An Abstract of the Thesis of

BRETT ALAN BERRY for the Degree of MASTER OF SCIENCE in Physical Education presented on May 10, 1995.

Title: THE EFFECTS OF CROSSED-DOMINANT VISION ON HITTING PERFORMANCE IN BASEBALL

Abstract Approved: _____

The purpose of this study was to determine if the factors of eye dominance, reaction time, and response time are predictive of hitting performance. A second purpose of this study was to determine if there is a difference in reaction time and response time between crossed-dominant hitters and unilateral hitters. The participants of the study were Emporia State University varsity baseball players (N=11) ages 18-23, who were members of the 1993 and 1994 teams. The participants were tested for reaction time using a Lafayette reaction time switchboard and for response time using a ruler drop test. Hitting performance was assessed using on-base average, batting average, and strikeout-to-walk percentage. Participants were also tested for eye dominance using two valid tests. A multiple regression was used to determine if eye dominance, reaction time, and response time could predict hitting performance. A t-test was used to determine if there was a difference in reaction

time and response time between crossed-dominant and unilateral hitters. All data were analyzed at the $p<.05$ level of significance. No significant results were found.

The Effects of Crossed-Dominant Vision, Reaction time and Response time on Hitting Performance in Baseball

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A THESIS

PRESENTED TO

THE DIVISION OF HEALTH,

PHYSICAL EDUCATION, RECREATION

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MASTER OF SCIENCE

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by

Brett Alan Berry

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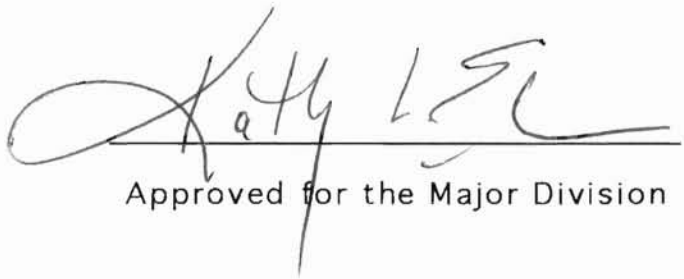

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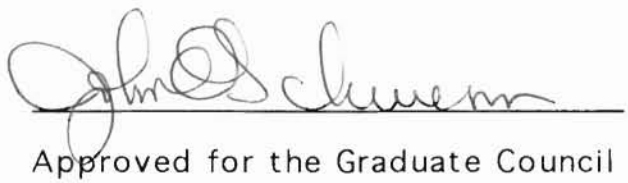

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CHAPTER I
INTRODUCTION

The game of baseball has been an American pastime since it was first introduced in 1839 by Abner Doubleday. More than 150 years later, baseball is still being played. The game is enjoyed by children, adolescents, and adults. It is played in sandlots, churchyards, and multi-million dollar stadiums. It is a popular spectator sport in virtually every civilized country. Baseball may well be the most popular, widespread, and deeply rooted sport in our culture.

Baseball players spend countless hours practicing skills, refining speed, fine-honing agility, tempering coordination, and perfecting the skills of throwing, catching, and swinging. The baseball swing is arguably the most practiced aspect of the entire game. Hitting a baseball is one of the most difficult skills in sports and requires keen vision and sharp hand-eye-coordination. "In the realm of professional sports, a baseball player trying to hit a pitched ball faces a formidable task which ranks among the most difficult visual and physical coordination efforts that the human sensorimotor system is capable of performing" (Solomon, Zinn, Vacroux, 1988, p. 22).

Baseball is a game of speed. Pitched balls can be thrown up to 100 miles per hour (Spurgeon, French, Rivers, Bailey, and Ellisor, 1989). Plays are often

determined in a fraction of a second. Batters only have .4 seconds to react to a ball thrown at 90 miles per hour (Weiskopf, 1975). Based on these speeds, the factors that might affect batting performance are reaction time and eyesight. Good vision is imperative to hitting a baseball and allows the athlete to track the speeding baseball through a series of eye movements (Harrison, 1979). These eye movements, in conjunction with skeleto-muscular coordination, are what allow the baseball player to identify, track, and predict the precise location of the incoming pitch (Williams, and Helfrich, 1977). "Athletes covering a major portion of the sports spectrum agree that hitting a baseball traveling at speeds up to 100 miles per hour requires more timing and coordination than any single act in sport" (Mountour, and Monkarsh, 1979, p. 22).

