A COMPARATIVE STUDY ON THE EFFECTIVENESS
OF TWO GRIPS FOR TEACHING
BEGINNING GOLF

by

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ABSTRACT

The purpose of this study was to investigate which of two grips, the Vardon overlapping grip or the Spread grip, produces the best results in range, accuracy, velocity and the angle of impact when teaching the golf swing to the beginning golfer. Also investigated were the results produced when the beginner was taught a second grip after six weeks of instruction. The McKee test, representing the elements of the golf swing, was selected to examine the hypotheses.

Thirty-three University of British Columbia first and second year students enrolled in the service program of the School of Physical Education and Recreation were randomly selected and divided into two groups. Following the initial tests, the first experimental group, called the Vardon Group, underwent an eight week period of golf instruction, learning the Vardon grip in the first six weeks and the Spread grip in the last two weeks. The second experimental group, called the Spread Group, underwent an identical type of instructional program, except the Spread grip was taught for the first six weeks and the Vardon grip was taught over the last two weeks. Both groups were retested at the end of six weeks and at the end of eight weeks in the same manner.

Both groups averaged gains in performance that were statistically significant over the first six week period in the elements of range and the angle of impact. Over the last
two weeks of instruction, only the Spread Group exhibited a gain in performance that was statistically significant and this was in the element of accuracy. Over the total eight week period of instruction, the Vardon Group averaged gains that were statistically significant in the elements of range, angle of impact and accuracy, whereas, the Spread Group exhibited improved gains in performance that were statistically significant in the elements of range, angle of impact and velocity.

A statistically significant difference between the groups over both the six week period and eight week period was exhibited in the element of accuracy only. The Spread Group, using the Spread grip in the first six week period, and the Vardon grip in the last two week period, improved its performance whereas, the Vardon Group decreased in performance over both periods of instruction.

It was concluded that only in the element of accuracy can the Spread grip be construed as superior to the Vardon grip when teaching the golf swing to a group of beginners over an eight week period of twice-weekly instruction.
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CHAPTER I

STATEMENT OF THE PROBLEM

The purpose of this study is to investigate which of two grips, the "Vardon" grip or the "Spread" grip, produces the best results in range, accuracy, velocity and the angle of impact when teaching the golf swing to the beginning golfer. Also investigated are the results produced when the beginner is taught a second grip after six weeks of instruction.

The Vardon grip, or overlapping grip, as it is commonly called, is the method by which the right-handed golfer holds the club in both hands with the right hand grasping the club immediately below the left hand. The little finger of the right hand overlaps, and rests upon, the index finger of the left hand. The fingers hold the club firmly. The hands are on the club in such a position that the "V" formed by the index finger and thumb of each hand points approximately to the golfer's right shoulder.

The Spread grip, which is often mistakenly called the "baseball" grip, is applied to the handle of the golf club in the same manner as the Vardon grip except for one major difference, the little finger of the right hand rests against the index finger of the left hand and is on the club itself.

In both grips the left thumb rests along the shaft of the club inside and beneath the palm of the right hand. This is distinctly different from the "baseball" grip where
the left thumb is wrapped around the shaft outside the right hand.

In the Spread grip there are eight fingers in contact with the club, whereas, in the Vardon grip, there are seven fingers grasping the club. The exponents of the Spread grip state that eight fingers tend to give more leverage to the golf swing, while those golfers who use the Vardon grip claim that seven fingers lend more "compactness" to the grip. This difference in opinion has resulted in a controversy as to which method is the better.

For the purposes of this study, it is, therefore, hypothesized that:

1. there is no significant difference between the gains resulting from the use of the Vardon grip or the Spread grip in any of four selected criteria used in the testing of beginning golfers following six weeks of instruction, and

2. there is no significant difference between the original groups in any of four selected criteria following an additional two weeks of training in which the grips for both groups are interchanged.
CHAPTER II

JUSTIFICATION OF THE PROBLEM

Most golfing authorities agree that the method by which the golf club is held is one of the most important components of the golf swing. Though there is considerable literature concerning the use of the Vardon grip, there are little or no objective data in the literature to support the argument that it is superior to the Spread grip. The Vardon grip is taught to beginners mainly because it is the grip the teacher uses himself, because it is the grip advocated by the leading performers in the golf world or because it is the grip the teacher learned himself when he first started to play. There has been no attempt made to discover if the Spread grip would be more suitable for the teaching of beginners.

If this experiment indicates that one grip is significantly more effective than the other, or that practice of both grips is significantly more effective, it may be of some value to golf teachers.

If no conclusive results are produced, it will have, at least, supplied some objective data.
CHAPTER III

REVIEW OF THE LITERATURE

....it took me a year of constant experimentation to satisfy myself as to the superiority of this grip over all others. It seems to create just the right amount of fusion between the hands and involuntarily induces each to do its proper work. (1)

It was with this statement that Harry Vardon changed the grip which golfers had been using for 350 years. The fact that Vardon, the best known golf professional of his day, was holding the golf club in a certain manner was enough for his grip to become the most universally accepted component in the golf swing. Since the inception of this grip in 1905 the majority of successful golfers, professional and amateur, have used this grip. Many professionals proclaim their particular method of doing various things in the golf swing will insure success, but it is almost without exception that they advocate the overlapping Vardon grip.

The best description of the overlapping Vardon grip comes from Vardon himself. He states (2):

The club is held in the last three fingers of the left hand, the shaft pressing into the top joint of the forefinger. As the wrist should be turned so as to show the knuckles, the left thumb will be urged past the shaft. We now have the left thumb firmly on the club, and the top joint of the left forefinger exercising a determined hold. It is with these two members that we want to grip tightest; that is why we are
making use of the strongest part of the left forefinger. In an ordinary way it is the finger with which we find we apply least pressure when we take hold of anything. It seems to be a law of nature that the little fingers shall be able to grip more securely. Consequently, let the second, third and little fingers fall into natural position after a firm grip has been taken with the left thumb. That rounded protuberance of admirable proportions, the ball of the right thumb, is placed over the left thumb, the top of which alone remains exposed to view. The first three fingers of the right hand clasp the shaft, and the little finger overlaps and presses firmly on the forefinger of the left hand. Then the union is complete.

Tommy Armour, the leading golf teacher of this era, in discussing the grip, says (3) that one of the first things which determines how well one is going to be able to play is the way in which the club is held, and that both hands must be fitted compactly together to coordinate the essential factors of left-hand control and right-hand power. He admits that there are several grip variations which a few of the experts use, but they can get away with these deviations because they have the opportunity for considerable practice and play. Armour advocates the overlapping grip because it contributes to excellent hand action, a necessary factor in hitting a golf ball well.

Novak (4) adds to this by saying that the overlapping grip is responsible for positioning the club correctly, for maintaining that position at all points in the swing, and for transmitting to the club, through leverage, the force created by the body turn. He thinks the overlapping grip is the only
way to set the hands so that it is almost impossible for them not to counterbalance properly.

It appears most of the professional golfers consider this counterbalancing of the hands important. Nelson (5), Turnesa (6), Burke (7) and Mangrum (8) all mention in one way or another that the hands must act in opposition to each other, and that the overlapping grip is the grip that best promotes this opposing action.

Guldahl (9) stresses the importance of making sure the right hand supplies the power and the left hand supplies the control. He thinks the main idea of the overlapping grip is to remove some of the right-hand control from the swing. He tells us to remember that the power to be gained from wrist action in the swing depends entirely upon the correct placement of both hands on the club.

However, even the professionals tend to disagree on some of the finer points concerning the proper grip. Ben Hogan (10) for example, emphasizes that the hands act as one unit; that both hands supply an equal share of power and control. Hogan is as certain that the overlapping grip does this as the others are certain that it does not. Hogan, who has probably done more experimentation on his grip than any of the other professionals, feels that unless you have a co-operative union of the hands, the right hand will achieve dominance and ruin the swing.

Both Hogan (11) and Mangrum (12) agree, however, that
the reason the club has less chance of slipping either at the top of the swing or at impact with the ball is due to the fact that the hands are locked together and form a single unit caused by the overlapping of the little finger of the right hand.

Seri (13), in his analysis of the golf swing, states that the proper hand grip is essential since the hands will determine the direction and path the head of the club takes to make contact with the ball. He thinks the overlapping grip provides the compactness to make this possible.

Rehling (14), in his analysis of techniques of the golf drive, discovered from studying films of twelve well-known professionals and one amateur that eleven out of the thirteen golfers used the overlapping grip.

Rehling (15) also feels that there is a definite dividing line between knowledge and skill in connection with the grip, and it is with this problem in mind that he feels the overlapping grip is the best grip to use in teaching beginning golfers.

