# THE AFFECT OF THREE TINTS OF RED ON THE MOTOR FUNCTION OF CHILDREN WITH LEARNING DISABILITIES AND OF NORMAL CHILDREN

---

A Dissertation

Presented to

the Faculty of the Department of Education

University of Houston

---

In partial Fulfillment

of the Requirments for the Degree

Doctor of Education

---

by

Sue Ann Boehm

August 1973

# THE AFFECT OF THREE TINTS OF RED ON THE MOTOR FUNCTION OF CHILDREN WITH LEARNING DISABILITIES AND OF NORMAL CHILDREN

---

An Abstract of a Dissertation

Presented to

the Faculty of the Department of Education

The University of Houston

---

In Partial Fulfillment

of the Requirements for the Degree

Doctor of Education

---

by

Sue Ann Boehm

August 1973

ABSTRACT

Ninety learning disability and ninety normal boys were tested with a block design from the Wechsler Intelligence Scale for Children. The blocks consisted of combinations of three tints of red and three values of gray in three degrees of difficulty. Performance time was measured in seconds. A three factor mixed design analysis of variance was calculated for both the learning disability and control groups. Results indicated that red and white and rose and black required significantly less time to complete than did the other combinations. It was concluded that red × white and black × rose were the more effective tint × value combinations.

Table of Contents

List of Tables

# CHAPTER I

# THE PROBLEM AND DEFINITION OF TERMS USED

## Introduction

Much emphasis has been placed upon visual perception and the learning aspects of children with learning disabilities. It has been observed that certain visual stimuli produce hyperkinetic responses in these children. (3:223) It has also been demonstrated that certain hues ostensibly reduce the performance time of certain performance tasks among these children. (8:5)

Color is used extensively in the classroom for these children. Color cues are used for discriminating such phonetic elements as consonant blends or digraphs. Color is seen constantly in pegboard and parquetry patterns. The question, therefore, arises: "Would a particular tint of a specific hue be more effective than other tints of the same hue in reducing the performance time of this particular population of children?"

## I. The Problem

### Statement of the problem

It was found in a previous study that the hue of red seemingly required less time during a particular performance task than did blue, green or yellow (8:5) Thus, the color red was chosen for this particular study. It is the purpose, therefore, of this study to investigate the effect of three tints of the hue of red upon the motor function of a group of children with learning disabilities as compared with a group of "normal" children.

Importance of the study

Color and its effect upon man has been studied extensively. Many tests have been made involving color with both normal and pathological organisms. (6:14) Children in the classroom are constantly bombarded by color in the form of color cues and perceptual materials. However, very little has been done concerning the effect of color on the minimally brain-injured individual. Since it has been found that red is a significant color in evoking a response from such an individual, it is important to discover if a particular shade of red is more provocative than another shade. (8:2 )

## II. Definition of Terms Used

For the purpose of this study the terms "learning disability" and "minimal brain-injury" shall be used interchangeably.

Minimally Brain-Injured. The term minimally brain-injured is defined in the Texas State Plan for Special Education as follows:

> Children who are normal or above intelligence but who have learning difficulties directly attributable to an organic defect caused by a neurological condition, and who are unable to adjust to or profit from a regular school program without the provision of special education services may be considered for a program for minimally brain-injured children. (9:3)

<u>Learning Disabilities</u>. Clements, according to McCarthy, lists the following most frequently cited characteristics of children with learning disabilities:

1. Hyperactivity.
2. Perceptual-motor impairment.
3. Emotional lability.
4. General orientation defects.
5. Disorders of attention (e.g., short attention span, distractability).
6. Impulsivity.
7. Disorders of memory and thinking.
8. Specific learning disabilities in reading, arithmetic, writing and spelling.
9. Disorders of speech and hearing.
10. Equivocal neurological signs and electroencephalographic irregularities. (17:8)

McCarthy, again, quotes Kirk and Bateman:

> A learning disability refers to retardation, disorder, or delayed development in one or more of the processes of speech, language, reading, writing, arithmetic, or other school subjects resulting from a psychological handicap caused by a possible cerebral dysfunction and/or emotional or behavioral disturbances. It is not the result of mental, sensory deprivation, or cultural or instructional factors. (17:1)

Hue. The term hue may be defined as color or one of three attributes (hue, value, intensity) of some colors by virtue of which they fall into the classes of red, yellow, green or blue. (5:402)

Value. "Value may be defined as that property of color by which it is distinguished as light or dark." (5:940) Or, in other words, it is the amount of white or black added to a particular hue.

