1967

A Study to Determine the Fastest Pivot a Second Baseman Could Use in Completing a Double Play

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A STUDY TO DETERMINE THE FASTEST PIVOT A SECOND BASEMAN COULD USE IN COMPLETING A DOUBLE PLAY

(TITLE)

BY

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THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF

Master of Science in Education

IN THE GRADUATE SCHOOL, EASTERN ILLINOIS UNIVERSITY
CHARLESTON, ILLINOIS

1967
YEAR

I HEREBY RECOMMEND THIS THESIS BE ACCEPTED AS FULFILLING
THIS PART OF THE GRADUATE DEGREE CITED ABOVE

4 AUG 1967
DATE

4 August 1967
DATE

DEPARTMENT HEAD

ACKNOWLEDGMENTS

I wish to thank Dr. Curtis Twenter, my advisor, for his assistance in the preparation of this thesis. I wish to also thank Dr. Walter Lowell and Dr. William Riordan, members of my committee, for their interest and suggestions in the writing of this thesis.

I wish to express special thanks to my wife, Jennifer, and to my Mother and Father who made my education possible.

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CHAPTER I

THE PROBLEM AND DEFINITIONS OF TERMS USED

The double play is one of the most important aspects of defensive baseball. It is of such importance, that it determines the way the defensive team will be arranged. Most double plays are initiated by the shortstop,[1] who fields a batted ball and throws to the second baseman, who steps on second base for the first out. The second baseman then relays the ball to the first baseman who steps on first base for the second out. This completes the double play. For a team to consistently complete double plays, the second baseman must be able to pivot quickly.

It is very unusual for a baseball game to be played without the second baseman being involved in at least one double play. It is of great importance for the second baseman to know the proper and most efficient method of pivoting. It is also important, not only to the players involved, but to the team and coach, for the second baseman to be able to complete the double play without being injured by the runner. Much has been written concerning the personal styles of pivoting of professional baseball players, but little research has been completed regarding the actual time involved in executing the pivot.

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[1]Herman Weiskopf, "Outs and Ins of the Double Play," Sports Illustrated, XV (September, 1961), 36-41.

There were many variables related to the study. A number of variables have been eliminated, including the action of the batter, shortstop, and the time it would take the second baseman to reach second base. Because timing and rhythm varies with each individual, the variables eliminated might have caused inaccuracy in timing. The writer feels that an investigation of the time involved to perform the pivot would be most beneficial to players, coaches, and managers in the game of baseball.

THE PURPOSE OF THE STUDY

The purpose of the study was to determine the fastest of three alternate pivots a second baseman could use in completing a double play.

DEFINITION OF TERMS

The following is a list of terms which are applicable to the study and are unique to the game of baseball.

Pivot "A" refers to the approaching of second base in order to be in position to receive the throw from the shortstop on the back side of the base. When the second baseman catches the ball, he steps directly back toward left field with the right foot, and makes a strong throw to first base.

Pivot "B" refers to the approaching of second base in order to be

in position to receive the throw from the shortstop on the inside part of the base with the right foot on the base. When the ball is caught, the movement forward continues to the inside part of the infield, by crow hopping. The second baseman must then continue the movement toward first base and make a strong throw.

Pivot "C" refers to the approaching of second base in order to be in position to receive the throw from the shortstop with the right foot on top of the base. When the ball is caught, the second baseman moves directly into the line of the runner, with his weight transferring from his left foot, and he makes a quick throw to first base. Interference by the runner is avoided by riding him out.

Riding Out refers to escaping the sliding runner by stepping over him and letting him slide under the second baseman without interfering with the throw. This is of great importance to the success of the play and safety of the player.

Crow Hopping refers to a short fast skip followed by a quick throw while moving.

Back Side of Base refers to the left field side of second base.

Inside of Base refers to the third base side of second base.

Inside Part of the Infield refers to the inside part of the baseline, which is still part of the dirt infield.

Pivot refers to the time it takes the second baseman to catch the ball, step on second base, and throw the ball to first base.

Mechanics refers to the abilities which a second baseman has acquired and must utilize in executing the double play.

Rhythm refers to the second baseman's timing. It is the ability to approach second base in order to have the body in position to make an accurate throw as soon as the ball arrives.

Strong Throw refers to a powerful overhanded throw.

Baseball, like many other things, is unique in that it has a language of its own. For the many people who are not associated with baseball terminology, the above terms have been listed to make the content of the study more meaningful.

