GRIOT, MARY ANN. The Construction of a Badminton High Clear Test Utilizing a Fan Shaped Target. (1968) Directed by: Dr. Gail Hennis. pp. 89

The purpose of this study was to devise a badminton high clear skill test utilizing a fan shaped target and to determine the objectivity, reliability and validity of this test. After preliminary research on the badminton high clear stroke, skill testing and target patterns used in testing, a fan shaped target was constructed.

Five lines depicting a fan shape were extended from a center point on the net line to a line two feet beyond the back line of the badminton court. Four horizontal lines were drawn at two foot intervals in the back court area. This fan shaped target provided for measurement of placement as well as height and distance of the high clear stroke.

The fan shaped high clear test was administered to forty-five college students enrolled in beginning badminton classes. Each subject was given twenty trials of the Griot fan shaped high clear test and three trials of the Miller wall volley test.

Data for the Griot fan shaped high clear test were recorded by three scorers. Six different scoring methods were devised and the raw data were converted into numerical values in relation to each scoring method.

The reliability coefficients were determined for each scoring method by correlating the ten odd trials with the ten even trials by using the Pearson Product Moment method of

correlation. The Spearman-Brown Prophecy formula was then applied to determine the reliability for twenty trials.

The validity of each scoring method was established by using the Pearson Product Moment method of correlation. The Miller wall volley test served as criterion for one method of validation and the French high clear test served as criterion for the second method of validation.

The Griot fan shaped high clear test with twelve scoring areas and a net rope proved to be a reliable measure of the badminton high clear. The reliability coefficient established for this test was .78 for ten trials stepped up to .88 for twenty trials.

The Griot fan shaped high clear test is also a valid measure of the high clear stroke in badminton. When the French high clear test served as criterion for validation, a coefficient of .76 was obtained. When the Miller wall volley test was correlated with the Griot fan shaped high clear test, the validity coefficient was .45.

A test of significance of difference was calculated between the correlations on the Miller : Griot fan shaped high clear test, and the Miller : French high clear test to determine whether the relationships were truly different. There was a significant difference between the Miller : Griot fan shaped high clear test, and the Miller : French high clear test at the .05 level of confidence.

THE CONSTRUCTION OF A BADMINTON HIGH CLEAR TEST UTILIZING A FAN SHAPED TARGET

by

Mary Ann Griot

A Thesis Submitted to
the Faculty of the Graduate School at
The University of North Carolina at Greensboro
in Partial Fulfillment
of the Requirements for the Degree
Master of Science in Physical Education

Greensboro
July, 1968

Approved by

Gail M. Hennis

APPROVAL SHEET

This thesis has been approved by the following committee of the Faculty of the Graduate School at the University of North Carolina, Greensboro, North Carolina.

Thesis Director

Oral Examination Committee Members

July 18, 1968
Date of Examination

ACKNOWLEDGMENTS

The writer wishes to express sincere appreciation to Dr. Gail Hennis for her guidance, patience and valuable suggestions throughout the course of this study.

The writer also expresses gratitude to Beth Alphin, Jeri Burgdorf, Carolyn Callaway, Carolyn Hodges, Betty Jaynes, Beth Kerr and Fran Mariello for their invaluable assistance during the testing sessions.

Appreciation is extended to Miss Anita Childrey, Dr. Pauline Loeffler and Dr. Frank Pleasants, who willingly allowed the use of their classes for the testing sessions.

TABLE OF CONTENTS

CHAPTER PAGE

CHAPTER PAGE

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION AND STATEMENT OF PROBLEM

Badminton is among the popular sports activities in the United States. Skill and interest levels range from the friendly backyard type game which serves as a means of social and recreational activity for young and old alike to the highly competitive tournament game. The game can be played and enjoyed at all skill levels and serves as an enjoyable co-educational activity.

Badminton is commonly included in the physical education curricula of high schools and colleges. When offered in school programs, some means of evaluating the aims and objectives of desired outcomes is needed. One method of evaluating the results of an instructional unit in badminton is through skill testing. Scientifically constructed skill tests have been devised to measure ability in specific skills and, in some sports, over-all playing ability. However, many skill tests are not refined enough nor are they perfected to the extent that the teacher can depend totally upon these tests to accurately evaluate the true ability of a student. Clark (6) states that the progressive physical educator should view testing from both a liberal and critical standpoint. The liberal attitude will allow him to use the best available tests at the time, "in hope that through their greater

use better tests will eventually result." (6:22) A criticial viewpoint will sharpen his awareness that there is a need for more scientifically constructed skill tests.

> The scientific construction of tests in the field of physical education is still so relatively recent that a willingness to use existing tests and to analyze them critically is essential to the growth of this movement and of the profession itself. (6:22)

Tests have been developed to measure the most important aspects of a game. In badminton, a majority of the skill tests have been designed to measure a player's ability in executing such strokes as the serve, high clear, drive, smash, and long serve. The essential qualities or characteristics of each stroke are usually emphasized in the skill test. In both the long and short serve tests, placement and height of the shuttlecock are the important features of the test. High clear tests tend to emphasize the distance and height of the shuttlecock. The main feature of the smash tests are height of the shuttlecock and placement of the smash. Most of the tests which have been constructed consider the placement of the shuttlecock in a general area of the court. However, specific placement has not been given much emphasis. Most skill tests in badminton have failed to discriminate among the forehand, backhand and middle court areas for directional placement of a stroke.

This directional placement to the forehand, backhand or middle section of the court is an essential factor in a high clear stroke, one of the most important strokes in the game of

badminton. (29) A shuttlecock traveling down the center of the court is much easier to return than a shuttlecock traveling to the backhand or forehand side of the court. This fact proves to be true in a high clear stroke. Since the clear is high and deep, the player is allowed more time to position himself for a return stroke. By forcing the opponent to move to either the forehand or backhand side of the court to return a shot, he has less time to position himself for a return stroke and less time to recover from that return shot. Returns from the extreme corners of the court are usually weak hits. Therefore, it seems logical to provide for directional placement along with the factors of height and distance in a test of the high clear stroke.

Fan-shaped targets have been used in some sports as a means of measuring directional deviation. Tests, using such targets, have been constructed in archery, golf and volleyball. Some of these fan-shaped target tests have been purely experimental and others are scientifically established tests. If a fan-shaped target were applied to a badminton court, the court could be divided into four directional sections. On the forehand side of the court there would be a section near the sidelines and corners of the court and a section near the middle of the court. The backhand side of the court would also be divided into a section near the sidelines and corners of the court and a section near the middle of the court. Values could be placed on these directional sections or areas of placement according to

the value this particular location has in a game situation. One might assume then that all of the factors required in a high clear stroke could be accounted for. Value could be given to placement as well as height and distance. It was to test this assumption that this study was undertaken.

STATEMENT OF THE PROBLEM

The purpose of this study was to devise a badminton skill test to measure the factors of placement, height and distance of the high clear stroke. A fan-shaped target was utilized to provide for these factors. The reliability and validity of this skill test was then to be determined.

CHAPTER II

REVIEW OF LITERATURE

Skill testing is a means of evaluating the achievement and progress of a student's performance in the physical education class. The physical educator needs an objective method of accessing the various skill levels of the participants. The well-established skill test allows the teacher to measure the current status of the student's ability and to make accurate discriminations among various skill levels.

> The development of tests to evaluate sports skills began as the content of physical education programs showed an emphasis on games and sports. As the so-called 'natural program' evolved, evaluative procedures in harmony with the content of that program became a must. (3:67)

Up to about 1916, subjective judgments were the only type of evaluations made on sport skills and activities. With the appearance of the sports oriented curriculum, scientific and objective evaluative methods began to emerge.

The early tests in sport skills might be considered crude by today's standards. Attempts were made to test specific game skills in a game-like situation. Many times, the test turned out to be little more than a modification or a simplified version of the game. More often than not the tests failed to discriminate among the various levels of skill. But, this was a start! Since

this early "pioneer" work in testing, notable progress has been made. Efforts have been made to establish objectivity, reliability and validity in tests measuring sport skills. However, . . . "there is still much work to be done. Tests available at the present time are not yet of a quality to enable a physical educator to make strict judgments on the basis of scores obtained." (3:67) Hopefully through scientific research in measurement, skill tests will continue to improve and become truer measures of skill.

Badminton Skill Tests

Badminton skill testing has followed the same pattern of growth from simply constructed tests to those of a more scientifically constructed nature. The earliest of the badminton skill tests dates back to 1938 when Campbell (39) devised skill tests for college women to measure form and placement of shots involving the serve, the forehand return, and the backhand return.

The serve test did not designate the type of serve to be used. It is assumed that any legal serve in badminton was acceptable. The subject stood in the right hand service court and served the shuttlecock to the opposite right hand service court. Ten trials were administered. For scoring purposes, any shuttlecock landing in the legal half court service area or on lines bounding that court received two points. Serves landing outside the legal half court service area did not score.

Campbell's forehand return test consisted of hitting ten shuttlecocks with a forehand return stroke to the court diagonally opposite and across the net from the subject. The test administrator stood on the opposite side of the net from the subject, near the net, and threw the shuttlecock over the net in such a way as to set it up for the stroke. Two points were scored if the shuttlecock landed in the correct court or on a line bounding that court. If the shuttlecock landed in the adjoining court, one point was scored and no points (zero points) were given for an out of bounds hit or a net shot. The same procedure was followed for the backhand return test.

Reliability coefficients reported by Campbell for one hundred college women were: serve test .06, forehand return test .38 and backhand return test .38. (39) Criteria for the validation of these tests were judgment ratings by two judges and scores on the Brace Motor Ability test. The validity coefficients ranged from .43 to .93. None of these tests can be considered reliable measures. The low validity is probably due to the large target area. It is doubtful if such a large area would discriminate among various levels of skill.

Scott (45) devised a skill test based on accuracy and placement of shots. He reported that his volleying test required agility, speed and stamina and that all of the essential strokes used in a game must be executed in order to score highly on the test. (45) Scott administered the test to college men on a hand ball court. A line of net height was marked on the back wall of

the hand ball court. A vertical line on this wall divided the area. A six-foot line on the floor served as a restraining line during the test. The subject volleyed the shuttlecock against the wall alternating from right to left of the vertical line for thirty seconds. Three trials were administered and reliability coefficients of .87, .51 and .68 were obtained for each trial respectively in a test - retest situation. The average of three trials in a test - retest situation yielded a reliability coefficient of .84. A ladder tournament served as criterion for validation of the volley test to obtain a coefficient of .94. (45)

In this same study Scott evaluated a rotation test. This test attempted to determine to what extent the recording of faults and errors made by players was an indication of their playing ability. (45) Scott indicated that the rotation test was a measure of playing ability and was comparable to game conditions in that the players actually participated in a game while three judges recorded faults and errors made by the players. The judges also rated the players during their game. The scores of the three judges from the first testing period were correlated with the scores of the same judges from a second testing period. This type of test - retest method, using the combined ratings of the three judges for each subject, yielded a correlation coefficient of .92. Criteria for validation of the test were a ladder tournament and the judges rankings. The validity of the test was .93 when correlated with the ladder tournament results. (45)

A high clear test and a short service test were constructed by French (33) in 1941. These tests were designed to meet the requirements of a well-constructed test. The skills were selected "on the basis that the tests would measure those abilities considered important to success in playing the game of badminton." (23:258) The tests were developed to "serve as an incentive toward improvement of testing and as a suggestion of procedures to follow in evaluating new examinations." (33:242)

For the short serve test a rope was stretched twenty inches directly above the net and attached to the net standards. A series of arcs in the right service court was marked on the floor from the short service line to the center line. Each arc was given a numerical value according to its position in relation to the strategic placement of the short serve. The player being tested was allowed to stand any place in the service area diagonally opposite the target. She was instructed to serve the shuttlecock through the space between the rope and the net and onto the target area on the floor. Twenty trials were given.

