8-1963

Effects of Various Tests on the Improvement of Reaction Time of Selected Students at Tennessee School for the Deaf

Joseph Glennon Lanford
University of Tennessee - Knoxville

To the Graduate Council:

I am submitting herewith a thesis written by Joseph Glennon Lanford entitled "Effects of Various Tests on the Improvement of Reaction Time of Selected Students at Tennessee School for the Deaf." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Education.

Ben Plotnicki, Major Professor

We have read this thesis and recommend its acceptance:

E. Casper, Nancy Lay

Accepted for the Council:
Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

August 10, 1963

To the Graduate Council:

I am submitting herewith a thesis written by Joseph Glennon Lanford entitled "Effects of Various Tests on the Improvement of Reaction Time of Selected Students at Tennessee School for the Deaf." I recommend that it be accepted for nine quarter hours of credit in partial fulfillment of the requirements for the degree of Master of Science, with a major in Physical Education.

Ben A. Rothrock
Major Professor

We have read this thesis and recommend its acceptance:

E Capen

Nancy Lay

Accepted for the Council:

Hilton A. Smith
Dean of the Graduate School

EFFECTS OF VARIOUS TESTS ON THE IMPROVEMENT OF REACTION TIME OF SELECTED STUDENTS AT TENNESSEE SCHOOL FOR THE DEAF

A Thesis

Presented to

The Graduate Council of

The University of Tennessee

In Partial Fulfillment

of the Requirements for the Degree

Master of Science

---

by

Joseph Glennon Lanford

August 1963

ACKNOWLEDGMENTS

The writer wishes to express his appreciation for the encouragement, assistance, and guidance given by Dr. Ben Plotnicki, for his efforts in guiding this research project. He also wishes to express gratitude to Mr. Conley Akin, Instructor of Physical Education at the Tennessee School for the Deaf, for his assistance in obtaining subjects for this project.

TABLE OF CONTENTS

LIST OF TABLES

CHAPTER I

I. INTRODUCTION

In the fields of physical education and in athletics it is a well known fact that reaction time is a desirable characteristic of all who participate. Comparable to that of speed, strength, power, and agility, reaction time can mean the difference between success and failure. There are many ways in which the above mentioned characteristics can be improved. It is the writer's belief that if a test or battery of tests could be developed to improve reaction time, it would greatly benefit the physical educator, the coach, and the individual who participates in athletics.

II. STATEMENT OF THE PROBLEM

It was the purpose of this study to show the relationship between the results of the tests of the two experimental groups and a control group in order to determine: (1) if there was any significant improvement within each group, and (2) if there was any difference in the three methods used.

III. SCOPE OF THE PROBLEM

This study was concerned with reaction time to a simple visual stimulus. The study was developed through the use of the t-statistic from data collected on the initial and final tests of two experimental groups and a control group.

The first experimental group was given the Dyer Tennis Test, the Johnson Basketball Dribble Test and the Brady Wall Volley Test.

The second experimental group was given tests on the reaction-time apparatus used in the experiment.

The control group participated in the regular physical education classes with no specified practice for the purpose of increasing reaction time.

The study was conducted at The Tennessee School for the Deaf, Knoxville, Tennessee. It should be noted that when a sense is lacking, the other senses tend to become keener.[1] The selection of deaf students as subjects, therefore, did not influence the outcome of this study. The

---

[1] Samuel Grove Dow, Society and Its Problems (New York: Thomas Y. Crowell Company, 1922), p. 547.

tests conducted on the reaction-time apparatus did not necessitate the sense of hearing.

CHAPTER II

REVIEW OF THE LITERATURE

I. STUDIES OF REACTION TIME

According to Ladd, the simplest reaction time is a very complex affair which is composed of seven elements.

1. An action of the stimulus on the end-organ of the sense.
2. Centripetal conduction in the nerve.
3. The same in the spinal cord and lower parts of the brain.
4. Transformation of the sensory into the motor cerebral process.
5. Centrifugal conduction in the lower brain and cord.
6. The same in the motor nerve.
7. Setting-free of the muscular motion.[1]

Reaction time varies with the quality of the stimulus, with its duration, its intensity, size, with the individual subject and his age, training, interest, attention, practice, fatigue, and with the character of the response required. Simple reaction is learned and is not a native response. It

---

[1]Miriam Guthrie, "Social Modification of Simple Reaction Time of Adults," (unpublished Master's thesis, The University of Tennessee, Knoxville, 1941), p. 21.

involves not only the lower, but also the higher nerve centers. Special preparation on the part of the subject and special instructions and ready signals are necessary if reliable and uniform results are to be obtained.[2]

Slater-Hammel conducted a study for the purpose of obtaining further evidence on the psychological refractory period, i.e. delay in an individual's reaction time to the second to two stimuli, when such stimuli are presented in close proximity to another. Two groups of five subjects completed simple and varied reaction-time responses to the appearance of visual signals and the procedure for groups were varied only in respect to the duration of stimuli.

