

**A TEST OF PREDICTABILITY FOR THE
BEGINNING TENNIS PLAYER**

by

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TABLE OF CONTENTS

	Page
ACKNOWLEDGMENTS	ii
CHAPTER	
I. INTRODUCTION	1
Statement of the Problem	2
Definition of Terms	2
Limitations and Assumptions	3
Review of the Literature	5
II. PROCEDURE	10
Subjects	10
Ranking	10
Skill Survey	10
Test Selection	11
Statistical Methods	12
III. FINDINGS AND INTERPRETATIONS	13
IV. SUMMARY	16
LIST OF REFERENCES	18
APPENDIX	20

LIST OF TABLES

TABLE		Page
1.	Correlations	14

CHAPTER I

INTRODUCTION

Every sport has its levels of excellence which ultimately will depend upon several influencing aspects of the game. To control or guide or even be able to label all these causal learning phases as they apply to a particular sport would be an insurmountable task. But to measure a novice performer, only in regard to his innate ability to learn the new game, does seem to be within the realm of reasonable and yet challenging research.

Today's methods of selecting or "trying-out" the beginning athlete vary from a mere signing up, followed by a gradual weeding of the masses, to fitness testing of various types which usually becomes a survival of the fittest. Both extremes are haphazard and time consuming at best. If a sport has its own set of demanding techniques of movement and these motions could be isolated, then a more accurate system of testing could be devised.

Since all sports are constantly undergoing changes which exhibit higher and higher levels of achievement, it follows that the teaching and/or coaching of these same sports should also keep pace. How convenient it would be to be able to measure the very young and to categorize their talents and thus be able to predict abilities and pluck a potentially good player from the masses through the use of

a relatively short testing program.

The intriguing possibility of developing such a test peculiar to the game of tennis was what prompted this study.

Statement of the Problem

The purpose of this study was to develop a test of predictability which would measure an untrained person's ability to learn the skills of tennis. Its usage would allow testing either on an individual or a large group basis utilizing a relatively short period of time. In order to construct the test it was necessary to isolate those skills which seemed special to the game of tennis.

The problem was divided into three general areas: (1) an analysis of the skills which were special and vital to the game of tennis; (2) selecting tests for measuring these skills; (3) validating these tests.

Definition of Terms

Beginner, as used in this study, refers to those persons who have never received any formal tennis instruction either in class lessons or private lessons and have never been in any tournament competition.

Proven player, as used in this study, refers to college girls between the ages of 18 and 22, who have played tournament competition and have had several (more than three)

years of practice with private coaching in their history of play.

Tennis coach or professional, as used in this study, refers to an active teacher of the game whose daily instruction was at least partially devoted to the teaching of tennis.

Tournament rankings, as used in this study, refer to rankings based on one double elimination-consolation tournament using 16 proven players.

Limitations and Assumptions

It was understood that there were many variables which this test would not attempt to control or measure. Only the actual physical qualifications as related to the game of tennis would be isolated and tested. Such items as individual desire, opportunity for practice and competition, quality and amount of instruction, age, health, emotional control, and intelligence were but a few of the extraneous contributing influences which ultimately could make a skilled player fail or a poor player succeed. These qualities were not measured in this study.

It was also possible that one or more of the skill tests used may have been a part of previous teaching for some of the participants, which would have given them some advantage in scoring. However, since one of the purposes of the test was to arrive at an evaluation of skills both

acquired and innate, this transfer training would be to the subjects' advantage.

One other limitation was assumed arbitrarily: that of intentionally not using any of the basic equipment of the game of tennis as a part of the testing devices. It was felt that uncoached tennis practice on the part of the beginner, frequently resulted in more of a handicap to the player than no practice at all.

Due to the unique opportunity of having in one location 16 proven players who were willing to participate in a tournament merely for the sake of establishing a ranking within the college, this study used the tournament as its criterion. The assumption was made that the same skills which appeared to a high degree in the better player must also be necessary in the beginner. It was also assumed that the relative rate of improvement in all 16 of the proven players would be approximately the same.

Keeping time, space, and equipment to a minimum so that administration of the test would not become a cumbersome tool, was both a prime objective and a limitation. If validity and reliability could be established in a relatively simple test, then many requirements would have been resolved in the designing of such a test.

Review of the Literature

A study of previous research did not reveal other tests of prediction which were related to motor skills or physical education activities. Tests of body strength and agility which exhibited improvement through sport participation were numerous. Hence, other studies contributed a good background of skills, abilities, somatotypes, and attitudes as they related to the game of tennis. From this knowledge three areas of relevance were useful in the formulation of this test.