Statement of the Problem

Hitting requires hand-eye coordination and timing. Eye dominance may be a factor in hitting. There is a popular theory among some coaches pertaining to the effects of eye dominance on hitting. The theory is based on which eye, the dominant or the non-dominant, is closest to the pitcher. The batter whose dominant eye is closest to the pitch is, theoretically, in a better position to see the incoming pitch (Adams, 1965).

The purpose of this study was to determine if the factors of eye dominance, reaction time and movement

time are predictive of hitting performance. Eye dominance relative to this study was examined in light of which eye, the dominant or non-dominant, is the closest eye to the pitcher when the hitter is in the hitting stance. Reaction time was tested by determining the amount of time necessary to respond to a simple stimulus using a light and switchboard. Response time was tested by using a simple ruler drop test. Finally, hitting performance was assessed by examining batting average, walks, and strikeouts. A sub-problem of this study was to determine the difference in reaction time and response time between crossed dominant and unilateral hitters.

Hypotheses

The following hypotheses served as a basis for investigation in this study.

1. Reaction time, response time, and eye dominance are predictors of hitting performance.
2. There is a difference in reaction time and response time between crossed dominant hitters and unilateral hitters.

Significance

To date, there is no general consensus regarding the effects of eye dominance and reaction time on hitting performance. Determining if eye dominance, reaction time and response time are factors in hitting performance will provide insight to coaches, players, and researchers as to the relationship among these factors. If these factors

influence hitting performance coaches will be better able to focus some of their training on these areas.

Definitions

Batting average: The number of times a batter gets a hit divided by the total number of times at bat.

Crossed-dominant vision: The characteristic of having opposite eye dominance from hand dominance. For example, a left-handed hitter with a dominant right eye.

Eye dominance: This is determined by which eye the individual uses most or relies upon most. The dominant eye is the one that leads or directs the other eye in tracking an object.

Movement time: The time from when a movement is initiated to the time that the movement is completed.

On-base average: The number of times that a hitter reaches base safely divided by the total number of times at bat.

Reaction time: Reaction time is the time required for a person to initiate a response to a given stimulus.

Response time: The time taken to initiate and complete a response to a given stimulus. This time includes both reaction time and movement time.

Strike-out to walk ratio: The number of strikeouts in proportion to the number of walks.

Unilateral eye dominance: The characteristic of having the same eye dominance as hand dominance. For example, a right-handed hitter with a dominant right eye.

Delimitations

The study consisted of 11 university baseball players from Emporia State University. The age range for the participants was 18 to 23 years of age.

Limitations

1. Participants for this study were volunteers.
2. Relatively few participants were involved in testing.

Assumptions

It is assumed that all participants provided maximum effort on all tests.

Summary

The purpose of this study was to determine if the factors of eye-dominance and reaction time and response time are predictive of hitting performance. A second purpose of this study was to determine if there is a difference in reaction time and response time between crossed dominant hitters and unilateral hitters. Although there is currently some speculation on the relationship among these variables, there is very little data that conclusively show any significant relationship. Those coaches who believe there is a relationship between these factors contend that the hitter having the dominant eye as the eye closest to the pitcher is at an advantage over the hitter whose dominant eye is to the rear. Since the dominant eye, which is more important in tracking moving objects and completing action/reaction skills than the non-dominant eye, is closer to the stimulus (baseball)

than the non-dominant eye, it can pick up the pitch more quickly. However, this conclusion has very little research to support it.

In the second chapter, the Review of Literature, research related to the topics of eye-dominance, hitting performance, and reaction time/response time will be examined. The third chapter, Methodology, will contain a discussion of the methods and procedural testing used in this study. Chapter Four, Results, will contain the analysis of data, and Chapter Five, Discussion and Recommendations, will contain discussion about the results of the study and recommendations for future study.

CHAPTER II
REVIEW OF LITERATURE

Introduction

The purpose of this study was to determine if there is a relationship among eye dominance, reaction time, response time, and hitting performance in baseball. In this study, eye dominance was examined in light of which eye, the dominant or non-dominant, is the closest eye to the pitcher when the hitter is in the hitting stance. Research suggests that both vision, reaction time, and response time are important and essential ingredients for success in hitting (Solomon, Zinn, and Vacroux, 1988). However, few specific recommendations regarding these factors have been made on the basis of scientific study. This chapter discusses eye-dominance, reaction time, response time and hitting performance.

