

J. 2475 203

AN INVESTIGATION TO ESTABLISH RELIABILITY
AND VALIDITY IN A BATTERY OF GOLF TESTS.

By

ROBERT ROCKWELL STOPPERT

A THESIS

Submitted to the School of Graduate Studies
of Michigan State College of Agriculture and
Applied Science in partial fulfillment of the
requirements for the degree of

MASTER OF ARTS

Department of Physical Education,
Health, and Recreation for Men.

1950

THESIS

ACKNOWLEDGEMENTS

The author would like to take this opportunity to sincerely thank the many people who contributed a great deal toward making this investigation possible. First, Dr. Randolph Webster, his advisor at Michigan State College, whose advice and encouragement kept this study going over the rough spots. Keith Carey and James Barclay, fellow staff members at Midland High School, who assisted with the testing. Hal Whittington, Midland professional, offered valuable technical advice, while the entire Midland golf squad spent many afternoons and evenings helping to perfect some of the finer points of the tests. And, other members of his committee, Mr. Russell Daubert, Dr. Henry Montoye, and Dr. Morton Malter, all of whom gave freely of their time and advice.

Again, many thanks to each and all for his most helpful assistance.

R.R.S.

TABLE OF CONTENTS

CHAPTER	PAGE
I. INTRODUCTION	1
Need for the study	2
Purposes of the study	2
Limitations	3
Definition of terms used	3
Procedure	5
Summary	6
II. REVIEW OF LITERATURE	7
Clevett	7
University of Wisconsin theses	8
Golf instructor's tests	12
Mechanical tests	16
Knowledge tests	17
Research in other aspects of golf	17
Summary	18
III. THE DRIVING TEST	19
Developing the test	19
Results of the experiment	21
The target	24
Other details of the test	25
Procedure used for testing	27
Summary	28

CHAPTER	PAGE
IV. THE SHORT APPROACH TEST	29
Development of the test	29
Procedure used for testing	32
Summary	32
V. THE LONG APPROACH TEST	34
Development of the test	34
Procedure used for testing	37
Summary	38
VI. ESTABLISHING THE VALIDITY AND RELIABILITY .	
FOR THE BATTERY	39
The driving test	39
Reliability of the driving test	42
The validity of the short approach test .	44
The reliability of the short approach test	44
The validity of the long approach test .	44
The reliability of the long approach test	44
Summary	45
VII. SUMMARY	46
Results of the investigation.	46
Conclusions of the investigation	49
Recommendations	50
BIBLIOGRAPHY	53
APPENDIX	56

LIST OF TABLES

TABLES	PAGE
1. A LIST OF ALL OF THE SCORES MADE BY A SELECT GROUP FROM THE ONE HUNDRED FIFTY WHO WERE TESTED TO SHOW COMPARISON BETWEEN TEST SCORES AND ACTUAL GOLF SCORES	51

LIST OF FIGURES

FIGURE		PAGE
1.	CLEVETT'S DRIVING TARGET	9
2.	CLEVETT'S APPROACH TARGET.	10
3.	AUTREY'S DRIVING TARGET	13
4.	AUTREY'S APPROACH TARGET	14
5.	GRID OF STRINGS ACROSS GOAL POSTS TO LOCATE AREAS THROUGH WHICH THE BETTER DRIVES PASSED	20
6.	THE APPROXIMATE TRAJECTORY OF A WELL DRIVEN GOLF BALL AS IT PASSED THROUGH THE TARGET AREA FROM TEES 20', 30', and 45' FROM THE TARGET	23
7.	THE DRIVING TEST TARGET	26
8.	THE SHORT APPROACH TARGET	31
9.	THE LONG APPROACH TEST	36
10.	DIAGRAM DRAWN ON GROUND TO MEASURE DIS- TANCE OF DRIVES FROM 250 YARD POINT AFTER THEY WERE HIT THROUGH THE GOAL POST GRID	41
11.	THE TARGET AREAS SHOWING THE AVERAGE DISTANCE FROM THE 250 YARD POINT MADE THROUGH EACH	43

Chapter I

INTRODUCTION

The game of golf is an intriguing and enjoyable pastime. There are many aspects that make it so, and not the least of these is the fascinating fact that a player is never through with learning the game. There is no perfection, though many attain a high degree of skill. There are few sports indeed which can claim golf's great number of disciples, of whom many will never be anything but "dubs".

Golfers are constantly attempting to improve their score, drop their strokes for 18 holes below 100, 90, 80, or even 70, depending upon in which group their ability happens to place them. The search for that "one good round" is an endless, but tireless, fairway over which many thousands of men and women unceasingly tread.

There are many who have written books, articles, and pamphlets on how to improve one's game of golf, but few have sought out methods of testing for the skills of the sport. It was a chance discovery of this hitherto unexplored field that led the author to accept the challenge so many have ignored in the past, to attempt to develop a battery of tests that would be of use to America's army of golfers.

Need For The Study. Golf as a unit of instruction in physical education is rapidly gaining stature and popularity throughout the country. This is only natural in view of the game's tremendous following, coupled with the fact that one of physical education's most important objectives is the teaching and developing of sport skills which can be used in later life. Almost every other sport now being played has had tests of some sort developed for use in conjunction with instruction, except the game of golf..

Probably no other sport claiming so many participants has been so completely ignored by researchers. This attitude is best summed up by the common statement of many writers that "golf makes its own tests". Evidently accepting that theory few people have investigated any further.

Purposes of The Study. Why develop these tests? What can be done with them after they are created? Perhaps these questions have stymied others who might have experimented with this phase of golf. It is the author's hope that this battery will be of value to the golf coach, physical education instructor, and the player himself for the following reasons:

1. Help improve a player's game through practicing on the tests.

2. Measure progress and improvement.

3. Present an opportunity for diagnosis of an individual's play.

4. Help to improve the golf instruction unit.

5. Aid in classifying students.

It is the specific purpose of this paper to (1) devise a battery of golf tests that can be used by any and all golfers in as small an area as possible to measure an individual's ability to use the driver, the long iron, and the short iron; and (2) to establish the validity and reliability of these tests.

Limitations. The author believes that it might be possible to predict the potential ability of a golfer through the use of these tests. However, he makes no such claims at this time. It could well be the subject for another study in this field.

Definition of Terms Used. Some of the terms common to golf used in this paper which may be strange to the "uninitiated" reader are as follows:

Drive - a ball hit by a golf club known as a Driver or #1 wood. It is usually the first shot of each hole, and the ball is teed up, the only time this practice is permitted on the course.

Dub - a beginner or an unaccomplished player. Some players never do escape this classification.

Pitch or Loft - a ball which is lifted high into the air to prevent it from rolling after it lands. This type of shot is usually played by the short irons.

Short Irons - those iron clubs which have open faces of varying degrees so that the ball when hit will rise up quite high. Clubs included in this category are numbers 6, 7, 8, and 9.

Long Irons - those clubs whose faces are closer to being perpendicular to the ground than the short irons. They are used for longer approach shots and, to obtain more roll after landing, they are constructed so that the ball does not rise too high. Long irons are numbers 1, 2, 3, 4, 5 and possibly 6.

Slice - the name given to any shot which curves sharply to the right. It is caused by improperly swinging from the inside out, making the ball spin to the right.

Hook - the name given to any shot which curves sharply to the left. It is caused by improperly swinging from the outside in, making the ball spin to the left.

Stance - the position a player takes when he is going to hit the ball. This position may change with the use of different clubs.

Source of Material. Since very little has been done in regard to establishing golf skill tests in the past this paper is for the most part an original study.

The tests were developed through experimenting by the author and his associates. Related studies, those few in existence, have been used for comparison only.

Procedure. It is usually an accepted fact that the fundamental strokes in the game of golf are driving, long approach, short approach, and putting. Each must be mastered before a player can hope to combat that ever elusive "par". To construct a battery of tests that would serve to measure the ability to use the clubs for each of these strokes a series of experiments were made to determine what could be devised that would best fulfill all of the necessary requirements. Some of the main factors considered during the construction of the tests were: space, cost of equipment, scoring accuracy, simplicity, time involved, and, most important of all, similarity to actual game conditions.

After considerable experimenting and a thorough study of related materials tests for driving, long approach, and short approach were constructed. A large group of men and boys were then tested to determine the validity and reliability of the tests.

Hope of constructing a satisfactory putting test was abandoned when it was found that no method simulated playing conditions closely enough. This was largely due to the lack of a suitable playing surface since regulation

putting greens are built of such luxuriant and smooth grasses.

Summary. It is the purpose of this study to devise a method of testing a golfer's ability to use a driver, long iron, and short iron. The need and value of such a study is established.

Following a review of related studies the procedures used to devise each test will be found in the succeeding chapters. A chapter also explains the results of testing a large group of men and boys. Conclusions and recommendations appear in the final chapter.

CHAPTER II

REVIEW OF LITERATURE

As is so often the case when one is investigating or experimenting with a new problem the available material previously written on golf tests was negligible. Although several people have done some work with golf tests of one sort or another, few have written of their results, and fewer yet have attempted to check for validity or reliability.

Clevett. In 1931 Clevett wrote of tests he had set up to aid him in comparing different methods of presenting golf instruction¹. However, as he himself pointed out, they were empirical and no norms were developed.

Clevett developed three tests for use indoors, the brassie-midiron, the mashie, and the putter. They were as follows:²

1. Brassie-midiron- these tests were given in a cage. The target was 10' square, marked off into twenty five areas each of which was 24" square. Players took

1 Melvin Clevett, "An Experiment in Teaching Methods of Golf", Research Quarterly, I, (December, 1931), 104.

2 Ibid., p.105.

ten shots each with a brassie and mid-iron from 21' away. Point values of the areas were as shown in Figure 1. Balls striking to the left side of the target were scored higher than those striking the right side since Clevett maintained that a ball which struck the right side was slicing. No practice shots were allowed.

2. Mashie test- the mashie test was designed for indoor use to determine an individual's ability to make a short approach shot to the green. The approach was from 15' from the nearest edge of the target, which was constructed of gymnasium mats marked off into twenty four areas. The overall size of the target was 22'x22'. Point values for the various areas were as shown in Figure 2. Ten shots were permitted a player, and they were scored according to where they landed rather than where they stopped rolling. No trial shots were allowed.

3. Putting test- the putting was done on smooth carpets 27" wide and 20' long securely fastened to the floor. Players stood 15' from the "hole", which was in the farthest third of the target. Forty eight areas, each 9" square were marked off on the carpet. No practice shots were allowed.

