaction time; and within both, speed of movement increased with practice. However, no significance was found for the division of anxious and nonanxious individuals. In another experiment also dealing with manifest anxiety and reaction time (same article) the authors again found no evidence for the thesis that variations in anxiety affected reaction time in any manner, either as a main effect, or as a function of stress, task complexity, stimulus intensity, or generalization.

In a related study, Palermo (1961) measured starting speed and movement speed in a simple visual reaction time task. This was related to scores on the CMAS. A total of 113 sixth graders were given 40 trials each. Results show no differences in reaction time between high and low scores on the CMAS.

Similarly, Grice (1955) measured discrimination reaction time as a function of anxiety. Grice points out that in his sample of air force men TMAS scores differentiated out both anxiety and intelligence. In his work the reaction time apparatus contained four lights. One of the lights came on one second prior to the reaction time light. There were several variations in which several combinations of stimulus lights called for differential reactions: e.g., problem three consisted of red light right of green, push the right switch; red left of green push the left switch;

red up from green push upper switch and red down from green, push lower switch. In the instructions both speed and accuracy were emphasized. Resulting discrimination reaction times, when adjusted for intelligence, were not significant across the two levels of anxiety. Grice points out the importance of the intelligence factor in determining the reaction time score.

In a more extensive design, Turner (1962) examined discrimination reaction time as a function of anxiety and task difficulty. Turner criticized Grice's work in that there was no clearly identifiable scale of increasing difficulty. In his unpublished dissertation, Turner attempted to vary systematically the complexity of his stimulus material. This material was presented to high and low anxious groups of college students. Pre-testing showed no difference in intelligence between his two groups. His method of presentation was to display four checkerboard patterns to subjects. Complexity could be varied by changing the pattern of the checks. Subjects were instructed that three of the patterns were identical and one was dissimilar. The dependent measure was the time that it took the subject to determine the dissimilar pattern and to press a corresponding lever. Results revealed no significant difference attributable to the anxiety factor. Two points that Turner failed to take into account were:

1) his foreperiods were randomly varied between one and four seconds. Investigations already cited demonstrate that this factor can exert a significant influence on reaction time performance;

2) wrong reactions were handled in a dubious fashion. They were thrown out. This could also be responsible for altering the results. In the present study both factors will be controlled.

A publication by Clement (1962) supports Grice's (1955) findings. Clement tested 750 subjects ranging in age from 16 to 100 years. They pressed a lever in response to a light signal. His results showed that reaction time increases with age, and also that it is correlated +.25 with I.Q. . He also found the expected sex difference, with men having the faster reaction time.

CHAPTER II

SUMMARY PLAN OF THIS STUDY AND HYPOTHESES

This study proposes to examine the role of sharpening and leveling under three conditions of visual complexity. Based on Holzman's generalized conception of the trace system, it is expected that Hudesman's findings in the auditory modality will be operative in the visual modality. This is stated as Hypothesis 1.

> Hypothesis 1: When reactions to a simple repetitive visual stimulus are required of levelers and sharpeners, levelers will have shorter response latencies than sharpeners.

Sharpening--leveling theory leads to the expectation that as stimuli become more complex the homogeneous trace system of the leveling subject will become progressively less efficient in coping with the increasingly difficult task. The distinct trace system of the sharpener will become more effective. This is stated as Hypotheses 2.

> Hypothesis 2: When somewhat more complex and varied reactions are required of levelers and sharpeners, sharpeners will have shorter response latencies.

When the visual reaction is so complex as to require a high correlation with nonlanguage intellectual functioning, it seems possible that no relation will be found between sharpening--leveling and visual perception. This is stated as Hypothesis 3.

> Hypothesis 3: When visual stimuli are so complex that reactions to them are highly correlated with measures of intellectual functioning, there will

be no difference in the response latencies of leveling and sharpening subjects.

Since the foregoing hypotheses are independent of each other, each will be tested separately by t tests. All tests of significance will be two tailed.

CHAPTER III

PROCEDURE

Session 1: a. Klein Schematizing Test

Subjects were 78 paid male volunteers who were Psychology 1 day session students at the City College of New York. The reason for a nominal payment was that subjects were asked to appear on three separate occasions. It was hoped that the fee paid would keep the drop out rate to a minimum. To facilitate the screening process, up to twelve students were tested per session.

The following arrangements were made prior to the subjects' entrance into the Psychology Laboratory.

1. The slide projector, a voltex model #2, was set up on a table 137" from a blackboard panel which served as a screen. Arrangements were made to turn the projector on for a period of three seconds automatically and to turn the projector off automatically for a period of eight seconds. The apparatus employed for this purpose was a Stoelting Interval Timer, model #2001. The correctness of the designated interval was independently checked by a stop watch.

2. Equipment on the experimenter's table was arranged to form the sides of a rectangle. The purpose of these

obstructions was to enable the experimenter to place the various slides in the projector with a minimal chance that subjects would gain any hint from the experimenter's movements.

3. The slides consisted of 14 of the 16 slides that comprise the Klein Squares Schematizing Test. The present slides are reproductions of the originals.

The presented series consists of 2 anchor squares, 1.2 and 15 inches, for the smallest and largest anchors respectively. Dimensions for the other squares in the series are: 1.6, 2.0, 2.4, 2.8, 3.2, 3.8, 4.6, 5.5, 6.6, 7.9, 9.5, and 13.7 inches. Differences between these squares are all above the D. L.

During the actual administration the room lights were turned off and the shades drawn. There was still enough light so that subjects could write easily, but it was dark enough so that projected images were clear.

4. Subjects were admitted by the experimenter and shown to their seats. Once seated, the experimenter reintroduced himself as a student trying to "run his thesis". He then asked subjects to fill out the heading of the data sheet as he read each item in turn.

Although subjects were shown only 135 of the 150 Klein Squares, the data sheet had 150 spaces. This was done in order to prevent the subject from suddenly shifting his estimate - not because he saw the squares were getting larger, but rather because he realized he was getting to the end of the test.

After the heading on the data sheets was completed, the following instructions were given to the subjects:

> "I wish to see how well you can judge the size of squares. I'm going to show you a number of squares on the screen and I want you to tell me how big they are. The squares may range anywhere from about one inch to fifteen inches. This does not mean that you will necessarily get a square that is as small as one inch or as large as fifteen inches, although you may. The squares will always be somewhere within this range.
>
> "To help you judge the size of the squares, I will show you what a 1.2" square looks like, the smallest end of the range, and what a 15" square looks like, the largest end of the range."

(The 1.2" and the 15" squares were then exposed individually for three seconds each.)

> "I will show them to you again. I want you to write your estimation of the size of each square in its own numbered space. Thus, for square number one, record its size in inches next to space number one. Every so often I will call out what the number of the next square presentation will be. If for any reason you are out of step, just correct yourself at that point and fill in your estimate for the announced space. Please do not ask me to stop the procedure; just correct yourself.
>
> "After making an estimate, don't go back over your judgements to change them. In changing them you are more likely to be inaccurate. Please don't compare your estimate with anyone else or make any comment during the testing. Make your judgements independently.
>
> "Now to remind you once again of the range in which the squares will fall, I will show you again the smallest and largest ends of the range."

(The 1.2" and 15" squares were then exposed twice, with three seconds allowed for each exposure.)

> "Now we are ready to begin. You will see each of the following squares for only a few seconds. Look at the square all the time it is being projected, and make your estimation when it disappears. The next square you will see will be number one."

(Instructions adapted from Gardner <u>et</u> <u>al</u>, (1959) pp. 23-25.)

After the completion of the task, subjects were given a rest and a brief explanation of the test.

Session 1: b. Intelligence Testing

This part consisted of a group administration of the California Short Form Test of Mental Maturity, level 5, (1963 revision). The seating arrangement differed from Session 1.a. in that the experimenter sat facing the subjects. The experimenter handed out to each person an answer sheet No. 5559. It was placed face side up in front of the subject. In addition, each person received a pencil, a sheet of scratch paper and a copy of the test booklet, closed and face up. Instructions for filling out the answer sheet were read from pp. 16-18 of the examiner's manual (SF-5-63). As an added precaution a blackboard model of the answer sheet was used to demonstrate procedures as the instructions were read.

General instructions, for each of the seven tests, were read from the examiner's manual (pp. 18-21). All tests were timed by a stop watch.

After the completion of the test, subjects were given a brief explanation of the tasks. Subjects were paid one dollar and they were asked not to mention anything about the experiment to their classmates. As a further precaution, whenever possible, all volunteers from a given section were screened at the same time.

Selection of Subjects for Further Testing

Subjects selected for further testing were those who received consistent scores on the sharpening--leveling test. Two standard measures were derived from the Klein Squares Schematizing Test. The procedures for calculation of these measurements are explained in Appendix I. Since no cut off points have been published, criteria were selected to maximize the number of subjects in the sharpening and leveling groups. These criteria are in general accord with those of Gardner et al (1959). In order for an individual to be classified as a sharpening subject it was necessary for him to have an increment error of less than .5099 and a rank error of less than .1899. To be classified as a leveling subject it was necessary for an individual to have an increment error of more than .5100 and a rank error of more than .1900.

Nonlanguage I.Q. scores were inspected for sharpening and leveling subjects. There was no mean difference. If such a difference had occurred, the data would have been handled via covariance procedures. This would have taken account of differences in nonlanguage intelligence for sharpening and leveling subjects.

Simple and Intermediate Response Latency Conditions

This part of the study was carried out in a reaction time laboratory at the City College of New York (Appendix II.)

The experimenter met the subject outside the laboratory. The subject was asked: (1) "On the Schematizing Test did you receive any hint concerning square size through my movements or those of the other participants?" (2) "Do you have any hobbies that could influence your reaction time performance?" If the subject answered "yes" to either question, he was ineligible for the rest of the experiment.

No subjects were disqualified because of these questions.

Session II: a. Simple Response Latency, Simple Designs: Repeated

This condition was designed to test the first hypothesis.

The subject was introduced to the equipment in the following way:

> "Since it is necessary, because of noises and other factors, we will be working in separate rooms during the experiment. In order to talk to me you will use this microphone, and in order to hear what I am saying you will use these earphones.

The mike and earphones would be unnecessary if the rooms were quiet, but they are not. Since you will be reacting to visual material, I want to shut out as much extraneous noise as possible."