Eye Dominance and Hitting Performance

Success in baseball is related to several factors. These factors include acuity, eye dominance, depth perception, and ocular motilities (Grove, 1989). Two other important factors are visual reaction time and visual timing (McLeod, and Jenkins, 1991). Hitting a baseball that travels at speeds up to 104 miles per hour ranks among the

most difficult skills in sports (Solomon, Zinn, Vacroux, 1988). The hitter must detect the ball at (or just before) release, track the ball, note the speed and rotation of the ball, continue to track the ball despite body movements, and predict the location of the ball in the hitting zone (Grove, 1989). These processes must all be carried out accurately before the swing ever begins.

A major portion of these processes involves tracking the ball with the eyes. Each person has a dominant and non-dominant eye. The two eyes work together as a unit in tracking a baseball (Yudin, 1985). The dominant eye is that eye which leads the other eye in fixation or tracking an object. Studies have shown that the brain receives visual information from the dominant eye faster than the non-dominant eye (Berman, 1989).

A hitter whose dominant eye is closest to the pitcher while in the hitting stance is said to have "crossed-dominant" vision, while a hitter whose dominant eye is the eye farthest away from the pitcher is said to have unilateral or normal eye dominance. Both types of hitters rely on their eyes to aid them in hitting. However, crossed-dominant hitters have their lead, dominant, or controlling eye nearest to the pitcher and, theoretically, in a more advantageous position to

be able to follow the flight of the ball (Adams, 1965).

Adams (1965) examined the effects of eye dominance on hitting performance. The participants were 28 university baseball players. Adams categorized these players as "unilaterals" and "crossed laterals." Players who batted from the same side of the plate in their hitting stance as their dominant eye were considered "unilaterals." Players who batted from a different side of the plate as the dominant eye were considered "crossed laterals." These two groups were compared on batting average, on-base percentage, missed swings, strikeouts, and called strikeouts over the course of an entire season. Adams found that unilaterals had a higher batting average and on-base average than crossed laterals. However crossed laterals had a slightly lower percentage of strikeouts, called strike outs, and missed swings. Of these findings, the only significant difference between unilaterals and crossed laterals was the batting average.

In a related study, Lange (1974) used 29 participants from a university baseball team to investigate the effect of eye dominance on baseball batting. The participants were divided into unilateral and crossed lateral groups and data were

collected on struck-balls, batting average, strikeouts, missed swings, and successfully batted balls over the entire baseball season. Lange (1974) found no significant difference between the two groups in any category.

Teig (1981) tested 275 professional baseball players from seven major league teams on several visual factors. These factors included eye-dominance, depth perception, hyperopia and myopia, astigmatism, esophoria and exophoria, color and night vision, sensitivity to glare, and other variables. Teig (1981) concluded the teams that were most successful, or had the highest batting average, had the highest number of crossed dominant hitters. In addition, he found 50% of the players tested were crossed dominant. The Kansas City Royals, who led the major leagues in batting average, had 70% crossed dominant batters. Teig (1981) theorized that since it takes about 0.4 milliseconds for a ball to travel to the plate, the hitter whose dominant and faster eye is nearer the pitcher had an advantage over the hitter who is unilateral. The crossed-dominant hitter has an additional split second to react to the ball.

Spurgeon, French, Rivers, Bailey, and Ellisor (1989) collected data on 50 college and 21 professional baseball players. Data were collected

on batting average and eye dominance. The college players were selected from three university baseball teams and the professional baseball players were members of the Atlanta Braves team. The collegiate players were identified by their coach, as the three best and three worst hitters on the team. The study was conducted to identify data on various visual functions, including eye dominance and to determine if there were differences in eye functions between good college hitters, poor college hitters and professional baseball players, and to determine if these eye functions are related to batting performance. The study found no significant relationship between eye dominance and hitting performance.

Reaction time, Response time and Hitting Performance

At times a batter must bat a pitched ball traveling at speeds up to 104 miles per hour. One of the most important components of completing this skill under such circumstances is reaction time (Williams, and Macfarlane, 1975). Reaction time refers to the time between the initiation of a stimulus and the onset of action (McLeod, and Jenkins, 1991).

