Effects on Perception and Accuracy of Live Putting when Leaving the Flagstick in the Hole

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Effects on Perception and Accuracy of Live Putting when Leaving the Flagstick in the Hole

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Department of Education

Honors Research Project

Submitted to

The Williams Honors College
The University of Akron

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ABSTRACT

The purpose of this study was to investigate the preferences of golfers and how those preferences affected their putting. This study involved participants who were golfers with a four-handicap or better by taking a survey of their preferences of having the flagstick in and out and then assessing their putting from various distances with the flagstick in and out. The survey questions included whether or not participants usually putted with the flagstick in from three, six, nine, fifteen, eighteen, twenty-one, and twenty-four feet as well as indicating any other circumstances that they would leave the flagstick in, and whether or not they thought leaving the flagstick in was an advantage. Those distances were also the distances used when the participants started the putting portion of the research. Participant putted twenty-four putts with the flagstick in and twenty-four putts with the flagstick out at the eight distances. The order of putts was randomized so that the participants did not have the same putt twice in a row. The researcher measured the distance of the golf ball away from the hole after it had finished rolling and whether the putt was short or long. Then, t-tests were used to compare the data with the flagstick in and flagstick out to determine if there is a significant difference. The results of this research based on p-values of the t-tests indicate that participants were significantly closer to the hole after three attempts with the flagstick out than with the flagstick in. In addition, participants made significantly more putts from twelve feet with the flagstick out than with the flagstick in and significantly more putts from fifteen feet with the flagstick in than with the flagstick out. Finally, participants who preferred the flagstick out from nine and twelve feet were significantly closer to hole with the flagstick out than with the flagstick in while participants that preferred the flagstick in from nine and twelve feet did not see a significant difference. It is difficult to draw a
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firm conclusion based on these results, but it is clear that having the flagstick in or out can make a difference on certain putts.

INTRODUCTION

The United States Golf Association recently had several rule changes that went into effect on January 1, 2019. One of these rule changes was the ability to leave the flagstick in the hole while players are putting on the green. Before this rule change, players had to have the flagstick either out of the hole completely or tended by another player or caddie (this is when someone holds the flagstick in the hole and then takes it out as soon as the player has putted). The new rule was meant to speed up play by allowing players with longer putts to simply leave the flagstick in so that fellow players can continue to read their putt without having to tend the flag. In addition, when golfers chip or hit an approach shot close to the hole, instead of pulling the flag out and setting it down, putting, and then putting the flagstick back in, they can simply tap their putt in with the flagstick still in.

This rule has caused some controversy because some PGA Tour players like Bryson Dechambeau and Adam Scott have started leaving the flagstick in for all putts. The USGA had stated that leaving the flagstick in or out should not be an advantage or disadvantage because the ball can miss going in just as easily as it can go in if the flagstick is left in. In the first PGA Tour event where the new rules were in effect, Bryson was number one in strokes gained putting that week; he left the flagstick in for every putt. In other words, Bryson putted better than his average during the tournament and he saved the most putts on the green compared to the rest of his competition that week. It seems doubtful that this is a coincidence. As a golfer, I am very motivated personally to find out if this is true because it might help me with my own golf game.
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The specific research questions to be addressed include (1) Psychologically, is it statistically beneficial to leave the flagstick in while putting? And (2) Looking at mechanics and the results of the test participants, is it better to have the flagstick in or out while putting?

PURPOSE

There have been several studies regarding the physics of leaving the flagstick in and out, but very few regarding the psychology behind it. Compared to many other sports, golf arguably may have a higher ratio of necessary mental skills to necessary physical ones and the visual of the flagstick in the hole could have some effect on players while they are putting. My hypothesis before I began the experiment is that putting with the flagstick in, although beneficial in regards to physics, will be detrimental psychologically to golfers and cause fewer putts to be made as well as cause players to be further away from the hole compared with if they had the flagstick out. However, I think that looking at individual people putting with the flagstick in and out will give varying results. Golf is a very visual game and if something is not visually appealing, it could affect how a player is performing. Some people may not have any trouble with the hole seemingly smaller than it normally is; but it might bother others that are used to having the full four and a quarter inches of space to make a putt with. Although statistically according to a machine it may be better to leave the flagstick in, if it does not visually look appealing to the player, then there may be more missed putts. I think this part is important because personally I have negative thoughts about the flagstick being in because it does not visually look appealing to me, which is a bias of mine as a researcher performing this experiment. This experiment will determine if this affects how many putts a person makes or their distance away from the hole if
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they miss. Therefore, the purpose of this study is to evaluate the perception and accuracy of live putting from different distances with the flagstick in and out of the hole.