The major findings were: (a) the duration of signals had no significant effect upon either single or paired reaction times; (b) delays in the second reaction time in paired responses persisted throughout the entire range of 50-500 milliseconds between signals; (c) when the interval between signals was greater than the first reaction time in paired responses, the second reaction time was inversely related to

---

[2]William S. Foster, Experiments in Psychology (New York: Henry Holt and Company, 1934), pp. 132-44.

the interval between signals; and (d) the first reaction time in paired responses was significantly longer than the simple reaction time for that number.[3]

Cattell found that practice has little effect upon the time of responses after the first few trials, in which the subjects reactions often vary markedly. After practice a subject's responses are apt to become habitual or automatic, and the reaction may temporarily become a "secondary" reflex (conditional reflex).[4]

Moore's hypothesis was that individual differences in reaction time arise from the fact that there is a natural and permanent tendency in all people to take the same cue for movement as for speech. Voluntary motor performance, as in speech, depends, in each particular exercise of it, upon the possibility of getting clearly in mind some mental picture which has to represent particular movements involved. This may be a sensory or motor cue. Therefore, in simple hand movements, people may be sensory or motor types. The

---

[3]A. T. Slater-Hammel, "Psychological Refractory Period in Simple Paired Responses," Research Quarterly, 29:468, December, 1958.

[4]Foster, loc. cit.

individual who gives relatively shorter sensory reaction is "sensory," and his attempt to think of movement as movement interferes with the prompt and exact execution of it, just because he is not accustomed to executing movements that way. The former type of individual possesses what is known as the muscular attitude. For people in general, the reaction time is shorter when the attention is concentrated on the motion.[5]

As early as 1888, Lange, in Wernt's new psychological laboratory in Germany, showed that reaction time varies with the attentional predisposition of the observer.[6]

A further study, comparable to that of Lange, was made by Forster, in which he found the reaction time of adults to be shorter than the reaction time of children and chimpanzees. The chimpanzees' reaction time was more rapid than that of the children when the stimulus was visual, slower when the stimulus was auditory and equal when it was tactual. He also found in children a decreasing variability with increasing age. Sensory and motor processes differ in degree from individual to individual, but they are about the

---

[5] Guthrie, op. cit., p. 22.

[6] Ibid.

same from race to race; however, there are sex differences, and Thompson found that 68 per cent of the men reached or exceeded the median of the women in reaction time.[7] Also, there is a fairly regular decrease in reaction time with age (subjects used ranged from three and a half years to adults in college), and boys, on the average, react somewhat more quickly than girls. Reaction time becomes more stable as well as faster with age, but in old age it becomes more variable. Adults from sixty to eighty-five years of age are usually not more than approximately 25 per cent slower than comparable individuals in middle life.[8]

Holmes, in 1925, tested reaction time to photometrically equal chromatic stimuli and found the difference in time to be not only small, but also unreliable. He used five lights: green, blue, red, white and yellow.[9]

---

[7] Ibid., p. 24.

[8] W. K. Miles, "Correlation of Reaction Time and Coordination Speed with Age in Adults," American Journal of Psychology, 43:377-91, July, 1931.

[9] J. L. Holmes, "Reaction Time to Photometrically Equal Chromatic Stimuli," American Journal of Psychology, 37:414-17, July, 1926.

Obrist writes that simple reaction time to light or sound has been found by most observers to decrease with age until around twenty years, when it has its lowest value. Bellis observed a subsequent increase in reaction time from middle age to sixty years and a substantial increase in the next two decades. Inspection of tables presented by both authors suggest a trend of greater individual differences with advancing age. Miles places particular emphasis on differences between individuals, noting that about a quarter of the people in their seventies and eighties have, in spite of their age, reaction times that are faster than the general average for adults.[10]

In any reaction experiment, the reaction of the subject is determined according to a set formula. In simple reaction, the response is generally made by moving the index finger. Practice increases speed of all fingers but some more than others; for this reason, if for no other, directions are usually given for the subject to use the same finger for the duration of the experiment. Another prerequisite is the "ready signal." The experimenter must vary the

---

[10]Walter D. Obrist, "Simple Auditory Reaction Time in Aged Adults," Journal of Psychology, 35:259, January, 1953.

time between the ready signal and the stimulus, or the subject will use the signal as a stimulus and react to the interval. Under several sets of conditions, where a light was used as a stimulus, reactions to the disappearance of the light were a little faster than reactions to the coming on of the light.[11]

Woodrow found the most favorable interval between the warning stimuli and the true stimuli to be two seconds, and the reaction time is increased in a marked manner when the interval is either shorter or longer than the favorable two seconds. High tensions on the part of the subject seem to handicap activities, because they diminish ease of movement. On the other hand, low tension is probably involved in lack of alertness or effort. A moderate amount of tension is best.[12]

Fay reports that smoking apparently affects reaction in people in different ways. It facilitates some and

---

[11]Guthrie, op. cit., p. 26.