Delucia and Cochran (1985) tested nine experienced softball players on their ability to

track a softball through various phases of its flight. They inhibited vision during the first third, middle third, and last third of a softball's flight. For example, the first third was blocked while the last two-thirds of the ball's flight was open to view. Next, the middle third was blocked and the first and last third were open to view. A 1.5m by 1.5m screen was used to block the batter's view of different segments of the ball's flight. A hole was cut into the middle of the screen that allowed the ball to travel through the screen. The ball was pitched by a machine. They found when the middle section was blocked, contact was significantly lower than when the other parts were screened. They found the hitter was able to draw information on the ball throughout the ball's flight. When the middle third was blocked, contact was significantly lower. They also noted the hitter's timing was disrupted. There were no significant findings when either the first or last third were blocked. This finding suggested reaction time does not significantly influence hitting.

Williams and Macfarlane (1975) examined the reaction time and movement time in 30 male university students. They conducted a test that measured reaction time and movement time while trying to field a struck ball. They assessed

reaction time and movement time by using two 1/100 second timers aligned so that when a microswitch on a ball-throwing device was triggered it started the reaction time clock. Ball velocities were increased to different levels. The reaction time clock stopped when the participant's right hand pulled away from a reaction key to catch the ball. This movement initiated the timer for movement time which stopped when the participant's wrist moved 10 inches. Participants were also tested for reaction time and movement time by responding to a stimulus light that followed a warning signal. When the stimulus occurred, participants reacted as fast as possible and pulled the wrist-string out 10 inches. Participants were batted a ball at varying velocities with the aid of a mechanical bat machine. The principal finding of this study was that reaction time decreased progressively while movement time was relatively stable and does not change even though the velocities of the balls changed. All participants were less successful at catching when ball velocity increased. The authors indicated that the faster reaction time would increase performance. However, no significant findings were found between reaction time, movement time and fielding performance.

Shank and Haywood (1987) studied the visual-search patterns used in viewing a pitched ball and attempted to determine differences in these patterns between expert and novice batters. The participants were 9 varsity university expert baseball players and 9 novice players. Eye movement reaction time was measured by analyzing a videotaped segment of their eye movements. The participants were tested for eye movement reaction time by filming their eye movements while they viewed a videotaped segment of a pitcher throwing a fastball. The tape was filmed from the perspective of a right-handed batter. The eye movements were recorded with an Applied Science Laboratory Model 210 Eye-Trac (Shank, et al), in accordance with a dynograph and display. The test indicated no significant difference in search patterns or eye movement reaction time between novice or expert hitters, type of pitch, or motion.

A player batting against a fast ball thrown at 90 miles per hour has only 23/100 of a second to adjust to the ball and swing (Yudin, 1985). While there appears to be a relationship among reaction time, movement time, eye dominance and hitting performance, the extent to which these factors predict hitting performance is unclear.

Stine, Arterburn, and Stern (1982) cited a study conducted by Buchellew (1982) studying a sample of twenty-six football and basketball players. Visual peripheral reaction time, or, reaction time to a stimulus in the peripheral field of vision, was measured by using a group of lights mounted at different horizontal angles in the subject's peripheral field of view. The time taken to respond to the light was measured in hundredths of a second. This study found visual reaction time is faster in each of the athletic groups studied as compared to a non-athletic group. These findings suggested there may be a relationship between reaction time and motor performance, but no significant findings were presented.

Summary

Literature related to eye dominance and hitting performance seem to indicate an inconclusiveness and contradiction among studies. Studies by Lange (1974) and Adams (1965) found no significant relationship between eye dominance and hitting performance. Lange's and Adam's results were contradicted by Teig (1981). He found the teams with the most crossed dominant batters had the highest batting averages.

Literature related to the relationship between reaction time and motor performance seemed to indicate a small, but insignificant relationship. Again, studies reviewed indicated contradiction in findings. DeLucia and Cochran (1985) found reaction time played a minor role in hitting performance. The results of their tests revealed that softball players could track a ball throughout any phase of its flight, requiring very little time to react. These results indicated that reaction time is less significant in hitting than might be expected.

Whiting (1991) suggested reaction time has more to do with the onset of a stimulus than the ongoing actions. With regard to hitting, he suggested the more important factor is not reaction time, but rather the processes involved in tracking and timing. Spurgeon et. al (1989) found that reaction time, eye dominance and hitting were not significantly related.

CHAPTER III
METHODOLOGY

This study investigated the effects of reaction time/movement time and eye dominance on hitting performance in baseball. This chapter describes the methods and procedures used in this study. Information on population, sampling methods, and procedures are also discussed.

Participants

The participants of this study were 11 varsity baseball players from Emporia State University. All of the participants were physically fit and without injury. Partcipants were volunteers from the 1993-1994 baseball team. The accessible population was the 1993-1994 Emporia State baseball team. The target population was collegiate baseball players from 18-23 years in age.

