THE EFFECTIVENESS OF A SELECTED AIMING METHOD IN ARCHERY FOR USE WITH CROSS-DOMINANT SUBJECTS

by

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This study was conducted to determine the effectiveness of a selected aiming method in archery for use with cross-dominant subjects.

The subjects consisted of nine sophomore and five graduate women students attending The University of North Carolina at Greensboro during the academic year 1965-66. On the basis of a selected test of handedness and the hole-in-card test of eye dominance, these subjects were classified as cross-dominant. Each subject had had at least one semester of archery instruction and was familiar with the basic techniques of shooting.

Scores from the pre-test were ranked and paired and the subjects were divided into two groups. A coin was tossed to determine which group was experimental and which was control. The experimental group used the selected aiming method of closing the dominant eye, suggested by Falkenstine (22:27) and Edwards and Heath (18:61). An eye patch was placed over the eye to insure the maintenance of proper controls. Those in the control group used whatever visual aiming technique they wished. The Seven Steps of Shooting taught at Teela-Wooket National Archery Camp were utilized as the basis for instruction on archery form for both groups. Both groups shot thirty-two ends, or 192 arrows, over a six-week period, shooting once a week with no practice in between.

Fischer's "t" test of significance of difference between means for small correlated groups was used to determine if any significant difference

existed between pre-test and post-test scores within groups. Fisher's "t" test of significance of difference between means for small uncorrelated groups was used to determine if any significant difference existed between the experimental and control groups on the pre-test scores, the fourth trial scores and the post-test scores.

The following results were obtained:

1. No statistically significant difference existed between the experimental group and the control group on the pre-test, fourth trial, or post-test scores.

2. There was no statistically significant difference found between the pre-test and post-test scores within either the experimental group or the control group.

Within the limits of this study the following conclusions were drawn:

1. Placing an eye patch over the dominant eye of cross-dominant subjects as an aid to aiming, did not result in a statistically significant change in scores.

2. The eye patch did not appear to be detrimental to the subjects' scores.

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TABLE OF CONTENTS

LIST OF TABLES

CHAPTER I

INTRODUCTION

The utter frustration, in archery, of continually missing the target when all techniques are being properly executed is not uncommon.

Several years ago the writer, while attending Teela-Wooket National Archery Camp, became aware of the fact that a person with the dominant eye on the side opposite from the dominant hand experienced difficulty in aiming. He consistently missed the target to the right or left, even though his shooting form appeared perfect.

While teaching at North Syracuse Central High School in New York the writer found several students who developed correct shooting form but had unusual difficulty hitting the target consistently. They were found to be cross-dominant and had been sighting with both eyes open, focusing on the wrong image of the double image which normally occurs.

When looking through the literature or talking to persons involved in the teaching of archery, one finds a limited amount of material and conflicting opinions on how to help the cross-dominant archer. Edwards and Heath (3:61) and Falkenstine (37:27) suggest closing the dominant eye, Reichart and Keasey (13:70-71) and Forbes (5:135) advocate keeping both eyes open, and Miller (58:25) suggests switching hands to coincide with the dominant eye. Since little research has been done in this area, it was decided to test one of the methods suggested to

see if it would result in an increase in scores. Closing the dominant eye was chosen as the method to be tested. It was felt that this method would be the least confusing and most practical for class use if it was found to be significantly helpful in aiming.

CHAPTER II

STATEMENT OF THE PROBLEM

It was the purpose of this study to determine the effectiveness of a selected aiming method in archery for use with students whose eye and hand dominance do not coincide.

Nine sophomore and five graduate women student attending The University of North Carolina at Greensboro during the academic year 1965-66 were selected as subjects on the basis of eyedness and handedness tests. They were assigned to either an experimental or control group. Visual aiming restrictions were placed upon the experimental group while those in the control group used whatever visual aiming methods they wished.

The pre-test, fourth trial, and post-test scores were statistically treated by means of Fisher's "t" Tests of Significance of Difference.

I. DEFINITION OF TERMS

For the purposes of this study, the following definitions were accepted:

Eye-Dominance -- used synonomously with the term eyedness to designate the general condition of one eye being consistently chosen for use whenever a test for alignment is given. The hole-in-card test was used to determine dominance in this study.

Handedness -- preferring to use a certain hand when performing the

skills of brushing the teeth, throwing a ball, hammering with a mallet, and combing the hair.

Cross-Dominance -- refers to the condition of the dominant eye being on the opposite side from the preferred hand, as determined by the tests selected for use in this study.

II. LIMITATIONS

The recognized limitations in this study were as follows:

1. Since it was impossible to select subjects at random, the results of this study are applicable only to the subjects in this study.
2. Because of the individual nature of the activity, it was difficult to place objective controls on the amount and type of instruction given each student.

CHAPTER III

REVIEW OF LITERATURE

Very few attempts have been made to relate the trait of eye dominance to performance in archery or other skills requiring a sighting technique. An investigation of the available literature revealed numerous studies and research on the nature of eye dominance, its frequency of occurrence and means of measurement, and its relationship to handedness, all of which have application to the present study.

I. DEFINITION OF EYE DOMINANCE

The phenomenon of eye dominance is recognized and accepted in scientific areas, but its nature and full significance are as yet unexplained to the satisfaction of the experts. It is known that the human body is basically bilateral. When there is a tendency toward unilaterality in the functioning of bilaterally symmetrical sense organs, as in the establishing of a dominant eye, hand, or foot, it presents a problem in basic science. There are many definitions of eye dominance in existence in the literature, several of which are presented here for clarification and comparison.

Blakiston's New Gould Medical Dictionary states that the dominant eye is " . . . the eye which is unconsciously and preferentially chosen to guide decision and action." (8)

The Optometrist's Dictionary explains dominance as "the faculty which one of the eyes commonly exercises of dominating, or leading the other, both in fixation and in attentive or perceptive function." (16)

Pascal suggested a sensory or motor explanation, stating that dominance may be due to sensory superiority or a motor coordination which results in one eye maintaining a greater steadiness of fixation. (52:358)

Duke-Elder considered the basis of eye dominance to be physiological deficiency, stating that eye dominance was a habit due to reliance on one eye to a greater extent because of motor imbalance or sensory inequalities involving such factors as acuity, brilliance, after-image persistence, retinal rivalry, or diplopia vividity. (2:192)

Mills states that " . . . one eye always possesses a greater sense of power and discrimination, even when both are alike in retinoscopic measurements and in manifest acuity." (51:940)

Miles concluded that eye dominance referred to the clearing of the visual field so that the dominant eye image gained the right of way, making it appear much more substantial than the other. (49:115)

Lund observed that eye dominance was the tendency for one eye to become the directing and controlling eye when close coordination of eye and hand were required. (45:756)

Duke-Elder (2:192), Fink (38:556), Carmichael (1:338), and Miles (50:427) among others, agreed that ocular dominance is found almost universally in some degree. However, Walls suggested that so many different conceptions

of eye dominance make it difficult to form one standard definition. (56:412) Indeed, while reading, one comes across numerous synonyms for the term eye-dominance, such as eyedness, eye preference, anisopia, and anisdominance. The individual eye has been called dominant, master, preferred, fixating, sighting, and leading. The eye which is not dominant has been called the weak eye, non-dominant eye, and the non-leading eye. No definite dominance has been referred to as lack of dominance, ambiocularity, impartial eyedness, and amphiocularity. The conflicting and varying terminology is the result of the conflicting beliefs in the etiology of eye dominance and the extreme variation in methods of investigation. (36:4) In this particular study the terms eye dominance and eyedness, left-eyedness and right-eyedness will be used to refer to the general condition under consideration, and for the designation of the direction of laterality.