(At this point subject tried on the earphones, and then took them off.)

The experimenter moved to the reaction time key and said: "Are you a righty or lefty? O.K., then you will be using the second finger of your (right) (left) hand.

"Although I'll explain the procedure to you again, let me sketch it for you now. This will be a test of your reaction time, i.e., how fast you can react. You will be told to press down on the key. As soon as you hear this, press down immediately, and keep the key depressed. You don't have to press down hard since the key only requires light pressure. I will say 'press down' and you will push down on the key like this. After you press down a design will be flashed on the screen." (experimenter points to a screen) "This design will remain on the screen for a few seconds and then disappear. All this time you will keep the key depressed like this. After a short time the same or another design will be flashed on the screen. As soon as you see the second design let go of the key as quickly as you can, like this." (The experimenter then demonstrated letting go of the key.) "It is very important to wait until you actually see the second design. Do not let go beforehand. Several times I will say 'press down' and you will see the first design; but after the pause only a flash of light will appear. There will be no second design. If you react to this flash of light it may be necessary to start over again or to throw all of the data away. So it's really important not to release the key until you see the second design. O.K. Remember you are to react as fast as you can. Now I'm going to go into the other room and we'll try some practice trials on the screen. It will also give you a chance to try out the earphones and microphone."

(Experimenter then helped the subject on with the earphones and set up the screen.)

The instructions were then repeated, this time through the intercom system. At the end of the repeated instructions experimenter asked, "Are there any questions?" "O.K. just to check out, when I say 'press down' what will you do?" (subject answer). "Fine, you will then keep your finger down on the key while you see the first design and the pause between the designs. When do you release the key?" (subject answer) "Right, but remember only after you see the second design, because there will be catch tests, i.e.,

> times when you have the key depressed for the first design and pause, but you won't see a second design; only a flash of light will appear. Do not react to this. Keep the key depressed. O.K. any questions? O.K. let's try it out."

The instructions were followed by four practice trials, with a catch test on the third trial. This was followed by 33 experimental trials. A trial consisted of a green circle flashed on the ground glass panel for a period of four seconds. This was followed by a 1.5 second blank foreperiod. Then followed a presentation of another identical green circle. Subject had to react to this second green circle by releasing a telegraph key. To control for false starts three catch tests were interspersed as part of the series. The positions of the catch tests were: trial 8, trial 15 and trial 23. If the subject reacted to any one of these he was "severely" warned. If he responded to three of the tests he was dropped from the experiment. No subjects were dropped because of catch tests.

After the first series was completed, there was a rest period of about two minutes.

<u>Session II.</u> <u>b. Simple Response Latency, Simple Designs: Varied</u>

This condition was also designed to test hypothesis 1.

The subject was told:

> "This will be a second test of your reaction time. This series will be almost the same as the first. You will again see a design flashed on the screen for a few seconds. This design will then go off and a new one will appear. You are to release the key as soon as you see the second design flashed on the screen. Remember, if no design flashes on the screen, don't react. If a second image is any type of design at all, you are to release the key as quickly as possible."

This series again contained 33 trials with three catch tests. The positions of these tests were: trial 9, trial 16 and trial 25. A complete list of the designs used can be found in Appendix III.

After this series, there was another short rest period.

Session II: c. Intermediate Response Latency, Dual Designs: Varied

This condition was designed to test the second hypothesis.

The subject was instructed:

> "Now we come to the third test of your reaction time. This time the procedure is going to be somewhat different. You are again going to see a design flashed on the screen. This design will stay on the screen for a few seconds and then go off. This is the same as before. The difference is with the new slide that comes on. If the second slide contains a picture of the first design you are to release the reaction time key. By this I mean that the second design will have a design in it that has the same or just about the same shape and color as the first design. If the second design does not contain the first design you are not to react. This means that you are not to release the key. Now remember the second design only has to include the first design somewhere within the total context. It will always appear in the same position as the first design. You should also notice in this series I don't need any catch tests. Instead of a blank flash of light I will flash a second design that doesn't contain the first design somewhere within it."

This series contained 32 trials with three catch tests. The positions of these tests were: trial 2, trial 9 and trial 31.

After this series was completed, subject was given an explanation of the equipment.

Arrangements were made for the subject's next appointment. He was told that he would be paid at the end of the last session. All but two subjects agreed to this procedure. Those two were paid after each session.

Session III. a. Complex Response Latency: Embedded Figures Test

This condition was designed to test the third hypothesis.

This part of the experiment consisted of an administration of Jackson's (1956) abbreviation of Witkin's Embedded Figures Test. In this part of the study, the experimenter was seated next to the subject. Instructions were adapted from Witkin's (1950) procedure.

At the beginning of the experimental situation, the subject was given the following instructions:

> "I am going to show you a series of colored figures. Each time I show you one of these designs, I want you to describe the over-all pattern that you see in it. After you have examined each design, I will show you a simpler figure which is contained in that larger design. You will then be given the larger design again and your job will be to locate the smaller figure in it."

The subject was then shown the complex practice figure for 15 seconds, after which he was shown the simple practice figure for 10 seconds. The simple figure was then removed, and the complex figure was presented again. The subject was then instructed to outline the simple figure upon discovering it. The following instructions were then given.

> "This is how we will proceed on all trials. In every case the smaller figure will be present in the larger design. It will always be in the same position as shown you. There may be several of the smaller figures in the same design, but you are to look only for the one in the same position. Work as quickly as you possibly can, since I will be timing you. But be sure that the figure you find is exactly the same as the simple figure in size, proportion and position. As soon as you have found the figure let me know at once. If you ever forget what the small figure looks like, you may ask to see it again. Are there any questions?"

Subjects were required to indicate the location of the simple figures by tracing them with a stylus. They were not, however, allowed to use the stylus during the search for the simple figures. Time in seconds was recorded and the stopwatch was halted when the subjects found the simple figure. A three minute limit was used.

Session III. b. Taylor Manifest Anxiety Scale

The subject was handed a copy of the Biographical Inventory (a short form of the Taylor Manifest Anxiety Scale). While the subject filled out the form, the experimenter set up equipment in the adjoining room. This allowed the subject relative freedom in filling out the form.

After the completion of Section III. b., the subject was paid and given a full explanation of the experiment. He was also given the results of the Schematizing and Intelligence Tests.

CHAPTER IV

RESULTS

The correlation coefficient for increment and rank error scores for the 78 subjects screened was $r = +.074$. The correlation coefficient between increment and rank error scores for the 39 experimental subjects was found to be significant ($r = +.546$; $p < .001$). Despite this significance it is to be noted that the correlation accounts for only 30% of the variance.

If we keep increment and rank error separate, we have two disparate but overlapping groups of sharpeners and two of levelers. It is obviously desirable to obtain a single index for the two sharpening-leveling measures. A combined index error score based on centiles and corresponding z scores was formulated. The procedures for such calculations are indicated in Appendix I. Correlations between the index error scores and the increment and rank error scores are $r = +.911$ ($p < .001$) and $r = +.824$ ($p < .001$) respectively. Means and standard deviations of the error scores are presented in Table I, which also summarizes other scores, to be discussed below. Complete Schematizing scores for experimental subjects are shown in Appendix IV.

Table I also presents a summary of scores on the short form of the Taylor Manifest Anxiety Scale. The scores represent responses to 50 statements dealing with anxiety traits, and scores can range from zero to 50. A higher score indicates greater manifest anxiety. The test was employed to determine whether any differences in anxiety exist between experimental groups of sharpeners and levelers. Results indicate no difference in anxiety between these two groups under these test conditions ($t = .42$).

A major phase of this investigation consisted of a series of tests to measure response latencies. Three of these tests were variations of type c disjunctive reaction time (Woodworth and Schlosberg, 1954). This method required the subject to react to certain stimuli while not reacting to other presented stimuli. The fourth test consisted of average solution times for an abbreviated version of the Witkin Embedded Figures Test. Because of the skewed nature of these four distributions a transformation was indicated. Edwards (1963) suggests that the reciprocal transformation is useful in studies where time to solution is the dependent variable. He specifically includes the examples of reaction time and problem solving in his discussion. Therefore it was decided that a reciprocal transformation would be employed for all response latency measures in this experiment. The mean scores for these transformations for experimental subjects are presented in Appendix VII. The reciprocal scores for simple and intermediate conditions are in units of a hundredth of a second. E.F.T. scores are in reciprocal units based on one second. (If equivalent reciprocal scores had been employed the resulting E.F.T. scores would have been too extreme.)

Table I presents the reciprocal means, reciprocal standard deviations, and resulting t values for sharpeners and levelers for the four response latency conditions. The four treatments are ordered from hypothesized low to high perceptual complexity rather than in their administered order. As a result of the reciprocal transformation a smaller number indicates a longer response latency. This holds true between sharpening and leveling groups. It should be noted that t tests among response latency conditions indicate three different levels of perceptual complexity. t tests of these levels of complexity show no difference between sharpeners and levelers on the four response latency conditions.

An examination was also made by dividing sharpening-leveling into its component error scores. This was done via a correlation matrix relating measures of sharpening-leveling to the conditions of visual complexity. These findings are presented in Table II.

The data in Table II indicate several types of significant relationships. As stated earlier, correlations between all sharpening--leveling error scores are significant ($p < .001$). Both increment and index error scores are related to response latency for the Dual designs series ($p < .05$). The negative correlation indicates that the higher the error score, the longer the response latency to the Dual designs series.

There are significant positive correlations between responses to the first three levels of visual complexity ranging from $r = +.677$ to $r = +.817$. These associations do not carry through for the highly complex level, the Embedded Figures Test (E.F.T.). Correlations between simple and intermediate levels are significantly different from correlations with the E.F.T. This indicates that the properties of the E.F.T. are different from those being measured under the first three response latency conditions.

Table I presents the means, standard deviations and resulting t values for sharpeners and levelers for relevant measures on the California Short Form Test of Mental Maturity-level 5 (1963 revision). Complete scores for all experimental subjects are presented in Appendix V. All scores were calculated in accordance with the test manual. For this study only raw scores were employed. The alternative would have been percentile scores which took into account the age of the individual. The rationale for using raw scores was that the Klein Squares Schematizing Test had no similar provision for age differences. The weighting procedure would therefore have unevenly affected older and younger subjects in other areas of the experimental situation. Results indicate no significant difference between the groups on any measure of intellectual functioning employed. One measure, logical reasoning, was suggestive with t = 1.93 ($p < .10$).