METHODOLOGY

Demographics

Participants in this experiment were females and males between 18-55 years of age. A total of 18 participants took part (8 females and ten males). This was a convenience sample based on participants that the researcher already knew. To be included in the study, participants had to be below a four handicap and had experience playing tournament golf. Two of the participants were left-handed and the other sixteen were right-handed. This study was approved by The University of Akron IRB and all participants signed an informed consent prior to participating (Appendix C).

Preference Survey

First, test participants filled out a short survey of their flagstick preference at different distances as well as any other times that they prefer to leave the flagstick in; in addition, they were asked whether or not they thought that putting with the flagstick in was an advantage or a disadvantage (Appendix A).

Quantitative Measures Taken

After taking the survey, test participants started their testing using the indoor golf facility at the University of Akron. Several variables were able to be eliminated from the experiment because it was indoors: wind, dew on the greens, differing green speeds from day to day,
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different temperatures, and most importantly: different hole positions. All of these variables
were maintained from one individual test to the next.

Testing was completed over a period of two weeks. Test participants putted eight putts of
different distances with the flagstick in and out around six different holes so that the breaks were
different for each one. In addition, a random generator was used so that the order of the putts
was unknown for the participants and they did not have any of the same putts twice in a row.
This randomness was to try to prevent participants from memorizing or remembering the break
of past putts. This is a total of twenty-four putts with the pin in and twenty-four putts with the
pin out of varying lengths between three feet and twenty-four feet.

The participants did the experiment at different times so that their results were not skewed
by watching each other. Putting practice was permitted on one hole that was not being used for
the experiment prior to testing so that participants could get a feel for the speed of the green.
Table one shows the distances of the putts that were tested in this experiment with a description
of the slope of those putts.

<table>
<thead>
<tr>
<th>Putt Length</th>
<th>Slope of Putt</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 Feet</td>
<td>Flat and breaking slightly to the left</td>
</tr>
<tr>
<td>6 Feet</td>
<td>Downhill and breaking mildly to the right</td>
</tr>
<tr>
<td>9 Feet</td>
<td>Flat and straight</td>
</tr>
<tr>
<td>12 Feet</td>
<td>Uphill and breaking slightly to the left</td>
</tr>
<tr>
<td>15 Feet</td>
<td>Flat and straight</td>
</tr>
<tr>
<td>18 Feet</td>
<td>Flat and breaking severely to the left</td>
</tr>
<tr>
<td>21 Feet</td>
<td>Uphill and breaking slightly to the right</td>
</tr>
<tr>
<td>24 Feet</td>
<td>Slightly downhill and straight</td>
</tr>
</tbody>
</table>

Table 1. Description of Putt length and slope.

There are nine holes on the indoor putting facility green. However, three of these holes have
an unfair break where if the golf ball is within six inches of the cup, the ball filters towards the
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hole and goes in. Therefore, these holes were eliminated from testing, leaving a possible six holes to choose from. With eight different putts, two of the holes have two putts on them but they are from different angles and therefore have different breaks. Figure 1 shows an aerial view of the putting green in the University of Akron’s golf facility with the holes that were used for this experiment as well as the holes that were not used and the approximate positions where participants putted from. The black dots represent the holes that were used during the experiment while the white dots represent the holes that were not used. The numbers indicate the distances of the putts and the arrows indicate what holes the putts were attempted at.

Figure 1. Aerial view of The University of Akron Indoor Putting Green.

Appendix B shows a list in order of the random putts that each participant putted. The order was the same for every test.

After each putt, the distance away from the hole was measured (inches away from the hole). In addition, the researcher took note of whether the putt was long or short of the hole. A
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A putt was considered short if it did not have enough speed to get to the hole. A putt was considered long if it had enough speed to go in the hole; in other words, if part of the ball was next to the front edge of the cup, it was considered long because the ball had the potential to go in. These data were then compiled into another table and the total length of distance away from the hole was calculated for each distance with the flagstick in and out.