NEED FOR THE STUDY

There has been much controversy concerning the quickest method of pivoting during a double play situation. Written material on the subject has been reviewed concerning the actual pivot time, but little scientific evidence has been found.

There is an important psychological effect on the offensive team when a double play is successfully completed. The double play is of such great importance, that it determines the pitching tactics and defensive arrangement of players. A pitcher's confidence is strengthened when he knows that his teammates are capable of performing a double play. As it is a tremendous psychological advantage to the offensive team, it inversely provides a great psychological let down to the

opposing team.

Baseball has become more specialised in recent years, and the use of the most effective mechanics is mandatory for more efficient fielding and protection of players involved. Methods used by professional athletes are often considered the best, but professionals are not average athletes, as they possess highly developed skills and abilities.

Because of the lack of research and available data about the average athlete, and the necessity for modern mechanics and safety devices, the writer feels there is a need for such a study.

LIMITATIONS OF THE STUDY

The study was not conducted under actual game conditions. The absence of a runner, and accompanying game situation, might have effected the second baseman's pivot and accuracy of his throw. The five subjects used to conduct this experiment, practiced the three pivots, but the amount of practice was insufficient for each to become adequately orientated to the mechanics of the pivots. Another limitation was that the five subjects had already established their own methods of pivoting.

The amount of fatigue the subjects experienced between trials and pivots, would be another factor to consider. As time was an important factor in the study, each participant completed all trials and pivots in one session.

The actual hitting of the ball to the shortstop, the time it would take to field the ball, and the shortstop's throw to the second baseman have been eliminated. The writer also chose to have the second baseman begin the experiment with the ball in his glove, in an attempt to control unrelated variables. The experimenter used a procedure of having the actual timing begin when the second baseman touched second base, and stop when the first baseman received the throw from the second baseman. As timing and rhythm varied with each player, the approach to second base and catching the ball from the shortstop have been labeled as variables which would cause inaccuracy in timing.

When performing the actual experiment, the first baseman was responsible for stopping the Automatic Performer Analyser, which was the timing device used in the study. The first baseman coordinated the switch with the arrival of the ball from the second baseman, and some variation in timing may have entered. The same person operated the device at all times, to guard against any variance in timings.

The study was based on the hypothesis that the quickness of the pivot was the deciding factor in the successful completion of the double play.

CHAPTER II

REVIEW OF RELATED LITERATURE

The investigation of literature on baseball produced very little material on the actual amount of time it takes the second baseman to pivot. An abundance of material was found on methods of pivoting and on personal styles used by professional baseball players. Only one study was found which had any relation prior to this study. It was a Master's thesis completed by K. M. Karrer of the University of California and was entitled, "A Study to Determine the Time Required by a Second Baseman to Complete a Double Play Using Alternate Methods of Pivoting".[1] The study employed two methods of pivoting, both of which are used in this study. Karrer used a running across method, and a step-back method. Two varsity second basemen were used in conducting his thesis. The methodology consisted of completing two hundred and fifteen throws for each pivot. Karrer concluded from his results that stepping back off the base was significantly faster than running across the base.

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[1] K. M. Karrer, "A Study to Determine the Time Required by a Second Baseman to Complete a Double Play Using Alternate Methods of Pivoting" (Unpublished Master's Thesis, The University of California, Riverside, 1950).

Additional literature concerning the second baseman's pivot reveals that most professional people in the sport of baseball feel that the three pivots used in the study should be the main pivots in the second baseman's repertoire. Such authorities as Archie P. Allen, Bobby Richardson, O.H. Vogel, Danny Litwhiler, Lew Watts, Herman Weiskopf, Ethan Allen, Alex Grammas, and Johnny Pesky, all advocated one of the methods used in the study as the most effective. They stated that the game situation, the time it takes the second baseman to reach second base, and the throw of the shortstop, all dictate which method of pivoting should be used.