University of Wisconsin Theses. According to

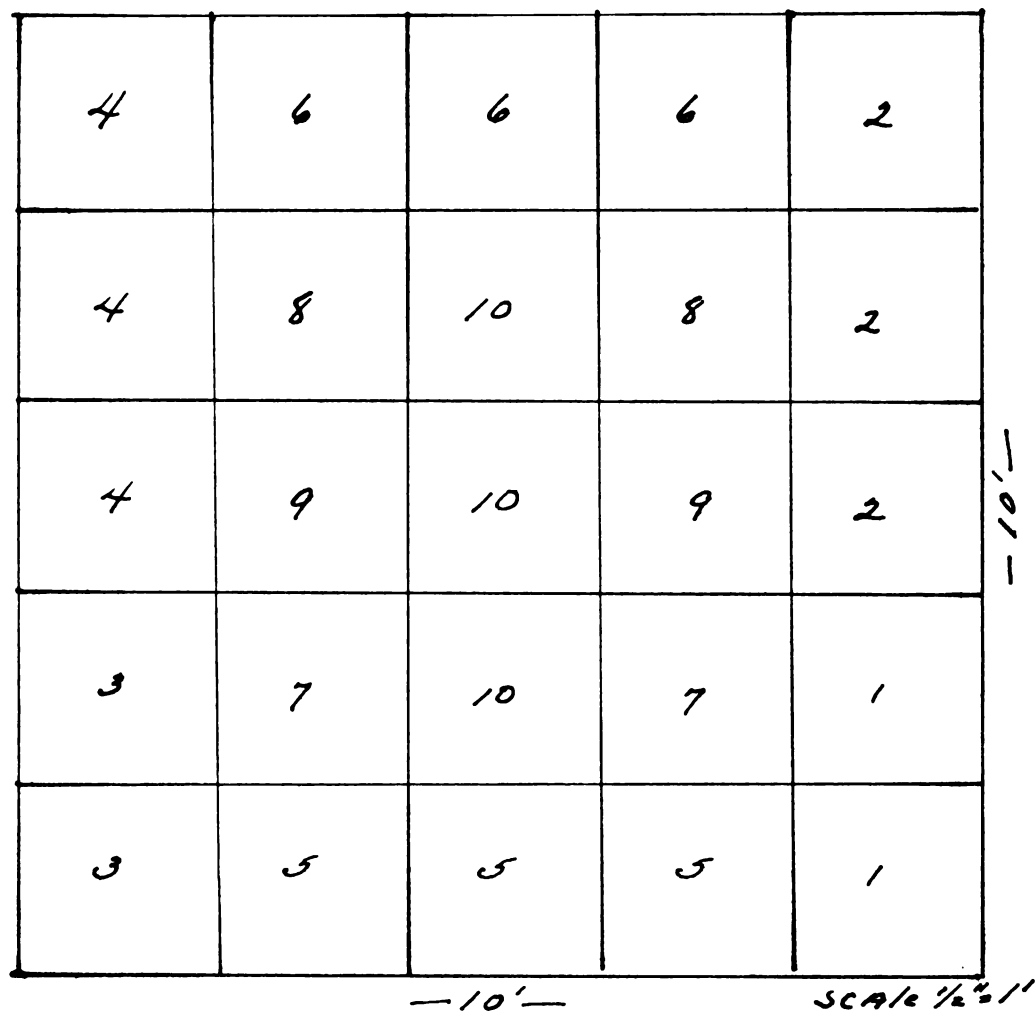


FIGURE 1

CLEVETT'S DRIVING TARGET

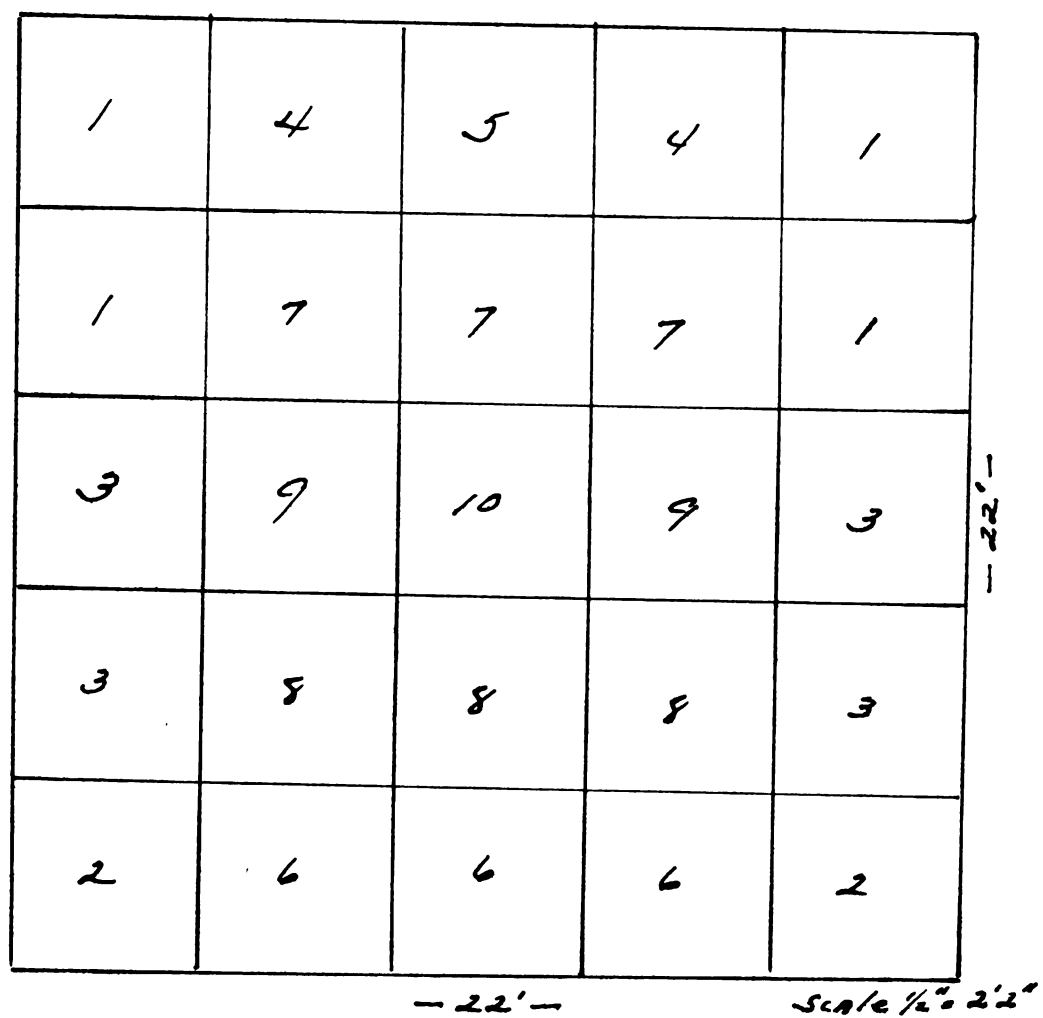


FIGURE 2

CLEVETT'S APPROACH TARGET

Glassow and Broer³, two students of the University of Wisconsin wrote unpublished theses concerning golf tests. In 1933 Isabel Woods set up tests to measure the ability of a player to control the brassie and mid-iron. She also tested the value of a driving cage. As a result she found that an expert player tended to send his shots to a concentrated area on the target, and that this concentration was higher up on the target for the mid-iron than it was for the brassie. Miss Woods did not find a sound method of measuring putting, nor did she attempt to establish the validity or reliability of her tests.⁴

Elizabeth Autrey made use of Miss Woods' tests and some of her own to measure the ability of a group of college women golfers⁵. Miss Autrey set up the following tests:

1. The brassie- the target was four concentric circles, the center of which was 3' above the floor. The center circle had a radius of 2', and each of the others

3 Ruth Glassow and Marion Broer, Measuring Achievement in Physical Education (Philadelphia: W.B. Saunders, 1939), 189.

4 Isabel Woods, "A Study For The Purpose of Setting Up The Specifications of A Golf Driving Cage Target and Test For The Mid-Iron and Brassie Clubs", (unpublished thesis, University of Wisconsin, Madison, 1933), 6.

5 Elizabeth Autrey, "A Battery of Tests for Measuring Playing Ability in Golf", (unpublished Masters thesis, University of Wisconsin, 1937), 10.

$\frac{1}{2}$ $\frac{1}{2}$
 $\frac{1}{2}$ $\frac{1}{2}$

were 1' larger. Players stood 20' from the target and hit thirty balls into scoring areas as shown in Figure 3. Norms were established, as was a reliability score of .68⁴.15. for forty three cases.

2. Approach- five concentric circles of 18' to 50' radius composed the target. Students hit thirty balls from 50 yards away after four practice shots. Balls were scored where they stopped, and were given points as shown in Figure 4. Reliability score for this test was .44⁴.08 for forty three cases.

Golf Instructor's Tests. Along with her group instruction drills, Helen Schleman mentioned a few tests that might be used⁶. The first of these was a pitching test, the second putting on a rug, the third for long and short approaches, and the fourth was a driving test. Her tests were as follows:

1. Short pitch test-tilted a bushel basket to a 45° angle and propped it there. Shots were taken from varying distances in an attempt to land in the basket. No scoring system was offered.

2. Longer approach- shots were taken from a distance 25 to 100 yards at a flag planted in the center of five

6 Helen Schleman, Group Golf Instruction (New York: A.S.Barnes and Company, 1934), 49.

•

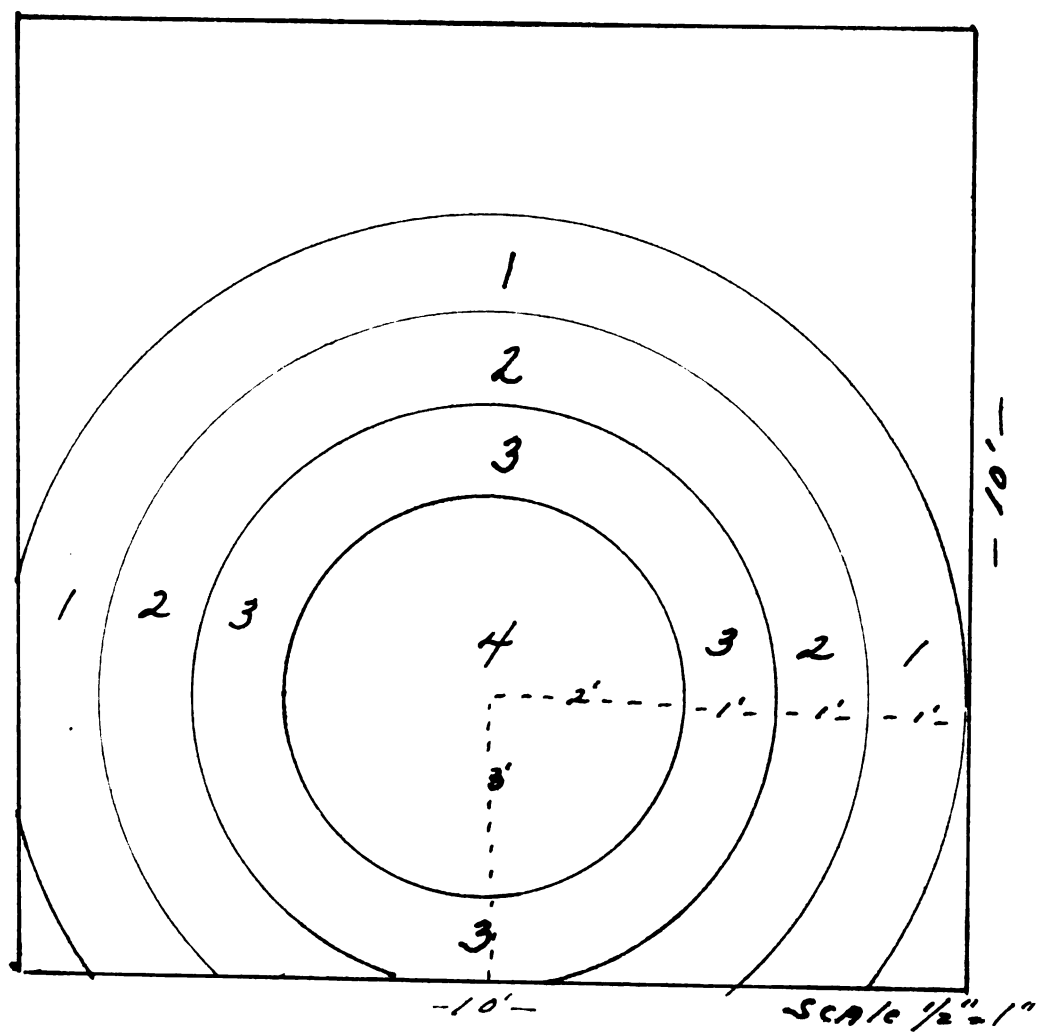


FIGURE 3

AUTREY'S DRIVING TARGET

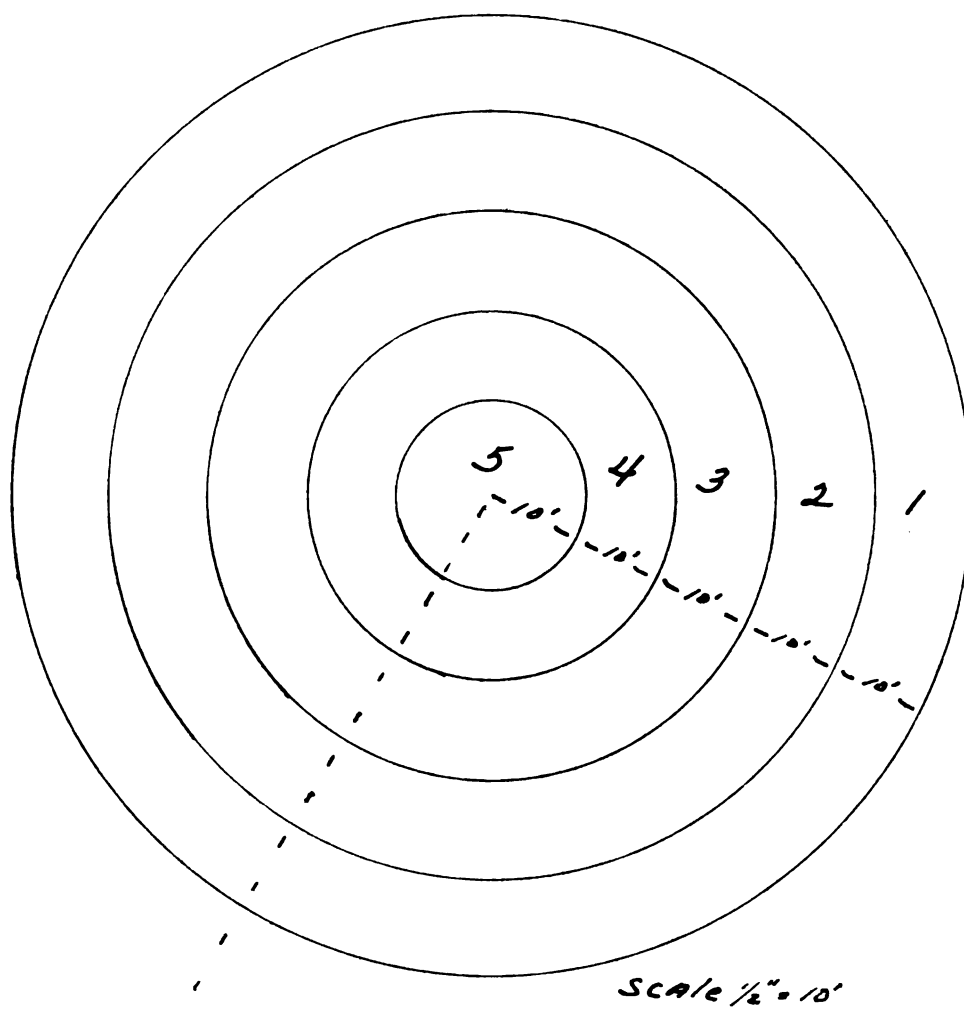


FIGURE 4

AUTREY'S APPROACH TARGET

concentric circles. The inner circle had a radius of 10', and each of the others was 10' larger. Points scored were 5,4,3,2,1 from the center out. This was identical to Autrey's target except for the distance from tee to target.

