A STROKE OF GENIUS: PUTTING AND THE VISUAL SYSTEM

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A STROKE OF GENIUS: PUTTING AND THE VISUAL SYSTEM

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ABSTRACT

Background: The purpose of this study is to examine the visual system's effect on golf, specifically in putting. By inspecting different aspects of this system, we are able to describe visual efficiency in relation to putting. We look at phoric posture and it's correlative relationship with putting and underhand golf ball tossing accuracy. **Methods:** Fifteen subjects from an accredited Professional Golf Management program were tested. Visual testing involved visual acuity, eye dominance, stereopsis, phoric posture and comitancy, and saccadic efficiency as measured by NSUCO testing. Accuracy of putting was measured by recording number of putts made and distance from the hole of missed putts during testing. **Results:** Outcome variables measured in this project will include (1) putting accuracy (2) ball tossing efficiency and (3) visual efficiency measured by the battery of visual skills testing as stated in the 'Methods' portion. Statistical analysis with a correlation coefficient was used to compare visual skills to putting and tossing accuracy. **Conclusions:** This study will provide insight into the level of significance the visual system plays while putting in golf. We will be able to determine if there is a correlation between normal visual skills and putting accuracy.

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CHAPTER 1

INTRODUCTION OF PUTTING AND IT'S AFFECT ON THE VISUAL SYSTEM

As simple as it may seem, putting in the game of golf can be considered a very complicated and precise task. Time and again, those golfers able to minimize strokes on the putting surface are typically the most successful. Such a simple stroke involves intricate analysis and precision mechanics. The slope of the green, the condition of the putting surface, the grip on the putter, the stance of the putter, the velocity the ball must reach in order to get to the hole without leaving too long of a comeback putt - suddenly every minute detail plays a role. However, one key aspect that is often just assumed is that each golfer has equivalent vision or visual abilities. It is also assumed that these visual abilities meet all expected norms, especially in those golfers that have above-average skills. In this project, we take a specific look at the phoric posture, or eye alignment, of a group of golfers and try to see if there is any correlation to their putting skills.

CHAPTER 2

METHODS OF PUTTING AND IT'S AFFECT ON THE VISUAL SYSTEM

Fifteen subjects from an accredited Professional Golf Management program were run through two testing situations. The first involved an assessment of two skills on an outdoor practice putting green. All participants were tested in consecutive days in similar weather environments as to eliminate any variability in course condition. The second set of tests comprised a vision screening, which included visual acuity, hand- and eye-dominance, stereopsis, phoric posture, and saccadic function.

Skills Testing

For the first skill on the putting green, contestants were asked to stand three pre-determined distances away from a hole on the putting surface. The distances were six, twelve, and twenty-five feet. While standing with feet and shoulders facing the hole, subjects were asked to toss a golf ball underhand with two objectives: 1. Roll the ball into the hole or 2. Toss the ball in a manner as to stop the ball as close to the hole as possible. Each student was given three tosses from each distance. All made tosses were recorded, as well as the distance from the ball to the hole when the toss was missed.

After the participants completed the tossing skill, they were asked to putt five golf balls from the same pre-determined spots. There was no time limit given for either skill, and participants were allowed to use any putter they felt comfortable with. They were again given two objectives: 1. Putt the ball into the hole or 2. Putt the ball in a manner as to stop the ball as close to the hole as possible. Again, all putts that ended up in the hole

were recorded as a 'make' and a distance of zero inches was recorded. The distance from the ball to the hole was measured and recorded for all missed putts.

Vision Screening

Subjects returned on a separate occasion for a vision screening. The screening involved testing visual acuity, hand- and eye-dominance, stereopsis, phoric posture, and saccadic function. Visual acuity was tested monocularly and binocularly with snellen acuity charts on the Canela 20/20 Vision software program. Global and local stereopsis were measured with Randot and Wirt Rings, respectively, and phoric posture was measured by Maddox Rod with a Saladin Card. Hand dominance was evaluated by asking which side of the ball the golfer stood on when he was putting or hitting a golf ball, and eye dominance was evaluated with the Miles, or hole-in-hand technique.