There are many factors centered around the condition of eye dominance which have been studied. The first is the relationship of visual acuity to eye dominance. Merrell (47:327), Coons and Mathias (27:632), and Gahagan (40:458) found no indication of superior acuity determining eye preference. In fact, Pascal states that occasionally he has found incidences of the eye with the lower visual acuity being the dominant eye. (52:358) Eyre and Schmeeckle state that if visual acuity is defective to the same extent in both eyes there seems to be no effect upon eyedness. (36:77)

As the result of a study done to check the relationship of a number of conditions to eye dominance, Crider concludes " . . . There is no relation

between visual acuity and eye closure facility . . . there is no indication that eye preference is related to sex differences . . . and there is no significant difference in the intelligence of the groups divided according to eye preference." (30:365)

One interesting study was done by Greenberg at Duke University to determine if any correlation existed between eye dominance and head tilt. He found that subjects with a right eye dominance carried the head to the left, and vice versa, and subjects with no discernible dominance had not established any consistent head tilt pattern. A suggested interpretation was that the head tilt was an attempt to bring the sighting eye closer to the midline of the body, thus aiding alignment of the individual. (42:151)

In terms of the classification of eye dominance, there are four groups to which a person may belong:

1. The pure dextral is right-handed, and the right eye is the master eye.
2. The pure sinsitral is left-handed, and the left eye is the master eye.
3. The crossed dextral is right-handed, and the left eye is the master eye.
4. The crossed sinistral is left-handed, and the right eye is the master eye.

(51:940)

II. EXPLANATION OF EYE DOMINANCE

Several theories have been offered in an attempt to shed some light on the physiological explanation of eye dominance. McAndrews has reported the work of Hillemans in Germany and the conclusions from his studies on the convergence power and muscular balance of the eye in close work. Hillemans found that the non-dominant eye deviated outward more than the dominant eye when under cover during convergence. One eye, usually the right, predominates for all close work, while the non-dominant eye serves little purpose. The assumption was made that the eye demonstrating the greater convergence is the master eye, and that this dominance is not congenital. He suggested that it is developed and strengthened in childhood and cannot be changed to the other eye. He also stated that the line of sight tends to deviate to the side of the dominant eye and is not in the median plane of the body. (46:452)

Miles' theory concerns "normal diplopia" or seeing two images, with which problem every individual learns to cope. " . . . this is due to the fact that most objects in any given field of view do not cast their images on corresponding points of the two retinae. For each fixation point, or distance of fixation, there is a 'horopteric surface' which includes all objects that are seen single, while others if examined closely, would be found double." Individuals usually manage to combat this diplopia by disregarding double images and by giving one eye the dominance, or as stated before, by clearing the visual field for the image that belongs to the dominant eye. (49:113)

Love uses the term "blanking out" to refer to the action of the less dominant eye. " . . . visual impulses reaching the brain through the less dominant eye are not perceived or registered (the brain learns to disregard visual impulses sent to it over the less dominant eye when it is necessary to do so)." (9:48)

Walls' theory, based on motor response, suggests that an innervation is kept only for the muscles of the dominant eye.

> The motor coordination of the eyes, as we know, is insured by a complex of synkineses and reflexes which operate to secure and maintain 'fusion'. The imaging of the same object on both foveas is brought about automatically. The binocular seeing of the object as single, and as lying on a single (egocentric) direction follows. Whatever the innervation pattern going to one set of eye muscles may be, it is complemented by a particular pattern going simultaneously to the other set. There should be no need of keeping and using, for localizing purposes, two records of innervation when one would do as well as the two. In statistical work, if two coefficients always add up to unity, one does not bother to write down both of them. If one of them is on file, one always knows what the other must be.
>
> The visual system sensibly avoids a source of confusion to itself by watching only one essential telautograph, instead of trying to watch the two at once . . . (56:399-400)

III. FREQUENCY RATIO

When investigating the frequency of particular eye dominance types, one finds many conflicting reports in the literature.

Miles (50:428) and Duke-Elder (2:198) report that sixty-four per cent of adults are right-eyed, thirty-four per cent are left-eyed, and two per cent show no well-defined dominance habit.

From a limited number of experiments Pascal concludes that six per

cent show left eye dominance, two per cent show no dominance, and the rest (ninety-two per cent) are right eye dominant. (52:358)

Merrell reports that in matings R x R for the dominant eye, twenty-three and seven-tenths per cent of the children had the left eye dominant; in R x L, forty-three and nine-tenths per cent; and in L x L, fifty-four and two-tenths per cent, thus demonstrating the influence of heredity on the trait. (47:327)

Coons and Mathias find that we seem to be a dextral, right-eyed people, and that the sinistral and left monocular are the exceptions. (27:632) Mills agrees by stating that about seventy-six per cent of all people are pure dextrals, and about nine and three-tenths per cent are pure sinistrals. (51:940)

In relation to cross-dominance, from twenty per cent to forty per cent of the population show a crossed laterality characteristic, according to Hildreth. (44:24)

Mills states that about thirteen per cent of the population are crossed dextrals, while one and seven-tenths per cent are crossed sinistrals. (51:940) Miles (50:428) and Coons and Mathias (27:632) found that the right handed tend more to right eye dominance than do the left handed to the dominance of the left eye. Duke-Elder's research showed that thirty-three per cent of the right handers showed a left eye dominance, while the left-handed people were approximately equally divided. (2:198)

Miles has found that about fifty per cent of superior adults know which is their leading or dominant eye, resulting from their many experiences in everyday life. (50:428)

IV. EYE DOMINANCE AND AIMING IN SKILL PERFORMANCES

Through the years some attention has been given to the investigation of eye dominance as it relates to success in tasks of skill requiring aiming. One of the first studies was done by Lund who tested 247 subjects, requiring them to use the non-dominant eye to guide the dominant hand. His results show " . . . that the scores made with the dominant eye (the non-dominant eye being covered) were better than those for the non-dominant eye." (45:762)

Banister studied the shooting scores of 1,000 infantrymen, after noting that those with the best vision did not always get the best scores, and found that the men with right eye dominance had a considerable advantage over others when required to shoot from the right shoulder, all other things being equal. (21:48)

Fink did a study similar to Lund, experimenting with 125 subjects who used one eye or the other for aiming, and found that the use of the dominant hand and dominant eye resulted in the highest degree of coordination. (38:581)

During World War II the question arose as to what influence eye dominance had on the ability to shoot a rifle. Crider has compiled statements written by some of the eye experts of that time, in response to the investigation of eye dominance as it relates to marksmanship. The opinions are conflicting, to say the least:

> Dr. Karl M. Dallenbach, Professor of Psychology, Cornell University; Chairman, Emergency Committee in Psychology, National Research Council, states: Expert rifle and pistol shots shoot with both eyes open--particularly on indoor ranges. They, of course, aim with one eye--the

better or so-called "master eye", but they keep both eyes open, so as to increase the brightness of the visual target.