3. Putting- very little was said about this test except that the putting was done on a rug covered with sand. Balls were hit toward a spot in the center which represented the hole.

4. The drive- an area 300 yards long and 60 yards wide was laid out with lines crossing at the 100 and 200 yard marks. Players hit the ball to see how far and accurately they could drive. Three shots were taken and the total yardage of all three represented the score.

None of the above tests were established with a definite purpose in mind, but rather as some games that "could be used along with golf instruction."⁷

An anonymous writer constructed a test of pitch shots toward a hole cut in a slanted canvas.⁸ Those balls which did not go through the hole rolled back down the canvas and returned to the player. This test might have

⁷ Autrey, op. cit., p. 12.

⁸ (), "A High School Golf Program", Scholastic Coach, XI and XII, (November, 1941), 31.

been fairly successful, had a scoring system been worked out.

Mechanical Tests. Two mechanical methods of measuring golf ability were developed and placed on the market. The first of these was the Golf Register⁹. An aluminum trough, it was fitted with a length of heavy rubber to which a golf ball was attached. The amount of rubber that was pulled out when the ball was hit indicated the distance the ball would have gone, marked in yards. The ball was also centered on a spindle which indicated the direction the ball spun, if any, when hit. The entire apparatus, anchored at the end where the ball was placed, swung with the direction of the drive, right or left. Thus, the direction of spin, distance and deviation from a straight line were all measured. Though a very popular and interesting mechanism, Glassow and Broer did not feel that it was a valid and reliable test.¹⁰

The second commercial golf mechanism was the Bobbie Meter, which measured the distance of the drive only.¹¹ A fake ball was attached to the end of an arm. When the

⁹ The Golf Register Co., 10 East 42nd Street, New York

¹⁰ Glassow and Broer, op. cit., p.190.

¹¹ The Georgell Company, P.O. Box 1275, New Britain, Conn.

ball was hit the arm revolved around and indicated the distance that might have been made had the ball been a real one. Miss Autrey experimented with this test and found that it had a reliability score of .62 for forty three cases.¹² Both of these commercial tests have since been removed from the market and the companies have ceased operations.

Knowledge Tests. Several people have written golf knowledge tests that were very valuable, but not as an aid to measure the skills of the game. Two of these best known for their knowledge tests were Mary Murphy¹³ and Catherine Snell.¹⁴

Research In Other Aspects of Golf. At least two authors have delved into the game of golf from a research standpoint, with no attempt to seek a method of measurement. In 1937 Adams wrote of his investigation to determine what relation there was between the length of a hole and the number of strokes it required to play that hole.¹⁵

¹² Autrey, op. cit., p.12

¹³ Mary Murphy, "Criteria For Judging A Golf Knowledge Test", Research Quarterly, III (September, 1933), 81.

¹⁴ Catherine Snell, "Golf, Riding, Tennis, and Baseball Knowledge Tests", Research Quarterly, VI (May, 1936), 77.

¹⁵ Henry Adams, "A Statistical Analysis of Golf", Journal of Applied Psychology, XXI (August, 1937), 384.

Schudel approached the game from still another aspect by studying the respiration processes of a golfer as he drove and putted.¹⁶ Neither study contributed anything to testing the skills of the sport.

Recently, a method was devised to compare the results of approach tests which used a regular golf ball and a cotton ball. It was found that the cotton ball could be used for practice with good results in predicting possible range.¹⁷

Summary. Only a very few people have taken an interest in developing skill tests for the game of golf, and even fewer have carried out experiments to establish validity and reliability for their tests. As far as has been ascertained no one has developed a satisfactory driving test and established its validity.

Both Misses Woods and Autrey developed and used tests which have proved to be of value to the author when making the extensive experiments which preceded the construction of his battery. In the ensuing chapters each test of the battery was described and explained in detail, as was the establishment of the validity and reliability of the tests.

¹⁶ Helen Schudel, "A Study of the Respiration of Golfers during The Drive and The Putt", Research Quarterly IV (May, 1934), 62.

¹⁷ Mary Ellen McKee, "A Test for the Full Swinging Shot In Golf", Research Quarterly XXI (March, 1950), 46.

Chapter III

THE DRIVING TEST

Under actual playing conditions most golf courses provide fairways 100 to 500 yards long and 50 to 100 yards wide. Since very few schools or colleges can afford to make that much land available, it was obvious that some type of backstop or target which could stop a driven golf ball was needed if a test of this phase of a golfer's ability was to be devised. If this same target could be used indoors as well as outside, it would be doubly valuable.

Developing The Test. In searching for a suitable test those of other writers, namely Clevett, Wood, and Autrey, were first tried out. However, none of their targets proved entirely satisfactory to the author, so he investigated various methods of setting up a new type.

The first step taken was to find some method of checking the distance, direction, and flight of a driven golf ball in relation to where it passed through a possible target area. Because of its size and convenience (almost all schools have them), a football goal post was selected as a possible target frame. Strong cord was then strung across the posts forming a grid of two foot squares, as shown in Figure 5.

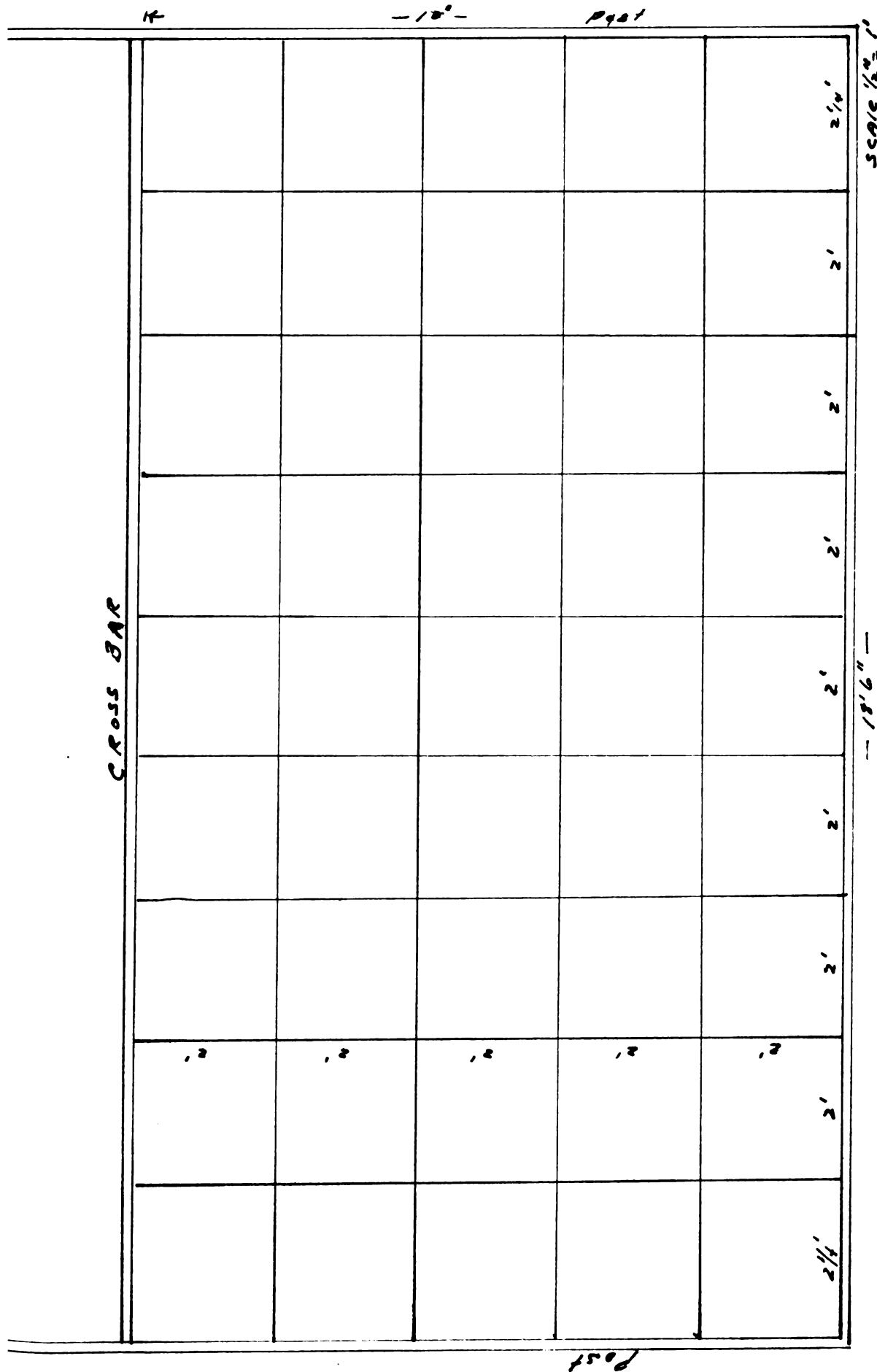


FIGURE 5

GRID OF STRINGS ACROSS GOAL POSTS TO LOCATE AREAS
THROUGH WHICH THE BETTER DRIVES PASSED

Over one thousand golf balls were driven by the Midland High School golf squad (Michigan's state Class A champions in 1948, 1949, and 1950), two professionals, and several members of the Midland athletic staff at 20', 30' and 45' from the grid. Three scorers checked on replica sheets of the grid the exact spots the balls passed through the goal posts, while three more boys plotted the exact location of the balls after they stopped rolling.

Results of The Experiment. The results of this experiment were as follows:

1.A well driven ball traveled in a trajectory which started low, raised very gradually, and then dropped abruptly when it neared the end of its flight. This was true, however, of only those balls which carried 180 yards or more.

2.The tee 30' away from the goal posts proved to be the ideal distance for a target area of this size, 10' x 18'6". From 21', the distance used by Clevett, the concentration of balls traveling 200 yards or more was only 1' above the ground. This height would not allow room for topped balls to hit the target, and would thus eliminate a large number of scores. Since Clevett's scoring system gave maximum credit to balls which struck his target 5' above the ground and only five points to

those 1' high it would appear that, on the basis of above findings, Clevett's test was not valid.¹⁷ From 30' the concentration of long drives was at 5' above the ground, while from 45' good shots soared completely over the top of the 10' high goal post. These trajectories were illustrated in Figure 6.

3. When one player hit thirty or more balls, a definite concentration or pattern developed, showing the characteristics of that individual. This tended to support Miss Wood's findings.¹⁸ However, contrary to her theory, there was no reason to believe that one player's concentration would be similar to another's.

4. Mid-iron shots concentrated 8' high above the ground, which tended to refute Clevett's theory that the same target could be used for both the mid iron and brassie or driver¹⁹, and substantiated Miss Wood's findings.²⁰

5. The use of concentric circles for a target, as set up by Miss Autrey, was not supported by the grid.²¹ Autrey gave the same number of points to a ball which

17 Clevett, op. cit., p. 104.

18 Wood, op. cit., p. 16.

19 Clevett, loc. cit.

20 Autrey, op. cit., p. 14.

21 Loc. cit.

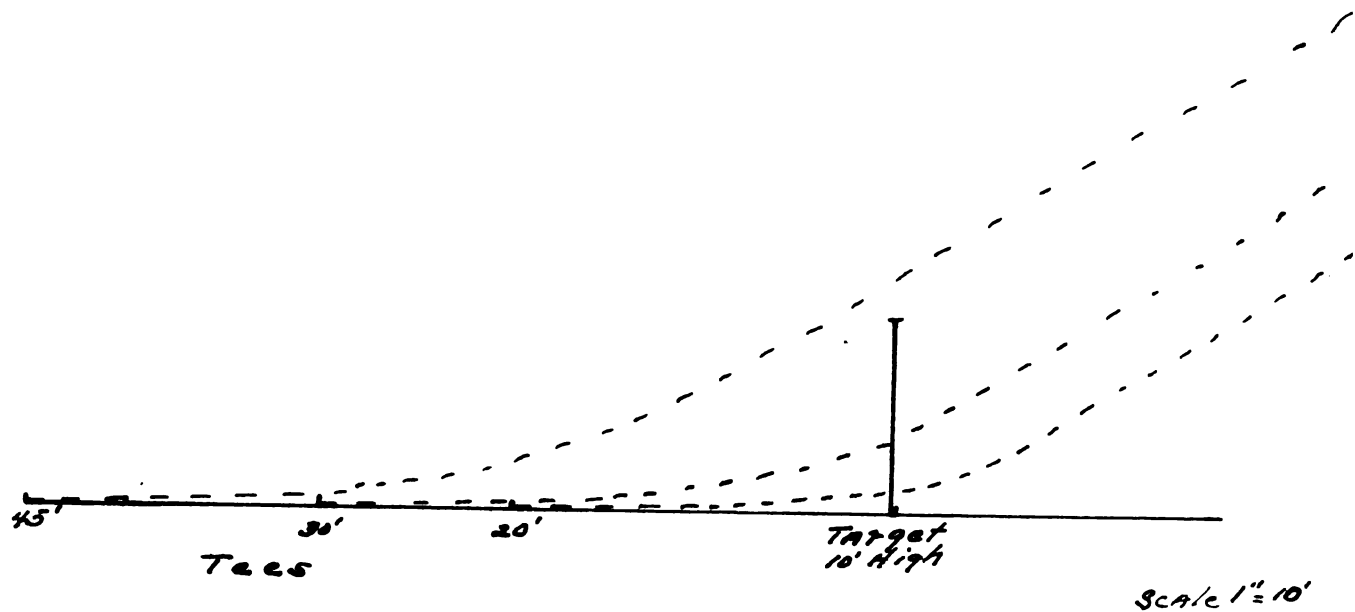


FIGURE 6

THE APPROXIMATE TRAJECTORY OF A WELL DRIVEN GOLF BALL AS IT PASSED THROUGH THE TARGET AREA FROM TEES 20', 30' and 45' FROM THE TARGET.

struck inches above the ground as were accorded those which struck the upper part of that same circle 5' above the ground. The grid indicated that those in the upper part of the circle carried much farther than those at the bottom. The circular target also awarded the same number of points to balls striking the outer edge as those which hit the top. Results of the grid indicated that any deviation from the center area caused a greater loss of yardage than those which struck above center.