[12]Herbert Woodrow, "The Effect Upon Reaction Time of Variation in the Preparatory Interval," Psychological Monograph, 17:16-18, December, 1914.

inhibits some; the differences are not reliable.[13]

In contrast to the effect of smoking upon one's reaction time, Hartmann says odor can temporarily increase visual acuity when the subject is allowed to sniff various odorous substances. He also points out that odor has a general sensitizing effect on the nervous system as a whole, and on certain attuned sensorimotor systems in particular.[14]

Other external factors appear to affect reaction time. Encouragement or mild praise increases reaction time by about eight milliseconds, but negative incentive, or punishment, speeds it up twenty milliseconds or more. Drugs have a variable effect upon reaction time: coffee and tea appear to shorten it; small doses of alcohol just shorten and then lengthen it; morphine, ether, and chloroform usually lengthen it.[15]

---

[13]Paul J. Fay, "The Effect of Smoking on Simple and Choice Reaction Time to Colored Lights," Journal of Experimental Psychology, 19:602, October, 1936.

[14]G. W. Hartmann, "Changes in Visual Acuity Through Simultaneous Stimulation of Other Sense Organs," Journal of Experimental Psychology, 16:382-92, June, 1933.

[15]Guthrie, op. cit., p. 28.

II. STUDIES PERTAINING TO ATHLETIC SUCCESS

Knapp conducted a study to test the hypothesis that the simple reaction times to a visual stimulus of top-class racket-game players are significantly shorter than those of research students.

The subjects consisted of twenty international competitors in squash or badminton and twenty men selected at random from a test of all research students at the University of Birmingham.

Knapp found that the reaction times of the sportsmen were significantly shorter than those of the research students. She also found that the variation in the reaction times of the sportsmen were significantly less than the variation in the reaction times of the research students.

This study would seem to support the hypothesis that the simple reaction times to a visual stimulus of top-class racket-game players are significantly shorter than those of a normal sample of the population as presented by a random sample of research students.[16]

---

[16]Barbara Knapp, "Simple Reaction Times of Selected Top-Class Sportsmen and Research Students," Research Quarterly, 32:409, October, 1961.

Olsen studied the relationship between psychological capacities and success in college athletics. The purposes of the study were to determine whether significant differences existed in reaction time, depth perception, and visual span of apprehension between groups of varsity athletes, intermediate athletes, and non-athletes at Boston University, and to determine the relationship, if any, of these three psychological capacities to selected sports skills in basketball, soccer, hockey, and baseball. This study was concerned with reaction time only, and the writer will point out the importance it played in the above study.

Three separate tests were used in measuring an individual's reaction time. These were (1) a choice reaction-time test, (2) a simple reaction-time test, and (3) a discriminatory reaction-time test.

Olsen concluded that (1) athletes had faster simple reaction time, choice reaction and discriminatory reaction time than the intermediate and non-athletes; and (2) intermediate athletes were faster in simple reaction time, choice and discriminatory reaction time than the non-athletes.

The simple reaction time, choice reaction time, and discriminatory reaction, depth perception, and span of

apprehension scores of small groups of athletes were correlated with sports skills to determine whether significant relationship existed. Of twenty correlations, only two were considered significant at the .05 level of confidence: +.477 for discriminatory reaction time and soccer ability; and +.394 for simple reaction time and offensive hockey skills.[17]

Tuttle and Westerlund investigated the relationship between running events in track and reaction times. The investigation was undertaken in order to determine whether there is a difference between the reaction times of those running the short distances and those who specialize in the distance events and also to see if there is any correlation between speed in running and reaction time.

The authors concluded: The mean reaction time--.121 seconds--of a group of champions is definitely shorter than that of any group studied regardless of the distance run. (2) The mean reaction times of the distance groups as defined in this investigation are distinctly different.

---

[17]E. A. Olsen, "Relationship Between Psychological Capacities and Success in College Athletics," Research Quarterly, 27:79, March, 1956.

The short distance men responded fastest--.131 seconds; the middle distance men were next in speed of response--.149 seconds; and the distance men had the slowest reaction time --.169 seconds. (3) There was a high degree of relationship between speed in running seventy-five yards and the reaction time. The coefficient of correlation was .893.[18]

Tuttle and Lautenbach did a similar study but instead of measuring the relationship between voluntary response by reaction time and running events, they measured the relationship between involuntary response by reflex time and the same events.

Their investigation found: (1) There is a direct relationship between the reflex times of sprinters and the distance of the race for which they are specially trained. The short distance men had the shortest and the distance men the longest reflex time. The middle distance men fell between these two. (2) There is a high degree of relationship between reflex time and speed in sprinting. The coefficient

---

[18] J. H. Westerlund and W. W. Tuttle, "Relationship Between Running Events in Track and Reaction Time," Research Quarterly, 2:95-100, October, 1931.

of correlation is .815.[19]

Beise and Peasly did a study to determine whether individuals skilled in sports demonstrate a similarity (1) in speed of reaction, (2) in speed of running, and (3) in speed when action requiring movement of the entire body is necessary.