Dr. Samuel W. Fernberger, Chairman, Subcommittee on Perceptual Problems, National Research Council states: I think we can be perfectly sure of one fact--the eye is more important for shooting than the hand. Hence it is of greater importance to have the dominant eye do the sighting than which hand squeezes the trigger or aims the gun. Also, we can be perfectly sure that it is necessary, especially for army shooting, to have both eyes open.

However, Dr. W. R. Miles, Professor of Psychology, Yale University, School of Medicine, was of the opposite opinion. When commenting on difficulties experienced by cross-dominant persons he stated that handedness was more influential than eyedness and that a right handed and left eyed person would want to shoot with the gun to the right shoulder. He suggested that cross dominants should receive careful instruction, and should try shooting with the gun to both the right and left shoulders. He also stated:

> Obviously a man who is left eyed and left handed can learn to shoot right handed but it seems quite clear that this is a rather expensive re-education. He can obviously do much better and achieve greater skill as a rule if he is allowed to use his own dominance pattern. (31:146-147)

Mills feels that eye dominance is more important than handedness and that cross-dominant persons are at an anatomic and physiologic disadvantage. He states that persons with a dominant right hand often are discovered to be left eyed because of their indifferent or uncertain ability at golf, shooting, tennis, baseball, and other types of sports. He suggests that as long as a cross-dominant person does not strain and merely uses muscle sense and two-eyed vision, he will shoot and play games fairly well and even very well at times. But, if he becomes anxious or picks up alignment with the left eye his aiming

will be thrown off. He feels that when exact sighting is necessary binocular vision is replaced by monocular vision and the sight is brought into line with the object by the master eye along its line of vision. (51:566)

Adams, who recently completed research on eye dominance and baseball batting, found that cross-dominant batters did not perform better than unilateral batters. The unilateral reached base significantly more often than the cross-dominants, and also had a higher batting average. Although other factors may be involved, he suggests that eye dominance should be regarded as a possible influential factor in mastery of the skill of batting. (20:9)

When relating the concepts of eyedness and handedness to archery, many viewpoints are presented as to how these conditions should be considered in teaching the sport.

Love feels that both eyes should be kept open when aiming, and that the archer, seeing two arrow tips as he aims (using point-of-aim method) must figure out which of the images he must disregard while shooting. He also suggests that once the master eye is identified, the archer should shoot with the hand corresponding to that eye. (9:48)

Reichart and Keasey, using point-of-aim method of sighting, also suggested keeping both eyes open and learning to ignore the false image. However, they do suggest closing one eye if the double image confuses the archer. (13:70-71)

Miller states that arrows will go to the extreme right when a left eyed archer shoots right handed. The suggested remedy is to teach the archer to

shoot left-handed instead of right, or to align the point-of-aim to the left of the target if right handed shooting is continued. (58:25)

Forbes advocates keeping both eyes open while shooting and adds that in the case of a right handed, left eyed shooter, the right eye will become the sighting eye if the bow is brought to full draw with the arrow shaft under the right eye. (5:135)

Edwards and Heath stated that a right handed but left eyed archer has two alternatives. He can shut his left (dominant) eye and force the right eye to do the work, or he can switch to shooting left handed. The opposite procedure would apply for a left-handed right eye dominant shooter. Another possible choice is to bring the drawing hand underneath the chin and across to the left side of the face, so the arrow shaft is lined up under the left eye. It is uncomfortable and was recommended only for extreme cases. (3:61)

And finally, Falkenstine, in a study of cross-dominant competitors at the National Archery Tournament in Ohio in 1955, found that archers with the dominant eye opposite the shooting side, closed the dominant eye allowing the other eye to do the sighting task alone. He strongly advocated using this aiming technique, and suggested that more research be done in the area. (37:27)

V. MEASUREMENT OF EYE DOMINANCE

Many tests of eye dominance have been developed and reported in the literature through the years. These tests tend to fall into four categories: the pencil test (or finger test), the hole test, the cone test, and the mirror test, all

of which are based on alignment. As explained by Meyers:

> The most repeatable, most easily administered, and yet the simplest tests have been the alignment tests, the bases of which is the physiological diplopia occurring with the image of the aligning finger when one gazes past the finger to a far point. Since visual alignment of the finger and the far point can only be accomplished with one eye, the assumption is that the eye used for alignment is the dominant eye. (10:13)

The mirror test, developed by Crider, consists of a mirror with a circle one inch in diameter drawn in the center with black ink. The subject is instructed to hold the mirror at arm's length and keep both eyes open, and try to get the end of his nose in the black circle. The examiner can tell which eye is being used by the position of the mirror; or, the subject is instructed to close one eye and then the other, and the spot or nose shifts when the subject subsequently closes the dominant eye. Two chances are given each subject. After testing 422 cases, Crider repeated the test two months later and found scores to be identical in ninety-eight per cent of the cases. (29:669-670)

Greenberg describes the pencil test, which involves simply a pencil and a mark placed on the wall or blackboard. With both eyes open, the subject brings the pencil, held at arm's length, into line with the mark on the blackboard. He then closes one eye and reports if the pencil is still in line with the mark. Eight trials are given--four with the pencil held in each hand, and four with each eye being closed. If the pencil remains in line when the right eye is closed, the subject is left eyed; if it jumps to the right he is right eyed. If it remains in line when the left eye is closed he is right eyed, and if it jumps left he is left eyed. If there is inconsistency on fewer than six of the eight trials, the

subject is classified as "ambiguous". (42:150)

One form of the cone test is the Miles A-B-C test, also known as a "forced choice" test. In this test, the subject holds in both hands a funnel shaped paper so designed that the test object can be seen through the device with one eye only. The tester simply observes which eye is being used. Several advantages of the test are that it may be repeated many times on the same person with little worry about the handedness factor, and the subject also is not immediately aware of the findings. (50:428) Eyre, when summarizing the studies of Cornell, Drat, and Turner, stated: "All three experimenters found the peep-hole (binocular) the most reliable test for eyedness." (35:113)

The hole-in-card test is accurately described by Scheidemann:

> Tear a small hole (about a half-inch in diameter) in a sheet of paper. Place the bit of torn out paper upon the floor or table. Require the subject to hold the paper with the hole in it at arm s length and to look through the hole at the bit of paper. Without permitting him to move the sheet of paper or his head, require him to close his right eye--if he still sees the scrap of paper he is left-eyed; if he is no longer able to see it, he is right-eyed . . . Its accuracy is not decreased when the subject knows the purpose of the test for it is only by special and readily detectable adjustment that the subordinate eye is accommodated. (54:126)

Buxton, Crosland and Crider, among others, have all established high reliability for this test. There are several variations of the test, one of which includes raising and lowering the card and sighting through the hole, both eyes open each time, at the test object. Because of the size of the hole the subject will place the card in front of one eye or the other, the choice indicating the dominant eye. This method was used by Love (9:47) and Meyers (10:14), among others.

Crider (28:164) has commented that as the number of opportunities for sighting increases and the criterion remains constant the percentage of eye preference varies. He points out that the data of no two investigators are comparable unless the number of sighting opportunities and the criterion are stated, and are in agreement.

Hamilton and Beitel (43:562) administered eight different sighting tests to 104 college sophomores and found a surprisingly high number of cases in which dominance could not be determined, a lack of consistency among the various tests, and a low positive relationship between right eye dominance and right handedness. This seems to emphasize Crider's remarks that tests must be standardized before any accurate information on eye dominance can be gained.