Procedures

Permission to conduct this study was obtained from the Human Subjects Committee of Emporia State University (see Appendix A). Over a period of two days, players participated in two separate testing sessions. The first session tested eye dominance and reaction time. The second session tested reaction time and response time. For both sessions, the researcher demonstrated the proper testing techniques. Hitting performance was assessed in several categories of the 1993-1994 season.

Eye dominance was determined using two different methods. The first method required the participant to hold his arm in an extended position out in front of his body. The thumb was extended upward in a "thumbs up" position. Next, the participant sighted an object on a wall 10 to 15 feet away, and held his thumbnail in line with the object; blotting out the object with the thumb. Both eyes were open during this process. Participants were then asked to close one eye. If the thumb appeared to move off of the line with the object, then the particular eye that was closed was considered to be the dominant eye. If the thumb continued to remain in line with the object, then that eye which remained open was considered to be dominant.

The second test used to determine eye dominance was conducted by forming a tube or tunnel out of an ordinary legal-sized piece of paper. The participant then extended the paper tube outward in front of him and sighted an object on a wall 10 to 15 feet away using the tube, at arm's length, to look through. The participant then slowly drew the tube back to his face toward one eye. The particular eye that the participant drew the tube back to was considered to be the dominant eye. For example, "X" extended his arm toward a far wall, holding the paper tube so he could sight a nail through the opening. "X" slowly drew the tube back to his face and

found himself using his left eye to sight through. "X" was considered to be left eye dominant.

The second factor tested in the initial testing session was response time. This study used the ruler drop to test response time. In the ruler drop test, response time was measured for both eyes using a blindfold to test each eye separately. To perform the ruler-drop test, a yardstick was used and scores recorded on a scoresheet. The researcher placed the yardstick vertically against the wall so that the yardstick's 24 inch mark was level with the participant's eyes and even with a mark on the wall. Participants then stood in their particular hitting position (right or left-handed) as though the ruler were the pitcher. The lead arm, that arm closest to the pitcher, was extended to the wall and the hand placed flat on the wall with the thumb placed even with the 24 inch mark, one inch above the ruler's surface. The participant's thumb never touched the yardstick. The participant focused on this mark. The researcher held the ruler at the 34 inch mark. One eye was blindfolded so the participant only had use of his dominant eye or non-dominant eye. At this point, the tester released the yardstick, allowing the ruler to fall freely toward the ground. The participant attempted to stop the falling yardstick as quickly as possible by depressing the thumb on the yardstick and against the wall. Once the yardstick had been stopped, the point at which the upper edge of

the thumb made contact with the yardstick was recorded. Participants were allowed three practice trials. After a three to five second break participants were tested five times. The time taken to complete this procedure was calculated by using the following formula:

$$\text{Time} = \frac{\text{distance in inches}}{192}$$

This process was repeated with each eye. Only the lead arm, or closest arm to the pitcher, was used for each eye. The scores were converted to times and averaged together by subject and by eye-dominance. For example, "X" was a right-handed batter meaning his left arm was nearest the wall. He was crossed dominant meaning his left eye is dominant. "X" was blindfolded in his left eye. He assumed the hitting position in front of a wall. The researcher held the 34 inch mark on the ruler and moved the 24 inch mark so it was even with "X's" line of sight. "X" then extended his left arm toward the wall and held his hand flat on the wall next to the ruler with his thumb over the 24 inch mark one inch away from the surface of the ruler. The researcher released his hold on the ruler allowing it to free fall. "X" depressed his thumb and stopped the ruler on the 30 inch mark indicating a drop of 6 inches. This score was recorded and the process repeated four more times. These scores were averaged and rounded to the nearest hundredth. This process was repeated with the other eye. The formula for the time

conversion of these scores was used to change the scores into time. These scores were correlated with eye dominance and hitting performance for the year.

The method used to assess reaction time involved a Lafayette reaction time switchboard. The switchboard included a control panel for the tester and a response panel for the participants. The control panel included a stimulus selection switch that varied the type of stimulus by sound or light color. All stimuli used for this test were white light. No audio signal accompanied the light. Also included on the control panel were a stimulus initiation switch and a clock to measure reaction time. The response panel included lights and a depression/release switch with which to react to the stimulus. Participants stood in the hitting stance and reacted to the stimulus by releasing a button on the control panel with the forefinger. The switchboard included a small board between the control side and response side. The researcher sat on the control side of the switchboard. The participant stood in front of the reaction time switchboard with the index finger depressing the contact key. The researcher instructed the participant to respond as rapidly as possible by releasing the button. This procedure was practiced three times and participants were tested five times and the scores recorded. These scores were averaged.