According to the statistical data recorded for the serve test given to college women, the reliability by the odd-even method of correlation for beginners was .63, which was stepped up to .77 with the Spearman Brown Prophecy formula for twenty trials. Reliability for the advanced group was .77 for ten trials stepped up to .87 for twenty trials. Validity for the beginners and advanced players was .43 and .70 respectively. Criterion for the validity was a subjective rating by the instructor of the classes. (33)

For the high clear test, the subject was required to stand between two squares marked on the court opposite the target. These squares were marked eleven feet from the net and three feet from the right and left side line. The person administering the test stood on the side of the court where the target was marked and "set-up" the shuttlecock with an underhand clear. The set-up had to be directed to the subject between the marks on the floor in the opposite court. The set-up had to be high enough for the subject to execute an overhead high clear. After the shuttlecock was set up, the subject being tested was allowed to move to any position on the court. The subject was then required to send the shuttlecock with a high clear stroke over the net, above an eight foot rope, placed fourteen feet from the net and parallel to it, and onto the target. The subject was given twenty trials. The subject was instructed not to play any set-up or trial that was not sent high enough to execute a good clear stroke or that was not placed between the two squares on the floor. Any set-up that was rejected did not count as a trial unless the bird was hit.

The target for the clear test was constructed in the back court area. A line was marked two feet nearer the net than the rear service line in the doubles game and parallel to that line. Another line was constructed two feet farther from the net than the rear service line in the singles game and parallel to it. Each scoring area provided by these lines was assigned a numerical value.

Any trial that failed to go over the eight foot rope or failed to land on the target received no score. Any shuttlecock that landed on a line received the value of the higher scoring area. The score for the French high clear test was the total of twenty trials. Any hit that was "carried" or "slung" was considered a foul and that trial was repeated.

The reliability for twenty trials on the clear test was correlated by the odd-even method at .82 for beginning players, stepped up to .90 by the Spearman-Brown formula, and .95 for the advanced players, stepped up to .98. French reported that "ten trials were sufficient on each test, with exception of the service test for beginners." (35:245) It was also stated that

> the combined clear and service tests measure playing ability for the advanced player more satisfactorily than the beginner, though they should be useful for both groups. (33:245)

Williams' study in 1945 consisted of testing badminton skills in the forehand and backhand clear, low serve, high serve, back court drop shot, hair pin drop shot, and the cross court drop shot. These particular skills were selected because they are, according to Williams, "the skills most used by beginners." (47:31) The target areas for the tests were very similar to those designed by French. (33)

> The target areas were designated by squares and quadrilateral figures because of ease in marking the court. They measure approximately the same area that could be measured by circular or arc shaped targets. The points selected for the highest scoring areas were those from which the opponent has the most difficulty in returning shots. (47:42)

In the clear test the subject stood approximately centered on the court on the opposite side of the net from the target. The test administrator tossed the shuttlecock over the net to the subject in such a manner that the shuttlecock fell waist high and to the right of a right handed player. The return flight of the shuttlecock had to be higher than a rope which was stretched across the court at a height of ten feet and at a distance of thirteen feet in front of the back boundary line. If the shuttlecock landed in the corners of the court on the target area, the highest score was given since the corners are the most difficult areas from which to return a clear.

The object of all the tests was to hit or return the shuttlecock to the proper target area for that particular test. Ten trials were administered for each of the tests. The tests were administered to college women and reliability was correlated by the odd-even method. Reliability coefficients after the Spearman-Brown formula was applied to adjust for ten trials were: forehand clear .83, backhand clear .86, low serve .60, high serve .54, back court drop shot -.63, hair pin drop shot .56, and cross court drop shot .86. Criteria for validation of the tests were the results of a ladder tournament and the ratings of three judges. The validity coefficients were quite low, ranging from .17 to .54. One explanation for the low validity coefficients might be that the judges rated the players after observing only one minute of doubles play. It is doubtful that an accurate

estimate of playing ability can be obtained in a one minute observation.

Testing in the low serve, high serve, forehand and backhand lob, forehand drop shot and smash was completed in 1945 by Boldrick. (38) These skills were selected because they were "the fundamental skills in badminton." (38:27) Floor targets were used for all of the tests. The targets divided the placement area on the court for each particular shot into sections with numerical values - the highest scoring area being the most difficult location from which to return a shot. The subject or player would use this most strategic area for placement according to the type of shot to be executed. For the low serve the highest value was given along the short service line in the corner of the service area next to the center line. The area along the back boundary line received the greatest scoring value on the high serve. The area nearest the net received the most points on the forehand drop shot. The most desirable placement for the smash is along either side line in the midcourt area. These sections scored highest on the smash test. According to Boldrick, the most strategic area of the court for placement of the forehand and backhand lob is along the back boundary line from side line to side line. This area scored five points on the test. Another area in the back court from side line to side line was given a value of three points. The short service court received a value of one point. A rope eight feet high

was extended across the court at midcourt. In order for the clear or lob to receive point value, the shuttlecock had to clear the rope. A machine that would eject shuttlecocks was used to set up the shots for the subject. The subject was instructed to stand near the center of the back court area. The best ten scores out of twelve trials were recorded for all of the tests.

Boldrick tested seventy college women. The reliability of each test was computed by the odd-even method. The reliability coefficients reported were: low serve .71, high serve .60, forehand lob .92, backhand lob .90, forehand drop shot .24 and smash .59. Validation of each test was based on subjective judgments of each subject's playing ability, scores made playing against a standard player and a composite ranking obtained from averaging the previous mentioned criteria. The only tests that Boldrick found valid, according to her standards, were the high serve, .69, the forehand lob, .76, and the backhand lob, .81.

In 1946, Davis (40) with slight revisions repeated Boldrick's study by administering the low serve, high serve, smash and the forehand and backhand lob tests and validating them. Davis used the same target areas that Boldrick had used. She also used a machine to eject shuttlecocks. Again the best ten out of twelve trials were reported for all of the tests administered. Davis tested thirty-seven college women and obtained reliability coefficients of .82 on the high serve, .87 on the

forehand lob and .80 on the backhand lob. The odd-even method of correlation was used. Davis had Boldrick rank the subjects, since she used these same tests in her study, and also had three judges rank the subjects. Using these rankings as the criterion for validation, Davis computed validity coefficients of .35 for the low serve, .44 for the smash, .18 for the high clear, .72 for the forehand lob and .61 for the backhand lob.

Lockhart and McPherson (26) constructed a test in 1948 to measure badminton playing ability. "This test requires no special equipment, involves only one player, the testing time is brief, and many subjects may be tested simultaneously." (26:402)

An unobstructed wall space at least ten feet in height and ten feet in length is needed for the test. A net line is marked on the wall five feet above and parallel to the floor. The subject must start the test from behind a line six feet six inches from the base of the wall. During the test the subject must observe a restraining line three feet from the wall. The subject puts the shuttlecock in play by serving it against the wall on or above the net line. The shuttlecock is played as many times as possible against the wall in thirty seconds. Three trials are administered. The score is the sum of the number of legal hits made on or above the net line in the three trials.

Data for statistical analysis were obtained from five hundred twenty-nine college women. The reliability coefficient was .90 when test - retest scores were correlated. Three experienced judges rated the players. The validity coefficient obtained

was .71. Lockhart and McPherson concluded that "the test is simple to administer, objective, involves little time and is useful as a practice device." (26:405)

In 1949, French and Stalter (23) conducted a follow up on the original badminton study of the clear and serve test devised by French in 1941. In this study, tests were constructed for foot work, wrist action and the ability to smash. A battery of skill tests in badminton was also established. The clear test and the serve test served as a nucleus for the battery. Reliability and validity coefficients, based upon scores of fifty-nine college women, were determined for each test. Judges' ratings served as the criterion for test validation. The tests were intercorrelated and multiple correlation coefficients were analyzed. French and Stalter reported that a four-item battery consisting of a shuttle test, wrist volley test, short serve and high clear test combine to give the best measure of a player's ability to play badminton. The validity of the battery was .698. (23)

In 1949, Miller (29) constructed a badminton wall volley test. This test was developed to determine the playing ability of badminton players. In order to determine which badminton strokes contributed most to total playing ability, Miller observed and recorded the number of times services, drop shots, clears, smashes, drives and half court drives were used during games at the North Annual United States Amateur Badminton Championship

Tournament held in Chicago in 1949. From an accumulative record of the number of times each stroke was used, Miller discovered that clears were used consistently more than any other stroke in men's and women's singles as well as doubles games. Other most frequently used shots were drop shots, smashes and half court drives respectively. Miller also established that long serves were predominantly used during singles games and short serves were most frequently used during doubles games.

Through the use of cinematography, Miller filmed the various types of clears used during the badminton games. Analysis of these films enabled Miller to determine the required minimum height of the shuttlecock during the clear. Through information gathered from the films, she determined floor and wall markings for the wall volley test. The floor and wall markings position the subject taking the test so that he must execute a clear in order to perform the test.

A one-inch line was constructed on the wall seven feet, six inches from and parallel to the floor. The width of the wall space was at least ten feet and the preferable height was a minimum of fifteen feet. A straight line was marked on the floor ten feet from and parallel to the wall. The line extended the length of the wall distance.

The subject was instructed to serve the shuttlecock in a legal manner against the wall from behind the restraining line on the floor. If the serve hit on or above the wall line, that hit

counted as one point. The subject repeatedly volleyed the shuttlecock against the wall, on or above the wall line. The shuttlecock remained in play until the subject missed and it fell to the floor. When this occurred, the subject was allowed to pick up the shuttlecock and put it in play again with a legal serve. A hit was not counted if the subject stepped over the floor restraining line. The subject's score was the number of accumulative hits made within a thirty-second trial. Three, thirty-second trials were given.

A reliability coefficient of .94 was obtained from a test - retest situation involving one hundred college women of all skill levels in badminton. A round robin tournament was played by twenty subjects in order to establish the validity of the test. Validity was checked in relation to total playing ability and a coefficient of .83 was revealed. Since the test was structured in such a way that the subject could only clear the shuttlecock during the test, Miller declared that the test possessed face validity with respect to the clear.

Test-like situations can also be used in badminton for practice purposes, as suggested in most of the tests thus far reviewed. Ball (15) suggested practicing the high clear by hitting the shuttlecocks over an eight-foot rope placed fourteen feet from the net in the opposite court. The rope was stretched across the width of the court and was parallel to the net. It was recommended that players set up the shuttlecock for each other and hit

over the rope and into target areas with numerical values. The players could keep track of the number of points they receive from hitting ten shuttlecocks over the rope and into the various scoring sections. This practice device is very similar to the French (33) clear test. Test-like practice devices have been developed for most of the basic strokes used during a badminton game.

In 1967, Sebolt (34) developed a test to measure the ability to legally serve into the regulation service court area on a badminton court. The target for the serve test was located in the left fore-court corner of the service court. The most strategic area for placement of the serve is near the service line and along the center line. This area received the greatest point value. Point value decreased as the scoring areas progressed toward the center of the service court. A rope was stretched sixteen inches above the net. To score the shuttlecock had to go between the rope and the net and onto the target.

The subject was instructed to legally serve the shuttlecock from the right service court into the target area in the right service court on the opposite side of the net. The subject was given a five-minute practice period prior to the test. Twenty trials were administered for the test. No score was awarded for a trial that failed to go between the rope and the net. If the shuttlecock hit the rope, the trial was repeated. Any shuttlecock landing on a line received the higher score value. The score for the test was the total of twenty trials.

Sebolt selected thirty-three college men by a cluster sampling technique. A reliability coefficient of .84 was obtained through an analysis of variance. Sebolt stated that the test possessed face validity when measuring the performance of the short serve. A validity coefficient of .61 was established when the short serve test was correlated with the results of a ladder tournament. Sebolt concluded that the serve test was a reliable and valid measure of the short serve but not a valid measure of playing ability.

Wolf (36) described several badminton drills which are directly related to actual game situations. As a high clear drill Wolf emphasized hitting to the opposing team's backhand corner. He suggested that players should strive to place as many shots as possible in the corners and try to play shots down the outside alleys.

Targets Used in Skill Testing

Targets have been used in many types of skill tests. They are of various shapes and sizes, depending upon the type of test for which they are used. Lines, circles, squares, arcs, rectangles, and grids are among the familiar target shapes. The use of targets in testing can add to the objectivity, reliability and validity of the test. Target type tests create a common goal for all subjects.