The subjects were divided into three groups. The first group was selected on the basis of demonstrated skill in either tennis, golf, or archery. The second group was selected on the basis of demonstrated inability in physical education activities, i.e., the most noticeably uncoordinated. The third group was composed of those students who had made either the low score or the high score on the set of Brace's Motor Ability Tests.

The authors concluded that (1) with the small number of subjects and with the small number of trials, significant differences between skilled and unskilled individuals can be determined by the speed, agility, and reaction time test. They also concluded (2) within the skilled group, different

---

[19]Ruth Lautenbach and W. W. Tuttle, "The Relationship Between Reflex Time and Running Events in Track," Research Quarterly, 3:138-43, October, 1932.

levels of speed are found to exist, depending upon the sport in which the individual is proficient. Apparently, the more active the sport, the faster the speed in each element of the speed, agility, and reaction time tests.[20]

Keller, trying to determine the relationships between "quickness of bodily movement" and success in athletics, found that there is a positive relationship between the ability to move the body quickly and success in athletics. He also found that the requirements in quickness of bodily movements are not the same for all sports. A person with relatively slow total body reaction time has a better chance at attaining success in the more individual activities such as gymnastics, swimming, and wrestling than in sports in which he is required to react to rapidly changing conditions and to the movements of several team mates and opponents, such as in baseball, basketball and the like.[21]

---

[20]Dorothy Beise and Virginia Peasley, "The Relationship of Reaction Time, Speed and Agility of Big Muscle Groups to Certain Sport Skills," Research Quarterly, 8:133, March, 1937.

[21]Louis F. Keller, "The Relation of Quickness of Bodily Movement to Success in Athletics," Research Quarterly, 13:146-54, May, 1942.

Pierson investigated the comparison of fencers and non-fencers in speed of arm movement, space perception, the ability to make rapid, correct judgments, and certain reaction and anthropemetric measures. Here again the only concern is reaction time. The author concluded that: (1) fencers are significantly faster than non-fencers in those measures which involve movement of the arm, and (2) fencers and non-fencers do not differ in discriminatory or simple reaction time when it is measured by the fingers-press method.[22]

---

[22]William K. Pierson, "Comparison of Fencers and Non-fencers by Psychomotor, Space Perception and Authropmetric Measures," Research Quarterly, 27:90-95, March, 1956.

CHAPTER III

PROCEDURE

I. SUBJECTS

The subjects were twenty-seven male students from The Tennessee School for the Deaf. They were selected from four physical education classes, with their ages ranging from sixteen years to twenty years and their classifications from freshmen to junior.

All the subjects were right handed and each one had scored above the fiftieth percentile on the American Association for Health, Physical Education, and Recreation physical fitness tests. The subjects indulged in neither drinking nor smoking, and all seemed to be in excellent health.

All the subjects volunteered their services, and insofar as it was possible to observe, there were no exceptional cases; but, rather, all seemed to be the average for the high school students at Tennessee School for the Deaf.

All the subjects were willing to participate and both experimental groups practiced each and every test with enthusiasm. None of the subjects were familiar with the methods

used; however, some had practiced drills in dribbling in basketball, in tennis wall volley, and volleyball wall volley tests.

II. APPARATUS

Chronoscope. The particular chronoscope used in the experiment was chosen because each hand could be tested separately and also could be tested together as was done in the third experiment.

The chronoscope was the box type with devices on two sides which controlled the initial and final reactions of the subjects.

The side which faced the tester showed a timing device which read in 1/100 seconds, five lights, and a switch to control each light. To the right of these five switches was another switch which controlled the starting of the chronoscopic action and to the right of it was a switch which controlled the stopping of the chronoscopic action. On the far right side of the chronoscope, there were two green lights which showed the tester which hand was being used by the subject. When the green light on the right side came on, the subject was using his right hand and when the

green light on the left side came on, the subject was using his left hand. These lights were used to be certain that the subject was using the proper hand designated by the tester. Below these lights, on the far right side of the chronoscope, was a delay switch which delayed the beginning of the chronoscopic action from one to five seconds after the starter switch had been turned on. This is shown in Figure 1.

The side facing the subject (Figure 2) had two switches, one for the right hand and one for the left hand. Above these switches were five lights, red, blue, white, purple, and orange. (Only the blue, red and white lights were used in this experiment.) When one of these lights came on, the subject was instructed to press the switch, which would in turn stop the timing device facing the tester.

III. EXPERIMENTAL PROCEDURE

The subjects were divided into three groups of nine each, two were experimental and one was control.