6.The grid demonstrated that balls could start out to the right or left and curve back in the opposite direction before landing. These, of course, were hooks and slices. Total yardage for hooked and sliced balls was a good deal less than for straight ones. It was also shown that a ball could hit the center area and then curve right or left. This type was in the minority, however, and would not have too much effect upon a scoring system.

7.The grid established the fact that if a target was drawn up according to the dimensions of a goal post, and a scoring system devised based upon the results of the grid experiment, it would be possible to construct a test which would indicate the probable distance and direction of a driven golf ball with valid results.

The Target. Applying the results of the grid experiment to an actual target was the next step. Using

the 10' x 18'6" area of the goal posts because they provided a convenient frame for use out of doors, a piece of heavy duty double thickness canvas was selected for the target. An area $4\frac{1}{2}'$ wide and $5\frac{1}{2}'$ high was first painted on the center of the canvas $1\frac{1}{2}'$ from the bottom. This was established as the area a ball must strike to obtain the maximum distance and direction for an individual's drive. Other areas were then painted on and a point value given each in accordance with the results of the grid, as shown in Figure 7.

For indoor use a 2"x6" board 20' long was hung by two strong ropes from pulleys attached to the ceiling supports of the gym. Hooks were placed on the under side of the 2"x6" so that the canvas, which had eyelets sewn in the top edge, could be hooked on and pulled up to 10'. When the target was not in use it was unhooked and stored, while the 2"x6" was pulled up to the ceiling out of the way.

Other Details of The Test. The distance from the tee to the target was set at 30' since that length proved to be the most effective for a target of this size. It was far enough to allow the many different areas to be struck, and yet not so far that a large percentage of balls would completely miss the canvas.

For indoor use a standard cocoa mat was placed at the

(H)		(G)		(F)		(E)		(D)		(C)		(B)		(A)	
3		6		9		6		9		6		3		3	
(F)	1	(G)	4	(H)	6	(I)	8	(J)	10	(K)	5 1/2'	(L)	8	(M)	6
2'		2'		1 1/2'		4 1/2'		1 1/2'		1 1/2'		2'		2'	
(O)	1	(P)	3	(Q)	4	(R)	1 1/2'	(S)	3	(T)	1 1/2'	(U)	3	(V)	1
2'		1 1/2'		4 1/2'		1 1/2'		1 1/2'		1 1/2'		2'		2'	
(W)	1	(X)	6	(Y)	8	(Z)	5 1/2'	(AA)	10	(AB)	8	(AC)	6	(AD)	4
2'		1 1/2'		4 1/2'		1 1/2'		4 1/2'		1 1/2'		2'		2'	
(AE)	1	(AF)	4	(AG)	6	(AH)	8	(AI)	10	(AJ)	5 1/2'	(AK)	8	(AL)	6
2'		2'		1 1/2'		4 1/2'		1 1/2'		1 1/2'		2'		2'	
(AM)	1	(AN)	3	(AO)	4	(AP)	3	(AQ)	4	(AR)	1 1/2'	(AS)	3	(AT)	1
2'		1 1/2'		4 1/2'		1 1/2'		1 1/2'		1 1/2'		2'		2'	
(AV)	1	(AW)	6	(AX)	8	(AY)	5 1/2'	(AZ)	10	(BA)	8	(BB)	6	(BC)	4
2'		1 1/2'		4 1/2'		1 1/2'		4 1/2'		1 1/2'		2'		2'	
(BD)	1	(BE)	4	(BF)	6	(BG)	8	(BH)	10	(BI)	5 1/2'	(BJ)	8	(BK)	6
2'		2'		1 1/2'		4 1/2'		1 1/2'		1 1/2'		2'		2'	
(BL)	1	(BM)	3	(BN)	4	(BO)	3	(BP)	4	(BQ)	1 1/2'	(BR)	3	(BS)	1
2'		1 1/2'		4 1/2'		1 1/2'		1 1/2'		1 1/2'		2'		2'	
(BT)	1	(BU)	6	(BV)	8	(BW)	5 1/2'	(BX)	10	(BY)	8	(BZ)	6	(CA)	4
2'		1 1/2'		4 1/2'		1 1/2'		4 1/2'		1 1/2'		2'		2'	
(CA)	1	(CB)	4	(CC)	6	(CD)	8	(CE)	10	(CF)	5 1/2'	(CG)	8	(CH)	6
2'		2'		1 1/2'		4 1/2'		1 1/2'		1 1/2'		2'		2'	
(CI)	1	(CJ)	3	(CK)	4	(CL)	3	(CM)	4	(CN)	1 1/2'	(CO)	3	(CP)	1
2'		1 1/2'		4 1/2'		1 1/2'		1 1/2'		1 1/2'		2'		2'	
(CM)	1	(CN)	6	(CO)	8	(CP)	5 1/2'	(CQ)	10	(CR)	8	(CS)	6	(CT)	4
2'		1 1/2'		4 1/2'		1 1/2'		4 1/2'		1 1/2'		2'		2'	
(CU)	1	(CV)	4	(CW)	6	(CX)	8	(CY)	10	(CZ)	5 1/2'	(DA)	8	(DB)	6
2'		2'		1 1/2'		4 1/2'		1 1/2'		1 1/2'		2'		2'	
(DA)	1	(DB)	3	(DC)	4	(DD)	3	(DE)	4	(DF)	1 1/2'	(DG)	3	(DH)	1
2'		1 1/2'		4 1/2'		1 1/2'		1 1/2'		1 1/2'		2'		2'	
(DE)	1	(DF)	6	(DG)	8	(DH)	5 1/2'	(DI)	10	(DJ)	8	(DK)	6	(DL)	4
2'		1 1/2'		4 1/2'		1 1/2'		4 1/2'		1 1/2'		2'		2'	
(DI)	1	(DJ)	4	(DK)	6	(DL)	8	(DM)	10	(DN)	5 1/2'	(DO)	8	(DP)	6
2'		2'		1 1/2'		4 1/2'		1 1/2'		1 1/2'		2'		2'	
(DO)	1	(DP)	3	(DQ)	4	(DR)	3	(DS)	4	(DT)	1 1/2'	(DU)	3	(DV)	1
2'		1 1/2'		4 1/2'		1 1/2'		1 1/2'		1 1/2'		2'		2'	
(DU)	1	(DV)	6	(DW)	8	(DX)	5 1/2'	(DY)	10	(DZ)	8	(EA)	6	(EB)	4
2'		1 1/2'		4 1/2'		1 1/2'		4 1/2'		1 1/2'		2'		2'	
(EA)	1	(EB)	4	(EC)	6	(ED)	8	(EE)	10	(EF)	5 1/2'	(EG)	8	(EH)	6
2'		2'		1 1/2'		4 1/2'		1 1/2'		1 1/2'		2'		2'	
(EG)	1	(EH)	3	(EI)	4	(EJ)	3	(EK)	4	(EL)	1 1/2'	(EM)	3	(EN)	1
2'		1 1/2'		4 1/2'		1 1/2'		1 1/2'		1 1/2'		2'		2'	
(EI)	1	(EJ)	6	(EK)	8	(EL)	5 1/2'	(EM)	10	(EN)	8	(EO)	6	(EP)	4
2'		1 1/2'		4 1/2'		1 1/2'		4 1/2'		1 1/2'		2'		2'	
(EP)	1	(EQ)	4	(ER)	6	(ES)	8	(ET)	10	(EU)	5 1/2'	(EV)	8	(EW)	6
2'		2'		1 1/2'		4 1/2'		1 1/2'		1 1/2'		2'		2'	
(EV)	1	(EW)	3	(EX)	4	(EY)	3	(EZ)	4	(FA)	1 1/2'	(FB)	3	(FC)	1
2'		1 1/2'		4 1/2'		1 1/2'		1 1/2'		1 1/2'		2'		2'	
(FA)	1	(FB)	6	(FC)	8	(FD)	5 1/2'	(FE)	10	(FF)	8	(FG)	6	(FH)	4
2'		1 1/2'		4 1/2'		1 1/2'		4 1/2'		1 1/2'		2'		2'	
(FG)	1	(FH)	4	(FI)	6	(FJ)	8	(FK)	10	(FL)	5 1/2'	(FM)	8	(FN)	6
2'		2'		1 1/2'		4 1/2'		1 1/2'		1 1/2'		2'		2'	
(FI)	1	(FJ)	3	(FK)	4	(FL)	3	(FM)	4	(FN)	1 1/2'	(FO)	3	(FP)	1
2'		1 1/2'		4 1/2'		1 1/2'		1 1/2'		1 1/2'		2'		2'	
(FO)	1	(FP)	6	(FQ)	8	(FR)	5 1/2'	(FS)	10	(FT)	8	(FU)	6	(FV)	4
2'		1 1/2'		4 1/2'		1 1/2'		4 1/2'		1 1/2'		2'		2'	
(FQ)	1	(FR)	4	(FS)	6	(FT)	8	(FU)	10	(FV)	5 1/2'	(FV)	8	(FW)	6
2'		2'		1 1/2'		4 1/2'		1 1/2'		1 1/2'		2'		2'	
(FR)	1	(FS)	3	(FT)	4	(FU)	3	(FV)	4	(FW)	1 1/2'	(FX)	3	(FY)	1
2'		1 1/2'		4 1/2'		1 1/2'		1 1/2'		1 1/2'		2'		2'	
(FS)	1	(FT)	6	(FU)	8	(FV)	5 1/2'	(FW)	10	(FX)	8	(FY)	6	(FZ)	4
2'		1 1/2'		4 1/2'		1 1/2'		4 1/2'		1 1/2'		2'		2'	
(FT)	1	(FU)	4	(FV)	6	(FW)	8	(FX)	10	(FY)	5 1/2'	(FZ)	8	(GA)	6
2'		2'		1 1/2'		4 1/2'		1 1/2'		1 1/2'		2'		2'	
(FU)	1	(FV)	3	(FW)	4	(FX)	3	(FY)	4	(FZ)	1 1/2'	(GA)	3	(GB)	1
2'		1 1/2'		4 1/2'		1 1/2'		1 1/2'		1 1/2'		2'		2'	
(FV)	1	(FW)	6	(FX)	8	(FY)	5 1/2'	(FZ)	10	(GA)	8	(GB)	6	(GC)	4
2'		1 1/2'		4 1/2'		1 1/2'		4 1/2'		1 1/2'		2'		2'	
(FX)	1	(FY)	4	(FZ)	6	(GA)	8	(GB)	10	(GC)	5 1/2'	(GD)	8	(GE)	6
2'		2'		1 1/2'		4 1/2'		1 1/2'		1 1/2'		2'		2'	
(FY)	1	(FZ)	3	(GA)	4	(GB)	3	(GC)	4	(GD)	1 1/2'	(GE)	3	(GF)	1
2'		1 1/2'		4 1/2'		1 1/2'		1 1/2'		1 1/2'		2'		2'	
(FZ)	1	(GA)	6	(GB)	8	(GC)	5 1/2'	(GD)	10	(GE)	8	(GF)	6	(GG)	4
2'		1 1/2'		4 1/2'		1 1/2'		4 1/2'		1 1/2'		2'		2'	
(GA)	1	(GB)	4	(GC)	6	(GD)	8	(GE)	10	(GF)	5 1/2'	(GG)	8	(GH)	6
2'		2'		1 1/2'		4 1/2'		1 1/2'		1 1/2'		2'		2'	
(GB)	1	(GC)	3	(GD)	4	(GE)	3	(GF)	4	(GG)	1 1/2'	(GH)	3	(GI)	1
2'		1 1/2'		4 1/2'		1 1/2'		1 1/2'		1 1/2'		2'		2'	
(GC)	1	(GD)	6	(GE)	8	(GF)	5 1/2'	(GG)	10	(GH)	8	(GI)	6	(GJ)	4
2'		1 1/2'		4 1/2'		1 1/2'		4 1/2'		1 1/2'		2'		2'	
(GD)	1	(GE)	4	(GF)	6	(GG)	8	(GH)	10	(GI)	5 1/2'	(GJ)	8	(GK)	6
2'		2'		1 1/2'		4 1/2'		1 1/2'		1 1/2'		2'		2'	
(GE)	1	(GF)	3	(GG)	4	(GH)	3	(GI)	4	(GJ)	1 1/2'	(GK)	3	(GL)	1
2'		1 1/2'		4 1/2'		1 1/2'		1 1/2'		1 1/2'		2'		2'	
(GF)	1	(GG)	6	(GH)	8	(GI)	5 1/2'	(GJ)	10	(GK)	8	(GL)	6	(GM)	4
2'		1 1/2'		4 1/2'		1 1/2'		4 1/2'		1 1/2'		2'		2'	
(GH)	1	(GI)	4	(GJ)	6	(GK)	8	(GL)	10	(GM)	5 1/2'	(GN)	8	(GO)	6
2'		2'		1 1/2'		4 1/2'		1 1/2'		1 1/2'		2'		2'	
(GI)	1	(GJ)	3	(GK)	4	(GL)	3	(GM)	4	(GN)	1 1/2'	(GO)	3	(GP)	1
2'		1 1/2'		4 1/2'		1 1/2'		1 1/2'		1 1/2'		2'		2'	
(GJ)	1	(GK)	6	(GL)	8	(GM)	5 1/2'	(GN)	10	(GO)	8	(GP)	6	(GQ)	4
2'		1 1/2'		4 1/2'		1 1/2'		4 1/2'		1 1/2'		2'		2'	
(GK)	1	(GL)	4	(GM)	6	(GN)	8	(GO)	10	(GP)	5 1/2'	(GQ)	8	(GR)	6
2'		2'		1 1/2'		4 1/2'		1 1/2'		1 1/2'		2'		2'	
(GL)	1	(GM)	3	(GN)	4	(GO)	3	(GP)	4	(GQ)	1 1/2'	(GR)	3	(GS)	1
2'		1 1/2'		4 1/2'		1 1/2'		1 1/2'		1 1/2'		2'		2'	
(GM)	1	(GN)	6	(GO)	8	(GP)	5 1/2'	(GQ)	10	(GR)	8	(GS)	6	(GT)	4
2'		1 1/2'		4 1/2'		1 1/2'		4 1/2'		1 1/2'		2'		2'	
(GN)	1	(GO)	4	(GP)	6	(GQ)	8	(GR)	10	(GS)	5 1/2'				

tee so that regulation tees could be used under the balls, while the regular turf served out of doors.

