BADMINTON SKILL TESTS FOR THE SMASH AND OVERHEAD DROP SHOT

by

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The purpose of this study was to establish the validity, reliability, and objectivity of badminton skills tests for the smash and overhead drop shot. These tests attempted to distinguish between players better able to execute the smash and drop strokes, and those of lesser proficiency.

The tests were administered to forty-five women students during the twelfth week of fourteen-week instructional service classes in beginning badminton at The University of North Carolina at Greensboro. Subjects had little or no previous experience in badminton recreationally and/or instructionally. Three sections were tested in the study and later combined into one group of forty-five subjects.

A one-way analysis of variance method was used to determine whether there were any significant differences between the performances of the three groups on the tests. No significant differences in performance were found, thus allowing the three groups to be combined into one group for further analysis.

Conclusions

1. There were no significant differences between the performances of the three sections of beginning badminton players tested.

2. Weak inter-judge coefficients of correlation make the findings on validity for both tests questionable.

3. Recording methods for both the smash and drop shot tests were highly objective.

4. The coefficient of validity for the smash test was weak, leaving question as to whether the test really measured the ability to smash.

5. The coefficient of validity for the overhead drop shot test was extremely low, showing that the test probably did not measure the ability to perform the overhead drop shot.

6. The coefficient of reliability for the smash test was weak, leaving question as to whether the test consistently measured the same skill.

7. The coefficient of reliability for the overhead drop shot was weak, leaving question as to whether the test consistently measured the same skill.

APPROVAL PAGE

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

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Sincerest thanks to my adviser, Dr. Rosemary McGee, my roommate, and the graduate and undergraduate faculty and students who made this study a reality.

And there are those who give and know
not pain in giving, nor do they seek joy,
nor give with mindfulness of virtue;

They give as in yonder valley the myrtle
breathes its fragrance into space.

Through the hands of such as these God
speaks, and from behind their eyes
He smiles upon the earth.

(Kahlil Gibran)

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CHAPTER I

INTRODUCTION AND STATEMENT OF THE PROBLEM

A growing interest in badminton is mentioned in nearly all available materials related to the topic of badminton. The game seems to have universal appeal that can be attributed to certain elements that draw people to participate. Miller and Ley (9) summarize several of these elements: badminton can be played by all age levels and both sexes; it can be played co-recreationally; it can be played at various levels in school, college and the community; and it can be played at various levels of exertion and skill. Some other elements of this appeal seem to be related to the minimum of equipment and space required, the low cost of equipment, and the enjoyment that comes with being able to participate successfully from the outset. Although badminton can be learned in a recreational situation, most badminton instruction occurs in a school setting. The increased appearance of badminton in school physical education programs has created a need for more precise and objective measuring instruments to aid in the evaluation of the student, and the badminton instructional program.

Authors (1, 3, 4, 7, 10, 13, 14, 15, 17, 22, 23) writing on badminton stress that the game consists of a variety of skills and strokes; clears, drives, serves, drops, and smashes are the strokes most frequently mentioned. The mastery of the game of

badminton requires the accomplished performance of these strokes and skills. Research in badminton skill test construction seems to be concentrated on attempts to develop a precise way of determining playing ability in relation to these strokes and elements such as footwork and strategy. Other research into skill test construction seems to be focused on the strokes used most often in the game.

The author found that the only work done with the smash and overhead drop shot was in studies attempting to develop skill test batteries. The smash and overhead drop shot tests usually were reported to be the least sound statistically. As a result, these tests have been eliminated from the batteries recommended by the researchers.

The importance of the smash and the overhead drop shot is mentioned in many badminton resources. (3, 7, 10, 13, 14, 15, 16, 19, 22, 23) The drop shot is mentioned primarily as a tool used to move one's opponent around the court. (3, 4, 7, 10, 13, 14, 15, 16, 17, 22, 23) The smash is regarded as the point winner or the "put away" shot in badminton. (3, 4, 7, 10, 13, 14, 15, 16, 17, 22, 23) These two strokes would seem to constitute an important part of the offensive game and as such should be included in a student's repertoire of strokes.

The importance of these two strokes, plus the lack of statistically sound skill tests in these areas, induced the author to undertake the development of skills tests for the smash and the overhead drop shot. It was not the intention of the researcher to

measure overall badminton playing ability. These tests were developed to aid badminton teachers in the evaluation of skill level attained by students in performing the smash and the overhead drop shot. These two tests, used in combination with other tools such as tournament standings, overall ability tests, subjective ratings, and other skill tests, should aid the teacher in evaluating the badminton student.

Statement of Problem

The purpose of this study was to establish the validity, reliability, and objectivity of badminton skill tests in the smash and the overhead drop shot. The skill tests attempted to distinguish the better beginning level players from the poorer beginning level players in the execution of the smash and the overhead drop shot by measuring accuracy of placement.

Definitions

Smash. The hard overhead stroke hit downward with great force. It is the principal attacking stroke of badminton. (10)

Overhead drop shot. A stroke played above head level which just clears the net and immediately starts to fall in the opponent's court. (10)

Beginner. Student enrolled in beginning college badminton. Such students have little or no previous playing experience in badminton.

Limitations

1. The findings of this study are limited to beginning level badminton players of college level.

2. The statistical analysis is done with data provided by women subjects.

CHAPTER II

REVIEW OF LITERATURE

A survey of studies on the topic of badminton revealed that such studies can generally be categorized in one of three broad topic areas. The first grouping of studies dealt with teaching techniques and experimentation with various factors related to learning in general and learning badminton skills specifically. Studies in the second area pertained to the anatomical, physiological, and neurological aspects of man as these factors influence and are influenced by badminton performance. The remaining group of studies were related to the measurement of the student's badminton skills and knowledges. Since the purpose of this study was the construction of tools to measure skill attainment, this review pertains to studies in the skills area of the last category of studies. This review is arranged chronologically in two groupings. The first part of the chapter gives a general overview of studies and skills tests available for various badminton skills. The last part of the chapter is devoted to a more in-depth review of studies and tests devised specifically for measuring skill attainment in the smash and drop shot.

The first available skills tests in badminton began to appear in the late 1930's. Miller (21) mentioned Campbell's (26) 1938 study involving the construction of skills tests for the

serve, forehand return, backhand return, and control. Edgren and Robinson (4) offered the reader several skills tests in the badminton section of their book, Group Instruction in Tennis and Badminton. This group of tests included a smash test which will be discussed later in the chapter. These two sources seemed to mark the beginning of more objective and scientific attempts at skill measurement in badminton.

Throughout the 1940's these beginnings were expanded as research in badminton skill test construction increased. Scott (24) and a committee of several other women constructed achievement exams in badminton which included skills tests for the short serve and the high clear. These tests were drawn from a previous unpublished study conducted by French in 1940. The tests were found to be highly reliable for beginning through advanced players with beginners showing a bit less consistency in performance. Validity coefficients were variable and somewhat questionable for the beginners, but consistently higher for the more advanced players. These two tests reappeared quite frequently in subsequent badminton literature.

In the same year, Scott (37) attempted to evaluate badminton playing ability through the use of tests for reaction time, wall volley, and singles playing ability in an equated doubles situation. The author used subjective judges' ratings and ladder tournament standings as criteria in estimating the validity coefficients for his tests. Although Scott found his volley test and playing test to be highly reliable and valid, his study warrants

further investigation due to the small number of subjects he used.

Two studies involving skills tests were completed in 1945. Boldrick (25) constructed a battery of badminton skills tests in order to find an objective and scientific measure of skill in badminton. Her seventy subjects were administered tests in the low and high serve, the forehand and backhand lob, the forehand drop, and the smash. Boldrick used four different criteria thus allowing her to determine which criteria gave the most statistically sound validity coefficients. A coefficient of .60 was preset as the lowest acceptable coefficient of reliability and validity. Using this standard, the author had to reject all tests except the high serve, and the forehand and backhand lob. One of the unique features of this study was the robot machine Boldrick used for setting shuttles. She had hoped to eliminate any variables caused by using a human setter but decided the machine may have been detrimental to the subject's performance.

Williams (40) undertook the other study completed in 1945. She constructed a battery of tests for the long and short serve, the forehand and backhand clear, and a variety of drop shots. All the validity coefficients were relatively low; the highest coefficient was a .55 for the backhand clear. Reliability coefficients were stepped-up using the Spearman-Brown Prophecy Formula. These coefficients generally fell in the .60 and .80 range except for one test which had a coefficient of -.50. The tests were subjected to statistical analysis and various batteries were thus devised. The

various batteries produced validity coefficients ranging from .43 upward to .68.

The lone study completed in 1946 was a revision of the Boldrick (25) tests conducted by Davis (27). Davis was able to obtain only thirty-seven of the original seventy subjects used in the Boldrick study. Most of the test revisions were minor except for the elimination of the robot setting machine and the drop shot test. Davis obtained reliability coefficients which exceeded the pre-set .60 level, but only the forehand and backhand lob tests could exceed this mark in the area of validity.

The last studies conducted in the 1940's were done by two teams of researchers. French and Stalter (18) constructed a preliminary battery including tests for footwork, wrist volley, the smash, the clear, and the short serve. Following administration and statistical analysis, the researchers recommended a battery including the shuttle test for footwork, the wrist volley test, and French's (24) original tests for the clear and short serve. This battery, recommended by the two authors, represented the battery they thought gave the best measure of badminton playing ability.

The final study conducted in the forties was done by Lockhart and McPherson. (20) Up to this date all the researchers attempting to measure badminton playing ability had used a combination of tests as opposed to the single test used by these two authors. The wall volley test produced a validity coefficient of .71 $\pm$ .06 against a criterion of subjective ratings. A

reliability coefficient of .90 ± .03 was obtained. These coefficients would suggest that the test was fairly sound statistically. In addition, the test proved to be economical of time, equipment, and testing space.

Badminton skill test construction decreased in the 1950's. Royer (36) attempted to find a sound battery among tests for the wall volley, the cross-court serve, the short serve, the long serve, the clear, and the backhand. The author worked with slight variations in scoring and calculated her validity and reliability coefficients using each of the variations in scoring, and criteria of form ratings, tournament standings, general playing ability ratings, and a combination of the three. The tests for the wall volley, the short serve, the long serve, and the clear were quite similar to the tests discussed by Scott and French (11) in their book, Evaluation in Physical Education. Royer recommended five different batteries with validity coefficients above .72. The most highly recommended battery consisted of the clear test and the 15-second volley test.

Scott and French (11) discussed five badminton skills tests in the book mentioned above. The tests included the short serve and high clear tests by French, the long serve test by Scott and Fox, the wall volley test by Stalter, and the shuttle footwork test by French and Stalter.

Miller (21) planned to measure badminton playing ability and thus chose to observe an amateur badminton championship to choose the most important skills to test. She constructed a wall

volley test which demanded that the subject perform the skills essential to the performance of a good clear, the stroke most frequently used in the previously mentioned observations. The restraining line distance and the height of the wall line were determined by way of a cinematographical analysis of an expertly executed clear. The one hundred female subjects performed consistently in a test-retest situation as demonstrated by a reliability coefficient of .94. The test also produced a high validity coefficient of .83 when a criterion of round robin tournament standings was used with twenty of the subjects.

The remaining study of the 1950's was conducted by Shields. (38) Shields constructed footwork and body control tests, and used the clear, short serve, shuttle footwork, and wall volley tests devised by French and Stalter. (18) With the exception of the short serve and clear tests, all reliability coefficients were above .90. Validity coefficients were estimated using the Miller wall volley (21) as a criterion. The resulting coefficients were below .63 except for the Stalter wall volley. (18) Tests for the clear, shuttle footwork, 15-second lunge and reach, and wall volley were included in the battery recommended by the researcher.

Badminton skill test construction once again increased as the 1960's progressed. Greiner (29) constructed a short serve test that credited each serve with points according to the height, depth, and lateral deviation of the serve. The author worked with two forms of the test, one with a net and the other without a net. Greiner was able to claim content validity since the test called

forth the elements she deemed essential to the performance of a good short serve.

Hicks (32) constructed a battery of tests for the purpose of measuring badminton playing ability. She administered the tests to pilot groups and then submitted the tests to a panel of experts for revisions. Following revision of the five tests, the author administered the tests to sixty-four women subjects. Out of a battery of five tests, Hicks found only her clear and smash tests to be reliable and valid. The validity coefficients for the two tests were .60 and .54 respectively.

A placement test constructed by Johnson (33) was completed in the same year as the Hicks (32) study. Johnson hypothesized that her test would predict playing ability better than the tests published previous to her study. The test allowed the subject to return a driven serve set with any stroke but allotted the highest point values to drop shot returns. The subjects' returns were limited to straight sideline returns. Johnson obtained a reliability coefficient of .59 and a validity coefficient of .66. She concluded that the test did not adquately discriminate between the better and poorer players.

The Davis (28) study involved the combination of two already existing service tests into one test. Working with two groups of men subjects, the author combined a short serve and long serve test in such a way that the subjects were alternately delivering the two serves. Although Davis obtained very different validity coefficients for her two groups, she combined the data for the groups and obtained a combined validity coefficient of .70.

Kowert's (34) study was an attempt to establish a battery of badminton performance tests for men. All the tests used by Kowert were previously constructed by other researchers. The tests used by the author included the French clear and short serve (24), the Greiner short serve (29), the Miller wall volley (21), the French and Stalter wrist volley and smash (18), and the Scott and Fox long serve. (11) Analysis by the Doolittle method produced a coefficient of .85.

Performance of the high serve was the concentration of the McDonald (35) study. The author constructed her test for all skill levels and assumed face validity. The test proved to be more reliable for the beginning level subjects tested. A reliability coefficient of .83 was obtained when the performance of the whole group of subjects was stepped up using the Spearman-Brown Prophecy Formula.

A study involving the construction of a wall test for the short serve was completed by Washington (39) in 1968. The various forms of her test were validated against a modified version of the French (18) short serve test. Washington found that the wall practice her subjects experienced was of no significant benefit toward improving performance in the short serve. She obtained low coefficients for all the forms of her test.

Poole (10), in his book, Badminton, presented skills tests for seven different skills. These tests covered the smash, overhead and net clears, overhead and net drops, and the low and high serves. All the tests called for the subject to set the shuttle

for his own trials. Scoring patterns utilized the areas most commonly recognized as the "best" for the stroke being tested. This particular aspect of these tests and other tests discussed in this review will be discussed in the next chapter. Poole failed to give any statistical information on the tests, and thus the reader was left with no indication of the statistical soundness of the tests.

The most recent study reviewed was completed in 1970 by Hale. (31) Her test for the long serve was constructed to measure height, depth, and placement variance from a preset target. Evaluation of each of the previously mentioned factors allowed the author to claim content validity for her test. Reliability coefficients were obtained with the Feldt-McKee analysis of variance and were all extremely high.

The literature discussed to this point represents a general overview of the badminton skills tests available to most teachers. The next portion of this review will be devoted to a more detailed discussion of the skills tests constructed to ascertain the level of performance in the smash and drop shots.