It can be seen, therefore, that the majority of opinion indicates that the Vardon overlapping grip is the best method by which to hold a golf club. There are, however, a few dissenters.

Whitlach (16), in 1910, said that various reasons have been given to explain why the overlapping grip is superior to
any others, but the one heard most frequently was that men with large hands were compelled to adopt the Vardon grip. He failed to see the logic in the inference that it would not be as beneficial to a man with small hands.

Seymour Down (17) is of the opinion that a golfer should experiment with the various hand grips. He postulates that the exact setting of the hands varies with individuals because of the variation in muscle development, and that each player should experiment with various hand settings until the correct one is found.

The fact that beginners tend to use a "natural" or Spread grip at the beginning emerges from an article by Dr. D. Veller. One of the most common mistakes, claims Veller (18), is that most beginners grasp the club in one of two ways; they either grasp it like a baseball bat or place their right thumb directly behind the shaft.

John W. Bunn, in his book on the scientific principles of coaching, states (19):

It has always disturbed me this tendency in others to accept blindly the methods employed by the star athlete and to assume these methods are correct merely because the man is a top performer. The overlapping grip which in some form or other is universally used has certain mechanical disadvantages. The stroking movement so far as the hands are concerned is such that the top hand is pushing back while the bottom hand is pushing forward with a fulcrum midway between the center of the hands. Thus, the further the hands are spread, within practical limits of course, the greater the power of the stroke. The effective force is increased in proportion to the
length of the force arm.

Dana (20) measured the relative power produced in the golf swing when utilizing each of the three types of grips; the Vardon grip, the Spread grip and the baseball grip. He used eighteen subjects who ranged from beginners to members of the varsity golf team. He found there was no statistically significant difference to prove one grip superior to either of the others. The largest median velocity came from the Vardon grip and the largest single velocity came from a person using the Spread grip.

The success of the Spread grip in tournament golf was well demonstrated in 1959 by two of the better known professionals, Art Wall, Jr., who won the United States Master's Tournament, and Bob Rosburg, who won the Professional Golfer's Association Tournament. Both these players used the Spread grip.

Wall (21) especially recommends the Spread grip for women and men with small hands because it is more natural, less tense and requires less wrist action.

Golf Tests: Tests applicable for the full swinging shot in golf which are found in the literature are generally limited to measuring either accuracy or distance.

Clevett (22), Wood (23) and Alway (24) designed target tests to measure the accuracy of a golf shot. The highest reliability obtained was 0.79 in the Wood test. The tests
measuring distance are limited to a measurement of total yardage or a measurement of total force against a machine specially designed for this purpose. Orlando (25) and Autrey (26) designed tests to measure the distance of a golf shot outside and Dana (27) designed a machine to measure the force of a golf shot from which he calculated its distance. These tests had reliabilities ranging from 0.72 for the ten trials in the Autrey test to 0.79 for ten trials in the target test of Wood.

The test chosen for this study was the Mary Ellen McKee Test for the Full-Swinging Shot in Golf (28). This test measures not only accuracy and distance but velocity as well. The criteria for the selection of this particular test were based upon the established statistical standards for its reliability. The reliabilities calculated from the average of the ten odd- and ten even-numbered trials in the experiment were 0.92 and 0.95 in the element of range, 0.86 and 0.89 in the element of velocity, 0.81 and 0.89 in the angle of impact and 0.82 and 0.60 in the angle of deviation.

A complete explanation of the test may be found in the next chapter on pages 17-19.
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1 Vardon, H., How To Play Golf, Toronto, Bell and Cockburn, 1912, p.86.

2 Ibid., p.84

3 Armour, T., How To Play Your Best Golf All the Time, New York, Simon and Shuster, 1953, pp.48-57.


9 Guldahl, R., Groove Your Golf, Indianapolis, Bookwalter-Ball-Greathouse, 1939, p.25.


11 Ibid., p.23.

12 Mangrum, L., op. cit., p.10.


CHAPTER IV

METHODS AND PROCEDURE

Two groups of first and second year students registered in the required program of physical education at the University of British Columbia were selected randomly for the purposes of this study. The study was carried out for a semester of eleven weeks' duration. The two groups were divided into a Vardon experimental group and a Spread experimental group.

The Vardon or Overlapping Group: This was a required golf activity class of seventeen students. These students had not played golf previous to this study. The subjects were tested with the Mary Ellen McKee Test for the Full Swinging Shot in Golf (1) prior to the beginning of instruction and were allowed to use any grip which they knew. After six weeks of instruction they were given the same test again, and then, after two more weeks of instruction a third and final test.

The class was subjected to a supervised and planned programme of golf instruction. The plan of the golf lessons is found in Appendix H.

Each subject in this group was instructed in the use of the Vardon or overlapping grip: the grip in which the little finger of the right hand overlaps the index finger of the left hand and the left thumb fits down along the shaft underneath
the right hand. Each subject in this group was ordered to use only this grip during the classes of instruction. It was impressed upon each subject in the group that, under no circumstances, was he to play any outside golf during the duration of the experiment. At the end of six weeks this group was again given the McKee Golf test. Immediately following the second test, two more weeks of instruction ensued and the subjects, at the beginning of this two week period, were taught the Spread grip, commonly known as the baseball grip. This grip is exactly the same as the Vardon grip except for one major difference; the little finger of the right hand does not overlap the index finger of the left hand but fits snugly on to the shaft and against the index finger of the left hand. This grip serves to put one more finger on the club than the Vardon grip. The subjects were ordered to use only this grip during this two week period of instruction. The group was then given the McKee Golf Test for the third time and instructed to use the Spread grip during the test.

The group as a whole met twice weekly for periods of thirty minutes each.

Due to the fact that this group began their instruction with the Vardon grip, they will be referred to, hereafter, as the Vardon group.

The Spread Group: This was a required golf activity class of sixteen students. These students had not played
golf previous to this study. The subjects were tested with the Mary Ellen McKee Test for the Full Swinging Shot in Golf prior to instruction and were allowed to use any grip which they knew. After six weeks of instruction the group was again given the same test. Immediately following this test the group was given two more weeks of instruction and given a third test.

The class was subjected to a supervised and planned programme of golf instruction. The plan of the golf lessons is found in Appendix H.

Each subject in this group was instructed in the use of the Spread grip. This grip entails laying the thumb of the left hand down along the shaft inside the right hand, and not wrapping it around the shaft outside the right hand as it is done in the baseball grip. This grip also entails fitting the little finger of the right hand against the index finger of the left hand and resting it on the club. This is different from the Vardon grip in which the little finger of the right hand overlaps the index finger of the left hand. Each subject in this group was ordered to use only this grip during the classes of instruction. It was impressed on each subject in the group that, under no circumstances, was he to play any outside golf during the entire period of the experiment.

At the end of six weeks this group was again given the McKee Golf Test. They were compelled to use the Spread grip
during the test. Immediately following this second test, two more weeks of instruction ensued and the subjects, at the beginning of this two week period, were taught the Vardon grip. The subjects were ordered to use only this grip during this two week period of instruction. The group was then given the McKee Golf Test for the third time and instructed to use the Vardon grip during the test.

The group as a whole met twice weekly for periods of thirty minutes each.

Due to the fact that this group began their instruction with the Spread grip first, they will be referred to, hereafter, as the Spread Group.

**Testing Personnel**: A team of three testers administered the testing programme to each group. The members of the testing team were two university students and the instructor. The same instructor taught both groups. Practice in the administration of the test and the handling of the different sets of stakes was provided for all members of the testing team, and all were familiar with the testing routine before actually testing the first group. The duties of the two students who were on the testing team consisted of planting the appropriate stakes where the balls first touched the ground.

**Administration of Tests**: The three tests were administered to the two groups of subjects on the football field of the University of British Columbia.
The initial test was administered in late September, the second test six weeks later in the last week of November and the third test two weeks later in the second week of December. The two groups met for their respective activities and instruction on different days and at two different times in the afternoon. All testing for the two groups was carried out on the same day but at different times during the day. The weather was the same for all three tests with the temperature being a little lower for the second and third tests.

The same test instructions were read to both groups, and each group completed the tests in an identical manner.

The following statement was read to each group prior to the commencement of each test:

You are being submitted to a series of ten trials designed to measure your ability in hitting a golf ball. The accurate results of these tests are dependent on your giving forth of your best performance in each trial. For this purpose your co-operation is requested.