A division of sharpening--leveling error scores into their three component measures was performed. Pearson product moment correlations were calculated between each of the three measures of sharpening--leveling and the measures of intellectual functioning. These findings are presented in Table III. For the sharpening--leveling component scores, the results indicate that increment error scores are related to logical reasoning as well as to total intelligence test scores ($p < .05$). Rank error and index error scores are associated with verbal concept scores ($p < .05$). These correlations indicate that sharpeners tend to have higher intelligence test scores on logical reasoning, verbal concepts, and total intelligence. The data therefore reflect some relationship between sharpening--leveling and intellectual functioning.

Pearson correlation coefficients between measures of intelligence and response latency are presented in Table IV. There are two interesting types of associations indicated by these results. One is the existence of significant relationships between these two variables. The second is that the strongest of these associations occurs between response latency and language intelligence. With reference to the second relationship, it would be expected that if associations existed between intelligence and response latency they would be reflected primarily in the nonlanguage portion of the intelligence test. Inspection of Table IV indicates no such relationships. The source of present connections raises theoretical problems.

In recognizing that relationships between response latency and intelligence exist, a problem for this study becomes apparent. It is now clear that intelligence contributes to the variance of both response latency and sharpening--leveling error scores. It is therefore necessary to partial out the effects of intelligence when considering relationships between response latency and the various error scores. Partial correlations were calculated between error scores and response latencies with the effects of intelligence measures held constant. The results of these partial correlations are presented in Table V. None of the resulting correlations reach [redacted], significance. The conclusion, therefore, must be that the correlations presented in Table II are inflated by a third variable, intelligence. When this variable is statistically controlled as in Table V, significance disappears.

Since none of the expectations were realized, it was decided that some exploratory data groups should be created. These will be examined in the next section.

<u>Examination of Exploratory Groups</u>

Several investigators when confronted with the problem of no significance for initial samples, have alternatively limited comparisons to extreme scoring groups. Spence (1958) found significance for extreme scorers on the Taylor Manifest Anxiety Scale where none was found when the entire sample was employed. Eysenck (1950) has labeled this procedure, the use of criterion groups.

In an attempt to test the hypotheses in a more refined, albeit post hoc manner, several criterion groups were established. Criterion groups were determined on the basis of extreme increment error scores, extreme rank error scores, and extreme index error scores. Each group consisted of 20 subjects, ten extreme sharpeners and ten extreme levelers. Summaries of the results of these group formations are presented in Tables VI, VII and VIII. A complete listing of criterion subjects for all groups is presented in Appendix VI.

Tables VI, VII and VIII also present comparisons for criterion groups on the Taylor Manifest Anxiety Scale. Results indicate no difference within any of the criterion groups examined.

For extreme error groups t tests between conditions of response complexity indicated three different levels of complexity.

For the extreme increment error group, t tests were conducted between sharpening and leveling groups and each of the four response latency measures. The reciprocal means, reciprocal standard deviations, and resulting t values for these comparisons are presented in Table VI. No differences were found in this comparison.

A parallel group of comparisons was then performed for the extreme rank errors. The reciprocal means, reciprocal standard deviations and resulting t values are presented in Table VII. Comparisons here indicate a significant difference between sharpening and leveling groups for the Dual designs: varied series. Extreme sharpeners have shorter response latencies ($p < .02$).

The third parallel series of comparisons, using the index error score, is consistent with the results of the rank error scores. Table VIII shows the comparison between sharpeners and levelers based on index error scores. Results again indicate that extreme sharpeners respond more quickly than extreme levelers ($p < .01$) to the Dual designs series.

For a further analysis, separate correlation matrices were set up for each of the extreme subject groups, as shown in Tables IX, X and XI.

Table IX A shows the correlations between increment error scores of extreme sharpeners and response latency. Most apparent are the associations of the increment error score with both simple and intermediate measures of response latency. These values indicate that for extreme sharpening subjects, response latency decreases as increment error decreases. It should be noted that in contrast, response latency for the E.F.T. series shows no evidence of any relationship to increment error. Again this is supportive of the earlier finding that the visual properties in the E.F.T. are different from the properties of the tasks that are at simple or intermediate levels of perceptual complexity.

In contrast to these findings, Table IXB shows that there is no evidence relating increment error to any of the response latencies for leveling subjects.

Table X indicates a somewhat puzzling reversal of the data in the previous Table IX. Results here indicate no relationships between rank error scores for extreme sharpening subjects and the four series of perceptual tasks. In contrast, the rank error correlations for leveling subjects and the response latency tasks indicates that for simple visual situations, higher rank error scores are associated with faster responses.

Another result is that for one series of simple response latency (Simple designs: varied) the sharpening and leveling correlations are statistically different ($p < .05$). For the other simple response series, (Simple designs: repeated) the relationship falls just short of significance.

Table XI describes the relationship between extreme index error scores and the four series of response latencies. Results indicate no evidence of such association.

Another problem for investigation is the relationship between extreme scoring sharpening-leveling subjects and areas of intellectual functioning. Again the three divisions of increment error, rank error, and index error are employed. The means, standard deviations and resulting t values for these comparisons have already been presented in Tables VI, VII and VIII.

Table VI compares the performance of the sharpeners and levelers (increment error) on the California Short Form Test of Mental Maturity. Results of t tests indicate no differences between the two groups on any of the measures employed.

Table VII compares extreme subject groups (rank error) and various intelligence test measures. Here results indicate that sharpeners obtain higher scores in the areas of verbal concepts, memory and language intelligence ($p < .05$).

Table VIII shows a similar comparison of sharpening--leveling, based on index error scores, and measures of intelligence. The results here are most impressive, indicating that sharpeners obtain higher scores than levelers in the areas of logical reasoning ($p < .02$), memory ($p < .05$), nonlanguage intelligence ($p < .02$), language intelligence ($p < .05$) and total intelligence ($p < .01$).

The conclusion based on the data presented in Tables VII and VIII is that there are definite differences in intellectual functioning when comparisons are made between extreme scoring of rank and index error scores on the California Short Form Test of Mental Maturity.

Table XII presents matrices that were set up to test correlations between the measures of the Klein Squares Schematizing Test and intellectual functioning, measured by the California Short Form Test of Mental Maturity. Results indicate no significant associations between increment error scores and intellectual activities for either extreme sharpening or leveling subjects. Based on rank error, extreme sharpeners show significant correlations with logical reasoning ($p < .01$), nonlanguage intelligence ($p < .05$), and total intelligence ($p < .01$). For extreme levelers, there were no similar relationships.

Correlations between index error scores and the intelligence test reveal no significant associations for either extreme sharpening or leveling subjects.

As in the first results section, it was desirable to determine the possibility of relationships between intelligence and response latency, for each of the three criterion groups. The results are presented in Tables XIII, XIV and XV. Examination of Table XIII A indicates that for extreme sharpeners there are several significant correlations between response latency and measures of intelligence. Again it is mostly the language and total intelligence scores that are significantly related to response latency. By contrast, Table XIII B shows no evidence of any relationship between response latency and intelligence for levelers when the increment error criterion is employed.

Table XIV presents relationships between response latency and intelligence for the rank error criterion. It is notable that in this Table there are no significant relationships for either sharpening or leveling subjects.

Table XV presents the relationships between response latency and intelligence for the index error criterion. Here there is a reversal of the results presented in Table XIII. While there are no relationships between intelligence and response latency for sharpeners, there are several indications of significant relationships between intelligence and response latency for extreme leveling subjects. Again the significant relations are in the areas of language and total intelligence test scores.

Based on the above findings it was possible to compute a series of partial correlations. Tables XVI and XVII present partial correlations between the various error scores and response latency with the effects of intelligence held constant.

Table XVI presents these partial correlations for sharpening subjects. The results of these correlations indicate only two instances of significant relationships between extreme error scores and response latency for sharpening subjects. One is between increment error and response latency for Simple design: varied, with the effect of language I.Q. held constant, $r = -.640$ ($p < .05$). The other significant relationship is between the index error score and Simple designs: repeated with non-language intelligence held constant, $r = -.653$ ($p < .05$).

Table XVII presents the partial correlations for leveling subjects. These results are somewhat more consistent. All correlations between rank error and Simple designs (repeated and varied) are significant ($p < .01$). Also significant is the relationship between the index error score and Simple designs: repeated, with the effects of language intelligence held constant.

Tables XVI and XVII indicate that extreme levelers show a more consistent relation than sharpeners to simple response latency when rank error is employed to define sharpening and leveling.

It should be noted that in comparing the various groups, both experimental and exploratory, a large number of calculations were employed. This increases the risk of an alpha or type I error. However, out of 272 calculations, 64 or 23% are significant. This high percentage of significant results, indicates that there is more operative than chance or a type I factor.