It was determined that balls which struck a painted line dividing two areas were scored the same as that area adjacent to the line which gave the greatest number of points.

No special provision for hooks or slices was made in the scoring formula. The failure of other writers to find a satisfactory method of scoring these driving defects, coupled with the author's own inability to find an adequate solution, led to the abandonment of any such plan. However, only those balls which started out through the center and then curved right or left were not taken care of in the adopted scoring system, and these were found by the grid to be in the minority.

Procedure Used For Testing. A group of 129 boys from the Midland High School physical education classes, two professionals, one assistant professional, sixteen members of the varsity team, and two Midland coaches were given the test twice. Each person hit thirty balls, after three practice shots, and a week later repeated the procedure. Shots were made consecutively in approximately fifteen minutes' time.

Only one individual could be tested at one time. His scorer stood behind him and recorded on a replica

sheet of the target the exact spot the ball struck the canvas (Sample score sheet found in the Appendix).

Balls, clubs, and tees were provided, while players could use their own clubs if they so desired.

Summary. After considerable experimenting with other established tests, a grid of strings was constructed across a football goal post, and approximately one thousand golf balls were driven through this area from distances of 20', 30', and 45' to determine where they ended their flight in relation to the areas they passed through the grid. Several conclusive results were obtained of which the most important was the fact that it was entirely possible to construct a target which could indicate the approximate distance and direction of a driven golf ball.

A group of one hundred fifty men and boys hit thirty balls apiece into the target, and then repeated the procedure one week later.

In subsequent chapters other tests were devised, and the validity and reliability of each was established.

Chapter IV

THE SHORT APPROACH TEST

The second fundamental shot in the game of golf selected for study was the short approach, a term which usually applies to balls which are played from one to fifty yards away from the green. As a rule golfers attempt to loft their ball high when making the short approach in an effort to land as close as possible to the hole with very little, if any, roll. To accomplish this feat clubs 7, 8, and 9 are most commonly used.

As was mentioned in Chapter II, several fine approach tests have been set up and used by others, and, in constructing this test, the author drew considerably from their findings. However, certain basic fundamentals of golf seemed to be missing, and so an effort was made to incorporate something new into this test.

Development of The Test. First of all, the objective was to develop a test that would simulate actual playing conditions and still adhere to the idea of conserving space. Since golf greens usually contain anywhere from 2000 to 4500 square feet, it was decided that the target should approximate the larger figure. Drawing a circle of lime with a radius of 45' at one end of the football field created an area of approximately 4200

square feet. Two concentric circles were then drawn inside of the first with radii of 30' and 15' respectively. Thus, the target was formed.

The second fundamental factor which appeared to be important to the success of a short approach test was a scoring system that would give more credit to the ball which landed in the target area than those which rolled in. As was previously mentioned a well played shot should be lofted high so that the ball stops dead on the green. This is also done to overcome the sand traps that usually surround the greens, though it is possible to roll the ball on from at least one side. With these facts in mind the following scoring formula was established: Balls which landed inside of the target area were scored ten, eight, and six points according to the circle in which they stopped, as shown in Figure 8. No balls were scored if they rolled or bounced out of the target area. Any ball that stopped on a line was given the larger number of points of the two areas that line divided.

A distance of thirty five yards was selected as being ideal for the average person to use a #8 iron, the club decided upon for use in this test. The tee was located off to the side of the football field so that the turf would not be dug up on the gridiron. As many as four players were able to approach to the target at one

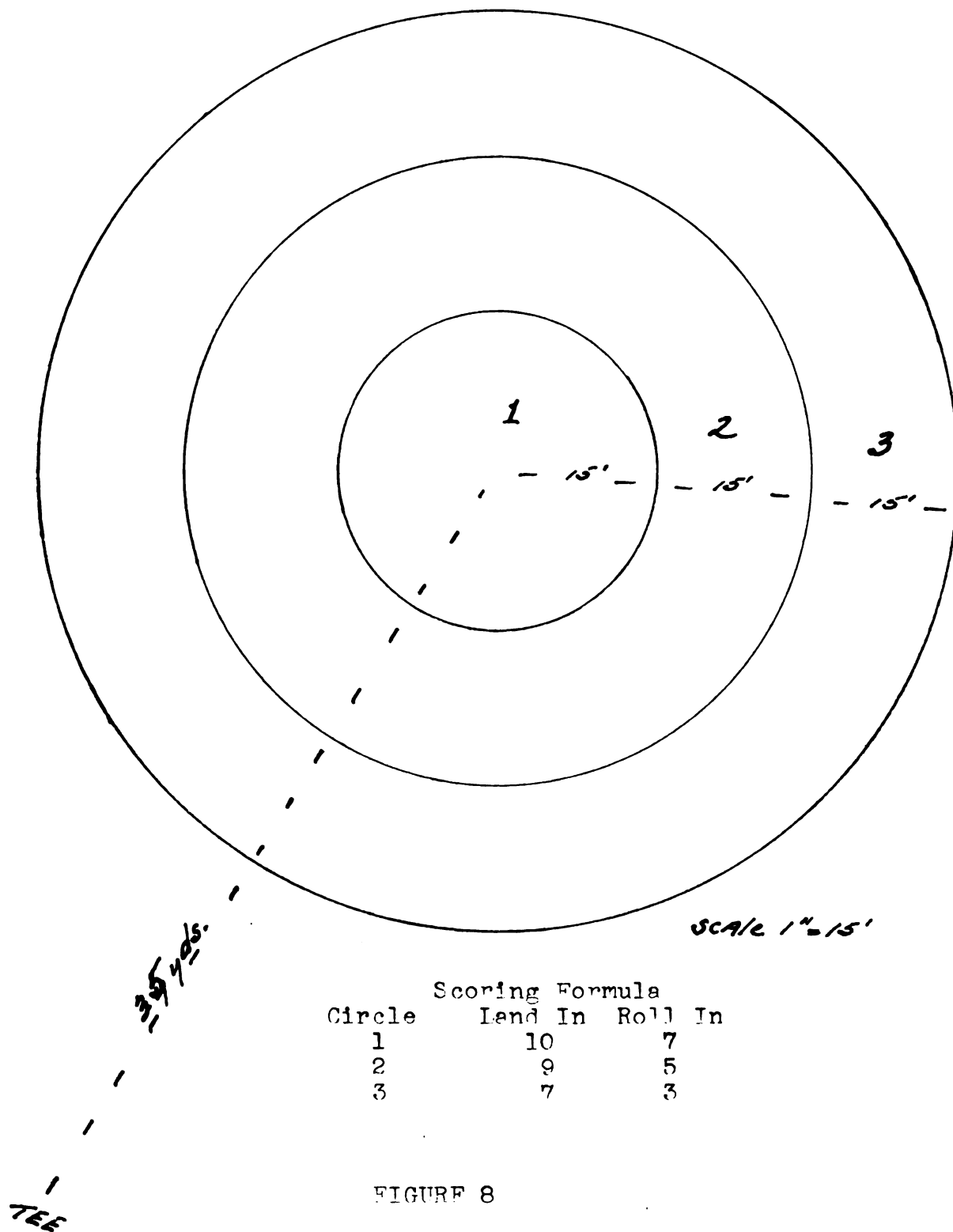


FIGURE 8

THE SHORT APPROACH TEST

time.

Procedure used For Testing. One hundred twenty nine Midland High School boys from physical education classes, sixteen varsity team players, two professionals, one assistant professional, and two Midland coaches were tested twice. Each hit thirty balls, after three practice shots, and repeated the procedure one week later. The thirty shots were taken consecutively, averaging about ten minutes per player.

One scorer for each player, four could hit at one time, stood off to the side of the target and recorded the balls as they came to a stop by marking either an "x" or an "o" on the score sheet, which was a replica of the target area. The "x" indicated a ball that landed in the target, while "o" was for those which rolled in (sample score sheet found in Appendix).

Balls and clubs were provided for the use of the players, or they could use their own club.

Summary. A short approach test was constructed, consisting of three concentric circles with radii of 15', 30' and 45', and one hundred fifty men and boys hit thirty balls apiece from a distance of thirty five yards from the "hole". The target was placed at one end of the football field.

In the following chapters a long approach test was

devised and the validity and reliability of each test was established. The results, conclusions, and recommendations of the study were listed.

Chapter V

THE LONG APPROACH TEST

The third fundamental shot in the game of golf selected for study was the long approach, a term usually applied to balls which lie from 50 to 175 yards from the green. To make this shot golfers choose irons #2, #3, #4, #5, or #6, depending upon the distance involved. The longer the distance the smaller the club number.

Chapter II mentioned a few approach tests but as most were tests designed for indoor use, it was difficult to simulate actual playing conditions while using them. It was, therefore, the objective of this study to construct a long approach test that would closely parallel actual playing conditions, and at the same time be contained in the limited space available to most schools.

Development of The Test. In the game of golf the green and hole are the ultimate goal of the player. To construct a suitable long approach test it was decided that a green must first be established. Since one had already been created for use in the Short Approach Test ways and means of making use of the same target were sought. Results of investigation determined that it would be possible to hit long approach shots down the length of the football field toward the Short Approach

target if the tee selected could be within the confines of the quarter mile track circling the field.

From the "green", the center of which lay in the middle of one of the 20 yard lines, back to the farther goal line measured eighty yards. The end zone made ten more yards, and there was still room enough to go back another thirty yards and remain inside of the track. Thus, the tee was placed on a line 120 yards from the "hole".

The "green" area, already divided by three concentric circles, must naturally contain the largest number of points in a long approach test. However, with the tee 120 yards away, it would have been difficult for inexperienced players to score many points if the "green" had been the only scoring area. Another factor which had to be considered was the width of the average fairway. Since most of them are long and not too wide, a target area that gave credit to balls stopping in areas short and beyond the green would be closer to actual game conditions than one which considered the green only. It was therefore determined that the 10 yard stripes on the football field should be utilized, thereby creating several more possible scoring areas. Of these a total of eleven were chosen and a scoring formula could then be applied.