The three tests were standardized for both groups. Specific details of the Mary Ellen McKee Test administered to each group are outlined below:

1. Equipment:
   a. A rope 210 yards long. This rope was marked at 25 yard intervals with ribbons of different colours; each five yards between the coloured ribbons was marked with white ribbons. This rope was on the ground throughout the
tests and designated the line of flight. The rope was laid diagonally from the northwest corner of the football field to the southeast corner of the football field.

b. Several sets of stakes numbered from one to ten. Each set of stakes was designated by a capital letter (e.g. A1, B2, C3, D8, E10, etc.).

c. One stop watch.

d. A rope 60 yards long. This rope was marked at ten yard intervals with red ribbons; each yard between the red ribbons was marked with white ribbons.

e. One hundred golf balls.

f. Thirty-three individual score sheets and four group score sheets.

g. Four number one woods; two right-handed and two left-handed.

h. One rubber mat.

2. Procedure: Each test consisted of ten trials for each subject. A hit which was in the air less than 0.6 of a second was not counted as a trial. Topped shots and whiffs were recorded. A specified set of ten stakes was assigned for the ten trials of each subject. As the test was taken, the stake whose number corresponded to the number of the trial, and whose capital letter corresponded to the subject, was placed in the ground at the point where the ball first struck. The time of flight of a trial was measured by a stop watch calibrated to one-tenth of a second. Each subject, prior to his ten trials, was allowed ten warm-up swings.
3. Measurements: Measurements of the straightaway distance, and the deviation right or left of the designated line of flight were made after five sets of ten trials had been taken. The measurements for each stake were recorded on the appropriate group sheet (cf. Appendix D, p.62) designated by the letter of the stake and the space indicated by the number on the stake. These measurements were later transferred to the individual score sheets (cf. Appendix C, p.61).

a. Range. The range was not measured directly. The distance recorded was the straightaway distance determined to the nearest five yards by the rope marked with the coloured and white ribbons and which was serving as the designated line of flight. This distance was determined by right angle alignment with the stake.

b. Deviation. Deviation to the right or left was measured by the 60 yard rope perpendicular to the straightaway rope. The amount of deviation was the distance between the straightaway rope and the stake. The 60 yard rope was moved to measure the deviation of each stake, and each deviation was measured to the nearest yard.

c. Time of Flight. The time of flight was measured from the moment of impact until the ball first touched the ground. This was recorded immediately after each trial.
Treatment of Raw Scores: The elements in the skill of executing a full wood shot are first, velocity imparted to the ball by the clubhead; second, accuracy in direction, the deviation from the intended line of flight; third, the accuracy of impact, the angle at which the ball leaves the mat and with the velocity determines the arc of flight; fourth, the range, the distance the ball travels.

The test selected, the Mary Ellen McKee Test for the Full Swinging Shot in Golf, measures these four elements.
The measurement of these four elements was achieved by recording three facts concerning each trial - 1) the distance between the point of impact and a point on the designated line of flight level with the point where the ball first touched the ground, 2) the time consumed by the flight of the ball and 3) the amount of deviation right or left of the designated line of flight, measured on a line perpendicular to the designated line of flight.

Treatment of these recordings for conversion into the four elements of skill in the golf swing was done in the following manner:

1. **Velocity**: The velocity desired was that imparted to the ball by the impact of the clubhead. The range could not be used to determine velocity because it was the result of not only the clubhead acceleration, but also, the acceleration of gravity. A right-angled triangle was constructed to determine the distance the ball travelled within the time of flight in the direction of the clubhead acceleration. The right-angled triangle was constructed in a vertical plane, one side being the range and the other a perpendicular erected at the point where the ball first touched the ground. The height of the perpendicular was the distance through which gravity moved the ball within the time of flight and was found by using the formula, \( S = \frac{1}{2}gt^2 \). The hypotenuse of the triangle, the line which connected the height of the perpendicular to the point of impact, represented the
distance the ball would have travelled in the direction of the clubhead acceleration had there been no gravity. The velocity was found by dividing the latter distance by the time of flight.

2. **Angle of Impact:** The angle of impact was found by using the right-angled triangle that was constructed to determine the velocity. The angle of impact was the angle formed by the line representing the range and the hypotenuse.

3. **Angle of Deviation:** The angle of deviation was determined by the construction of a right-angled triangle in a horizontal plane. The two sides were the straightaway distance and the deviation from the straightaway distance. The angle of deviation was the angle formed by the straightaway distance and the hypotenuse of the triangle.

4. **Range:** The range was found by using the right-angled triangle that was constructed to determine the angle of deviation. The range was the hypotenuse of this triangle.

A sample of the treatment of the raw scores is found in Appendix B.

**Equating the Groups:** The groups were equated on the basis of equivalent groups; the matching was done initially by pairs so that each person in the Vardon Group had a match in the Spread Group.

Due to the unique aspects in the determining the skill elements in the golf swing it was impossible to
equate the groups on the basis of one skill element only (e.g. two subjects equated on the basis of range would not be equal in the elements of velocity, angle of impact or angle of deviation). As a result, four different sets of matched pairs emerged from the equating of the groups. Ten pairs were matched in the element of velocity, eight different pairs were matched in the element of range, nine pairs were matched in respect to the angle of deviation and nine pairs were matched in the angle of impact. Each of the four different elements of the skill in hitting a golf ball had a different set of pairs.

This procedure enabled the experimenter to set off the effects of the use of the Vardon grip against the effects of the use of the Spread grip in four different elements of skill concerned with the full number one wood shot in golf.

Following the treatment of the raw scores of each group, the matching was done in relation to the particular skill element concerned. Appendix G shows the results of the raw score treatment and the way in which subjects were equated on the basis of the four different skill elements.

REFERENCES

CHAPTER V

ANALYSIS OF THE RESULTS

The data obtained from the two experimental groups are summarized in the following tables. The statistical treatment of the results deals with the degree of improvement in the mean performance of each group between the initial and the second test, between the second and the third test and between the initial and the third test in the elements of velocity, range, angle of deviation and angle of impact. Also statistically treated are the comparisons of the means of improvement in each test between the groups in the elements of velocity, range, angle of deviation and angle of impact.

A. Velocity

Initial to Second Test: The mean increase in velocity varied in the Vardon Group from 2.24 ft./sec. to 55.69 ft./sec., whereas, in the Spread Group, the mean increase in velocity varied from 4.61 ft./sec. to 29.81 ft./sec. There were five subjects in the Vardon Group who showed a decrease in velocity over the six week period of instruction, the largest decrease being 22.4 ft./sec. In the Spread Group, over the same six week period, there were four subjects who showed a decrease; these decreases ranged from 3.89 ft./sec. to 14.92 ft./sec.

The differences in the performance levels of each group over the six week instructional period are summarized in
Table I. Of the two groups, neither showed a difference between the initial and second test that was statistically significant. The mean improvement of the Vardon Group was 7.34 ft./sec. with a t ratio of 0.83 which was not statistically significant. The subjects of the Spread Group showed an increase in mean performance of 5.02 ft./sec. with a t ratio of 0.99 which again was not statistically significant.

**TABLE I**

Comparison of Results Between Initial and Second Test Means in the Element of Velocity

<table>
<thead>
<tr>
<th>Groups</th>
<th>$\bar{M}_1$</th>
<th>SD$_1$</th>
<th>$\bar{M}_2$</th>
<th>SD$_2$</th>
<th>$M_1-M_2$</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vardon Group</td>
<td>108.45</td>
<td>10.28</td>
<td>115.79</td>
<td>19.43</td>
<td>7.34</td>
<td>0.83</td>
</tr>
<tr>
<td>Spread Group</td>
<td>108.94</td>
<td>10.81</td>
<td>113.96</td>
<td>9.23</td>
<td>5.02</td>
<td>0.99</td>
</tr>
</tbody>
</table>

**Second to Third Test**: Of the ten subjects in the Vardon Group five showed an improvement in performance following this two week period of instruction. In the Spread Group, six of the ten subjects exhibited improved performance over the same period.

Table II summarizes the differences in performance levels of each group over the two weeks period during which both groups had switched over to the other grip; the Vardon Group to the Spread grip and the Spread Group to the Vardon grip.

The most notable mean gain in performance was exhibited by the Spread Group, using the Vardon grip. In this group, the mean performance in velocity was increased 13 ft./sec.,
whereas, the mean performance gain in velocity of the Vardon Group, using the Spread grip, only increased 3.5 ft./sec. following the two weeks of instruction. The difference between the test means of 3.5 ft./sec. with a t ratio of 0.74 for the Vardon Group was not statistically significant. The difference between test means of 13 ft./sec. with a t ratio of 1.74 for Spread Group also was not statistically significant.