After all the participants were done with the experiment, the data were compiled into another larger table where averages were able to be calculated from each distance with the flagstick in and out. Then, t-tests were performed to determine if the results were significantly different from each other before dividing the data based on the participants’ preferences of wanting the flagstick in and out. After the data were divided again depending on the participants’ preference of the flagstick, more t-tests were performed to test. In addition, the average number of putts made for each participant was determined and there were t-tests run for this as well to determine if there was a significant difference.

RESULTS

Participants had various answers to questions on the survey. The first extended response question asked participants if they thought putting with the flagstick in was an advantage. Six participants thought that putting with the flagstick in was an advantage, eleven thought that putting with the flagstick in was not an advantage and one was unsure. The reasons that some participants gave for the flagstick being an advantage were: it takes the speed control out of play, the flagstick acts as a backstop to allow the ball to drop instead of hitting the cup and popping up, the ability to see the distance and line better from further away, and depth perception. The reasons that some participants gave for the flagstick being a disadvantage were: the hole looks
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smaller with the flagstick in, the visual appeal of the flagstick being in, a putt with too much speed could be forced out of the hole, past experiences when the putt has not gone in the hole due to the flagstick being in, and personal preference.

The second survey question asked if there are any other circumstances when participants would putt with the flagstick in. The situations that participants listed as reasons were: long putts that they can’t see the hole without the flagstick in, pace of play, when participants would have otherwise had the flagstick tended, downhill putts, downhill putts with extreme slope, extremely uphill putts, not wanting to walk to take the flagstick out during practice, putting off the green, when the ball is very closer to the hole and it is easier to tap the ball in without taking the flagstick out, if the flagstick shadow is on the line for a straight putt and it can act as an aid, and putting from off the green.

The handicaps of the participants also ranged from between plus three and four. Figure 2 shows relationship between the number of putts made and the handicap. There is no correlation between the handicap and putts made according to this figure.

![Figure 2. Relationship between Putts Made and Handicap of participants.](image-url)
After performing paired t-tests on the data above without separating based on preferences, the only distance that was significantly different between having the flagstick in and the flagstick out was the twelve-foot distance. The other seven distances all had p-values of over 0.05 and were therefore not significantly different to each other.

Table three shows the p-values of the compared data of distances away from the hole with the flagstick in against the flagstick out. A p-value of less than 0.05 is denoted by an asterisk.
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Average Number of Putts Left Short and Long

<table>
<thead>
<tr>
<th></th>
<th>Flagstick In (SD)</th>
<th>Flagstick Out (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Average Number of</strong></td>
<td><strong>Putts Hit Short</strong></td>
<td>4.722 (3.03)</td>
</tr>
<tr>
<td></td>
<td><strong>Putts Hit Long</strong></td>
<td>11.778 (3.52)</td>
</tr>
<tr>
<td><strong>P-Value</strong></td>
<td>0.031*</td>
<td>0.157</td>
</tr>
</tbody>
</table>

Table 4. Number of putts that were short and long of the hole with the flagstick in and out.

**Putts Made**

There are also data regarding the number of putts made for each distance with the flagstick in and out. Table 5 shows that two of the eight distances showed a significant difference in the number of putts made. Participants made significantly more putts with the flagstick out from twelve feet than with the flagstick in, as seen in the p-value of 0.044. In addition, participants made significantly more putts with the flagstick in from fifteen feet than with the flagstick out, as is seen in the p-value of 0.022. Table 5 shows the number of putts made from each participant as well as an average and a p-value from each t-test for each distance.
Effects on Perception and Accuracy of Live Putting when Leaving the Flagstick in the Hole