The scoring formula adopted for the Long Approach Test, as shown in Figure 9, awarded ten points to the two

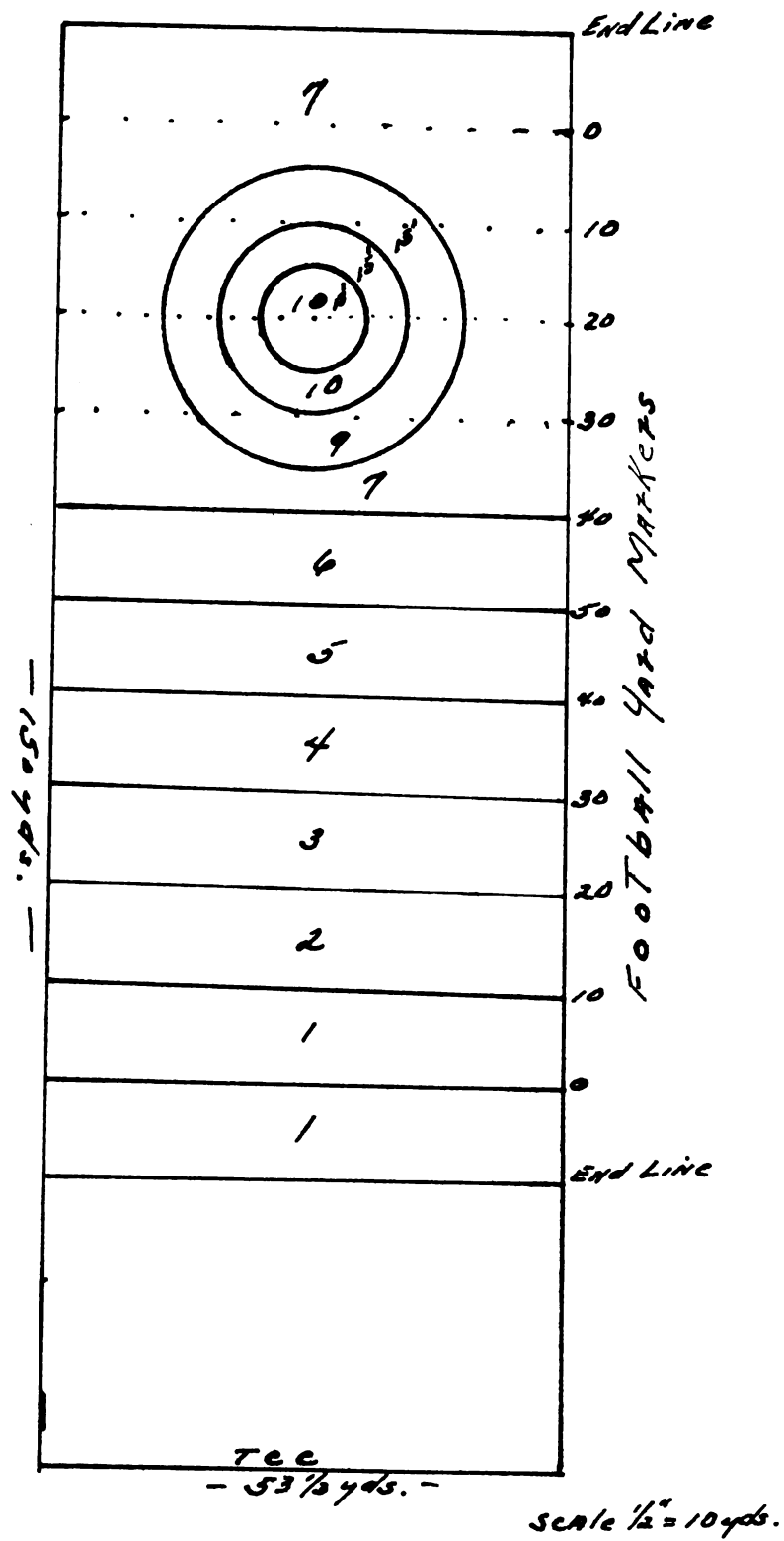


FIGURE 9
THE LONG APPROACH TEST

center circles, and nine to the third. All balls not on the "green" which remained within the confines of the football field and between the end zone and 40 yard lines were credited with seven points. The other areas and points were: 40 to 50 yard lines = six, 50 to 40 yard lines = five, 40 to 30 yard lines = four, and 30 to 20 yard lines = three, 20 to 10 yard lines = two, and 10 to end zone line = one. Thus, any ball which remained inside of the boundary lines could earn at least one point if it traveled 30 yards or more.

Balls which stopped on a line were given the larger number of points as was awarded to the two areas that line divided.

Procedure Used for Testing. The same group of one hundred fifty tested by the other two tests was used for this test. Each person hit thirty balls consecutively, after three practice shots, and then repeated the procedure one week later. Three players were able to hit at one time, and there was a scorer for each stationed at the side of the target area, somewhere near the middle, with a replica score sheet. He marked the exact spot the ball came to a stop, including those which went outside of the boundaries.

A #5 iron was selected as being ideal for an approach shot of 120 yards. Clubs and balls were provided

the players, or they could use their own clubs.

Summary. A long approach test was constructed on the football field which required the players to hit thirty balls 120 yards with a #5 iron. The test was given twice to a group of one hundred fifty, with one week separating the two dates.

The remaining chapters discussed the validity and reliability of the three tests, plus the results and conclusions found.

Chapter VI

ESTABLISHING THE VALIDITY AND RELIABILITY FOR THE BATTERY

The Driving Test. In order to establish the validity of the driving test it was necessary to compare the test scores with the average distance made on actual drives; also to prove that balls which struck Area J, that area which gave the largest number of points, would travel farther and straighter than those hitting another area of the target.

This check was accomplished by turning back to the grid where the development of the target first began. Cords were again strung across the goal posts. This time, however, they were located in the same positions as the lines painted on the canvas, thereby creating the same target, but one which the balls could pass through.

To measure the distance of the drive a point 250 yards from the tee was located. This particular point was chosen because it was felt that only a few of those being tested could drive beyond 250 yards, and it would simplify measuring the drives if they were measured in a negative fashion, so many yards from the established point. To make things even simpler, a diagram of twelve concentric half circles was drawn from the point, the circles having radii of 10 to 120 yards as shown in

Figure 10.

A group of forty five was chosen from the one hundred fifty originally tested. It contained the sixteen varsity team members, two professionals, one assistant professional, two Midland coaches, and twenty four boys from the gym classes. Each hit thirty balls at the string target, while a scorer marked on replica sheets the number of each drive in the exact spot the ball passed through the strings. Two more scorers marked on replica sheets of the distance diagram the number of the drive in the exact spot the ball came to a stop.

When the target and distance figures were tabulated two numerical scores resulted which could be compared for correlation, if any. The string score was of course figured in the same manner as the canvas target, while the average distance from the 250 point was found by adding up the total yardage and dividing by thirty. Balls which stopped within the 10 yard circle or went beyond the point were scored as zero. The others were measured in tens of yards, i.e. 10,20,30 etc., to simplify scoring. The resulting average distance from the 250 point became a negative range score.

Using the Pearson product-moment method²² it was

²² Warren R. Good, The Elements of Statistics (Ann Arbor: The Ann Arbor Press, 1933), 20-23.

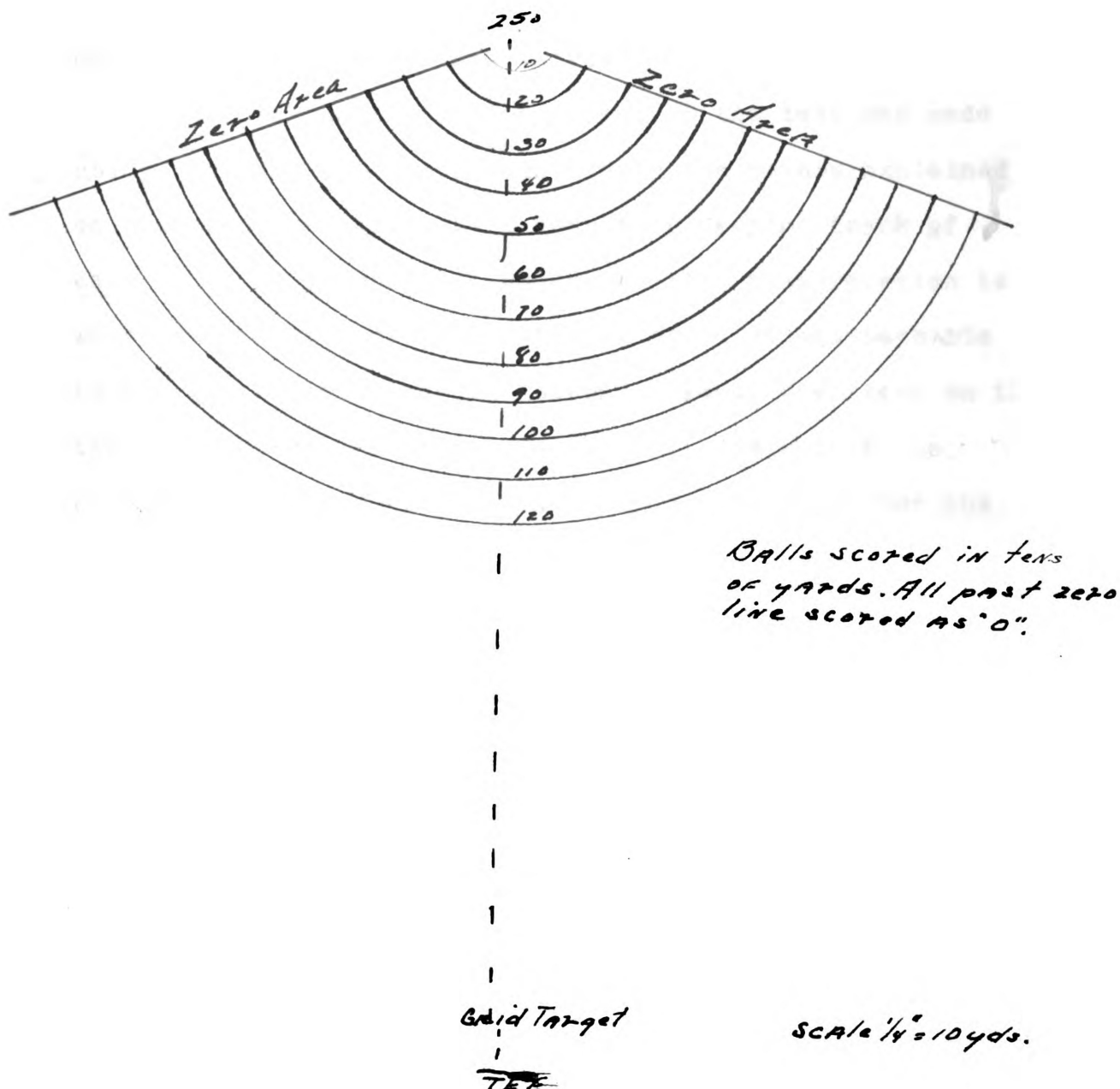


FIGURE 10

DIAGRAM DRAWN ON GROUND TO MEASURE
DISTANCE OF DRIVES FROM 250 YARD POINT AFTER
THEY WERE HIT THROUGH THE GOAT POST GRID.

determined that the coefficient correlation between the test score and the range score was $-.860$, and that The Driving Test was therefore valid.

A check on the scoring areas of the test was made using the same information gained by the method explained on the previous page. As a result of keeping track of each drive as to where it ended its flight in relation to where it passed through the target area, it was possible to add up the total yardage scored through each area on the target. These averages were listed in their areas in Figure 11. They indicated that the point values for the various areas were correctly established in relation to one another.

Reliability of The Driving Test. To determine the reliability of the Driving Test the first and second sets of scores made by the group of one hundred fifty were compared. Since the time lapse between the two dates the group was tested was only one week, it was felt that there was little opportunity for any of the group to practice enough to effect their score. Using the Pearsen product-moment method²³ of computing one score against another, a coefficient of correlation of $r = .990$ was established between the two sets of scores, indicating

²³ Good, op. cit., p.20-23.

103.1 yds				
(A)	(B)	(C)	(D)	(E)
98 yds.	70.8 yds.	40.3 yds.	65.1 yds.	100 yds.
(F)	(G)	(J)	(K)	(N)
113.5 yds.	92.9 yds.	23.6 yds.	55.1 yds	93 yds.
120+ yds.	78.5 yds	57.1 yds	78.3 yds	116 yds.
(O)	(P)	(Q)	(R)	
115.8 yds.	105 yds.	100 yds.	108.5 yds.	115.6 yds.
120+ yds.				
SCA 16 1/2" x 11"				

FIGURE 11

THE TARGET AREAS SHOWING THE AVERAGE DISTANCE FROM
THE 250 YARD POINT MADE THROUGH EACH

that the Driving Test could be considered as being reliable.

Validity of The Short Approach Test. The Short Approach Test was constructed so that it simulated actual playing conditions, and the results of testing proved that it was a test of a player's ability to approach to the target. It was concluded, therefore, that the test was valid.

Reliability of The Short Approach Test. The Pearson product-moment method²⁴ was used to compute the coefficient of correlation between the two sets of test scores. The result was $r = .988$, indicating that the test was reliable.

Validity of The Long Approach Test. The Long Approach Test was constructed to measure the ability of a player to use a #5 iron to approach to the established target. Results of testing demonstrated that the test accomplished what it was designed to do, thereby indicating that the test was valid.

Reliability of The Long Approach Test. Computing the two sets of Long Approach Test scores with the Pearson product-moment method²⁵ it was determined that a coefficient correlation of $r = .962$ was established, indicating that

24 Good, op. cit., p. 20-23

25 Loc. cit.

the test was reliable.

Summary. The entire battery of tests proved to be both valid and reliable. The Pearson product-moment method²⁶ was used to find the coefficient of correlation in reliability checks for all of the battery, as well as the validity check for the Driving Test. Scatter grams for all checks were included in the Appendix.

26 Good, Loc. cit.

Chapter VII

SUMMARY

Results of The Investigation. It was the purpose of this investigation to (1) devise a battery of golf tests which could be used by any and all golfers, in as small an area as possible to measure an individual's ability to use the driver, the long iron, and the short iron; and (2) to establish the validity and reliability of these tests. Also, in the construction of the tests, such factors as space, cost of equipment, scoring accuracy, simplicity, time involved, and, most important of all, similarity to actual game conditions were to be considered.

After considerable study and investigation the following results were obtained:

1. A Driving Test was constructed which made use of an upright canvas target 10'x18'6". Designed for either in or out of doors use, the test proved to be both valid and reliable as a method of measuring a player's ability to use a Driver or #1 wood.

- (a) Only a space 20'x30' with a 10' ceiling was necessary for the test.