**TABLE II**

Comparison of Results Between Second and Third Test Means in the Element of Velocity

<table>
<thead>
<tr>
<th>Groups</th>
<th>M2</th>
<th>SD2</th>
<th>M3</th>
<th>SD3</th>
<th>M2-M3</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vardon Group</td>
<td>115.79</td>
<td>19.43</td>
<td>119.29</td>
<td>14.99</td>
<td>3.5</td>
<td>0.74</td>
</tr>
<tr>
<td>Spread Group</td>
<td>113.96</td>
<td>9.23</td>
<td>126.96</td>
<td>22.21</td>
<td>13.0</td>
<td>1.74</td>
</tr>
</tbody>
</table>

**Initial to Third Test:** Improved mean performances in velocity varying from 4.39 ft./sec. to 54.88 ft./sec. were recorded for the Vardon Group over the total eight week period of instruction. This mean gain in performance was the result of the subjects having been taught both grips, the Vardon and Spread grips, but using the Spread grip in the third and final test. In the Spread Group, over the same period of time and with them using the Vardon grip in the third test, the mean improvement in velocity varied from 4.52 ft./sec. to 70.38 ft./sec.

A summary of the performance levels of each group is shown in Table III. Of the two groups, only the results of the Spread Group, which learned the Spread grip first and
the Vardon grip second, were statistically significant. The improvement in performance between the initial test mean and the third test mean was 18.02 ft./sec. \( (t = 2.79) \) which was acceptable at the 5 percent level of confidence. The mean improvement in velocity over the same period of time for the Vardon Group was 10.84 ft./sec. \( (t = 1.46) \), which was not statistically significant.

**TABLE III**

Comparison of Results Between Initial and Third Test Means in the Element of Velocity

<table>
<thead>
<tr>
<th>Groups</th>
<th>( M_1 )</th>
<th>SD_1</th>
<th>( M_3 )</th>
<th>SD_3</th>
<th>( M_1 - M_3 )</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vardon Group</td>
<td>108.45</td>
<td>10.28</td>
<td>119.29</td>
<td>14.99</td>
<td>10.84</td>
<td>1.46</td>
</tr>
<tr>
<td>Spread Group</td>
<td>108.94</td>
<td>10.81</td>
<td>126.96</td>
<td>22.21</td>
<td>18.02</td>
<td>2.79*</td>
</tr>
</tbody>
</table>

* Significant at the 5 percent level of confidence

The Vardon Group compared with the Spread Group: The degrees of improvement between the initial and second test, between the second and third test and between the initial and third test of the Vardon Group were compared with those of the Spread Group. The evaluation of the significance of the difference between the means of both groups in the element of velocity is shown in Table IV.

In none of the tests was the mean improvement of the Vardon Group found to be significantly greater than that of the Spread Group.

The mean improvement between Test 1 and Test 2 in the Vardon Group was 7.34 ft./sec., whereas, the mean improvement
for the same period in the Spread Group was 5.02 ft./sec.
The difference between these two gains resulted in a t ratio of 0.26 which was not statistically significant. Between Test 2 and Test 3 the difference between the mean improvement of 3.5 ft./sec. for the Vardon Group and the mean improvement of 13 ft./sec. for the Spread Group resulted in a t ratio of 0.85 which was not statistically significant. Between Test 1 and Test 3 the difference between the mean improvement of 10.84 ft./sec. for the Vardon Group and the mean improvement of 18.02 ft./sec. for the Spread Group resulted in a t ratio of 0.68 which was not statistically significant.

TABLE IV

Degrees of Improvement Between the Means of the Spread Group and the Vardon Group

<table>
<thead>
<tr>
<th>Tests</th>
<th>Vardon Group Mean</th>
<th>Spread Group Mean</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test 1 - Test 2</td>
<td>7.34</td>
<td>5.02</td>
<td>0.26</td>
</tr>
<tr>
<td>Test 2 - Test 3</td>
<td>3.50</td>
<td>13.00</td>
<td>0.85</td>
</tr>
<tr>
<td>Test 1 - Test 3</td>
<td>10.84</td>
<td>18.02</td>
<td>0.68</td>
</tr>
</tbody>
</table>

B. Angle of Deviation

Initial to Second Test: The mean increase in deviation from the designated line of flight varied in the Vardon Group from 57 minutes to 13 degrees 15 minutes, whereas, in the Spread Group there was mean decrease in the angle of deviation varying from 42 minutes to 12 degrees 50 minutes. There were five subjects in the Vardon Group who showed an increase in the angle of deviation over the six week period of instruction. In the Spread Group there were five subjects
who showed a decrease in the angle of deviation over the same period.

A summary of the performance levels of each group over the six weeks of instruction is shown in Table V. None of the results of either group was statistically significant. The mean increase in the angle of deviation for the Vardon Group was 4 degrees with a t ratio of 1.56 which was not statistically significant. In the Spread Group, the mean decrease, or mean improvement, in the angle of deviation was 57.56 minutes with a t ratio of 0.37 which was not statistically significant.

<table>
<thead>
<tr>
<th>Groups</th>
<th>$M_1$</th>
<th>S.D.</th>
<th>$M_2$</th>
<th>S.D.</th>
<th>$M_1 - M_2$</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vardon Group</td>
<td>843</td>
<td>258.14</td>
<td>1082.78</td>
<td>345.66</td>
<td>239.78</td>
<td>1.56</td>
</tr>
<tr>
<td>Spread Group</td>
<td>842.56</td>
<td>230.91</td>
<td>785</td>
<td>278.16</td>
<td>-57.56</td>
<td>0.37</td>
</tr>
</tbody>
</table>

**Second to Third Test:** Only eight out of the eighteen subjects in both groups, four in each group, showed improvement in the angle of deviation when they switched to the second grip.

Table VI summarizes the differences in the performance levels of each group over the two weeks of instruction. In the Vardon Group, the mean performance in the angle of deviation increased 1 degree 34 minutes with a t ratio of 0.61 which was not statistically significant. The Spread
Group had mean performance improvement of 55 minutes for a t ratio of 0.66 which was not statistically significant.

### TABLE VI

Comparison of Results Between Second and Third Test Means in the Angle of Deviation (in minutes)

<table>
<thead>
<tr>
<th>Groups</th>
<th>$M_2$</th>
<th>$SD_2$</th>
<th>$M_3$</th>
<th>$SD_3$</th>
<th>$M_2-M_3$</th>
<th>$t$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vardon Group</td>
<td>1028.78</td>
<td>345.66</td>
<td>1171.11</td>
<td>295.81</td>
<td>94.33</td>
<td>0.61</td>
</tr>
<tr>
<td>Spread Group</td>
<td>785</td>
<td>278.16</td>
<td>729.67</td>
<td>250.96</td>
<td>-55.33</td>
<td>0.66</td>
</tr>
</tbody>
</table>

Initial to Third Test: In the Vardon Group, only one out of the nine subjects improved in his accuracy over the total eight week period of instruction, whereas, five out of the nine subjects in the Spread Group improved.

The differences in performance levels of each group over the eight week period of instruction are summarized in Table VII. The most notable gain in performance was exhibited by the Spread Group. In this group, the mean performance was improved by 1 degree 53 minutes for a t ratio of 0.95 which was not statistically significant. The difference between test means for the Vardon Group over the same period of time showed an increase in the angle of deviation of 5 degrees 34 minutes for a t ratio of 4.22 which was significant at the 1 percent level of confidence.

### TABLE VII

Comparison of Results Between Initial and Third Test Means in the Angle of Deviation (in minutes)

<table>
<thead>
<tr>
<th>Groups</th>
<th>$M_1$</th>
<th>$SD_1$</th>
<th>$M_3$</th>
<th>$SD_3$</th>
<th>$M_1-M_3$</th>
<th>$t$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vardon Group</td>
<td>843</td>
<td>258.15</td>
<td>1177.11</td>
<td>295.81</td>
<td>334.11</td>
<td>4.22*</td>
</tr>
<tr>
<td>Spread Group</td>
<td>842.56</td>
<td>230.91</td>
<td>729.67</td>
<td>250.97</td>
<td>-112.89</td>
<td>0.95</td>
</tr>
</tbody>
</table>

*Significant at 1 percent level of confidence
The Vardon Group compared with the Spread Group: The degrees of improvement between the initial and second test, between the second and third test and between the initial and third test of the Vardon Group were compared with those of the Spread Group. The evaluation of the significance of the difference between the means of both groups is shown in Table VIII.

The results showed that between the initial and second tests the difference between the mean gain in improvement of the Spread Group and the mean decrease in performance of the Vardon Group was sufficiently great to be accepted statistically. No statistically significant difference was established between the groups between the second and third test. However, between the initial and third test the difference between the mean gain in improvement of the Spread Group and the mean decrease in performance of the Vardon Group was again sufficiently great to be accepted statistically.