The Edgren and Robinson (4) wall skill test for the badminton smash appeared to be one of the first smash tests available. The subject smashed the set at a four by two-foot wall target twelve feet from the smashing line. The wall target consisted of three concentric rectangles beginning at a height of five and one-half feet above the floor. All hits were executed on shuttles set to the hitter over a ten-foot high rope. Although the authors

suggested five trials for the other tests in the badminton section, a specific number of trials was not mentioned in relation to the smash test. No statistical data were given concerning the reliability, objectivity, or validity of the test.

Boldrick (25) included skills tests for the smash and forehand drop in her battery. Test subjects were required to make very little movement preliminary to hitting since a robot setting machine consistently set shuttles to the same approximate spot. Subjects executed smashes from a spot on the center line four feet behind the short service line. The best ten trials out of twelve attempts were used for scoring purposes. Smash target areas allotted points of five, three, and one to the mid-court sidelines, mid-court, and shallow mid-court forward to the short service line (Figure 1, page 15). A validity coefficient of .33 was obtained for the smash test with a criterion of points earned against a standard player. The reliability coefficient obtained for the smash test was .59. Subjects taking the drop shot test executed the shot from the center line five feet forward of the back boundary line. This test only used two target areas for scoring. The five point area included that half of the area between the net and short service line closest to the net and extended the width of the doubles court. Three points were allotted to the area in the other half of this space nearest to the short service line (Figure 2, page 16). A criterion of subjective ratings was used in obtaining a validity coefficient of .22. The reliability coefficient of .24 was determined by the odd-even method, the same method used to determine the smash reliability.

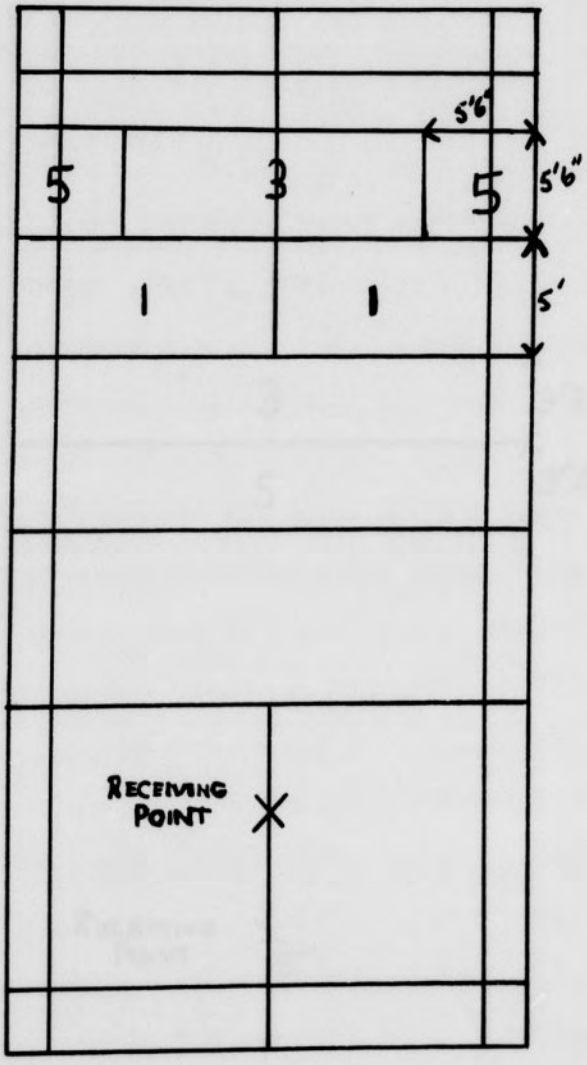

FIGURE 1

BOLDRICK SMASH TEST TARGET

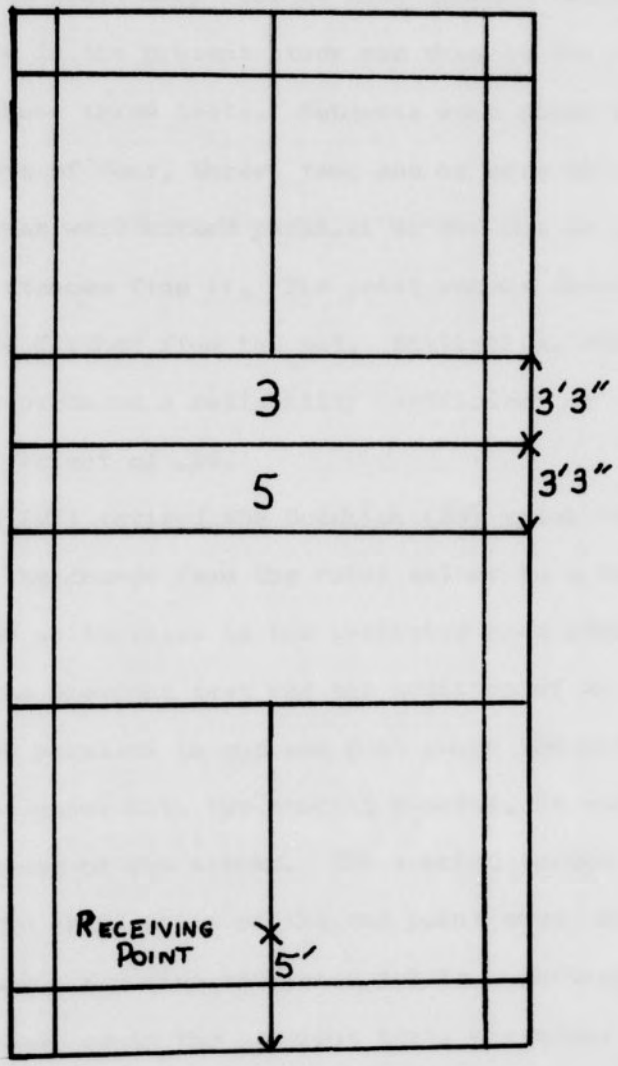

FIGURE 2

BOLDRICK DROP TEST TARGET

In the same year, 1945, Williams (40) devised three drop shot tests as part of a seven item battery. The Williams' tests were for the back court drop, the hairpin drop, and the crosscourt drop. The back court drop test is most closely related to the skill measured in the present study and thus is the only one discussed from these three tests. Subjects were given ten trials and allotted points of four, three, two, one or zero on each trial. The target areas were marked parallel to the net at one, two and three-foot distances from it. The point values decreased as the shuttle landed farther from the net. Statistical evidence obtained by the author produced a reliability coefficient of -.50, and a validity coefficient of .19.

Davis (27) revised the Boldrick (25) smash test during her 1946 study. The change from the robot setter to a human setter was accompanied by an increase in the receiving area (Figure 3). Another change from the previous test was the addition of an invisible black thread running parallel to and one foot above the net. Although the thread did not enter into the scoring process, it was used to judge the effectiveness of the stroke. The scoring target revisions resulted in the elimination of the one point area, and a rearrangement of the areas for five and three points. Instead of two separate five point areas, as in the previous test, one area, extending the width of the doubles court, was used. This change caused the three-point area to occupy an area farther from the net than previously (Figure 3). The reliability coefficient obtained through the odd-even method was a .70 and was stepped up to .80. A validity

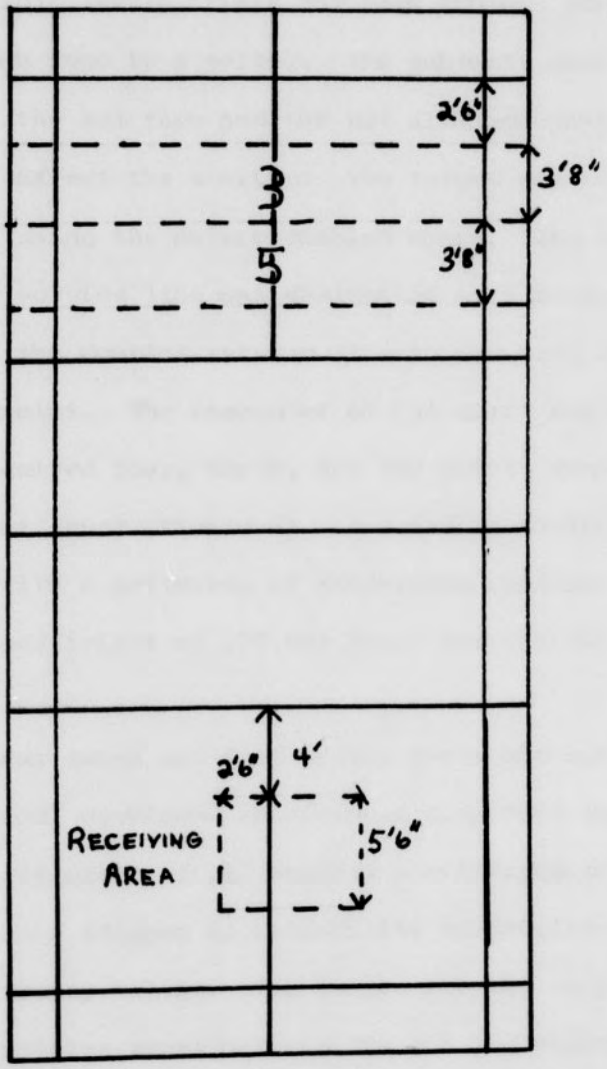

FIGURE 3

DAVIS SMASH TEST TARGET

coefficient of .45 was produced with a criterion of subjective ratings.

Another skill test for the smash was constructed by French and Stalter. (18) Twenty trials for each subject were set over a seven-foot high rope by a setter. The subjects were directed to smash between the set rope and the net although their failure to do so did not affect the scoring. The target was divided into five scoring areas using the entire doubles court. The area between the net and short service line was designated as a five-point area. The area from the doubles service line to the back boundary was allotted one point. The remainder of the court was divided into thirds and received four, three, and two points respectively, going deeper into the court (Figure 4). A validity coefficient of .13 was obtained with a criterion of subjective ratings. A stepped up reliability coefficient of .73 was found for the fifty-nine subjects tested.

The next smash and drop skills tests did not appear until 1967. Hicks (32) developed an overhead drop test that produced a validity coefficient of .17 against a criterion of judges ratings of that skill. A stepped up reliability coefficient of .62 was obtained for twenty trials. The target for the drop test had four areas. The sideline areas between the net and short service line were worth five points. Three points were allotted to shuttles landing between these two five point areas. An area running parallel to these areas but deeper than the short service line was worth one point (Figure 5). Shuttles were set to the left,

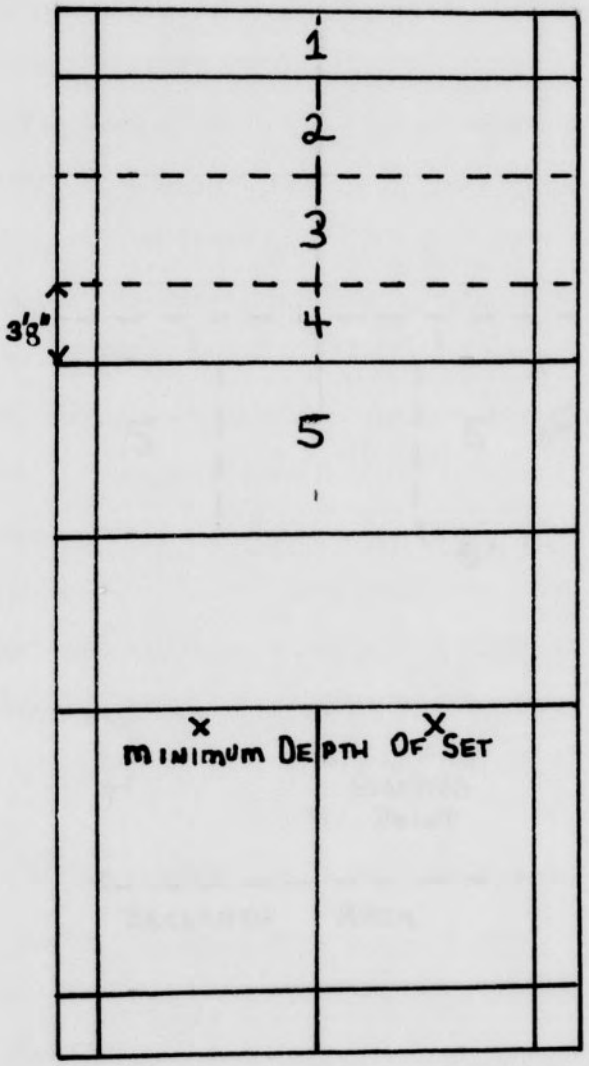

FIGURE 4

FRENCH AND STALTER SMASH TEST TARGET

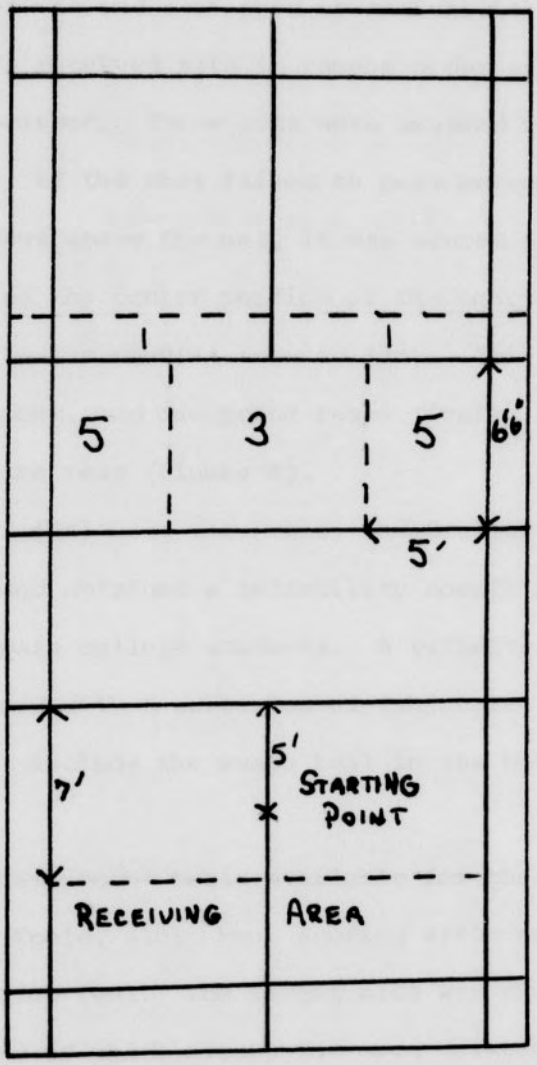

FIGURE 5

HICKS DROP TEST TARGET

right, and middle in random order over an eight-foot three-inch high rope. These sets were to be returned between this rope and the net by the subjects. Hicks' smash test produced a validity coefficient of .54 and a stepped up reliability coefficient of .83. Subjects received sets in random order as in the drop shot test just discussed. These sets were smashed from the rear portion of the court. If the shot failed to pass between the net and the rope, three feet above the net, it was scored a zero trial. The target occupied the center portion of the court from the short service line to the doubles service line. This area was worth three, five, four, and one point respectively, from the front of the court to the rear (Figure 6).