TABLE I

SUMMARY OF SCORES OF SHARPENERS AND LEVELERS

	Sharpeners (N=20) Mean	S.D.	Levelers (N=19) Mean	S.D.	t
Schematizing Test					
Increment Error	.3072	.1658	.7738	.1892	--
Rank Error	.1662	.0246	.2307	.0429	--
Index Error	162	78	470	110	--
Taylor Manifest Anxiety Test	15.5	9.9	14.4	5.8	.42
Response Latency, Reciprocal Scores					
Simple design:varied	271.8	43.8	273.2	38.4	.10
Simple design:repeated	291.1	60.9	284.8	43.9	.36
Dual designs:varied	233.0	33.7	218.0	21.7	1.64
Embedded Figures Test	1053.9	513.9	868.1	441.7	1.21
Intelligence Test - Raw Scores					
Logical Reasoning	32.6	5.0	29.7	4.8	1.93
Numerical Reasoning	19.0	2.8	20.1	3.4	1.10
Verbal Concepts	22.2	1.9	21.3	2.3	1.34
Memory	20.2	3.4	19.1	2.9	1.10
Non-Lang. Intelligence	45.5	6.2	42.7	6.2	1.42
Language Intelligence	48.6	4.9	47.6	5.8	0.58
Total Intelligence	94.1	9.5	90.3	9.7	1.24

TABLE II

PEARSON PRODUCT MOMENT CORRELATIONS BETWEEN INDICES OF SHARPENING-LEVELING AND CONDITIONS OF VISUAL COMPLEXITY

($N^1 = 39$)

	Rank Error	Index Error	Simple Designs: Varied	Simple Designs: Repeated	Dual Designs: Varied	Embedded Figures Test
Increment Error	+.546[c]	+.911[c]	-.182	-.240	-.331[a]	-.158
Rank Error		+.824[c]	+.022	-.088	-.288	-.181
Index Error			-.127	-.191	-.352[a]	-.211
Simple Design: Varied				+.817[b]	+.786[b]	+.022
Simple Design: Repeated					+.677[a]	-.088
Dual Design: Varied						-.283

[a] $p < .05$

[b] $p < .01$

[c] $p < .001$

TABLE III

PEARSON PRODUCT MOMENT CORRELATIONS BETWEEN INDICES OF SHARPENING-LEVELING AND MEASURES OF INTELLECTUAL FUNCTIONING ($N^1 = 39$)

	Increment Error	Rank Error	Index Error
Logical Reasoning	-.331[a]	-.201	-.298
Numerical Reasoning	-.021	+.080	+.003
Verbal Concepts	-.269	-.344[a]	-.326[a]
Memory	-.270	-.223	-.298
Non-Language Intelligence	- 271	-.149	-.239
Language Intelligence	-.275	-.238	-.306
Total Intelligence	-.327[a]	-.227	-.323

[a] $p < .05$

TABLE IV

PEARSON PRODUCT MOMENT CORRELATIONS BETWEEN RESPONSE LATENCY AT THREE LEVELS OF VISUAL COMPLEXITY AND MEASURES OF INTELLIGENCE ($N^{1}=39$)

	Non-Language Intelligence	Language Intelligence	Total Intelligence
Simple Designs: Varied	+,105	+.371[a]	+.275
Simple Designs: Repeated	+.060	+.283	+.196
Dual Designs: Varied	+.216	+ .452[c]	+.390[b]

[a] p ∠.05

[b] p ∠.02

[c] p ∠.01

TABLE V

PARTIAL CORRELATIONS BETWEEN INDICES OF SHARPENING-LEVELING AND RESPONSE LATENCIES WITH INTELLIGENCE FACTORS HELD CONSTANT (N^1=39)

Response Latency	Intelligence Factor Being Held Constant	Partial Correlation Coefficient		
		Increment Error	Rank Error	Index Error
Simple Designs: Varied	Non-Language Intelligence	-.161	+.043	-.105
	Language Intelligence	-.089	+.122	-.015
	Total Intelligence	-.102	+.089	-.042
Simple Designs: Repeated	Non-Language Intelligence	-.233	-.081	-.182
	Language Intelligence	-.176	-.022	-.115
	Total Intelligence	-.190	-.046	-.138
Dual Designs: Varied	Non-Language Intelligence	-.291	-.232	-.317
	Language Intelligence	-.243	-.215	-.239
	Total Intelligence	-.234	-.223	-.260

TABLE VI

SUMMARY SCORES OF EXTREME SHARPENERS AND EXTREME LEVELERS ASSIGNED ON THE CRITERION OF INCREMENT ERROR

	Sharpeners (N = 10)		Levelers (N = 10)		
	Mean	S.D.	Mean	S.D.	t
Schematizing Test					
Increment Error	.1760	.1319	.9121	.1528	--
Taylor Manifest Anxiety Scale	15.6	12.6	14.7	6.7	0.18
Response Latency--Reciprocal Score					
Simple designs: varied	275.4	44.8	260.0	20.0	0.99
Simple designs: repeated	304.0	56.5	272.7	31.2	1.53
Dual design: varied	231.4	38.2	218.2	16.7	1.00
Embedded Figures Test	967.3	471.9	809.8	457.3	0.75
Intelligence Test--Raw Scores					
Logical Reasoning	32.5	6.4	29.7	5.2	1.02
Numerical Reasoning	19.7	3.1	19.4	3.1	0.20
Verbal Concepts	22.2	1.7	20.8	2.6	1.35
Memory	20.3	4.2	18.1	2.9	1.29
Non-Language Intelligence	46.0	7.7	42.7	6.3	0.99
Language Intelligence	48.7	5.5	45.3	6.6	1.18
Total Intelligence	94.7	12.0	88.0	10.9	1.24

TABLE VII

SUMMARY SCORES OF EXTREME SHARPENERS AND EXTREME LEVELERS ASSIGNED ON THE CRITERION OF RANK ERROR

	Sharpeners (N = 10) Mean	S.D.	Levelers (N = 10) Mean	S.D.	t
Schematizing Test					
Rank Error	.1495	.0255	.2569	.0452	--
Taylor Manifest Anxiety Scale	12.8	8.3	14.8	7.3	0.54
Response Latency, Reciprocal Scores					
Simple design: varied	279.7	44.1	261.3	42.6	0.94
Simple design: repeated	316.1	68.1	268.2	44.5	1.86
Dual design: varied	242.2	28.7	210.0	20.3	2.89[b]
Embedded Figures Test	992.3	507.7	797.1	341.7	1.00
Intelligence Test-Raw Scores					
Logical Reasoning	33.5	4.4	30.2	5.3	1.43
Numerical Reasoning	20.2	2.6	19.5	3.3	0.50
Verbal Concepts	22.7	2.2	20.2	2.3	2.35[a]
Memory	21.4	2.1	18.5	3.4	2.21[a]
Non-Language Intelligence	47.1	5.2	43.4	6.6	1.32
Language Intelligence	50.7	4.0	45.0	6.4	2.27[a]
Total Intelligence	97.7	6.7	88.4	11.6	2.08

[a] $p < .05$

[b] $p < .02$

TABLE VIII

SUMMARY SCORES OF EXTREME SHARPENERS AND EXTREME LEVELERS ASSIGNED ON THE CRITERION OF INDEX ERROR

	Sharpeners (N = 10) Mean	Sharpeners (N = 10) S.D.	Levelers (N = 10) Mean	Levelers (N = 10) S.D.	t
Schematizing Test					
Index Error	99	59	549	89	--
Taylor Manifest Anxiety Scale	16.0	12.4	14.8	7.5	0.24
Response Latency, Reciprocal Scores					
Simple Design: varied	292.1	34.8	267.2	39.1	1.50
Simple Design: repeated	320.3	59.0	274.7	40.1	2.02
Dual Designs: varied	245.6	22.2	216.3	13.9	3.53[c]
Embedded Figures Test	1040.5	504.5	802.7	467.3	1.09
Intelligence Test--Raw Scores					
Logical Reasoning	34.0	4.6	28.7	3.8	2.60[b]
Numerical Reasoning	20.5	2.2	19.5	3.2	0.81
Verbal Concepts	22.3	2.2	20.1	2.4	2.03
Memory	21.2	2.3	18.2	3.2	2.29[a]
Non Language Intelligence	48.2	5.1	41.9	4.9	2.68[b]
Language Intelligence	49.8	3.9	44.6	6.2	2.13[a]
Total Intelligence	97.7	6.7	86.5	9.1	3.03[c]

[a] $p < .05$

[b] $p < .02$

[c] $p < .01$

TABLE IX

PEARSON PRODUCT MOMENT CORRELATIONS BETWEEN EXTREME SHARPENING AND EXTREME LEVELING INCREMENT ERROR SCORES AND RECIPROCAL RESPONSE LATENCIES, FOR FOUR LEVELS OF VISUAL COMPLEXITY

	Simple Designs: Varied	Simple Designs: Repeated	Dual Designs: Varied	Embedded Figures Test
A. SHARPENERS (N^1=10)				
Extreme Increment Error	-.747[b]	-.646[a]	-.688[a]	+.033
Simple Design:Varied		+.745[b]	+.930[d]	+.031
Simple Design:Repeated			+.785[c]	+.022
Dual Designs:Varied				-.130
B. LEVELERS (N^1=10)				
Extreme Increment Error	-.008	+.008	-.387	-.132
Simple Design:Varied		+.715[a]	+.725[b]	-.166
Simple Design:Repeated			+.586	-.620
Dual Designs:Varied				-.438

[a] $p < .05$

[b] $p < .02$

[c] $p < .01$

[d] $p < .001$

TABLE X

PEARSON PRODUCT MOMENT CORRELATIONS BETWEEN EXTREME SHARPENING AND EXTREME LEVELING RANK ERROR SCORES AND RECIPROCAL RESPONSE LATENCIES FOR FOUR LEVELS OF VISUAL COMPLEXITY

	Simple Designs: Varied	Simple Design: Repeated	Dual Design: Varied	Embedded Figures Test
A. SHARPENERS (N^1=10)				
Extreme Rank Error	-.241	-.014	-.041	+.008
Simple Designs:Varied		+.939[c]	+.869[b]	+.352
Simple Designs:Repeated			+.835[b]	-.241
Dual Designs:Varied				+.293
B. LEVELERS (N^1=10)				
Extreme Rank Error	+.771[b]	+.823[b]	+.299	-.146
Simple Design:Varied		+.928[c]	+.648[a]	+.302
Simple Design:Repeated			+.616	+.069
Dual Design:Varied				+.088

[a] $p < .05$

[b] $p < .01$

[c] $p < .001$

TABLE XI

PEARSON PRODUCT MOMENT CORRELATIONS BETWEEN EXTREME SHARPENING AND EXTREME LEVELING INDEX ERROR SCORES AND RECIPROCAL RESPONSE LATENCIES FOR FOUR LEVELS OF VISUAL COMPLEXITY

	Simple Designs: Varied	Simple Designs: Repeated	Dual Designs: Varied	Embedded Figures Test
A. SHARPENERS (N^1=10)				
Index Error	-.372	-.387	-.410	+.306
Simple Designs:Varied		+.794[b]	+.710[a]	+.211
Simple Designs:Repeated			+.787[b]	+.197
Dual Designs:Varied				-.087
B. LEVELERS (N^1=10)				
Index Error	+.238	+.478	-.077	-.291
Simple Designs:Varied		+.892[c]	+.578	+.194
Simple Designs:Repeated			+.459	-.147
Dual Designs:Varied				-.094

[a] $p < .05$

[b] $p < .01$

[c] $p < .001$

TABLE XII

PEARSON PRODUCT MOMENT CORRELATIONS BETWEEN ERROR SCORES OF EXTREME SHARPENERS AND EXTREME LEVELERS AND MEASURES OF INTELLECTUAL FUNCTIONING