The mean improvement in the Spread Group between Test 1 and Test 2 was 4 degrees, whereas, the mean decrease in performance in the Vardon Group was 57.56 minutes over the same six week period. The difference between this increase and decrease was 6 degrees 56 minutes which resulted in a t ratio of 2.32 which was significant at the 5 percent level of confidence. Between Test 2 and Test 3 the difference between the mean improvement of 55.33 minutes for the Spread Group and the mean decrease in performance of 1 degree 34 minutes for the Vardon Group was not statistically
significant. The mean improvement between Test 1 and Test 3 for the Spread Group was 1 degree 53 minutes, whereas, for the Vardon Group there was a mean decrease in performance of 5 degrees 34 minutes for the same eight week period of instruction. The difference between this increase and decrease was 7 degrees 27 minutes and gave a t ratio of 2.68 which was significant at the 5 percent level of confidence.

TABLE VIII

Degrees of Improvement Between the Means of the Vardon Group and the Spread Group (in minutes)

<table>
<thead>
<tr>
<th>Tests</th>
<th>Vardon Group Mean</th>
<th>Spread Group Mean</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test 1 - Test 2</td>
<td>-239.78</td>
<td>57.56</td>
<td>2.32*</td>
</tr>
<tr>
<td>Test 2 - Test 3</td>
<td>-94.33</td>
<td>55.33</td>
<td>0.89</td>
</tr>
<tr>
<td>Test 1 - Test 3</td>
<td>-334.11</td>
<td>112.89</td>
<td>2.68*</td>
</tr>
</tbody>
</table>

* Significant at the 5 percent level of confidence.

C. Angle of Impact

Initial to Second Test: Increased angles of impact varying from 3 degrees 30 minutes to 41 degrees 48 minutes were recorded for seven of the nine subjects in the Vardon Group. Eight of the nine subjects in the Spread Group had increased angles of impact over the same six week period of instruction.

A summary of the performance levels of each group is shown in Table IX. Both the Vardon Group and the Spread Group showed differences between the initial and second test means that were statistically significant. The mean increase of the Vardon Group was 12 degrees 14 minutes for a t ratio of 2.66 which was significant at the 5 percent level of
The subjects in the Spread Group showed a mean increase of 9 degrees 7 minutes for a t ratio of 3.24 which was significant at the 5 percent level of confidence.

### TABLE IX

<table>
<thead>
<tr>
<th>Groups</th>
<th>$M_1$</th>
<th>$SD_1$</th>
<th>$M_2$</th>
<th>$SD_2$</th>
<th>$M_1 - M_2$</th>
<th>$t$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vardon Group</td>
<td>773.33</td>
<td>297.86</td>
<td>1506.89</td>
<td>619.58</td>
<td>733.56</td>
<td>2.66</td>
</tr>
<tr>
<td>Spread Group</td>
<td>772.78</td>
<td>328.56</td>
<td>1320.11</td>
<td>313.62</td>
<td>547.33</td>
<td>3.27</td>
</tr>
</tbody>
</table>

* Significant at the 5 percent level of confidence.

**Second to Third Test:** Of the nine subjects in the Vardon Group, only two showed increases after switching to the Spread grip and after having had two more weeks of instruction. In the Spread Group, five of the nine subjects showed increases in the angle of impact upon switching to the Vardon grip.

Table X summarizes the differences in performance levels of each group over the two week period. The most notable result between Test 2 and Test 3 was the decrease of 2 degrees 7 minutes exhibited by the Vardon Group using the Spread grip. This decrease between the two tests gave a t ratio of 0.57 which was not statistically significant. The Spread Group had an increase over the same period of only 8.11 minutes for a t ratio of 0.057 which was not statistically significant.
TABLE X
Comparison of Results Between Second and Third Test Means in the Angle of Impact (in minutes)

<table>
<thead>
<tr>
<th>Groups</th>
<th>M₂</th>
<th>SD₂</th>
<th>M₃</th>
<th>SD₃</th>
<th>M₂-M₃</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vardon Group</td>
<td>1506.89</td>
<td>619.58</td>
<td>1380.00</td>
<td>541.64</td>
<td>-126.89</td>
<td>0.57</td>
</tr>
<tr>
<td>Spread Group</td>
<td>1320.11</td>
<td>313.62</td>
<td>1328.22</td>
<td>446.65</td>
<td>8.11</td>
<td>0.057</td>
</tr>
</tbody>
</table>

Initial to Third Test: Increases in the angle of impact varying from 2 degrees 44 minutes to 30 degrees 45 minutes were recorded for eight of the nine subjects in the Vardon Group over the total eight week period. The same results held true for the Spread Group in which eight of the nine subjects in the group had increases in their angles of impact over the same period.

A summary of the performance levels of each group is shown in Table XI. The mean increases of both groups over the total eight weeks of instruction were sufficiently great to be statistically significant. The increase in mean performance of the Vardon Group was 10 degrees 7 minutes for a t ratio of 2.90 which was significant at the 5 percent level of confidence. The mean increase for the Spread Group over the same period was 9 degrees 14 minutes for a t ratio of 4.53, which was significant at the 1 percent level of confidence.

TABLE XI
Comparison of Results Between Initial and Third Test Means in the Angle of Impact (in minutes)

<table>
<thead>
<tr>
<th>Groups</th>
<th>M₁</th>
<th>SD₁</th>
<th>M₃</th>
<th>SD₃</th>
<th>M₁-M₃</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vardon Group</td>
<td>773.33</td>
<td>297.86</td>
<td>1380</td>
<td>541.64</td>
<td>606.67</td>
<td>2.90★</td>
</tr>
<tr>
<td>Spread Group</td>
<td>772.78</td>
<td>328.56</td>
<td>1328.22</td>
<td>446.65</td>
<td>554.40</td>
<td>4.53★★</td>
</tr>
</tbody>
</table>

★ Significant at the 5 percent level of confidence
★★ Significant at the 1 percent level of confidence
The Vardon Group compared with the Spread Group: The amounts of increase between the initial and second test, between the second and third test and between the initial and third test of the Vardon Group were compared with those of the Spread Group. The evaluation of the significance of the difference between the means of both groups is shown in Table XII.

No statistically significant differences were established between the two groups for any of the three periods of instruction.

Comparison between the mean increase of 12 degrees 14 minutes for the Vardon Group and the mean increase of 9 degrees 7 minutes for the Spread Group between Test 1 and Test 2 gave a t ratio of 0.91 which was not statistically significant. Between Test 2 and Test 3 the Vardon Group showed a decrease of 2 degrees 7 minutes in performance, whereas, the Spread Group showed an increase in performance of 8.11 minutes. Comparison of the decrement with the increment gave a t ratio of 0.71 which was not statistically significant. Comparison between the mean increase of 10 degrees 7 minutes for the Vardon Group between Test 1 and Test 3 and the mean increase of 9 degrees 14 minutes for the Spread Group over the same eight weeks of instruction gave a t ratio of 0.27 which was also not statistically significant.
TABLE XII

Degrees of Improvement Between the Means of the Vardon Group and the Spread Group (in minutes)

<table>
<thead>
<tr>
<th>Tests</th>
<th>Vardon Group Mean</th>
<th>Spread Group Mean</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test 1 - Test 2</td>
<td>733.56</td>
<td>547.33</td>
<td>0.91</td>
</tr>
<tr>
<td>Test 2 - Test 3</td>
<td>-126.89</td>
<td>8.11</td>
<td>0.71</td>
</tr>
<tr>
<td>Test 1 - Test 3</td>
<td>606.67</td>
<td>554.40</td>
<td>0.27</td>
</tr>
</tbody>
</table>

D. Range

Initial to Second Test: Of the eight subjects in the Vardon Group, seven showed improvement in performance over the six weeks of instruction. In the Spread Group all of the eight subjects in the group exhibited improvement in performance over the same period of instruction.

Table XIII summarizes the differences in performance levels of each group over the first six weeks of instruction. Both groups showed improvement gains that were statistically significant. The mean improvement of 116.13 feet for the Vardon Group gave a t ratio of 4.73 which was significant at the 1 percent level of confidence. The Spread Group exhibited a mean improvement of 74.25 feet over the same period of instruction for a t ratio of 3.73 which was significant at the 1 percent level of confidence.

TABLE XIII

Comparison of Results Between Initial and Second Test Means in the Element of Range

<table>
<thead>
<tr>
<th>Groups</th>
<th>$M_1$</th>
<th>SD$_1$</th>
<th>$M_2$</th>
<th>SD$_2$</th>
<th>$M_1 - M_2$</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vardon Group</td>
<td>158.5</td>
<td>64.34</td>
<td>274.63</td>
<td>80.42</td>
<td>116.13</td>
<td>4.73</td>
</tr>
<tr>
<td>Spread Group</td>
<td>160.5</td>
<td>70.84</td>
<td>234.75</td>
<td>53.57</td>
<td>74.25</td>
<td>3.73</td>
</tr>
</tbody>
</table>

★☆☆ Significant at the 1 percent level of confidence.
**Second to Third Test:** Improved performances in range varying from 5 feet to 105 feet were recorded for the Vardon Group in the last two weeks of instruction and after switching over to the Spread Grip. Of the eight subjects in the Spread Group, seven exhibited improved performance in range over the same two week period. The subjects in this group had switched over to the Vardon grip during this period of instruction.

