

RACIAL COMPARISONS AND RELATIONSHIPS OF
REACTION TIME, BODY MOVEMENT TIME,
AND SIXTY YARD DASH
PERFORMANCE

By

DON PAUL FERGUSON

Bachelor of Science

Oklahoma State University

Stillwater, Oklahoma

1964

Submitted to the faculty of the
Graduate College of
the Oklahoma State University
in partial fulfillment of
the requirements for
the degree of
MASTER OF SCIENCE
July, 1967

OKLAHOMA
OKLAHOMA
STATE UNIVERSITY
LIBRARY
LIBRARY
JAN 19 1968

RACIAL COMPARISONS AND RELATIONSHIPS OF
REACTION TIME, BODY MOVEMENT TIME,
AND SIXTY YARD DASH
PERFORMANCE

Thesis Approved:

Ray B. Harrison
Thesis Adviser
John W. Bayless
N. N. Durham
Dean of the Graduate College

658734

TABLE OF CONTENTS

Chapter	Page
I. INTRODUCTION	1
Purpose of Study	2
Definitions	2
Hypothesis	3
Limitations	3
Assumptions	3
II. REVIEW OF RELATED LITERATURE	4
III. METHODOLOGY	9
Subjects	9
Measuring Devices	9
Experimental Design and Procedure	10
IV. RESULTS	12
Reaction Time	12
Body Movement Time	12
Sixty Yard Dash Time	13
V. DISCUSSION OF RESULTS	16
Reaction Time	16
Body Movement Time	16
Sixty Yard Dash Time	17
Comparison of Combined Scores by Event Specialties	18
Correlation of Reaction Time to Body Movement Time	19
Correlation of Reaction Time to Sixty Yard Dash Time	20
Summary	21
VI. CONCLUSIONS	23
Recommendations	23
BIBLIOGRAPHY	25
APPENDIX	27

LIST OF TABLES

Table	Page
I. Mean Reaction Times	12
II. Mean Body Movement Times	13
III. Mean Sixty Yard Dash Times	13
IV. Correlation of Reaction Time to Body Movement Time	14
V. Correlation of Reaction Time to Sixty Yard Dash Time	14
VI. Correlation of Body Movement Time to Sixty Yard Dash Time	14
VII. Combined Averages According to Event Specialties	15

CHAPTER I

INTRODUCTION

The primary requisites for success in the sport of track are speed and endurance. The factor of endurance becomes less important as the length of the race decreases. It can be noted throughout the history of track in the United States that the negro athlete has dominated the events in which speed alone is the primary factor. These events include all distances from the fifty yard dash through the 440 yard dash. The domination of the negro is evidenced by the fact that a negro competitor either holds or shares the present world record in each of the events. Past world record holders in these events have also been predominantly of the negro race. As the length of the race increases, the domination by the negro tends to decrease.

In searching for a reason for negro domination of the dashes, the fact that the start becomes more important as the distance decreases should be considered. A participant's ability to react to the sound of the starting gun would therefore be a factor contributing to his success. Should the negro athlete possess an inherent physiological superiority in reaction time performance to the white athlete; such a factor could be considered of primary value

in affording a physiologically sound reason for negro domination of the dashes.

Purpose of Study. The primary purpose of this study was to compare the reaction times of selected negro athletes competing in track at the college level with the reaction times of selected white athletes competing in track on the same level, in an effort to find a possible factor contributing to the negro domination of the dash events in track.

Secondary purposes of this study included finding the correlations of reaction time to sixty yard dash performance, reaction time to body movement time, body movement time to sixty yard dash performance, and a comparison of results according to the nature of the events participated in by the subjects.

Definitions. The term "reaction time" refers to the interval of time that elapses from the instant a stimulus is presented until the instant any measurable amount of movement is made in response to the stimulus. For this study, "reaction time" was the interval of time which elapsed from the sound of an audio stimulus until the subject initiated movement in the thumb of his dominant hand to press a button. This time interval is a reflection of the time it takes nerve impulses to transmit directions to muscles through the central nervous system after receiving a stimulus.

