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The Development of a Tennis Backhand Drive Skill Test of Beginner Ability and the Use of This Test to Study the Effects of Two Styles of Backhand Drives in Female Students

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THE DEVELOPMENT OF A TENNIS BACKHAND DRIVE SKILL TEST OF BEGINNER ABILITY AND THE USE OF THIS TEST TO STUDY THE EFFECTS OF TWO STYLES OF BACKHAND DRIVES IN FEMALE STUDENTS

by

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VITA

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In June, 1968, she received the degree of Bachelor of Science with a major in Physical Education and a Psychology minor. During her university years, she was a member of a number of honorary societies. Among these were CWENS, Delta Psi Kappa, and Psi Chi.

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CHAPTER I

INTRODUCTION

In this era of automation, Americans today appear to spend more time in leisure time activities that their pre-automation counterparts. An increased emphasis on sports seemed to create a climate for this increase in leisure time activities. Over the past five years, the popularity of tennis has been increasing on all levels of participation. Enrollment quotas in elective tennis instruction offered in the high schools reflected this recent upsurge in popularity by being filled quickly each succeeding year. During evaluation, tennis instructors often find it necessary to assess the student's attainment of the techniques necessary to achieve an acceptable game of tennis.

In the past thirty years, some major skill tests were developed to determine skill ability levels of individuals. Skill tests now available for the tennis drive often do not discriminate sufficiently for the delineation of the beginner's ability in the various stages of development. The tennis drive enables a player to hit a bounced tennis ball with a sidearm stroke so the ball travels low across the net. Two factors used to describe the tennis drive are power and accuracy. The accuracy factor described the ability of the player to direct the tennis ball to a particular area of the tennis court using

the drive stroke. Power was a factor which combined the speed of the ball with the height at which the ball traveled over the net. The power factor was either lacking in many drive skill tests or was interpreted as the height at which the ball crossed the net. In previously developed skill tests, the accuracy factor measured either side placement or depth placement, but not the combination of both.

PURPOSE

The prime goal of this study was the development of a discriminating skill test for the beginning backhand drive ability of teen-age female tennis students. The skill test developed in this study was used also in a second portion of this experiment, i.e. to provide a comparison of the presently popular two-handed backhand tennis drive with the standard one-handed style.

The backhand drive was chosen in the development of this test as it was often more difficult than the forehand drive for a teen-aged female beginner to execute with power and accuracy.

A secondary purpose of this experiment was to determine whether either the standard or two-handed backhand drive style had a testable advantage for the beginning female player in achieving power and accuracy in the use of the backhand drive.

Experience with female students indicates that the backhand drive often presented problems for novice tennis players. The use of the two-handed style was sometimes suggested for

those young students lacking the strength of older, stronger beginning players. This study expanded upon and tested this concept in teen-aged girls, who often lack strength when executing the backhand tennis drive.

SIGNIFICANCE OF THE SKILL TEST

Skill tests have validity to both the student and the instructor when the content is directly related to playing the game of tennis. Generally, the authorities agree that the drive stroke is an important technique for any tennis player. To devise a skill test of the backhand drive, the stroke was considered in its components. In the development of the skill test utilized in this study, the power of the drive and the accuracy of placement were considered as components of the stroke. These components were analyzed to determine what produced a desired effect. To aid in these analyses, considerable literature of drive skill tests were reviewed. Those skill tests reviewed were judged as either too gross in their measurement to delineate beginner ability or did not effectively test the components in the drive stroke. The literature revealed that measurement of the accuracy factor was solely either depth placement or side placement. None of the reviewed skill tests utilized a combination of depth and side placement as does the test presented in this study. In many of the skill tests reviewed, a rope called the "restraining rope" was strung above the net to aid in judging the height at which the ball passed over the net. While this may be a component of power,

it was ineffective in describing total power of the drive. One of the skill tests reviewed measured power by the use of a line drawn behind the tennis court designated as the "power line". The number of times the stroked ball bounced before crossing the power line was to be a gauge of the power of the drive. While this method of gauging power was utilized in the pilot study, it was judged too gross for delineation of beginner skill ability. The basic concept, however, was a satisfactory indicator of power; consequently, the skill test developed in this study utilized this basic concept in innovating a scoring system. Some of the skill tests reviewed in the literature were judged impractical for use with large class sizes often found in high school.