The coaches listed above recommended that second baseman know all three pivots. Each had his own opinion of which elements were the most important to insure the success of the pivot. Weiskopf stated, "One-tenth of a second is very important to the second baseman, since most double plays take between three and five tenths of a second, and four and five tenths of a second."[2] He also mentioned the fact that Bobby Richardson, of the New York Yankees, utilized five different pivots in completing double plays. Weiskopf said Richardson's choice of pivoting was dependent upon four things. These were, "Where and

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[2] Herman Weiskopf, "Outs and Ins of the Double Play," Sports Illustrated, XV (September, 1961), 36-41.

how sharply the ball is hit, how quickly and hard the runner arrives, where Kubeck's throw is, and the speed of the man going to first."[3] According to Weiskopf, Richardson's favorite pivot and the one he feels was the fastest, was pivot "C" of the study. Ethan Allen, baseball coach at Yale University,[4] O. H. Vogel, baseball coach at the State University of Iowa,[5] and Alex Grammas[6] and Johnny Pesky,[7] coaches for the Pittsburgh Pirates, all advocated the same type of procedure as has Richardson. Lew Watts, baseball coach at Gunnery High School, Washington D. C., stated in his book, "Whatever method is used, the secret of a powerful and accurate throw is to shift the weight to the right foot before throwing."[8]

Danny Litwhiler, baseball coach at Michigan State University and former major league baseball player, taught his second basemen two

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[3] Ibid.

[4] Ethan Allen, Baseball: Major League Techniques and Tactics (New York: The MacMillan Company, 1930), p. 168.

[5] O. H. Vogel, Ins and Outs of Baseball (St. Louis: The C. V. Mosby Company, 1952), 168-173.

[6] Letter from Mr. Alex Grammas, Coach, Pittsburgh Pirate National League Baseball Club, Pittsburgh: June 28, 1967.

[7] Letter from Mr. Johnny Pesky, Coach, Pittsburgh Pirate National League Baseball Club, Pittsburgh: June 28, 1967.

[8] Lew Watts, The Fine Art of Baseball (Englewood Cliffs, New Jersey: Prentice-Hall, 1964), p. 188.

principles no matter which pivot was used. He said, "The second baseman must move toward second base, getting there as early as possible so as to take the throw with the right foot on top of the base. Then, he must throw from this position and follow through to ride out the oncoming runner."[9]

In a chapter written on the play of the second baseman, Carol R. Gast, head baseball coach at North High School, Omaha, Nebraska, mentioned definite principles of approaching and throwing the ball, regardless of the type of pivot used. He said, "On a ball hit to the shortstop, the second baseman must move into a line that will put the bag directly between himself and the shortstop."[10] He said that this was mandatory as it allowed the shortstop to throw as soon as he received the ball. Archie P. Allen, baseball coach at Springfield College, Springfield, Massachusetts, supported Gast's statements.[11] Gast further stated, "The second baseman must be in position to get rid of the ball as quickly as possible, get out of the way of the charging runner, and be sure to get the out at second base before trying to complete the

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[9]Danny Litwhiler, Baseball Coach's Guide to Drills and Skills Englewood Cliffs, New Jersey: Prentice-Hall, 1963), p. 129.

[10]Carol R. Gast, Skill on the Diamond (Dubuque, Iowa: William C. Brown Company, 1953), p. 70.

[11]Archie P. Allen, Coach's Guide to Defensive Baseball (Englewood Cliffs: Prentice-Hall, Inc., 1960).

double play."[12]

While it was impossible to obtain unanimous agreement concerning a particular skill, there appeared to be a concensus among baseball coaches that the quicker one threw the ball, the greater the chances were of completing the double play successfully. The baseball coaches concurred that body movement takes up time. Pivot "A" and Pivot "B" require more body movement after the ball is received. Pivot "C" is based on the idea of throwing the ball as soon as it is received, using as little body movement as possible.

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[12]Gast, loc. cit.

CHAPTER III

METHODOLOGY

The five subjects for the trials were second basemen who played on the freshman baseball team of Eastern Illinois University during the 1967 season. The experiment was conducted in the field house of the Charles P. Lantz Physical Education and Recreation Building. It was held indoors, with the intent of decreasing any chances of variables due to wind and weather, thus adding to the objectivity of the study.

The timing device used for the study was the Automatic Performance Analyzer, which is produced by the Dekan Timing Device Company, Glen Ellyn, Illinois. The analyzer is powered by a standard 120-volt AC electrical current. The timing device is used to measure movement, reaction time, or both, by the recording of time intervals. The unit records the elapsed time in one/one-hundreth (1/100) of a second.

The purpose of and methods used in conducting the study, were explained to the subjects two months in advance of the beginning of the experiment. The timing device used was explained and demonstrated. Questions concerning the machine and the methods of pivoting were discussed until each subject understood thoroughly the method of recording time and the position from which each would throw.