A summary of the performance levels of each group over the two week period is shown in Table XIV. The Vardon Group showed a mean improvement of 6.62 feet ($t = 0.26$) which was not statistically significant. The Spread Group, however, exhibited a notable gain in performance. The mean improvement for this group over the two week period was 75.75 feet for a $t$ ratio of 2.86 which was significant at the 5 percent level of confidence.

**TABLE XIV**

<table>
<thead>
<tr>
<th>Groups</th>
<th>$M_2$</th>
<th>$SD_2$</th>
<th>$M_3$</th>
<th>$SD_3$</th>
<th>$M_2 - M_3$</th>
<th>$t$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vardon Group</td>
<td>274.63</td>
<td>80.42</td>
<td>281.25</td>
<td>74.51</td>
<td>6.62</td>
<td>0.26</td>
</tr>
</tbody>
</table>
| Spread Group    | 234.75| 53.57  | 310.50| 88.72  | 74.75       | 2.86 *

* Significant at the 5 percent level of confidence

**Initial to Third Test:** All subjects in the Vardon Group showed improvement gains over the total eight week period. In the Spread Group only one of the eight subjects exhibited a decrease in performance over the same period and he
dropped from 296 feet to 285 feet.

The performance levels of both groups are summarized in Table XV. The results of both groups over the eight week period showed improvement gains that were statistically significant.

The Vardon Group had a mean improvement for the eight week period of 122.75 feet for a t ratio of 5.29 which was significant at the 1 percent level of confidence. The improved performance results for the Spread Group over the same period was 150 feet for a t ratio of 3.89 which was significant at the 1 percent level of confidence.

TABLE XV
Comparison of Results Between Initial and Third Test Means in the Element of Range

<table>
<thead>
<tr>
<th>Groups</th>
<th>M₁</th>
<th>SD₁</th>
<th>M₃</th>
<th>SD₃</th>
<th>M₁-M₃</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vardon Group</td>
<td>158.5</td>
<td>64.34</td>
<td>281.25</td>
<td>74.51</td>
<td>122.75</td>
<td>5.29**</td>
</tr>
<tr>
<td>Spread Group</td>
<td>160.5</td>
<td>70.84</td>
<td>310.50</td>
<td>88.72</td>
<td>150.00</td>
<td>3.89**</td>
</tr>
</tbody>
</table>

**Significant at the 1 percent level of confidence.

The Vardon Group compared with the Spread Group: The degrees of improvement between the initial and second test, between the second and third test and between the initial and third test of the Vardon Group were compared with those of the Spread Group. The evaluation of the significance of the difference between the means of both groups is shown in Table XVI.

In none of the tests was the mean improvement of the Vardon Group found to be significantly greater than that of
the Spread Group.

The mean improvement in the Vardon Group between Test 1 and Test 2 was 116.13 feet, whereas, the mean improvement for the same six weeks of instruction in the Spread Group was 74.25 feet. The difference between these two gains was 39.88 feet for a t ratio of 1.47 which was not statistically significant. Between Test 2 and Test 3 the difference between the mean improvement of 6.62 feet for the Vardon Group and mean improvement of 75.75 feet for the Spread Group was 69.13 feet for a t ratio of 1.48 which again was not statistically significant. The mean improvement gain between Test 1 and Test 3 for the Vardon Group was 122.75 feet, whereas, the mean improvement gain for the same eight week period of instruction for the Spread Group was 150 feet. This resulted in a difference of 29.25 feet for a t ratio of 0.62 which was not statistically significant.

TABLE XVI

Degrees of Improvement Between the Means of the Vardon Group and the Spread Group

<table>
<thead>
<tr>
<th>Tests</th>
<th>Vardon Group Mean</th>
<th>Spread Group Mean</th>
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CHAPTER VI

DISCUSSION

The foregoing analysis would seem to indicate that there is relatively no superiority, in the items measured, to be gained by teaching either hand grip to beginners at the university level over an eight week period of instruction. However, there are several factors which must be considered in this discussion.

The subjects in this study were beginners who had not played golf before and, as a result, caution should be taken in comparing the results of this study with those obtained in investigations which involved subjects who had previous golf experience.

Between the initial and second test, during which the subjects were in command of only one grip, and all were equated beginners, there was very little indication of superiority shown between the two grips except in one factor, that of accuracy. In this element, the Spread grip was found to be more effective for the subjects in these two groups. This would seem to be contrary to popular thought, as the Spread grip is primarily used because it is thought to provide more power, not accuracy (1). Dana (2) found it to be as powerful as, and possibly more powerful than the other grips, but he did not measure accuracy or the arc of flight because he was using a force machine. Under the conditions of this study however, the only statistically
significant difference over the first six weeks was in accuracy.

In the element of range, or the ability to hit the ball long distances, there was no significant difference between the two grips, even though the mean improvements within each group were statistically significant.

In the phase of the experiment where the subjects switched over to another grip, there entered the factor of learning a new grip after having learnt another grip quite recently. Would the knowledge of one grip, after only six weeks of instruction, affect the individual when learning a new grip? Would it help him or hinder him? Would one particular grip taught before the other grip prove to be more effective than vice versa? The results showed there was no statistically significant effect on either of the groups in this phase. The subjects in the Vardon Group, upon switching over to the Spread grip hit their shots a little lower than did the subjects in the Spread Group who were using the Vardon grip, but the degree of change was not statistically significant. On the other hand, the subjects in the Spread Group tended to hit their shots with more velocity upon switching over to the Vardon grip than did the subjects in the Vardon Group, but again the increase was not statistically significant.

In the element of accuracy neither group showed any statistically significant results upon switching over to the other grip. The Vardon Group was slightly more inaccurate
while using the Spread grip, while the Spread Group was a little straighter using the Vardon grip, but the difference between the decrement and the increment was not statistically significant. In the element of range both groups improved, the Spread Group using the Vardon grip slightly more than the Vardon Group but again the difference was not statistically significant.

The third phase of the experiment was concerned with measuring the degrees of improvement between the groups when they had the knowledge of both grips but were using the second one learned. In both groups, in the elements of range, the angle of impact and velocity, there was slight improvement shown but no statistically significant difference resulted from the order in which the grips were taught. Only in the element of accuracy was there any statistical significance shown. In this element the Spread Group, with the knowledge of the Spread grip following six weeks of instruction and using thereafter, the Vardon grip, showed a decided advantage over the Vardon Group which learned the Vardon grip first and the Spread grip second.

It has been contended by the experts that the Vardon overlapping grip is superior in all respects to any of the other grips. In regard to the Spread grip, this opinion was not substantiated in this experiment.
REFERENCES


CHAPTER VII

SUMMARY AND CONCLUSIONS

Thirty-three University of British Columbia first and second year students registered in the required physical education programme were randomly selected and divided into two groups. Each group was given an initial test to determine its ability to hit a golf ball with a number one wood. The test given was the Mary Ellen McKee Test for the Full Swinging Shot in Golf. The test measured four elements in the ability to hit a golf ball: the range, the velocity of the ball, the angle of deviation from the designated line of flight and the angle of impact. Only those students who had not played golf previous to the experiment were selected.

The first group, called the Vardon Group, was given golf instruction, using the Vardon overlapping grip, for six weeks. The second group, called the Spread Group, was given the same amount and type of instruction except the Spread grip was taught. Both groups were then given a second test, identical to the initial test. Following the second test, both groups were given identical instruction for two more weeks. The Vardon Group was instructed in the use of the Spread grip during this period of instruction, and the Spread Group was taught the use of the Vardon grip. At the end of this two week period both groups were then given a third test, identical to the first two tests. In the third test, the subjects were required to use the grip they had just learned
in the two weeks immediately preceding the third test.

The improvements were analyzed statistically within each group and comparisons were made between the groups.

On the basis of statistical treatment the following results were evident:

A. Velocity

1. The only statistically significant result in the velocity element was the improvement gain of 18.02 ft./sec. \((t=2.79)\) between the initial and third test in the Spread Group. This was significant at the 5 percent level of confidence.

2. The Vardon Group also exhibited a mean gain over the same period (10.84 ft./sec.) but it was not sufficient to be accepted statistically \((t=1.46)\).

3. There was not sufficient difference between these two gains in improvement over the eight week period to be statistically significant \((t=0.68)\).

These results tend to indicate that over an eight week period of twice-weekly instruction, a group of beginners, when taught the Spread grip initially and the Vardon grip secondly, showed a significant improvement in velocity of the golf shot, when compared to a group in which the introduction to the grips was reversed.