<table>
<thead>
<tr>
<th>PUTTS MADE</th>
<th>Distance of Putt (Feet)</th>
<th>3</th>
<th>6</th>
<th>9</th>
<th>12</th>
<th>15</th>
<th>18</th>
<th>21</th>
<th>24</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average number of Putts Made with Flagstick In</td>
<td>2.222</td>
<td>1.222</td>
<td>1.222</td>
<td>0.444</td>
<td>1.167</td>
<td>0.5</td>
<td>0.389</td>
<td>0.222</td>
</tr>
<tr>
<td></td>
<td>Average Number of Putts Made with Flagstick Out</td>
<td>2.333</td>
<td>1.111</td>
<td>1.611</td>
<td>0.889</td>
<td>0.556</td>
<td>0.333</td>
<td>0.222</td>
<td>0.167</td>
</tr>
<tr>
<td></td>
<td>P-Value</td>
<td>0.315</td>
<td>0.304</td>
<td>0.065</td>
<td>0.044*</td>
<td>0.022*</td>
<td>0.134</td>
<td>0.094</td>
<td>0.358</td>
</tr>
</tbody>
</table>

Table 5. Average number of putts made for each distance with the flagstick in and flagstick out and p-values.

![Figure 3](image.jpg)

Figure 3. Average Number of putts made per participant from each of the eight distances.

Generally looking at Figure 3, there is a trend of more putts made with the flagstick out for the shorter putts (twelve feet and under) and more putts made with the flagstick in for longer putts (fifteen feet and more).
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<table>
<thead>
<tr>
<th>Distance</th>
<th>Average Putts Made</th>
<th>T-Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-12 Feet with Flagstick In</td>
<td>1.2775</td>
<td>0.10239508</td>
</tr>
<tr>
<td>3-12 Feet with Flagstick Out</td>
<td>1.486</td>
<td></td>
</tr>
<tr>
<td>15-24 Feet with Flagstick In</td>
<td>0.5695</td>
<td>0.06771744</td>
</tr>
<tr>
<td>15-24 Feet with Flagstick Out</td>
<td>0.3195</td>
<td></td>
</tr>
</tbody>
</table>

Table 6. This table shows the grouped average number of putts made comparing putts of distances 12 feet and shorter with putts 15 feet and longer.

Table 6 shows grouped putts that shows there is no significant difference in putts made with the flagstick in and out when the putts are grouped into two different categories: putts 12 feet and shorter and putts 15 feet and longer.

There was only one participant out of the eighteen who preferred the flagstick in for the three foot putt so differences were not tested for participants that preferred the flagstick in and participants that preferred the flagstick out for that putt since that subject's results were the same for both flagstick in and out. However, there were t-tests performed for the rest of the seven distances.

Preferences: 6 Feet

The six-foot putt, which is downhill and breaks mildly to the right did not show significantly different results for those that preferred the flagstick in and those that prefer the flagstick out. The average of the participants that prefer the flagstick out was 46.4 inches with the flagstick in and 47.7 inches with the flagstick out. These results are not significantly different with a p-value of 0.45. Also, the participants that prefer the flagstick in for that putt, had an average of 66.4 inches with the flagstick in and 57.6 inches with the flagstick out, and there was no significant
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difference in these numbers either with a p-value of 0.32. Table 6 shows a comparison of those that preferred the flagstick in and those that preferred the flagstick out from six feet.

<table>
<thead>
<tr>
<th>Participants that Preferred Flagstick Out (n = 9)</th>
<th>6 Feet/Flagstick in</th>
<th>6 Feet/Flagstick Out</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average (SD)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preferred Flagstick Out</td>
<td>46.444 (26.67)</td>
<td>47.667 (31.76)</td>
<td>0.455</td>
</tr>
</tbody>
</table>

Table 7. Comparison of participants that prefer flagstick in and out from six feet.

Preferences: 9 Feet

The nine-foot putt, which is relatively flat and straight showed significantly different results when looking at the data of the participants who prefer the flagstick out for that distance. The average of the fifteen participants that prefer the flagstick out was 28.5 inches with the flagstick in and 17.7 inches with the flagstick out. These results are significantly different with a p-value of 0.03. However, with the participants that prefer the flagstick in for that putt, their average was closer at 23.7 inches with the flagstick in and 29.3 inches with the flagstick out, so there was no significant difference in these numbers. The following tables show a comparison of those that preferred the flagstick in and those that preferred the flagstick out from nine feet.
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### Table 8. Comparison of participants that prefer the flagstick in and out from nine feet.