Kowert (34) used the French and Stalter (18) smash test in his study and obtained a reliability coefficient of .67 in working with male college students. A validity coefficient of .38 was obtained with a criterion of subjective ratings. The author did not include the smash test in the batteries he recommended.

The most recent tests available for the smash and drop were found in Poole. (10) Four scoring areas were designated for the overhead drop test. The target area was divided into four sections, three of which occupy the area between the net and the short service line. Points for these areas went from high to low as one moved from the net toward the rear of the court (Figure 7). The ten trials suggested by the author were taken from the rear of the court. Statistical data were not offered by the author although

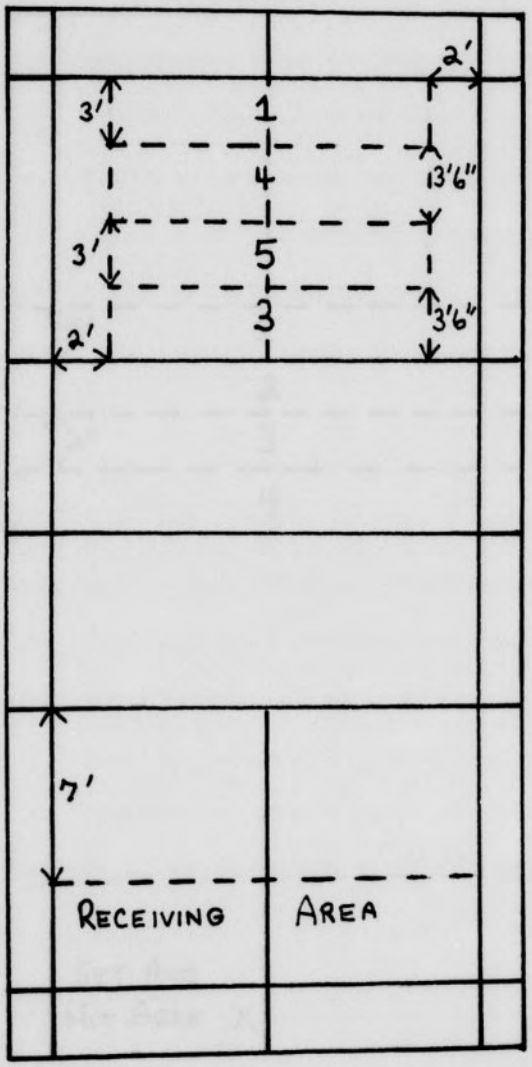

FIGURE 6

HICKS SMASH TEST TARGET

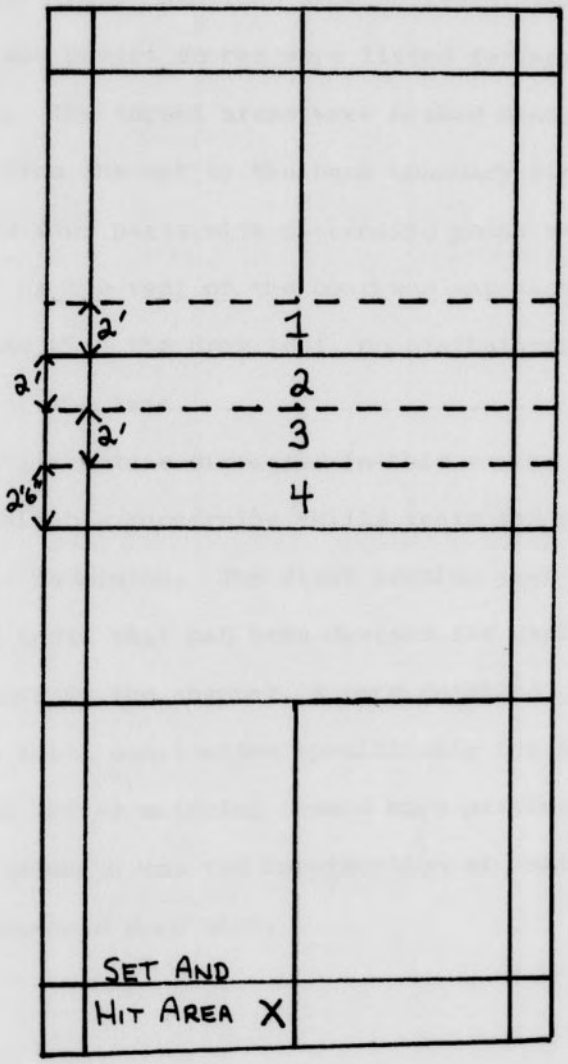

FIGURE 7

POOLE DROP TEST TARGET

he suggested a preset scale as appropriate for various levels of proficiency at the preliminary and final testing stages. The smash test devised by Poole followed the same general pattern as the drop shot test. Shuttles were self-set, ten trials were suggested, and preset scores were listed for various levels of proficiency. The target areas were marked along the singles sideline areas from the net to the back boundary line. This area was divided into four parts with descending point values from four through one as the rear of the court was approached (Figure 8, page 26). As with the drop test, no statistical data were offered in support of the test.

The literature discussed in this review represents that material available concerning skills tests and skill test construction in badminton. The first section gave a fairly general overview of tests that had been devised for various badminton skills. Later in the chapter, a more detailed discussion covered the various tests constructed specifically for the smash and drop shots. This latter material seemed more pertinent to the concern of this study which was the construction of skills tests for the smash and overhead drop shot.

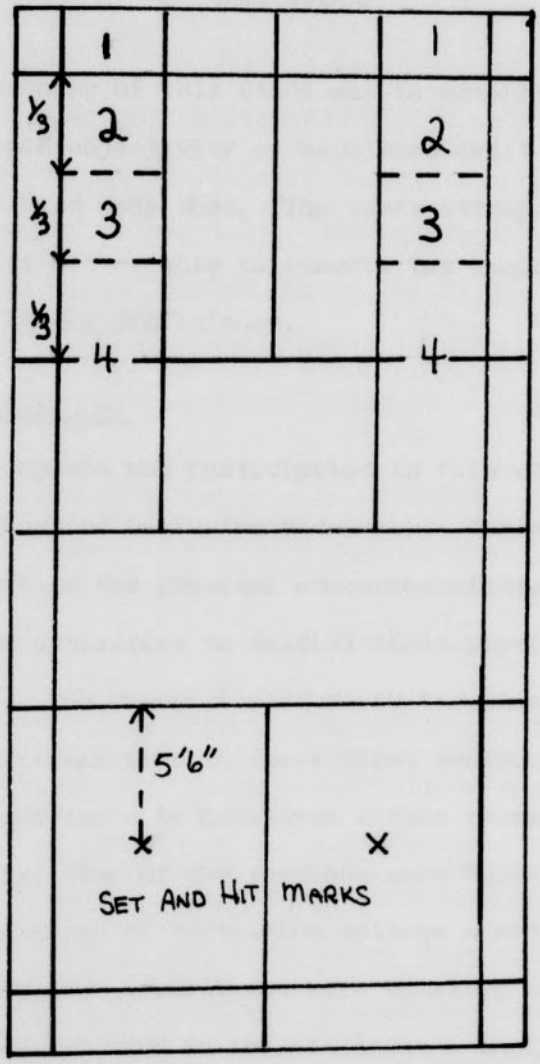

FIGURE 8

POOLE SMASH TEST TARGET

CHAPTER III

PROCEDURES

The purpose of this study was to establish the validity, reliability, and objectivity of badminton skill tests for the smash and overhead drop shot. The tests attempted to distinguish between players better able to execute the smash and drop strokes and those of lesser proficiency.

Selection of Subjects

The subjects who participated in this study were enrolled in three sections of beginning badminton. These sections were offered as part of the physical education classes from which students chose activities to fulfill their physical education requirements at The University of North Carolina at Greensboro. All the students enrolled in these three sections had little or no previous experience in badminton either recreationally or instructionally. Two of the sections were taught by the same instructor. A total of forty-five college women participated in the study. Although several men were enrolled and took the tests, their data were not used in the statistical analysis because of the small number involved.

Test Construction Concerns

The test construction process began with a critical look at the various elements of the already existing smash and drop

shot tests. The elements of major concern that arose out of that examination were the flexibility of the scoring pattern, the procedures of setting, and the likeness to a game situation. The Poole (11) tests for the smash and overhead drop were originally considered for use in the study. Later it was decided that these tests did not allow the flexibility desired. All the tests reviewed for this study had an established target that did not change during the administration of the test. Such a target worked on the assumption, generally with the backing of experts, that there are certain areas on the court that are most appropriate for the placement of a specific stroke. This researcher thought such a target created an ungamelike testing situation. In such an isolated situation, it could be questioned as to how well these tests have measured playing ability.

In discussing and defining skill, Knapp stated,

> . . . games players must take action which is appropriate and, therefore, the skill involves interpreting the needs of the situation and making the right decision as well as carrying out the necessary movements. (8:3)

Most of the tests did not allow the interpretation so essential to performance in a game of badminton. The targets were pre-established and unchanging. Often the setting situation was limited so that very little decision making or movement was involved in preparation for the delivery of the stroke. The targets used in previous studies would seem to have ruled out the use of appropriate but varied responses in a game situation. A sideline or mid-court area may or may not be the best placement for a smash,

depending on location of one's opponent and various other considerations. The previous tests would seem to be measuring a player's ability to hit a target in a situation void of decision making and isolated from the game situation, instead of measuring ability as related to the game or a specific stroke. With these elements in mind, the construction of the smash and overhead drop shot tests began.

Pilot Work

The fifteen subjects used in the pilot work were of various skill levels in badminton, beginning through advanced. The size and make-up of the group varied from situation to situation. It was thought that such a group of subjects could offer criticism and insight into the testing situation from a background of experience as well as a background similar to that of the subjects in the study.

Following the decision not to use the Poole (11) tests, pilot work began on the use of a battery run robot setting machine. Although the machine consistently set the shuttles to a height of more than ten feet and a depth of twelve to fourteen feet, its use was ruled out. The nine to ten-second pause between sets slowed down the planned testing time sufficiently to require two days rather than one to complete the testing. In addition, the machine was found to be distracting to the individuals who worked against it in the pilot work. A third factor in the rejection was the subject's impaired view of the target side of the court. An effort

was made to overcome these faults by investigating the possible construction of a duplicate machine modified to run on electrical power. The cost, time and lack of a craftsman to carry out this project made this solution prohibitive; therefore, the use of the robot setter was dropped from consideration.

The second stage of pilot work concerned the use of the Sony video-taping equipment. The researcher had planned to video-tape the subjects taking the tests and then submit these tapes to a panel of five judges. This arrangement would widen the population from which judges could be drawn because of the flexibility of scheduling involved. When studying the tapes made during experimentation, it was discovered that the equipment was not sophisticated enough to pick up the fast flight of the shuttle on the smash. As a result, the plan to video-tape the tests was dropped. The video-taping plan was once more investigated when only three of six judges were available on the testing days. The equipment was found to be satisfactory when used in conjunction with the overhead drop shot.

The next stage of pilot work involved the construction of two rating scales to be used as criteria in establishing the validity of the tests. These scales were constructed in such a way that form was of little consideration except insofar as it affected the mechanical performance of the stroke. The major elements essential to the performance of an effective stroke were picked out by the researcher. These elements were then arranged in the sequence in which they appeared in the execution of the

stroke. Brief paragraphs were constructed to describe the five beginning skill levels listed in the rating form. These two rating scales, one for the smash and one for the overhead drop shot, were submitted to a panel of six judges who made suggestions to make them more workable. New rating scales were constructed using the suggestions they offered. These scales met with the approval of all six judges and thus were used in the study. These scales appear in the Appendix.

Pilot work continued on the elements essential to the administration of the tests. The next stage of pilot work involved testing the "targets" to be used during the administration of the tests. These were not true targets but served to section off the target area so that the recorders could easily transfer the placement of each shot from the floor to the score sheet. The smash target was the largest of the two and would have taken the most time to mark out on the floor for each testing. In an effort to alleviate this time consuming process, two nine by twelve-foot light weight plastic tarps were joined along the twelve-foot side in such a way that their outer edges met the inner edges of the singles sidelines, and their front edge met the short service line. On this larger tarp, the section lines were mounted permanently so that the entire target could be folded up and later replaced without remeasuring or remarking. These section lines were made of bright orange lawn chair webbing and were mounted with two-way-stick carpet tacking tape. The entire smashing tarp was held in position with strategically placed pieces of masking tape. The

target was found to be quite durable and withstood the wear and tear of pilot work and testing with very minimal damage. This wear and tear included being walked on by the setter and retrievers as well as taking up and replacing from use to use.

The materials used for the drop shot test sectioning target included the lawn chair webbing and the two-way stick tape. These lines were measured to the appropriate size and then permanently mounted to each other and marked as to the exact placement on the court. This series of lines was simply unrolled and secured to the floor with several pieces of masking tape. The materials used in these targets were inexpensive, light weight, easy to obtain, easy to work with, durable, and easily seen by both the recorders and subjects.

Next, the "opponent representatives" to be used in the tests were checked. In both tests, five-foot tall representatives served to mark different positions of an opponent on the target side of the court. Each representative was made of a four-foot long, three-quarter inch diameter wooden dowel on which was mounted a five-inch wide, eighteen-inch long strip of heavy tag board painted different colors with Tempra paint. The dowels were mounted in the center hole of a three-hole red brick, the bottom of which was padded to protect the wooden gymnasium floor. An illustration of the target representatives appears in the Appendix on the court diagrams for the smash and overhead drop shot tests. The purpose of the pilot experiment was to determine the final positioning of the representatives and to ascertain whether these particular

instruments would serve the function for which they were constructed. The pilot subjects experienced no difficulty in working with the target representatives and, in fact, commented on the enjoyment and challenge they experienced in that particular work.

In the smash test the final positioning of the two rear dowels was changed to the inside of the two front dowels so that they could be viewed without obstruction. The materials used to construct these instruments were inexpensive and light weight, making them very portable.

As pilot work continued, experimentation with the positioning of the video-taping camera for filming the drop shot subjects was undertaken. Several subjects were filmed for the purposes of deciding angle and height of the camera. This film was used for training purposes and evaluated by the raters concerning possible improvements for viewing in the final study. An increased lateral angle for final filming was adopted as a result of the raters' recommendations.

Final pilot work, resulting in a variety of changes, was carried out during the training sessions for raters, recorders, and setters. Work done in conjunction with the setters and pilot subjects resulted in increased areas for the testee to receive the set. These areas can be found marked on the test diagrams in the Appendix. The recorders on both tests experienced difficulties in transferring shot placements to the score sheets because of positioning and the gross sectioning of targets. Observation positions were changed from the sideline areas to a rear mid-court

position to alleviate the first problem. In an attempt to correct the transfer problem, small black tapes were placed at established intervals on the sectioning lines and similar lines were placed on the scale size score sheets. A copy of the score sheets may be found in the Appendix. Both the positioning and sectioning corrections seemed to work satisfactorily in further training sessions. The pilot sessions and changes just discussed played a major role in determining the final procedures to be used in testing, as well as testing the practicality and workability of the smash and overhead drop shot tests.