Each subject in each group was given an initial test on the reaction-time apparatus prior to any practice time or experimental sessions. The subjects were given three tests

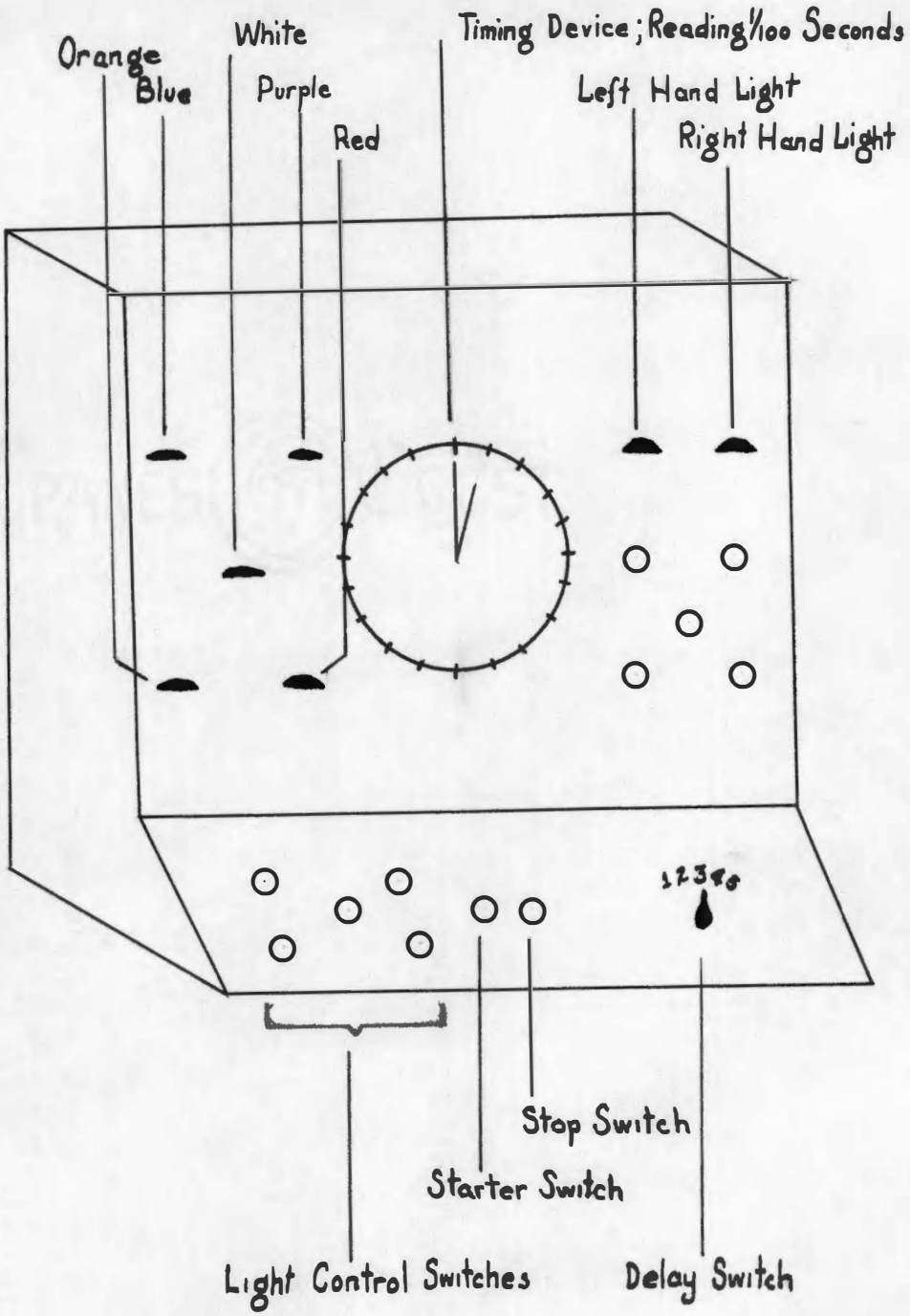

FIGURE 1
CHRONOSCOPE

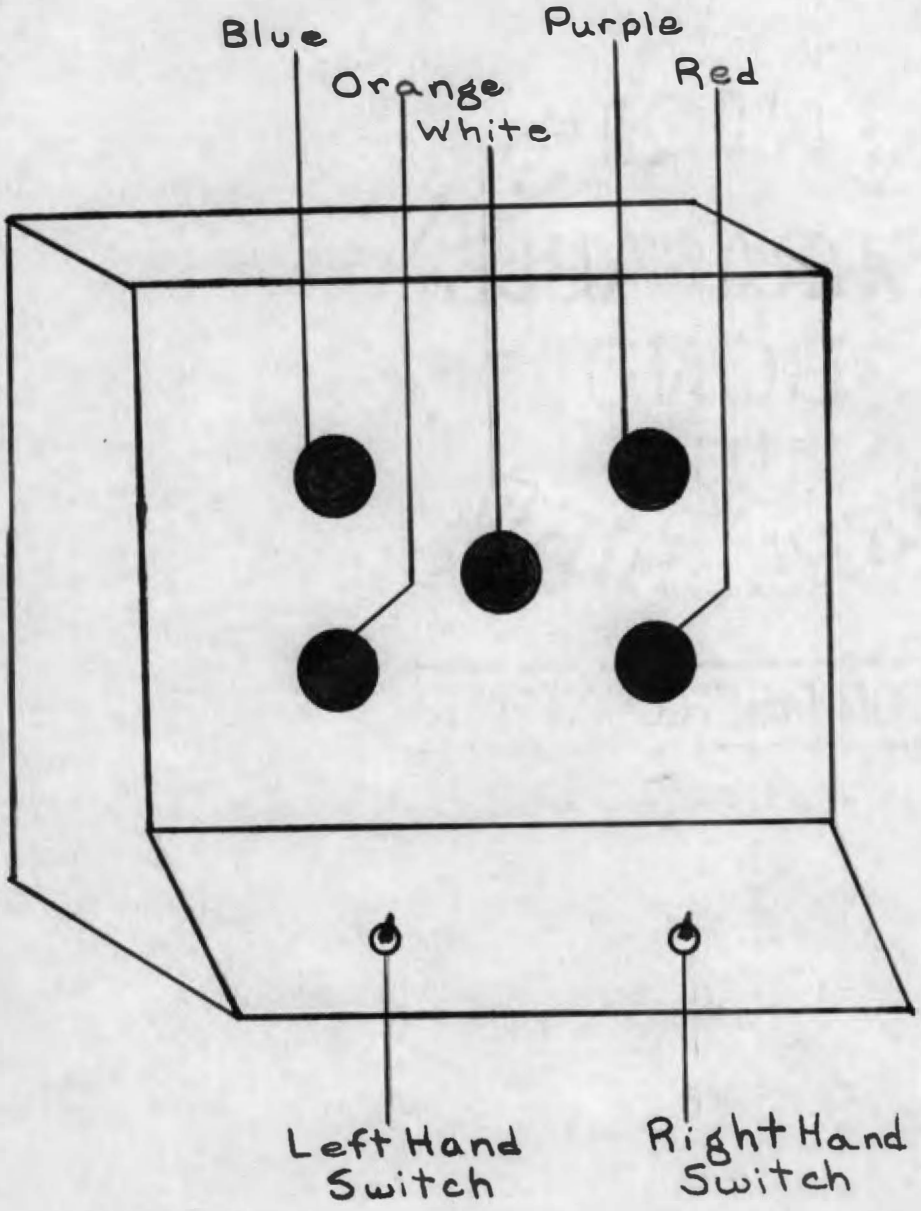

FIGURE 2
CHRONOSCOPE

of three different types. The first test was with the index finger on the right hand, the second was with the index finger on the left hand, and the third was with the index finger on either the right or the left hand, depending on the color of the light. When the blue light appeared on the subject's side of the apparatus, it indicated that right hand movement was required to stop the timing device; and when the red light appeared, the left hand movement was necessary. The results collected from these tests were labeled as initial data.

Eighteen of the subjects were then put into experimental groups with nine in each. The first experimental group was given practice tests in (1) the Johnson Basketball Test, (2) the Dyer Tennis Test, and (3) the Brady Wall Volley Test. These tests were used to see if they would aid in the eye-to-hand coordination, similar to that required to perform the reaction-time tests.

The Johnson Basketball Test is used to test one's ability in dribbling. The starting line is six feet long and the first hurdle is located parallel to and twelve feet from the starting line. The second, third and fourth hurdles are located parallel to the first hurdle--eighteen,

twenty-four, and thirty feet, respectively, from the starting line. Dribbling diagonally, the player passes the left end of the first hurdle, the right end of the second hurdle, the left end of the third hurdle and the right end of the fourth hurdle. He dribbles around the fourth hurdle and continues to dribble diagonally past the left end of the third hurdle and to the right end of the second hurdle, the left end of the first hurdle, and the right end of the starting line.[1]