In a majority of the tests reviewed, the scoring values were assigned according to the most strategic point of aim in the game. Malinak (43) tested the tennis serve by diving the

service court into sections. Each section was given a numerical value. Since the forehand and backhand corners are considered to be the most strategic areas for placement of the serve, these corners were given the highest score. The serve to the backhand corner is the most difficult serve to return, therefore, the backhand corners received a higher score than the forehand corners.

Edgren and Robinson (8) described several badminton ability tests which used floor and wall type targets for tests in the long serve, short serve, direct hit or drive serve, overhead forehand lob, backhand overhead lob, underhand forehand lob, backhand underhand lob, and the smash. The targets varied in size depending upon the type of stroke being tested. The floor targets were a set of three rectangles, one inside the other, located at the area of the court where each particular shot should be received. The wall type target consisted of three concentric circles and was used for the direct hit or drive serve.

Edgren and Robinson did not report statistical evidence in support of these tests which were originally set up to

> aid the teacher in determining the ability of all class members and serve as a measure of progress if players are retested again after a period of instruction and play. (8:85)

Without statistical evidence to support this statement, little confidence can be placed in these tests.

French and Cooper (22) studied the volleyball serve and concluded that the best area for placement of the serve was in an area deep in the court along the back boundary line and along

the back side lines. They assigned the back end line area five points, the back side lines four points, the forecourt side lines two points, the middle portion of the backcourt three points and the middle portion of the forecourt one point.

Clevett (18) constructed targets for testing accuracy in golf skills. An analysis of each skill served as the basis for establishing the target scoring pattern. Clevett maintained that a slice is one of the most common errors for a right-handed golfer. This theory served as a basis for the scoring pattern for the target for the brassie and five iron tests. Areas on the left side of the target scored higher than those on the right. (6) The areas near the center of the target, representing the cup area, scored the highest and dropped in numerical value as they deviated from the center of the target.

Clevett's putting test target was constructed on a long smooth carpet which was divided into scoring areas with various numerical values. The highest scoring area was the cup. Area around the cup was assigned a scoring value on the assumption that

> balls that roll slightly short of the hole are considered to be lower in point value than balls that travel slightly beyond the hole, as on an irregular green such a ball often rolls into the hole. (6:316-317)

Greiner (42) experimented with a grid or a fan-shaped target in constructing a badminton short serve test. Before constructing the target, Greiner analyzed the serve as well as the weaknesses and strengths of targets used in badminton serve

tests by Dewitt, French, (33) and Edgren and Robinson. (8) She considered that height and distance are primary factors of good performance and that a serve should be low in height when passing over the net as well as short in distance. A good serve should land in the extreme corner of the service court near the center line. The grid or fan-shaped target was placed in this area with the higher scoring values being in the previously mentioned ideal location for placement of the short serve. Four ropes were stretched above the net at four-inch intervals. The best score was achieved when the shuttlecock passed under the lowest rope. The reliability coefficient for Greiner's test was .65. The low reliability coefficient may have been due to the fact that there were too many scoring divisions on the target and that the divisions were too small.

Bohn (37) also conducted a study involving a grid type target. The grid was applied to an archery target and was superimposed on the concentric circles. Three directional distances were identified in this target - horizontal, vertical and radiant. The target face was divided into a grid of horizontal and vertical lines with the median drawn through the center of the target. The lines were drawn parallel to and two inches from each median. The target recorded a face value score in addition to a code for deviations. The directional deviations were referred to as horizontal right, horizontal left, vertical above and vertical below. The purpose of the grid type target was to determine the effectiveness of other purposed methods of scoring. (37) Reliability for

a test - retest situation correlated to .72. Validity was established at .93 when compared to tournament rankings.

The main concern in constructing all of these targets was to arrange the scoring pattern so that greatest value was placed upon the strategic placement of the object being projected. When the scoring pattern is logically and strategically planned, it would appear that the test would have a better chance of discriminating among the skill levels of the players. Highly skilled players should be more accurate in placement of the object being projected than the poorly skilled player and this accuracy should be reflected in a game situation.

Summary

Skill tests have been developed to measure the distance and height of the high clear stroke in badminton. (18, 23, 29, 33, 38, 40, 47) In a game situation a high clear must be high and deep into the back of the court. However, a high clear of this nature is not as difficult to return as a high clear that is strategically placed in either the backhand corner or forehand corner of the court. A high clear that is directed to the back corners of the court pulls the opponent out of position from the center of the court. It is difficult to move to the corner, execute the shot and recover to a well-balanced ready position in the center of the court. This is a much more difficult task than returning a high clear that has been hit down the center of the court. The player who can strategically place a high

clear in the back corners of the court is more likely to win the rally. Since placement of the high clear is an influential factor in the game of badminton, some attempt should be made to place value upon this factor, along with distance and height, in skill tests.

CHAPTER III

PROCEDURE

The purpose of this study was to develop a badminton skill test to measure the ability to perform the high clear stroke. In order to develop a test of this nature, it was essential to define a high clear stroke and to analyze the characteristic components of the high clear. These factors were considered to assure face validity of the test.

CHARACTERISTICS OF THE HIGH CLEAR STROKE

Definition of the High Clear

The high clear is a stroke used in badminton to send the shuttlecock high into the air and very deep into the back of the opponent's court. The flight of the shuttlecock should be well above the reach of the opponent's vertically out-stretched racket arm. After this high flight across the court, the shuttlecock should reach a point almost above the back boundary line and fall straight down. According to Varner, "A shuttlecock falling perpendicular to the floor is most difficult to play." (14:14-15)

The high clear is both an offensive and defensive stroke. It is a defensive stroke when it is used to keep the opponent away from the net. (20) By keeping the opponent in the back court

area, the type of return stroke the opponent can use is somewhat limited. The clear is also a good defensive stroke for use by a player pulled out of position on the court. (20) A strong high clear to the opponent's baseline provides enough time to recover an adequate position.

The high clear is considered an offensive stroke when the opponent is playing at mid-court and the flight of the shuttlecock is high enough to be out of the opponent's reach but still remains within the boundaries of the back court area. The offensive high clear rushes the player making the return and forces a weak shot. (32) The high clear is also an offensive tactic when it is hit from corner to corner. This strategic placement of the shot forces the opponent to run from sideline to sideline and be pulled out of position for return shots.

Requirements for the Clear

Three basic factors are required for a good high clear. Power, distance and height must be considered when analyzing the components of the high clear.

The power of the stroke influences both the height and depth of the clear. Sufficient power is essential to send the shuttlecock to its required height and depth. As the racket contacts the shuttlecock there must be an explosive action to achieve the proper distance on the shot.

The distance the shuttlecock travels must be far enough to enable it to travel into the back court area and to land as near to the back boundary line as possible. Most good clears

will land on the back boundary line or in the area between the rear service lines for the singles and doubles games. A clear that does not travel far enough to reach the back court area is a perfect set-up for a smash return. Varner has stated that it is difficult for a beginner to clear from the back boundary line. The beginning badminton player usually lacks the power necessary for the back line high clear return. Varner contended that it takes an advanced player or a strong player to continually execute a high clear from one baseline to the other. (14)

As previously mentioned, the flight of the shuttlecock must reach a height that will enable it to go over an average size opponent's head when the arm and racket are extended upward. (29) Based on the results of a cinematographical study, Miller stated that the shuttlecock must cross the net two and one-half feet above a five foot net in order to obtain the minimum height required for an ideal driven high clear. (29) Miller's study only reported the minimum height necessary for the high clear since "a badminton clear can go an indefinite height and still be in the court." (29:210) A high clear below this minimum height is subject to a smash return shot.

Placement of the High Clear

In addition to the factors of power, height and distance another important aspect to be considered is placement of the high clear shot. Strategy in placement of the high clear stroke can influence the effectiveness of the shot. Martin has contended

that, "court strategy goes hand in hand with shot execution." (28:82) Without strategic placement of the high clear, the stroke looses its offensive qualities and becomes a strictly defensive stroke. (28) Poole suggested that badminton players of similar skill abilities and command of shots can play each other and "the victor will be the more capable strategist." (31:75) Poole predicted that a player of lesser skill can defeat a more talented opponent by using proper strategy and accurate placement.

The best basic strategy is to force the opponent out of his primary position of operation, the center of the court. This basic position of operation, or the center of the court, is usually the opponent's "base of defense." A player that applies sound strategy will use the corners of the court as his point of aim for placement of a high clear and will attempt to draw the opponent out from his base of defense. Martin agreed that a strong player or an advanced badminton player possesses a knowledge of court tactics capable of forcing the opponent out of position.

There was agreement in the literature reviewed that the most strategic placement for the high clear is to the opponent's backhand. Since hits directed to the corners of the court force the opponent out of position, the players first objective, when executing a high clear, should be to aim for the backhand corner of the opposite court. A good backhand return is normally a difficult shot to perform successfully. Martin indicated that,

"a good backhand return, meaning a backhand smash or sharp placement, is a rarity." (28:83) A majority of high clears to the backhand corner of the court are usually returned as set-ups for a smash or result in a weak return shot. The forehand corner is also a strategic area for placement of the high clear. The player is forced out of position from the center of the court to play a hit directed to the forehand corner of the court. Howard recommended hitting the shuttlecock to the forehand and backhand corners during a rally in such a way that the opponent has to run from side to side to return the clears. The average badminton player has a difficult time maintaining this type of pace. (25)

Placement is an important facet in the game of badminton. The placement of the shuttlecock depends upon good skill, quick thinking and sound strategy. According to most experienced badminton players, the most logical placement for the high clear is to the backhand and forehand corners respectively.

CONSTRUCTION OF THE HIGH CLEAR TEST

Design of the Target for the High Clear Test

When constructing the target for the high clear test, emphasis was given to placement of the high clear stroke. The review of literature, experience in and observation of tournament play, all supported the forehand and backhand corners of the court as the most strategic location for placement of the high clear stroke. Thus, a target was devised to provide a

scoring area for a high clear directed to the corners as well as down the center of the court. In this way, greater value can be given for the strategically placed shots. As previously noted, corner shots in a game situation are far more valuable than shots down the middle of the court.

In constructing the target, a vertical line was drawn through the length of the court on one side of the net. The line was located in the center of the court in such a way that the court was divided in half, providing a forehand side of the court and a backhand side of the court. This vertical center line was perpendicular to the net line. To provide a target area for forehand and backhand shots, lines were constructed on the right and left side of the court at designated angles. A line was marked on each half of the court from the center of the net line, at a sixty-one degree angle, through a point six inches beyond the side line at the rear service line in the doubles game and continued to a point two feet beyond an extension of the rear service line in the singles game. Another line was drawn on each half of the court from the center of the net line at a seventy-three degree angle to that line, and extended through the center of the rear service line in the doubles game and continued to a point two feet beyond the rear service line in the singles game. These lines gave the target a fan-shaped appearance.

Horizontal lines were also constructed on the target in the back court area so that the flight of the shuttlecock had to meet a distance requirement as well as a placement requirement.

These lines conformed to those used in the French (23) clear test. A line was marked two feet nearer the net than the rear service line in the doubles game and parallel to it. The line was extended beyond the sidelines to meet the outer fan-shaped lines. A second line was marked two feet farther from the net than the rear service line in the singles game and parallel to it. This line was also extended beyond the sidelines to meet the outer fan-shaped line. When measuring from these lines, the exact center of each line was used. This type of target with fan-shaped lines and straight horizontal lines provided for measurement of both distance and placement in the high clear stroke.