Test Descriptions

Both tests were constructed to operate along the same basic pattern and on the same basic rule of strategy. The strategy rule says the best placement for a smash or overhead drop shot is out of reach of the opponent. In the smash, this includes shots to the body because of the difficulty encountered in handling such a shot. Employing this rule causes the opponent to move more and thus fatigue sooner, and/or to make a weak return jeopardizing his position further. The test pattern forces the subject to execute strokes from both the left and right receiving courts, and to place these shots in relation to the opponent representative functional for that trial.

In the smash test, the subject is given twenty trials and has five different opponent positions to work against. The setting pattern is arranged in such a way that each position is attacked four times, twice from the right receiving court, and twice from

the left receiving court. This pattern also allowed the researcher to compare strokes from the left and right on each position with similar strokes in an odd-even analysis for reliability.

The overhead drop shot test worked in the same fashion as the smash test. The subject received twenty trials but had only two opponent representatives to work against. The setting pattern was arranged so that an odd-even analysis could be used for establishing reliability. Thus, each half being compared included drops from the left and right and straight and cross-court drops from each of these sides.

Further information concerning the tests can be found in the directions to the setters, recorders, and subjects in the Appendix section.

Training Sessions

Raters. Raters had a single training session held at the end of the week previous to testing. Questions were answered and discussions took place concerning the two rating forms. The raters first worked on rating several subjects from video-tape. These ratings on the overhead drop shot were discussed to clarify questions and bring the judges closer together on their ratings. This same tape was then re-rated by the judges. After discussion on these ratings, and a bit more rating and viewing, the raters and researcher thought the ratings were sufficiently close to go on to the rating form for the smash. Smash ratings were done live, compared, and discussed. The raters continued to rate until each had

an understanding of their own discrepancies, and could reach a consensus of opinion on the same subject. This combined session gave the raters an opportunity to become familiar with the rating situation as well as the rating forms. The training session time involved a total of two and one-half hours.

Setters. The setters' first training session met at the same time as that for the raters. Training for these assistants involved learning the standards and procedures to be followed for each of the tests as well as setting practice. Instructions for the setters appear in the Appendix. After questions were answered concerning the instructions and procedures for setters, a practice session was held. Two hours of practice left the setters feeling insecure about their ability to carry out their duties without error; therefore, a second practice session was scheduled for the next day. This next session lasted an hour and one-half and prepared the setters well to carry out their duties.

Recorders. Recorders met on the same training schedule as the setters. Their duties were concerned with accurately transferring the placement of each shot from the floor to the scale size score sheet. Such a task involved learning the exact procedures and symbols, and training oneself to observe the shuttle carefully, record quickly and accurately, and prepare for the next shot. The recorders began to show more proficiency following correction of the difficulties discussed in the pilot work section. At the second session, the recorders received their final preparation

for the testing. Instructions for these assistants also appear in the Appendix. The researcher thought the testing personnel, at the completion of these training sessions, were well prepared to handle all the administrative aspects of testing.

Administration

Pre-administrative preparation included a brief visit to each of the three sections involved in the study. On this visit, subjects were introduced to the use of the opponent representatives and given an opportunity to practice smashes and drops using these substitutes. Other duties completed previous to testing included coding of the rating and scoring sheets, and setting up all equipment.

The classes of thirteen, fourteen and eighteen women were tested in the twelfth week of a fourteen-week instructional period. All the testing was done in the eight and nine o'clock time slots on two successive mornings. The testing period, including instructions by the researcher, consumed approximately 45-50 minutes per class.

The equipment used in the testing included two regulation badminton courts and nets, one for each test. Four tightly strung nylon metal shafted rackets were provided for the use of the setters and subjects. Each setter was given thirty new Carlton nylon indoor shuttlecocks in a box which was placed on a knee high stool. All the raters and recorders were provided with the proper pack of forms coded in color for the class and assistant, and

number coded for the subjects. In addition, a Sony video-recorder, monitor, portable camera and tripod were set up near the drop shot testing station.

The subjects were gathered together in a group and given the standardized instructions for subjects included in the Appendix. The subjects were also told the purpose of the study, the function of the different individuals involved in the testing, and the purpose of the video-taping equipment. Questions were answered and examples were given to clarify points questioned by the subjects. The subjects were encouraged to do their best and were informed that the results of the tests would only be identified by number and thus the results would not be used for grading purposes. This point was emphasized since students in all three sections showed visible signs of anxiety concerning the possibility of using test results for grading. The subjects were instructed to go to the testing stations in groups of three to begin, to retrieve their birds after they were tested, and then to get another person to replace them before going on to the next test or to the free courts. Subjects who had not taken the tests were encouraged not to sit on the sidelines watching but to practice on the other two courts.

The subjects taking the smash test were rated by three judges using the form discussed earlier in the chapter. Six judges had originally been asked to assist in the study, thus making it possible to rate two courts or both tests. Due to schedule conflicts only three of the judges were available for all three

testing times. Therefore, it was necessary to video-tape the subjects taking the drop shot test. The filming was done by the researcher with the occasional aid of a subject who called, "out," when the drop shots landed outside the test boundaries. These tapes were played back to the judges later in the week and rated.

Testing progressed with very few problems. The raters, recorders, and setters cooperated closely to maintain smooth and accurate testing sessions. The data from the recorders and raters were collected for analysis.

Analysis

The first step of analysis was the scoring of the trials recorded for each subject. This was done by hand, by the researcher, through the use of scoring overlays. Acetate sheets cut to the desired size were used for the overlays. The scoring patterns were drawn on these sheets with colored pens especially made to mark overlays. The scoring pattern itself consisted of concentric circles using the opponent representative positions as the center of the circle. A different overlay was needed for each position, making a total of five for the smash test, and two for the overhead drop test. Each overlay was coded with the trial numbers for that position and the side from which the shot had come. The point system worked on the basis of the strategy rule stated earlier in this chapter and can be seen on the overlays included in the Appendix section. The appropriate overlay was placed on the score sheet, the desired trial number was sought out and scored according to which circle it was in.

The circle sizes for both tests were founded on the same rationale. In the smash test, the smallest inner-most circle and cone were high point value areas. The circle with a radius of one foot, and its three-foot radius cone were equivalent to an area in which a shot directed at the body or feet of an opponent would land. Two slightly different sides were established for the cones on any one overlay, because the four trials for that sheet came from both the left and right sides of the court. These sides marked the widest possible angle a shot could come from on a particular side, passing within a foot and a half of the position, and still land in the cone area. The cone sides were coded by color with their matching trial numbers to speed the scoring process. Reference to the smash overlays in the Appendix will serve to clarify the appearance of these cones. Similar tangent lines were drawn off the five-foot radius circle to prevent shuttles passing through the low point area from scoring high points by landing in a deeper high scoring area. An inner circle of the radius just mentioned marked an area considered to be easily accessible to an opponent with a single step in any direction. Each additional circle increased its radius by three feet, a distance the researcher thought could be covered easily by each additional step an opponent might take. The scoring pattern for the circles will be discussed in the next section. The entire system of overlays and score sheets was constructed to facilitate a left-handed scorer by placing the scoring blanks to the left of the overlay, thus eliminating the necessity of reaching across the overlay to record.

Two slight variations in scoring were employed in analyzing the data for each test. The first method worked strictly on the strategy rule employed during testing, that is, to hit directly at the opponent or as far away as possible. In this method, the drop shot inner-circle area was assigned a value of zero, except for a small portion between the net and the short service line. This area was considered too easily accessible to an opponent. Each circle progressively farther from the opponent position received progressively more points. The second scoring method gave additional credit of one point to trials that landed in the area between the net and the first sectioning line because such placement allowed an opponent less time to get to the shot and return it.

A similar plan was followed in scoring the smash data. During the first scoring, the five-foot radius circle area was worth one point. This point was given because, although such a shot could be reached easily by an opponent, it could still force a weak return, unlike a more easily returned shot such as a drop. Each circle progressively farther from the opponent position received progressively more points. In the second method of scoring, the area from the first sectioning line forward to the net allotted an additional point to all trials landing in the area. Exception was made for shots landing in one point areas. Shuttles landing in the rear of the court from the last sectioning line back, lost one point, again with the exception of one point trials. These changes were made with consideration for

the length of time a particular shot was in flight. The front area shots allowed an opponent less time to get to the shot. Rear court shots increased an opponent's possibilities of getting to and returning a shot because of increased time and decreased shuttle speed. Therefore, the second scoring method deleted points from rear court placements. The procedure of recording the landing spot and trial number of each trial allowed the researcher some flexibility in using different scoring procedures within the limitation of the strategy rule employed. Data for both scoring methods appear in the Appendix section of the study.

The second step of analysis involved the statistical treatment of data gathered in the study. All calculations were done by hand on a Friden 1162 electronic calculator. In order to work with the three sections as one group of subjects, the researcher had to determine whether these groups varied significantly from one another. A one-way analysis of variance was used to make this determination. Means and standard deviations were calculated for each section and for the entire group through the use of the raw score method. The Pearson product-moment coefficient of correlation method was used to compute coefficients of validity, reliability, objectivity, and inter-judge correlations for each test. The reliability coefficients were estimated using the odd-even method of calculation and then stepped up using the Spearman-Brown Prophecy formula. All the findings of these statistical procecures are found in the next chapter.

CHAPTER IV

ANALYSIS

The purpose of this study was to determine the validity, reliability, and objectivity of badminton skill tests in the smash and overhead drop shot. The statistical findings presented in this chapter pertain to the objectives mentioned in the purpose of the study.

Following the collection of data and scoring of this data, means and standard deviations were calculated for each of the three groups and for the total forty-five subjects. These means and standard deviations were quite similar for the three groups and between the two scoring methods for each test. This similarity can be seen in an examination of Tables I and II, page 44. A one-way analysis of variance method was used to further determine whether any of the groups had performed significantly different from the other groups. Results presented in Tables III and IV, page 45, show no significant differences in performance between the groups at the .05 level of significance. The author thought these findings showed statistical soundness and thus the three groups were combined and treated as one for further analysis.

Coefficients of correlation for determining validity were calculated using a criterion of total judges ratings on the subject's skill performance during test administration. The

TABLE I

MEANS AND STANDARD DEVIATIONS FOR ALL GROUPS AND BOTH SCORING METHODS FOR THE SMASH TEST

Group	N	Mean Scoring Method - 1	Mean Scoring Method - 2	S. D. Scoring Method 1	S. D. Scoring Method 2
1	13	28.077	28.462	7.392	10.591
2	14	24.500	25.000	11.867	12.086
3	18	25.028	25.528	8.525	8.775
Total	45	25.744	26.211	9.536	10.517

TABLE II

MEANS AND STANDARD DEVIATIONS FOR ALL GROUPS AND BOTH SCORING METHODS FOR THE OVERHEAD DROP SHOT TEST

Group	N	Mean Scoring Method - 1	Mean Scoring Method - 2	S. D. Scoring Method 1	S. D. Scoring Method 2
1	13	30.385	36.500	10.138	13.481
2	14	36.428	41.321	6.845	9.043
3	18	33.778	38.833	11.675	14.359
Total	45	33.622	38.933	10.212	12.803

TABLE III

F RATIOS FOR ANALYSIS OF VARIANCE OF PERFORMANCE FOR ALL GROUPS OF SUBJECTS ON THE SMASH TEST

Scoring Method	Source	Sum of Squares	d.f.	Mean Squares	F Ratios*
1	Between	101.6519	2	50.8259	.5349
	Within	3990.1593	42	95.0037	
	Total	4091.8112	44		
2	Between	94.7775	2	47.3887	.4076
	Within	4882.9670	42	116.2611	
	Total	4977.7445	44		

*$F_{05} >$ 19.47 (d.f. 42, 2)

TABLE IV

F RATIOS FOR ANALYSIS OF VARIANCE OF PERFORMANCE OF ALL GROUPS OF SUBJECTS ON THE OVERHEAD DROP SHOT TEST

Scoring Method	Source	Sum of Squares	d.f.	Mean Squares	F Ratios*
1	Between	246.9610	2	123.4805	1.1665
	Within	4445.6168	42	105.8480	
	Total	4692.5778	44		
2	Between	156.9964	2	78.4982	.4567
	Within	7218.8036	42	171.8768	
	Total	7375.8000	44		

*$F_{05} >$ 3.22 (d.f. 2, 42)

intercorrelation coefficients between the three judges were statistically weak for both tests as shown in Table V. In retrospect, these poor coefficients could be attributed to several possible factors. Possibilities include insufficient training time and rating guidelines, poor quality video film and the time lapse between training and the rating of the films in the drop shot and rater bias.

Although the researcher and judges thought the training time was adequate, more time would probably have set the rating scales more firmly in the minds of the raters. The judges were quite experienced in badminton and thus had formed their own opinions on the make-up of various strokes. These opinions were set enough in their thinking so that a short training session could have been of little benefit. In such a case, observations could be unconsciously tainted by personal opinion to the extent that the elements set forth in the rating scales were of little

TABLE V

COEFFICIENTS OF INTER-CORRELATION FOR JUDGES RATINGS IN THE SMASH AND OVERHEAD DROP SHOT TESTS

Test	Judge 1 vs 2	Judge 2 vs 3	Judge 1 vs 3
Smash	.6333	.5953	.6983
Drop	.4097	.4090	.2265

consideration in the rating observations. A predetermined percentile standard for each level of the scales had been considered as a possible guideline to the judges. This guideline was rejected to avoid having the fulfillment of the percentile take precedent over the honest and objective rating of the subjects. Adoption of such changes could possibly help to improve the coefficients of correlation between the judges if further study with these tests and scales were considered.

The drop shot rating coefficients of .4097, .4090, and .2265 were considerably lower than the coefficients obtained for the smash ratings. A contributing factor could have been the one week lapse in time between the training session and the rating of the video tapes. The judges had a tendency to overuse one particular level of the drop shot scale and not to use all five levels. The video-tape equipment was not able to produce films that clearly and distinctly showed all the elements essential to the raters; one film, in particular, was very poor and almost had to be eliminated. The author would recommend the use of more sophisticated video-taping equipment or the use of raters in a live situation for similar studies.

Coefficients of validity for the smash test (Table VI, page 48), .4065 and .4144, were statistically weak but significant at the .05 level of confidence. These correlations could possibly have been improved if the inter-judge correlations had been higher. A major difficulty at the beginning level of skill is distinguishing whether the stroke delivered is truly a smash.