V. HANDEDNESS

Most people have a preferred hand for performing the skills found in everyday life. According to Smith (55:415), and by just browsing through the literature on the subject, one can find evidence of conflicting opinions among the experts as to whether handedness is acquired or innate. Mills, for instance, states that handedness is determined by eyedness, the line of vision of the fixing eye regulating the matter of the dominance of the corresponding side of the body which it guards and controls. (51:940) It seems that skills are better performed with the preferred hand, due to finer neuromuscular function and consequently less fatigue, and greater strength and precision. A different

hand preference for varied activities is not uncommon, as handedness is not always consistent. It seems fairly certain that whatever the cause of dominance of one hand over the other, the dominant hand can be changed with only a great deal of trouble.

There are several forms of handedness tests, ranging from simple to complex, almost all of which involve the questionnaire format. An example of the most commonly used type is that developed by Crovitz and Zener (34:272-273) which is administered as follows:

> Answer the following questions carefully. Imagine yourself performing the activity described before answering each question. Answer by drawing a circle around the appropriate set of letters appearing to the left of each question whose meanings are:
>
> Ra - right hand always
> Rm - right hand most of the time
> E - both hands equally often
> Lm - left hand most of the time
> La - left hand always
> X - do not know which hand

1. Ra - Rm - E - Lm - La - X: is used to write with
2. Ra - Rm - E - Lm - La - X: to hold nail when hammering
3. Ra - Rm - E - Lm - La - X: to throw a ball
4. Ra - Rm - E - Lm - La - X: to hold bottle when removing top
5. Ra - Rm - E - Lm - La - X: to use to draw with
6. Ra - Rm - E - Lm - La - X: to hold potato when peeling
7. Ra - Rm - E - Lm - La - X: to hold pitcher when pouring out of it
8. Ra - Rm - E - Lm - La - X: to hold scissors when cutting
9. Ra - Rm - E - Lm - La - X: to hold knife when cutting food

10. Ra - Rm - E - Lm - La - X: to hold needle when threading

11. Ra - Rm - E - Lm - La - X: to hold drinking glass when drinking

12. Ra - Rm - E - Lm - La - X: to hold tooth brush when brushing teeth

13. Ra - Rm - E - Lm - La - X: to hold dish when wiping

14. Ra - Rm - E - Lm - La - X: holds tennis racket when playing

Every item is scored on a 5-point scale. On items 1, 3, 5, 7, 8, 9, 11, 12, and 14, Ra is scored "1"; Rm "2"; E "3"; Lm "4"; and La "5". All other items (2, 4, 6, 10, 13) are scored in the reverse fashion. Items marked X are prorated. The highest possible right-handed score is 14, and the highest left-handed score is 70.

Meyers chose to use a four-factor battery as a test of dominance, each element chosen on the basis of its simplicity of performance, laterality of action, and freedom from gross environmental pressures, commonly found in the skills of eating and writing. The four factors selected were brushing the teeth, throwing a ball, hammering with a mallet and combing the hair. A subject was classified as left handed if he used the left hand for any of the four actions. (10:15)

Falkenstine chose to select handedness for his archery study by determining the hand preferred for throwing speed and accuracy. He felt that this skill is established early in life and is stabilized and would withstand change due to social pressures. (37:26)

As in eyedness, there is no standardized procedure for determining "handedness", and until there is, conflicting results will always be in evidence.

CHAPTER IV

PROCEDURE

I. SELECTION OF TESTS

Since the purpose of this study is to work with cross-dominant archers, using a specific aiming technique, it was first necessary to select and administer suitable tests for eye-dominance and handedness to establish the presence of cross-dominant traits.

Eye-Dominance Test

The hole-in-card test as used by Meyers was selected as the test for ocular dominance to be used in this study. This test has several very practical and important features: (1) subjects are usually unaware of their choice; (2) the test requires little equipment and is easily and quickly administered; (3) double images are less noticeable.

Crider obtained a coefficient of reliability of .92 on the basis of a retest of 113 subjects after two months with this particular test (29:670). Miles (48:156) calculated a coefficient of .95 from data resulting from the retesting of fifty-nine subjects after one week, and Meyers obtained a .92 on retesting sixty-three children after one year (10:21).

As reported by Meyers (10:15), Guttman attempted to establish validity on four different alignment tests. He tested twenty-five university students, and

when the results of each different alignment test were compared with the results of the battery of tests on each subject, it was found that the mirror test showed sixty-eight per cent agreement, the pencil alignment test ninety-two per cent, the cone test ninety-six per cent, and the hole-in-card test, one hundred per cent.

On the basis of the above findings as well as the ease of administration, the hole-in-card test was selected for the test of ocular dominance.

Handedness Test

Falkenstine, in a study involving archery, chose as his basis for determining handedness the hand used for throwing a ball for speed and accuracy. He felt that this skill involves a long established neuromuscular pattern which was less likely to change as a result of social pressures (37:26).

Meyers also used the skill of throwing, but added brushing the teeth, combing the hair, and hammering a mallet, to form a battery for determining handedness. If any of these skills were performed with the left hand, the subject was classified as left-handed (10:15).

The battery used by Meyers was the one chosen for use in this study, the skill of throwing deemed the most indicative, and the other skills serving to reinforce this criteria.

II. SELECTION OF SUBJECTS

Ninety-seven students presently attending the University of North Carolina at Greensboro, and who had one semester of instruction in archery,

were tested for eye and hand dominance. The testing was carried out entirely by the author, in the following manner:

Eyedness

Each student was informed that the author was doing a study on archery, and was asked to submit to a quick and easy eye test, and to answer a few questions. The testing was done in the student's dormitory room in most cases. The student was instructed to sit on the bed or chair directly facing the author, who was also seated, about six feet away. The student was given a five-by-eight index card with a half-inch hole in the center, and was asked to hold the card with both hands, one on the left side of the card, and one on the right side. The student started with the card in her lap. She was instructed to raise the card on the word "UP" and look through the hole at the author's nose. She was asked to keep both eyes open and to hold the card at arm's length during the entire test. On the word "DOWN" she was asked to return the card to her lap. The author asked if there were any questions and started the test with the words "READY...UP...DOWN...UP...DOWN", etc. The word cues were given five times and the subject was then asked to rest. Once again the test was started with the words "READY...UP...DOWN...", until five more turns were completed. Each trial was checked off on a scoresheet by the author. The author practiced on approximately forty people before attempting to administer the test. There was absolutely no question as to which eye was favored in all cases of the actual testing. The hole in the card was easily determined as being held in front of the left or right eye. In all cases the card was held consistently in

front of one eye for the ten trials. In case of a mixed response, the majority answer would have determined eyedness. The purpose and explanation of the test were given to all ninety-seven students tested. A facsimile of the scoresheet used may be found in the Appendix.

Handedness

Immediately following the eye test the subject was asked the following questions in the order stated:

1. Which hand do you use to throw a ball for speed and accuracy?
2. Which hand do you use to comb your hair?
3. Which hand do you use to hold a hammer when hammering?
4. Which hand do you use to hold the toothbrush when brushing your teeth?

If the student answered "right hand" each time she was classified as right-handed, and vice versa. If one of the questions was answered "left hand", the student was classified as left-handed. The responses to these questions were also included on the scoresheet, which enabled the author to tell at a glance if the student were cross-dominant.