While testing is utilized to evaluate student progress in skill development, it likewise points out deficiences in performance to both the student and the instructor. If the skill test is efficiently administered and scored, it can be used repeatedly. By analyzing its content, a skill test may be used at an early stage in the instructional unit as an indicator of the skill ability of each student. The instructor may utilize such information to aid in the structure of the learning tasks presented in the unit. Likewise, the pre-test measurement could be used by both the instructor and the student as a base upon which to judge improvement. Motivationally, skill tests can be used to challenge the student toward improvement in the final test, or by pointing out to the student and teacher how the student compares with classmates. Thus, pre-

test diagnosis of individual strengths and weaknesses in the drive stroke would provide benefits for both student and instructor, as well as enabling classification of students into skill ability groups and class tournaments. When the term of the instructional unit is completed, the test could provide improvement scores both on an individual basis as well as relationship to classmates. While the skill test provides information on present levels of achievement, strengths, and weaknesses, it can also be a very beneficial tool for motivation, evaluation, and classification. As such a tool, it should relate to skills and techniques inherent in the game of tennis.

Many times the tennis instructor has the task of evaluating students at the termination of the instructional unit. At that time, it is often necessary to classify ability into grade levels, such as A, B, C, D, or F. Occasionally classes provide a wide range of skill ability, and some of the skill tests presented in the literature would be suitable for evaluation of such students. However, many times classes present a small range of skill ability due to designation of ability as a prerequisite for the class (Beginning Tennis), or due to the background of the students who compose the class. Classes with such limited range of skill ability should also have an objective form of skill measurement to aid in evaluation of the students. Relative to the backhand tennis drive, the skill test developed in this study was used to discriminate within the beginner level of skill ability.

CHAPTER II

REVIEW OF LITERATURE

SKILL TESTS

Studies have been made of objective and subjective forms of rating tennis drives. Broer and Miller[1] developed a test for use on the tennis court. In this test, a line was stretched four feet above the net and the stroked ball was to pass between the rope and the net. If the ball passed over the top of the rope, the value of the depth score was halved. The rope was used to gauge the force or power of the drive. Balls that passed between the rope and the net were designated as having more force than balls passing over the rope. The tennis court was marked into point value areas according to depth. The end nine feet of the court earned the largest point value. Point values were assigned also to balls landing outside the court boundaries. The ball is put into play by the subject dropping the ball from shoulder level and stroking the ball after it bounced. This method of starting the ball is called a "self-drop". Both forehand and backhand drives were tested by the same method. Using split-halves reliability, the Broer-Miller test for beginners "was shown to be .80 $\pm$ .047"[2]. The test

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[1]Marion R. Broer and Donna Mae Miller, "Achievement Tests for Beginning and Intermediate Tennis". Research Quarterly, 21 (October, 1950), 308-313.

[2]Ibid., 311.

for beginners produced a combined correlation of .61 when validated against judges' ratings. The instructor of the course and two independent tennis instructors became judges. Inasmuch as two or three judges saw the beginners tested on one day only could produce inconsistency which might account for the low correlation. The correlation for the intermediate group was .85.[3]

In another study, Fox[4] further evaluated the Broer-Miller test along with another popular test. She indicated that when backboard practice was used, the Broer-Miller test could be a fairly valid measure of the forehand and backhand beginner drives. In her study, greater care was taken to see that the subjective ratings of the judges were more reliable. She accomplished this by constructing rating charts which attempted to divide tennis playing ability into components. The judges then practiced with the rating charts to gain familiarity and consistency. Fox reported an average reliability for the four judges as .88 $\pm$ .018.[5]

DiGennaro[6] also attempted to develop a tennis test for the drive that was included in a battery of tennis skill tests

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[3]Ibid., 308-313.

[4]Katherine Fox, "A Study of the Validity of the Dyer Backboard Test and the Miller Forehand-Backhand Test for Beginning Tennis Players". Research Quarterly, 24 (1953), 1-7.

[5]Ibid.

[6]Joseph DiGennaro, "Construction of Forehand Drive, Backhand Drive, and Service Tennis Tests". Research Quarterly, 40, 497-501.

which he called the Tennis Tests of Achievement (TTA). He reported a .78 correlation with play during a round robin tournament for the backhand drive. Subjects were ranked according to a success percentage based on successful hits divided by hits attempted. In his test he used a three foot restraining line over the top of the net with accuracy scores halved if the ball traveled above the line. Three concentric circles five, ten, and fifteen feet in diameter were utilized in the measurement of accuracy. The method of putting the ball into play was similar to the self-drop method with the exception that an independent person dropped the ball for the subject.[7] The TTA did not take into consideration the side areas of the court for placement, but aimed the subject toward the middle of the backcourt. A weakness of the test was in a lack of sufficient discrimination in accuracy or power to distinguish among beginning players. When the test was repeated comparing the ball drop method used in the original test with the ball-boy (ball tossing machine), the correlation coefficient dropped from .78 to .60 for the backhand drive. Reliability using the test-retest method was reported .66 for the backhand drive.[8]

The Hewitt[9] drive test was similar to the Broer-Miller test in that lines were drawn across the court to measure accu-

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[7]Ibid.