The timing device was operated by two switches. One was set in a

rubber mat, which was used as second base and it initiated the timing as soon as one of the subjects stepped on the mat to begin one of the methods of pivoting. The first baseman held the other switch in his left hand, since he was lefthanded. He coordinated the stopping of the machine with the arrival of the ball in his glove from the second baseman. The same first baseman was used throughout the study to help eliminate variables in timing. When the ball arrived at first and the timing device stopped, the time was read on the dial of the machine. The reading represented the time it took the subject to complete the pivot, and was recorded in hundredths of a second. The times were then transferred to a master sheet containing all the times and trials of the other subjects.

The experiment consisted of three alternate pivots made by five subjects. Each subject completed fifteen throws from each of the three pivots, therefore, the five subjects completed a total of seventy-five throws.

Each subject completed his part of the experiment in one session. To prevent the element of fatigue from affecting any one particular method, the procedure for each subject was interchanged. The first subject performed his pivots in the order of "A", "B", "C". Subject number two performed his pivots in the order of "B", "C", "A". The third subject executed his pivots in the order of "C", "A", "B". The final two subjects completed their pivots in different sequences. The reason for interchanging the pivot order was to minimize any effect that fatigue might have on any one pivot.

Each subject was allowed ten minutes to warm up prior to his trials. Times were then recorded for the fifteen trials from each of the three alternate pivots. Five minutes were permitted between each method for recouperation. When all the timings were completed, the trials for each subject were made ready for IBM processing. The procedure consisted of key punching the times for each pivot on IBM cards, so that these cards could be submitted to an IBM computer program.

In summarising Chapter III, the writer has reviewed the experiment. Five subjects completed fifteen trials for each of three alternate pivots. Each trial was timed through the use of the Automatic Performance Analyzer. The times for each trial were recorded and then submitted to an IBM computer program.

CHAPTER IV

PRESENTATION AND INTERPRETATION OF RESULTS

Five subjects completed fifteen trials from pivot "A", pivot "B", and pivot "C", for a total of seventy-five throws from each pivot. The data for these pivots are presented in the seven tables of the chapter. Tables I through V contain the recorded timings of the five subjects for the three alternate pivots. The mean time for each pivot is recorded at the bottom of its corresponding column. Table number VI contains the mean times for the five subjects for each pivot, with the average mean time recorded at the bottom of the columns. Table number VII contains the scores for means between groups.

The data for the first subject is presented in Table I. The facts from the table have shown that the highest time for pivot "C" was lower than the lowest time for either pivot "A" or "B". Pivot "A" was the most consistent of the three pivots with a variance of twenty-four hundredths (.24) of a second. The fastest time recorded for subject one was one and ten hundredths (1.10) of a second for pivot "C", as compared to the slowest time of one and ninety-two hundredths (1.92) of a second for pivot "B". The range for subject one was eighty-two hundredths (.82) of a second.

Table II presents the data for the second subject. As was the case in Table I, the fastest time of the second subject for pivot "C" was lower than the lowest time for either pivot "A" or pivot "B". Pivot "C" was the

TABLE I

RECORDED TIMINGS FOR FIRST SUBJECT

Trials	Pivot "A"	Pivot "B"	Pivot "C"
(1)	1.52	1.81	1.11
(2)	1.61	1.71	1.26
(3)	1.76	1.68	1.10
(4)	1.58	1.64	1.24
(5)	1.57	1.64	1.31
(6)	1.67	1.71	1.29
(7)	1.65	1.62	1.29
(8)	1.58	1.60	1.36
(9)	1.59	1.66	1.24
(10)	1.62	1.86	1.26
(11)	1.67	1.88	1.36
(12)	1.59	1.90	1.33
(13)	1.59	1.90	1.28
(14)	1.58	1.92	1.33
(15)	1.72	1.70	1.28
Mean Time	1.62	1.75	1.27