TABLE VI

COEFFICIENTS OF VALIDITY AND RELIABILITY FOR THE SMASH TEST

Scoring Method	N	Coefficient of Validity	Coefficient of Reliability Odd-Even	Stepped Up Reliability 20 Trials
1	45	.4065*	.3258	.4914*
2	45	.4144*	.3856	.5565*

*$r_{05} > .304$ (d.f. 40)

Use of a rope running above and parallel to the net had been considered, but rejected because it introduced an ungamelike element to the test. Hicks' (32) technique of eliminating trials contacted below head level may have been beneficial in distinguishing and eliminating non-smashed trials. Another improvement to be considered is random placement of trials through the use of shuttles marked for the side and opponent representative. This technique was not practical in the present study because there was not sufficient time to run a test-retest situation for establishing reliability. These considerations could be helpful in improving the statistical soundness of the smash test if further study is undertaken.

The reliability coefficients for the smash test (Table VI), .4914 and .5565, were also statistically weak but significant at the .05 level of confidence. Evidence strongly suggests that

beginners are not consistent performers. This is a possibility which must be considered in these findings. In addition, the subjects' inconsistent performance could be attributed to the structure of the test itself. In twenty trials the subject had only four attempts against any one opponent representative. Of these four trials, only two were from the same side of the receiving court. In analysis for reliability, these two trials were split so that each half of the twenty trials were of like make-up. It is difficult, especially for beginners, to score consistently in an accuracy situation where, in reality, one has only two attempts for each target situation. When one trial is being compared to one other trial, and a series of these situations are combined in analysis, findings can be influenced by extreme scores. Perhaps the reliability of the test could be better established with intermediate through advanced players as originally planned. Another possibility would be to decrease the number of opponent representatives, thus increasing the number of trials for each remaining representative.

The overhead drop shot test produced very poor non-significant coefficients of .1248 and .1332 for validity (Table VII, page 50). These coefficients could be questionable to some extent because of the weak inter-judge correlations. Two slight changes could possibly help to improve the validity coefficients. The beginners in this study had difficulty executing a drop shot that met the performance standards followed in the drop shot rating scale. Most subjects hit high lob flight shots rather

TABLE VII

COEFFICIENTS OF VALIDITY AND RELIABILITY
FOR THE OVERHEAD DROP SHOT TEST

Scoring Method	N	Coefficient of Validity	Coefficient of Reliability Odd-Even	Stepped Up Reliability 20 Trials
1	45	.1248	.5030	.6693*
2	45	.1332	.4171	.5886*

*r_{05} > .304 (d.f. 40)

than the safer descending drop shot. The strokes that took a lob flight and landed close to the net and cross-court from the opponent representative scored as highly as the well executed and strategically safer low shots. Employing a rope similar to the one discussed in the smash test could help differentiate between these two shots. An invisible type material could be used for the rope or string to help prevent the subjects from becoming overly concerned with this element of the test. Use of a random setting order could help make the test more game-like and possibly bring the scores and ratings closer together. If improvements did not occur with these suggestions, the low validity suggests that it might be best to drop the test and start once again.

Coefficients of .6693 and .5886 were obtained in calculating the reliability of the overhead drop shot test (Table VII). Although these coefficients are higher than those obtained for the smash test, they are still statistically weak. One possible

explanation for the higher coefficients is the increased number of trials per opponent representative due to the decreased number of representatives. The only suggestion for improving the reliability is administration of the tests to intermediate through advanced players because of more consistent performance from one testing situation to the next.

To evaluate the soundness of the validity and reliability coefficients just presented, it is essential to know how objective the collection of data was. The objectivity coefficients obtained were .8666 and .9565 for the smash test, and .9866 and .9860 for the overhead drop shot test (Table VIII, page 52). All these coefficients are considered to be very acceptable and sound. The changes in coefficients from the first scoring method to the second method are a result of changes in point values for various areas. Discrepancies between recorders resulted because of slight variations in placements near lines splitting point value areas. This made little difference in totals except in the case of the five-point smash test scoring cone. This cone area was surrounded by a one-point area where a difference in placement would make a four-point difference in the total for each case of this discrepancy. These coefficients suggest that the recording method used in the smash and overhead drop shot tests was very dependable.

The use of the opponent representatives seemed satisfactory. Judging from observations and conversations, the use of these representatives added an interesting and challenging aspect to the tests.

TABLE VIII

COEFFICIENTS OF CORRELATION FOR OBJECTIVITY OF RECORDERS IN THE SMASH AND OVERHEAD DROP SHOT TESTS

Scoring Method	Smash Test	Overhead Drop Shot Test
1	.8666	.9866
2	.9565	.9860

Evaluation of the two scoring methods is difficult. The validity coefficients for both tests improved slightly when the second method was employed (Table VI, page 48, and Table VII, page 50). This would seem to suggest that this scoring method had a closer relationship to the elements rated by the judges. The second scoring method seemed to improve the internal consistency of the smash test slightly as evidenced by an increased reliability coefficient (Table VI, page 48). However, the opposite was true of the reliability findings for the drop shot test (Table VII, page 50). The second method of scoring may have been the better of the two methods, but this cannot be positively stated because the findings obtained in this study did not appear to be significantly different in favor of this method. These findings are also dependent on the weak inter-judge correlations in relation to the findings on validity.

All the findings reported in this study are limited to beginning level college women. Suggestions for improvements and changes are provided where the author thought these changes could be carried out without eliminating the game-like quality of the tests. Conclusions drawn from these statistical findings are presented in the next chapter.

CHAPTER V

SUMMARY AND CONCLUSIONS

The purpose of this study was to establish the validity, reliability, and objectivity of badminton skills tests for the smash and overhead drop shot. These tests attempted to distinguish between players better able to execute the smash and drop strokes and those of lesser proficiency.

The tests were administered to forty-five women students during the twelfth week of fourteen-week instructional service classes in beginning badminton at The University of North Carolina at Greensboro. Subjects had little or no previous experience in badminton recreationally and/or instructionally. Three sections or classes were tested in the study and later combined into one group of forty-five subjects.

A one-way analysis of variance was used to determine whether there were any significant differences between the performances of the three groups on the smash and drop shot tests. No significant differences in performance were found thus allowing the three groups to be combined into one group of subjects. In addition, means and standard deviations were calculated for each of the groups and the total group on both tests by means of the raw score method. The means and standard deviations also revealed similar performances between the three groups on each of the tests.

The Pearson product-moment coefficient of correlation method was used to calculate the validity, reliability, objectivity, and inter-judge correlation coefficients for the smash and drop shot tests. Statistical findings revealed weak coefficients of correlation for reliability on both tests, and inter-judge agreement on the smash test. Coefficients of validity for the smash and drop shot tests, and inter-judge agreement on the drop shot test were low; the drop shot test validity was the lowest coefficient obtained. Analysis of the objectivity of both tests produced quite high coefficients of correlation.

CONCLUSIONS

1. There were no significant differences between the performances of the three sections of beginning badminton players tested.
2. Weak inter-judge coefficients of correlation make the findings on validity for both tests questionable.
3. Recording methods for both the smash and overhead drop shot tests were highly objective.
4. The coefficient of validity for the smash test was weak, leaving question as to whether the test really measured the ability to smash.
5. The coefficient of validity for the overhead drop shot test was extremely low, showing that the test probably did not measure the ability to perform the overhead drop shot.

6. The coefficient of reliability for the smash test was weak, leaving question as to whether the test consistently measured the same skill.
7. The coefficient of reliability for the overhead drop shot was weak, leaving question as to whether the test consistently measured the same skill.

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APPENDIXES

APPENDIX A

Evaluation of the Smash
Evaluation of the Overhead Drop

EVALUATION OF THE SMASH

SCALE: 5 - Excellent 4 - Good 3 - Average 2 - Fair 1 - Poor

EXCELLENT

Moves quickly Reaches high Contacts ahead of body Angled toward floor Forceful hit Good placement Consistent	Moves quickly and is able to hit from a balanced position. Reaches high and contacts shuttle high and ahead of the body. Shot is steeply angled toward the floor and well placed within the boundaries and out of reach of the opponent, includes shots to the body. Shuttle is hit with enough force to maintain good speed to where it is being hit. Player is consistent.

GOOD

Moves quickly Reaches high Contacts ahead of body Generally well angled Generally forceful Generally well placed Generally consistent	Player generally meets the requirements for "EXCELLENT" but is less consistent in hitting fast, steep, well placed shots. The inconsistency may be in one aspect such as moving soon enough to deliver a shot from a balanced position, or it may be a lack of edge on the total of the components mentioned above.

AVERAGE

Less balanced in hitting Good contact high and ahead Less forceful Placement not always the best	Player usually moves quickly but is forced to hit from unbalanced positions occasionally. Contacts the shuttle high and ahead of the body, but hits less forcefully thus causing deeply placed shots to slow down quickly.

FAIR

Inconsistent in: Moving quickly, Reaching high, Contacting ahead of body Imparting force, and Making good placements	Player does not move quickly enough and/or soon enough to hit from a balanced position. Player is not consistent in reaching high and/or contacting the shuttle ahead of the body. Hits less forceful shots and with less angle. Inconsistent at placing shots with regard to opponent's position, but usually places within the court boundaries.

POOR

Does not execute shot or does so very poorly	Moves slowly, seldom has enough time to deliver the required stroke. Seldom reaches high or contacts the shuttle ahead of the body. Places shots poorly, usually out-of-bounds or with poor angle and to the opponent's racquet.

CLASS: _____ NUMBER: _____ RATING: _____

JUDGE: _____

NOTE: This rating scale appeared on one page in its original form.

EVALUATION OF THE OVERHEAD DROP

SCALE: 5 - Excellent 4 - Good 3 - Average 2 - Fair 1 - Poor

EXCELLENT

Moves quickly
Reaches high
Contacts perpendicular or ahead of body
Descends from contact
Passes close to tape
Well placed
Consistent

Moves quickly and is able to hit from a balanced position. Reaches high and contacts the shuttle high and perpendicular or just in front of the body. Shot descends from the contact and passes close to the tape falling to the floor close to the net and out of the opponent's reach. Player is consistent.

GOOD

Moves quickly
Reaches high
Contacts perpendicular or ahead of body
Generally descends
Generally passes close to tape
Generally well placed
Generally consistent

Player generally meets the requirements for "EXCELLENT" but is less consistent in delivering a descending shot which passes close to the tape, and falls to the floor close to the net and away from the opponent. The inconsistency may be in one area of these components, or it may be a lack of edge on the total of the above requirements.

AVERAGE

Less balanced in hitting
Good contact
Passes tape higher
Falls deeper in court
Placement not always the best

Player usually moves quickly but is forced to hit from unbalanced positions occasionally. Contacts the shuttle high and perpendicular or slightly ahead of the body, but does not have as fine a control over the height and depth of the shot delivered.

FAIR

Inconsistent in: Moving quickly, Reaching high, Contacting properly, Delivering descending shots, Making good placements	Player does not move quickly enough and/or soon enough to hit from a balanced position. Player is not consistent at reaching high and/or contacting the shuttle perpendicular or slightly ahead of the body. Shots do not pass close to the net tape, and fall to the floor deeper in the court. Is inconsistent at placing shots with regard to opponent's position, but usually places within bounds.

POOR

Does not execute shot or does so very poorly	Moves slowly, seldom has enough time to deliver the required stroke. Seldom reaches high or contacts the shuttle in the correct position. Places shots poorly, usually out-of-bounds or to the opponent.

CLASS: _____ NUMBER: _____ RATING: _____

JUDGE: _____

NOTE: This rating scale appeared on one page in its original form.