Eighteen of the ninety-seven students were found to be cross-dominant. Seventeen were right-handed and left-eyed, and one was left-handed and right-eyed. Fourteen students volunteered to participate in the study. Of this number, thirteen were right-handed and left-eyed, and one was left-handed and right-eyed.

III. SELECTION OF AIMING METHOD

The aiming method decided upon for use in this study was that of keeping the dominant eye closed during shooting. An eye patch was utilized to insure control. The method of closing the dominant eye has been suggested by Edwards and Heath (3:61), Falkenstine (37:27), and Charles Pierson (former National Flight Shooting Champion and presently a manufacturer of custom archery equipment and archery instructor, in personal correspondence).

It was felt that switching shooting hands to alleviate the cross-dominance, as suggested by Miller (58:25) and Edwards and Heath (3:61), although probably ultimately the most effective means of coping with the condition, required transferral of an intricate neuromuscular task. The short time span of the experiment could possibly make this a frustrating experience for the archers, and would require such individual assistance that controls would be difficult to maintain.

Keeping both eyes open, as suggested by Love (35:48), Reichart and Keasey (13:70-71) and Forbes (5:135), was considered as a possibility, but from the author's past experience this method, which results in a double image, is very confusing to the average student. Reichart and Keasey have even suggested closing one eye if this confusion should occur.

Since the bowsight was selected as the aiming device for this study, the suggestion made by Miller (58:25) to align the point-of-aim to the left of the target would not apply in this case.

Edwards and Heath suggested aligning the string under the dominant

eye, but they did state for extreme cases only. It was felt that this technique would result in poor shooting form since it requires the assumption of a generally uncomfortable position (3:61).

It was decided to experiment with closing the dominant eye, using a patch for the following reasons: (1) it would be easy to maintain controls; (2) little or no effort was required on the part of the student to adopt this technique; (3) it could be quickly taught; (4) it does not involve the change of a neuro-muscular pattern; (5) the author was interested to see if using the non-dominant eye would improve the archer's consistency.

IV. TECHNIQUES OF SHOOTING

The shooting method advocated by Myrtle K. Miller (58:6-9) is widely used throughout the country in schools and camps, and is taught at the University. This method is considered the most efficient and easily understood, and was selected as the basis for shooting form for the subjects. Most subjects were familiar with the technique, and only minor changes in form (from point-of-aim to bowsight) were made to facilitate controls. The following is a break-down of the skills as they should be performed. All directions are given for Right handed archers:

1. The Stance

   a. Stand with left side toward target with face turned toward target.
   b. Have weight equally distributed on both feet.
   c. Have feet just far enough apart for good balance (8" - 16")
   d. Have one foot on each side of the shooting line (straddling shooting line)

2. Nocking The Arrow

   a. The arrow is nocked perpendicular to the bowstring.
   b. The cock feather for 3-fletch arrows is away from the bow.

3. The Draw

   a. The left hand is placed so that the bow rests in the heel of the hand, the wrist is behind the bow, the forefinger is placed around the bow, the thumb is on top of the end joint of the forefinger without pressure.
   b. The left arm is slightly bent (elbow rotated down and out) in such a position that if flexion were continued, the arm would swing in toward the body like a door closing. (The elbow joint acting as a hinge)
   c. Place the first, second, and third fingers on the bowstring, the string cutting just in front of or in the first joints, not near the ends of the fingers. The nock of the arrow rests between the first and second fingers with very little contact but NO pressure on the nock. The draw takes place by use of the upper arm, shoulder, and upper back muscles, increasing the spread between the shoulder. In the draw, the shoulders come back, bringing the shoulder blades toward each other. The arm is away from the body, and the elbow moves back from the very beginning of the draw. The right elbow is back at full draw, in direct line behind the point of the arrow. In the draw, no pulling is done with the fingers; they merely act as hooks on the string. Pulling with fingers instead of upper arm, shoulder, and back muscles gives the beginner much trouble in keeping the arrow on the string.

4. The Anchor

   (The step which actually AIMS the NOCK end of the arrow - like a "back sight")

   a. The forefinger comes directly under the jaw bone at the completion of the draw. If this is too difficult, the forefinger may rest along the side of the jaw bone or on the jaw bone, the end of the forefinger resting at the center of the chin. The thumb is relaxed, completely without use in the anchor. For target archery, the low anchor under the jaw should be encouraged. It gives the archer a higher sight which is a great advantage in shooting at longer ranger. Most students can use the anchor under the jaw.
   b. The string touches the tip of the nose and the center of the chin. With an extremely "sloping jaw", it may not be possible to have the string touch the nose and still maintain the low anchor. In this

case have the string come as close as possible, but keep the forefinger in contact with the jaw bone.

c. In target archery, field archery or bowhunting, it is essential that the anchor be the same for each shot. It must be firm and comfortable for the individual.

5. Aiming or Holding

a. Sight Method - due to the scientific improvements in the construction of bows today, they are far more efficient than the bows used by most archers in the past. The increased cast (energy) in bows today increases the velocity of arrows to such an extent, that the sight method of aiming has become the more accurate and more popular method of aiming.

A simple sight may be put on any bow by placing a six or eight-inch strip of adhesive tape, moleskin, or felt on the back of the bow just above the handle. A small black-headed straight pin can be inserted so that the head or "bead" projects from the left of the bow, or mechanical bowsights may be purchased from archery dealers.

Holding is essential for accurate shooting with a sight as well as with point-of-aim. Sufficient time should be allowed for the steadying down of the bow arm so that the sight is seen in a very definite spot on the object to be hit.

In sight aiming, the line of vision goes from the right eye through the bead to a definite spot on the gold of the target or any other object to be hit.

With the sight method, if arrows go too HIGH, correction is made by moving the sight UP. If arrows go too LOW, the sight is moved DOWN. The lateral dispersion of arrows is affected by the position of the sight and its closeness to the bow. If arrows go RIGHT, push the "bead" RIGHT (in toward the bow). If they go LEFT, pull the sight out to the LEFT (away from the bow). EXTREME ACCURACY IN AIMING IS ESSENTIAL TO GOOD SCORING.

6. The Loose or Release

a. Right hand . . . relax the fingers of the right hand. This allows the fingers to roll off the string smoothly. As the contact is broken, the action of the back muscles will cause the right elbow to come back as the shoulder blades come together. If alignment is kept, the right hand will pass along the side of the neck. This is a

natural reaction and not a conscious motion, if the back muscles are properly used. The inside of the forearm and upper arm must remain close together and move back as one segment.

b. Left hand . . . keep the left hand in the same position as at full draw. Relax the left wrist at the instant the string leaves the fingers of the right hand and allow the bow to do as it wants to do. Avoid gripping the bow . . . keep alignment . . . avoid tension . . . keep the bow at the same level it was at full draw.

7. Follow-Through and After-Hold

a. Hold the position assumed after the arrow lands. Analyze each shot completely in the afterhold by checking on where your right hand ended in the release, where the bow hand is, etc. Keep the eye on the sight during the afterhold.

The sight method was also chosen for the following reasons: (a) a fairly accurate guess can be made by a person with experience as to where to initially place the sight, based on weight of bow and shooting distance; (b) the sight can be quickly adjusted right on the shooting line; (c) students have the psychological advantage of aiming directly at what they want to hit.

By placing a patch over the dominant eye of the experimental group, it was attempted to learn if the non-dominant eye would be forced into straight line vision, adequately filling in for the job of the dominant eye in placing the pin, which is approximately 10" from the eye, on the center of the gold, with no visual confusion.