Motor Ability

Isolation of particular skills fundamental to tennis proved to be quite varied and elusive, but some common, basic demands of acquiring various skills began to be repeated with frequent regularity as searching progressed. One of the best observations was made in a study of tennis, golf and archery by Beise:

. . . reaction time, speed and agility, seem to be fundamental to skill in certain sport activities. If skill in sport is an indication of general motor ability, then it would seem that these elements are fundamental to a valid measurement of motor ability. (2, p. 139)

To more clearly understand the separation between inborn talent and acquired skill, Scott (11) explained a broad division of college women in this manner:

. . . the first is that of her innate capacity, or her potentialities for acquiring various skills. The second type of difference is the wide variation of previous training and experience in motor activities. (11, p. 65)

To separate the former from the latter, a variety of tests have been tried with various degrees of success. Throwing, shooting, passing, kicking, batting, catching, racing (both agility and speed), all have been integral parts of tests measuring athletic skill.

Anthropometry

If tests are to be selected on a sound basis, some study of the actual physical dimensions that seem to be inherent in good tennis players should be considered. Through observation and specific somatotyping the lean, linear type of person would seem to be best adapted to the learning of tennis. Cureton (5) called this type the "grasshopper . . . with relatively long legs (particularly the forelegs) which make good jumpers, runners, vaulters, hurdlers, and agility athletes." (5, p. 315) Maureen Connolly Brinker (3) once described the ideal tennis player as one who was tall and agile, with quick reflexes and with good concentration. Certainly the very young player cannot be discounted because of his size which will undoubtedly change with age, but this obviously should be an area of consideration if not a part of the actual testing. Bartzen (1) emphasized

flexibility and spring in the legs and arches as a clue toward playing an aggressive game.

Previous skill tests

To substantiate the theory that prior exposure to the game of tennis did not necessarily indicate a player's potential, a survey of previous studies and their results was made. In a series of tests given to college women Gladys Scott concluded:

The prevalence of achievement norms at all ages indicates that much of the evaluation of student ability is in terms of absolute accomplishment rather than potentialities of accomplishments.
(11, p. 66)

Hence a truer measurement would be one that would weigh both aspects of learning. If the Dyer test (6) had a limitation which weighed both the backhand and the forehand equally, or if the Broer-Miller test (4) could be combined with the Dyer test, this would bring about a broader measurement of the skills. However, this combination would be time consuming and involve both practice and instruction using the actual game equipment. Scott (10) also was using tennis equipment in her testing, but Beise (2) devised a test which measured the reaction time, speed and agility and then compared three different sport groups to one another on a test, retest basis with periods of instruction in-between. Not only did the latter study show the influence before and

after instruction but a comparison was made between the sports of golf, archery and tennis. The excellence of agility was much higher in the tennis group than in the other two sports. Scott (11) in another study found that strength tests had a lower correlation toward tennis achievement than did over-all general ability and achievement in previously learned activities. She also concluded that "knowledge of the student about tennis is not directly related to the degree of skill." (10, p. 43) Hence, the excellent student of the rules or a nationally rated official might very well be a poor player.

In Jack Hewitt's Tennis Achievement Test (7, p. 231) beginners, advanced, and varsity players were compared through the testing of three basic components of the game: the serve (both for speed and for accuracy), the forehand drive, and the backhand drive. He found that the speed of the serve in beginners had the highest correlation (.89) to a rank-order obtained through a round robin tournament, and that the accuracy of the serve had the highest correlation (.93) on the varsity level. The revised Dyer wall test was also given and showed lower correlations (.73 and .87 respectively) than either the speed or accuracy serving test, but was higher than the forehand and backhand tests as administered by Hewitt. Although instructions and the use of all tennis equipment were involved in this study, there is a definite implication as to the ultimate skills

necessary for the game of tennis. Some type of test using movements which are centered around the serve must be at least a partial key toward discovering tennis potential.

CHAPTER II

PROCEDURE

Subjects

The subjects used in this study were 16 college girls who were attending Texas Technological College. All were judged to be advanced players on the basis of: (a) past tournament records, (b) four or more years of actively playing tennis, (c) having had at least three years of coaching. Their ages ranged from 18 to 22 years.

Ranking

To obtain a ranking of the 16 girls a double elimination consolation tournament was held over a period of eight weeks. Regulation matches were played throughout the tournament. As each girl lost and entered the consolation phase, care was taken to switch her to the opposite bracket level to avoid playing the same opponent twice. Ranking of last four players, who were eliminated from the tournament immediately with two losses, was based on their scores while losing and the relative ranking of their victors.