The Dyer Backboard Tennis Test consists of rallying the ball against a wall for periods of thirty seconds scoring as many strokes in that time as possible.[2]

The Brady Volleyball Test consists of volleying the ball against the wall in a space five feet wide and above a line eleven feet and six inches from the floor.[3] This was also done for thirty seconds, scoring as many strokes in that time as possible.

---

[1]Charles Harold McCloy and Norma Dorothy Young, Tests and Measurements in Health and Physical Education (New York: Appleton-Century-Crafts, Inc.), 1954, pp. 245-53.

[2]Ibid.

[3]Ibid.

Each of the subjects in experimental group number one practiced the tests three times a week for five weeks. At the end of five weeks, they were again given the reaction-time test, which results were classified as final data.

The second experimental group, which also consisted of nine subjects, practiced three times a week for five weeks on the reaction-time apparatus exactly like the test given for the initial data. At the end of five weeks, they again took the tests and the results compiled were classified as final data.

The third group, which was a control group, had no special practice sessions, but participated in the regular physical education program, which included learning and practicing the high jump for two weeks and swimming for three weeks. At the end of five weeks, as in the two experimental groups, they were given the reaction-time tests, which results were classified as final data.

Each subject was given several practice tests on each experiment before actual testing began. They were also given a ready signal before each test and strict attention was required before testing began.

CHAPTER IV

RESULTS

It is the purpose of this chapter to present the data which were compiled and to show and clarify further the results of this investigation. For analyzing these data, the t-statistic was utilized and the significant differences were determined between the initial and final tests. Further analysis determined the significant differences between the experimental groups and the control group.