On the opposite side of the net, two small marks two inches square were drawn. One mark was placed eleven feet from the net and three feet from the center line toward the right sideline. The other mark was located eleven feet from the net and three feet from the center line toward the left sideline. When measuring from these lines the exact center of the line was used. These two inch square marks served as a starting point for the subject. The subject assumed his ready position in the area between and slightly behind these marks and then moved to any position to perform the high clear stroke. The subject could move immediately after the tester contacted the shuttlecock for the set-up. Most experienced badminton players will assume some type of ready position while positioning themselves or waiting for a return stroke from their opponent. This ready position is usually assumed near the center of the court. By establishing the ready position in

this area, the player is able to move quickly to any area of the court to execute the next stroke. The marks were to act as a guide line for the subjects and to keep them near the center of the court until the set-up was hit. Having the subjects start in this area forced all of them to begin from the same location. The starting point remained constant for all subjects throughout the test. The starting marks gave the tester setting up the shuttlecock a constant and specific area to place the set-up for each trial. Directing the set-up to the same place for each trial increased the testers accuracy in placement of the set-up.

Two ropes were included in the design of the badminton high clear test. A clothesline rope was attached to the net standards and stretched above the net. The rope was stretched two and one-half feet above a five foot net. Miller (29) established, through the cinematographical study, that the minimum height of a high clear as it crosses the net is two and one-half feet above the five foot net. Miller's analysis further revealed that a shuttlecock reaching this minimum height as it passed over the net would go over an averaged sized opponent's reach when the racket was fully extended into the air.

The second rope was stretched across the court fourteen feet from the net and parallel to it. This rope was attached to two badminton standards at a height of eight feet from the floor. According to French (33), a high clear must reach a minimum height of eight feet at a point fourteen feet from the net and land in the back court area. A shot below eight feet at

fan-shaped target lines and eighty-six feet of yellow tape were used on the horizontal lines.

White clothesline rope was used for the net and mid-court ropes. Each piece of rope was at least twenty-five feet to thirty feet in length. A bright white clothesline rope must be used so the scorers can readily see if the shuttlecock passes over or under the rope. It is also important for the subject to be able to see the results of the high clear stroke as it passes the ropes.

New indoor shuttlecocks were used for the high clear test. An eighty-five grain shuttlecock with sixteen white goose feathers fixed in a cork base one and one-eighth inches in diameter was used. The feathers were two and five-eights inches in length from the tip to the top of the cork base. These shuttlecocks were regulation indoor tournament shuttlecocks which meet the specifications stated in the Division of Girls and Women's Sports 1966 - 1968 Tennis and Badminton Guide. Twenty shuttlecocks were needed for each trial. If any feathers were broken, that shuttlecock was not used for the test.

The Miller wall volley test was selected as the criterion for validating the high clear test. This test was designed to measure the badminton high clear and overall playing ability. An unobstructed wall space was used at the same end of the gym where the high clear test was constructed. A ten foot strip of yellow Scotch Brand Plastic Tape, one and one-half inch width,

that point of the court could easily be smashed by the opponent. A diagram of the court markings may be found in Appendix A.

Pre-Test Preparation

One side of the court best suited for the testing situation was designated as the side from which the subject must perform. Factors such as sunlight and glare from windows would not affect the subject on this side of the court. The two-inch squares were marked on this side of the court in the proper area, thus providing the starting area for the subject. These squares were made with one and one-half inch width yellow Scotch Brand Plastic Tape.

The target for the high clear test was marked on the opposite side of the net. Lines were measured with a steel tape measure and marked on the floor with a tightly stretched chalk line. The chalk lines served as guide lines when applying the tape to the floor. The center of the width of the tape was applied to the chalk line. One and one-half inch width red Scotch Brand Plastic Tape was used for the fan-shaped lines and one and one-half inch width yellow Scotch Brand Plastic Tape was used for the straight horizontal lines in the back court area. It was essential to use bright colors for the target lines so the subject could easily see the target from the opposite side of the court. Red and yellow were chosen because they contrast well with each other and with the floor. Approximately one hundred twenty-eight feet of red tape were used on the

was extended across the wall seven feet, six inches from the floor and parallel to the floor. The width of the wall space far exceeded the ten feet minimum recommended for the test. A floor line was marked with a ten foot strip of red Scotch Brand Plastic Tape. This line was ten feet from the wall and parallel to it. The red and yellow plastic tape contrasted well with the surfaces they adhered to and could be easily seen by the subject. The same type of shuttlecocks used for the high clear test were used for the Miller wall volley test.

Individual score sheets were planned and dittoed. One score sheet could accommodate data from the high clear test and the Miller wall volley test. The score sheet provided a space for the necessary information concerning each subject, such as; name, class and the date of the administration of the tests. A drawing of the target and the target side of the court from the net back to the rear target line was reproduced on the score sheet. In this way, the scorer could mark on the score sheet where the shuttlecock landed for each trial in relation to the target area or court area. Immediately below the drawing of the court and target was a key to the scoring technique used for recording the data on the high clear test. A space was also provided for the scorer of the high clear test to sign her name. In the upper right hand corner of the score sheet, spaces were also provided for recording the scores of the Miller wall volley test. Data for trials one, two and three and the total of these trials were

to be recorded in this area. A line was marked on the score sheet for the wall volley scorer's name. All of the information needed for each subject was recorded on each individual's score sheet. (See Appendix B for a copy of the score sheet.)

Test Administrators

Personnel needed to administer the high clear test and wall volley test were contacted and assigned a specific responsibility for the duration of the testing period. One person experienced in playing badminton and setting up underhand clears was needed to actually administer the test. Each set-up had to be high and directed to the subject in a specific area of the court.

One person was assigned to watching both the net and mid-court ropes. The rope watcher's duty was to call out the number of the trial being performed and verbally announce if the shuttlecock passed over or under the net rope and mid-court rope. The rope watcher stood on a chair so she would be elevated high enough to easily distinguish whether the shuttlecock passed over or under the ropes. Test instructions were given to the rope watcher prior to the first testing day. These written instructions were read again at the first testing session. In addition the investigator gave an oral explanation of the test. The rope watcher practiced ten trials before the first subject was tested.

Three scorers recorded the necessary data for each subject taking the high clear test. Each scorer was given a clip board

and pencils and received a score sheet for each subject attached to the clip board. The scorer's duty was to watch where the shuttlecock landed for each trial and place the number of that trial in the corresponding area of the target or court drawn on the score sheet. Next to the number of the trial, the scorer marked a plus if the shuttlecock passed over the net rope and a minus if it passed under the net rope. Below this plus or minus another plus was marked if the shuttlecock passed over the mid-court rope and a minus if it passed under the mid-court rope. Twenty trials were recorded in this nammer for each subject. The scorers were requested to position themselves in such a way that they could see the entire court and target area without any obstructions. Standing on either side of the court near the sideline was recommended as a desirable position. Scoring directions for recording the data for the high clear test, a copy of which is included in Appendix C, were given to the scorers prior to the testing experience. These instructions were attached to the clip board given to scorers each day. On the first testing day the scorers were asked to reread the scoring directions and practice recording the data for ten trials before scoring the first subject. Each scorer was asked to observe and record each shot independently.

Three people were needed to administer the Miller wall volley test. A timer was responsible for administering three, thirty-second trials to each subject. The timer used an accurate

stop watch and gave verbal signals to the subject to begin and to stop each trial. A second person was assigned the task of watching the floor restraining line. The subject was allowed to step on but not over the ten foot restraining line. Any time the subject stepped over the line, the person watching the line was instructed to verbally announce "line". A scorer counted the number of volleys the subject hit against the wall throughout each trial. The scorer was instructed to count each legal volley contacting the wall on or above a seven foot, six inch wall line. The scorer also recorded the numerical score for each trial on the individual score sheets.

The timer, scorer, and line watcher involved in administering the wall volley test received specific directions for their part of the testing prior to the testing date. Each person reread these directions the first testing day and practiced performing their job before the first subject was tested. The directions for the scorer, timer, and line watcher were attached to a clip board and kept near the testing station during the entire testing week. A copy of the wall volley test directions was also kept at the testing station.

Subjects

Three beginning badminton classes were offered during the spring semester at the University of North Carolina at Greensboro. The instructors teaching these three classes were contacted and

permission was obtained to administer the high clear test and wall volley test to their students. All totaled, the three classes provided forty-five subjects for this study. Approximately fifteen subjects were enrolled in each class. The class periods were forty-five minutes of actual instructional time. To insure ample organizational and testing time, two testing sessions, or two class periods, were arranged for each class. The week of May 6 through May 9, 1968 was designated as the testing week for this study, thus putting both testing periods for each class in the same week. One badminton class met on Monday and Wednesday at 8:00 A. M. which set their testing dates on May 6 and May 8. The other two badminton classes met on Tuesday and Thursday, one at 8:00 A. M. and the other at 9:00 A. M. The testing dates for these two classes were May 7 and May 9. The testing periods occurred during the fourteenth week of the semester. Since beginning badminton classes were used for this study, the tests had to be administered near the end of the term in order for the subjects to develop enough skill to be able to perform the tests properly. Development of a good high clear stroke usually requires several weeks of practice for most beginning badminton players.

The subjects were told by two of the instructors the class session before the testing date that they would be given two badminton tests. Two of the instructors also informed their

class that the results of the tests would be used in determining a portion of their final grade.

Administration of the Tests

The testing stations were set up the day before the first testing period. The targets were constructed and the testing equipment was organized well in advance of the test. The tests were performed several times to check that everything was set up properly and that all the equipment was available.

The first testing day, the scorers and people assisting in the testing reported to the test stations early and the tests were explained. These assistants were informed as to the organization of the subjects and the general procedures for the test. After the high clear test and wall volley test were explained and demonstrated, the assistants practiced their specific duties for ten practice trials.

The tests were then explained and demonstrated to the subjects. The subjects were called, one at a time, to take the test. Each subject was given five practice trials before taking the test. The subjects were reminded before taking the test that they were to send the shuttlecock over the net rope and mid-court rope and onto the target using a forehand high clear stroke. They were directed to the yellow marks where they were to begin each trial. The subject was also reminded that she did not have to attempt to play an unsatisfactory set up and that the trial would not count

a plus was marked if the shuttlecock passed over the net rope and a minus if it passed under the net rope. The same symbols were marked for the mid-court rope. Scores were also recorded for three trials on the Miller wall volley test. The sum of the three trials was calculated to give each subject one total score for the wall volley test.

The data from the fan-shaped high clear test had to be converted into numerical score values. Six scoring methods were devised from the fan-shaped target. In addition test results were recorded according to the French high clear test scoring method.

First Scoring Method

One method provided twelve scoring areas along with a net rope to insure the proper height on the high clear stroke. The fan-shaped lines and the horizontal lines divided the target into the twelve scoring areas. Each of the twelve targets involved in this scoring technique was given a numerical value in relation to the value a high clear would possess in that particular court location in a game situation. (See Figure 1) The forehand and backhand corners of the court were given a value of five points. The areas two feet immediately in front of these corners received a value of three points and the areastwo feet immediately behind these corners had a value of four points. The target area in the back of the court, between the rear service line in a singles

unless the bird was contacted. Each subject was given twenty trials for the high clear test.

After the twenty trials were completed for the high clear test, the subject took her score sheet from the first scorer and moved on to the wall volley test. The directions for the wall volley test were reviewed and the subject was then given a one minute practice period. Three, thirty-second trials were administered to each student. The subject was allowed a thirty-second rest period between each trial. When the subject completed the wall volley test, she returned to a court to begin or continue a game of badminton.

All of the subjects were called from a game to take the high clear and wall volley tests. They were called one at a time so no one could sit and watch someone else take the test. Class tournament games were conducted during the testing session. After the tests, the subjects returned to the class games.