APPENDIX B

Smash Test Sectioning Target and Receiving Area

Overhead Drop Shot Test Sectioning Target and Receiving Area

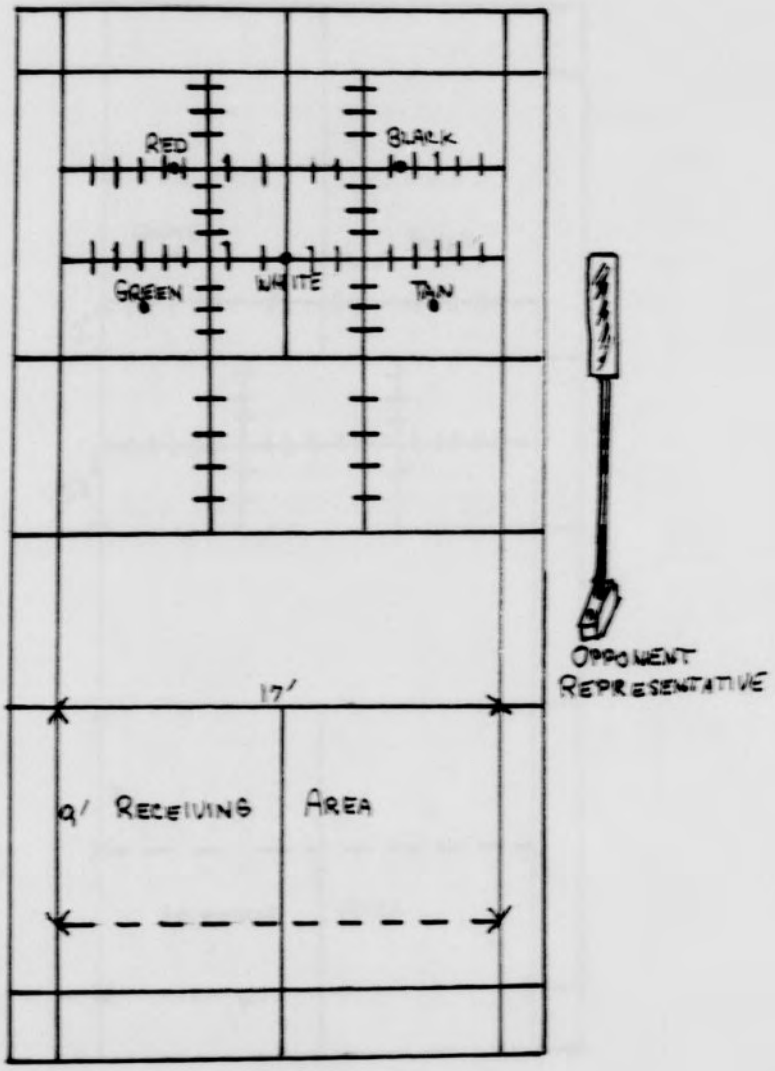


FIGURE 9

SMASH TEST SECTIONING TARGET AND RECEIVING AREA

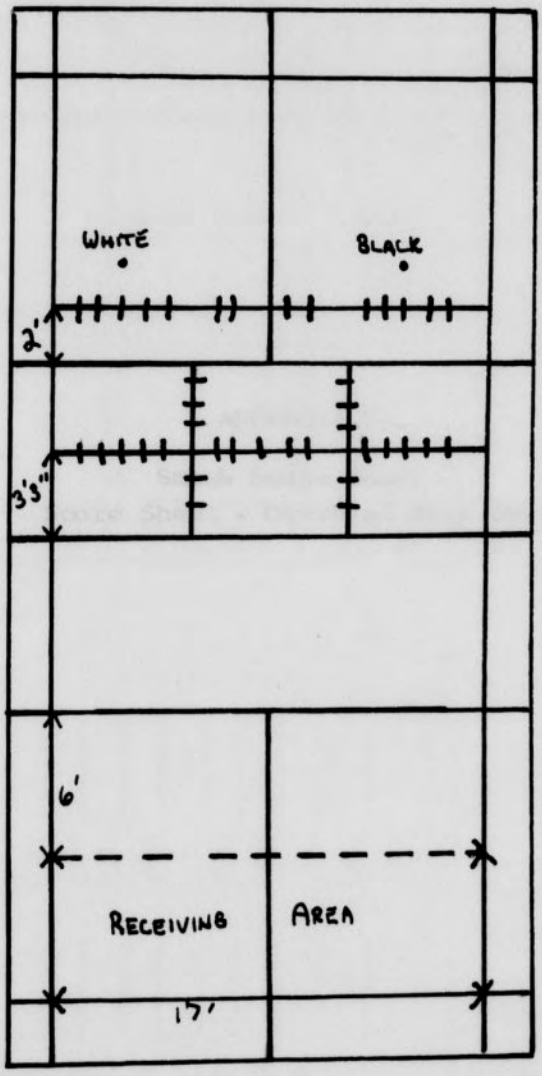


FIGURE 10

OVERHEAD DROP SHOT TEST SECTIONING
TARGET AND RECEIVING AREA

APPENDIX C

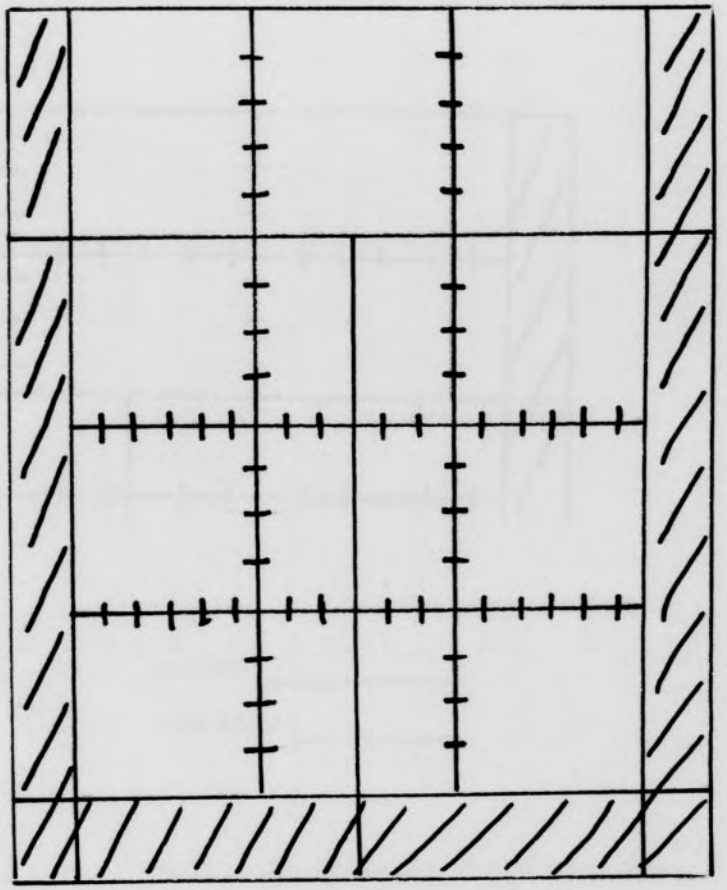
Smash Score Sheet
Score Sheet - Overhead Drop Shot

SCORE SHEET FOR THE SMASH TEST

Class: _____ Subject: _____

TRIALS	ODD	EVEN
1. _____	1. _____	2. _____
2. _____	3. _____	4. _____
3. _____	5. _____	6. _____
4. _____	7. _____	8. _____
5. _____	9. _____	10. _____
6. _____	11. _____	12. _____
7. _____	13. _____	14. _____
8. _____	15. _____	16. _____
9. _____	17. _____	18. _____
10. _____	19. _____	20. _____
11. _____		
12. _____	_____	_____ TOTALS
13. _____		
14. _____	RATING _____	
15. _____	RECORDER _____	
16. _____		
17. _____		
18. _____		
19. _____		
20. _____		

_____ TOTAL



NOTE: Score sheet scale size for original was ¼/ft.

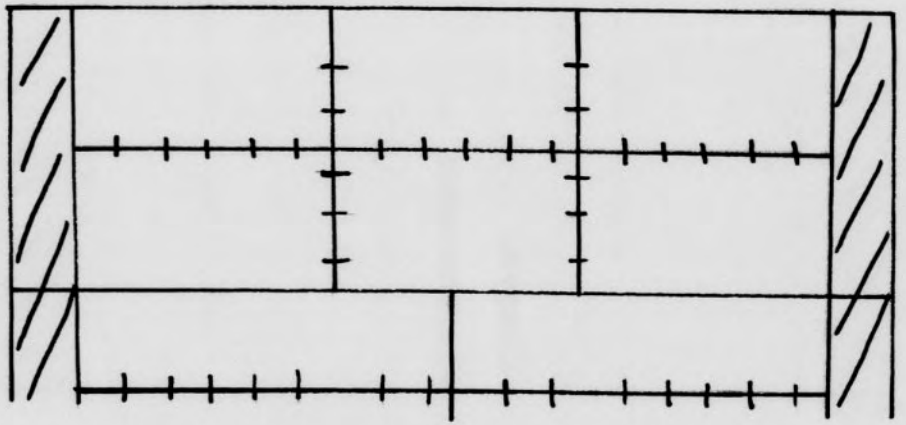
SCORE SHEET FOR THE OVERHEAD DROP SHOT TEST

Class: _____ Subject: _____

TRIALS

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____
13. _____
14. _____
15. _____
16. _____
17. _____
18. _____
19. _____
20. _____

_____ TOTAL



	ODD	EVEN
	1. _____	2. _____
	3. _____	4. _____
	5. _____	6. _____
	7. _____	8. _____
	9. _____	10. _____
	11. _____	12. _____
	13. _____	14. _____
	15. _____	16. _____
	17. _____	18. _____
	19. _____	20. _____
TOTALS	_____	_____

RATING _____

RECORDER _____

NOTE: Score sheet scale size for original was 3/8"/ft.

APPENDIX D

Instructions for Tests

INSTRUCTIONS TO SUBJECTS - SMASH TEST

This test is designed to measure how well you place your smash in relation to your opponent's position. The different colors will represent different positions of your opponent. The colors are tan, green, red, white for the setter, and black. The setter will call the color as she sets the bird; place your shot according to the color called.

A good smash will pass close to the top of the net and be directed at the target, or at a spot within the boundaries but as far out of your opponent's reach as possible. The boundaries will be the singles sidelines as far back as the doubles deep service line. Birds landing on boundary lines are counted as good.

You will have twenty trials. You must receive the set between the masking tape line and the short service line within the singles sidelines. Any sets you think will land outside this area can be rejected so long as you do not attempt to hit the bird. Simply call "no" and let the bird fall to the floor. You will be allowed another attempt to hit any sets you reject.. If you attempt to hit the set after calling "no," it will be counted as a trial. If you forget to call "no" and do not attempt to hit a trial, it will be counted as a zero.

The setter will be ready to set the next trial as soon as your last shot hits the floor and is recorded. Be prepared to move and hit again immediately following each hit. You will be required to hit from both your left and right courts. A ready

position in the middle of the court a few feet behind the short service line will best prepare you to move to either side.

If you find yourself hitting several shots in a row into the net, or out of bounds, relax and try hitting for the center of the court or a bit higher. When you regain your control, begin to place your hits to the best areas again.

DROP SHOT TEST INSTRUCTIONS

This test is designed to measure how well you place your overhead drop shot in relation to your opponent's position. The two colors will represent different positions of your opponent. The colors are black and white. The setter will call the color as she sets the bird; place your shot according to the color called.

A good drop shot will pass over the net close to the tape and land close to the net and out of your opponent's reach. The best shot is one landing as close to the net and as far out of your opponent's reach as possible. The boundaries will be the singles sidelines as far back as the second orange line. Birds landing on boundaries will be counted as good.

You will have twenty trials. You must receive the set between the masking tape line and the doubles deep service line within the singles sidelines. Any sets you think will land outside this area can be rejected so long as you do not attempt to hit the bird. Simply call "no" and let the bird fall to the floor. You will be allowed another attempt to hit any sets you reject. If you attempt to hit the set after calling "no," it will be counted as a trial. If you forget to call "no" and do not attempt to hit a trial, it will be counted as a zero.

The setter will be ready to set the next trial as soon as your last shot hits the floor and is recorded. Be prepared to move and hit again immediately following each hit. You will be required to hit from both your left and right courts. A ready

position in the middle of the court a few feet behind the short service line will best prepare you to move to either side.

If you find yourself hitting several shots in a row into the net, or out of bounds, relax and try hitting for the center areas or a bit higher. When you regain your control, begin to place your hits to the best areas again.

INSTRUCTIONS TO SETTER FOR THE SMASH TEST

Sets should be high enough to give the subject time to move into position and hit the required shot. Sets must be deeper than the short service line and not beyond the back setting line marked on the floor. The singles sidelines will serve as the side boundaries for your sets. The subject can choose to reject a set she feels is bad but she must do so by saying "no" and allow the shuttle to fall to the floor. If a set is rejected, the next set will be to the same side and the same color must be called. Do not reset if the subject fails to call "no" or attempts to hit the shuttle.

The first set will be to the subject's right service court, the next to the left, and continue to hit right-left until you have set 10 shuttles. On the 11th set, the set goes to the left, then right and continue to alternate in this pattern until 20 trials have been completed.

As you hit, you must also call the color for the subject. The order is tan, green, red, white, and black; there will be a sheet with the order and colors posted for your use. Make sure you follow the order since scoring is done on the assumption of this pre-determined order.

Do not pause between sets except to allow recorders to record; the subject is aware that you will set the next trial immediately. In case of mistakes, stop, find the error, and correct the situation.

SETTING ORDER

Right (your left)	Left (your right)
1 - tan	2 - green
3 - red	4 - white
5 - black	6 - tan
7 - green	8 - red
9 - white	10 - black
12 - tan	**11 - green
14 - red	13 - white
16 - black	15 - tan
18 - green	17 - red
20 - white	19 - black

INSTRUCTIONS TO SETTER FOR THE DROP SHOT TEST

Sets should be high enough to give the subject time to move into position and hit the required shot. Sets must be deeper than the masking tape line and not beyond the rear doubles service line. The singles sidelines will serve as the side boundaries for your sets. The subject can choose to reject a set she feels is bad but she must do so by saying "no" and allow the shuttle to fall to the floor. If a set is rejected, the next set will be to the same side and the same color must be called. Do not re-set if the subject fails to call "no" or attempts to hit the shuttle.

The first set will be to the subject's right service court, the next to the left, and continue to hit right-left until you have set 10 shuttles. On the 11th set, the set goes to the left, then right, and continue to alternate in this manner until 20 trials have been completed.

As you hit you must also call the color for the subject. Make sure you follow the order since scoring is done on the assumption of this order; there will be a sheet with the order and colors posted for your use.

Do not pause between sets except to allow recorders to record; the subject is aware that you will set the next trial immediately. In case of mistakes, stop, find the error, and correct the situation.

SETTING ORDER

Right (your left)	Left (your right)
1 - black	2 - white
3 - white	4 - black
5 - black	6 - white
7 - white	8 - black
9 - black	10 - white
12 - white	**11 - black
14 - black	13 - white
16 - white	15 - black
18 - black	17 - white
20 - white	19 - black

INSTRUCTIONS TO RECORDER FOR THE SMASH

Your job is to record on the score sheet EXACTLY where the cork of the shuttle first hits the floor on each shot. Watch the subject hit the set, follow the bird until you are sure where it is going. Focus your attention on the floor, noting the placement in relation to the floor grid and do the following:

1. Mark a dot on the score sheet where the cork hit.
2. Number the dot with the number of that trial.
3. Mark small but clearly so that the dot and number can be read.

Special Instructions

1. Hitting the net and/or not going over: mark the dot and trial number on the subject's side of the net.
2. Landing out of bounds: mark the dot and number next to the boundary, outside the court.
3. Birds hitting the targets, poles, or setters: mark on the target spot with the dot, number, and a star (*).
4. Birds landing on boundaries should be marked right on the line with the dot, then number; do not mark the dot outside the boundary since such shots are counted as good in scoring.

Some shots will not be smashes; you must decide this and mark the trial as if it did not go over the net (dot, number, and an x next to the number). Cues to non-smashes: shot goes

up rather than down from contact, little or no force behind the shot.

In case of a mistake, stop the setter immediately, find the problem, and correct it, then re-start from the trial you left off on.

INSTRUCTION TO RECORDER FOR THE DROP SHOT

Your job is to record on the score sheet EXACTLY where the cork of the shuttle first hits the floor on each shot. Watch the subject hit the set, follow the bird until you are sure where it is going. Focus your attention on the floor, noting the placement in relation to the floor grid and do the following:

1. Mark a dot on the score sheet where the cork hit.
2. Number the dot with the number of that trial.
3. Mark small but clearly so that the dot and number can be read.

Special Instructions

1. Hitting the net and/or not going over: mark the dot and trial number on the subject's side of the net.
2. Landing out of bounds: mark the dot and number next to the boundary, outside the court.
3. Birds landing on boundaries should be marked right on the line with the dot, then numbered. Do not mark the dot outside the line since such shots are counted as good in scoring.

Some shots will not be drop shots, you must decide and mark the trial as if it did not go over the net (dot, number, and an x next to the number.

In case of a mistake, stop the setter immediately, find the problem, and correct it; then re-start from the trial last set or the correction.