TABLE II

RECORDED TIMINGS FOR SECOND SUBJECT

Trials	Pivot "A"	Pivot "B"	Pivot "C"
(1)	1.67	1.66	1.25
(2)	1.54	1.75	1.26
(3)	1.72	1.59	1.28
(4)	1.69	1.57	1.29
(5)	1.55	1.59	1.27
(6)	1.54	1.56	1.29
(7)	1.56	1.64	1.27
(8)	1.55	1.58	1.27
(9)	1.57	1.59	1.28
(10)	1.53	1.63	1.32
(11)	1.48	1.52	1.32
(12)	1.58	1.54	1.31
(13)	1.49	1.50	1.32
(14)	1.57	1.53	1.28
(15)	1.46	1.62	1.24
Mean Time	1.57	1.59	1.29

most consistent pivot with a variance of eight hundredths of a second. The highest recorded time was one and seventy-five hundredths (1.75) of a second for pivot "B", and the lowest time was for pivot "C", at one and twenty-four hundredths (1.24) of a second. The range for subject two was fifty-one hundredths (.51) of a second.

The data for subject three is presented in Table III. It was found that the fastest time was on pivot "C", one and twenty-five hundredths (1.25) of a second, while the slowest time recorded was for pivot "B", one and seventy-six hundredths (1.76) of a second. The most consistent pivot was pivot "A", with a variance of sixteen hundredths (.16) of a second. The range for subject three was fifty-one hundredths (.51) of a second.

The data for the fourth subject is presented in Table IV. The table has shown that subject four recorded the highest time on pivot "A", one and eighty-four hundredths (1.84) of a second, and the lowest time on pivot "C", one and seventeen hundredths (1.17) of a second. He was the most consistent in his performance of pivot "B" with a variance of twenty hundredths (.20) of a second. The range for subject four was sixty-seven hundredths (.67) of a second.

Table V presents the data for the fifth subject. It was observed that the fifth subject had the highest time of any of the subjects. The lowest time was recorded on pivot "C", one and thirty-two hundredths (1.32)

TABLE III

RECORDED TIMINGS FOR THIRD SUBJECT

Trials	Pivot "A"	Pivot "B"	Pivot "C"
(1)	1.58	1.76	1.36
(2)	1.54	1.59	1.27
(3)	1.48	1.69	1.25
(4)	1.49	1.61	1.27
(5)	1.46	1.62	1.48
(6)	1.42	1.70	1.30
(7)	1.48	1.63	1.25
(8)	1.50	1.53	1.28
(9)	1.47	1.62	1.25
(10)	1.50	1.69	1.26
(11)	1.53	1.67	1.29
(12)	1.54	1.51	1.33
(13)	1.58	1.51	1.32
(14)	1.53	1.52	1.30
(15)	1.51	1.60	1.30
Mean Time	1.50	1.61	1.32

TABLE IV

RECORDED TIMINGS FOR FOURTH SUBJECT

Trials	Pivot "A"	Pivot "B"	Pivot "C"
(1)	1.67	1.60	1.26
(2)	1.59	1.49	1.31
(3)	1.80	1.49	1.38
(4)	1.75	1.59	1.52
(5)	1.55	1.52	1.37
(6)	1.54	1.53	1.31
(7)	1.49	1.53	1.27
(8)	1.61	1.50	1.24
(9)	1.64	1.57	1.31
(10)	1.70	1.46	1.40
(11)	1.71	1.50	1.18
(12)	1.67	1.45	1.17
(13)	1.74	1.56	1.20
(14)	1.84	1.65	1.28
(15)	1.77	1.54	1.19
Mean Time	1.67	1.53	1.29

TABLE V

RECORDED TIMINGS FOR FIFTH SUBJECT

Trials	Pivot "A"	Pivot "B"	Pivot "C"
(1)	1.89	1.78	1.35
(2)	1.88	1.60	1.39
(3)	1.87	1.59	1.40
(4)	1.82	1.56	1.38
(5)	1.80	1.59	1.52
(6)	1.79	1.62	1.35
(7)	1.84	1.53	1.50
(8)	1.90	1.61	1.41
(9)	1.84	1.61	1.32
(10)	1.75	1.51	1.33
(11)	1.79	1.64	1.56
(12)	1.72	1.59	1.65
(13)	1.65	1.87	1.43
(14)	1.78	1.62	1.38
(15)	1.92	1.62	1.45
Mean Time	1.81	1.60	1.43

of a second, and the highest time recorded was on pivot "A", one and ninety-two hundredths (1.92) of a second. Subject five's most consistent times were recorded for pivot "A" and "B", with a variance of twenty-seven hundredths (.27) of a second.