	Logical Reasoning	Numerical Reasoning	Verbal Concepts	Memory	Non-Language Intelligence	Language Intelligence	Total Intelligence
A. SHARPENERS (N^1=10)							
Increment error	-.617	-.466	-.471	-.283	-.602	-.503	-.619
Rank error	+.776[c]	+.019	+.491	+.336	+.639[a]	+.484	+.773[b]
Index error	+.558	-.177	-.050	-.152	+.605	-.341	+.234
B. LEVELERS (N^1=10)							
Increment error	-.299	-.234	-.140	-.217	-.161	-.349	-.303
Rank error	-.364	+.332	-.312	+.018	-.241	+.014	-.130
Index error	-.521	-.333	-.116	-.275	-.368	-.389	-.467

[a] $p < .05$

[b] $p < .02$

[c] $p < .01$

TABLE XIII

EXTREME SHARPENING AND EXTREME LEVELING INCREMENT ERROR SCORES: PEARSON PRODUCT MOMENT CORRELATION FOR RESPONSE LATENCY AT THREE LEVELS OF VISUAL COMPLEXITY AND MEASURES OF INTELLIGENCE

	Non-Language Intelligence	Language Intelligence	Total Intelligence
A. SHARPENERS (N^1=10)			
Simple design: varied	+.649[a]	+.677[a]	+.730[b]
Simple design:repeated	+.574	+.592	+.643[a]
Dual design: varied	+.619	+.796[c]	+.767[c]
B. LEVELERS (N^1=10)			
Simple design:varied	+.417	+.304	-.059
Simple design:repeated	-.513	+.120	-.225
Dual design:varied	-.126	+.504	+.230

[a] $p < .05$

[b] $p < .02$

[c] $p < .01$

TABLE XIV

EXTREME SHARPENING AND EXTREME LEVELING RANK ERROR SCORES: PEARSON PRODUCT MOMENT CORRELATION FOR RESPONSE LATENCY AT THREE LEVELS OF VISUAL COMPLEXITY AND MEASURES OF INTELLIGENCE

	Non-Language Intelligence	Language Intelligence	Total Intelligence
A. SHARPENERS (N^1=10)			
Simple design: varied	+.066	+.038	+.086
Simple design: repeated	+.333	+.063	+.300
Dual design: varied	+.223	+.246	+.322
B. LEVELERS (N^1=10)			
Simple design: varied	-.161	+.293	+.069
Simple design: repeated	-.385	+.050	-.194
Dual design: varied	-.295	+.157	-.083

TABLE XV

EXTREME SHARPENING AND EXTREME LEVELING INDEX ERROR SCORES: PEARSON PRODUCT MOMENT CORRELATIONS FOR RESPONSE LATENCY AT THREE LEVELS OF VISUAL COMPLEXITY AND MEASURES OF INTELLIGENCE

	Non-Language Intelligence	Language Intelligence	Total Intelligence
A. SHARPENERS (N^1=10)			
Simple design: varied	-.087	-.305	-.222
Simple design: repeated	+.203	-.011	+.156
Dual design: varied	+.015	+.247	+.162
B. LEVELERS (N^1=10)			
Simple design: varied	+.070	+.495	+.378
Simple design: repeated	-.206	+.322	+.108
Dual design: varied	+.309	+.831[b]	+.738[a]

[a] $p < .02$

[b] $p < .01$

TABLE XVI

PARTIAL CORRELATIONS BETWEEN ERROR SCORES OF EXTREME SHARPENERS AND RESPONSE LATENCIES WITH INTELLIGENCE FACTORS HELD CONSTANT (N^1=10)

Response Latency	Intelligence Factor Being Held Constant	Partial Correlation Coefficient: Increment Error	Rank Error	Index Error
Simple Design: Varied	Non-Language Intelligence	-.589	-.369	-.404
	Language Intelligence	-.640[a]	-.296	-.532
	Total Intelligence	-.552	-.486	-.338
Simple Design: Repeated	Non-Language Intelligence	-.461	-.310	-.653[a]
	Language Intelligence	-.502	-.050	-.415
	Total Intelligence	-.413	-.405	-.441
Dual Design: Varied	Non-Language Intelligence	-.504	-.244	-.527
	Language Intelligence	-.521	-.188	-.358
	Total Intelligence	-.425	-.495	-.466

[a] $p < .05$

TABLE XVII

PARTIAL CORRELATIONS BETWEEN ERROR SCORES OF EXTREME LEVELERS AND RESPONSE LATENCIES WITH INTELLIGENCE FACTORS HELD CONSTANT (N^1=10)

Response Latency	Intelligence Factor Being Held Constant	Partial Correlation Coefficient		
		Increment Error	Rank Error	Index Error
Simple Design: Varied	Non-Language Intelligence	-.083	+.766[b]	+.284
	Language Intelligence	-.127	+.803[b]	+.538
	Total Intelligence	-.026	+.788[b]	+.506
Simple Design: Repeated	Non-Language Intelligence	-.087	+.817[b]	+.443
	Language Intelligence	+.052	+.824[b]	+.692[a]
	Total Intelligence	-.064	+.820[b]	+.601
Dual Design: Varied	Non-Language Intelligence	-.416	+.246	+.040
	Language Intelligence	-.262	+.230	+.480
	Total Intelligence	-.343	+.292	+.448

[a] $p < .05$

[b] $p < .01$

CHAPTER V

DISCUSSION

The first hypothesis stated that under operationally defined, visually simple conditions, levelers would respond faster than sharpeners. No mean difference was found. The hypothesis was not supported in the form stated.

The second hypothesis stated that when stimulus conditions approached an intermediate level of visual complexity, the more distinct trace system of the sharpener would permit faster responses. No mean difference between sharpeners and levelers was found. Again the hypothesis was not supported.

The third hypothesis stated that when visual stimuli became so visually complex as to be related to measures of intelligence, there would be no difference in response latency for sharpening and leveling groups. In this study no such differences were obtained. Thus, this hypothesis was supported in the form in which it was stated.

It would be misleading to let these statements of formal support or lack of support stand without qualification. Further analysis of the data gives partial support to the first two hypotheses and casts doubt on the third.

Before describing these analyses, it is necessary to define certain measures. The index error score employed centiles and z scores to bring together the increment and rank error scores. [redacted]-

[redacted]. There are, however, limitations to the use of the index error score. In the event that one of the error components is significant and the other is not, the index error might also yield insignificant results.

Another limitation, to be discussed later, is the condition under which increment and rank error scores show opposite relations to behavior. When the two components are combined in the index error score they might well cancel each other out. Because of these restrictions it is suggested that the index error be used as an additional measure in relating sharpening--leveling to other areas of functioning. This approach will be employed in this section.

The cognitive control sample used in this investigation is divided into experimental and criterion groups. Experimental subjects are the 39 individuals who obtained consistently high or low increment and rank error scores on the Schematizing Test. A further division of these subjects into upper and lower quartiles on each of the three component measures, allowed for an examination of the criterion groups and gave added power to the data.

In this section the results of the experimental and criterion groups will be merged in order to allow for separate discussion of response latency and intelligence test results.

Although the first hypothesis was not supported when all levelers and sharpeners were compared, there is limited support within the criterion leveling group (rank error). Under this condition a high error score is associated with a shorter response latency, and low rank error is associated with a longer response. This gives at least limited support to Hudesman's (1965) findings that levelers respond more quickly than sharpeners to simple auditory stimuli.

Initial investigation of the second hypothesis indicated no mean difference between experimental groups of sharpeners and levelers. When criterion groups were examined, however, results showed that sharpeners, (rank and index scores), had shorter average response latencies than levelers for the intermediate complexity condition. This gives indirect support to the second hypothesis: i.e., given intermediately complex stimuli, sharpeners will respond faster.

Additional support is derived from a Pearson correlation analysis of the experimental groups. Increment and index error scores indicate that sharpeners show shorter response latencies, while levelers show longer response latencies for visual material of intermediate complexity.

A Pearson correlation analysis of each of the two criterion groups yields similar results. For extreme sharpeners (but not extreme levelers), increment error is related to both simple and intermediate levels of visual complexity. These results indicate that for extreme sharpeners shorter response latencies are associated with lower error scores.

The present findings complement the work of Umanskii and Shapiro (1965). They concluded that personality and differences in reaction time are related. They offer an explanation of personality in terms of the speed and strength of the nervous system. Similarly in this experiment, the differences in response latency provide [redacted] towards attaching sharpening--leveling to a physiological framework. These results also give support to the Holzman and Klein's (1954) concept of a trace [redacted] system (described on p. 8).

The third hypothesis stated that there was no difference between sharpeners and levelers in response latency for visually complex material. Although the hypothesis was supported, certain problems arise. Because of the nature of the problem it was not possible to employ the accepted form of hypothesis statement. Since equivalence cannot be directly tested, the possibility of an alpha or type I error is substantially increased.

Another problem is also present. The visually complex task, Embedded Figures Test (E.F.T.), has been related to a variety of intellectual factors. In this study no relationships between the Jackson (1956) version of the E.F.T. and measures of intelligence was observed. This is probably due in part to the large variances resulting from a relatively small sample of subjects. The possibility also exists that the E.F.T measures intellectual factors different from those being tapped by the California Short Form Test of Mental Maturity which was used in this study, since it does not have a large correlation with the W.A.I.S. There will be a further discussion concerning the relationship between sharpening--leveling and intelligence in a later portion of this section.

The lack of hypothesized response differences between sharpeners and levelers under conditions of simple and intermediate visual complexity deserves further discussion. Methodologically, procedures involved in this study might not be equivalent to the operations employed by Hudesman (1965). In that investigation the reaction time foreperiod was defined by the interval between the verbal onset of the trial and a buzzer which served as the reaction time signal. In the present study there was an auditory signal that the trial would begin. This was followed by a four-second standard visual stimulus. Then came a blank period of 1.5 seconds duration which was operationally defined as the foreperiod. If the subject used either the auditory or standard visual stimulus to signal the onset of the foreperiod, the operationally defined foreperiod could be extended by as much as four seconds. According to Karlin (1959) and Hudesman (1965) a longer foreperiod decreases the speed of the reaction time. In the present investigation, this increase in the foreperiod could also result in a decreased chance of performance differences between sharpening and leveling groups.