It was attempted to gear the shooting as much as possible to these techniques for all subjects.

V. ESTABLISHMENT OF SHOOTING GROUPS

From the fourteen cross-dominant subjects, seven were assigned to the experimental section, using the eye patch, and seven were placed in the control group, using any method of aiming with the eyes that they wished. Groups were established according to pre-test scores.

Pre-test

For the pre-test the subjects shot in three groups of four and one group of two. Each group shot on a different night. The author demonstrated and gave a quick rundown of the basic shooting techniques to be used, taking extra time to explain the use of the sight to those students who were unsure of the method of adjustment. Students were given an opportunity to ask any questions on shooting techniques and they were answered fully, to the best of the author's ability. With no further instructions or coaching hints, except those given to protect the subjects from hitting the left elbow with the string, the subjects shot one practice end, followed by six ends which were scored. It should be emphasized at this point that instructions throughout the testing were given in all aspects of shooting except the area of vision. No suggestions were given as to what to do with the eyes, therefore subjects presumably used whatever technique they had previously employed.

Choosing Groups

The pre-test scores were ranked and paired and a t-test was run to

see if the groups were equated. There was no significant difference between the groups. A coin was then tossed to see which group of subjects would be experimental, and which group control. From this point on subjects shot only with members of their own group.

Restriction of Groups

The seven students in the experimental group were each given an eye patch and asked to wear it on the left eye (all subjects were left eye dominant and right handed) while shooting each end. Students placed the patch on the eye and kept it on while shooting, removing it between ends to retrieve arrows. All other archery techniques remained the same. Subjects were unaware of the reason for wearing the patch.

The seven students in the control group were told they would continue to shoot as on the first night. Help was given in adjusting the sight, but absolutely no mention was made of visual technique.

Neither group was aware of what the other was doing, each being asked not to mention the exact procedure employed.

VI. DESCRIPTION OF SHOOTING PROCEDURES

Shooting Area and Equipment

All shooting was done in one of the University gymnasiums equipped with a backdrop for indoor shooting. This site was selected because: (1) it was adjacent to the archery equipment room; (2) it helped maintain the shooting schedule by ruling out the effects of bad weather; (3) archers were not required

to cope with such problems as wind, sun, etc.; (4) no time was wasted searching for lost arrows, etc.

Students were supplied with fiberglass backed recurve bows for the most part, although a few used lemonwood bows. All bows were equipped with sights and nocking points. Cedar shafted arrows were used.

Distance and Targets

All ends were shot at a thirty-six inch regulation target face from twenty yards. No more than two people shot at a target at one time. The archery backdrop accommodated three targets, consequently the maximum number shooting at one time was six. The average number of shooters per session was four.

Ends and Length of Time

Subjects shot a total of thirty-two ends, or 192 arrows. The ends were shot over a period of six weeks. Subjects shot for approximately an hour a night, one night a week, with no practice in between sessions. The breakdown of ends is as follows:

TRIAL	NO. PRACTICE ENDS	NO. ENDS SCORED
1 (pre-test)	1	6
2	1	4
3	1	5
4	1	6
5	1	5
6 (post-test)	1	6

It was necessary to consider several factors when determining the number of ends to be shot to provide data for the study: (1) fourteen was the

ts available, and most had volunteered with the
on their time would not be too numerous or lengthy;
ts for dominance, there was a six-week block of
uous shooting, before a school vacation would inter-
ts had shot for about one year, and the endurance
consideration. Shooting six ends at one time was
verly strenuous, but still giving a fair measure of
tests; (4) since a total number of ends had to be
as arbitrarily chosen as a satisfactory number for the
the first day of shooting consumed more time than
due to instructions on procedure given to each group.
on consisted of four ends to shorten the shooting
nsisted of six ends to allow for statistical analysis

approximately halfway through the study, to see if using the eye patch was affecting the scores of the experimental group.

A sample of the archery scoresheet used by the subjects may be found in the Appendix.

Coaching Hints

In an attempt to maintain some control on this aspect of shooting, the groups were purposely kept small (three or four persons per group). The author attempted to assist archers on basic techniques only, and helped each subject no more than two arrows per end. Suggestions were made for things such as maintaining correct anchor point, developing proper release, checking

maximum number of subjects available, and most had volunteered with the understanding that demands on their time would not be too numerous or lengthy; (2) after completing the tests for dominance, there was a six-week block of time left to allow for continuous shooting, before a school vacation would interrupt; (3) none of the students had shot for about one year, and the endurance factor had to be taken into consideration. Shooting six ends at one time was decided upon as not being overly strenuous, but still giving a fair measure of ability for the pre and post tests; (4) since a total number of ends had to be decided upon, thirty-two was arbitrarily chosen as a satisfactory number for the purposes of this study; (5) the first day of shooting consumed more time than any of the other sessions, due to instructions on procedure given to each group. Therefore, the next session consisted of four ends to shorten the shooting time. The fourth trial consisted of six ends to allow for statistical analysis approximately halfway through the study, to see if using the eye patch was affecting the scores of the experimental group.

A sample of the archery scoresheet used by the subjects may be found in the Appendix.

Coaching Hints

In an attempt to maintain some control on this aspect of shooting, the groups were purposely kept small (three or four persons per group). The author attempted to assist archers on basic techniques only, and helped each subject no more than two arrows per end. Suggestions were made for things such as maintaining correct anchor point, developing proper release, checking

string alignment (mentioned to all shooters at the third trial), or correct arm position to prevent elbow injury. After the initial explanation, subjects were encouraged to adjust their own bowsights.

Any new instructions that were deemed necessary (string alignment) were given to the entire group, experimental and control.

VII. TREATMENT OF DATA

Fisher's "t" test for significance of difference between means for small uncorrelated groups was used to determine if any difference existed between the means of the experimental and control group on the basis of the pre-test scores. Within groups comparisons between pre and post-test scores were made on the basis of Fisher's "t" test for significance of difference between means for small correlated groups. The change which occurred between pre-test and fourth trial scores between groups was tested for significance by the Fisher's "t" test for small uncorrelated groups.

Throughout the statistical treatment, the point for rejecting the hypotheses was the five per cent level of confidence.

CHAPTER V

ANALYSIS AND INTERPRETATION OF DATA

This study was undertaken to determine the effectiveness of a selected aiming method for use with cross-dominant subjects. The subjects were nine sophomore and five graduate women students at The University of North Carolina at Greensboro who had had at least one semester of college archery instruction. The subjects were assigned to two treatment groups, experimental and control. The experimental group wore an eye patch over the dominant eye, forcing them to use the non-dominant eye, which coincided with the dominant hand, for aiming. The control group used whatever visual aiming method they wished. All subjects used the bowsight as an aiming device. They were coached on basic shooting form according to the Teela-Wooket Archery Camp method.

Eye dominance was determined by administering ten trials for the hole-in-card test. Handedness was determined on the basis of the preferred hand for throwing a ball for speed and accuracy, combing the hair, holding a hammer, and brushing the teeth.

I. PRESENTATION OF DATA

Five assumptions, stated as Null Hypotheses, were tested in this study. The hypotheses were as follows:

1. There is no difference between the experimental and control groups in archery scores on a pre-test of six ends of arrows.