Table VI presents the mean time each subject scored on the three pivots, and the average mean times for each pivot. The average mean time for pivot "A" was one and sixty-three hundredths (1.63) of a second. Pivot "B" had an average mean time of one and sixty-one hundredths (1.61) of a second. Pivot "C" had an average mean time of one and thirty-two hundredths (1.32) of a second.

One may observe in Table VI, that pivot "C" was the fastest of the three pivots tested. The Student "T" Score for Means Between Groups was applied, as described by Dr. DiPietro,[1] to establish any possible significant difference among the three pivots. The five percent level of confidence was selected as the basis for acceptance or rejection. It was found that pivot "C" was significantly faster than pivot "A" or pivot "B".

Table VII presents the Student T-Scores for Means Between Groups. One observes in Table VII that pivot "C" is significantly quicker than pivot "A" or "B" at the five (.05) percent, one (.01) percent and one (.001) tenth percent level of confidence.

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[1] Alphonso J. DiPietro, "Student T-Scores for Means Between Groups" (Eastern Illinois University, Charleston, 1964).

TABLE VI

AVERAGE MEAN TIMES

Subject's Mean Time	Pivot "A"	Pivot "B"	Pivot "C"
(1)	1.62	1.75	1.27
(2)	1.57	1.59	1.29
(3)	1.50	1.61	1.32
(4)	1.67	1.53	1.29
(5)	1.81	1.60	1.43
Average Mean Time	1.63	1.61	1.32

TABLE VII

STUDENT T-SCORES FOR MEANS BETWEEN GROUPS

Pivot	Mean Time	Mean Time	"T" Ratio
"A" to "B"	A(1.63)	B(1.61)	1.22
"A" to "C" *	A(1.63)	C(1.32)	17.3
"B" to "C" *	B(1.61)	C(1.32)	18.0

* Significant at the .001 percent level of confidence

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

SUMMARY

The writer conducted the study in an attempt to determine which of the three alternate pivots would be the quickest for completing a double play. Pivot "A" was defined as stepping off the back side of second base and making a strong throw to first base. Pivot "B" was defined as tagging second base, crow hopping, and making a strong throw to first base. Pivot "C" was defined as tagging second base, throwing from that position, and riding out the oncoming runner.

An experiment was devised to accumulate timings from the three pivots. Five infielders were selected as subjects from Eastern Illinois University's freshman baseball team. An Automatic Performance Analyzer was used to record the times. It was an instrument that measured time to one/one hundredth (1/100) of a second. A total of seventy-five (75) trials were recorded for each pivot in the experiment.

The Student T-Test for Means Between Groups was applied to establish any significant differences that might exist among the three pivots. The Test was applied at the five per cent (5%) level of confidence. Pivot "C" was found to be significantly faster than pivot "A" or pivot "B".

CONCLUSIONS

The following conclusions resulted from the experiment.

1. Pivot "B" was slightly faster than pivot "A".
2. Pivot "C" was significantly faster than both pivot "A" and "B".

RECOMMENDATIONS

The following recommendations are presented as a result of the study.

1. In an attempt to establish a greater degree of reliability, further investigations, which use more subjects, should be used.
2. Further investigations should be conducted with professional baseball players as the subjects.
3. Further investigations should be conducted during game situations.
    A. The studies should consider the total elapse of time between the hitting of the ball and its arrival at first base.
    B. The studies should give consideration to the responsibility of the shortstop in fielding the ball and throwing it to the second baseman.

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APPENDICES

APPENDIX A

Test subjects from Eastern Illinois University freshman baseball team.

Allen, Robert	First baseman
Choate, John	Second baseman
Corey, David	Third baseman, with experience at second base
Emerling, Robert	Second baseman
Kight, Wayne	Second baseman
Porter, James	Second baseman

VITA

JERRY DALE SMITH

The writer was born in St. Louis, Missouri, on May 2, 1944. He lived in University City, and attended University City Public Schools. In high school he participated in baseball and basketball. The writer received his Bachelor of Science Degree from Sterling College, Sterling, Kansas, with a double major in physical education and social science. While attending Sterling, he lettered four years in baseball, receiving all-conference and NAIA All-American status his senior year. Following graduation at Sterling, the writer received a graduate assistantship, for advanced study in the field of physical education, at Eastern Illinois University. In the fall of 1967, the writer plans to teach and coach at Cheney High School, Cheney, Kansas. He will be assistant football and track coach, and head basketball coach. His teaching will consist of American History, Government, and Physical Education.