"Movement time" is normally referred to as the interval of time which elapses beginning with the initial movement

in response to a stimulus and ending with the completion of the specified movement. Reaction time ends with the beginning of movement time. For the purposes of this study, the movement time measurement was actually a combination of reaction time and body movement time as the measurement included the time which elapsed from the presentation of an audio stimulus until the completion of a horizontal jump of eighteen inches.

Hypothesis. The Null Hypothesis was used for the purposes of this study. This hypothesis suggests that there are no significant differences in the reaction time of negro athletes as compared to white athletes, and for all practical purposes the groups are equal.

Limitations. A random sample was not used in conducting this study because of the fact that the nature of the study was more directly related to varsity track athletes. The size of the groups studied was comparatively small and would be a limiting factor in applying the results to track athletes of the negro and white races as a whole.

Assumptions. It was assumed that the measuring devices produced valid measures and that the motivational factors within the groups were equal.

CHAPTER II

REVIEW OF RELATED LITERATURE

Many studies of various types have been done involving reaction times, but few of them can be related specifically to the primary purpose of this study. Most of the differences involve either the age of the subjects, the athletic nature of the subjects, or the fact that direct comparisons according to race were not made. Studies involving the correlation of reaction time to movement time, which is a secondary purpose of this study, are more readily found.

In a 1935 investigation to determine whether or not the negro race possesses neuro-muscular characteristics which could account for their outstanding performances in sprints, Browne (1) compared the patellar reflex times of negroes and whites. The results of eighty-two white subjects produced a mean patellar reflex time of $.0861 \pm .0013$ while eighty-one negro subjects produced a mean time of $.0774 \pm .0009$. The difference between the groups was 5.43 times the probable error of difference which made the findings significant.

Hutinger (2) conducted a study involving grade school children of the negro and white races. In his study, a comparison of the races in performance of the thirty-five

yard dash was made. Both boys and girls in the fourth, fifth, and sixth grades were tested with a total of 390 white subjects and 402 negro subjects. The results indicated that the negro children were faster in all six groups with the results being statistically significant in all groups except the sixth grade boys. The largest mean difference was .61 seconds for fourth grade boys and the lowest mean difference was .20 seconds for the sixth grade boys. Reaction times were not included as part of the study.

In a Masters Thesis study, Harsch (3) compared the reaction times of negro and white athletes at the State University of Iowa. There were twenty-seven negro athletes and forty-three white athletes involved in the study. The conclusion was that negro athletes do not react or respond more quickly than white athletes.

Hipple (4) compared whites and negroes in a study involving the influence of motivation on muscular tension, reaction time, and speed of movement. The subjects were thirty white and negro boys between the ages of twelve and fourteen. The results showed no significant differences in reaction times of the races during the unmotivated portion of the test with motivation affecting only the white group to a significantly positive degree.

The velocity curve of sprint running was studied by Henry and Trafton (5). Inexperienced runners were used in this study and it was found that reaction time was an important factor for a five yard dash, but was of no

importance if the race was twenty yards or longer. Such a conclusion is questionable due to the fact that any advantage gained through superior reaction time during the first five yards of a race remains as a factor which competitors of slower reaction must overcome in winning, regardless of the distance of the dash. With all other factors being equal, the advantage gained during the first five yards would be the deciding factor.

Various studies involving the correlation of reaction time to movement time have been done, and differing results have led to differing conclusions. Slater-Hammel (6) conducted a study utilizing twenty-five physical education majors as subjects. The results of his study were interpreted as indicating that measurement of reaction time can not readily be used to predict speed of movement. The movement utilized by Slater-Hammel involved the arm moving through 120 degrees of a circle. In a similar study by Henry (7) involving 120 undergraduate students and an arm movement through ninety degrees, it was concluded that individual differences in reaction time and movement time are independent and unrelated.

Mendryk (8) compared reaction times and movement times using subjects in the age groups of twelve, twenty-two, and forty-eight. There were no significant correlations between reaction time and movement time in any of the groups. The correlation for the combined groups was only $r = .127$. The movement time in this study also involved

the arm.

In a study comparing women athletes and non-athletes, Youngen (9) found a low positive correlation between reaction time and movement time in both groups. The correlation was $r = .25$ for the non-athletes and $r = .27$ for the athletes. Again, the movement involved the arm through a horizontal distance of eleven inches.