APPENDIX E

Overlay Scoring Sheets for the Smash and Overhead Drop Shot Tests

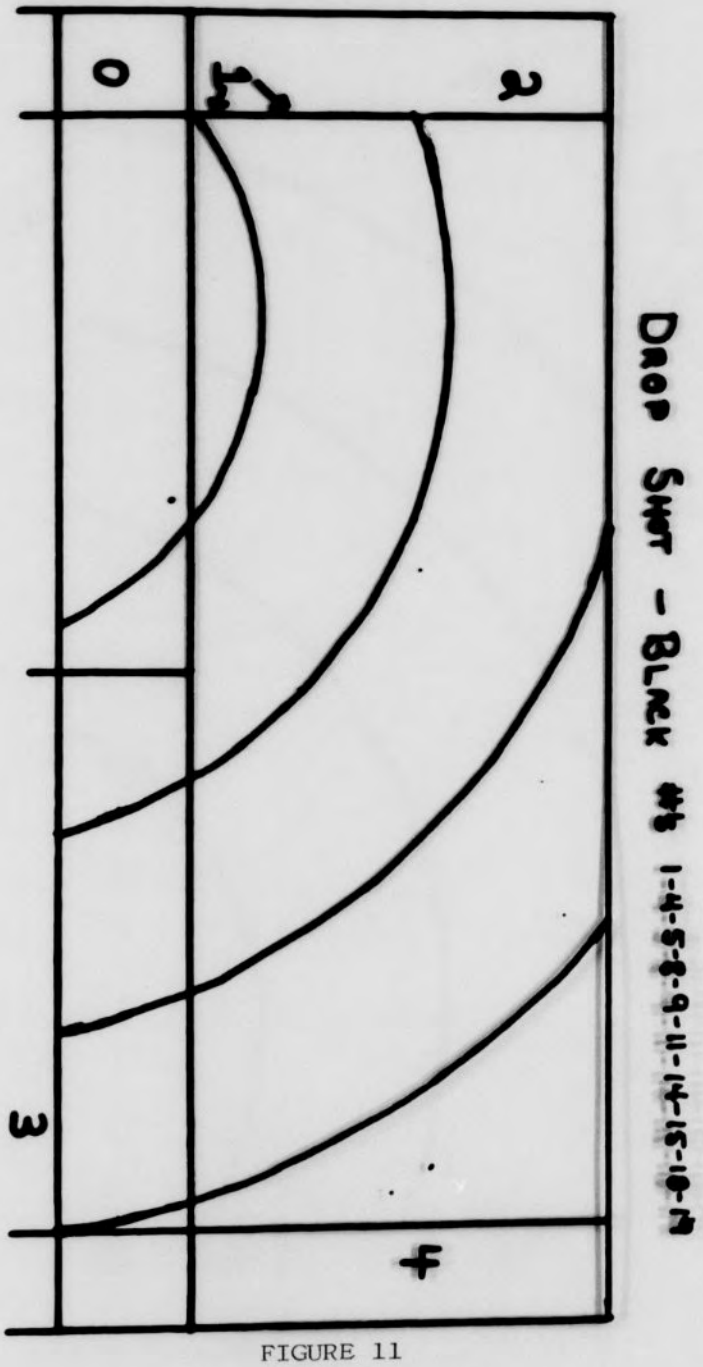


FIGURE 11

DROP SHOT OVERLAY FOR TRIALS 1, 4, 5, 8, 9, 11, 14, 15, 18, 19

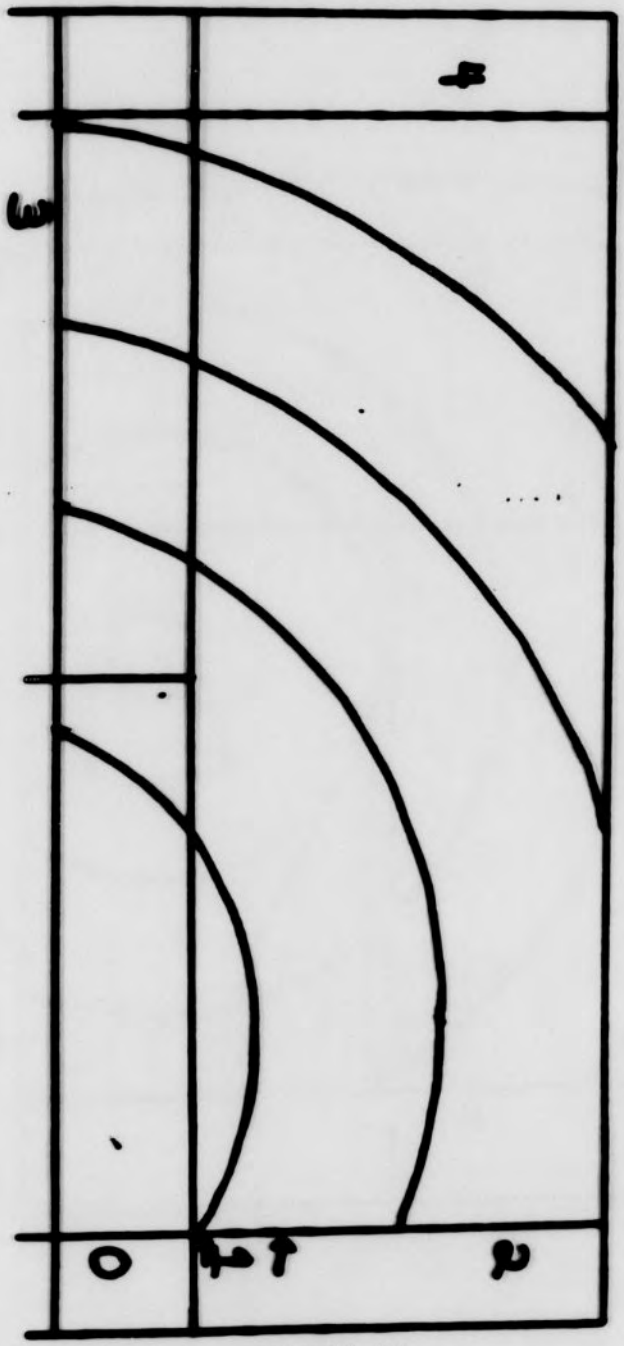


FIGURE 12

DROP SHOT OVERLAY FOR TRIALS 2, 3, 6, 7, 10, 12, 13, 16, 17, 20

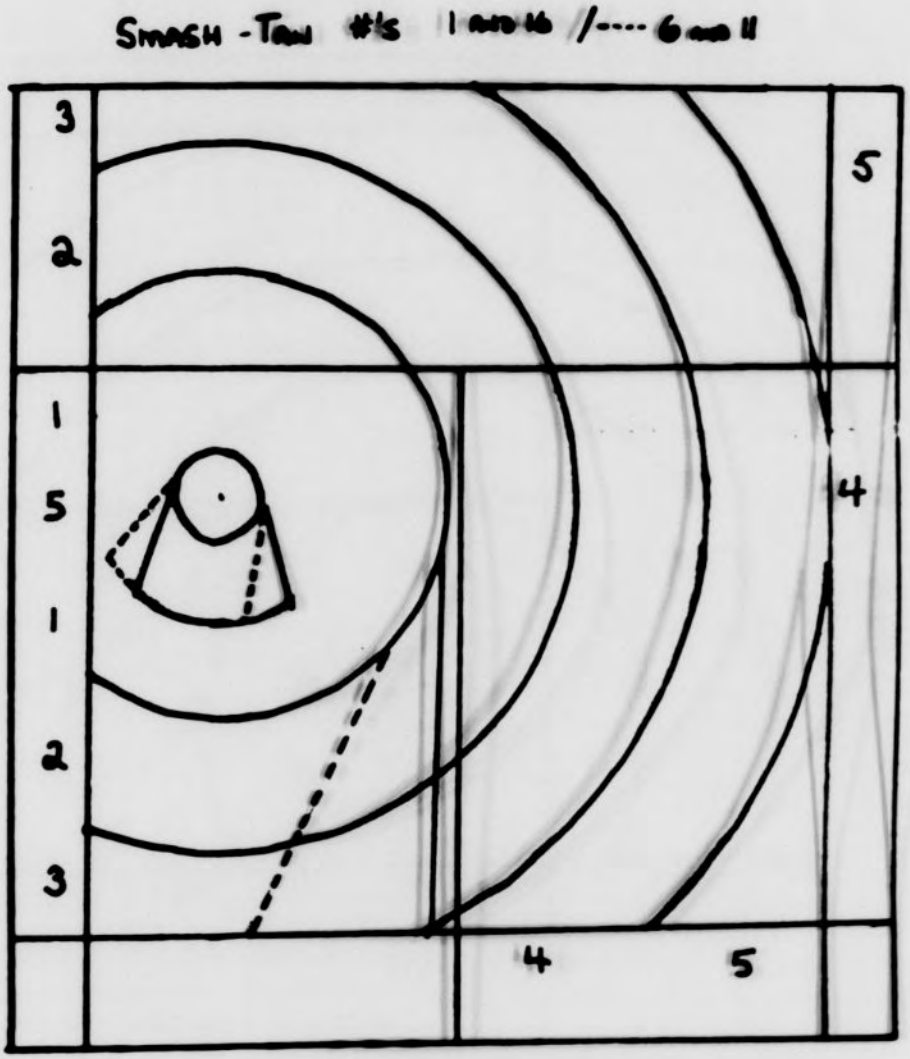


FIGURE 13

SMASH OVERLAY FOR TAN REPRESENTATIVE
TRIALS 1, 6, 11, 16

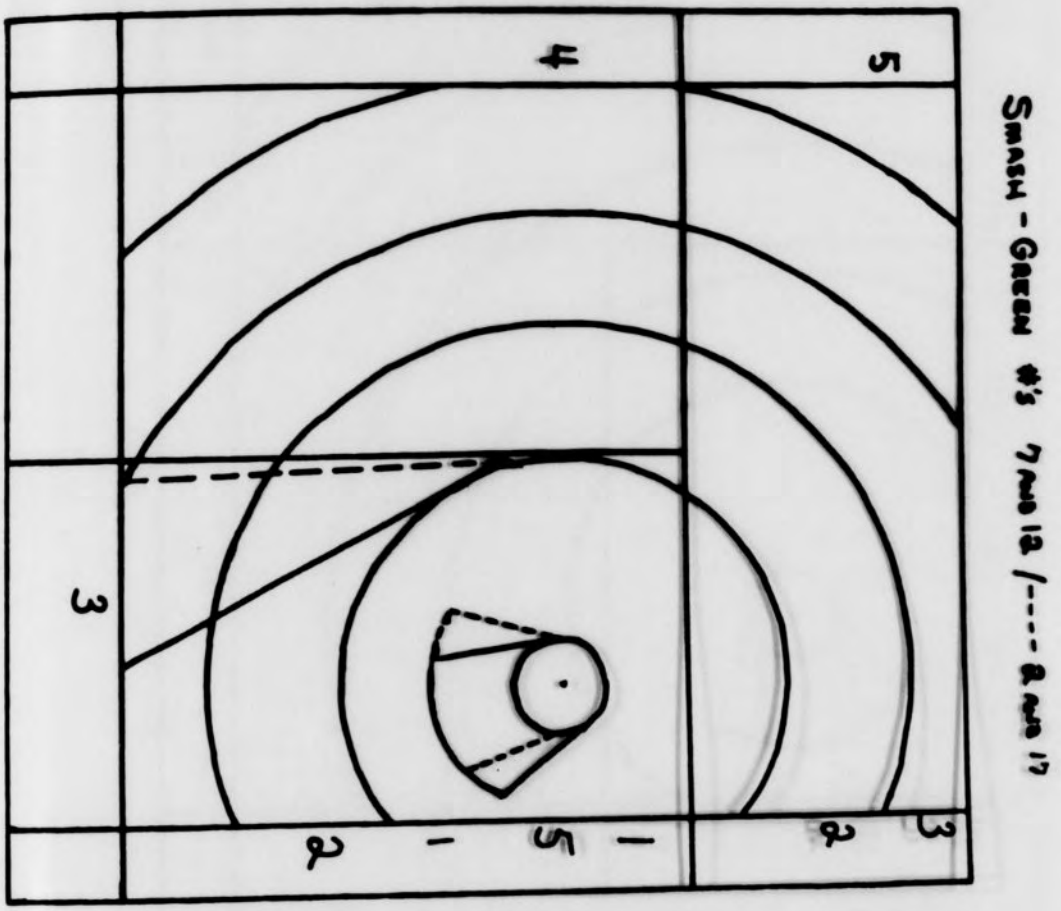


FIGURE 14

SMASH OVERLAY FOR GREEN REPRESENTATIVE
TRIALS 2, 7, 12, 17

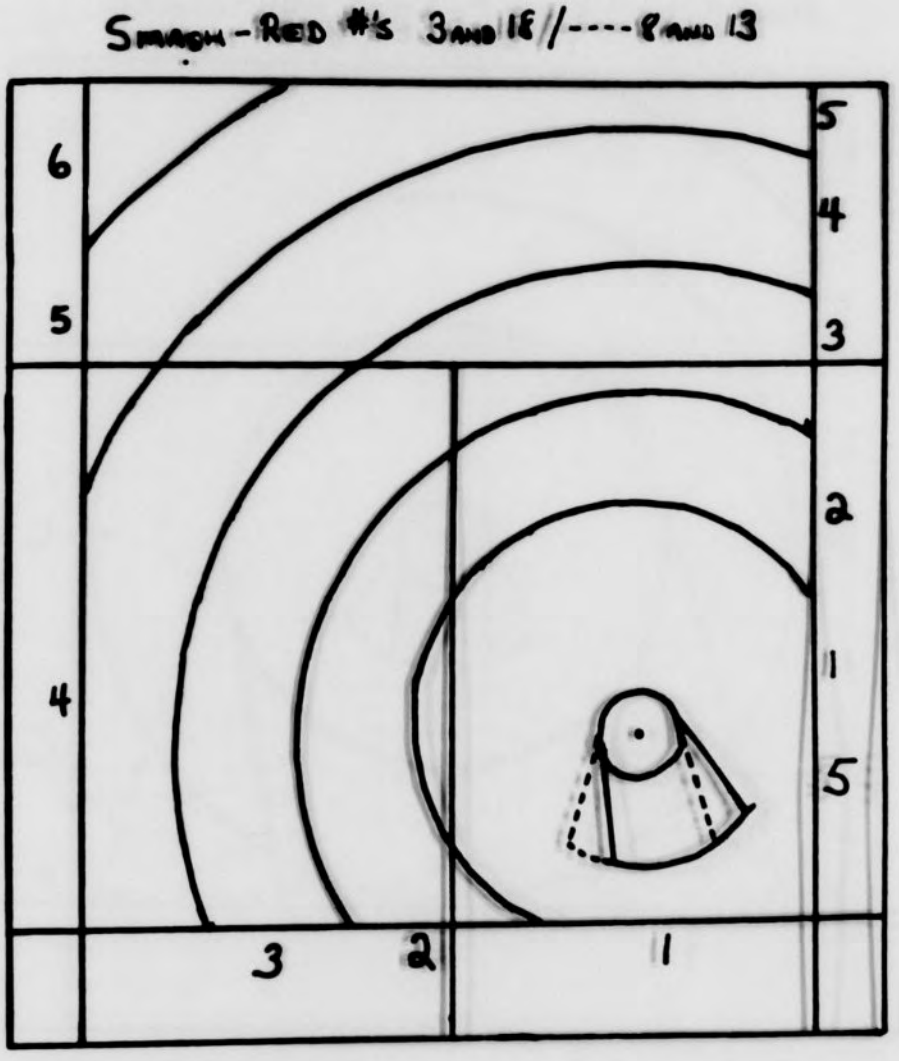


FIGURE 15

SMASH OVERLAY FOR RED REPRESENTATIVE
TRIALS 3, 8, 13, 18

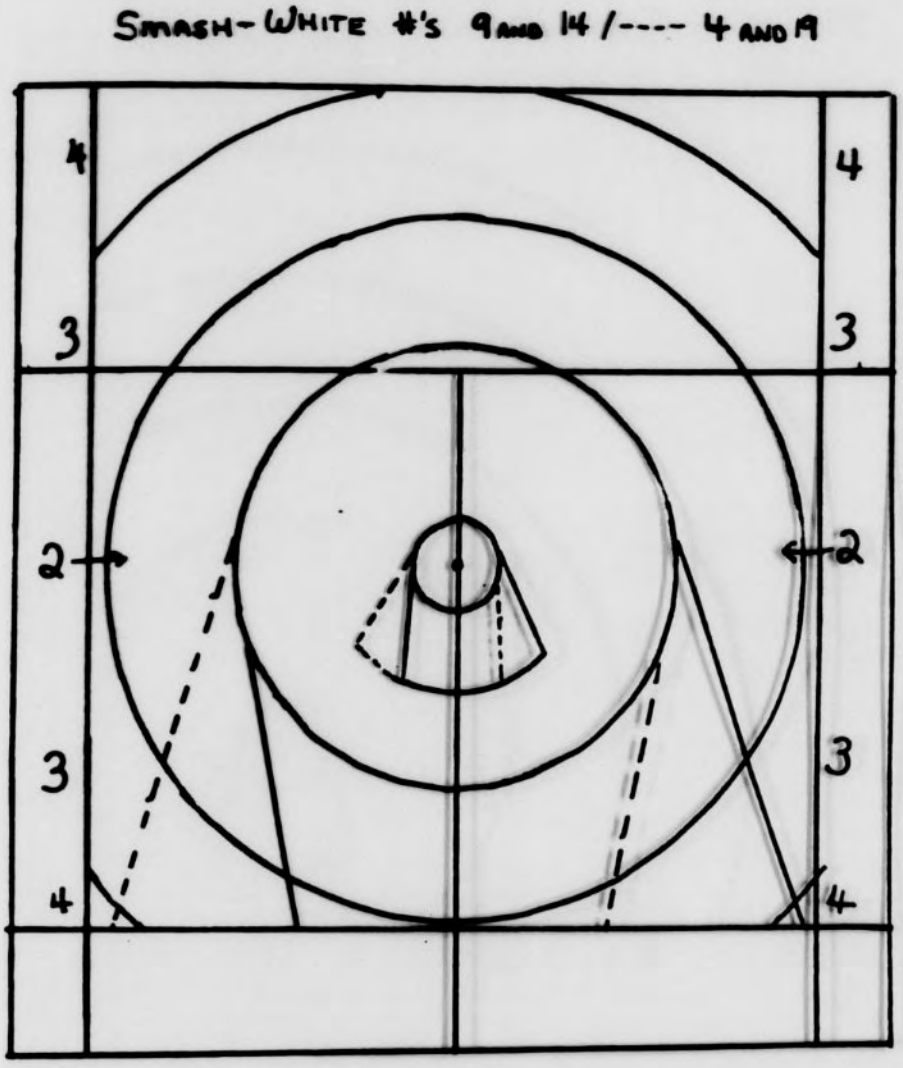


FIGURE 16

SMASH OVERLAY FOR WHITE REPRESENTATIVE
TRIALS 4, 9, 14, 19

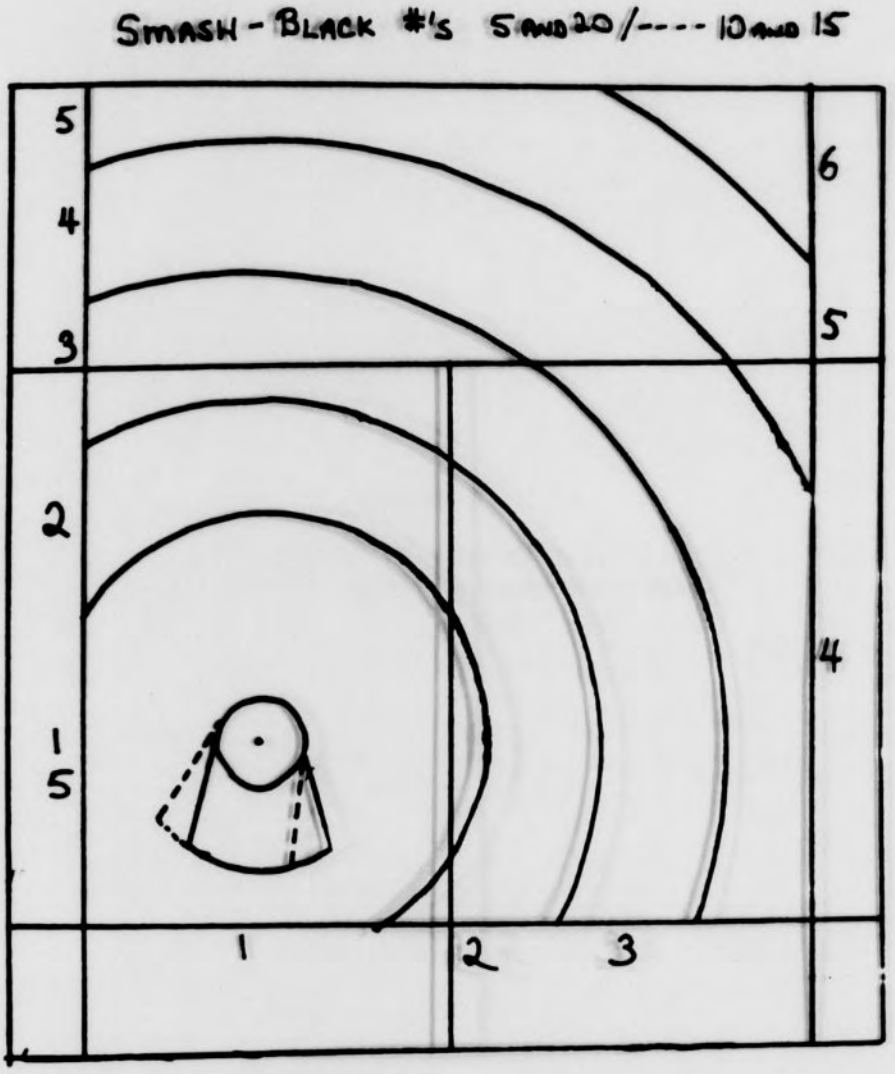


FIGURE 17

SMASH OVERLAY FOR BLACK REPRESENTATIVE
TRIALS 5, 10, 15, 20

APPENDIX F

Raw Data for the Smash Test
Raw Data for the Overhead Drop Shot Test

TABLE IX

RAW DATA FOR THE SMASH TEST

Scoring Method - 1					Scoring Method - 2					Judges Ratings			
Smash	Trials		Recorders		Smash	Trials		Recorders			Judges		
Score	Odd	Even	1	2	Score	Odd	Even	1	2	Total	1	2	3
28	14	14	28	28	29	15	14	29	29	7	2	2	3
19.5	7.5	12	23	16	19	7	12	23	15	8	2	3	3
7	3	4	11	3	7	3	4	11	3	4	2	1	1
23.5	14	9.5	26	21	23.5	14.5	9	26	21	10	3	3	4
33	15	18	35	31	32	15	17	32	32	14	5	4	5
36.5	11	25.5	36	37	37.5	11	26.5	37	38	11	4	3	4
21.5	8	12.5	20	21	21.5	8	13.5	21	22	9	3	2	4
28.5	13	15.5	31	26	28.5	13	15.5	31	26	5	1	2	2
11.5	10	1.5	13	10	12.5	11	1.5	14	11	8	2	3	3
19	10	9	15	23	20	10	10	16	24	6	2	2	2
37	21	16	41	33	37.5	20.5	17	42	33	11	4	3	4
35.5	13	22.5	34.5	36.5	37	14.5	22.5	36	38	4	1	1	2
24	3	21	24	24	25	3	22	25	25	7	2	2	3
21	10	11	21	21	22	10	12	22	22	11	4	3	4
28	10	18	30	26	28	10	18	30	26	10	3	3	4
28.5	11	17.5	29	28	28.5	11	17.5	29	28	8	3	2	3
34.5	17	17.5	33	36	37	18	19	36	38	6	2	2	2
14	5	9	14	14	14	5	9	14	14	7	2	2	3
26.5	22	4.5	29	24	26.5	22	4.5	29	24	7	2	3	2
9	8	1	9	9	9	8	1	9	9	3	1	1	1

TABLE IX (continued)

Scoring Method - 1					Scoring Method - 2					Judges Ratings			
Smash	Trials		Recorders		Smash	Trials		Recorders			Judges		
Score	Odd	Even	1	2	Score	Odd	Even	1	2	Total	1	2	3
40	22	18	42	38	41	22	19	43	39	11	3	4	4
36	18	18	36	36	36.5	18	18.5	37	36	3	1	1	1
33.5	11.5	22	33	34	34	12	22	34	34	7	2	3	2
13	10	3	13	13	13	10	3	13	13	6	1	2	3
27	11	16	29	25	28.5	11	17.5	31	26	9	3	3	3
5.5	5	1	6	5	5	5	-	5	5	9	2	4	3
20	9	11	20	20	20	9	11	20	20	10	2	4	4
48	25	23	48	48	48	25	23	48	48	11	4	3	4
25	14.5	10.5	26	24	26	15.5	10.5	27	25	10	3	4	3
28	12	16	28	28	30	12	18	30	30	6	2	2	2
20	12	8	20	20	20	12	8	20	20	8	2	3	3
11.5	5.5	6	11	12	12.5	6.5	6	13	12	3	1	1	1
29	14	15	27	31	30	15	15	28	32	9	4	3	2
31.5	13.5	18	31	32	33.5	14.5	19	33	34	11	3	4	4
12.5	5.5	7	12	13	12.5	5.5	7	12	13	8	2	4	2