- (b) Cost of the target varied from twenty to thirty dollars, depending upon the materials used. The canvas used in this study was reclaimed and the pieces

sewed together.

(c) The scoring system was simple to apply. Scorers had little difficulty noting where the ball struck the target.

(d) The test was simple to handle and easy to conduct. The target itself was not complicated to construct, once the principle had been worked out.

(e) Approximately fifteen minutes time was necessary for each player to hit thirty balls. Only one person could be tested at once.

(f) The target definitely simulated actual game conditions in predicting the approximate distance and accuracy of a drive. A Driver or #1 wood was used by the players, as would be the case for the same shot on a golf course.

2. A Short Approach Test was constructed for use out of doors which proved to be both valid and reliable as a method of measuring a player's ability to use a #8 iron.

(a) An area 80'x50 yards was more than adequate to conduct the test. One end of the football field was used in this case.

(b) There was no cost other than the lime to mark the target on the grass.

(c) Scoring was accurate and easy to apply. Scorers used replica score sheets and merely indicated where the

ball came to a stop, and in what manner it entered the target, in the air or rolling.

(d) The test was simple to construct and to operate.

(e) Approximately ten minutes time was required for each player to be tested hitting thirty balls. Four persons could be tested at one time.

(f) The test definitely simulated actual playing conditions in that the target area was approximately the size of the average green. Players used a #8 iron to play the 35 yards, as would usually be done on a golf course.

3. A Long Approach Test was constructed for use out of doors, which proved to be both valid and reliable in measuring a player's ability to use a #5 iron.

(a) An area 180 yards x 70 yards, the approximate space normally found within a quarter mile track, was more than adequate to conduct this test.

(b) There was no cost for equipment other than for the lime used to mark the lines on the grass.

(c) Scorers used replica scoring sheets and merely indicated the spot the ball came to a stop. The scoring formula was simple to apply.

(d) The test was simple to construct and conduct.

(e) Approximately ten minutes time was required for one person to hit thirty balls. As many as three

could be tested at once.

(f) The test definitely simulated actual playing conditions, since a regulation size green and the area in front and beyond the green were included in the scoring system. Players used a #5 iron, the club usually used by the average player for a distance of 120 yards.

4. The tests were established in such a way that any and all golfers, regardless of ability, could use them.

5. Less than 3% of balls hit at the driving target became misses, and most of these hit the floor in front. This indicated the target size was adequate for thirty feet.

Conclusions of The Investigation. After viewing the tests while in use and studying the results the following conclusions were noted:

1. A great deal of interest was created by the tests, especially the Driving Test, and many requests were made by various people wanting to try their skill on them.

2. It was very apparent that a professional or qualified golf coach could study the concentration of shots made on the Driving target and diagnose errors in swing and stance.

3. The Driving Target gave an opportunity to golfers to practice driving throughout the winter. The golf coach was thus able to give each squad member more individual instruction, and the players were far ahead of

other schools in their conditioning when the regular season got under way.

4. Progress and improvement in the use of all three clubs was noted in those boys who were playing golf for the first time, especially after a year of instruction in gym classes.

5. The tests proved to be a definite addition to the golf unit in physical education classes. Besides creating interest, the tests gave students something to shoot for, a method of comparing themselves with others of their own ability.

6. The tests proved to be an aid to classification of students in gym class instruction units.

7. Both the golf team and the physical education program benefitted greatly from the tests.

Recommendations. The tremendous interest shown by all of those who came in contact with this battery, and the satisfactory results obtained indicated there was both a need and a demand for research in golf testing. Only a small contribution was made by this study, leaving a great deal to be done through further investigation. One such study could well be made to determine what, if any, correlation could be found between these or other test scores and actual golf scores. Merely as an illustration of what might be done, Table I was set up to show how a

TABLE I

A LIST OF ALL OF THE SCORES MADE BY A SELECT GROUP FROM THE ONE HUNDRED FIFTY WHO WERE TESTED TO SHOW COMPARISON BETWEEN TEST SCORES AND ACTUAL GOLF SCORES

Name	Drive Score (Target)	Drive Score (Grid)	Dist. Av.	Long 1	App. 2	Short 1	App. 2	Av. Score 180 Holes
Dorsey	280	279	5.6	285	282	280	282	76
Whittington	272	279	8.3	287	284	286	287	75
Sovereign	271	276	9.0	277	273	270	260	77
Davenport	283	277	11.3	278	280	262	266	78.7
Morris	273	272	13.3	270	279	257	262	78.2
Stanford	271	278	13.6	266	261	267	276	80.0
Barclay	251	262	15.3	267	271	258	265	85.0
Cummins	252	251	20.0	275	267	266	261	86.2
Campbell	269	271	30.0	266	267	255	254	88.4
Bakeman, J.	247	240	38.3	238	241	256	268	91.7
Jernigan	232	233	41.0	243	237	220	191	101.3
Harrison	235	230	42.0	234	242	206	214	91.1
Badder	230	224	45.4	241	239	209	199	92.7
Stoppert	217	214	50.0	234	237	228	248	95
Brown	204	212	51.0	236	229	203	192	93.3
Powers	210	200	51.3	202	220	188	201	103.0
Lee	202	205	51.5	237	227	191	193	102.2
Harger	198	194	52.0	211	212	193	183	91.0
Bakeman, G.	190	196	52.2	204	221	195	190	94.3
Wade	217	216	57.0	219	201	213	198	96.0
Marx	175	173	51.0	210	196	180	188	95.6

Note- Dorsey, Whittington and Sovereign are professionals and assistant professional. Barclay and Stoppert are coaches, while the others are members of the Midland High School team.

small, select group scored in this battery as compared with their average scores for 180 holes of golf.

It is hoped that this investigation proves to be as interesting and useful to its readers as it has been to its author.

BIBLIOGRAPHY

A. BOOKS

- Berg, Patty, Otis Dypwick, Golf. New York: A.S. Barnes Company, 1941. xiii / 81 pp.
- Bovard, J.F., and F.W. Cozens, Tests and Measurements In Physical Education. Philadelphia: W.B. Saunders, 1938 (2nd Edition). vii / 363 pp.
- Campbell, William Giles, A Form Book For Thesis Writing. Boston: Houghton Mifflin Company, 1939. iv / 122 pp.
- Good, Warren R., The Elements of Statistics. Ann Arbor: The Ann Arbor Press, 1933. iv / 29 pp.
- Glassow, Ruth, and Marion Broer, Measuring Achievement In Physical Education. Philadelphia: W.B. Saunders, 1939. iii / 344 pp.
- Schleman, Helen, Group Golf Instruction. New York: A.S. Barnes and Company, 1934. v / 316 pp.

B. Periodical Articles

- Adams, Henry, "A Statistical Analysis of Golf", Journal of Applied Psychology, XXI (August, 1937), 384-395.
- Clevett, Melvin, "An Experiment In Teaching Methods of Golf", Research Quarterly, III (December, 1933), 81.
- Murphy, Mary, "Criteria For Judging a Golf Knowledge Test", Research Quarterly, III (December, 1933), 81.
- Schudel, Helen, "A Study of The Respiration of Golfers During The Drive and The Putt", Research Quarterly, IV (May, 1934), 62.
- Snell, Catherine, "Golf, Riding, Tennis, and Baseball Knowledge Tests," Research Quarterly, VI (May, 1936), 106.
- (), "Mechanical Golf Professional Aids," Popular Mechanics, CXXXV (April, 1946), 106.
- (), "A High School Golf Program," Scholastic Coach, XI and XII (November, 1941), 35.
- McKee, Mary Ellen, "A Test for the Full Swinging Shot In Golf", Research Quarterly, XXI (March, 1950), 40-46

C. Unpublished Theses

Autrey, Elizabeth, "A Battery of Golf Tests For Measuring Playing Ability." Unpublished Master's thesis, The University of Wisconsin, Madison, 1937. 34 pp.

Woods, Isabel, "A Study For The Purpose of Setting Up The Specifications of A Golf Driving Cage Target and Test For The Mid-iron and Brassie Clubs," Unpublished Master's thesis, The University of Wisconsin, Madison, 1933. 39pp.

APPENDIX

Name J. Wade

Score 1. 220 2.

x x

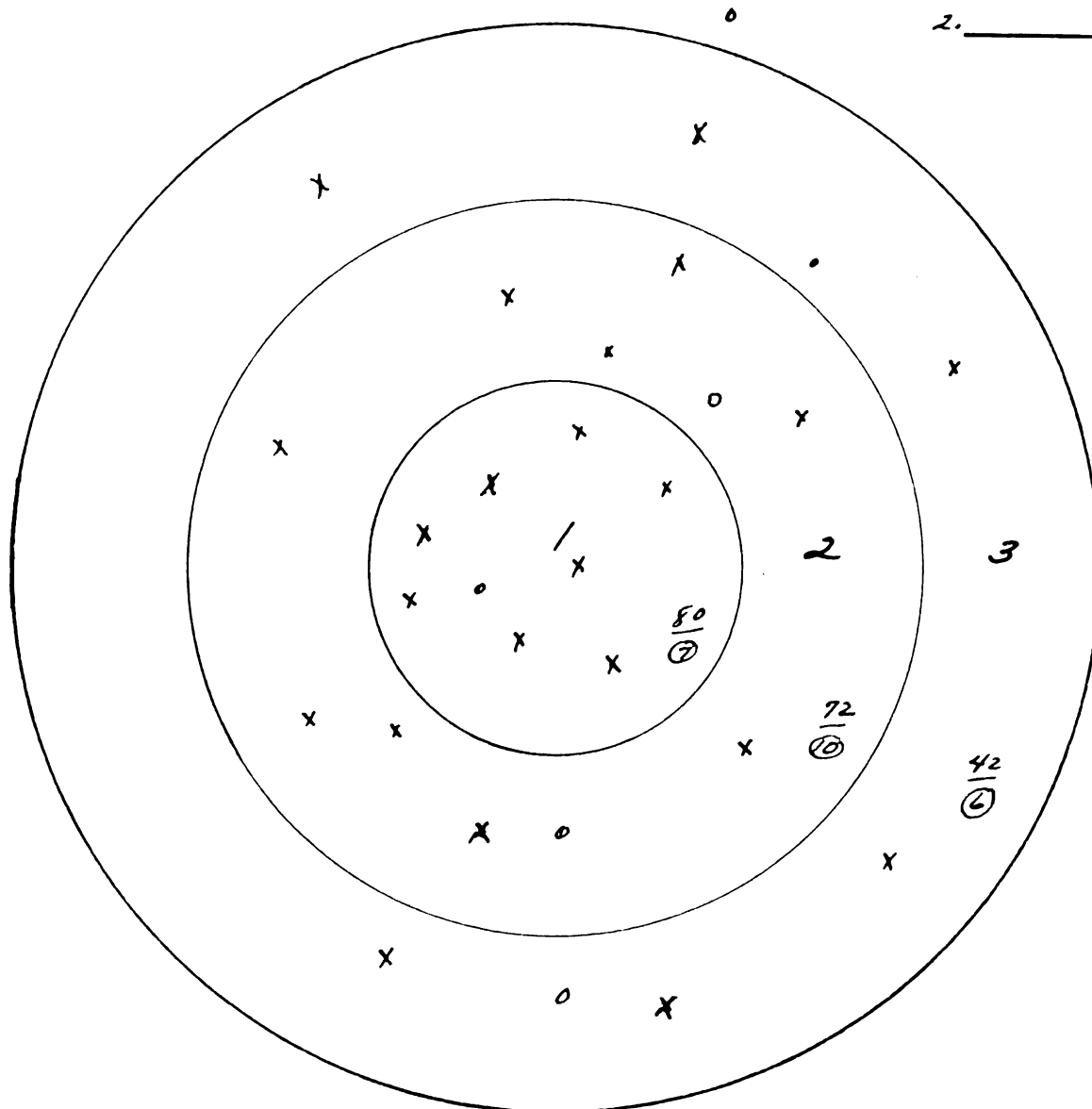
3	6	9	6	3
1	4	8	8	1
1	3	4	3	1

Mark "x" in exact spot ball hits target. Do NOT add up score.