Another possibility for error concerns the sample of subjects.

In the present investigation only male subjects were employed. Gardner _et_ _al_ (1959) pointed out that the sharpening--leveling factor appeared for female but not for male subjects. The authors pass over this finding by pointing out that results might be due to sample size. It is interesting that in their next major investigation Gardner _et_ _al_ (1960) used only female subjects. Other workers such as Long (1960) and Kauffman (1962) have also taken the sex difference seriously enough to employ only female subjects. It is possible that the exclusive use of male subjects contributes to the lack of significant differences between sharpening and leveling groups.

If such a sex difference exists it creates a theoretical question.

The problem concerns the definition of the cognitive control of sharpening--leveling. How is it possible for a cognitive control to be operative for female subjects and not for males, especially one based on a physiological trace system?

Another problem in definition manifests itself with reference to the relationship between sharpening--leveling error components and response latency. The error component used significantly affected the results obtained for the criterion groups. Increment error resulted in significant correlations for shapeners, rank error resulted in significant values for levelers, and index error, a combination of the two scores, yielded no significant relationships. The index error seems open to Klein's (1949) complexity criticism. The focus of this criticism was that any measure based on the results of two or more other measures might cancel out the opposite tendencies of its components.

A related error is committed in dealing with the entire distribution of sharpening--leveling scores. Correlations [redacted] indicate extremes of the sharpening--leveling distribution result in different tendencies for the same task. It seems an oversimplification to examine the distribution as a whole. Low correlations for the experimental samples in this and other studies might be due, not to any lack of significance, but rather to opposite tendencies for the two experimental or criterion groups. This is in line with the Gardner <u>et al</u> (1959) speculation that leveling may not merely be the opposite of sharpening. In the future, correlations might be examined separately for sharpening and leveling subjects.

Another problem concerns the results of the partial correlation technique. When the effects of intelligence are partialled out, there are no significant correlations between sharpening--leveling error components and response latency (simple and intermediate) for the experimental groups.

Results of the partial correlation technique for the criterion groups indicate that when intelligence is held constant for levelers, there is still a strong and consistent relationship between rank error and response latency for the simple condition. There is no similar relationship for sharpeners. When this association is examined for the intermediate level of visual complexity, it breaks down for leveling subjects. Why sharpeners do not exhibit a parallel relationship is unknown. It is possible that these results again support a thesis that leveling is not just the opposite of sharpening.

The evidence suggests that some of the relationship between sharpening--leveling and response latency is due to the variable of intelligence. Studies by Grice (1955) and Clement (1962) support the thesis that there is a connection between intelligence and reaction time. This need not be construed as indicating that relationships between sharpening--leveling and response latency are spurious. Rather it might be interpreted as indicating that the influences of the cognitive control of sharpening--leveling extends into other areas of functioning such as intelligence.

A major finding of this study is that with this male C.C.N.Y sample there are associations between the component error scores of sharpening--leveling and intelligence as measured by the California Short Form Test of Mental Maturity. The relationships between intelligence and sharpening--leveling can be analyzed in terms of a trace system. This system can be conceptualized in terms of separation of traces. For the sharpeners the neural system facilitates the orderly separation of information until such time as it is needed by the individual. For the leveling subject the traces are more global and information cannot be separated and/or retrieved as well.

A theory concerning rank and increment error scores and learning was offered by Kauffman (1962). He believed rank error was reflective of assimilation tendencies for received information, while increment error was more associated with the formation of set. In terms of Kauffman's formulations it would be expected that rank error would be more influential in those areas tapped by intelligence tests. Increment error with its set functions might play some role in nonlanguage functions. Increment error would also exercise its influence as a complementary measure via the index error score.

Examination of the experimental groups reveals that the low increment error scores of the sharpeners, are associated with higher scores in logical reasoning and total intelligence. For the total sample there is a negative relationship between rank error score and verbal concepts. This also holds for the index error score.

In comparing criterion groups, results indicate that rank error significantly differentiates a wide variety of language scores, e.g., memory, language intelligence and total intelligence. While increment error is not directly related to any criterion group measures of intellectual functioning, it appears to act in a complementary role, manifesting itself through the index error score. The index error differentiates criterion groups on the subtests of logical reasoning, memory, nonlanguage intelligence, language intelligence, and total intelligence.

The findings that the rank error differentiates sharpening and leveling on a variety of language subtests can be related to the results of Gardner _et al_ (1959) and Gardner and Long (1960). These authors claimed superior performance for sharpening subjects in a variety of verbal tasks. It is to be noted that in these studies only the rank error was employed. In spite of differential performance on verbal tasks no connection with intellectual functioning was inferred. In fact Gardner _et al_ (1960) tested levelers and sharpeners on a wide variety of intellectual tasks. The authors concluded that sharpening--leveling was not related to intelligence as defined by the tasks that they employed. This conclusion is reversed in the present investigation.

An analysis of criterion groups reveals certain relationships between measures of response latency and intellectural functioning. Response latency can be conceptualized in terms of set. Increment error is also viewed by Kauffman (1962) in terms of set. It would be expected that increment error and index error would be more effective in bringing out relationships between response latency and intelligence. For extreme sharpeners on the increment error criterion there are several associations between response latency and intelligence. Out of six significant correlations only one is between response latency and nonlanguage intelligence. The other significant correlation coefficients relate response latency with language and total intelligence. No similar correlations are obtained for levelers when increment error is employed.

There are no relationships between response latency and intelligence when rank error is used to differentiate criterion groups.

When index error scores are used to differentiate criterion groups, a reversal occurs. Now the leveler group provides significant correlations between intermediate response latency measures and language and total intelligence. No similar correlations are obtained for sharpeners when index error is employed.

A correlational analysis between response latency and intelligence was also performed for the experimental sample. Results indicated that no nonlanguage intelligence score was associated with response latency, whereas 50% of the language and total intelligence measures were related to response latency.

Both these findings are curious. It would be expected that nonlanguage intelligence has a closer relationship than language intelligence with essentially nonlanguage tasks such as response latency. If the reverse results had been obtained it might be inferred that nonlanguage intelligence and sensory motor reactions are associated. With the present results there is support for the thesis that response latency is a central nervous system function.

CHAPTER VI

OVERVIEW

This study has examined the relationship of sharpening--leveling to visual complexity. Holzman and Klein (1954) postulated physiologically different trace systems to account for sharpener--leveler performance differences. Levelers are thought to have a trace system that is relatively diffuse. It was hypothesized that under visually simple conditions the diffuse trace system of the leveler would permit shorter response latencies. Results indicated no difference between sharpening and leveling groups. However, within extreme leveling subjects (rank error), higher error scores were associated with shorter response latencies, and lower error scores were associated with longer response latencies.

When the visual stimuli became intermediately complex it was hypothesized that sharpeners, with their more distinct trace systems, would respond more efficiently. Although there was no mean difference between sharpeners and levelers, other forms of data analysis lent support to this hypothesis. Correlational analysis of all experimental subjects showed sharpening related to shorter response latencies and leveling associated with longer response latencies. Furthermore, an analysis of extreme scoring sharpeners and levelers revealed that sharpeners had shorter response latencies than levelers.

When the visual stimuli presented became so complex that responses to them would be expected to correlate with intelligence, no difference in response latency for sharpening and leveling groups was found. However, results of the present investigation indicate differences in intelligence test scores. With the total experimental sample sharpeners had higher scores than levelers for verbal concepts and total intelligence. When extreme groups of sharpeners and levelers were compared, sharpeners had higher scores in the areas of logical reasoning, verbal concepts, non-language intelligence, language intelligence, and total intelligence.

During the course of the investigation, it became desirable to obtain a single measure of sharpening--leveling. An index error score was developed for this purpose. This score combines the increment error and rank error scores. This merger was achieved through the use of centiles and z scores.

Another result of this study was an investigation of the relationship between response latency and intelligence. One finding was that response latency is related more to language and total intelligence functions than to non-language intelligence.

APPENDICES

APPENDIX I

Computational Procedures for Increment Error, Rank Error and Index Error Scores for the Klein Squares Schematizing Test

Increment Error Score

The percentage increase of each of the eight series means over the mean of the first series is computed as follows:

$$\frac{M_{series_2} - M_{series_1}}{M_{series_1}}, \quad \frac{M_{series_3} - M_{series_1}}{M_{series_1}} \quad \text{etc.}$$

A. The actual sizes of the stimuli were used in the above formula. This yielded an 8 point trend describing the objective shift in series means. (A series mean is the average of fifteen stimuli.)

B. This same procedure was followed using the judgements of sizes of stimuli for each subject. This yielded for each subject a set of increment values that could be compared with the increment values of the actual stimuli.

C. For each subject, the eight increment scores for judgments were then subtracted from the corresponding eight increment scores for objective value.

D. The average of all eight subtractions was the increment error score for that subject.

Rank Error Score

For each subject, the total number of inaccurately ranked squares was determined. A tie within a series of five judgements was scored one-half. The resulting total of inaccurately ranked squares was divided by the total number of squares presented (135). The resulting fraction was the rank error score for that subject.