Skill Survey

A breakdown of the skills involved in the game of tennis was necessary. Through suggestions gleaned from

interviewing "Tut" Bartzzen (1), and Maureen Connolly Brinker (3), combined with personal experience and observations, skills were selected which were considered fundamental to tennis. The skills were divided as they were related anatomically (arms, legs, trunk). Tests related to each area were selected on the basis of previous research and feasibility. A questionnaire (see Appendix C) was then sent out to 68 tennis coaches and professionals in the state of Texas with 84 per cent returned.

Test Selection

On the basis of the coaches' questionnaire tabulation, speed, run-stop-turn, overhand throwing, hand-foot-eye coordination, endurance, and balance were the top choice skills important in tennis. The preferred tests as indicated by the coaches were the shuttle-run, jump-reach, softball throw (overhand) for distance, balance stand and a timed jump rope test. In an effort to incorporate the speed, run-stop-turn, and hand-foot-eye coordination into one test an agility run test was devised. Since the shuttle-run was very similar to part of the agility run, it was eliminated as one of the testing items. Thus a battery of five test items consisting of the jump-reach, one minute jump rope, balance stand, softball throw for distance, and the agility run (see Appendix A) was administered at the conclusion of the tournament to the 16 competitors.

Statistical Methods

All raw scores were converted into t-scores using the formula:

$$\text{t-score} = 50 + \frac{10(X - \bar{X})}{\sigma}$$

From the t-scores correlations were computed between each of the five tests and the criterion. The Pearson Product-Moment method of correlation was used:

$$r = \frac{N \sum XY - (\sum X)(\sum Y)}{\sqrt{[N \sum X^2 - (\sum X)^2][N \sum Y^2 - (\sum Y)^2]}}$$

A multiple regression analysis using the Doolittle method was computed. If any of the multiple correlation coefficients between variables was so large that most of the variability in one was related to another, that variable was not included in the regression analysis.

CHAPTER III

FINDINGS AND INTERPRETATIONS

The correlation coefficients between the criterion and the predictive variables appear in Table 1. According to the Pearson Product-Moment correlations the highest coefficients were the jump rope test and the balance stand, both with .68. The agility run had a coefficient of .50 with both the jump reach and softball throw having much lower correlations. The intercorrelations shown in Table 1 indicate tests two and three had relatively high coefficients with the other three tests. On this basis, the jump reach and the softball throw were eliminated from the battery. The results of this study indicated that the hand-eye-foot coordination of the jump rope test was found to be the most significant single measure of tennis playing ability. The strength factors failed to contribute to the predictability of the tests, therefore the time and effort of administering two additional tests was found to be impractical.

The regression equation for the three test battery was as follows:

$$Y = 33.4783 + .2698X_1 + .0578X_4 + .1819X_5$$

By rounding the coefficients off to the nearest hundredth and multiplying by ten, each test result received a weighting. The weightings were 2.7 for the jump rope, .6 for the

TABLE 1
CORRELATIONS

		1	2	3	4	
	Cri- terion	Jump Rope	Jump Reach	Softball Throw	Agility Run	
1.	Jump Rope	.68*				
2.	Jump Reach	.23*	.34*			
3.	Softball Throw	.15*	.29*	.54*		
4.	Agility Run	.50*	.10*	.42*	.41*	
5.	Balance Stand	.68*	.15*	.18*	.24*	.37*

* Accepted at the 5 per cent level of significance

agility run and 1.8 for the balance stand. Since all raw scores were converted into t-scores these weightings were assessed to each score and each subject received a total score for the three tests. Accordingly, the higher the score on the jump rope test, the better were the subject's chances for scoring high on the overall test. A high score on the balance stand also increased the possibility of a high total score. Since the weighting of the agility run was .6, it was the least influential upon each subject's total score.

The three item test of the jump rope, agility run, and balance stand had a multiple correlation coefficient of .81 as computed by the Doolittle method. Consideration was given to the value of a multiple correlation using the original five item test which would have raised the coefficient slightly. The statistical gains were not sufficient to warrant the use of the longer test.

CHAPTER IV

SUMMARY

The intention of this study was to develop a test which would serve both as a predictor and as a rating scale of skills vital to the game of tennis. After a careful tennis skill analysis and a selection of tests to measure these skills, sixteen advanced or proven players were selected to play in a tournament which ranked the players one through sixteen. Using this ranking as a criterion each player was given a test battery which consisted of five items (see Appendix A). The correlations showed that a three-item test was more practical since the two tests which measured strength had relatively low coefficients when correlated with the criterion. On the basis of the multiple correlation and regression analysis, the single skill most related to the game of tennis was the hand-eye-foot coordination involved in the jump rope test for speed. An acceptable coefficient of .81 was achieved through the use of the three item test.