29.5	16.5	13	29	30	31.5	18.5	13	31	32	3	1	1	1
14	15	13	28	-	-	-	-	-	-	3	1	1	1
24.5	4	20.5	24	25	26.5	4	22.5	26	27	6	2	2	2
31	16	15	33	29	31	16	15	33	29	11	4	4	3
27	16	11	25	29	28	16	12	26	30	9	3	4	2
33.5	18	15.5	37	30	33.5	18	15.5	37	30	12	3	5	4
26	12.5	13.5	26	26	28.5	14.5	14	27	30	6	2	3	1
31	19	12	30	32	34.5	21	13.5	33	36	11	4	4	3
36.5	18.5	18	37	36	38.5	19.5	19	39	38	8	2	4	2
39	24	15	39	39	42	26	16	42	42	11	4	4	3

TABLE X

RAW DATA FOR THE OVERHEAD DROP SHOT TEST

Scoring Method - 1					Scoring Method - 2					Judges Ratings			
Drop Score	Trials		Recorders		Drop Score	Trials		Recorders			Judges		
	Odd	Even	1	2		Odd	Even	1	2	Total	1	2	3
10.5	8	2.5	10	11	12	8	4	12	12	9	3	3	3
33.5	18.5	15	31	36	38.5	22.5	16	35	42	10	4	4	2
43.5	21.5	22	42	45	48.5	24.5	24	46	51	9	4	2	3
35	21	14	35	35	39	24	15	39	39	7	2	3	2
28	12	16	28	28	29.5	12.5	17	29	30	9	2	3	4
22.5	11	11.5	20	25	24.5	12	12.5	22	27	8	2	2	4
31	17.5	13.5	30	32	33	18.5	14.5	32	34	6	2	2	2
42	24.5	17.5	41	43	51.5	29.5	22	50	53	11	3	4	4
9	-	9	9	9	10	-	10	10	10	11	2	4	5
25	7.5	17.5	23	27	27	7.5	19.5	25	29	9	3	3	3
54	22.5	31.5	52	56	62	25	37	59	65	9	3	3	3
53	22.5	30.5	52	54	63	28.5	34.5	62	64	9	3	3	3
32	14	18	31	33	36	17	19	35	37	7	2	2	3
40.5	21.5	19	40	41	50.5	28.5	22	50	51	8	3	2	3
40	16	24	39	41	49.5	18.5	31	48	51	9	2	3	4
38	23	15	37	39	46.5	29.5	17	45	48	8	2	3	3
36	17.5	18.5	36	36	38	18.5	19.5	38	38	11	2	4	5
34.5	14.5	20	34	35	40	17	23	38	42	10	3	3	4
36	17	19	36	36	40	18	22	40	40	8	3	2	3
40.5	25.5	15	40	41	44.5	28.5	16	44	45	5	1	2	2

TABLE X (continued)

Scoring Method - 1					Scoring Method - 2					Judges Ratings			
Drop Score	Trials		Recorders		Drop Score	Trials		Recorders			Judges		
	Odd	Even	1	2		Odd	Even	1	2	Total	1	2	3
30.5	17	13.5	30	31	33	18.5	14.5	32	34	9	3	3	3
29.5	11	18.5	29	30	30.5	11	19.5	30	31	7	2	2	3
33.5	21	12.5	33	34	43	28.5	14.5	42	44	8	2	2	4
29	16	13	29	29	31.5	18	13.5	31	32	6	2	2	2
34.5	11.5	23	34	35	40.5	13.5	27	40	41	9	3	2	4
31	10.5	20.5	30	32	34	10.5	23.5	34	34	5	1	2	2
36.5	19.5	17	36	37	43.5	24.5	19	43	44	9	2	3	4
44	22	22	44	44	53	26	27	53	53	7	1	3	3
54.5	27.5	27	54	55	63.5	30.5	33	63	64	10	3	3	4
35.5	20.5	15	35	36	37.5	22	15.5	36	39	8	2	2	4
31.5	12.5	19	29	34	33.5	13.5	20	35	32	7	1	2	4
43.5	24.5	19	43	44	50.5	29.5	21	50	51	8	3	2	3
9.5	3	6.5	9	10	9.5	3	6.5	10	9	9	2	4	3
37	13.5	23.5	37	37	49	17.5	31.5	50	48	6	1	2	3
32	14	18	30	34	37	15	22	35	39	7	2	3	2
27.5	12	15.5	27	28	28.5	13	15.5	28	29	11	4	3	4
46.5	19	27.5	46	47	58	23	35	58	58	10	3	3	4
20.5	12.5	8	21	20	23.5	14.5	9	24	23	4	1	1	2
36.5	22.5	14	36	37	46	28.5	17.5	45	47	11	3	4	4
40.5	15	25.5	39	42	47.5	18	29.5	46	49	12	3	4	5
39	18.5	20.5	36	42	48	23	25	44	52	8	3	3	2
23	9	14	24	22	27.5	9.5	18	27	28	11	3	4	4
39	12.5	26.5	39	39	48	15.5	32.5	48	48	7	2	3	2
20.5	11.5	9	20	21	24.5	13.5	11	24	25	5	1	2	2
23.5	10	13.5	24	23	27.5	12	15.5	28	27	6	1	2	3