Statistics were kept on participants for the entire 1993 and entire 1994 baseball seasons. Statistics used as indicators of hitting performance were on-base average, batting average, and strike-out to walk percentage.

Analysis of Data

The first hypothesis was that reaction time, response time, and eye dominance are predictors of hitting performance. Multiple regression was used to determine if the factors are predictive of hitting performance. All data was analyzed at the $p < .05$ level of significance.

The second hypothesis was that there is a difference in reaction time and response time between crossed dominant and unilateral hitters. A t-test was used to determine the difference between the two groups of hitters. All data were analyzed to the $p < .05$ level of significance.

Summary

The purpose of this study was to determine if eye dominance, reaction time, and response time could predict hitting performance. A sub-purpose of this study was to determine the relationship between eye dominance and reaction time/response time. The participants were 19 volunteers from the 1993-1994 Emporia State Varsity baseball team. Participants were tested for eye dominance using two different tests. Participants were tested for reaction time using a Lafayette reaction time

switchboard, and for response time by using a ruler drop test. Hitting performance was assessed using on-base average, batting average, and strikeout to walk percentage. The results of these tests were analyzed to determine the relationship between the three factors.

CHAPTER IV
RESULTS

The purpose of this study was to determine if the factors of eye-dominance and reaction time and response time are predictive of hitting performance.

A multiple regression was used to determine if eye dominance, reaction time, and response time could predict hitting performance as measured by batting average, on-base average, and strike-out to walk ratio. All data were analyzed at the $p<.05$ level of significance.

The participants of the study were 11 varsity baseball players from the 1993 and 1994 baseball teams. Table 1 provides a summary of the crossed and unilateral hitters' batting average, response time, and reaction time.

Hypothesis 1 stated that reaction time, response time, and eye dominance are predictors of hitting performance. This hypothesis was rejected at the $p<.05$ level of significance. While the data in Table 2 presents the results of response time as being somewhat predictive, the scores are not significant. The value for R^2 of .28467 indicates that the factors of response time, reaction time, and eye dominance account for approximately 29% of the variance.

Hypothesis 2 stated there is a difference in reaction time and response time among crossed dominant and unilateral hitters. The hypothesis was rejected at the $p<.05$ level of significance. While the data in Tables 3 and 4 show a p value of .051, indicating the possibility of a difference

between crossed dominant and unilateral hitters in response time, the results are not significant.

Table 1
Descriptive Statistics

Factors	Crossed-dom		Uni-dom	
	mean	sd	mean	sd
Batting Average	.308	.037	.301	.302
On-base average	.458	.051	.440	.025
So/BB ratio	.953	.037	1.36	.077

Table 2
Multiple Regression Analysis

Multiple R	=	.53354
R^2	=	.28467
Adjusted R^2	=	-.02191
Standard Error	=	1.84689

Variable	B	SE B	Beta	T	P
Resp. time	2.938	1.900	.5724	1.546	.1660
React. time	.085	.198	.1440	.427	.6823
Eye dom.	.839	7.181	.2398	.632	.5473

Mean Difference = -.3400

f= .239

p< .051

Variable	N	Mean	SD	SE Mean
Resp. time				
Crossed-Dom.	6	.210 sec.	.023	.009
Unilateral	5	.244 sec.	.042	.019

Table 4
t-test of reaction time among crossed dominant and unilateral hitters

Mean Difference = -1.8467
f= 5.085
p< .051

Variable	N	Mean	SD	SE Mean
React. time				
Crossed-Dom.	6	.276 sec	.032	.013
Unilateral	5	.295 sec	.030	.013

Summary

The purpose of this study was to determine if crossed dominant vision, response time, and reaction time were predictive of hitting performance. Hitting performance was measured by assessing batting average, strike-out to walk ratio, and on-base average. Hypothesis 1 stated that crossed-dominant vision, reaction time, and response time were predictive of hitting performance. This hypothesis was rejected. No significant results were found, thus indicating that these factors were not predictive of hitting performance. Hypothesis 2 stated that there was a difference between crossed dominant and unilateral hitters in reaction time and response time. The results from the study indicated no significant difference in reaction time and response time between crossed dominant and unilateral hitters. In Chapter 5, results from the study will be discussed further and recommendations for future study will be made.