[8]Ibid.

[9]Jack E. Hewitt, "Hewitt's Tennis Achievement Test". Research Quarterly, 37 (1965), 231-240.

racy through depth placement. From the net to the service line was rated one point and the balance of the court was divided into four foot six inch rectangular segments. No credit was allowed for balls landing outside the court area. Again, no consideration was given for side placement. In the Hewitt test, the instructor hit the balls toward the subjects. If available, a ball tossing machine was suggested for use. A restraining rope seven feet over the net was used in determining the speed of the ball. Balls passing over this rope scored half the point value of balls passing between the rope and the net top. Reliability was reported as .78 for the backhand drive using the test-retest method. The Spearman-Rho correlation on the backhand drive test was .62 at the 1% level of significance for beginners when correlated with the Hewitt tennis achievement scores which included forehand and backhand drive placement, and service speed and placement. Ranking of the players was done on the basis of a round-robin tournament.[10]

Neil Johnson[11] developed a standardized skill test which evaluated a player's complete all-around tennis ability. His Talent-N-Timing (TNT) utilized two factors in evaluating the drive stroke. The control factor measured side placement in a marked alley 81 inches wide on each side of the court. The second factor, power, was measured by the depth of the second

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[10]Ibid.

[11]Peter Schwed, "Now, You Can Find Out How Good A Player You Really Are". Tennis, 10 (August, 1974), 24-29.

bounce of a playable ball. Two points were awarded when the second bounce occurred beyond the power line. The power line was a long "v" extending behind the baseline of the court, 13 feet at the sidelines and 15 feet at the center mark. One point was scored when the second bounce was beyond the baseline but short of the power line. No credit was given for balls landing outside the court area. The ball was tossed to the subject. Each subject had the option of choosing to hit any of the tossed balls. In the TNT, the subject was directed to hit to a specific court alley to measure both cross-court and down-the-line drives.[12] The measurements used in the TNT were inadequate for the purpose of effectively discriminating among beginner abilities.

BACKHAND DRIVE STYLES

The literature reviewed pertaining to backhand stroke analysis was, in effect, a summary of opinions of various professional tennis players and instructors. It should be noted that the analysis was not gained through controlled experimentation.

Most of the books and articles reviewed suggest a standard form of one handed backhand swing, although each professional or analyst had a variation or two which he felt worked best. The grip was changed while the player was in the ready

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[12] Ibid.

position, moving the hand over the top of the racket to the left bevel of the grip. As the racket was then pulled back into a position where the right arm was fully extended behind the body and the racket was in line with the left hip, the position of the body pivoted so the right side was to the net and the feet were in a closed stance with the weight on the rear foot. When the racket was swung forward at hip level, the weight was transferred to the forward foot while the hips and shoulders uncoiled, tending to promote a leaning sensation. Contact with the ball was made about 12 inches in front of the forward foot with the racket and body continuing to uncoil after contact until the racket head was level and the stroking arm formed a straight line with the shoulders. The authorities claimed that the backswing was more natural, although less powerful, than the forehand drive. To compensate for this lack of natural strength, the body position was exaggerated on the backhand drive.

Two young tennis stars, Chris Evert and Jimmy Connors, have probably been most influential in promoting the current popularity of the two-handed backhand. It was generally conceded that the two-handed backhand was not as good as the standard backhand for reach and follow through. The two-handed swing did appear to add power for young players while it increased deception for the tournament player. The two-handed stroke could be helpful in teaching female beginners who often have difficulty keeping their wrist firm and their elbow

straight. In the two-handed backhand, the basic grip need not be changed as the left hand was placed above the right hand on the grip. While the backswing and follow through were shorter than those in the standard style, most of the body mechanics were similar to that of the standard swing with the exception that using two hands on the grip restricted some of the body movement. The left hand can be dropped from the racket after the beginner has acquired strength, body position, and swing necessary for the backhand stroke. It should be noted that a number of tournament players, especially new young stars, are using the two-handed backhand with success.

CHAPTER III

DEVELOPMENT and DESCRIPTION of the SKILL TEST

PILOT STUDY

During the first week of the tennis instructional unit in the fall of 1974, a pilot study was run on 142 sophomore, junior, and senior high school students. A backhand drive skill test similar to the test developed in this study was administered to the students. Since the students had no backhand instruction prior to the pilot study, they were asked to hit the ball on the backhand side of their body in any form they wished. For the pilot study, a ball-boy (ball tossing machine) was positioned in the center of the receiving court and set on low speed and average trajectory (further explanation given in the test description). Twelve new tennis balls were propelled from the ball-boy to the subject who stood approximately on the baseline near the center mark(back middle) of the tennis court. The first two hits were used as practice and the next ten balls were scored.