The first experimental group showed improvement in all three tests with the most noticeable gains being in the second and third tests. Each of the two tests recorded improvement at less than the 1 per cent level of confidence. The test with the right hand showed improvement at less than the 15 per cent level of confidence. The results are shown in Table I.

The second experimental group also showed improvement in all three tests; however, this improvement was not as significant as was the first group. The greatest improvement was noticed in the third test with a level of confidence

TABLE I

IMPROVEMENT IN REACTION TIME BY FIRST EXPERIMENTAL GROUP

	Initial Mean	Final Mean	Mean Difference	"t"	Per Cent Level of Confidence
Right hand	.28145	.2492	.0322	1.6	14.82
Left hand	.2773	.2425	.0348	3.5	0.80
Right or left hand	.4521	.3583	.0958	3.4	0.94

less than 2 per cent. The first test showed improvement at less than the 13 per cent level of confidence. The second test, which was with the left hand, was the least significant of the three with a level of confidence less than 49 per cent. See Table II.

The third group, which was the control group, showed the least amount of improvement. The first two tests in this group showed improvement at less than the 64 per cent level of confidence which was not significant. The final test for this group showed the improvement level to be lower than that for the previous two tests with the t being less than the 70 per cent level of confidence. These results are shown on Table III.

The t was then used to determine the significant differences between the two experimental groups as compared to the control group.

The first experimental group, when compared to the control group, showed little or no significant difference in the first two tests. However, in the third test, when either the right or the left hand could have been used, the significant difference was found to be less than the 1 per cent level of confidence. Table IV illustrates this point.

TABLE II

IMPROVEMENT IN REACTION TIME BY SECOND EXPERIMENTAL GROUP

	Initial Mean	Final Mean	Mean Difference	"t"	Per Cent Level of Confidence
Right hand	.2566	.2382	.0174	1.7	12.76
Left hand	.2524	.2452	.0072	0.72	50.37
Right or left hand	.3436	.3140	.0296	3.00	1.70

TABLE III

IMPROVEMENT IN REACTION TIME BY CONTROL GROUP

	Initial Mean	Final Mean	Mean Difference	"t"	Per Cent Level of Confidence
Right hand	.2963	.2754	.0209	0.5	63.06
Left hand	.2933	.3025	-.0092	0.5	63.06
Right or left hand	.4003	.3870	.0133	0.4	69.96

TABLE IV

SIGNIFICANT DIFFERENCE BETWEEN FIRST EXPERIMENTAL GROUP AND CONTROL GROUP

	Mean Difference Experimental Group I	Mean Difference Control	"t"	Per Cent Level of Confidence
Right hand	.0322	.0209	0.3	100
Left hand	.0348	.0092	0.0	100
Right or left hand	.0938	.0133	8.0	less than 1.0

After a comparison of the second experimental with the control group, it was again found that there was no evidence indicating the existence of any significant differences between these groups in the first two tests. The third test proved to be significant at less than the 13 per cent level of confidence. The results are shown on Table V.

TABLE V

SIGNIFICANT DIFFERENCE BETWEEN SECOND EXPERIMENTAL GROUP AND CONTROL GROUP

	Mean Difference Experimental Group No.1	Mean Difference Control	"t"	Per Cent Level of Confidence
Right hand	.0174	.0209	0.0	100
Left hand	.0072	.0092	0.0	100
Right or left hand	.0296	.0133	1.6	12.80

CHAPTER V

SUMMARY AND CONCLUSIONS

I. SUMMARY

The problem of testing the improvement of reaction time of selected students from Tennessee School for the Deaf to a visual stimulus was investigated. The subjects, twenty-seven male students, were tested twice--once before and then after the experiment. The subjects were divided into groups, consisting of nine students each. Two of the groups were experimental, with each individual taking part in various tests during a five week period. The third group was a control group which consisted of nine individuals taking part in the regular physical education classes. In each test, the subjects were given a preliminary practice period of one trial on each of the three tests.

Insofar as possible, all external conditions were controlled and the same conditions prevailed in the testing of all subjects.

The data were analyzed and the significant differences

were determined between the initial and final tests. Further analysis determined the significant differences between the experimental groups and the control group.

Results obtained showed noticeable differences in the improvement of reaction time within each experimental group. The first experimental group showed definite superiority in improvement over the second experimental group. In only the right hand test did the second experimental group show the most improvement and this difference was insignificant. In the left hand test and in the right or left hand test, the first experimental group showed the greatest improvement.

The differences noticed between these two experimental groups could be contributed to several things:

1. The first experimental group, while practicing the Brady Volleyball Test, the Johnson Basketball Test and the Dyer Tennis Test, could have developed a keener sense of reaction time than did the second experimental group. This does not necessarily mean that the first experimental group had the fastest time, but that they showed the most improvement.
2. The first experimental group, because of the variety of performance in the practice sessions, could have developed a sense of enthusiasm,

interest and willingness to do their best, which characteristic might not have been developed in the second experimental group, who day after day continued to do the exact same thing in each practice session.