B. Angle of Deviation

1. The Vardon Group exhibited a mean increase in the angle of deviation over the eight weeks of instruction. The
amount of mean increase of 5 degrees 34 minutes between the initial and third test was statistically significant at the 1 percent level of confidence (t = 4.22).

2. The Spread Group, on the other hand, over the same eight week period of instruction, showed a decrease of 1 degree 53 minutes. This decrease was not statistically significant (t = 0.94).

3. The difference between the mean increase in the angle of deviation over the eight week period of instruction for the Vardon Group and the mean decrease in the angle of deviation over the same period for the Spread Group was significant at the 5 percent level of confidence (t = 2.68).

4. The only other statistically significant result in the angle of deviation was the difference between the mean increase of the angle of deviation over the first six weeks of instruction (Test 1 to Test 2) for the Vardon Group and the mean decrease in the angle of deviation over the same period for the Spread Group. The difference between the increment of the Vardon Group and the decrement of the Spread Group was statistically significant at the 5 percent level of confidence (t = 2.32).

These results would tend to indicate that to improve the accuracy of a golf shot over a six week period of twice-weekly instruction, the beginner should be taught the Spread grip. An additional two weeks of instruction in which the group was introduced to the Vardon grip resulted in a continued improvement in accuracy.
C. Angle of Impact

1. Both groups recorded significant increases between the initial and second tests. The Vardon Group had a mean increase of 12 degrees 14 minutes for a t ratio of 2.67, while the Spread Group, over the same six week period of instruction, had an increase in its angle of impact of 9 degrees 7 minutes for a t ratio of 3.28. These t ratios were significant at the 5 percent level of confidence.

2. The difference between the increases by both groups over the six week period of instruction was not statistically significant (t = 0.91).

3. Over the total eight week period of instruction neither grip proved superior to the other, and the order in which the grips were taught had no statistical significance in regard to the angle of impact (t = 0.27).

These results tend to indicate that as a person progresses in his ability to hit a golf ball, there is a tendency to hit it higher in the first six weeks of twice-weekly instruction, whichever grip is used.

D. Range

1. Both groups exhibited mean improvements over the first six weeks of instruction in range that were statistically significant. The Vardon Group had a mean gain of 116.75 feet (t = 4.73), while the Spread Group improved 74.25 feet (t = 3.73). Both of these gains were significant at the 1 percent level of confidence.

2. When these two groups switched over to the other
grips for the last two weeks of instruction, only the Spread Group exhibited a mean gain in range that was statistically significant. The Spread Group, using the Vardon grip, showed an increase of 75.75 feet ($t = 2.86$) which was significant at the 5 percent level of confidence.

3. Both groups showed mean gains over the total eight weeks of instruction in the element of range that were statistically significant. The Vardon Group improved 122.75 feet ($t = 5.29$) and the Spread Group improved 150 feet ($t = 3.89$). Both these mean increases in range by the two groups were statistically significant at the 1 percent level of confidence.

4. Neither grip, or sequence of grips, showed a difference which was statistically significant with the other during any of the phases of instruction in the element of range.

The results tend to indicate that, in the element of range, over an eight week period of twice-weekly instruction, neither the Vardon grip nor the Spread grip is superior to the other for beginners at the university level.

In summary, therefore, the results of this experiment indicate that:

1. There is no significant difference between the Vardon grip and the Spread grip in the elements of range, velocity and angle of impact after six weeks of twice-weekly golf instruction with beginning golfers.
2. The Spread grip, over a six week period of twice-weekly instruction with beginners, shows a statistically significant superiority in accuracy over the Vardon grip.

3. There is no significant difference in the order in which the two grips, the Vardon grip and the Spread grip, are taught to a group of beginning golfers over a period of eight weeks instruction.

Recommendations for Further Study: It is suggested for future experimentation that:

1. Two control groups be included in this study design with each using only one grip during the total period of instruction.

2. Upon switching to the second grip for instruction, both of the experimental groups be allowed an equal amount of time to learn the second grip as was allowed for the first grip.

3. Only one element of the golf skill be measured.

4. Further investigation be conducted for purposes of measuring, more accurately, the elements concerned with the skill of hitting a golf ball.
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Cotton, H., This Game Of Golf, New York, C. Scribner, 1948.


Guldahl, R., Groove Your Golf, Indianapolis, Bookwalter-Ball-Greathouse, 1939.


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Vardon, H., How To Play Golf, Toronto, Bell, Cockburn, 1912.
PERIODICALS


APPENDIX A

STATISTICAL TREATMENT

The raw scores obtained from the initial, second and third test results of the four elements of skill concerned with the McKee Test for the Full Swinging Shot in Golf from each of the two groups were analyzed statistically in the following manner:

Study Design

A. The Vardon Group

B. The Spread Group

Tests of the Full Swinging Shot in Golf

Test 1..........The Mary Ellen McKee Test
Test 2..........The Mary Ellen McKee Test
Test 3..........The Mary Ellen McKee Test

Plan

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Procedure and Formulae

1. Determination of the significance of the difference between correlated means of the initial and second test results of each group in each test and in each of the four
skill elements. The level of confidence was required to reach 0.05 to be acceptable. The table of $t$ at both the 0.05 and 0.01 levels of confidence for nine degrees of freedom ($n-1$) is shown as 2.26 and 3.25 respectively, for eight degrees of freedom ($N-1$) as 2.31 and 3.36 respectively and for seven degrees of freedom ($N-1$) as 2.36 and 3.50 respectively (1). To obtain significance, the following formulae were used:

1. No. of subjects ($N$)

2. Mean Score $M = \frac{\Sigma X}{N}$

3. Standard Deviation $\sigma = \sqrt{\frac{\Sigma X^2}{N} - M^2}$

4. Standard Error of the Mean $\sigma_m = \frac{\sigma}{\sqrt{N-1}}$

5. Difference between the Means ($M_1 - M_2$)

6. Correlation between Initial and Second Test Results

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

7. Standard Error of the Difference between Correlated Means

$$SE_{diff} = \sqrt{\sigma_{M_1}^2 + \sigma_{M_2}^2 - 2r_{1,2} \sigma_{M_1} \sigma_{M_2}}$$

8. Calculation of the "$t$" Ratio

$$t = \frac{M_1 - M_2}{SE_{diff}}$$

2. Determination of the significance of the difference in the means of improvement between the initial and second test between groups and in each of the four skill elements. The level of confidence was required to reach 0.05 to be acceptable. The table of $t$ at both the 0.05 and 0.01 levels
of confidence for nine degrees of freedom (N-1) is shown as 2.26 and 3.25 respectively, for eight degrees of freedom (N-1) as 2.31 and 3.36 respectively, and for seven degrees of freedom (N-1) as 2.36 and 3.50 respectively. (2).

To obtain significance the following procedure was used:

1. No. of Subjects (N)
2. Mean Scores of the Initial Test (M.)
3. Standard Deviation of Initial Test (SD.)
4. Mean Scores of Second Test (M.)
5. Standard Deviation of the Second Test (SD.)
6. Gain in Means (M. - M.)
7. Standard Error of Means of Second Test (σM.)
8. Standard Error of the Difference of Means (uncorrelated) (σD)
9. Calculation of the t Ratio \[ t = \frac{M. - M.}{σD} \]

3. Determination of the significance of the difference between correlated means of the second and third test results of each test in each group and in each of the four skill elements. The level of confidence was required to reach 0.05 to be acceptable. The table of t at both the 0.05 and 0.01 levels of confidence for nine degrees of freedom (N-1) is shown as 2.26 and 3.25 respectively, for eight degrees of freedom (N-1) as 2.31 and 3.36 respectively, and for seven degrees of freedom (N-1) as 2.36 and 3.50 respectively. To obtain significance the same formulae as in 1. were used.

4. Determination of the significance of the difference in the means of improvement between the second and third test
results between groups and in each of the four skill elements. The level of confidence was required to reach 0.05 to be acceptable. The table of t at both the 0.05 and 0.01 levels of confidence for nine degrees of freedom (N-1) is shown as 2.26 and 3.25 respectively, for eight degrees of freedom (N-1) as 2.31 and 3.36 respectively, and for seven degrees of freedom (N-1) as 2.36 and 3.50 respectively. To obtain significance the same procedure as in 2. was used.

5. Determination of the significance of the difference between correlated means of the initial and third test results of each test in each group and in each of the four skill elements. The level of confidence was required to reach 0.05 to be acceptable. The table of t at both the 0.05 and 0.01 levels of confidence for nine degrees of freedom (N-1) is shown as 2.26 and 3.25 respectively, for eight degrees of freedom (N-1) as 2.31 and 3.36 respectively, and for seven degrees of freedom (N-1) as 2.36 and 3.50 respectively. To obtain significance the same formulae as in 1. and 3. were used.