Pierson (10) used 400 male subjects between the ages of eight and eighty-three and the same arm movement as used by Youngen (9) in correlating reaction time to movement time. It was concluded that for men of the specified ages there is a statistically significant correlation ($+ .31$) between reaction time and movement time. Although this general conclusion was made, it was also noted that the correlation was not significant when applied to college age subjects alone.

Lotter (11) conducted a study involving the interrelationships of reaction time and speed of movement in different limbs. The subjects were eighty college students and twenty-five graduate students. It was concluded that quickness of reaction and quickness of movement are distinctly different and unrelated abilities. Hodgkins (12) found positive correlations in some groups of her study involving reaction time and speed of movement in males and females of various ages, but concluded that the results tended to support the theory that functions of reaction time and quickness of movement are largely independent.

In studies more directly related to the one at hand, the results were more conclusive on the positive side of the correlation. Westerlund and Tuttle (13) used twenty-two university track men in their investigation. The group consisted of four dash men, eight middle distance men, seven distance men, and three champions who were dash men. The results of their reaction times progressed in order according to the distance of their events with the dash men having the fastest reaction times. The relation of reaction time to speed in running the seventy-five yard dash resulted in a positive correlation of $r = .863$, which is a very high correlation.

The athletic nature of the subjects and the type of movement used for movement time measurements seem to be determining factors in relating reaction times to movement times as indicated by the varying results of the studies. Reaction times of non-athletes have failed to correlate significantly to simple arm movements, while the reaction time of athletes have correlated very highly to the speed of movement involved in running. A published study was not found which involved the direct comparison of negro and white athletes in reaction time.

CHAPTER III

METHODOLOGY

Subjects. The subjects comprising the negro group consisted of all twenty members of the 1967 varsity track team at Langston University. Broken down according to their specialty events the team included eleven dash men, three middle distance men, three distance men, and three field event men.

The white subjects consisted of twenty members of the 1967 varsity and freshman track squad at Oklahoma State University. Some freshmen were used since freshmen were competing on the varsity squad of the negro group. Broken down according to event specialties the white group included eleven dash men, three middle distance men, four distance men, and two field event men.

Measuring Devices. Reaction time measurements were taken with a Dekan Athletic Performance Analyzer which is calibrated to 1/100th of a second. Readings were recorded to the nearest .005 of a second. A buzzer on the device served as an audio stimulus and the time interval between activation of the device and the actual sound stimulus could be regulated between one and five seconds. A simple hand device which required the pressing of a button was

used to stop the timer after activation at the buzzer.

Movement times were taken by plugging a switch mat into the timing device. Contact with the mat stopped the timer after activation at the buzzer. Sixty yard dash times were taken with a Hanhart Olympic style stop watch.

Experimental Design and Procedure. Reaction time measurements were taken first in each group. For this measurement the subjects were seated with their backs toward the timing device. The hand device was placed in their dominant hand with the thumb on the stop button. A signal of "ready" was given by the tester upon activation of the timing device. The time interval between the command of "ready" and the actual sound stimulus was varied between one and five seconds in a random manner so as to eliminate any advantages gained through anticipation of a set pattern. The subjects were given two unrecorded trials to familiarize themselves with the equipment and procedure. The next ten trials were then recorded and averaged for a final reaction time score.

Body movement times were taken immediately following the reaction time sequence. The subjects stood at a distance of eighteen inches from the switch mat which was attached to the timing device and was lying on the floor. At the sound of the buzzer the subjects jumped from both feet and landed on the mat with both feet. The trials were given in the same manner as was used for the reaction times.

The sixty yard dashes were run individually and strictly

against time. An official start was given each subject by a starter using a starting gun with .22 caliber blank ammunition. The same starter and gun was used for each group. Each subject was allowed two trials in the sixty yard dash with the best time being recorded for comparisons.

The reaction times and movement times were taken at the respective institutions of each group on different days between the hours of three and five p.m. during the last week in April. Both groups ran the sixty yard dash trials on the track at Oklahoma State University during the second week of May. Although the groups were timed on separate days in the sixty yard dashes, the weather and track conditions were comparable.