Motor performance. The term "motor performance" as applied to this study means the ability of the individual to move himself or a limb of his body from one position to another.

## CHAPTER II

## REVIEW OF THE LITERATURE

There is a lack of literature concerned directly with color and children with disabilities. The literature surveyed here shall be concerned with color and its effect on the organism.

Kurt Goldstein reports several instances of color affecting the motor behavior of patients with brain pathology. He mentions that such a patient's handwriting is closer to normal in green ink than in red ink. Another experiment he performed consisted of having the patient stand with his arms outstretched in front of him. Under the influence of a red light the arms tended to deviate outwardly, while under the influence of a green or blue light they tended to move toward each other. (13:147)

Goldstein's study confirms the work of Ehrenwald as reported by Felix Deutsch. According to Faber Birren, he demonstrated the theory that when the neck and face are illuminated from the side, the face and shoulders tend to deviate toward the light if the light is red and away from it if the light is blue. (15:149)

Goldstein, again, writes of a woman with a cerebellar disease who walked with an extremely ataxic gait when she wore a red dress, but whose gait returned to almost normal when she wore a green or blue dress. He concluded that red tends to incite to activity, is favorable for emotionally determined actions or a background for ideas and actions. Green, on the other hand, is meditative and is favorable for exact fulfillment of a task. (14:147)

Upon the basis of Goldstein's observations, this investigator tested a group of learning disability children during a performance task. Solid colored puzzles were used to test the time required for learning disability children to perform the task of working with the individual colors. It was concluded that the red puzzles took significantly less time to complete than the yellow or green ones. The yellow puzzles required significantly less time than the green ones and the blue puzzles required significantly less time than the green ones. With the exception of yellow vs. blue the warm colors required less time than the cool one. (8:5)

Robert Gerard conducted a study investigating the effect of different colors on the psychophysiological measures indicative of emotional changes. Blue, red and white lights were projected for ten minutes each on twenty-four normal male subjects. He found that the autonomic nervous system and visual cortex were significantly less aroused under the influence of the blue illumination than the red or white. Different colors elicited different feelings: greater relaxation, less anxiety under the blue lights; more tension and excitement under the red illumination. Gerard found the manifest anxiety level significantly correlated with increased physiological activation and subjective disturbance during the red stimulation. Findings in the opposite direction of quiesence and relief suggested that blue illumination may benefit individuals with chronic tension and anxiety. (13:340)

J. P. Guilford, using a series of four inch square cards of forty different colors flashed for five seconds each, tested a group of normal adult male and female subjects for the effectivity of color as a function of hue, tint and chroma. Using a rating scale from one to nine (unpleasant to pleasant), the subjects reported their subjective responses. The theoretical consequences of this study were as follows: 1) There are two distinct systems of color preferences--one being more primitive and fundamental than the other. 2) The more fundamental system is yellow-blue affective discrimination. 3) The other system is red-green-blue. (15:343)

A similar study was conducted by Sidney L. Pressey concerning the responses of a group of students to colored slides. He tested the subjects for the effect of color on rhythmic movement of the fingers, pulse, blood pressure, respiration, rate of multiplying, rate of continuous choice reaction and introspective reports. He found that there were differences among the hues and that bright was an important factor. (16:326)

Faber Birren states that beyond the feeling of warmth and coolness, brightness and dimness, the exact choice of a hue or tone is a fairly optical matter and its power to arouse pleasure or displeasure depends on the individual's predeliction. He quotes Kurt Goldstein: "It is probably not a false statement if we say that a specific color stimulation is accompanied by a specific response pattern of the entire organism." This would mean that color is organic and basic to mankind. (6:144)

Marguerite Emery, speaking of the psychological significance of color preferences, says that red connotes the death wish, blue is of masculine significance, green indicates growth or psycho-sexual infantilism and yellow suggests an infantile level. (11:42)

It has been suggested by Eric P. Mosee that red is the color choice of the manic, while brown is the color choice of a paranoic. He also writes of the patient's response to color:

> Touching color and paper with his own hands, the patient's dynamic expression of his whole body becomes much more vigorous and direct. (18:33)

Faber Birren cites the results of several studies made of color preferences in infants:

> R. Staples exposed disks to infants and measured the duration of visual concentration. The babies looked longer at bright colors than they did at dull tones. Their favorites, judged by certain eye fixations and reaching efforts, were red and yellow. Apparently the infant is most attracted to brightness and richness of hue. (5:175)

Another investigation in the same vein cited by Birren:

> C. W. Valentine likewise exposed colored skeins two at a time to three-month-old babies and measured the length of time each skein was given attention. The babies stared longest at yellow, then white, pink, red. Least attention was paid to black, green, blue and violet. (5:174)