2. There is no difference between the pre-test and post-test scores within the experimental group.

3. There is no difference between the pre-test and post-test scores within the control group.

4. There is no difference between the experimental and control group on the fourth trial scores.

5. There is no difference between the experimental group and the control group on the post-test scores.

The five per cent level of confidence was established as the point for rejecting the hypotheses.

The first null hypothesis was that:

> No difference exists between the experimental group and control group in archery scores on the pre-test.

The pre-test scores were ranked and paired. At this time one of the subjects was unable to participate further in the study. A substitute was found and her scores replaced the original subject's scores.

Fisher's "t" Test of Significance of Difference Between Means for Small Uncorrelated Groups yielded a "t" of 1.00. A "t" of 2.179 was needed to reject the hypothesis at the 5 per cent level of confidence. Therefore, the hypothesis that no difference existed between the experimental group and the control group based on pre-test scores was accepted. The data concerning this difference may be found in Table I.

The second null hypothesis stated that:

> There is no difference between the pre-test and post-test scores within the experimental group.

TABLE I

SIGNIFICANCE OF DIFFERENCE BETWEEN EXPERIMENTAL AND CONTROL GROUPS IN ARCHERY SCORES ON PRE-TEST

Subjects	N	Mean		t
Exp. Group I	7	129.14	67.57	1.00
Con. Group II	7	96.86	39.66	

t of 2.179 needed at .05 per cent level of confidence

Fisher's "t" Test of Significance of Difference Between Means for Small Correlated Groups was used to test the significance of difference between the two sets of scores. Since the "t" of 1.4244 was below that required to reject the hypothesis at the 5 per cent level of confidence, the hypothesis that no difference existed between the pre-test and post-test scores for the experimental group was accepted. These data are presented in Table II.

The third null hypothesis was:

> There is no difference between the pre-test and post-test scores within the control group.

Since Fisher's "t" Test yielded a "t" of only 2.1365, the hypothesis that no difference existed between the pre-test and post-test scores was found tenable. These data are found in Table III.

The fourth null hypothesis stated that:

> There is no difference between the experimental group and the control group on the fourth trial scores.

This hypothesis was also found tenable. Since Fisher's "t" Test of Significance of Difference Between Means for Small Uncorrelated Groups yielded a "t" of 1.3097. As indicated in Table IV a "t" of 2.179 was needed to reject the hypothesis.

The fifth null hypothesis was:

> There is no difference between the experimental group and the control group on the post-test scores.

The data presented in Table V indicated that no significant difference was found to exist between groups on the post-test scores, as determined by Fisher's "t" Test of Significance of Difference Between Means for Small

TABLE II

SIGNIFICANCE OF DIFFERENCE BETWEEN PRE-TEST AND POST-TEST SCORES WITHIN THE EXPERIMENTAL GROUP

Subjects	N	Mean Difference		t
Exp. Group I	7	37.2857	169.63	1.4244

"t" .05 (df = 6) = 2.447

TABLE III

SIGNIFICANCE OF DIFFERENCE BETWEEN PRE-TEST AND POST-TEST SCORES WITHIN THE CONTROL GROUP

Subjects	N	Mean Difference		t
Control Group I	7	39.4285	119.59	2.1365

"t" .05 (df = 6) = 2.447

TABLE IV

SIGNIFICANCE OF DIFFERENCE BETWEEN THE EXPERIMENTAL GROUP AND CONTROL GROUP ON THE FOURTH TRIAL SCORES

Subjects	N	Mean Difference		t
Exp. Group I	7	21.8571	43.10	1.3097
Con. Group II	7	58.2857	52.76	

"t" .05 (df = 12) = 2.179

TABLE V

SIGNIFICANCE OF DIFFERENCE BETWEEN THE EXPERIMENTAL GROUP AND THE CONTROL GROUP ON THE POST-TEST SCORES

Subjects	N	Mean Difference		t
Exp. Group I	7	37.2857	64.11	.0669
Con. Group II	7	39.4285	45.20	

"t" .05 (df = 12) = 2.179

Uncorrelated Groups.

II. INTERPRETATION OF DATA

After studying the results of the tests of significance on the pre-test, post-test, and fourth trial scores, it must be concluded that there was no statistically significant difference between or within the experimental group and the control group. Since the method of closing the dominant eye was strongly advocated by Falkenstine (22:27) and Edwards and Heath (18:61), several variables are presented which may have had bearing on the general lack of significance encountered.

It was accepted that there was no significant difference between the pre-test and post-test scores within the experimental group. This may be due to several factors. It is possible that the time devoted to the study was not of sufficient length. Students shot only once a week for six weeks with no additional practice in between sessions. Both length of time and number of ends may have been insufficient to enable subjects to adjust to the use of the eye patch. It should be mentioned here too that several subjects felt some form of eye strain and a definite lack of depth perception. These factors may have influenced shooting ability either physically or psychologically or both.

The third hypothesis was also accepted. This stated that no significant difference existed between the pre-test and post-test scores within the control group. It is interesting to note that although there was no statistical significance, the scores of the control group were slightly better than those of the

experimental group. The fact that the control group made no aiming adjustment whatever, and continually practiced a familiar style may have been an influential factor.

The hypothesis that no significant difference existed between the groups at the fourth trial was also accepted. The purpose of the analysis at this point was to see if the use of the eye patch resulted in any improvement or decline within the experimental group. The fourth trial was chosen since the number of ends was consistent with the pre-test and post-test and was, therefore, more conducive to statistical analysis. Although it was thought that the eye patch might have significantly helped or hindered at this point, there is very little difference in actual scores between groups.

The fifth hypothesis, which stated that there was no significant difference between the groups on the post-test scores, was also accepted. Once again, the time factor should be considered. Perhaps after several more weeks of shooting there may have been a significant difference in the scores of the groups. Secondly, due to indoor facilities, targets were only twenty yards away. This possibly caused a lack of discrimination, and many arrows that would have missed due to the magnification of the deviation at a longer distance, hit safely in the target at twenty yards.

The possible effect of eye strain or discomfort on shooting scores should not be overlooked. It may be that adaptation to this technique requires a definite length of time. The writer still questions the ability of the non-dominant eye to completely and effectively take over the work of the dominant eye where

sighting and focusing are important to success.

Within the limitations of this study, it was found that placing an eye patch over the dominant eye of cross-dominant subjects as an aid to aiming, did not result in a statistically significant increase in scores.

CHAPTER VI

SUMMARY AND CONCLUSIONS

I. SUMMARY

This study was conducted to determine the effectiveness of a selected aiming method in archery for use with cross-dominant subjects.

The subjects consisted of nine sophomore and five graduate women students attending The University of North Carolina at Greensboro during the academic year 1965-66. On the basis of a selected test of handedness and the hole-in-card test of eye dominance, these subjects were classified as cross-dominant. Each subject had had at least one semester of archery instruction and was familiar with the basic techniques of shooting.

Scores from the pre-test were ranked and paired and the subjects were divided into two groups. A coin was tossed to determine which group was experimental and which was control. The experimental group used the selected aiming method of closing the dominant eye, suggested by Falkenstine (22:27) and Edwards and Heath (18:61). An eye patch was placed over the eye to insure the maintenance of proper controls. Those in the control group used whatever visual aiming technique they wished. The Seven Steps of Shooting taught at Teela-Wooket National Archery Camp were utilized as the basis for instruction on archery form for both groups. Both groups shot thirty-two ends,

or 192 arrows, over a six-week period, shooting once a week with no practice in between.