The reaction times, movement times, and sixty yard dash times were totaled, averaged, and compared according to racial groups. Correlations were made involving reaction time to movement time, reaction time to sixty yard dash time, and movement time to sixty yard dash time for each group. Standard deviations were derived for each group and a t - ratio was used to determine the degree of significance where means were compared. Averages were also calculated according to event specialties for the combined groups.

CHAPTER IV

RESULTS

Reaction Time. The negro subjects had a mean reaction time of .169 of a second while the white subjects had a mean reaction time of .176 of a second. The difference between the two groups produced a t - ratio of .946. A t - ratio of 2.093 is required for significance at the 5 per cent level of confidence with nineteen degrees of freedom.

TABLE I
MEAN REACTION TIMES

	Whites	Negroes
Mean Reaction Time	.176	.169
Standard Deviation	.027	.022

t - ratio = .946

Body Movement Time. The negro subjects had a mean body movement time of .662 of a second and the white group had a mean body movement time of .692 of a second. The t - ratio

between the groups in body movement time was 1.875.

TABLE II
MEAN BODY MOVEMENT TIMES

	Whites	Negroes
Mean Movement Time	.692	.662
Standard Deviation	.052	.046

t - ratio = 1.875

Sixty Yard Dash Time. The negro group had a mean running time of 6.56 seconds for the sixty yard dash as compared to a mean running time of 6.82 seconds for the white group. The t - ratio obtained for the group difference was 1.870.

TABLE III
MEAN SIXTY YARD DASH TIMES

	Whites	Negroes
Mean Dash Time	6.82	6.56
Standard Deviation	.50	.34

t - ratio = 1.870

TABLE IV
CORRELATION OF REACTION TIME
TO BODY MOVEMENT TIME

Group	Correlation
White	+ .792
Negro	+ .178

TABLE V
CORRELATION OF REACTION TIME TO
SIXTY YARD DASH TIME

Group	Correlation
White	+ .570
Negro	+ .283

TABLE VI
CORRELATION OF MOVEMENT TIME
TO SIXTY YARD DASH TIME

Group	Correlation
White	+ .600
Negro	+ .474

TABLE VII
 COMBINED AVERAGES ACCORDING TO
 EVENT SPECIALTIES

Group	N	Mean R T	Mean M T	Mean 60 Yds.
Dash Men	22	.171	.668	6.48
Middle Distance Men	6	.164	.681	6.75
Distance Men	7	.176	.697	7.20
Field Men	5	.183	.681	6.84
Total	40			

CHAPTER V

DISCUSSION OF RESULTS

Reaction Times. The negro group had a faster mean reaction time than the white group to a degree of .007 of a second. This difference was not great enough to justify significance of difference between the races according to the t - ratio. To produce significance at the 5 per cent level of confidence the required t - ratio was 2.093. The obtained t - ratio of .946 for reaction time performance was far below that required for significance. Acceptance of the Null Hypothesis in regards to reaction time performance between the negro and white races was therefore justified.

In accepting the Null Hypothesis, the possibility of a physiologically superior reaction time within the negro race was ruled negative as a factor contributing to negro domination of the dash events in track. The obtained results were in agreement with those found by Hipple (3) which indicated no racial differences in reaction time during the unmotivated portion of his study involving white and negro subjects.

Body Movement Times. The negro group produced a faster mean in body movement time by .030 of a second.

This difference produced a t - ratio of 1.875 which was significant at the 10 per cent level of confidence. Acceptance of significance at this level of confidence would be considered as questionable by most statisticians.

The measurement of body movement time in this study proved to be the most difficult. Many false trials were made by the subjects due to the natural tendency to lean the body forward toward the switch mat from the starting position eighteen inches from the mat. A great many jumps were taken by the subjects prior to hearing the buzzer, and many times their jump was already under way when the buzzer sounded which produced an extremely fast time. An attempt was made by the tester to disallow any trials in which an invalid time was made due to such conditions.