Several studies have been made of children's preferences in matching by color or by shape. Norman L. Corah explored the relationship between the stimulus characteristics of color or shape with nursery school children. He found that both the amount of color in the stimuli and the complexity of stimulus forms were related to the number of color responses given by the prescribed population of children. (10:211)

Rosslyn G. Suchman studied color-form preferences among deaf and hearing children. She found that most deaf children discriminate color variations better than hearing children of the same age, and that hearing children discriminate forms better than deaf children. (17:451)

Color-form preference appears to be related to the age of the child. Brian and Goodenough found that younger preschool children prefer color to form. (9:212)

In conclusion, Birren states:

> It is an unquestionably normal condition for human beings to like color. There are precise reactions and 'moods' to be associated with sunny weather and with rainy weather, with a colorful world or environment and with a drab one. (5:175)

## Summary

The studies reviewed here are concerned with the effect of color on the physical and emotional states of the organism in general and upon the pathological organism. Although the hue of red has been mentioned as significant in the literature, it has not been studied in depth with regard to the minimally brain-injured.

# CHAPTER III

# THE INVESTIGATION

## Introduction

In most previous studies the effect of color upon the organism was tested by means of the use of colors or colored slides. Since the concern is with the effect of the color of materials and objects within the child's immediate visual space, a manipulative task was desired.

Because the effect of hue and value upon the motor performance of learning disability children has not been tested prior to this investigator's studies, a refined test instrument was needed. Based upon a previously standardized portion of a test instrument, the block design was employed.

## I. Subjects

The subjects tested consisted of 90 learning disabled boys and 90 normal boys. The boys' ages ranged from 9 years 0 months to 13 years 0 months. The IQ range for both groups was 75 to 115. The children were selected randomly from classes of 9 different schools of the Houston Independent School District. The learning disabled boys were all enrolled in MBI classes. The study was limited to boys because of the preponderance of boys in the MBI program.

The mean age for the learning disabled boys was 11 years 4 months and the mean IQ for this group was 93. The mean age for the normal boys was 10 years 8 months and the mean IQ was 99.

The boys were screened with the Slosson Intelligence Test and the AO H-R-R pseudoisochromatic Plated for color blindness. Two boys, one normal and one learning disability, were found to be color deficient and they were eliminated from the study. (See Table 1--Age and IQ, Means and Range.)

Table 1

Age and IQ Means and Range

| | Age Range | Mean Age | IQ Range | IQ Mean |
|---|---|---|---|---|
| Learning disabled boys | 9 years 0 months to 13 years 0 months | 11 years 4 months | 75-115 | 93 |
| Normal boys | 9 years 0 months to 13 years 0 months | 10 years 8 months | 75-115 | 99 |

## II. The Test Instrument

The test instrument consisted of one inch square blocks. The blocks were painted a tint of red on two sides, a value black, gray or white on two sides and half (diagonally) color and half value on two sides. Four blocks were painted in each of the following combinations:

pink and white

pink and gray

pink and black

rose and white

rose and gray

rose and black

red and white

red and gray

red and black

Identical patterns in three degrees of difficulty were made for each color combination. The patterns were copied from patterns 1, 2, and 3 of the Wechsler Intelligence Scale for Children. The colors were selected at equal intervals from Reinhold Color Atlas and identified as A-8, A-6, and A-4. Similarly, the values were identified as A-1, D-1, and F-1.

Patterns for the three degrees of difficulty, as identified as designs 1, 2, and 3 from the WISC, were cut from colored paper matching the color and value of the blocks. The patterns were one inch square pasted on cards three inches square.

The demonstration pattern was copied from pattern B of the WISC. The pattern was done in the middle tones of rose and gray.

## III. The Performance Task

The boys from both the learning disability and the normal groups were randomly assigned a color/value combination. Each child was then individually tested.

Each boy was first presented with the rose and gray blocks and the same demonstration pattern.

The child was then given the following instructions:

> 'You see these blocks have different colors on their different sides. They can be put together to make a design like the one you see on this card.'

The examiner then constructed the design for the child and the child was instructed:

> 'Now you make one just like this.'

Following successful completion of the demonstration pattern, the child was presented with the patterns for the randomly selected color/value combinations patterns and blocks (24). Each child constructed three patterns in three degrees of difficulty for his particular color/value combination. Each time he was given the directions:

> 'Now put these together just like this (indicating the pattern) as quickly as you can.'

Each time the blocks were tossed randomly in front of the child. The time required to complete the task was then recorded in seconds and tabled.