3. Eight of the nine subjects in the first experimental group had and were, at the time, participating in varsity sports at the school for the deaf. Only five of the nine in the second experimental group were participating in varsity sports. This is not an end in itself, but could possibly have had some influence on the amount of improvement noticed in the final analysis.

The third group, which was the control group, showed little significant improvement in either of the three tests. The same reasons given for the differences between the two experimental groups could also be applied to the differences found in the amount of improvement of the control group when compared to either of the experimental groups--but to a greater degree.

The t-statistic was then used to determine the significant difference between the two experimental groups. In all experiments with the right hand, there was no significant difference when comparing the two experimental groups

with the control group. The same was found to be true when comparing the results of the left hand. The results compiled from these two experiments were analyzed and the differences were found not to be significant. However, when comparing the third test of the experimental groups and the third test of the control group, the difference found was highly significant. When comparing the third test of the first experimental group and the third test of the control group, the significant difference was found to be less than the 1 per cent level of confidence. When comparing the third test of the second experimental group with the third test of the control group, the significant difference was not as great as the first experimental group, but was found to be significant at less than the 13 per cent level of confidence.

It is necessary to note here that when comparing the right hand test and the left hand test of the experimental groups with the same tests of the control group, there was no significant difference. However, when the third test was compared, there were significant differences found in both groups. The writer contributes these differences primarily to the practice sessions, the first experimental group being

more effective than the second. It is also possible that the student's pre-knowledge of what was necessary to perform the third test resulted in greater efficiency than when the test was first given. However, the writer feels that this was a secondary contribution.

II. CONCLUSIONS

1. Each group showed an improvement in reaction time to a light stimulus with the two experimental groups showing more improvement than the control group.

2. The reason for improvement was due primarily to the student's familiarity with the apparatus used.

3. The differences found between the experimental groups and the control group, as to which method was most significant, were found to be little or none in the two tests.

4. When the third test was compared, the difference was found to be highly significant. The writer feels that the practice sessions were primarily responsible for this significant difference. The first experimental group proved their method was best for improving reaction time. The results proved to be highly significant at less than the 1 per cent level of confidence and a difference of 12 per cent when compared with the second experimental group.

BIBLIOGRAPHY

BIBLIOGRAPHY

Beise, Dorothy, and Virginia Peasley. "The Relation of Reaction Time, Speed and Agility of Big Muscle Groups to Certain Sport Skills," Research Quarterly, 8:133-42, March, 1937.

Dow, Samuel Grove. Society and Its Problems. New York: Thomas Y. Crowell Company, 1922.

Fay, Paul J. "The Effect of Smoking on Simple and Choice Reaction Time to Colored Lights," Journal of Experimental Psychology, 19:592-603, October, 1936.

Foster, William S. Experiments in Psychology. New York: Henry Holt and Company, 1934.

Guthrie, Mirian. "Social Modification of Simple Reaction Time of Adults." Unpublished Master's thesis, University of Tennessee, Knoxville, 1941.

Hartmann, G. W. "Changes in Visual Acuity Through Simultaneous Stimulation of Other Senses," Journal of Experimental Psychology, 16:383-92, June, 1933.

Holmes, J. L. "Reaction Time to Photometrically Equal Chromatic Stimuli," American Journal of Psychology, 37:414-17, July, 1926.

Keller, Louis F. "The Relation of Quickness of Bodily Movement to Success in Athletics," Research Quarterly, 13: 146-54, May, 1942.

Knapp, Barbara. "Simple Reaction Times of Selected Top-Class Sportsmen and Research Students," Research Quarterly, 32:409-11, October, 1961.

Lautenbach, Ruth and W. W. Tuttle. "The Relationship Between Reflex Time and Running Events in Track," Research Quarterly, 3:138-43, October, 1932.

McCloy, Charles Harold and Norma Dorothy Young, Tests and Measurements in Health and Physical Education. New York: Appleton-Century-Crafts, Inc., 1954.

Miles, W. K. "Correlation of Reaction Time and Coordination Speed With Age in Adults," American Journal of Psychology, 43:377-91, July, 1931.

Obrist, Walter D. "Simple Auditory Reaction Time in Aged Adults," Journal of Psychology, 35:259, January, 1953.

Olsen, E. A. "Relationship Between Psychological Capacities and Success in College Athletics," Research Quarterly, 27:79, March, 1956.

Pierson, William R. "Comparison of Fencers and Nonfencers by Psychomotor, Space Perception and Authropmetric Measures," Research Quarterly, 27:90-95, March, 1956.

Slater-Hammel, A. T. "Psychological Refractory Period in Simple Paired Responses," Research Quarterly, 29:468, December, 1958.

Westerlund, J. H. and W. W. Tuttle. "The Relationship Between Running Events in Track and Reaction Time," Research Quarterly, 2:95-100, October, 1931.

Woodrow, Herbert. "The Effect Upon Reaction Time of Variation in the Preparatory Interval," Psychological Monograph, 17:16-18, December, 1914.