The system of scoring power was taken directly from the TNT described in the literature. The zero score, assessed when the ball took more than two bounces before crossing the power line or when the ball landed out-of-bounds, was scored for the majority of the trials. It was rare when a subject scored one point and very rare to score two points on any trial.

The evidence produced in the pilot study judged the power scoring described in the TNT as overly difficult to determine discrimination within the beginner skill level. The power scores in the pilot study did help justify the judgement of the instructor that the subjects were at the beginner skill level in tennis.

The accuracy factor was determined by dividing the court area, plus a small area outside and adjoining the court, into rectangles. These rectangles were assessed point values ranging from one through eight with the deepest corners of the court scoring the high values. Each ball hit was scored in accordance with the number of points shown on the rectangle in which it landed. Depth and side placement were combined to measure the accuracy factor. This system appeared reasonable in the pilot study and was left intact in the skill test. A court diagram and further explanation is provided in the skill test description.

The pilot study afforded the subjects, scorers, and instructor an opportunity to familiarize themselves with the testing format and methods of scoring accuracy and power. Problems in scoring and administering the test were corrected in the pilot study. Complete training of scorers was accomplished. The pilot study gave the subjects their first experience with the ball-boy. The machine was used during the instructional unit as both a teaching tool and a practice device. The subjects were familiar with the ball-boy when

they participated in the skill test at the end of the instructional unit.

DEVELOPMENT OF THE SKILL TEST

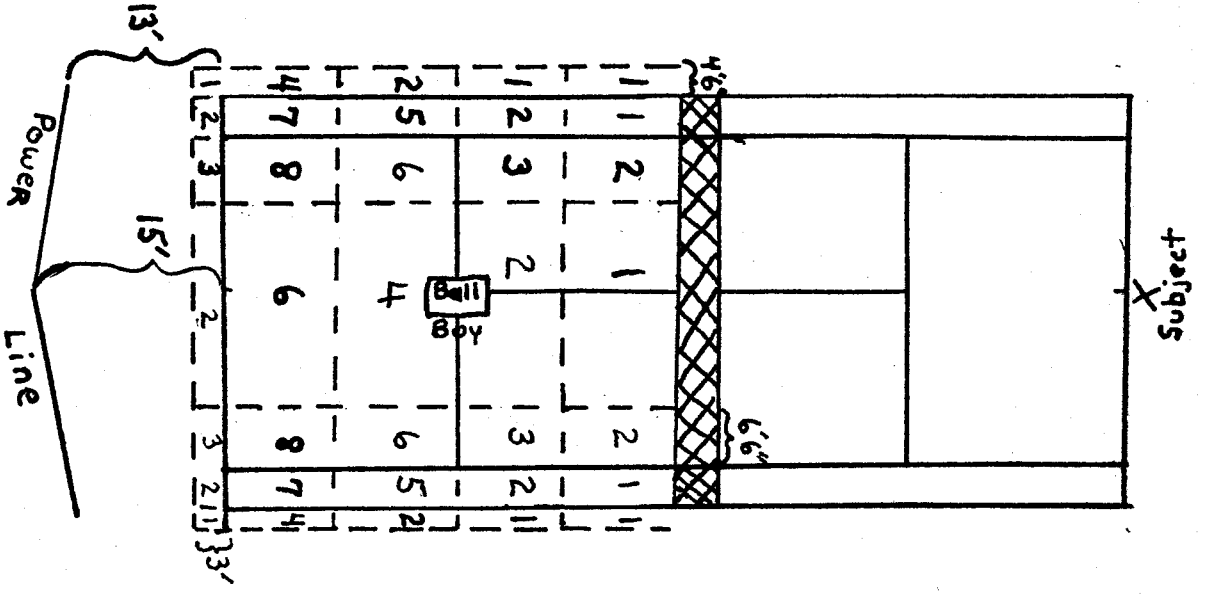
The measure developed in this study was a completely objective skill test used to delineate a beginner's ability to execute the backhand tennis drive. Scores of power and accuracy were used to determine the effectiveness of the backhand tennis drive. The test was administered during the last week of a six week tennis instructional unit in the fall of 1974.

The first score, accuracy, was measured by assessing to the subject a point value in accordance with the location of the ball when it landed on the tennis court area. Lower point values were assigned to the center of the court and to areas slightly outside the actual court. Higher point values were assessed for depth similar to the Broer-Miller and the Hewitt drive tests, and for side placement similar to the TNT. To provide delineation among beginning skills more accurately, the areas defined for accuracy in this skill test were more refined than in any of the tests reviewed in the literature. The court is marked in black on the diagram which follows, and the accuracy point values are marked in broken black lines.