## NULL HYPOTHESES

Hypothesis 1 - There shall be no significant differences among the three tints upon the motor performance time of learning disability children.

Hypothesis 2 - There shall be no significant differences among the three values of gray upon the motor performance time of learning disability children.

Hypothesis 3 - There shall be no differences among the interactions of the three tints of red and the three values of gray upon the motor performance time of learning disability children.

Hypothesis 4 - There shall be no significant differences of effectiveness among the three degrees of difficulty of puzzles upon the motor performance time of learning disability children.

Hypothesis 5 - There shall be no significant difference among the effects of the interactions of the three degrees of difficulty and three tints of red upon the motor performance time of learning disability children.

Hypothesis 6 - There shall be no significant difference among the effects of the interactions of the three degrees of difficulty and three values of gray upon the motor performance time of learning disability children.

Hypothesis 7 - There shall be no significant difference among the effects of the three tints of red by three values of gray by three degrees of difficulty upon the motor performance time of learning disability children.

Hypothesis 8 - There shall be no significant difference among the effects of three tints of red upon the motor performance time of normal children.

Hypothesis 9 - There shall be no significant difference among the effects of three values of gray upon the motor performance time of normal children.

Hypothesis 10 - There shall be no significant difference among the effects of the interaction of three tints of red and three values of gray upon the motor performance time of normal children.

Hypothesis 11 - There shall be no significant difference among the effects of three degrees of puzzle difficulty upon the motor performance time of normal children.

Hypothesis 12 - There shall be no significant difference among the effects of the interaction of three degrees of puzzle difficulty and three tints of red upon the motor performance time of normal children.

Hypothesis 13 - There shall be no significant difference among the effects of the interaction of three degrees of puzzle difficulty and three values of gray upon the motor performance time of normal children.

Hypothesis 14 - There shall be no significant difference among the effects of the interaction of three degrees of puzzle difficulty and three tints of red and three values of gray upon the motor performance time of normal children.

# CHAPTER IV

## ANALYSIS OF DATA

After the 90 learning disability and the 90 normal children were tested, the time required for each child to work each of the three puzzles was recorded in seconds. The results were then tabulated.

A three factor mixed design analysis of variance was then calculated for the learning disability children and the normal children separately as two different groups.

The final analysis of the effectiveness of the tints of red, values of gray and degrees of difficulty and their interaction as measured in seconds required to complete the task by the learning disability children is presented in Table 2.

From the data presented in the table it was concluded that there was no difference in the time required to work the puzzles of the three different tints of red, nor was there a significant difference in time required to work the puzzles of three values of gray between the subjects. There was, however, a significant difference in the effectiveness of the interaction of tints of red and values of gray between subjects.

Since reds x grays was found to be significant

(F=6.4040, p < .01, df 4), a t-test was conducted. (23:275-278) Inspection of Table 6 reveals those combinations which appear to be significantly different are red x white when compared with the rose x gray, rose x white and the other red combinations.

Examination of Table 2 for analysis of the within group reveals that the degree of difficulty, interaction of the degree of difficulty and tints of red and the interaction of degree of difficulty and values of gray were all significant.

Comparisons of the degrees of difficulty was tested for significance by the t-test as shown by Table 8. Difficulty 1 and Difficulty 2 were not found to be significantly different, however, Difficulty 2 and Difficulty 3 were found to be significantly different (t=56.07, p < .01). Difficulty 1 and Difficulty 3 were also significantly different, as would be expected (t-45.50, p < .01).

Degree of difficulty by reds was tested by the t-test as seen by Table 4. The color by difficulty factor that appears to be outstanding, according to the Table, is the rose at the second degree of difficulty.

The significant F of the difficulty by grays was also tested with the t-test as seen in Table 7. Those combinations which appeared to stand out as significantly different were Difficulty 2 by black, Difficulty 2 by gray and Difficulty 3

Table 2

Summary of Analyses of Varience of
Effects of Tints of Red, Values of Gray
and Degrees of Difficulty
For Learning Disability Children

| Source | df | ms | f | p |
|---|---|---|---|---|
| Between Subjects | | | | |
| SS Reds | 2 | 2560.69 | .3033 | ns |
| SS Grays | 2 | 5418.87 | .6417 | ns |
| SS Red x Gray | 4 | 54076.77 | 6.4040 | <.01 |
| Error | 81 | 8444.20 | -- | -- |
| Within Subjects | | | | |
| Degrees of Difficulty | 2 | 73483.30 | 9.76 | <.01 |
| Degrees of Difficulty x Red | 4 | 44706.61 | 5.94 | <.01 |
| Degrees of Difficulty x Gray | 4 | 43857.66 | 5.82 | <.01 |
| Degrees of Difficulty x Red x Gray | 32 | 874.37 | .12 | ns |
| Error | 138 | 7529.90 | -- | -- |

by black.