<table>
<thead>
<tr>
<th>Participants that Preferred Flagstick Out (n = 15)</th>
<th>Average (SD)</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>9 Feet/ Flagstick in</td>
<td>28.533 (20.08)</td>
<td>0.038*</td>
</tr>
<tr>
<td>9 Feet/ Flagstick Out</td>
<td>17.667 (19.49)</td>
<td></td>
</tr>
<tr>
<td>Participants that Preferred Flagstick In (n = 3)</td>
<td></td>
<td>0.39</td>
</tr>
<tr>
<td>9 Feet/ Flagstick in</td>
<td>23.667 (20.55)</td>
<td></td>
</tr>
<tr>
<td>9 Feet/ Flagstick Out</td>
<td>29.333 (40.86)</td>
<td></td>
</tr>
</tbody>
</table>

Preferences: 12 Feet

The twelve-foot putt, which is uphill and breaks slightly to the left showed significantly different results when looking at the data of the participants who prefer the flagstick out for that putt. The average of the fifteen participants that prefer the flagstick out was 38.2 inches away from the hole with three attempts with the flagstick out and 63.9 inches with the flagstick in. These results are significantly different with a p-value of 0.007. However, with the participants that prefer the flagstick in for that putt, their average was very similar at 24.7 inches and 25 inches, so there was no noticeable difference in these numbers. The following tables show a comparison of those that preferred the flagstick in and those that preferred the flagstick out from twelve feet.
Effects on Perception and Accuracy of Live Putting when Leaving the Flagstick in the Hole

<table>
<thead>
<tr>
<th>Participants that Preferred Flagstick Out (n = 15)</th>
<th>Average (SD)</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 Feet/Flagstick in</td>
<td>63.867 (32.67)</td>
<td>0.007*</td>
</tr>
<tr>
<td>12 Feet/Flagstick Out</td>
<td>38.2 (20.46)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Participants that Preferred Flagstick In (n = 3)</th>
<th>Average (SD)</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 Feet/Flagstick in</td>
<td>24.667 (15.5)</td>
<td>0.495</td>
</tr>
<tr>
<td>12 Feet/Flagstick Out</td>
<td>25 (24.88)</td>
<td></td>
</tr>
</tbody>
</table>

Table 9. Comparison of participants that prefer the flagstick in and out from twelve feet.

Preferences: 15 Feet

The fifteen-foot putt, which is relatively flat and straight putt had mixed results. For the participants that preferred the flagstick be out for a fifteen-foot putt, they were, on average, eleven inches closer to the hole after three attempts than with the flagstick out. For participants that preferred the flagstick be in for a fifteen-foot putt, they were, on average, fifteen inches closer to the hole after three attempts than with the flagstick in. The following tables show a comparison of those that preferred the flagstick in and those that preferred the flagstick out from fifteen feet.

<table>
<thead>
<tr>
<th>Participants that Preferred Flagstick Out (n = 15)</th>
<th>Average (SD)</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 Feet/Flagstick in</td>
<td>38.467 (25.67)</td>
<td>0.145</td>
</tr>
<tr>
<td>15 Feet/Flagstick Out</td>
<td>49.467 (21.62)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Participants that Preferred Flagstick In (n = 3)</th>
<th>Average (SD)</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 Feet/Flagstick in</td>
<td>64.333 (65.65)</td>
<td>0.374</td>
</tr>
<tr>
<td>15 Feet/Flagstick Out</td>
<td>49 (7)</td>
<td></td>
</tr>
</tbody>
</table>

Table 10. Comparison of participants that prefer the flagstick in and out from fifteen feet.
Effects on Perception and Accuracy of Live Putting when Leaving the Flagstick in the Hole

Preferences: 18 Feet

With a putt that breaks a lot such as the 18-footer that was tested, the participants' average distance of putts missed, although not significantly different, was lower with the flagstick out than with the flagstick in. For participants that preferred the flagstick out, they were about four inches closer per putt to the hole when the flagstick was out. In addition, participants that preferred the flagstick in for this breaking putt were also closer, on average, with the flagstick out, although the results were not significantly different for either group when viewing the p-value of the t-test. The following tables show a comparison of those that preferred the flagstick in and those that preferred the flagstick out from eighteen feet.