Although only advanced players were used in this study, the skills isolated through testing could measure any degree of skill and thus be applicable to a beginner. The measurement of skills acquired through the use of the racket was intentionally omitted in the testing due to the desire to create a useable test for both boys and girls

classified as beginners, intermediates, or advanced.

A linear study which would begin with the testing of novice players and continue through at least five years of tennis development should follow this study. The establishment of norms for various ages and both sexes should be a result of such a program of testing.

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APPENDIX A

THE FIVE ITEM TEST BATTERY

The administration of this test required a minimum of equipment and facilities and made use of the tennis court as the primary testing area. A stop watch, 16 jump ropes of eight and nine foot lengths, four softballs, a one by four foot chalk board, three folding chairs and a secondary testing area of a field marked off in 15 foot intervals were all the equipment necessary.

Consideration was given to the order of events on the basis of the amount of fatigue involved, the ease of administration, loss of time, and the location of the two testing areas.

The participants were divided into pairs so that on some tests an alternating procedure could be used with one partner acting as a scorer or counter. The individual testing time was about eight minutes. However, large groups could be tested in a relatively short period using the partner-scoring system. Individual scoring by the instructor would be necessary on the jump-reach, the agility run, and the softball throw. Three trials were given on the jump-reach, softball throw, and for the agility run.

The five tests in order of administration were:

1. One foot balance
2. Jump-reach

3. One minute speed jump rope
4. Agility run
5. Softball throw

Test 1--One Foot Balance

The subject was told to try to stand on one foot for one minute, with both eyes closed. She was allowed to select either foot, and told to place that foot on a one-inch square block which was marked on the floor. Time stopped when she: (a) touched the floor with her free foot, (b) opened her eyes, or (c) moved her standing foot so that any part of the one-inch square was exposed. The score was recorded in total number of seconds which she remained standing.

Test 2--Jump-Reach

A one by four foot chalk board which had previously been marked at one inch intervals was attached to the tennis court backstop at a height of six feet from the ground. The subject was told to stand sideways to the fence and flat-footed next to the backstop and measure her reaching height using her preferred arm. Then after rubbing chalk dust on the fingers she was told to jump as high as possible from a standing, two foot take off. Three trials were given with the highest jump being recorded. The score was recorded in total inches on the basis of the difference between the standing height and the best jumping height.

Test 3--One Minute Speed Jump Rope

With one partner sitting down on the court as a counter, the subject was told that she was to jump rope as fast as she could, in any manner that she wanted to, for the duration of one minute. If she missed she was to re-start the rope as soon as possible and the miss did not count against her. Since the loss of time was penalty in itself, the count was continued from where she missed. Scoring was based on the total number of times which the rope passed under her feet. An exchange of positions between the partners and a second timing resulted in the completion of this test item.

Test 4--Agility Run

Speed, agility, sense of direction, concentration, and peripheral vision were measured to some degree in this test by running a prescribed pattern on one-half of the tennis court. Three folding chairs were placed on the court (see diagram in Figure 1) as targets for the running pattern. A judge stood on the opposite side of the net in the center of the court to determine the number of times the subject looked away from straight ahead. The subject was told to look at the judge all the time if possible. The examiner stood behind the center baseline of the court with a stop watch to give the starting signal and time the event.

The subject was instructed in the pattern to be run (allowed to walk through the pattern), told to keep her eyes on the center judge, and that looking away would penalize her time. Time stopped when she crossed the six foot semi-circle at the center mark. For each time the subject looked away a penalty of five-tenths of one second was added to her time. Three trials were given with the first trial being untimed as the subject walked and familiarized herself with the turning patterns. Trials two and three were timed and the best time was recorded in seconds and tenths of a second. Penalty time was noted separately and added to the actual running time.

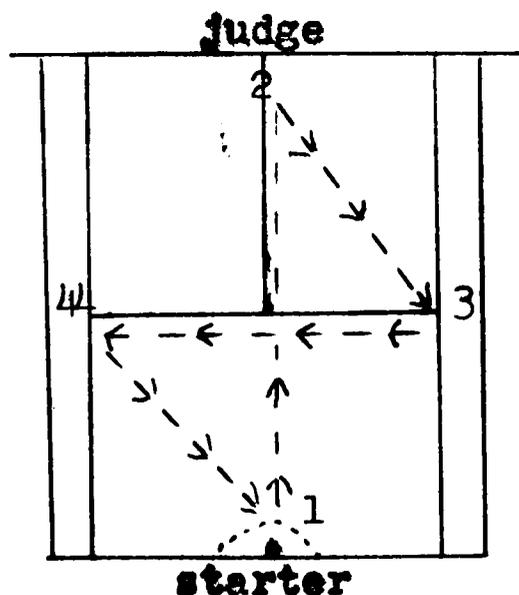


Figure 1. Court

The pattern was started from behind the baseline and run straight forward from number 1 to number 2; then run diagonally back right (or left) always facing forward moving to number 3 (or number 4); run straight across to number 4 (or number 3) still facing forward; and retreat