The second score, power, was measured by counting the number of bounces the ball took before crossing the power line marked behind the court (see court diagram). The power

line was adopted from the TNT, but the method of scoring power was revised following evaluation in the pilot study. The pilot study revealed that power as defined in the TNT was not measured at the beginner level. A zero score was assessed any ball that hit outside the areas marked for accuracy scores. One point was scored for any ball that landed within the boundaries but took seven or more bounces to cross the power line. Two points were assessed for balls that crossed the power line in five or six bounces. The power score for a ball that crossed the power line in three or four bounces was three points. Four points were awarded balls crossing the power line in two bounces and five points were given any ball crossing the power line in only one bounce. This method of scoring power was thought to be more complete and more accurate as an indicator of power than the various restraining lines used in many of the skill tests reviewed in the literature.

DIAGRAM OF MARKED COURT FOR SKILL TEST



SAMPLE

The sample for the skill test validation study involved 133 female high school students from a large Chicago suburban high school. Grade levels represented in the sample were second, third, and fourth year students. Each school day consisted of eight periods and the sample included five periods. The skill level of the sample was judged beginning tennis ability. The skill judgment was made by a combination of the results of the pilot study, which included the total sample, and the subjective rating of the instructor used in the study (who was an experienced teacher, coach, and player).

EQUIPMENT

The pilot study and skill test took place on five tennis courts adjoining the high school. One court was marked for use in the test, while the students not being tested participated in tournament games or other activities on the four courts not used for the skill test. Colored chalk was used to mark lines on the court designating the accuracy point values and the power line. The ball-boy was placed at the intersection of the service and center lines of the receiving court. The machine was used at the slowest speed and the trajectory was set so the ball traveled approximately three feet higher than the net. Pre-setting the ball-boy standardized the speed and trajectory of the balls as they traveled from the ball-boy to each subject. The ball-boy also provided a more game-like

task for use in skill testing than the self-drop method used in many of the skill tests reviewed in the literature. A tennis racket was provided for each student by the school. The tennis balls used for testing were checked to be sure they were of good quality and condition. They were a different type than the class balls so they were not confused. Numbered papers with instructions written on them were provided for the scorers. Pencils and a clipboard were also provided for each scorer. The scorers were fourth year students trained in leadership during their third year. They were trained during the pilot study in the scoring technique used in the skill test. Two leaders were assigned to each class - one scored the power factor and the other scored the accuracy factor. By using student scorers, the class instructor was left free to oversee the rest of the class and make sure that the rotation of groups was smooth and efficient. The objectivity of the test for the instructor was further enhanced by student scorers.

ADMINISTRATION OF SKILL TEST

The conditions under which the test was administered were rigidly controlled. The test instructions were given to the class as a whole on the day prior to testing and reviewed briefly on testing day. The subjects were divided into three equal groups. The first group lined up next to the testing side of the court. A second group was used to retrieve balls, while the third group was assigned to the other four courts. The test was also operated more informally in some classes by

letting the students come to the testing court when ready. After taking the test, each student was asked to retrieve balls for at least three other students before leaving the testing area. Both methods seemed equally efficient and an instructor should choose the method best suited to class facilities, situation, and student personality.

One scorer was placed to the side of the court to score accuracy. The other scorer was positioned behind the power line to score power. The subject being tested stood approximately on the baseline near the center mark, but could move anywhere to hit the ball. The student was allowed to take the first two hits as practice balls and the next ten balls were scored as trials for the test. When the subject finished her turn, she quickly got off the court and the next subject stepped into the testing position. The ball holder on the ball-boy was filled with balls and the machine was kept running until empty. Thus, three or four students could be tested before the machine was emptied. The ball-boy was pre-set to standardize speed and trajectory at the beginning of the testing day and remained at that setting for the entire test.

CHAPTER IV

RELIABILITY AND VALIDITY OF THE TEST

The sample utilized in this skill test consisted of 133 high school girls. These students had selected tennis from a field of four activity choices. All students at this high school were required to enroll in a physical education class unless they had a medical excuse. A computer randomly assigned girls to one of the classes meeting during the regular daily periods.

Reliability for the skill test was computed using the Hoyt reliability coefficient. The coefficient for the accuracy raw score in the ten trial skill test was .61 for 133 subjects of beginning tennis ability. The coefficient for the power raw score on the ten stroke test was .64 for 133 beginning tennis students following a six week instructional unit. The Spearman-Brown Prophesy Formula was used to combine and step up the coefficients to .77.

The validity of the drive skill test was evaluated by: a) correlation with grades assigned to the subject during evaluation in a game situation, b) correlation with a forehand drive test, and c) rating of the test by ten judges who were tennis instructors, coaches, and/or players.