TREATMENT OF DATA

Data were recorded for forty-five college students enrolled in beginning badminton classes. Twenty trials of the high clear test, using a fan-shaped target, were administered to each subject. The location on the target where the shuttlecock landed on each trial was marked on a court and target diagram reproduced on individual score sheets. The scorers marked this area by using the number of the trial. Next to the number of the trial

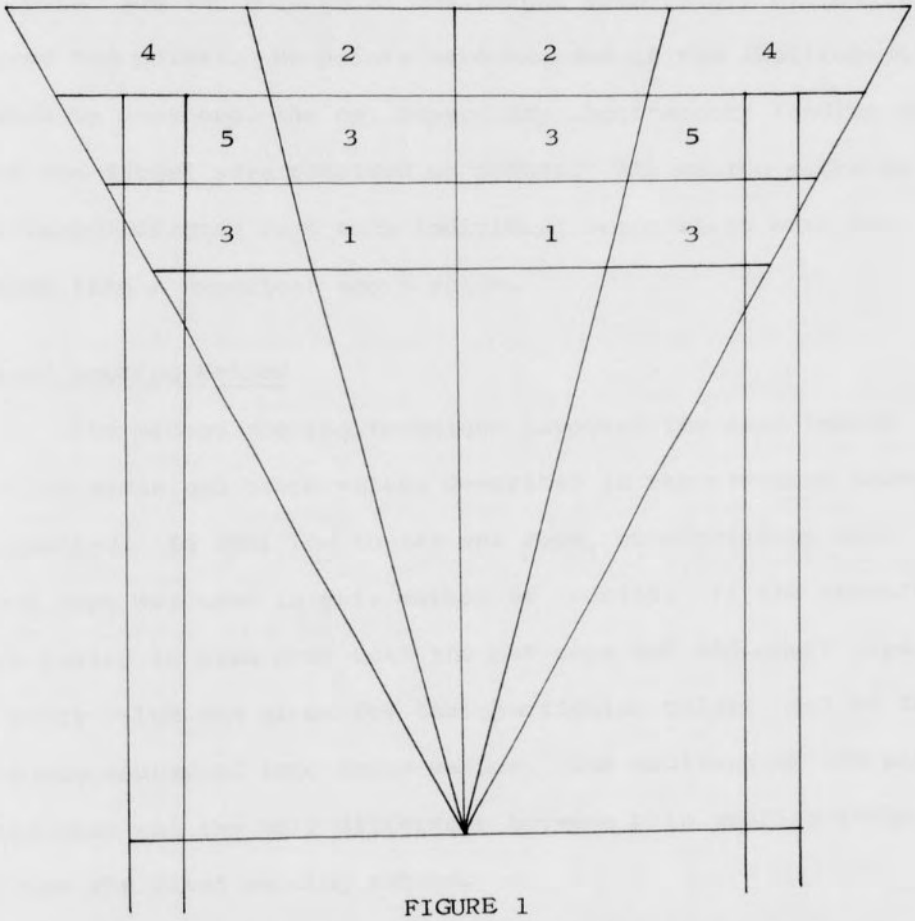


FIGURE 1

FAN-SHAPED HIGH CLEAR TEST TARGET CONSTRUCTED WITH TWELVE SCORING AREAS

game and the rear service line in the doubles game, and directly down the center of the court counted as three points. The scoring areas immediately in front of this three point area received one point and the portion of the target immediately behind it scored two points. No points were awarded if the shuttlecock failed to pass over the net rope. Any shuttlecocks landing outside the target area received no points. All of the marks on the target diagram from each individual score sheet were converted into a numerical score value.

Second Scoring Method

The second scoring technique involved the same twelve scoring areas and score values described in the previous scoring method. In addition to the net rope, an eight-foot mid-court rope was used in this method of scoring. If the shuttlecock failed to pass over both the net rope and mid-court rope, no score value was given for that particular trial. All of the data were converted into score values. The addition of the mid-court rope was the only difference between this scoring technique and the first scoring method.

Third Scoring Method

The third method of scoring the high clear test consisted of dividing the target into four scoring areas. The fan-shaped lines divided the target area into four fan-shaped areas. A horizontal line two feet behind the rear service line in a singles

game made up the back line of the target. A line two feet closer to the net than the rear service line in the doubles game designated the front boundary of the target. (See Figure 2) Any shuttlecock landing in the backhand fan-shaped section nearest the sidelines of the court scored four points. A shuttlecock landing in the backhand fan-shaped section near the center of the court received two points. The forehand fan-shaped section nearest the sidelines of the court was worth three points. Shuttlecocks landing in the forehand fan-shaped section near the center of the court scored one point. With this scoring pattern, the entire backhand and forehand side portions of the target received more point value than the sections in the center of the court. A rope was stretched two feet above the net. A shuttlecock that failed to pass over the net rope received no point value for that particular trial.

Fourth Scoring Method

The fourth scoring method was identical to the third scoring method except for the addition of a mid-court rope. The target divisions and the point values for the scoring areas remained the same as described in the third scoring method. In this technique, the shuttlecock was required to pass over the net rope and an eight-foot mid-court rope to receive point value. If the shuttlecock failed to pass over both of these ropes, no score was awarded for that trial.

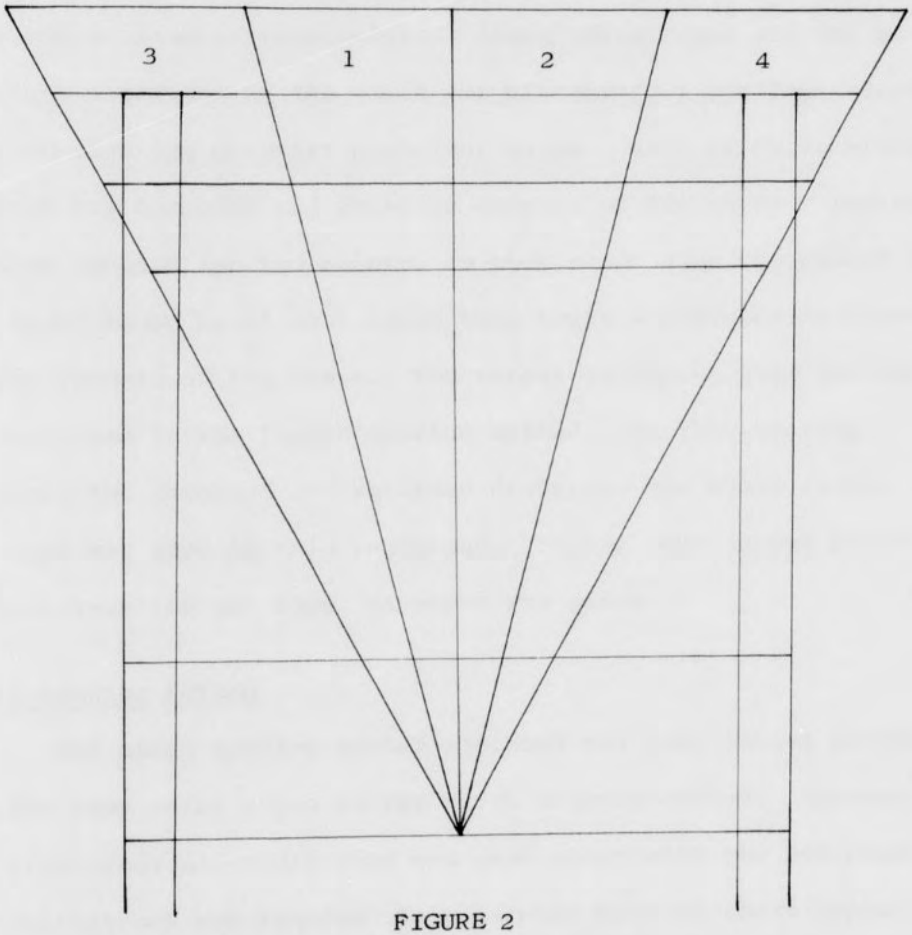


FIGURE 2

FAN SHAPED HIGH CLEAR TEST TARGET CONSTRUCTED
WITH FOUR SCORING AREAS

Fifth Scoring Method

For the fifth scoring pattern used on the high clear test, two main scoring areas were represented on the fan-shaped target. (See Figure 3) The two outer fan-shaped sections of the target received a value of four points. Since these areas are the most superior locations on the court for placement of the high clear, they receive the greatest numerical value. Both of these areas covered the backhand and forehand corners of the court. The middle section counted for two points. A high clear down the center of the court would be of less value than those strategically placed in the corners of the court. The target divisions were the same as described in the fourth scoring method. In this scoring pattern, the forehand and backhand divisions had equal value. A net rope was used in this technique. If the shuttlecock failed to pass over the net rope, no score was given.

Sixth Scoring Method

The sixth scoring method utilized the same target pattern and the same point value as the fifth scoring method. However, the eight-foot mid-court rope was used along with the net rope. The shuttlecock was required to pass over both of these ropes in order to score. Any shuttlecock that did not pass over the net rope and the mid-court rope prior to landing in a target area failed to score.

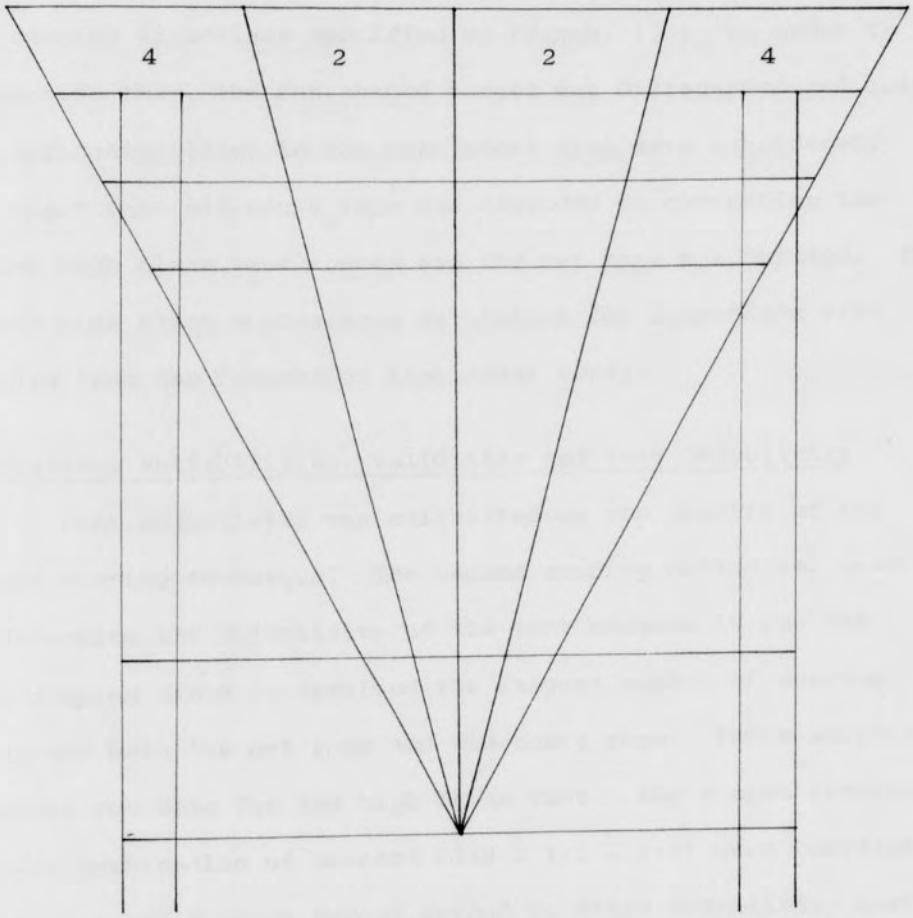


FIGURE 3

FAN SHAPED HIGH CLEAR TEST TARGET CONSTRUCTED
WITH TWO SCORING AREAS

French Test Scores

The raw data recorded for the fan-shaped high clear test was also converted into numerical score values for the French high clear test. The score values were determined according to the scoring directions specified by French. (33) In order to accomplish this, the fan-shaped target was disregarded and only the horizontal lines in the back court area were considered. The eight-foot mid-court rope was regarded in converting the French high clear test scores and the net rope was omitted. The French high clear scores were determined for comparison with results from the fan-shaped high clear test.

Determining Reliabilities, Validities and Test Objectivity

Test objectivity was calculated on the results of the second scoring technique. The second scoring method was used to determine the objectivity of the test because it was the most complex since it involved the largest number of scoring areas and both the net rope and mid-court rope. Three scorers recorded the data for the high clear test. The scores recorded by each combination of scorers (1:2 - 1:3 - 2:3) were correlated by the Pearson Product Moment method to yield objectivity coefficients.

To determine the reliability coefficients for the six versions or adaptations of the high clear test the odd numbered trials were correlated with the even numbered trials. The Pearson Product Moment coefficient was computed from the original

data. The Spearman-Brown Prophecy formula was used to estimate reliability for the total number of trials.