Sixty Yard Dash Times. The negro group had a mean running time of 6.56 seconds in the sixty yard dash and the white group had a mean time of 6.82 seconds. The difference of .26 of a second between the groups produced a t - ratio of 1.870. This was significant at the 10 per cent level of confidence. Although this level of confidence may be questionable statistically speaking, the actual winning margin on the track would be approximately two yards per individual in favor of the negro. In a race as short as the sixty yard dash this margin would seem quite significant to the track enthusiast. The results are an indication that the negro group as a whole tends to exhibit a domination over the white group in regards to performance of the sixty

yard dash.

Comparison of Combined Scores by Event Specialties.

Middle distance performers produced the fastest mean reaction time of .164 of a second. This fact prevented the results from progressing in a sequential pattern according to the distance run by the subjects. Westerlund and Tuttle (10) found that a sequential progression according to distance did exist in their study. The dash men came in second in this study with a time of .171 of a second followed by the distance men with a time of .176 of a second and the field event men were last with a time of .183 of a second.

The fastest reaction time in the negro group was made by a dash man with a time of .142 of a second with a middle distance man being second with a time of .143 of a second. The fastest reaction time in the white group was produced by a distance man with a time of .144 of a second.

The measurement of movement time did produce a sequential progression according to the distance run for the running event participants. The dash men had a mean movement time of .668 of a second while the middle distance men had a mean of .681 of a second and the distance men had a mean of .697 of a second. The field event men obtained the same mean movement time as the middle distance men, but were not considered in the sequential progression since their specialty did not involve running.

As should be expected, the sixty yard dash times followed a sequential progression from dash men to middle

distance men to distance men with respective times of 6.48, 6.75, and 7.20 seconds. The field event men obtained a faster mean time than the distance men with a time of 6.84 seconds.

Correlation of Reaction Time to Body Movement Time.

The most significant correlation obtained in the study was the correlation of reaction time to movement time within the white group. The correlation was $+0.792$ and was significant at the 1 per cent level of confidence. A sharp contrast was found to exist within the negro group in the correlation of these items. The correlation for the negro group was only $+0.178$ which is far from being significant and in fact shows practically no correlation. Such results indicate that a great deal more variability existed among negro individuals in relation to the performance of reaction time and movement time.

The results of the negro group tend to support the conclusions drawn by Slater-Hammel (5), Henry (6), Mendryk (7), and Youngen (8) that there is very little correlation between reaction time and body movement time. Slater-Hammel and Henry reported no significant correlations while Mendryk reported a correlation of $+0.127$, and Youngen found a correlation in women athletes of $+0.270$ and in non-athletes of $+0.250$.

Results of the white group substantiate the general finding of Pierson (9) who concluded that a significant correlation does exist between reaction time and body

movement time. The findings of Pierson were somewhat dubious, however, due to the fact that his conclusion did not hold true for the college age subjects used in his study which involved all ages. The movement used in all the studies referred to so far in regards to movement time and reaction time have involved the arm only, while movement of the whole body was involved for the purpose of this study. In an unpublished study involving the same type of movement as was used in this study Moudy (14) found a positive correlation of $+0.883$ existing between reaction time and movement time in elementary age school children.

Correlation of Reaction Time to Sixty Yard Dash Time.

The white group had a positive correlation of $+0.600$ in regards to movement time and the sixty yard dash, which was significant at the 5 per cent level of confidence. The negro group produced a positive correlation of $+0.474$. A correlation of 0.520 was needed to be considered significant at the 5 per cent level of confidence for nineteen degrees of freedom which was the case for both the white and negro group. Again the negro group demonstrated more variability among its individuals than the white group as was also demonstrated in the previous correlations of this study.

A greater correlation could have logically been expected within both groups for movement time and sixty yard dash time. It would seem that speed of initial

movement would be maintained to a greater degree over a distance of sixty yards and would be more of a determining factor in time for running sixty yards.

Summary. The negro performers had faster mean times in all three of the tested items of reaction time, movement time, and sixty yard dash time. Their results failed to show any significant correlation between any of the three items. The white group, however, produced significant correlations between all three items. It is interesting to note that the greater degree of variability within individuals of the negro race in this study was also found to be true in the study conducted by Hipple (3) which involved racial differences in motivation, muscular tension, reaction time, and speed of movement. He stated that the negroes were characterized by great individual variation in response to the experimental conditions. Although the consistent pattern of more variability within the negro subjects does suggest the possibility of some physiological differences, there have not been enough studies involving direct comparisons of the negro and white races on these items which would allow development of a valid theory.