Index Error Score

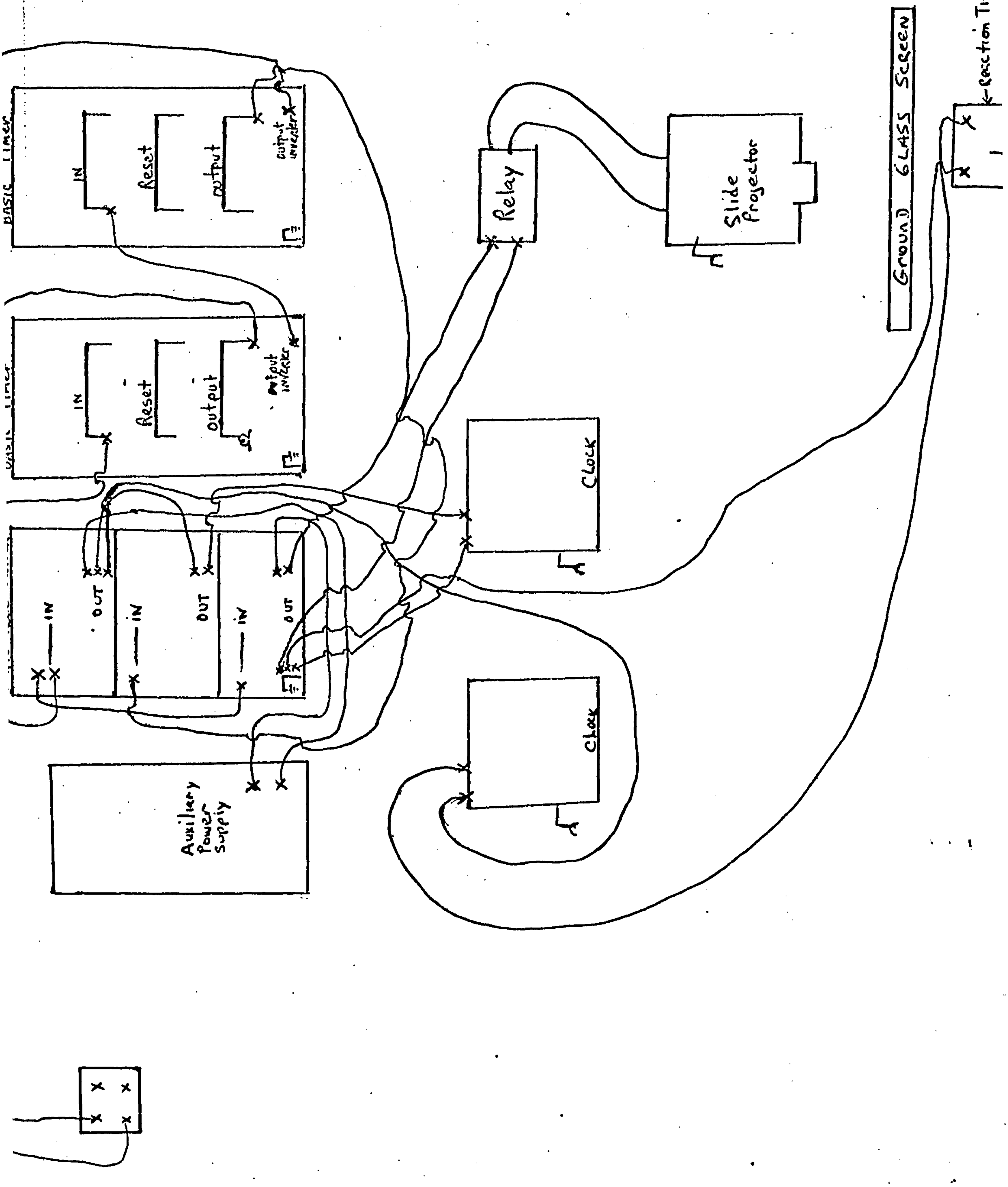
A. Separate frequency distributions were set up for increment and rank error scores. Scores for all subjects screened were used. Intervals of .03 and .01 were employed respectively for the increment and rank error distributions. Cumulative proportions, centiles and finally z scores were then obtained for each distribution. Because of the sample size an arbitrary outer limit of $z=\pm3.00$ was employed.

B. Increment and rank error z scores for each subject were then algebraically added. In order to avoid minus signs or decimal points, a constant (+260) was added to all scores and the resulting score was multiplied by one hundred.

Note: The magnitude of the constant will vary somewhat with the variation in scores for each study.

APPENDIX II

Wiring Diagram and Reaction Time Equipment Used For Response Latency Conditions 1-3



APPENDIX III

Geometric Designs Employed in the Four Response Latency Conditions

I. Series 1: Green circles were employed for standard and response stimuli for all trials.

II. Series 2:a. Green circles were employed as standard stimuli.

b.1. E.F.T. designs were employed as response stimuli for trials: 1, 2, 18, 23, 26.

2. Blue squares were employed as response stimuli for trials: 8, 22, 28, 30, 32.

3. Red crosses were employed as response stimuli for trials: 3, 5, 12, 15, 20.

4. Green rectangles were employed as response stimuli for trials: 4, 21, 24, 27, 29.

5. Orange Ts were employed as response stimuli for trials: 13, 14, 17, 19, 31.

6. Orange triangles were employed as response stimuli on trials: 6, 7, 10, 11.

III. Series 3:a.1. The following designs were employed as standard stimuli:

1. Blue squares on trials: 1, 2, 3, 19, 20, 29, 31.
2. Green rectangles on trials: 4, 6, 8, 12, 16.
3. Red triangles on trials: 5, 9, 14, 17, 21, 23, 28, 30, 32.
4. Orange Ts on trials: 10, 11, 13, 15, 26, 27.
5. Red crosses on trials: 7, 18, 22, 24, 25.

b. The following designs were used as response stimuli:

1. Blue squares were embedded in a green triangle.
2. Green rectangles were embedded in blue squares.
3. Orange triangles were embedded in blue circles.
4. Orange Ts were embedded in blue circles.
5. Red crosses were embedded in pink squares.

IV. Series 4: The following trials of the Witkin Embedded Figures Test were employed:

C-1, D-1, E-1, A-2, C-2, G-1, A-3, H-1, E-3, C-3, D-2, E-5.

APPENDIX IVA

Scores of Sharpening Subjects According to Increment Error, Rank Error, and Index Error Scores (N=20)

Subject Number	Increment Error Score	Rank Error Score	Index Error Score
1	.4497	.1851	247
12	.5053	.1703	247
13	.3833	.1777	208
15	.3908	.1037	51
18	.4708	.1703	227
25	.5035	.1555	188
27	.4620	.1851	255
28	.3797	.1777	208
30	.0167	.1703	67
36	.0619	.1851	142
37	.4488	.1629	182
41	.0983	.1851	157
45	.0371	.1629	57
50	.3852	.1851	236
51	.1919	.1629	121
54	.1727	.1777	158
55	.3005	.1851	203
59	.3850	.1851	236
61	.1404	.1185	4
A[s]	.3616	.1185	57

APPENDIX IVB

Scores of Leveling Subjects According to Increment Error, Rank Error, and Index Error Scores (N=19)

Subject Number	Increment Error Score	Rank Error Score	Index Error Score
3	.7098	.2444	472
6	.8749	.2148	489
7	1.0349	.2074	556
8	.6338	.3703	593
9	.8843	.2074	465
11	.5178	.2814	470
17	.6405	.2296	401
20	.6792	.2000	385
21	.6791	.2296	429
24	.7668	.2370	467
35	.6585	.1925	346
44	.7302	.1925	369
46	.6191	.2000	357
58	.5167	.2074	329
62	.8623	.2000	465
63	.6377	.2074	357
65	1.0492	.2814	670
66	1.0677	.2444	634
A^L	1.1413	.2370	683

APPENDIX V A

Raw Scores for Sharpening Subjects on the California Short Form Test of Mental Maturity - Level 5 (1963 revision) (N=20)

Subject Number	Logical Reasoning	Numerical Reasoning	Verbal Concepts	Memory	Non-Lang. Intel.	Lang. Intel.	Total Intel.
1	37	21	21	20	52	47	99
12	33	16	24	23	42	54	96
13	33	15	22	19	42	47	89
15	30	19	17	20	44	42	86
18	34	22	24	21	49	52	101
25	35	19	21	18	48	45	93
27	26	19	22	15	39	43	82
28	30	16	19	22	42	45	87
30	36	23	23	23	51	54	105
36	38	21	23	20	52	50	102
37	35	20	24	21	50	50	100
41	36	21	22	17	50	46	96
45	39	23	24	21	53	54	107
50	29	14	23	22	38	50	88
51	39	18	22	25	53	51	104
54	33	18	20	23	48	46	94
55	20	15	21	10	30	36	66
59	36	19	24	23	46	56	102
61	25	18	24	23	37	53	90
A^{S}	29	24	24	19	44	52	96

APPENDIX V B

Raw Scores for Leveling Subjects on the California Short Form Test of Mental Maturity - Level 5 (1963 revision) (N=19)

Subject Number	Logical Reasoning	Numerical Reasoning	Verbal Concepts	Memory	Non-Lang. Intel.	Lang. Intel.	Total Intel.
3	27	18	22	17	39	45	84
6	29	17	21	20	39	48	87
7	28	23	24	22	43	54	97
8	29	24	19	22	44	50	94
9	32	23	20	18	47	46	93
11	28	22	19	15	41	43	84
17	36	24	23	20	51	52	103
20	26	25	21	20	41	51	92
21	39	22	22	23	54	52	106
24	36	18	19	22	49	46	95
35	27	19	25	23	37	57	94
44	27	22	21	16	39	47	86
46	27	13	22	20	34	48	82
58	27	18	24	18	39	48	87
62	40	23	24	20	54	53	107
63	29	21	23	22	44	51	95
65	21	14	20	15	31	39	70
66	27	18	15	13	42	31	73
A[L]	30	18	22	18	44	44	88

APPENDIX VI

Extreme Sharpening and Leveling Subjects According to the Criteria of Increment Error, Rank Error and Index Error (N=20)

Category	Increment Error Subject No.	Increment Error Score	Rank Error Subject No.	Rank Error Score	Index Error Subject No.	Index Error Score
Sharpeners	28	.3797	12	.1703	15	51
	30	.0167	15	.1037	30	67
	36	.0619	18	.1703	36	142
	41	.0983	25	.1555	37	182
	45	.0371	30	.1703	41	157
	51	.1919	37	.1629	45	57
	54	.1727	45	.1629	51	121
	55	.3005	51	.1629	54	158
	61	— .1404	61	.1185	61	4
	A^S	.3616	A^S	.1185	A^S	57
Levelers	3	.7098	3	.2444	3	472
	6	.8749	6	.2148	6	489
	7	1.0349	8	.3703	7	556
	9	.8843	11	.2814	8	593
	24	.7668	17	.2296	9	465
	44	.7302	21	.2296	11	470
	62	.8623	24	.2370	24	467
	65	—1.0492	65	.2814	65	670
	66	1.0677	66	.2444	66	634
	A^L	1.1413	A^L	.2370	A^L	683

APPENDIX VII A

MEAN INVERSE TRANSFORMATION SCORES FOR RESPONSE LATENCY CONDITIONS FOR SHARPENING SUBJECTS (N=20)