It was thus found that the following combinations proved to be the most significant as affecting the time required by learning disability children to perform the required task:

Difficulty 2 by rose

Difficulty 2 by gray

Difficulty 2 by black

Difficulty 3 by black

Rose by gray.

The analysis of the effectiveness of the three tints of red, three degrees of difficulty and three values of gray upon the motor speed of normal is described by Table 3. It may be noted that there were no significant differences between the normal subjects for tints of red, values of gray nor the interaction of tints of red and values of gray.

Inspection of Table 3 shows that the effects of degrees difficulty and degrees of difficulty by grays were significant while degrees of difficulty by reds and degrees of difficulty by reds by grays were not significant.

Even though the F ratio showed a significant difference among the three degrees of difficulties, the t-test failed to prove any significant differences among the three. However, as seen by Table 8, there was a much greater difference between Difficulties 2 and 3 than between Difficulties 1 and 2 or Difficulties 1 and 3.

The degree of the effectiveness of the interaction of degrees of difficulty by values of gray is shown by Table 7. Inspection of Table 5 shows that Difficulty 1 by gray and Difficulty 3 by gray appeared to be the most meaningful. Other significant differences were scattered and without definite pattern.

Table 3

Summary of Analyses of Variance of
Effects of Tints of Red, Values of Gray
and Degrees of Difficulty
For Normal Children

| Source | df | ms | f | p |
|---|---|---|---|---|
| Between Subjects | | | | |
| SS Reds | 2 | 3821.62 | .1817 | ns |
| SS Grays | 2 | 5159.91 | .2527 | ns |
| SS Reds x Grays | 4 | 38149.40 | 1.8680 | ns |
| Error | 81 | 20422.99 | -- | -- |
| Within Subjects | | | | |
| Degrees of Difficulty | 2 | 16336.28 | 3.4646 | <.01 |
| Degrees of Difficulty x Red | 4 | 990.42 | .2100 | ns |
| Degrees of Difficulty x Gray | 4 | 15051.23 | 3.1921 | <.01 |
| Degrees of Difficulty x Red x Gray | 32 | 3725.99 | .7902 | ns |
| Error | 138 | 4715.19 | -- | -- |

Table 4

T-test-Difficulty by Reds
Learning Disability Children

| | | $X_1P$ 1 | $X_1R$ 2 | $X_1Ro$ 3 | $X_2P$ 4 | $X_2R$ 5 | $X_2Ro$ 6 | $X_3P$ 7 | $X_3R$ 8 | $X_3Ro$ 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| $X_1P$ | 1 | | | | | | | | | |
| $X_1R$ | 2 | NS | | | | | | | | |
| $X_1Ro$ | 3 | NS | NS | | | | | | | |
| $X_2P$ | 4 | NS | NS | NS | | | | | | |
| $X_2R$ | 5 | NS | NS | NS | NS | | | | | |
| $X_2Ro$ | 6 | 29.7 | NS | NS | NS | NS | | | | |
| $X_3P$ | 7 | 41.1 | 56.9 | 53.30 | 55.67 | 56.53 | 70.83 | | | |
| $X_3R$ | 8 | 28.6 | 44.43 | 40.83 | 43.20 | 44.06 | 58.36 | NS | | |
| $X_3Ro$ | 9 | 39.7 | 54.53 | 56.90 | 53.30 | 54.16 | 68.46 | NS | NS | |

Table 5

T-test-Difficulty by Reds x Grays
Learning Disability Children

| | | PxB<br>1 | PxG<br>2 | PxW<br>3 | RoxB<br>4 | RoxG<br>5 | RoxW<br>6 | RxB<br>7 | RxG<br>8 | RxW<br>9 |
|---|---|---|---|---|---|---|---|---|---|---|
| PxB | 1 | | | | | | | | | |
| PxG | 2 | NS | | | | | | | | |
| PxW | 3 | NS | NS | | | | | | | |
| RoxB | 4 | NS | NS | NS | | | | | | |
| RoxG | 5 | 31.77 | NS | 27.20 | NS | | | | | |
| RoxW | 6 | 35.77 | 27.10 | 31.20 | 28.90 | NS | | | | |
| RxB | 7 | 39.30 | 30.63 | 34.73 | 32.43 | NS | NS | | | |
| RxG | 8 | 38.74 | 30.07 | 34.17 | 31.87 | NS | NS | NS | | |
| RxW | 9 | NS | NS | NS | NS | 35.30 | 39.30 | 42.83 | 42.27 | |