Two validity coefficients were established for each testing method. One coefficient reveals the validity of the testing method when correlated with the Miller wall volley test. The French high clear test also served as criterion for validating each testing method. The second coefficient represents this method of validation. The Pearson Product Moment method of correlation was used to compute the validities of this test.

The correlation coefficients obtained from the Miller: fan-shaped target test (Scoring Method 1) and the Miller : French high clear test were subjected to a test of significance to determine whether the relationships were truly different.

CHAPTER IV

ANALYSIS OF DATA

A high clear badminton skill test utilizing a fan-shaped target was administered to forty-five college students enrolled in beginning badminton classes at the University of North Carolina at Greensboro during the second semester of the 1967-68 academic year. The test was administered during the fourteenth week of the instructional unit in badminton. Each subject performed twenty trials of the high clear test.

Test Objectivity

Three scorers independently scored the subjects on the fan-shaped high clear test. The Pearson Product Moment method of correlation was used to determine the objectivity between the scorers. An objectivity coefficient of .99 was obtained when the scores of scorer number one were correlated with the scores of scorer number two. Scorer number two and scorer number three also attained an objectivity coefficient of .99. A correlation between scorer number one and scorer number three yielded an objectivity coefficient of .98. These data are presented in Table I.

Reliabilities

Data were recorded for each subject and converted into numerical scores. Since six scoring techniques were devised,

TABLE I

OBJECTIVITY COEFFICIENTS FOR A BADMINTON HIGH CLEAR SKILL TEST USING A FAN-SHAPED TARGET

N = 45

Scorers	Objectivity
Scorer 1 - Scorer 2	.99
Scorer 2 - Scorer 3	.99
Scorer 1 - Scorer 3	.98

six sets of scores were recorded for the subjects in relation to each scoring method used. To establish the reliabilities of the six scoring methods, the ten odd numbered trials were correlated with the ten even numbered trials. The Pearson Product Moment method of correlation was used. The Spearman-Brown Prophecy formula was used to step up the correlation coefficient to determine the reliability of the high clear test for twenty trials. Reliability coefficient data are presented in Table II.

The first scoring method involved twelve scoring areas and a net rope. The reliability for ten trials of the fan-shaped high clear test was .78. When the trials were increased to twenty, the correlation coefficient was stepped up to .88. The reliability for ten trials on the second scoring method, which provided twelve scoring areas, a net rope and a mid-court rope, was .75. A reliability coefficient of .86 was the result of stepping up the coefficient and increasing the number of trials to twenty. The third method of scoring utilized four numerical scoring areas and a net rope. This method proved to have a reliability coefficient of .76 for ten trials. The reliability coefficient for twenty trials was .86 when stepped up by the Spearman-Brown Prophecy formula. In the fourth scoring method, the four scoring areas remained the same as in the third method. The net rope was retained and a mid-court rope was added. The reliability for ten trials of the test was .74. When this coefficient was stepped up and the trials increased to twenty, a coefficient of .85 was obtained. For the fifth method of scoring

TABLE II

RELIABILITY COEFFICIENTS FOR A HIGH CLEAR SKILL TEST UTILIZING A FAN SHAPED TARGET

(N=45 Beginning Badminton Students - College Level)

Scoring Method	Reliability Coefficients r 10 Trials	r 20 Trials*
Method 1. 12 scoring areas net rope	.78	.88
Method 2. 12 scoring areas net and mid-court rope	.75	.86
Method 3. 4 scoring areas net rope	.76	.86
Method 4. 4 scoring areas net and mid-court rope	.74	.85
Method 5. 3 scoring areas net rope	.71	.83
Method 6. 3 scoring areas net and mid-court rope	.21	.35

* Estimated by the Spearman-Brown Prophecy formula.

the fan-shaped high clear test, the target was divided so that two numerical score values were awarded. A net rope was also used. The reliability reported for this technique was .71 for ten trials. When the trials were increased to twenty, the reliability coefficient was .83. Two numerical score values, a net rope and a mid-court rope were used in the sixth scoring method. A reliability coefficient of .21 was obtained for ten trials of the test. When the reliability was determined for twenty trials, a coefficient of .35 was reported.

Validities

The Miller wall volley test was administered to serve as criterion for validating the fan-shaped high clear test. The sum for the three trials of the Miller wall volley test was correlated with the sum of twenty trials on the fan-shaped high clear test. The Pearson Product Moment method of correlation was used to obtain the validity coefficient. The French high clear test served as a second criterion for validating the fan-shaped high clear test. The Pearson Product Moment method was used to correlate the sum for twenty trials of the French high clear test with the sum for twenty trials of the fan-shaped high clear test. The data concerning test validities may be found in Table III.

A validity coefficient of .45 was reported for the first testing method when the Miller wall volley served as criterion. When the French high clear test was correlated with the fan-shaped

TABLE III

VALIDITY COEFFICIENTS FOR A HIGH CLEAR SKILL TEST

N = 45

Scoring Method	Criteria	
	Miller Wall Volley	French High Clear
Method 1. 12 scoring areas net rope	.45	.76
Method 2. 12 scoring areas net and mid-court rope	.44	.79
Method 3. 4 scoring areas net rope	.41	.68
Method 4. 4 scoring areas net and mid-court rope	.40	.72
Method 5. 3 scoring areas net rope	.44	.73
Method 6. 3 scoring areas net and mid-court rope	.41	.75
French clear	.35	

high clear test the validity coefficient was .76 for this first testing method. For the second testing method a validity coefficient of .44 was obtained when the wall volley test was used as criterion. The French high clear test correlated with the second method to yield a coefficient of .79. In the third testing technique, a validity coefficient of .41 was established when the fan-shaped high clear test was correlated with the Miller wall volley test. When the French high clear test served as criterion, the validity coefficient was .68 for the third method. The validity coefficient reported for the fourth testing method, with the Miller wall volley as criterion, was .40. When the French high clear test served as criterion for the fourth technique, a coefficient of .72 was obtained. The validity reported for the fifth testing method was .44 when correlated with the wall volley test. With the French high clear test as criterion for the fifth method, the validity coefficient was .73. Correlation of the sixth testing method with the Miller wall volley test yielded a coefficient of .41. When this version of the fan-shaped high clear test was correlated with the French high clear test, a validity coefficient of .75 was obtained.

The scores on the French high clear test were correlated with the wall volley test scores. A correlation coefficient of .35 was obtained between the scores on these two tests.

A test of significance of difference was calculated from the correlation coefficients of the Miller: fan-shaped high clear

test and the Miller: French high clear test. A t of 10.47 was obtained. A t of 2.021 or above was needed at the 5 per cent level of confidence in order to prove that the relationships were different.

Interpretation of Data

From the data gathered on the fan-shaped high clear test for forty-five beginning badminton students, a statistical analysis of the objectivity, reliability and validity of the test was conducted. The high clear test utilizing a fan-shaped target proved to be an objective test to score. All three of the objectivity coefficients between the scorers were extremely high. Two of the objectivity coefficients were .99 and one was .98.

The raw data were converted into numerical score values. The data was subjected to six scoring techniques and reliability coefficients were calculated. Methods one, two, three, four and five proved to be reliable measures of the badminton high clear stroke. For methods one through five the reliability coefficients ranged from .88 to .83 for twenty trials. According to Barrow and McGee (2), reliability coefficients ranging from .80 to .89 were considered acceptable. With this standard, methods one, two, three, four and five were reliable measures of the badminton high clear stroke. Due to an extremely low coefficient, method six was considered unreliable. The first scoring technique was considered the most reliable scoring method with an estimated reliability coefficient of .88 for twenty

trials. The scoring methods that possessed the most scoring areas proved to be more reliable than those with fewer scoring areas.'

The validity coefficients were quite low for the six methods, ranging from .45 to .41, when the Miller wall volley served as criterion. The subjects were beginners in badminton and experienced some difficulty in performing the wall volley test. Ideally, the wall volley is supposed to be practiced over a period of time prior to the testing experience. Beginners should be familiar with the test in order to achieve success in their performance of the test. The forty-five subjects in this study had never been exposed to the wall volley skill prior to the testing day. Each subject was given a one minute practice period before taking the test. This is not ample time to practice the wall volley skill. This lack of repeated practice before testing may be a reason for the low validity coefficients.

The fan-shaped high clear test was also validated with the French high clear test as criterion. The validity coefficients ranged from .79 to .68. Methods one, two, four, five and six have coefficients in the .70's. These validity coefficients in the .70's were all considered acceptable according to the standards for interpreting validity correlation coefficients given by Barrow and McGee. (2) The coefficient of .68 for the third method was considered unacceptable and was rejected. All of the test methods, with the exception of the third, can be accepted as valid measures of the high clear stroke.

When the correlation coefficients obtained from the Miller: fan-shaped high clear test, .45, and the Miller: French high clear test, .35, were subjected to a test of significance of difference, a t of 10.47 was obtained. In order to show a significant difference, a t of 2.021 or higher was needed at the 5 per cent level of confidence. The t obtained from the test of significance, 10.47, was well above the required number. The test of significance proved the relationships to be truly different.

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

SUMMARY

The purpose of this study was to devise a badminton high clear skill test utilizing a fan-shaped target and to determine the objectivity, reliability and validity of this test. After preliminary research on the badminton high clear stroke, skill testing and target patterns used in testing, a fan-shaped target was constructed for use with a high clear test.

Five lines depicting a fan shape were extended from a center point on the net line to a line two feet beyond the back line of the badminton court. Four horizontal lines were drawn at two foot intervals in the back court area. This fan-shaped target provided for measurement of placement as well as height and distance of the high clear stroke.

The fan-shaped high clear skill test was administered to forty-five college students enrolled in beginning badminton classes at the University of North Carolina at Greensboro. These students had fourteen weeks of instruction in badminton prior to the testing period. Each subject was given twenty trials of the fan-shaped high clear test and three trials of the Miller

wall volley test. The wall volley test was administered to serve as criterion for validation of the fan-shaped high clear test. Data were also recorded for the French high clear test which served as criterion for another method of validation.

Data for the fan-shaped high clear test were recorded by three scorers in order to establish the objectivity of the test. Six different scoring methods were devised and the raw data were converted into numerical values in relation to each scoring method. The six scoring methods were as follows:

Method one - twelve scoring areas and a net rope

Method two - twelve scoring areas, a net rope and a mid-court rope

Method three - four scoring areas and a net rope

Method four - four scoring areas, a net rope and a mid-court rope

Method five - three scoring areas and a net rope

Method six - three scoring areas, a net rope and a mid-court rope

The reliability coefficients were determined for each scoring method by correlating the ten odd trials with the ten even trials by using the Pearson Product Moment method of correlation. The Spearman-Brown Prophecy formula was then applied to determine the reliability for twenty trials.

The validity of each scoring method was established by using the Pearson Product Moment method of correlation. Two

validity coefficients were obtained for each scoring method. The Miller wall volley test served as criterion for one method of validation and the French high clear test served as criterion for the second method of validation.

Data from the Miller wall volley test were correlated with the data from the French high clear test by using the Pearson Product Moment method of correlation.

A test of significance of difference was calculated between the correlations on the Miller : fan-shaped high clear test and the Miller : French high clear test to determine whether the relationships were truly different.

Findings

The fan-shaped high clear badminton skill test proved to be an objective test to score with correlation coefficients of .99, .99, and .98.

The first testing and scoring method proved to be the strongest method with a reliability coefficient of .78 for ten trials stepped up to .88 for twenty trials and with validity coefficients of .45 with the Miller wall volley test as criterion and .76 with the French high clear test as criterion.

An estimated reliability coefficient of .86 for twenty trials was obtained for the second testing method and validity coefficients of .44 and .79 were figured when correlated with the Miller wall volley test and the French high clear test respectively.

The third testing method resulted in an estimated reliability coefficient of .86 for twenty trials, a validity coefficient of .41 with the Miller wall volley test as criterion and a validity coefficient of .68 with the French high clear test as criterion.