finally on another diagonal to the original starting position of number 1. Chairs at numbers 2, 3, and 4 were tagged with the hand before going on to the next number.

Test 5--Softball Throw

The subject was told to throw three balls in an overhand manner from behind a designated starting line. The target field was marked with lines at 15 foot intervals and a tape measure was used to measure to the nearest foot. In taking the test the subject was allowed to approach the throw in any manner desired but was given no instructions in regard to a running approach, a one step approach, or a three step approach. The subject was not allowed to cross the starting line at any time during a legal throw. The throw was measured from the starting line to the spot where the ball first struck the ground, and scored on the basis of the nearest number of feet. The best of three throws was recorded as the subject's score.

APPENDIX B

LETTER SENT TO COACHES

Monterey High School
Lubbock, Texas
October 3, 1964.

Dear Coach,

Enclosed is a short questionnaire concerning the types of skills and tests which might be used as a diagnosing method for determining tennis playing potential in beginning players. It is my desire to devise a test that will not involve the use of the racket, but rather measure the individual's innate ability to learn the sport. It has been my observation that previous experience without coaching is often as much if not more of a handicap than no playing at all; thus, my reasoning for not wanting to use the racket during these tests.

Your help in quickly answering this questionnaire and returning it in the enclosed stamped envelope will be greatly appreciated. If you are interested in the results and would like a tabulated report enclose a self addressed stamped envelope and I will be glad to furnish you with a copy of the results. Thank you for your considerate help.

Sincerely,

Jan Cannon
Tennis Coach

APPENDIX C

QUESTIONNAIRE

The following questionnaire is divided into physical categories much in the same way in which a tennis coach evaluates the assets and liabilities of a proven player. This test survey is aimed, however, at the beginning tennis player with little or no playing experience. Will you keep in mind three factors which should influence your decisions:

1. Thorough coverage of basic skills.
2. What are the basic and most important skills?
3. Ease of administration (not too time or space consuming, or too much record keeping!)

It is understood that there are many variables which this test will not attempt to control or measure. Such items as individual desire, opportunity for practice, quality of coaching, age, health, emotional control, and intelligence are but a few qualities which definitely influence the calibre of player, but will not directly show up in this type of test. These characteristics can perhaps be checked through other avenues, such as classroom grades, I. Q. tests, interviews, a check of extra-curricular activities, etc.

Remember to keep in mind the selection of tests should reflect the basic skills directly used in tennis.

RANK ACCORDING TO CHOICE IN EACH CATEGORY

<u>Category</u>	<u>Choice</u>				
	1	2	3	4	5
Speed					
L Lateral movement					
E Forward & back movement					
G Run - stop - turn					
S Jumping					
Other suggestions:					
Throwing overhand					
A Throwing underhand					
R Form					
M Strength					
S Other suggestions:					
Hand-foot coordination					
B Hand-eye coordination					
Q Trunk flexibility					
D Ball judgment					
Y Endurance					
Other suggestions:					

WHICH TESTS WOULD YOU PREFER TO USE IN MEASURING THESE SKILLS?

Rank according to 1-ex., 2-good, 3-ave., 4-poor, 5-too weak

	1	2	3	4	5
L 50 yd. dash					
E Side-line run (timed from side-line to side-line)					
G Shuttle - (according to nat'l phy. fitness)					
S Standing Broad jump (according to nat'l phy. fitness)					
Jump-touch (flat foot jump; measure standing reach, then jump)					
Others:					

<u>Category</u>	<u>Choice</u>				
	1	2	3	4	5
A Target throw - overhand or underhand (mark out one)					
R Chinning (boys) Pull-ups (girls) (See phys. fitness test)					
M Basketball rebound (30 sec. throw - 5' away from the wall)					
S Softball throw for distance (3 throws, record the best one)					
Others:					
B Jump rope (for speed - number of times in 1 minute)					
O Squat thrust (Number of times in 10 seconds)					
D Catching - (ball judgment; toss lob both in front and behind)					
Y 600 yd. run (see phys. fitness test)					
Other suggestions:					