Table 6

T-test-Difficulty by Grays
Learning Disability Children

| | | $X_1B$ 1 | $X_1G$ 2 | $X_1W$ 3 | $X_2B$ 4 | $X_2G$ 5 | $X_2W$ 6 | $X_3B$ 7 | $X_3G$ 8 | $X_3W$ 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| $X_1B$ | 1 | | | | | | | | | |
| $X_1G$ | 2 | NS | | | | | | | | |
| $X_1W$ | 3 | NS | NS | | | | | | | |
| $X_2B$ | 4 | 38.03 | NS | NS | | | | | | |
| $X_2G$ | 5 | 38.00 | NS | NS | NS | | | | | |
| $X_2W$ | 6 | NS | NS | NS | NS | NS | | | | |
| $X_3B$ | 7 | NS | 38.67 | 43.27 | 57.00 | 56.97 | 43.70 | | | |
| $X_3G$ | 8 | NS | NS | 29.94 | 43.67 | 43.64 | 30.37 | NS | | |
| $X_3W$ | 9 | 39.34 | 59.04 | 63.64 | 77.37 | 77.34 | 64.07 | NS | 30.70 | |

Table 7

T-test-Difficulty by Grays
Normal Children

| | | $X_1B$<br>1 | $X_1G$<br>2 | $X_1W$<br>3 | $X_2B$<br>4 | $X_2G$<br>5 | $X_2W$<br>6 | $X_3B$<br>7 | $X_3G$<br>8 | $X_3W$<br>9 |
|---|---|---|---|---|---|---|---|---|---|---|
| $X_1B$ | 1 | | | | | | | | | |
| $X_1G$ | 2 | 71.64 | | | | | | | | |
| $X_1W$ | 3 | NS | 55.57 | | | | | | | |
| $X_2B$ | 4 | NS | 84.94 | NS | | | | | | |
| $X_2G$ | 5 | NS | 47.70 | NS | 39.24 | | | | | |
| $X_2W$ | 6 | NS | 40.17 | NS | 46.24 | NS | | | | |
| $X_3B$ | 7 | NS | 64.67 | NS | NS | NS | NS | | | |
| $X_3G$ | 8 | 77.00 | NS | 60.93 | 92.30 | 76.94 | 46.06 | 59.97 | | |
| $X_3W$ | 9 | 45.07 | NS | NS | 60.57 | NS | NS | 38.37 | NS | |

Table 8

T-test for Degrees of Difficulty
Learning Disability Children

| Source | T-value | p |
|---|---|---|
| Difficulty 1 x Difficulty 2 | 10.58 | ns |
| Difficulty 1 x Difficulty 3 | 45.50 | < .01 |
| Difficulty 2 x Difficulty 3 | 56.07 | < .01 |

Table 9

T-test for Degrees of Difficulty
Normal Children

| Source | T-value | p |
|---|---|---|
| Difficulty 1 x Difficulty 2 | 11.94 | ns |
| Difficulty 1 x Difficulty 3 | 14.89 | ns |
| Difficulty 2 x Difficulty 3 | 26.89 | ns |

<u>Summary</u>

The affect of the results of the study upon the hypotheses may be summarized as follows:

Hypothesis 1 - There were no significant differences among the three tints of red upon the motor performance time of learning disability children.

Hypothesis 2 - There were no significant differences among the three values of gray upon the motor performance time of learning disability children.

Hypothesis 3 - There was a significant difference among the interaction of three tints of red and three values of gray upon the motor performance time of learning disability children.

Hypothesis 4 - There were significant differences among the three degrees of difficulty upon the motor performance time of learning disability children.

Hypothesis 5 - There was a significant difference among the effects of the interaction of the three degrees of difficulty and three tints of red upon the motor performance time of learning disability children.

Hypothesis 6 - There was a significant difference among the effects of the interactions of the three degrees of difficulty and three values of gray upon the motor performance time of learning disability children.

Hypothesis 7 - There was no significant difference among the effects of the three degrees of difficulty by three tints of red by three values of gray upon the motor performance time of learning disability children.

Hypothesis 8 - There was no significant difference among the effects of three tints of red upon the motor performance time of normal children.

Hypothesis 9 - There was no significant difference among the effects of three values of gray upon the motor performance time of normal children.