The fourth testing process yielded an estimated reliability coefficient of .85 for twenty trials and validity coefficients of .40 with the Miller wall volley test as criterion and .72 with the French high clear test as criterion.

The estimated reliability coefficient for the fifth method was .83 for twenty trials. Validity coefficients of .44 and .73 were obtained when the Miller wall volley test and French high clear test respectively served as criterion.

The sixth method was found to be unreliable with an estimated coefficient of .35 for twenty trials. The validity coefficients for the sixth method were .41 with the Miller wall volley as criterion and .75 with the French high clear test as criterion.

A correlation coefficient of .35 was obtained when the Miller wall volley test was correlated with the French high clear test.

A t of 10.47 was obtained when the correlations of .45 from the Miller : fan-shaped high clear test and .35 from the Miller : French high clear test were subjected to a test of

significance of difference. A t of 2.021 or above was needed to be significant at the 5 per cent level of confidence.

CONCLUSIONS

The fan-shaped high clear test places value on the height, distance and placement of the high clear stroke in badminton. The target area for the test is constructed on one half of the court and divides the back portion of the court into twelve scoring areas. A white clothesline rope is placed two feet above the net. The actual numerical values are marked in the appropriate scoring areas on the target. (See Figure 1) These scoring values should be visible to the subjects. The numerical values are recorded as the subject's score.

The test administrator sets up the shuttlecock for a high clear stroke. The subject clears the shuttlecock, with a forehand high clear stroke, over the net rope and into the target area. Twenty trials of the test are administered.

The fan-shaped high clear test with twelve scoring areas and a net rope proved to be a reliable measure of the badminton high clear. The reliability coefficient established for this test, based upon scores from forty-five subjects from three college classes, was .78 for ten trials stepped up to .88 for the twenty trials administered in the test.

The fan-shaped high clear test is also a valid measure of the high clear stroke in badminton. When the French high clear

test served as criterion for validation, a coefficient of .76 was obtained. When the Miller wall volley test was correlated with the fan-shaped high clear test, the validity coefficient was .45.

There was a significant difference between the Miller: fan-shaped high clear test and the Miller: French high clear test at the 5 per cent level of confidence.

RECOMMENDATIONS FOR FURTHER STUDY

It is recommended that the fan-shaped high clear test in its suggested form, twelve scoring areas and a net rope, be administered to intermediate and advanced badminton players. An analysis of the reliability and validity when using intermediate and advanced subjects should be determined.

It is also suggested the scores of beginning badminton players be compared to the scores of advanced badminton players. A study of this nature could determine if there is a significant difference between the scores of the groups on the fan-shaped high clear test.

BIBLIOGRAPHY

BIBLIOGRAPHY

A. BOOKS

1. Ainsworth, Broer, Goss, Culver, Byden, Mott and Tugman. Individual Sports for Women. Philadelphia: W. B. Saunders Company, 1963. 326 pp.

2. Barrow, Harold M. and Rosemary McGee. A Practical Approach to Measurement in Physical Education. Philadelphia: Lea and Febiger, 1964. 560 pp.

3. Bookwalter, Karl and Carolyn Bookwalter. "Sport Skills," Measurement and Evaluation Materials in Health, Physical Education and Recreation. Washington, D. C.: National Research Council of the Research Section, American Association of Health, Physical Education and Recreation, 1950. pp. 67-76.

4. Brace, David K. Skills Test Manual. Washington, D. C.: American Association of Health, Physical Education and Recreation, 1966. 47 pp.

5. Broer, Marion R. Efficiency of Human Movement. Philadelphia: W. B. Saunders Company, 1965. 351 pp.

6. Clarke, H. Harrison. Application of Measurement to Health and Physical Education. Second edition. New York: Prentice Hall, Inc., 1950. 493 pp.

7. Davidson, Kenneth and Lenore C. Smith. Badminton. New York: Athletic Institute Series, Sterling Publishing Co., Inc., 1961. 128 pp.

8. Edgren, Harry D. and Gilmer G. Robinson. Group Instruction in Tennis and Badminton. New York: A. S. Barnes and Company, 1939. 99 pp.

9. Friedrich, John and Abbie Rutledge. Beginning Badminton. Belmont, California: Wadsworth Publishing Company, Inc., 1962. 62 pp.

10. Jackson, Carl H. and Lester A. Swan. Better Badminton. New York: A. S. Barnes and Company, 1939. 150 pp.

11. Scott, M. Gladys and Esther French. Measurement and Evaluation in Physical Education. Dubuque, Iowa: Wm. C. Brown Company, 1959. 493 pp.

12. Smithells, Philip A. and Peter E. Cameron. Principles of Evaluation in Physical Education. New York: Harper and Brothers, 1962. 478 pp.

13. Thomas, George. The Art of Badminton. Fourth edition. London: Hutchinson and Company, 1932. 156 pp.

14. Varner, Margaret. Badminton. Dubuque, Iowa: Wm. C. Brown Company, 1966.

B. PERIODICALS

15. Ball, Virginia. "Overhead Strokes," Selected Tennis and Badminton Articles, DGWS. Second edition, 1963, pp. 88-91.

16. Bischoff, D. C. "Skill Grading System Using a Modified Ladder Tournament," Journal of Health, Physical Education and Recreation, Vol. 34, April 1963, pp. 10-11

17. Bourquardez, V. D. "Tricks of the Trade in Badminton," Journal of Health, Physical Education and Recreation 15:577-8, December 1944.

18. Clevett, Melvin A. "An Experiment in Teaching Methods of Golf," Research Quarterly, Vol. II, No. 4, December 1931, p. 104.

19. Davidson, K. R. "Badminton Footwork and Body Balance," Scholastic Coach 19:16- , February 1950.

20. Day, June. "First Lessons in Badminton," Journal of Health, Physical Education and Recreation, Vol. 34, March 1963, pp. 28-32.

21. Feldt, L. S. and M. E. McKee. "Estimation of the Reliability of Skill Tests," Research Quarterly, 29:279-293, October 1958.

22. French, Esther L. and Bernice Cooper. "Achievement Tests in Volleyball for High School Girls," Research Quarterly, 8:150-157, May 1937.

23. French E. L. and E. Stalter. "Study of Skill Tests in Badminton for College Women," Research Quarterly 20:257-72, October 1949.

24. Geever, G. "Backhand in Badminton," Athletic Journal, Vol. 36, December 1955, pp. 24-25

25. Howard, Evelyn. "Teaching Problems in Badminton," Selected Tennis and Badminton Articles, DGWS. Second edition, 1963, pp. 94-98.

26. Lockhart, A. and F. A. McPherson. "Development of a Test of Badminton Playing Ability," Research Quarterly, 20: 402-5, December 1949.

27. Lyon, M. Joan. "Fundamental Principles of Movement Applied to Badminton," Tennis-Badminton Guide, DGWS, American Association of Health, Physical Education and Recreation, June 1966-June 1968, pp. 103-106.

28. Martin, Wallace. "Badminton Shots and Their Execution. Selected Tennis and Badminton Articles, DGWS. Second edition, 1963, pp. 82-86.

29. Miller, F. A. "Badminton Wall Volley Test," Research Quarterly, 22:208-13, May 1951.

30. Odenal, B. "Fundamental Badminton," Scholastic Coach, Vol. 34, November 1964, pp. 70-71.

31. Poole, J. "Singles Strategy in Badminton," Journal of Health, Physical Education and Recreation, Vol. 30, February 1959, p. 75.

32. Rutledge, A. "Badminton Skills and Strategy," Journal of Health, Physical Education and Recreation, Vol. 26, May 1955, pp. 21-22.

33. Scott, M. Gladys, et al. "Achievement Exams in Badminton," Research Quarterly 12:242-53, May 1941.

34. Sebolt, Don R. "Badminton Short Service Test," Health, Physical Education and Recreation Review, Virginia Association of the American Association of Health, Physical Education and Recreation, March 1968, pp. 42-49.

35. Smith, V. and M. M. Lazier. "Badminton Strokes," Athletic Journal, Vol. 40, February 1960, pp. 38-39.

36. Wolf, H. M. "Badminton Drills," Athletic Journal, Vol. 45, February 1965, p. 31.

C. UNPUBLISHED MATERIAL

37. Bohn, Robert W. "An Achievement Test in Archery." Unpublished Master's thesis, University of Wisconsin, Madison, Wisconsin, 1962. Microcard.

38. Boldrick, Evelyn. "The Measurement of Fundamental Skills in Badminton." Unpublished Master's thesis, Wellesley College, 1945.

39. Campbell, Virginia M. "Development of Achievement Tests in Badminton." Unpublished Master's thesis, University of Texas, Austin, Texas, 1938.

40. Davis, Barbara. "The Relationship of Certain Skill Tests to Playing Ability in Badminton." Unpublished Master's thesis, Wellesley College, 1946.

41. Edwards, Janet. "A Study of Three Measures of the Tennis Serve." Unpublished Master's Thesis, University of Wisconsin, Madison, Wisconsin, 1965.

42. Greiner, Marilyn R. "Construction of a Short Serve Test for Beginning Badminton Players." Unpublished Master's thesis, University of Wisconsin, Madison, Wisconsin, 1964.

43. Malinak, Nina R. "The Construction of an Objective Measure of Accuracy in the Performance of the Tennis Serve." Unpublished Master's thesis, University of Illinois, Urbana, Illinois, 1961.

44. Ronning, Hilding E. "Wall Tests for Evaluating Tennis Ability." Unpublished Master's thesis, Washington State University, Pullman, Washington, 1959.

45. Scott, James H. "A Study in the Evaluation of Playing Ability in the Game of Badminton." Unpublished Master's thesis, The Ohio State University, 1941.

46. Timmer, Karen L. "A Tennis Skill Test to Determine Accuracy in Playing Ability. Unpublished Master's thesis, Springfield College, Springfield, Massachusetts, 1965.

47. Williams, Glenna. "A Study of Badminton Skill Tests." Unpublished Master's thesis, Texas State College for Women, Denton, Texas, 1945.