Subject Number	Simple Designs Varied	Simple Designs Repeated	Dual Designs Varied	Embedded Figures Test
1	273	274	217	927
12	244	271	209	1011
13	286	230	234	2208
15	340	400	251	1648
18	303	348	266	1613
25	209	212	202	552
27	264	260	252	371
28	229	279	184	1392
30	292	354	236	909
36	268	294	238	902
37	246	285	237	1265
41	295	260	223	1744
45	341	434	299	1310
50	201	180	190	1147
51	276	310	239	362
54	317	319	250	1012
55	190	243	162	789
59	317	323	288	663
61	304	295	261	145
A^S	242	252	222	1108

APPENDIX VII B

MEAN INVERSE TRANSFORMATION SCORES FOR RESPONSE LATENCY CONDITIONS FOR LEVELING SUBJECTS (N=19)

Subject Number	Simple Designs Varied	Simple Designs Repeated	Dual Designs Varied	Embedded Figures Test
3	245	274	220	616
6	262	246	218	1175
7	272	288	226	282
8	367	369	231	963
9	276	255	215	1830
11	234	248	202	310
17	276	269	211	1422
20	329	319	255	1133
21	213	209	167	634
24	247	234	226	815
35	335	361	248	1298
44	291	336	249	397
46	268	335	195	305
58	283	305	224	880
62	238	261	203	947
63	286	271	227	1452
65	276	304	210	591
66	227	245	186	987
A^L	266	284	229	458

BIBLIOGRAPHY

BIBLIOGRAPHY

Bauman, G. The stability of the individual's mode of perception and of personality-perception relationships. In Witkin, H., Dyk, R., Faterson, H., Goodenough, D., Karp, S. Psychological Differentiation. New York. John Wiley and Sons, 1962, 369.

Bieri, J., Bradburn, W., Galinsky, M. Sex differences in perceptual behavior. J. Pers., 1958, 26, 1-12.

Botiviwick, J., Thompson, L. Premotor and motor components of reaction time. J. exp. Psychol., 1966, 71, 9-15.

Bruner, J., Postman, L. Symbolic value as an organizing factor in perception. J. soc. Psychol., 1948, 27, 203-208.

Calloway, E., Factors influencing the relationship between alpha activity and visual reaction time. Electroenceph. clin. Neurophysiol., 1962, 14, 672-682.

Clement, F. Manifestations of simple reaction time as a function of age and some other factors. In E. Bovowman (ed) Psychol. Abstr., 1963, 37, 752.

Edwards, A. Experimental design in psychological research (rev. ed). New York. Holt Rinehart and Winston. 1963, Chapt. 10.

Eysenck, H. Criterion analysis - an application of the hypothetics-deductive method to factor analysis. Psychol. Rev., 1950, 57, 38-53.

Farber, I., Spence, K. Effects of anxiety, stress, and task variables on reaction time. J. Pers., 1956, 25, 1-17.

Fliegel, Z. Stability and change in perceptual performance of a late adolescent group in relation to personality variables. In Witkin, H., Dyk, R., Faterson, H., Goodenough, D., Karp, S. Psychological Differentiation. New York. John Wiley and Sons, 1962.

French, J.W. The description of aptitude and achievement tests in terms of related factors. In Gardner, R., Jackson, D., and Messick, S. Personality organization in cognitive controls and intellectual abilities. Psychol. Issues, 1960, V.2#4, 15.

Gardner, R. W., Holzman, P. S., Klein, G. S., Linton, H. and Spence, D. Cognitive control. A study of individual consistencies in cognitive behavior. Psychol. Issures, 1959, V.1 #4, 185pp.

Gardner, R., Jackson, D., Messick, S. Personality organization in cognitive controls and intellectual abilities. Psychol. Issues, 1960, V.2 #4 148pp.

Gardner, R. & Lohrenz, L. Attention and assimilation. Amer. J. Psychol, 1961, 74, 607-611.

Gardner, R., Long, R. Leveling-sharpening and social learning. Percept. mot. skills, 1960, 10, 179-185.

Gardner, R., Long, R. The stability of cognitive controls. J. abnorm. soc. Psychol., 1960, 61, 485-487.

Gardner, R., Lohrenz, L. Leveling-sharpening a seriel reproduction of a story. In Kauffman, H. unpublished doctor's dissertation, New York University, 1962.

Grice, G. Discrimination reaction time as a function of anxiety and intelligence. J. abnorm. soc. Psychol., 1955, 50, 71-74.

Hartmann, H. Ego psychology and the problem of adaptation. In Gardner, R., Holzman, P., Klein, G., Linton, H., and Spence, D. Psychol. Issues, 1959, V. 1 #4, 9.

Hollingworth, H. The central tendency of judgment in experimental studies of judgment. In Gardner, R., Holzman, P., Klein, G., Linton, H., and Spence, D. Psychol. Issues, 1959, V.1 #4, 23.

Holzman, P. The relation of assimilation tendencies in visual, auditory, and kinesthetic time-error to cognitive attitudes of leveling and sharpening. J. Pers., 1954, 22, 375-394.

Holzman, P. Repression and cognitive style. In Peatman, J. and Hartley, E. (Ed.) Festschrift for Gardner Murphy, New York: Harper, 1960.

Holzman, P., Gardner, R. W. Leveling and repression. J. abnorm. soc. Psychol., 1959, 59, 151-155.

Holzman, P., Gardner, R. Leveling-sharpening and memory organization. J. abnorm. soc. Psychol., 1960, 61, 176-180.

Holzman, P., Klein, G. The schematizing process: perceptual attitudes and personality qualities in sensitivity to change. Amer. Psychologist, 1950, 5, 312.

Holzman, P., Klein, G. Cognitive system-principles of leveling and sharpening: Individual differences in assimilation effects in visual time error. J. Psychol., 1954, 37, 105-122.

Hudesman, J. Speed of reaction time as a function of leveling and sharpening. Unpublished masters thesis, City College of New York, 1965.

Isreal, N. The orienting reflex and leveling-sharpening. Unpublished doctoral dissertation, New York University, 1966.

Jackson, D. A short form of Witkin's E.F.T. J. abnorm. soc. Psychol., 1956, 53, 254-255.

Karlin, L. Reaction time as a function of foreperiod duration and variability. J. exp. Psychol., 1959, 58, 185-191.

Kauffman, H. An analysis of the set-shift and assimilation hypothesis in leveling-sharpening. Unpublished doctoral dissertation, New York University, 1962.

Klein, G. A clinical perspective for personality research. J. abnorm. soc. Psychol., 1949, 44, 212-219.

Klein, G. The personal world through perception. In Blake, R. and Ramsey, G. (Eds.) Perception: An Approach to Personality, New York. Ronald Press, 1951, 328-355.

Klein, G. Cognitive control and motivation. In Lindzey, G. (Ed.) Assessment of Motives. New York, Holt, Rinehart and Winsteon, 1958, 87-118.

Klein, G., Salomon, A., [redacted]., Studies in cognitive style and the regulation of need. Amer. Psychologist, 7, 321-322.

Klein, G., Schlesinger, H. Where is the perceiver in perceptual theory. J. Pers., 1949, 18, 32-47.

Klein, G., Schlesinger, H., Meister, D. The effect of personal values on perception: an experimental critique. Psychol. Rev., 1951, 58, 96-112.

Levine, R., Chein, I., Murphy, G. The relation of the intensity of a need to the amount of perceptual distortion. J. Psychol., 1942, 13, 283-293.

McClelland, D., Atkinson, I., Clark, R., The projective expression of needs: I. The effects of different intensities of the hunger drive on perception. J. Psychol., 1948, 25, 205-232.

Palermo, D. Relationship between anxiety and two measures of speed in a reaction time task. Child Devel., 1961, 32, 401-408.

Pollack, M. Individual differences in the perception of the upright in hospitalized psychiatric patients. In Witkin, H., Dyk, R., Faterson, H., Goodenough, D., Karp, S. Psychological Differentiation. New York. John Wiley and Sons. 1962. p.400.

Sanford, N. Effects of abstinence from food upon imaginal processes: A further study. J. Psychol., 1937, 3, 145-159.

Spence, K. A theory of emotionally based drive and its relation to performance in simple learning situations. In Mednick, M. and Mednick, S. (Eds.) Research in Personality. New York. Holt, Rinehart and Winston. 1963, p. 255.

Teichner, W. Recent studies in simple reaction time. Psychol. Bull., 1954, 51, 128-149.

Telford, C. The normal wink reflex; its facilitation and inhibition. J. exp. Psychol., 1932, 15, 235-266.

Turner, A. Discrimination reaction time as a function of anxiety and task difficulty. Dissert. Abstr., 1962, 23, 712-713.

Umanskii, L., Shapiro, S. An experimental study of sensorimotor responses in a probabilistic situation as a function of the strength and speed of the nervous system. In Zusne, L. (Ed.) Psychol. Abstr., 1966, 40, 96.

Wenar, C. Reaction time as a function of manifest anxiety and stimulus intensity. J. abnorm. soc. Psychol., 1954, 49, 335-340.

Witkin, H. Individual differences in ease of perception of embedded figures. J. Pers., 1950, 19, 1-15.

Witkin, H., Dyk, R., Faterson, H., Goodenough, D., Karp, S. Psychological Differentiation. New York: John Wiley and Sons, 1962.

Woerner, M., Levine, T. A preliminary study of the relation between perception and thinking in children. In Witkin, H., Dyk, R., Faterson, H., Gooenough, D., Karp, S. Psychological Differentiation, New York. John Wiley and Sons, 1962, 59.

Woodrow, H. Measurement of attention. Psychol. Monogr., 1914, 17, entire #76.

Woodworth, R., Schlosberg, H. Experimental Psychology (rev. ed.) New York: Holt, Rinehart and Winston, 1954.

AUTOBIOGRAPHICAL STATEMENT

PERSONAL DATA

Address: Dept. of Psychology
City College of New York
138th Street and Convent Avenue
New York 10031

EDUCATIONAL BACKGROUND

School: The City College of the City University of New York

Degree: Ph.D. (expected May, 1968)
Major: Clinical Psychology

Degree: Master of Arts (June, 1965)
Major: General - Experimental Psychology

Degree: Bachelor of Business Administration (June, 1963)
Major: Industrial Psychology

PAPERS

Speed of Reaction Time as a Function of Leveling and Sharpening. Paper delivered at the Eastern Psychological Association, New York, April, 1966.