6. Determination of the significance of the difference in the means of improvement between the initial and third test results between the groups and in each of the four skill elements. The level of confidence was required to reach 0.05 to be acceptable. The table of t at both the 0.05 and 0.01 levels of confidence for nine degrees of freedom (N-1) is shown as 2.26 and 3.25 respectively, for eight degrees of freedom (N-1) as 2.31 and 3.36 respectively, and for seven
degrees of freedom (N-1) as 2.36 and 3.50 respectively. To obtain significance the same formulae and procedure as in 2. and 4. were used.

REFERENCES


2 Loc. cit.
APPENDIX B

EXAMPLE OF CALCULATIONS IN TREATMENT OF RAW SCORES

1. Data:
   Deviation ...................... 50 feet
   Straightaway Distance ........ 270 feet
   Time of Flight ............... 4 seconds

2. Calculations:
   a. Angle of Deviation: The amount of deviation from the designated line of flight.

   A = point of impact
   B = point from which CB is measured
   C = point where ball first touched ground
   AB = straightaway distance which ball travelled

   Tangent of Angle A = \frac{BC}{AB} = \frac{50}{270} = 0.18

   Angle A = 10 degrees 30 minutes

   b. Range: The range is the hypotenuse of the right-angled triangle constructed to calculate the angle of deviation.

   A = point of impact
   B = point from which CB is measured
   C = point where ball first touched ground

   \text{Range} = \frac{BC}{\text{Sine of Angle of Deviation}} = \frac{50}{0.182} = 274'$
c. **Angle of Impact**: The angle of impact, in a perpendicular plane, is the angle formed by the range and the direction of the acceleration imparted to the ball by the clubhead.

\[ \text{A = point of impact} \]
\[ \text{B = point where ball touched ground} \]
\[ \text{C = height of ball when neglecting gravity} \]
\[ \text{CB = distance gravity moved ball} \]
\[ \text{AB = the range} \]
\[ \text{AC = distance ball would have travelled in direction of clubhead acceleration} \]

\[
\text{Angle A = angle of impact}
\]

1) *distance gravity moved the ball*
\[
S = \frac{1}{2}gt^2 = \frac{1}{2} \times 32 \text{ ft./sec.} \times (4 \text{ seconds})
= 256 \text{ feet}
\]

2) tangent of angle of impact \[ \frac{\text{CB}}{\text{AB}} = 0.934 \]

3) angle of impact = 43.0 degrees 3 minutes.

d. **Velocity**: Use the triangle that was constructed to determine the angle of impact.

\[ \text{A = point of impact} \]
\[ \text{B = point where ball touched ground} \]
\[ \text{C = height of ball neglecting gravity} \]
\[ \text{AB = the range} \]
\[ \text{CB = distance gravity moved ball} \]
\[ \text{AC = distance ball would have travelled in direction of clubhead acceleration} \]
1) distance ball travelled in the direction of clubhead acceleration is the hypotenuse of the triangle

\[ \text{hypotenuse} = \frac{CB}{\sin \text{ of angle of impact}} = \frac{256 \text{ ft}}{.6828} = 375 \text{ ft.} \]

2) velocity = \[ \frac{AC}{\text{time of flight}} = \frac{375 \text{ ft.}}{4 \text{ sec.}} = 93.7 \text{ ft./sec.} \]
APPENDIX C

INDIVIDUAL SCORE SHEET

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APPENDIX G
EQUATED RESULTS OF RAW SCORE TREATMENT
Lesson One

The Grip

Main Points:
1. Club diagonally across left hand.
2. Heel of club beneath muscle pad in the left hand and down across the middle joints of the fingers and out the middle joint of the forefinger.
3. V formed by thumb and index finger of left hand points to right eye.
4. In the right hand the club lies right across the first joints of all fingers.
5. Left thumb fits into and underneath the depression in the right palm.
6. V formed by thumb and index finger on right hand points toward right of the centre of the forehead.
7. Vardon grip: little finger of the right hand overlaps and fits into the depression between the left index finger and second finger. N.B. Third finger of left hand must touch the little finger of right hand, and third finger of right hand must be firmly on the shaft of the club.
8. Spread grip: little finger rests snugly against index finger of right side of the club and against the index finger of the left hand.
9. Left thumbs in both grips rest down along the opposite side of the shaft underneath the right palm.

Lesson Two

The Stance

Main Points:
1. Ball off left heel.
2. Right foot pointed straight ahead.
3. Left foot slightly turned to left.
4. Feet slightly wider than shoulder width.
5. Knees flexed slightly.
6. Left arm straight.
7. Right shoulder lower than left shoulder.
8. Chin back of ball.
9. Line of hips pointing slightly back.
10. Slight bend forward at hips.
11. Clubhead slightly ahead of hands.
12. Weight slightly more on right foot. (60%)
Lesson Three  

The Backswing

Main Points:
1. Hands and shoulders start back together.
2. Hips start to rotate immediately after.
3. Head is steady.
4. Shoulders rotate ahead of hips.
5. Left hand grip is firm.
6. Left hand guides club back.
7. Right elbow is close to right side (hip).
8. Left arm is still straight.
9. Left foot rolls inward slightly.
10. Left knee comes to point to just behind ball.
11. Both knees slightly flexed.
12. Hips pivot for transfer of weight to right foot (90%).
13. Shoulders lift slightly and are on same plane.
14. Club is dragged straight back from ball.

Lesson Four  

The Top of Backswing

Main Points:
1. Chin is in same position as at start.
2. Most of weight is on right foot.
3. Left arm is straight.
4. Club face has opened.
5. Left shoulder is directly below chin.
6. Shoulders at right angles to line of flight.
7. Line of hips at 45 degree angle.
8. Wrists are cocked. Grip must stay tight.
9. Club shaft is horizontal to ground.
10. There must be a definite pause here.

Lesson Five  

The Downswing

Main Points:
1. Hips initiate downswing.
2. Shoulders follow, then arms, then hands.
3. Weight shifts with hip movement.
4. Head is steady.
5. Left arm is stiff.
6. Right elbow is in close to side.
7. Right knee comes in and points toward ball.
8. Left side starts to stiffen up.
9. Right shoulder starts to come down.
Lesson Six

The Hitting Area

Main Points:
1. Right hand is responsible for whipping action.
2. Brace right foot against the mat.
3. Left hand helps right hand to whip clubhead.
4. Right knee points toward the ball.
5. Left arm still straight.
6. Head still steady.
8. Left side stiff.
9. Right elbow against side.
10. Feel action of whipping clubhead into ball.

Lesson Seven

The Moment of Impact

Main Points:
1. Head is steady and exact same position as at address.
2. Left side is stiff and straight.
3. Wrists have uncocked and pronated.
4. Left foot has weight of body resting on it.
5. Head is slightly behind the ball.
6. Right heel is off the ground.
7. Hips turned slightly to the left.
8. Right elbow is close to side.
9. Right shoulder is a little lower than left.

Lesson Eight

The Follow Through

Main Points:
1. Head is not lifted at impact but is allowed to come up on its own volition.
2. Clubhead travels straight through towards target.
3. Arms are kept straight until shoulder height and then bent.
4. Right heel follows swing along the mat.
5. Hips turned towards the target.
6. Elbows must be on same plane at end of swing.

Lesson Nine

Main Point Breakdown

1. Arms must hang loosely away from body.
2. Feet on straight line.
3. As club starts back, left knee turns in toward the ball and behind it.
4. Left arm is straight throughout the swing.
5. Right elbow is kept close to right side.
6. Head is steady throughout swing.
7. Weight is 60% on right foot to start with.
8. Club is horizontal at top of backswing.
9. Club is dragged back to begin backswing.

Lesson Ten

Main Point Breakdown

1. Sequence in backswing is hands, arms, shoulders and hips.
2. Sequence in downswing is opposite.
3. Grip must be firm at all times.
4. Left hand initiates the right hand into whipping the clubhead through.
5. Right hand main factor in hitting area.
6. Right knee points toward ball in downswing.
7. Left side stiffens up at impact.
8. Follow through is straight toward target.
9. Clubface opens on way up and closes on way down.

Lesson Eleven

Practice With Individual Coaching

Lesson Twelve

Practice and Review of Lesson One on Grips

Lesson Thirteen

Same as Lesson One but Grip Instruction Switched

Lesson Fourteen

Same as Lessons on Backswing-Stance-Top of Backswing

Lesson Fifteen

Same as Lessons on Downswing-Hitting Area-Moment of Impact and Follow Through

Lesson Sixteen

Practice With Review of Grip Lesson and Coaching