The same instructor was used to evaluate all of the subjects in the study. At the time the tests were administered and grades were assigned, the instructor had no knowledge they

would be used to validate the backhand drive skill test. Thus the instructor, an experienced tennis instructor, coach, and player, could show no bias in any of the subjective evaluation. The subjects were rated for game play skill ability during a class tournament which took place at the end of the instructional unit. Included in the game play rating was the subject's use of strokes and strategy during a tennis game. The forehand drive skill test used in the validity study was similar in construction to the backhand skill test and produced an accuracy and power score. In the forehand drive skill test the court was marked into point value areas to assess accuracy, and power was measured by the use of a system of the power line concept.

Correlations of the backhand drive test with game play grades and the forehand drive test were computed using Pearson Product-Moment correlation coefficients. Backhand drive accuracy correlated .839 with power of the backhand drive. This coefficient was significant at the .01 level. The accuracy of the backhand drive correlated .3579 with the game play grade which also was significant at the 1% level. Coefficients correlating the accuracy of the backhand drive with the power and accuracy of the forehand drive skill tests were .1085 and .0862 respectively. Neither of these coefficients showed significance at the 5% level.

Pearson correlation coefficients for the power factor show more significance than the accuracy factor. The coefficient for the power of the backhand drive correlated with the accuracy of the backhand drive was .839 at the .01 level of

significance, the forehand power coefficient was .3043 and the game play coefficient was .4185 when correlated with the backhand drive power standard score. At the .05 level of significance, the correlation of the backhand power score with the forehand accuracy score gave a coefficient of .1915.

MATRIX OF PEARSON CORRELATION COEFFICIENTS FOR SKILL TEST

	Backhand Accuracy	Backhand Power	Forehand Accuracy	Forehand Power	Game Play
Backhand Accuracy		.8390*	.0862	.1085	.3579*
Backhand Power	.8390*		.1915#	.3043*	.4185*
Forehand Accuracy	.0862	.1915#		.6337*	.3693*
Forehand Power	.1085	.3043*	.6337*		.4651*
Game Play	.3579*	.4185*	.3693*	.4651*	

Legend: # Significant at 5% level
* Significant at 1% level
133 Subjects

A questionaire was written to assess the validity of the test by having independent tennis authorities judge the test in relation to the revelance of content and ease of scoring

and administration. This questionaire was given to tennis coaches, tennis instructors, and good adult tennis players. The first page of the questionaire was a large court diagram with accuracy scores and power line marked (see diagram on page 16). The second page of the questionaire follows.

TEST DESCRIPTION: This is a completely objective skill test used to delineate a beginner's ability to execute the backhand tennis drive. Scores of power and accuracy will be used to determine the effectiveness of the drive.

The student will hit two practice balls and then ten test balls projected from a ball-boy (ball tossing machine). The setting of the ball-boy are low speed and the ball height is approximately three feet above the net. The ball-boy is positioned at the service line. The student may stand anywhere she likes.

The accuracy score is measured by assessing the student a point value in accordance with the location of the ball when it lands on the court for each testing ball. No points are awarded if the ball lands outside the scoring areas marked on the court. (See diagram). The points awarded for each trial are summed.

Power will be measured by counting the number of bounces the ball takes to cross the power line ﹀ . (See diagram). The bounces are grouped as listed:

Bounces	Score
Outside of scoring area for accuracy.	0
7 or more	1
5 or 6	2
3 or 4	3
2	4
1	5

EVALUATION OF TEST: Please answer the questions below by rating the test on a 1 through 5 scale - 1 as the poorest rating possible and 5 as the best rating.

_____ 1. Do you feel the two factors, power and accuracy, measure the major influences that produce a good tennis drive?

_____ 2. Do you feel the factor of accuracy is measured adequately to distinguish between levels of beginning achievement?

_____ 3. Do you feel the factor of power is measured adequately to distinguish between levels of beginner achievement?

_____ 4. Do you feel the test is easily scored?

_____ 5. Do you feel the test is easily administered?

TENNIS JUDGES' RATINGS OF SKILL TEST

QUESTION NUMBER	JUDGES 1	2	3	4	5	6	7	8	9	10	Mean
1	5	4	4	5	3	5	5	4	4	5	4.4
2	5	4	3	3	5	4	4	4	3	3	3.8
3	5	5	4	5	4	1	4	5	3	5	4.1
4	5	5	5	5	5	3	5	5	3	3	4.4
5	4	5	5	3	4	5	5	5	4	4	4.4

The ten questionnaires returned yielded mean ratings greater than four for 80% of the questions. The questionnaire was intended to measure five important concepts a test user considers when evaluating a skill test. The table above indicates the mean results of the questionnaire. The highest possible rating was five. Questions one, two, and three deal with the content of the test. Question one, with a mean of 4.4, asked the judges to rate the component parts used to decribe the drive stroke. Questions two and three with means of 3.8 and 4.1 respectively asked the judges if the factors of accuracy and power were measured adequately for beginner

skill ability. Question four showed a mean of 4.4 and dealt with scoring procedures. Ease of administration of the test was evaluated in question five with a mean of 4.4. The overall average for all five questions was 4.2 as judged by the sample of ten tennis instructors, coaches, and/or players who had worked with female tennis players.