A pass/fail criterion was set for saccadic function, which was measured by the saccadic portion of the NSUCO oculomotor test. In order to pass, subjects needed to score at least a four on each subset of the test: head and body movement, saccade ability, and saccade accuracy. Two exclusion criteria were set for this experiment. Subjects were excluded upon failure of the NSUCO assessment or if visual acuity recorded was worse than 20/25 with habitual correction. However, no subjects had to be withheld from the study for either reason.

CHAPTER 3

RESULTS FOR PUTTING AND IT'S AFFECT ON THE VISUAL SYSTEM

Subjects were grouped based on their phoric postures. Each group and the number of subjects in each group consisted of phoric postures recorded as esophoric (1 subject), orthophoric (2 subjects), 1-2 exophoric (5 subjects), 2.1-5 exophoric (3 subjects), and >5 exophoric (4 subjects), see Table 1 and Table 8. The total length of missed putts and tosses determined putting and tossing efficiency. Obviously more efficient golfers made more putts and/or tosses, so their total distance of misses ended up with a lower score, just like in the game of golf itself. Average scores/distances for putting and tossing were taken in each group, and these averages were used as overall scores to be used in the correlation study, see Tables 2-7. Putting and tossing were both evaluated against phoric posture using a correlation coefficient equation. The equation is as follows:

Figure 1: Correlation Coefficient Equation

$$r = \frac{n\sum xy - \left(\sum x\right)\left(\sum y\right)}{\sqrt{n\left(\sum x^2\right) - \left(\sum x\right)^2}\sqrt{n\left(\sum y^2\right) - \left(\sum y\right)^2}}$$

*r = Correlation coefficient ($-1 < r < +1$)[1]

In this relationship, the variable 'r' represents the correlation coefficient, which can show a positive or negative linear correlation. This coefficient may range from 0 to 1, with higher numbers showing a more statistically correlating relationship and lower numbers representing variables with little correlation.[1] In general, if two variables (ie

putting efficiency and phoric posture) have a large positive correlation, the two can be said to have a linear relationship. That is, if one variable increases, the other will also increase. An example may be given with number of hours studying and its positive correlation with higher grades. An example of a negative correlation, in comparison, may be given with body weight and number of hours of exercise. From our data we calculated a negative correlation for both the tossing and putting category.

After analyzing our data, an interesting theory arose that could lead to further research on the topic. Comparing those subjects with the same dominant hand and eye (ie corresponding dominance) against subjects with opposite eye and hand dominance (ie cross dominance) proved interesting to say the least. While standing over a shorter putt (the 6 foot putt in this instance), cross-handed individuals are able to use peripheral vision from their dominant eye to see the hole while fixating their balls on the putting surface. In theory, cross-handed individuals may hold an advantage in this regard. The data collected does show some evidence of this theory. Cross-handed putters only had an average distance of missed putts of 45.2 inches, while those with corresponding dominance missed by an average of 53.0 inches. These results were included in this study, but they are not to be taken as any sort of comprehensive research findings.

The key result of our study can be seen numerically in Table 1 and graphically in Figure 2. These show the overall trend of a decrease in distance from the hole, as the subjects become more exophoric. The data that we gathered for this study is shown in the following tables:

Table 1: Group Breakdown of Putt and Toss Totals

MR Phoric Posture	Toss	Putt Distance	Putts Made
Eso	254	216	5
Ortho	199.5	223.5	5
1-2 XP	176.8	219.6	4
2.1-5 XP	166.67	173	3
>5.1 XP	162.25	166.25	5.25

Table 2: Individual Patient Putt Distance for 6 ft.

Patient #	6' Putts Made	(D) of 6' Putts Missed (in.)
1	1	75
2	3	44
3	4	27
4	1	73
5	1	90
6	4	25
8	2	99
10	2	39
11	3	45
13	0	132
14	4	2
15	4	9
18	1	96
24	5	0
25	5	0

Table 3: Individual Patient Putt Distance for 12 ft.