APPENDICES

APPENDIX A

DIMENSIONS FOR THE FAN-SHAPED HIGH CLEAR TARGET

APPENDIX A

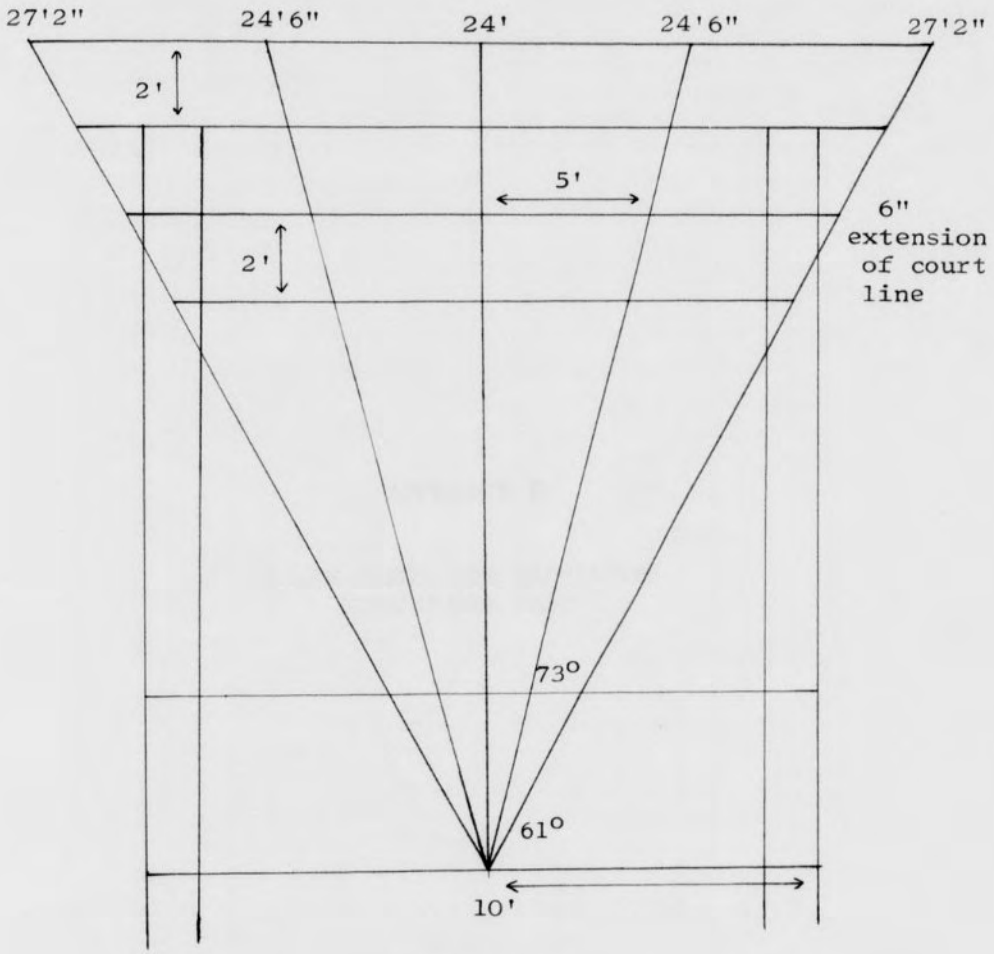


FIGURE 4

DIMENSIONS FOR THE FAN-SHAPED
HIGH CLEAR TARGET

APPENDIX B

SCORE SHEET FOR BADMINTON HIGH CLEAR TEST

SCORE SHEET FOR BADMINTON

HIGH CLEAR TEST

NAME _____

CLASS _____

DATE _____

Wall Volley Scorer

_____

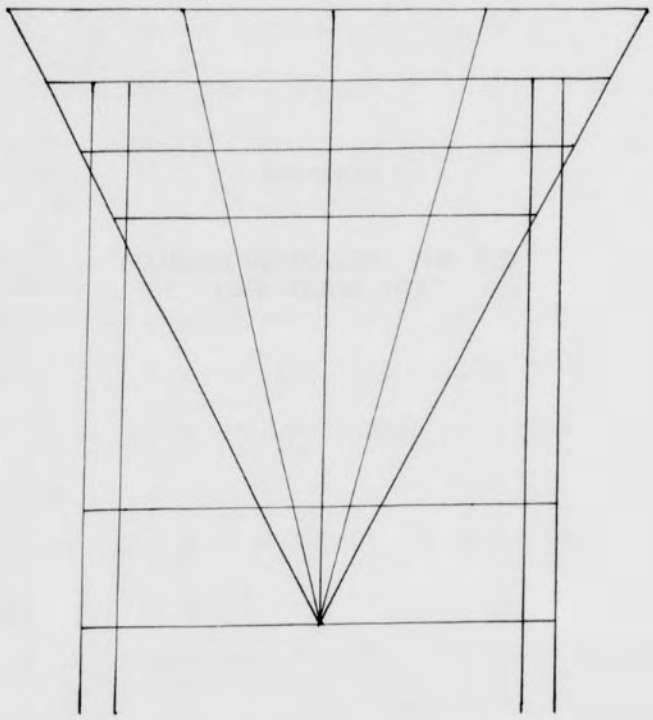
30 Sec. Wall Volley Test

Trial 1. _____

Trial 2. _____

Trial 3. _____

TOTAL _____



KEY

1^{+}_{+} - shot 1 over both ropes

$1^{+}_{=}$ - shot 1 over 1st rope and under 2nd

$1^{=}$ - shot 1 under both ropes

SCORER _____

APPENDIX C

SCORING DIRECTIONS FOR THE HIGH CLEAR TEST

SCORING DIRECTIONS FOR THE HIGH CLEAR TEST

Twenty trials will be scored on the high clear test. The bird will be set up to the subject. The subject will hit the bird with a forehand high clear stroke. A person watching the ropes will indicate whether the bird passed over or under the net rope and mid-court rope. The person watching the ropes will announce the number of the trial and then will call "over" or "under", which ever the case may be. The net rope will be announced first, then the mid-court rope. For example, the rope watcher may call, "trial three, over, under" or "trial three, over, over".

The scorers will observe where the bird lands on or off the court. That trial will be recorded by placing the number of that trial in the corresponding position on the score sheet. Next to the number, the scorer will place a plus if the bird passed over the net rope or a minus if it passes under the net rope. A plus or a minus will be placed below the previous one to indicate the flight of the bird over or under the mid-court rope. For example, the score for the third shot, if it passes over the net rope and mid-court rope, would be 3^{+}_{+}. A key to this scoring technique is provided at the bottom of each score sheet.

Please print your last name in the space marked SCORER at the bottom of the sheet.

APPENDIX D

TEST DIRECTIONS FOR HIGH CLEAR TEST

TEST DIRECTIONS FOR HIGH CLEAR TEST

This is a test of the ability to perform the forehand high clear. Stand between the two squares until the bird has been hit to you. Once the person administering the setup has contacted the bird, you may move anyplace on the court to perform the high clear stroke. Send the bird with a forehand clear stroke so that it goes over the net rope and the mid-court rope and lands on the target in the opposite court. The ideal area to place the bird with a high clear stroke is in the back of the court in the backhand corner or forehand corner. These areas receive the highest value on this test. You will be given twenty trials. The bird in being hit to you must go in the place between the two square marks and must be hit with enough force so that it does not reach the floor before it reaches an imaginary line between the two square marks. If you think that the flight of the bird is such that it will not meet these requirements, do not attempt to play it. It will not count as a trial unless you hit the bird.

You will be given five practice trials before your test begins. You will be told when the first trial starts.

APPENDIX E

SCORING DIRECTIONS FOR THE MILLER WALL VOLLEY TEST

SCORING DIRECTIONS FOR THE MILLER WALL VOLLEY TEST (29)

The subject will be given a one minute practice period. On the signal "Ready, go", the subject puts the bird in play in a legal manner from behind the floor restraining line. The bird must hit on or above the wall line. That initial hit or serve counts as one hit or volley. The subject continues volleying the bird against the wall. Each volley hitting above the wall line counts as one volley. The subject must not step over the floor restraining line. If she does, the person watching the line will call "line" and the counter will not count that particular hit. If the subject misses the bird and it drops to the floor, she may pick it up, move behind the floor restraining line and put the bird in play again. The number of accumulative hits during the thirty-second trial is the score for that trial. Three thirty-second trials will be administered to each subject.

APPENDIX F

TEST DIRECTIONS FOR THE MILLER WALL VOLLEY TEST

TEST DIRECTIONS FOR THE MILLER WALL VOLLEY TEST (29)

Stand behind the restraining line marked on the floor. Put the bird in play in a legal manner. The bird must hit the wall on or above the wall line. Volley the bird against the wall continuously as many times as possible. The bird must hit on or above the wall line on each volley to be counted. You may not step over the restraining line on the floor. If you do step over this line, the volley will not count. If you miss the bird and it falls to the floor, pick up the bird, move behind the line and put the bird in play again.

You will be given three thirty-second trials. The number of legal volleys will be counted for each trial.

APPENDIX G

DIAGRAM OF SCORING AREAS FOR THE
FRENCH HIGH CLEAR
TEST

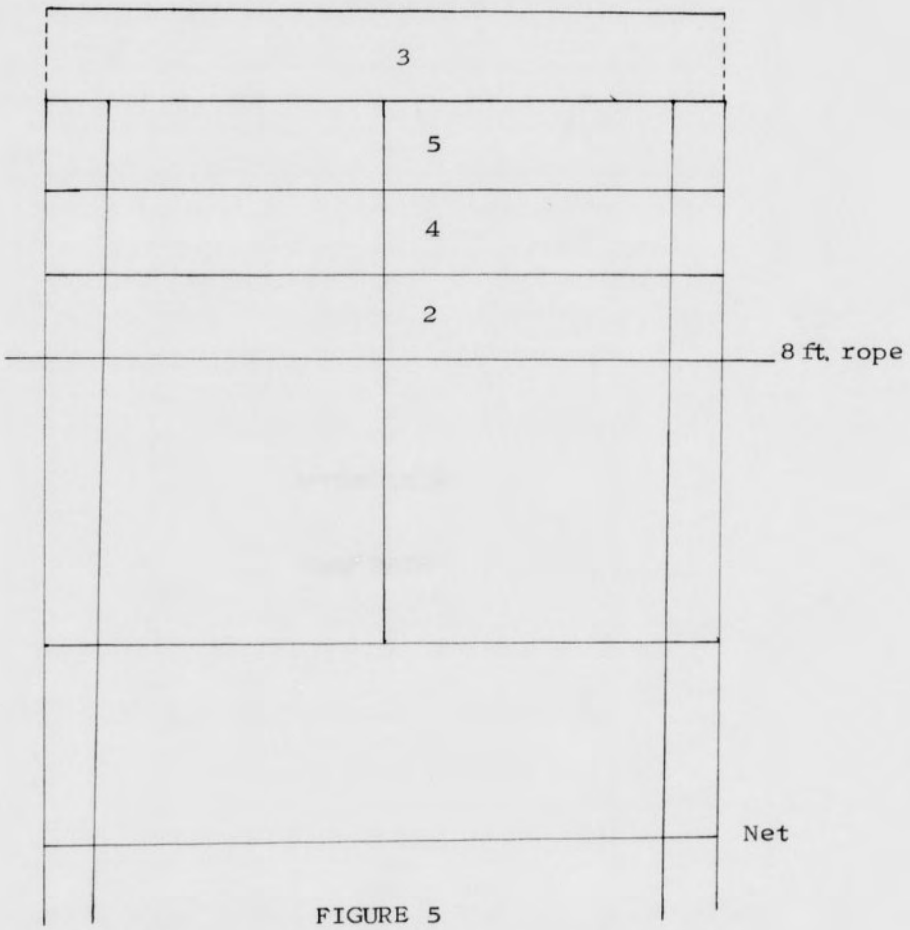


FIGURE 5

DIAGRAM OF SCORING AREAS FOR THE FRENCH HIGH CLEAR TEST

APPENDIX H

RAW DATA

RAW DATA

Ss	Miller Wall Volley Total	Griot High Clear Test Totals for Scoring Methods I	II	III	IV	V	VI	French High Clear Total
1	29	37	37	27	27	32	32	47
2	26	55	55	35	35	46	46	67
3	21	40	37	27	24	38	34	65
4	18	38	38	35	35	36	36	76
5	14	10	10	7	7	10	10	34
6	23	40	34	29	29	32	32	59
7	21	34	34	22	22	32	32	53
8	18	22	21	16	14	22	20	41
9	20	3	2	3	2	6	4	14
10	24	21	21	24	24	24	24	38
11	25	38	35	25	22	36	32	57
12	25	24	23	26	24	26	24	40
13	28	35	35	24	24	34	34	49
14	20	33	32	31	29	32	30	63
15	29	25	25	24	24	30	30	51
16	19	25	24	15	14	26	24	51
17	13	6	6	5	5	8	8	17
18	24	12	12	12	12	16	16	25
19	23	41	41	33	33	40	40	60
20	25	58	57	41	40	58	56	63
21	20	44	44	30	30	40	40	47
22	24	39	39	35	35	42	42	79
23	28	30	30	19	19	28	28	52
24	20	26	26	19	19	22	22	58
25	13	26	26	28	28	32	32	60
26	36	46	46	28	28	36	36	79
27	31	48	36	46	38	48	40	33
28	31	63	63	44	44	52	52	68
29	37	55	55	46	46	48	48	87
30	22	36	29	24	20	30	26	30
31	20	47	47	40	40	44	44	64
32	22	47	47	33	33	42	42	53
33	29	20	20	14	14	18	18	44
34	23	75	75	58	58	68	68	70
35	17	25	25	20	20	24	24	57
36	21	34	34	28	28	32	32	53
37	31	18	18	21	21	22	22	30
38	19	3	1	3	1	6	2	10
39	24	38	37	24	23	32	32	71
40	24	23	23	23	23	28	28	53
41	26	47	47	25	25	36	36	79
42	23	43	40	24	23	36	34	69
43	33	37	37	28	28	30	30	63
44	41	52	51	36	34	50	48	69
45	27	45	44	30	28	42	40	58