CHAPTER V
DISCUSSION

The purpose of this study was to determine if the factors of eye dominance, reaction time and response time are predictive of hitting performance. A second purpose of this study was to determine if a difference existed between reaction time and response time in crossed dominant and unilateral hitters. The results of this study indicate reaction time, response time and eye dominance are not significantly predictive of hitting performance. Also, results indicate that there is no significant difference between crossed dominant hitters and unilateral hitters in the areas of reaction time and response time. In the following chapter, these conclusions will be discussed and recommendations for future study will be offered.

Discussion

Although these results indicate reaction time, response time and eye dominance are not predictive of hitting performance and that there is no significant difference in reaction time and response time between crossed dominant and unilateral hitters, some factors may have influenced the results of this study. These factors include the small sample size, a range restriction in the factor of hitting performance, and test protocol. The accessible population, the 1993 and 1994 varsity baseball team at Emporia State

University, offered a relatively small sample size from which to draw participants.

A second reason for the results of this study may have been the small size of the range in batting averages. The small range from .170 to .380 makes it more difficult to find significance. This is the case because the scores of the batting averages are grouped so closely together.

A third reason for the results of this study may have been that the test protocol for reaction time and response time may not have been as valid as possible for testing these factors in their relationship with baseball. For instance, these factors were measured through the use of a Lafayette reaction time switchboard and a ruler drop test. A better protocol for these factors might have been a test that more closely resembles the hitting act.

Although not significant, response time accounted for the most variance in hitting performance. The findings of the present study compliment research done by Williams and Macfarlane (1975) and Delucia and Cochran (1985). Neither study found any significant difference between crossed dominant and unilateral hitters in reaction time, response time, and hitting performance.

Although results on eye dominance and hitting performance indicated that there may be a difference in response time between crossed dominant and unilateral hitters, no significant difference was found in this study. In addition, there was no significant difference between

crossed dominant and unilateral hitters in the area of reaction time.

In summary, the purpose of this study was to determine if the factors of eye dominance, reaction time, and response time were predictive of hitting performance. A second purpose was to determine if a difference existed between reaction time, and response time in crossed dominant and unilateral hitters. No significant predictiveness was found in any factors, although the factor of response time accounted for the most variance. Explanations for these findings include small sample size, range restriction of batting average, and testing protocol. In light of the findings of this study and the literature reviewed, it may be concluded that reaction time, eye dominance, and response time are not predictive of hitting performance.

Recommendations for Future Research

Recommendations for future research include:

1. increasing of sample size to at least 90 participants.
2. varying the test protocol so that the factors of reaction time and response time are measured by a method that involves using the baseball swing to conduct the test.
3. including the factor of movement time into the regression used to determine the predictiveness of factors to hitting performance.

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APPENDIX A

Informed Consent Form

EMPORIA STATE UNIVERSITY

1200 COMMERCIAL EMPORIA, KANSAS 66801-5087 316/341-5351 RESEARCH AND GRANTS CENTER - BOX 48

November 28, 1994

Brett Berry
2623 Road F
Americus, KS 66835

Dear Mr. Berry:

The Institutional Review Board for Treatment of Human Subjects has evaluated your application for approval of human subject research entitled, "The Effects of Eye Dominance on Hitting Performance and Reaction Time." The review board approved your application which will allow you to begin your research with subjects as outlined in your application materials.

Best of luck in your proposed research project. If the review board can help you in any other way, don't hesitate to contact us.

Sincerely,

John Schwenn, Dean
Office of Graduate Studies
and Research

JS:pf

cc: Kathy Ermler

APPENDIX B

Application For Approval
To Use Human Participants

APPENDIX B

APPLICATION FOR APPROVAL TO USE HUMAN SUBJECTS

This application should be submitted, along with the Informed Consent Document, to the Institutional Review Board for Treatment of Human Subjects, Research and Grants Center, Campus Box 4048.

1. Name of Principal Investigator(s) or Responsible Individuals: Brett Berry

2. Departmental Affiliation: HPERA

3. Person to whom notification should be sent: Brett Berry

   Address: 2623 Road F Americus, Ks 66835

4. Title of Project: The Effects of Eye Dominance on Hitting Performance and Reaction time in Baseball

5. Funding Agency (if applicable): na

6. Project Purpose(s): To study the effects of eye dominance on hitting performance and reaction time in baseball.

7. Describe the proposed subjects: (age, sex, race, or other special characteristics, such as students in a specific class, etc.) The participants are the varsity baseball team at Emporia State University. The subjects range in age from 19 to 22 years, are caucasian and male.