CHAPTER V

APPLICATION OF SKILL TEST IN STYLES OF BACKHAND DRIVE STUDY

The skill test discussed in the previous chapters was used in a second portion of this experiment. The objective of this portion of the study was to determine whether either the standard or two-handed backhand style had a testable advantage for the beginning female tennis player in achieving strength and accuracy in the use of the backhand drive.

Experience with female students would seem to indicate that the backhand drive often presented problems to beginning tennis players. The two-handed style of backhand drive was sometimes suggested for young students who have less strength than older, stronger beginning players. This study was used to expand and test this concept in teen-aged girls who often lack strength when executing the backhand drive. The null hypothesis used to test this concept stated that there was no difference in standard or two-handed backhand styles for use with teen-aged beginning students.

The second concept tested in this experiment dealt with the time of day each class met. The sample, made up of second, third, and fourth year high school girls, consisted of 108 students. The students selected this activity from a field of four activity choices. All students in this Chicago

suburban high school were required to enroll in an activity class for eight semesters unless they were excused medically. A computer randomly assigned the girls to one of the classes that met daily periods one through eight. The grade levels were combined to utilize an elective program. Although randomization within the school population was intended to be complete, there were many factors to consider in a student's program. For example, students involved in the work program were scheduled for work experience either in the morning or afternoon. In practice, however, most of the students attended school in the morning and were dismissed at noon to go to work. Thus, afternoon classes often had a greater than normal percentage of college bound and second year students. Another concept that must be considered was the physical condition of the students at the time the class met. Performance can be affected by hunger, fatigue, heat, cold, or emotional strains from daily activities which were often directly related to the time of day the class met. To control the time factor, periods one and five were paired using the standard backhand style, and periods two and seven were paired using the two-handed style. By pairing the periods in this manner, equalization of the effect tracts, programs, or the time of day may have had upon the texture or physical state of the student sample should have been achieved. The null hypothesis was there was no difference in performance between morning and ofternoon classes.

Although the athletic talents of the students ranged from novices to girls participating on interscholastic teams,

the tennis training of the subjects was minimal. The subjects were judged tennis beginners by the combination of instructor evaluation and pilot study scores. As expected, the academic background and talents of the students ranged from very low ability to students in advanced placement college level courses.

The pilot study also indicated that when the instructional unit began, the classes were about equal in skill ability. Identical instruction and practice was used in all classes with the exception that two classes utilized the standard backhand style while the remaining classes learned the two-handed style of backhand. The weather was good so the unit did not have to be modified for indoor activities. As a portion of the final evaluation of each student, the skill test developed in this study was administered during the last week of the activity unit.

A two-way ANOVA was utilized as the experimental design. The variables were style of backhand drive used by the class and the time of day the class met. Accuracy raw scores computed a combined main effect F ratio of .431. The F ratio for accuracy by time was .522 and accuracy by the style of backhand drive used (called method) was .339. Since each of these F ratios is less than 1.000, it is obvious, without consulting the F table, that none of the F ratios for the accuracy raw scores was significant at the 5% level. The power raw scores produced a main effect F ratio of .361, a time F ratio of .651, and a method F ratio of .071. The combined standard scores

for accuracy and power factors produced a main effect ratio of .464, a time F ratio of .885, and a method F ratio of .043. Likewise, none of the interactions revealed significance at the .05 level.

TWO-WAY ANOVA F RATIOS FOR STYLES OF BACKHAND STUDY

	Accuracy Raw Scores	Power Raw Scores	Combined Accuracy and Power Standard Scores
Main Effects	.431	.361	.464
Time	.522	.651	.885
Style of Backhand (Method)	.339	.071	.043
Interaction	2.642	.005	.915

As the chart summarizing the ANOVA F ratios shows, there was no evidence supporting differences beyond chance between styles of backhand drive or time of day on the basis of a sample of 108 subjects as evaluated on the drive skill test described in this study.