SCORE SHEET USED WITH DRIVING TEST

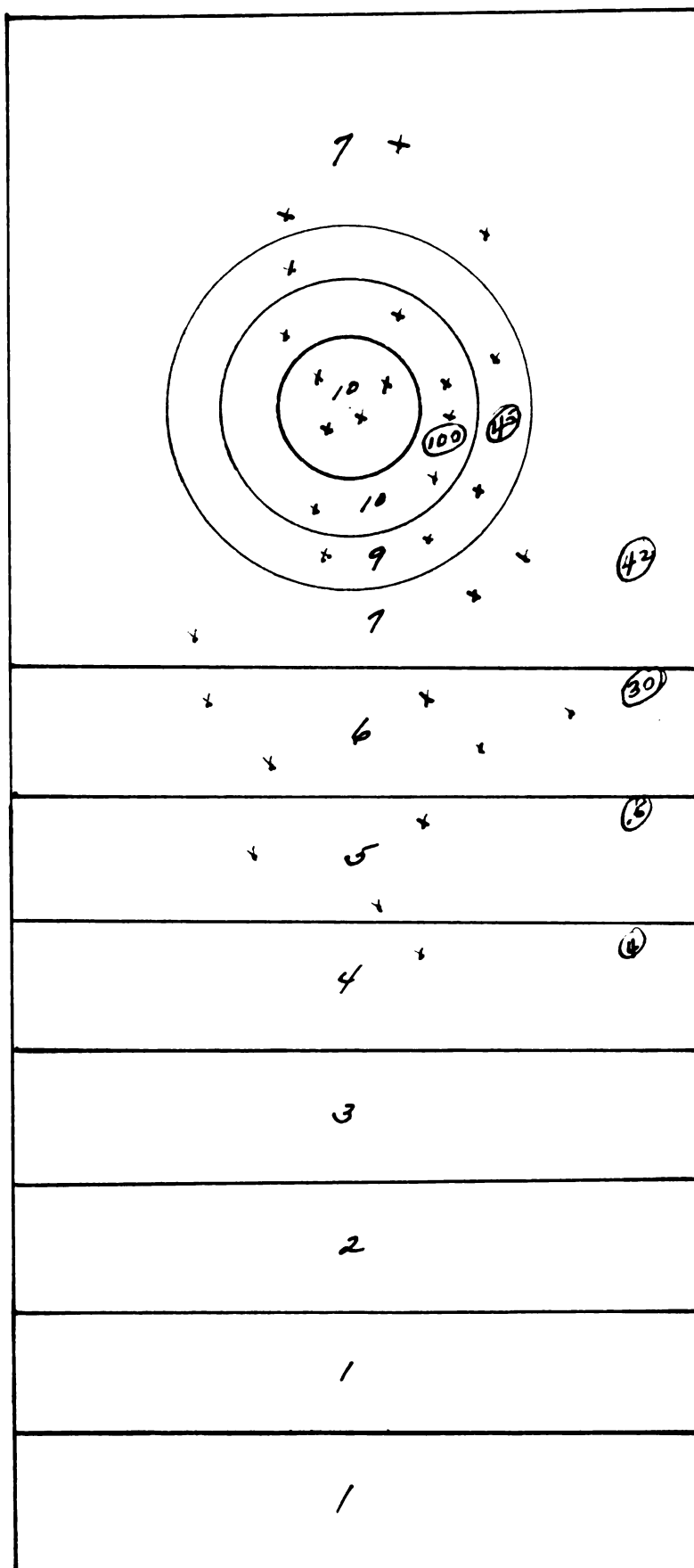
NAME J. WadeScore 1. 217

2. _____



Mark "x" in spot balls stop if they LAND in.
 " " " " " " " " Roll in.

SCORE SHEET USED FOR SHORT APPROACH TEST



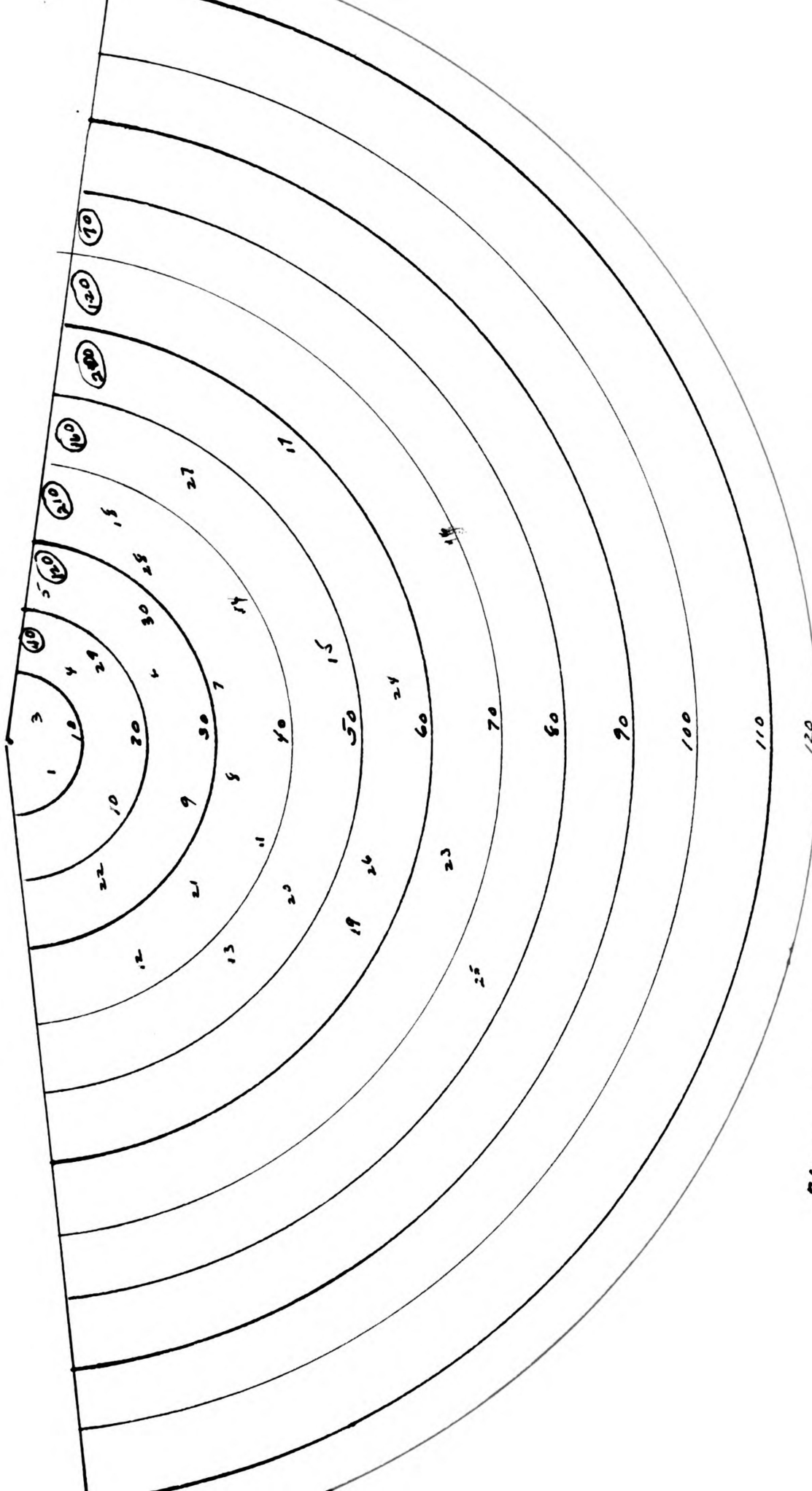
J. W. A. G. e
NAME

Score 1. 230

2. _____

MARK "x" in exact spot ball comes to a stop.
Do NOT Add Up score.

SCORE SHEET USED FOR LONG APPROACH TEST



Place Number on the shot in the exact spot ball stops.

Name J. Wade

Total yds 920

Av. Yds. 30

SCORE SHEET USED WITH DISTANCE DIAGRAM

Second Test Scores

61

	20-84	85-99	100-114	115-129	130-144	145-159	160-174	175-189	190-204	205-219	220-234	235-249	250-264	265-279	280-294	f_y	d_y	$f_y d_y$	$f_y d_y^2$
280-294															"	2	7	14	98
265-279												"	"	"	"	4	6	24	144
250-264												"	"	"	"	5	5	25	125
235-249																0	4	0	0
220-234											"	"				4	3	12	36
205-219											"	"				15	2	30	60
190-204											"	"				16	1	16	16
175-189							"	"	"	"	"					27	0	0	0
160-174							"	"	"	"	"					4	-1	-4	4
145-159							"	"	"	"	"					25	-2	-50	100
130-144							"	"	"	"	"					29	-3	-87	261
115-129							"	"	"	"	"					12	-4	-48	192
100-114							"	"	"	"	"					5	-5	-25	125
85-99							"	"	"	"	"					1	-6	-6	36
20-84							"	"	"	"	"					1	-7	-7	49
f_x		2	7	7	28	23	8	23	15	16	6	0	6	3	2	150	N	106	1246
d_x		-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7				
$f_x d_x$		-12	-35	-36	-84	-50	-8	0	15	32	18	0	30	18	14	-98	S		
$f_x d_x^2$		72	175	144	252	100	8	0	15	64	54	0	150	108	98	1240	U		
$\sum f_y d_y$		-12	-33	-37	-84	-53	-8	0	14	29	15	0	33	16	14	-106	t		
$d_x \sum f_y d_y$		72	165	148	252	106	8	0	14	58	45	0	165	96	98	1227	m		

SCATTER GRAM USED TO COMPUTE THE COEFFICIENT OF CORRELATION BETWEEN THE FIRST AND SECOND SHORT APPROACH TEST SCORES TO DETERMINE THE RELIABILITY OF THE TEST.

		Second Test Scores																		
		65-79	80-94	95-109	110-124	125-139	140-154	155-169	170-184	185-199	200-214	215-229	230-244	245-259	260-274	275-289	f_y	d_y	$f_y d_y$	$f_y d_y^2$
First Test Scores	275-289														"					
	260-274													1	12	2	6	12	72	
	245-259													5	20	5	6	5	30	150
	230-244												4	12	4		5	4	20	80
	215-229											3	15				6	3	18	54
	200-214										8	10	6				8	2	16	32
	185-199										7	5					12	1	12	12
	170-184																23	0	0	0
	155-169																			
	140-154																			
	125-139																			
	110-124																			
	95-109																			
	80-94																			
65-79																				
f_x	1	1	7	6	14	18	23	18	19	10	12	9	4	5	3	150	N	169	1437	
d_x	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7			6	0	
$f_x d_x$	-7	-6	-35	-24	-42	-36	-23	0	19	20	36	36	20	30	21	9	S			
$f_x d_x^2$	49	36	175	96	126	72	23	0	19	40	108	144	100	180	147	1315	U			
$\sum f_y d_y$	-8	-7	-41	-30	-53	-55	-52	0	-3	7	18	25	17	24	17	169	C			
$d_x \sum f_y d_y$	56	42	201	120	159	110	52	0	-3	14	54	100	85	144	119	1253	m			

SCATTER GRAM USED TO COMPUTE THE COEFFICIENT OF CORRELATION BETWEEN THE FIRST AND SECOND SETS OF LONG APPROACH TEST SCORES TO DETERMINE THE RELIABILITY OF THE TEST.

Second Test Score

First Test Scores	Second Test Score																			
	46-60	61-75	76-90	91-105	106-120	121-135	136-150	151-165	166-180	181-195	196-210	211-225	226-240	241-255	256-270	271-285	f_y	d_y	$f_y d_y$	$f_y d_y^2$
271-285															8	26	8	8	64	512
256-270															7	7	2	7	14	98
241-255															12	6	3	6	18	108
226-240																				
211-225																				
196-210																				
181-195																				
166-180																				
151-165																				
136-150																				
121-135																				
106-120																				
91-105																				
76-90																				
61-75																				
46-60																				
f_x	1	0	2	2	7	25	25	17	7	8	13	13	6	3	3	8	150		97	1601
d_x	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8				
$f_x d_x$	-7	-6	-10	-8	-21	-50	-25	0	7	16	39	52	30	18	21	64	106			
$f_x d_x^2$	49	0	50	32	63	100	25	0	7	32	117	208	150	108	147	512	1620			
$\Sigma f_y d_y$	-7	-6	-10	-8	-19	-49	-25	-1	4	15	39	52	30	18	21	63	97			
$\Sigma f_y d_y^2$	49	0	50	32	57	138	25	0	4	30	117	208	145	102	147	504	1602			

SCATTER GRAM USED TO COMPUTE THE COEFFICIENT OF CORRELATION BETWEEN THE FIRST AND SECOND SETS OF DRIVING TEST SCORES TO FIND THE RELIABILITY OF THE TEST.

T A R G E T T E S T S C O R E S		f ₄		f ₄ d ₄ f ₄ d ₄		f ₄ d ₄ f ₄ d ₄		f ₄ d ₄ f ₄ d ₄	
110-119	6	6	2	6	12	72			
100-109	10	15	6	5	30	150			
90-99	4	4	7	4	28	112			
80-89			2	3	6	18			
70-79			1	2	2	4			
60-69			3	1	3	3			
50-59			10	0	0	0			
40-49			3	-1	-3	3			
30-39			3	-2	-6	12			
20-29			1	-3	-3	9			
10-19			4	-4	-16	64			
0-9	3	5	3	-5	-15	75			
f ₄	-9	-8	-7	-6	-5	-4			
d ₄	-27	-40	-21	-24	-10	-12			
f ₄ d ₄	243	320	148	144	40	48			
f ₄ d ₄	16	25	13	15	7	2			
f ₄ d ₄	144	200	91	90	35	8			
f ₄ d ₄	144	200	91	90	35	8			

SCATTER GRAM USED TO COMPUTE THE COEFFICIENT OF CORRELATION BETWEEN THE DRIVING TEST SCORE AND THE AVERAGE DISTANCE FROM THE 250 YARD POINT TO DETERMINE THE VALIDITY OF THE TEST

ROOM USE ONLY

My 12 '53

~~FEB 15 1963~~

My 26 '53

~~MAR 19~~

Ja 12 '53

~~JAN 25 1965~~

Jo 26 '53

May 4 '55

Jun 12 '55

Jul 12 '55

Jul 12 '56

Aug 7 '56

Aug 9 '57

~~OCT 18 1962~~

ROOM USE ONLY

~~DEC 10 1962~~

~~SEP 22 1966~~

~~JAN 7 1963~~

~~JAN 18 1963~~

~~FEB 1 1963~~