II. FINDINGS

Fisher's "t" test of significance of difference between means for small correlated groups was used to determine if any significant difference existed between pre-test and post-test scores within groups. Fisher's "t" test of significance of difference between means for small uncorrelated groups was used to determine if any significant difference existed between the experimental and control groups on the pre-test scores, the fourth trial scores and the post-test scores.

The following results were obtained:

1. No statistically significant difference existed between the experimental group and the control group on the pre-test, fourth trial, or post-test scores.

2. There was no statistically significant difference found between the pre-test and post-test scores within either the experimental group or the control group.

III. CONCLUSIONS

Within the limits of this study the following conclusions were drawn:

1. Placing an eye patch over the dominant eye of cross-dominant subjects as an aid to aiming, did not result in a statistically significant change in scores.

2. The eye patch did not appear to be detrimental to the subjects' scores.

IV. SUGGESTIONS FOR FURTHER STUDY

1. Increase the number of subjects, number of ends shot, and shooting distance. (thirty yards is suggested)

2. Compare the following methods of aiming: both eyes open; the dominant eye covered with an eye patch; switch hands to coincide with the dominant eye.

3. Check the possible effects of eye strain or discomfort caused by placing the patch over the dominant eye.

4. Compare the shooting scores of cross-dominant individuals with those of unilaterals to observe the extent of deviation.

5. In general, more study should be done in the area of eye dominance as it affects performance in archery.

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APPENDIX

ARCHERY SCORE CARD

NAME							
DATE							
BOW #			ARROW LENGTH				
YARDS						H	S
TOTAL SCORE							

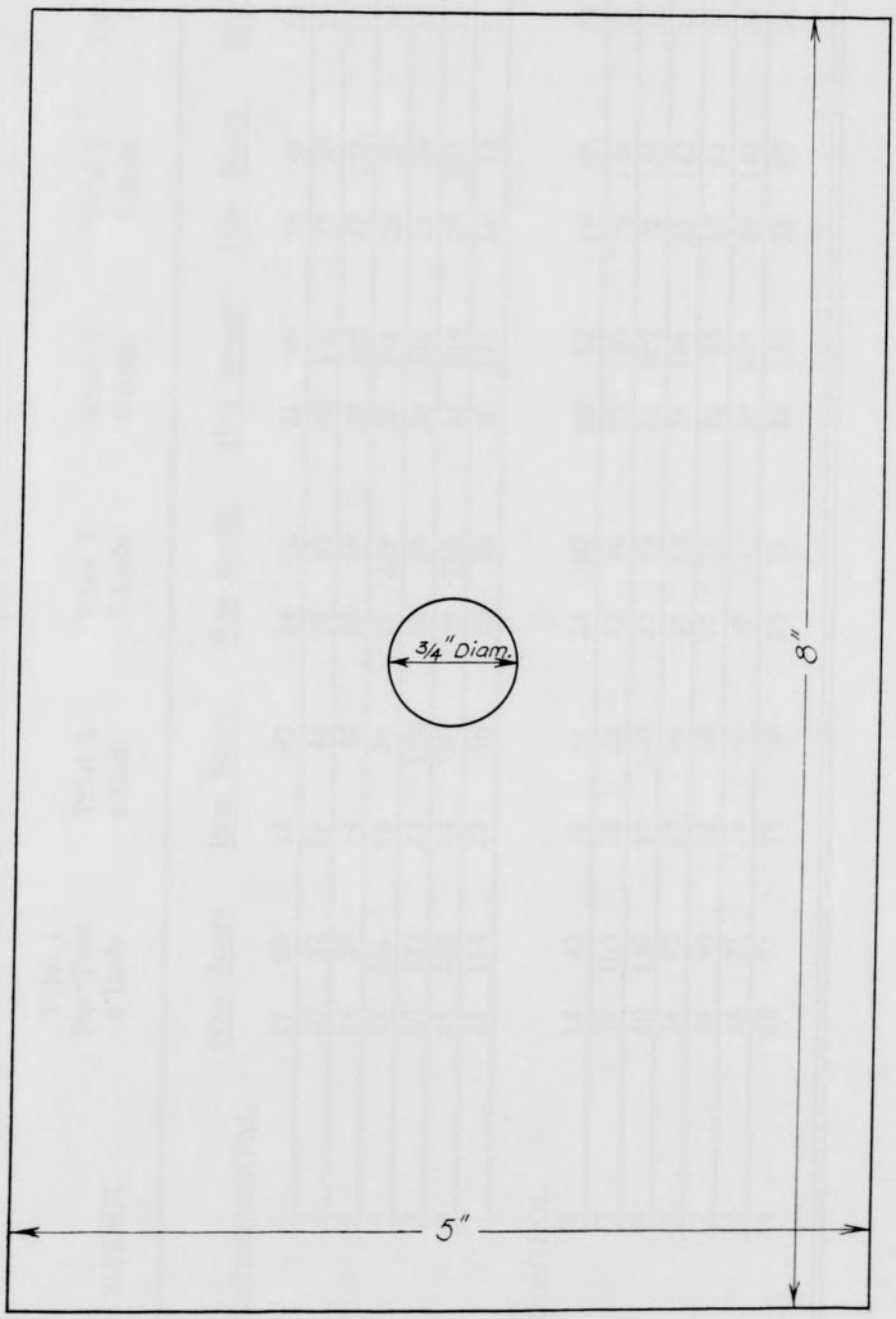
DATA CARD FOR EYEDNESS AND HANDEDNESS TESTS

NAME _____ CASE # 1

EYE PREFERENCE	TRIAL	R	L
	1		X
	2		X
	3		X
	4		X
	5		X
	6		X
	7		X
	8		X
	9		X
	10		X
	TOTAL		10

HANDEDNESS	R	L
1. THROW BALL	X	
2. COMB HAIR	X	
3. HOLD HAMMER	X	
4. HOLD TOOTHBRUSH	X	
TOTAL	4	

EYE DOMINANCE TEST CARD



RAW DATA

SUBJECT	Trial 1 Pre-Test 6 Ends		Trial 2 4 Ends		Trial 2 5 Ends		Trial 4 6 Ends		Trial 5 5 Ends		Trial 6 Post-Test 6 Ends	
	Hits	Score	Hits	Score	Hits	Score	Hits	Score	Hits	Score	Hits	Score
EXPERIMENTAL												
1	17	69	12	62	24	92	21	89	25	99	32	172
2	20	82	19	95	25	93	30	142	25	93	35	195
3	14	50	14	54	16	68	33	155	27	125	30	150
4	35	201	19	99	29	129	35	198	28	139	32	152
5	30	139	22	118	18	64	30	148	21	89	34	152
6	35	249	24	190	29	205	34	214	29	193	33	205
7	28	114	23	96	18	72	26	111	19	78	31	139
CONTROL												
8	14	42	11	51	24	100	20	82	19	85	24	86
9	33	166	10	32	12	34	35	186	28	136	32	146
10	30	140	20	100	23	83	32	202	26	132	32	170
11	24	92	17	89	25	85	33	196	25	147	34	154
12	24	96	12	38	17	71	22	65	17	51	20	70
13	19	71	19	86	26	131	36	216	29	148	34	158
14	23	71	18	98	23	91	33	139	28	97	34	170

Typed by

Marie E. Teague