Patient #	12' Putts Made	(D) of 12' Putts Missed (in.)
1	2	29
2	2	31
3	0	62
4	1	73
5	3	19
6	3	37
8	1	123
10	1	53
11	1	66
13	2	36
14	1	51
15	2	104
18	3	37
24	3	12
25	0	84

Table 4: Individual Patient Putt Distance for 25 ft

Patient #	25' Putts Made	(D) of 25' Putts Missed (in.)
1	0	108
2	0	61
3	0	140
4	1	136
5	0	113
6	0	68
8	0	179
10	0	145
11	0	102
13	0	122
14	0	163
15	0	112
18	0	114
24	0	108
25	0	102

Table 5: Individual Patient Toss Distance for 6 ft

Patient #	6' Tosses Made	(D) of 6' Tosses Missed (in.)
1	2	32
2	1	36
3	1	24
4	0	32
5	1	40
6	0	21
8	0	33
10	0	65
11	2	31
13	2	3
14	0	38
15	1	37
18	0	68
24	0	39
25	1	28

Table 6: Individual Patient Toss Distance for 12 ft

Patient #	12' Tosses Made	(D) of 12' Tosses Missed (in.)
1	1	33
2	0	22
3	0	90
4	0	84

5	2	28
6	1	64
8	0	113
10	0	28
11	0	29
13	0	30
14	0	63
15	0	121
18	1	30
24	1	42
25	1	70

Table 7: Individual Patient Toss Distance for 25 ft

Patient #	25' Tosses Made	(D) of 25' Tosses Missed (in.)
1	0	95
2	0	57
3	0	72
4	0	97
5	0	116
6	0	64
8	0	80
10	1	26
11	0	149
13	0	55
14	0	153
15	1	57
18	1	82
24	0	131
25	0	78

Figure 2: Group Breakdown Graph

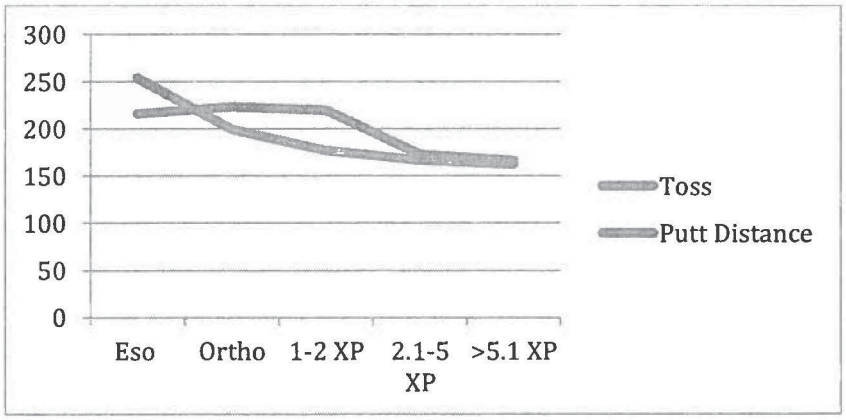

Table 8: Group Breakdown by Patient Number

Phoric posture group	Patient #
Eso	14
Ortho	5, 15
1-2XP	1, 4, 10, 18, 24
2.1-5XP	3, 8, 13
>5.1XP	2, 6, 11, 25