Hypothesis 10 - There was no significant difference among the effects of the interaction of three tints of red and three values of gray, upon the motor performance time of normal children.

Hypothesis 11 - There was a significant difference among the effects of three degrees of puzzle difficulty upon the motor performance time of normal children.

Hypothesis 12 - There was no significant difference among the effects of three degrees of puzzle difficulty by three tints of red upon the motor performance time of normal children.

Hypothesis 13 - There was a significant difference among the effects of three degrees of puzzle difficulty by three values of gray upon the motor performance time of normal children.

Hypothesis 14 - There was no difference among the effects of the interaction of three degrees of difficulty by three tints of red by three values of gray upon the motor performance time of normal children.

Thus it may be concluded that Hypotheses 1, 2, 7, 8, 9, 10, 12 and 14 were accepted while Hypotheses 3, 4, 5, 6, 11, and 13 were rejected.

## Discussion

Studies performed in the past revealed an affectiveness of the color red as opposed to green, blue and yellow in children with minimal brain injury. (8) These past studies then led to this current investigation of the three shades of red.

In general, it appears that boys with learning disabilities are more affected by differences in shades of reds and values of gray than normal children. This is suggestive of the concept that these children are more susceptible to variances in color and values. Therefore, such variances in these childrens' environment should be handled with care and thought.

Black appeared to be significant in its interaction with Difficulty 2, Difficulty 3 and rose. Since Uhlin found that Cerebral Palsied children reacted more favorably to activities involving white on black than black on white the black might be considered a factor in classroom methods. For instance, slates and chalk were found preferable to paper and pencil for the teaching of handwriting. This fact could reinforce suggestions for increased blackboard activities for children with learning disabilities. (22:10).

Use of the overhead projector might be a considered vehicle with these children. The utilization of old x-rays on which information is scratched--thus revealing white on black--should prove successful.

Saturation was seemingly a factor in the interaction of the red-gray combination. Red x white and rose x black were the more effective interactions. Children having handwriting problems could try using red crayons on white paper or black crayon on rose paper.

In general, differences of saturation seem to be of significance to the performance of minimally brain injured children. Such differences should be considered when involving the child in manipulative tasks. Saturation difference should be considered in terms of foreground-background as well as between the individual manipulatives involved.

CHAPTER V

# SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

## Summary

Ninety learning disability children and ninety "normal" children were tested with block designs from the WISC. The children were randomly assigned to work puzzles of color combinations as follows: red and white, red and gray, red and black; rose and white, rose and gray, rose and black; pink and white, pink and gray, pink and black. Each child was given one color combination of puzzles in three degrees of difficulty. The time required for the child to work each puzzle was recorded in seconds.

A three by three analysis of variance was calculated and the F ratio determined separately for the learning disability group and for the normal group. A t-test was determined for all positive F ratios. The three factors involved were three tints of red, three values of gray and three degrees of difficulty.

Positive F ratios were found for learning disability children for reds by grays, degrees of difficulty and difficulty and degrees of difficulty by grays.

A t-test was then determined for each of the positive significant F ratios.

For the learning disability group, a significant difference was found between the first and third degrees and between the second and third degrees of difficulties.

Inspection of the t-test for the red-gray interaction revealed that red-white and rose-black combinations appeared to be the most effective interactions.

The difficulty by red interaction was tested and results suggested that the second degree of difficulty by rose was the more effective of the interactions.

The difficulty by gray interaction revealed a rather diffuse patterning, suggesting three possible effective combinations: difficulty 2 by gray, difficulty 2 by black and difficulty 3 by black.

Thus, the most effective interaction revealed by the t-tests for learning disability children included:

difficulty 2 by difficulty 3

difficulty 1 by difficulty 3

difficulty 2 by rose

difficulty 2 by gray

difficulty 2 by black

difficulty 3 by black

rose by black

red by white

The analysis of variances for the normal children proved to be somewhat less revealing. There were no significant differences among tints of red, values of gray, interaction of tints of red and values of gray, interaction of difficulty by tints of reds nor interaction of difficulty by tints of red by values of gray.

The t-test for degrees of difficulty failed to reveal any significant differences among the three degrees of difficulties. However, the greatest difference appeared to exist between the second and third degrees.

The t-test for the interaction of degrees of difficulty by values of gray suggested that both difficulty 1 by gray and difficulty 3 by gray were the more effective of the interactions.

## Conclusions

Results of the study suggest the following conclusions:

1. Differences in difficulty between the second and third puzzles might indicate an unequal difference in difficulty between the puzzle patterns of the WISC Block Design subtest.
2. Neither pink nor white appeared to be an effective tint nor value. This may be due to the fact that they are the least saturated of the tints or values involved

in the study and hence the least attractive or stimulating.