8. Describe how the subjects are to be selected: The participants will be selected on a volunteer basis from the Emporia State varsity Baseball team.

9. Describe the proposed procedures in the project. Any proposed experimental activities that are included in evaluation, research, development, demonstration, instruction, study, treatments, debriefing, questionnaires, and similar projects must be described here. Copies of questionnaires, survey instruments, or tests should be attached. (Use additional page if necessary.)

   Participants will be tested for eye dominance, reaction time, and hitting performance using valid tests. Hitting performance for this experiment will include statistics from the 1993-1994 season.

10. Will questionnaires, tests, or related research instruments not explained in question #9 be used?
_____Yes __x__No (If yes, attach a copy to this application.)

11. Will electrical or mechanical devices be used? __x__Yes _____No (If yes, attach a detailed description of the device(s).) Mechanical device consists of simple switchboard with depressing button and light switch.

12. Do the benefits of the research outweigh the risks to human subjects? __x__Yes _____No This information should be outlined here.

1) There are no risks.
2) Benefits to the subjects and coaches, researchers, will far outweigh the risks in that this research will provide insightful information and insight to the field of physical education and the sport of baseball.

13. Are there any possible emergencies which might arise in utilization of human subjects in this project?
_____Yes __x__No Details of these emergencies should be provided here.

14. What provisions will you take for keeping research data private?
All research is encoded on disk and no names or identifying numbers (uniform numbers) will be used in detailing results on tables, charts and graphs in the final presentation of the analysis of data. Only general results from data will be published.

15. Attach a copy of the informed consent document, as it will be used for your subjects.

STATEMENT OF AGREEMENT: I have acquainted myself with the Federal Regulations and University policy regarding the use of human subjects in research and related activities and will conduct this project in accordance with those requirements. Any changes in procedures will be cleared through the Institutional Review Board for Treatment of Human Subjects.

Signature of Principal Investigator — Date 11/29/94

Signature of responsible individual (faculty advisor) — Date 11/29/94

APPENDIX C

Informed Consent Form

APPENDIX C

INFORMED CONSENT DOCUMENT

The Department/Division of HPER supports the practice of protection for human subjects participating in research and related activities. The following information is provided so that you can decide whether you wish to participate in the present study. You should be aware that even if you agree to participate, you are free to withdraw at any time, and that if you do withdraw from the study, you will not be subjected to reprimand or any other form of reproach.

Procedures to be followed in the study, as well as identification of any procedures which are experimental. The subjects are the varsity baseball team at Emporia State University. The subjects range in age from 19 to 22 years of age. They will be given a valid eye dominance test.

Subjects will also be tested for reaction time by using a simple switch-board. Subjects simply depress a button when a light flashes. Subjects will also be tested for reaction time by using a ruler-drop test. In this test, subjects simply depress their thumb against a ruler as it falls parallel to a wall.

Description of any attendant discomforts or other forms of risk involved for subjects taking part in the study.

NONE

Description of benefits to be expected from the study or research.

Benefits of this study will include a clearer understanding for baseball players, coaches, and researchers of the relationship involving reaction time, eye dominance, and hitting performance as well as contributing knowledge to this field of study.

Appropriate alternative procedures that would be advantageous for the subject.

NONE

"I have read the above statement and have been fully advised of the procedures to be used in this project. I have been given sufficient opportunity to ask any questions I had concerning the procedures and possible risks involved. I understand the potential risks involved and I assume them voluntarily. I likewise understand that I can withdraw from the study at any time without being subjected to reproach."

Subject and/or authorized representative _____ Date _____

I, Brett Berry, hereby submit this thesis/report to Emporia State University as Partial fulfillment of the requirements for an advanced degree. I agree that the Library of the University may make it available for use in accordance with its regulations governing materials of this type. I further agree that quoting, photocopying, or other reproduction of this document is allowed for private study, scholarship (including teaching) and research purposes of a nonprofit nature. No copying which involves potential financial gain will be allowed without written permission of the author.

Brett Berry

Signature of Author

8/31/95

Date

The Effects of Crossed-Dominant Vision on Hitting Performance in Baseball

Title of Thesis/Research Project

Signature of Graduate Office Staff Member

8/31/95

Date Received