CHAPTER VI

SUMMARY AND RECOMMENDATIONS FOR FURTHER INVESTIGATION

The controversy over standard or two-handed backhand styles increases as more young professionals are successfully using the two-handed technique introduced to them as youngsters. The evidence produced by this sample, however, supports the hypothesis that there is no difference in standard or two-handed backhand styles on testable performance with respect to drive power and accuracy. This evidence was produced in the testing of a sample of 108 teen-aged girls of beginning tennis skill ability. Accuracy, power, and a combination of accuracy and power raw scores attained from the skill tested sample supported the premise that the time of day at which the class met had no testable effect on performance beyond that of chance. Interpretation of these test results also supported the conclusion that there was little or no effect attributable to interaction. In fact, none of the F ratios computed in the two-way ANOVA utilized in this study was significant at the 5% level.

So long as it is useful and helpful in the assessment of the skill attainment of individual tennis players, reliable and valid objective skill tests are necessary. Validation of this skill test was computed utilizing a sample of 133 high school girls. When the backhand accuracy scores were compared to backhand power scores and to game play grades, the results were significant at the 1% level using Pearson correlation techniques.

The backhand power factor was significantly compared at the 1% level with backhand accuracy scores, forehand power scores, and game play grades. The Pearson correlation coefficient was significant at the 5% level when backhand power was compared with forehand accuracy. By analyzing the content, ease of administration and scoring, the tennis judges rated this skill test a mean of 4.2 on a five point scale (the score of 5 was the best possible rating). Using 133 subjects of beginner tennis ability, the Hoyt reliability coefficients were .61 for the accuracy raw scores and .64 for the power raw scores on this ten trial skill test. When these coefficients were stepped up using the Spearman-Brown Prophesy Formula, the coefficient became .77.

The influence of reliability and validity must be combined to produce a good skill test. In viewing the results of the validity study, it is suggested that replication using intermediate and advanced as well as beginning tennis students should be run. Male and female samples of various abilities could also be tested for similarities. Further replication should be done comparing this skill test with older and more proven skill tests. Generally, greater confidence in the evidence produced by this study would be achieved by replications using varied new samples.

Reliability in the skill test could possibly be improved by the use of more heterogeneous groups. Many zeros were recorded for both power and accuracy factors because of the restricted range of low skills shown by the subjects. More specifically, an interdependence of many factors, such as racket

grip, swing, body position, and eye-hand coordination, effect the production of a tennis drive. Many of the subjects had difficulty getting the ball over the net or keeping it in bounds because the drive is the complicated motor skill described earlier. Thus, although zero scores can be expected from beginning students, a zero gives little indication of the factors of power and accuracy except to the extent that the ball would not be playable in a game of tennis. Possibly this test could also be useful in testing intermediate and advanced skill levels of both the forehand and backhand tennis drives. In viewing the results of this experiment, replication studies would be suggested to test these suggestions.

Reliability could also possibly improve by lengthening the test. It was felt that by doubling the trials (20 rather than 10), the test could become too long to be practical for use with large classes found in most high schools. Although no accurate records in this respect were kept, approximately fifteen students could be tested in approximately 30 minutes. Even though testing is beneficial for many reasons already noted, it is important not to lose sight of the major objective in the instructional unit, which is to teach the student how to play tennis. If time permits, furture studies might test the effect of a 15 trial test.

The tennis judges sampled in this study felt that the skill test content was relevant to the production of a good backhand drive. They also rated the test high in administration and scoring ease. It should be pointed out that ten judges

made up the sample of raters, and they had all, previous to this test, worked with teen-age girls or were female players. An increased number of judges and a ten point scale might provide greater confidence in the results.

Novel work is presented in the skill test and backhand study. A possible limitation of this backhand study might be that the subjects were drawn from the same school and had taken the instructional tennis unit at the same time. Replication would help correct this limitation.

The hypothesis might also be modified to test whether more youthful subjects show any advantage produced by backhand style. Moreover, male and female samples could be compared and tested at various ages. Further study might also be undertaken to ascertain whether a physiological advantage is gained through style of backhand when used by players of various age groups and various skill levels.

The validity correlations show a possible limitation in the accuracy factor of this skill test which is of interest since this test was used to study the differences in backhand styles. Further studies involving point value areas may be able to improve the present division of court area. Possibly, the area within the court boundaries could be divided into larger or smaller rectangles. More or less area outside the court boundaries could also be assigned points.

The skill test presented in this study can be useful as a tool for teaching and evaluating the tennis drive. A new avenue of experimentation was opened with this study of the styles used for the backhand drive stroke.

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APPROVAL SHEET

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The final copies have been examined by the director of the thesis and the signature which appears below verifies the fact that any necessary changes have been incorporated and that the thesis is now given final approval by the Committee with reference to content and form.

The thesis is therefore accepted in partial fulfillment of the requirements for the degree of Master of Arts.

August 18, 1975 Samuel T. Mayo
Date Director's Signature