3. Decreased effectiveness of the pink-white interaction could be due to the closeness of degree of saturation of the two.
4. The increased effectiveness of the red-white interaction could be due to the difference in the degree of saturation of the two.

## Recommendations

From the conclusions of this study, the following recommendations might be suggested:

1. Each successive design of the Block Design subtest of the WISC should be checked to determine if they are truly equidistant apart in degrees of difficulty and are actually successively difficult.
2. Although racial differences were not considered in this study, such differences were observed. The differences among the Negro, Latin-American and Caucasian races should be studied. This might be

considered a highly significant factor in the validity of the Block Design subtest of the WISC irregardless of tint or value. This may also be considered a factor in teaching methods to be utilized in the classroom.

3. Neither pink nor white appeared to be an effective tint nor value for either group of children. Such colors might, therefore, be considered for backgrounds for other tints or values desirous of attention.
4. Differences among the three tints of red might be checked to determine their effectiveness on learning rate with learning disability children.

BIBLIOGRAPHY

1. Allen, Frank, and Manuel Schwartz. "The Effect of Stimulation of the Senses of Vision, Hearing, Taste and Smell Upon the Sensibility of the Organs of Vision," Journal of General Psychology, September 20, 1940.

2. Arnheim, Rudolf. Art and Visual Perception. Berkeley: University of California Press, 1965.

3. Bender, M. B., and H. L. Teuber. "Disturbances in Visual Perception Following Cerebral Lesions," Journal of Psychology, 28:223-233, July, 1949.

4. Benton, A. L. "The Color Responses: The Experimental Validation of the Rorschach Test," American Journal of Orthopsychiatry, 22:755-763, October, 1952.

5. Birren, Faber. Color Psychology and Color Therapy. University Book, Inc., 1950.

6. Birren, Faber. New Horizons in Color. New York: Reinhold, 1955.

7. Boehm, Sue A. "The Effect of Color Upon the Motor Coordination of Cerebral Palsied Children During a Performance Task." Unpublished Master's Thesis, University of Houston, 1965.

8. Boehm, Sue A. "The Effect of Color Upon the Motor Coordination of Minimally Brain-Injured Children During a Performance Task." Unpublished paper, University of Houston, 1969.

9. Brian, C. R., and F. L. Goodenough. "The Relative Potency of Color and Form Perception at Different Ages," Journal of Experimental Psychology, 12:197-213, 1929.

10. Corah, N. L. "The Influence of Some Stimulus Characteristics on Color and Form Perception in Nursery-School Children," Child Development, 37:205-211, 1966.

11. Emery, Marguerite, "Color Therapy," Occupational Therapy and Rehabilitation, 21:41-44, February, 1942.

12. Gaines, R. "Color-Form Preferences and Color-Form Discriminative Ability of Deaf and Hearing Children," Perceptual and Motor Skills, 18:1, 1964.

13. Gerard, Robert. "Color and Emotional Arousal," American Psychologist, 13:34, July, 1958.

14. Goldstein, Kurt. "Some Experimental Observations Concerning the Influence of Colors on the Function of the Organism," Occupational Therapy and Rehabilitation, 21:147-151, June, 1942.

15. Guilford, J. P. "Affective Value of Color as a Function of Hue, Chroma and Tint," Journal of Experimental Psychology, 17:343-369, June, 1934.

16. Kagan, J., and S. Lemkin. "Form, Color, and Size in Children's Conceptual Behavior," Child Development, 32:25-28, 1961.

17. McCarthy, James J., and Joan F. McCarthy. Learning Disabilities. Boston: Allyn and Bacon, Inc., 1969.

18. Mossee, Eric P. "Color Therapy," Occupational Therapy and Rehabilitation, 21:33-35, February, 1942.

19. Pressey, Sidney L. "The Influences of Color Upon Motor and Mental Efficiency," American Journal of Psychology, 32:326-356, July, 1921.

20. Suchman, R. G. "Color-Form Preference Discrimination Accuracy and Learning of Deaf and Hearing Children," Child Development, 37:439-451, 1966.

21. Texas State Plan for Special Education.

22. Uhlin, Donald M. The Basis of Art for Neurologically Handicapped Children, California Association for Neurologically Handicapped Children, Berkeley, California.

23. Guilford, J. P. Fundamental Statistics in Psychology and Education. New York: McGraw Hill Book Company, 1956.

24. Wechsler, D. Manual for the WISC. New York: Psychological Corp., 1949.