Figure 3: 6 foot putt Corresponding vs Crossed Dominance

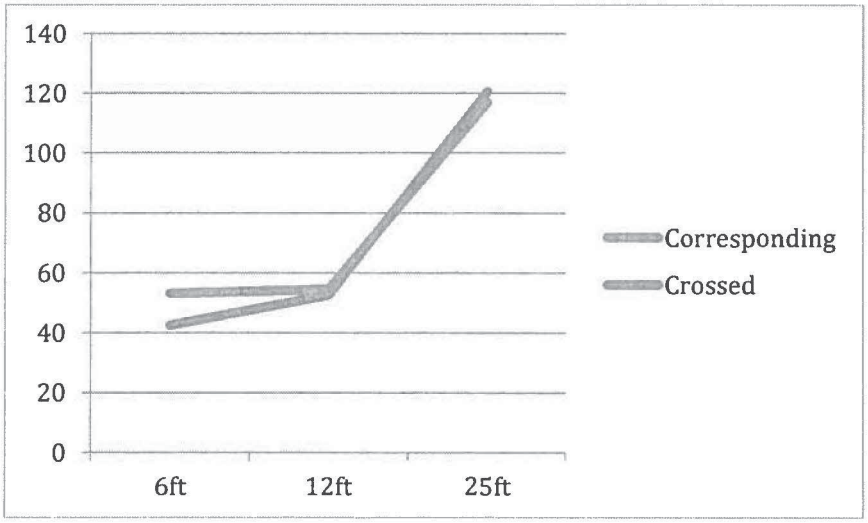

Table 9: Cross Handed Putt and Toss Misses

	Av (D) of CrHand Toss Misses	Av (D) of CrHand Putt Misses
6 Ft	29.8"	45.2
12 Ft	68.4"	52.6"
25 Ft	88.4"	120.6"

Table 10: Same Hand Putt and Toss Misses

	Av (D) of SaHand Toss Misses	Av (D) of SaHand Putt Misses
6 Ft	37.8"	53"
12 Ft	50.5"	54.4"
25 Ft	87"	117"

CHAPTER 4

DISCUSSION OF PUTTING AND IT'S AFFECT ON THE VISUAL SYSTEM

Based on our data, we calculated a negative correlation coefficient for both the toss and putt category. These results indicate that as the subject group increases in exophoria their toss and putt distances decreased. The only spot where this does not hold true is between the esophoric and orthophoric group in the putting category, and these two numbers are very close. The overall results do answer our initial investigation question of whether or not the visual system has an effect on putting or tossing. Although the sample size was small, the data clearly shows that an exophoric subject is more successful at putting and tossing than an esophoric subject. For this specific subject group of experienced golfers, the act of putting is a skill that is very familiar, while tossing a golf ball is a new skill. This fact shows how crucial the visual system is in regards to tasks involving judging distances, whether the task is familiar or new.

Looking back, there are a few more testing procedures that could have been performed to allow a stronger conclusion. One specific test is to look for an A/V pattern in subjects by a cover test in different gazes. This would have been valuable for this specific study because of the fact that golfers spend most of their time putting in a down gaze position. Another procedure that could have been done on the putting green is another toss, but from a putting position, in comparison to the toss with toes and shoulders facing the hole. This would have added another way to assess an unpracticed skill with a different view and body position from the hole.

The main downfall of this study was the small sample size that was tested. A larger scale follow up study would need to be performed to in order to better prove the

hypothesis. Along with additional subjects, a larger testing size would given more variance in phoric posture. The phoric range for the test group was 2^ esophoric to 7^ exophoric. It would be interesting to see if these figures hold up at greater ranges, and if so up to what point? It would also be interesting to explore the extra tests mentioned above to further explore the hypothesis.

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APPENDIX A

IRB APPROVAL LETTER

Ferris State University

Institutional Review Board (FSU - IRB)
Office of Academic Research
Ferris State University
1201 S. State Street-CSS 310 H
Big Rapids, MI 49307
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To: Dr. Josh Lotoczky, Mr. AJ Johnson and Mr. Dan Marsac
From: Dr. John Pole, Interim IRB Chair
Re: IRB Application #130604 (Title: *A Stroke of Genius: The Visual System and Putting*)
Date: June 20, 2013

The Ferris State University Institutional Review Board (IRB) has reviewed your application for using human subjects in the study, "*A Stroke of Genius: The Visual System and Putting*" (#130604) and approved it as *expedited -2D* from full committee review. This approval has an expiration date of one year from the date of this letter. As such, you may collect data according to procedures in your application until *June 20, 2014.* It is your obligation to inform the IRB of any changes in your research protocol that would substantially alter the methods and procedures reviewed and approved by the IRB in this application. Your application has been assigned a project number (#130604) which you should refer to in future applications involving the same research procedure.

We also wish to inform researchers that the IRB requires follow-up reports for all research protocols as mandated by Title 45 Code of Federal Regulations, Part 46 (45 CFR 46) for using human subjects in research. We will send a one-year reminder to complete the final report or note the continuation of this study. The final-report form is available on the IRB homepage. Thank you for your compliance with these guidelines and best wishes for a successful research endeavor. Please let us know if the IRB can be of any future assistance.