The basic purpose of this study was to test the possibility of a superior reaction time capacity existing within the negro race which might be an accountable factor for their domination of the dash events in track. Even though the negroes exhibited a faster mean reaction time, the difference was not statistically significant. If the

difference had been significant, the fact that the negroes exhibited very little correlation between reaction time and sixty yard dash time would have prevented a valid conclusion that reaction time performance was a major factor for the domination. This would hold true since the fastest dash performers did not demonstrate the fastest reactions to any significant degree and in fact the middle distance group had faster reaction times than the dash men as a group in the combined averages.

CHAPTER VI

CONCLUSIONS

The results of this study warrant the following conclusions in regards to the subjects of this study:

1. Negro domination of the dash events in track can not be attributed to a superior reaction time capacity within the negro race.
2. Negro athletes demonstrated a tendency for greater success in the sixty yard dash than white athletes.
3. White athletes exhibited a positive correlation between the three variables of reaction time, body movement time, and sixty yard dash time to a significant degree.
4. Individuals of the negro race exhibited more individual variability and very little correlation between reaction time, body movement time, and sixty yard dash time.

Recommendations. It is recommended that further studies in this area include a larger number of subjects of both the negro and white races and include random samples of both athletes and non-athletes. Exceptionally high or low scores tend to affect the results too greatly when the groups are as small as they were for the present study, thus endangering the validity of the central tendency.

Additional benefits might be gained by obtaining a true body movement time which would involve subtracting the reaction time from the total body movement time as was used in this study. It would also be possible to devise a reaction time test which would be more directly related to the act of a sprinter's start. Such a test would involve standing the subject on a switch mat to start, and simply jumping from both feet to lose contact with the mat upon hearing the audio stimulus.

Problems with the body movement time as was used in this study might be alleviated through more practice and special coaching of the subjects prior to recording their scores.

BIBLIOGRAPHY

- (1) Browne, R.L. "A Comparison of the Patellar Tendon Reflex Time of Whites and Negroes." Research Quarterly 6:121, May 1935.
- (2) Hutinger, P.W. "Differences in Speed Between American Negro and White Children in Performance of the 35 Yard Dash." Research Quarterly 30:366-367, October 1959.
- (3) Harsch, L.A. "A Comparative Study of the Reaction Times and Response Times of Negro and White Athletes." (unpub. M.A. thesis, State University of Iowa, 1959).
- (4) Hipple, J.E. "Racial Differences in the Influence of Motivation on Muscular Tension, Reaction Time, and Speed of Movement." Research Quarterly 25:297-306, October 1954.
- (5) Henry, F.M., and Trafton, I.R. "The Velocity Curve of Sprint Running." Research Quarterly 22:409, December 1951.
- (6) Slater-Hammel, A.T. "Reaction Time and Speed of Movement." Perceptual and Motor Skills Research Exchange 4:109-113, 1952.
- (7) Henry, F.M. "Reaction Time - Movement Time Correlations." Perceptual and Motor Skills Research Exchange 12:63-66, February 1961.
- (8) Mendryk, Stephen. "Reaction Time, Movement Time, and Task Specificity Relationships at Ages 12, 22, and 48." Research Quarterly 31:156-162, May 1960.
- (9) Youngen, Lois. "A Comparison of Reaction and Movement Times of Women Athletes and Non-Athletes." Research Quarterly 30:349-355, October 1959.
- (10) Pierson, W.R. "The Relationship of Movement Time and Reaction Time from Childhood to Senility." Research Quarterly 30:227-231, May 1959.

- (11) Lotter, W.S. "Interrelationships Among Reaction Times and Speed of Movement in Different Limbs." Research Quarterly 31:147-155, May 1960.
- (12) Hodgkins, Jean. "Reaction Time and Speed of Movement in Males and Females of Various Ages." Research Quarterly 34:335-343, October 1963.
- (13) Westerlund, J.H., and Tuttle, W.W. "Relationship Between Running Events in Track and Reaction Time." Research Quarterly 2:95-100, October 1931.
- (14) Moudy, F.D. "Reaction Time and Movement Time in Elementary School Children." (unpub. M.S. thesis, Oklahoma State University, 1965).
- (15) Cureton, T.K. Physical Fitness of Champion Athletes. Urbana: University of Illinois Press, 1951.
- (16) Teichner, W.H. "Recent Studies of Simple Reaction Time." Psychological Bulletin 51:128-149, March 1954.

APPENDIX A

RAW DATA - NEGROES

<u>Subject</u>	<u>Event</u>	<u>Sixty Yd. Dash</u>	<u>Mean Reaction Time</u>	<u>Mean Movement Time</u>
A	dash	6.4	.155	.594
B	"	6.5	.199	.647
C	"	6.4	.160	.594
D	"	6.2	.192	.659
E	"	6.6	.156	.605
F	"	6.5	.142	.685
G	"	6.3	.157	.652
H	"	6.5	.183	.655
I	"	6.8	.198	.697
J	"	6.3	.157	.705
K	"	6.4	.157	.738
L	mid. dist.	6.4	.155	.633
M	"	6.5	.160	.709
N	"	6.7	.143	.660
O	dist.	7.0	.170	.647
P	"	7.0	.158	.697
Q	"	6.8	.175	.666
R	field	6.5	.176	.668
S	"	6.8	.175	.663
T	"	6.7	.214	.678

APPENDIX B

RAW DATA - WHITES

<u>Subject</u>	<u>Event</u>	<u>Sixty Yd. Dash</u>	<u>Mean Reaction Time</u>	<u>Mean Movement Time</u>
A	dash	6.2	.153	.642
B	"	6.6	.181	.637
C	"	6.5	.161	.610
D	"	6.6	.174	.642
E	"	6.3	.183	.667
F	"	6.6	.176	.685
G	"	6.7	.196	.759
H	"	6.5	.164	.716
I	"	6.4	.160	.650
J	"	6.8	.215	.763
K	"	6.6	.152	.710
L	mid. dist.	6.8	.165	.647
M	"	6.7	.176	.650
N	"	7.4	.188	.792
O	dist.	7.3	.144	.645
P	"	7.2	.170	.701
Q	"	8.0	.187	.766
R	"	7.1	.236	.762
S	field	7.3	.180	.691
T	"	6.9	.172	.705

APPENDIX C

FORMULAS

For t - ratio calculations:

$$s = \sqrt{\frac{\sum X^2}{N} - M^2}$$

$$s = \frac{s}{\sqrt{N-1}}$$

$$s_{diff} = \sqrt{s_{M_1}^2 + s_{M_2}^2}$$

$$t = \frac{M_1 - M_2}{s_{diff}}$$

For calculation of correlations:

$$r = \frac{\frac{\sum XY}{N} - M_x M_y}{s_x s_y}$$

VITA

Don Paul Ferguson

Candidate for the Degree of

Master of Science

Thesis: RACIAL COMPARISONS AND RELATIONSHIPS OF REACTION TIME, BODY MOVEMENT TIME, AND SIXTY YARD DASH PERFORMANCE

Major Field: Health, Physical Education, and Recreation

Biographical:

Personal Data: Born in Alton, Illinois, February 20, 1941, the son of Haskell Paul and Opal Bernice Ferguson.

Education: Attended the public schools in Sapulpa, Oklahoma and graduated from Sapulpa High School in May, 1959. Received the Bachelor of Science degree from Oklahoma State University in January, 1964, with a major in Health, Physical Education, and Recreation; completed the requirements for the degree of Master of Science in July, 1967.

Professional Experience: Competed as a member of the Varsity Track team at Oklahoma State University during the period 1960 - 63. Entered the United States Army in May, 1964, and served as Special Services Officer at Ft. Stewart, Georgia for a period of two years. Worked as a graduate teaching assistant in the Department of Health, Physical Education, and Recreation at Oklahoma State University while completing the requirements for the degree of Master of Science. Member of the Oklahoma Association for Health, Physical Education, and Recreation, and the American Association for Health, Physical Education, and Recreation.