<table>
<thead>
<tr>
<th>Participants that Preferred Flagstick Out (n = 12)</th>
<th>Average (SD)</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>18 Feet/Flagstick in</td>
<td>85.417 (46.73)</td>
<td>0.134</td>
</tr>
<tr>
<td>18 Feet/Flagstick Out</td>
<td>73.542 (22.72)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Participants that Preferred Flagstick In (n = 6)</th>
<th>Average (SD)</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>18 Feet/Flagstick in</td>
<td>105 (24.92)</td>
<td>0.403</td>
</tr>
<tr>
<td>18 Feet/Flagstick Out</td>
<td>101.5 (27.97)</td>
<td></td>
</tr>
</tbody>
</table>

Table 1. Comparison of participants that prefer the flagstick out from eighteen feet.

Preferences: 21 Feet

A slightly uphill and breaking right putt such as the 21-footer in this experiment showed no significant difference in their results and whether they preferred the flagstick in or out. The results were not significantly different according to the p-values of 0.368 and 0.396, but the average distance away from the hole for three attempts was lower with the flagstick in. The following tables show a comparison of those that preferred the flagstick in and those that preferred the flagstick out from twenty-one feet.
Effects on Perception and Accuracy of Live Putting when Leaving the Flagstick in the Hole

<table>
<thead>
<tr>
<th>Participants that Preferred Flagstick Out (n = 13)</th>
<th>Average (SD)</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>21 Feet/Flagstick in</td>
<td>67.154 (33.67)</td>
<td>0.368</td>
</tr>
<tr>
<td>21 Feet/Flagstick Out</td>
<td>70.769 (20.61)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Participants that Preferred Flagstick In (n = 5)</th>
<th>Average (SD)</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>21 Feet/Flagstick in</td>
<td>50.2 (24.25)</td>
<td>0.396</td>
</tr>
<tr>
<td>21 Feet/Flagstick Out</td>
<td>56 (13.55)</td>
<td></td>
</tr>
</tbody>
</table>

Table 12. Comparison of participants that prefer the flagstick in and out from twenty-one feet.

Preferences: 24 Feet

With a longer straighter putt such as the 24-footer that was tested, the participants’ average distance of putts missed was not significantly different. In addition, the results of participants that preferred the flagstick in for this putt were not significantly different when viewing the p-value of the t-test. The following tables show a comparison of those that preferred the flagstick in and those that preferred the flagstick out from twenty-four feet.

<table>
<thead>
<tr>
<th>Participants that Preferred Flagstick Out (n = 12)</th>
<th>Average (SD)</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>24 Feet/Flagstick in</td>
<td>62.167 (29.25)</td>
<td>0.199</td>
</tr>
<tr>
<td>24 Feet/Flagstick Out</td>
<td>76.167 (45.73)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Participants that Preferred Flagstick In (n = 6)</th>
<th>Average (SD)</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>24 Feet/Flagstick in</td>
<td>61.5 (30.49)</td>
<td>0.44</td>
</tr>
<tr>
<td>24 Feet/Flagstick Out</td>
<td>62.5 (27.86)</td>
<td></td>
</tr>
</tbody>
</table>

Table 13. Comparison of participants that prefer the flagstick in and out from twenty-four feet.
Effects on Perception and Accuracy of Live Putting when Leaving the Flagstick in the Hole

Figure 4. Average distance away from the hole after three attempts for participants that prefer the flagstick out.

Figure 5. Average distance away from the hole after three attempts for participants that prefer the flagstick in.
Grouped Comparison

<table>
<thead>
<tr>
<th></th>
<th>Average Distance Away from the Hole after 3 attempts</th>
<th>T-Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-12 Feet with Flagstick In</td>
<td>39.72</td>
<td>0.107033792</td>
</tr>
<tr>
<td>3-12 Feet with Flagstick Out</td>
<td>31.915</td>
<td></td>
</tr>
<tr>
<td>15-24 Feet with Flagstick In</td>
<td>64.775</td>
<td>0.264484273</td>
</tr>
<tr>
<td>15-24 Feet with Flagstick Out</td>
<td>67.73</td>
<td></td>
</tr>
</tbody>
</table>

Table 14. Grouped comparisons between the 3-12-foot putts and between the 15-24-foot putts.

Table 14 shows that although there is a difference in averages between putts with the flagstick in and out, there is no significant difference between the 3-12-foot putts with the flagstick in and out. In addition, by looking at the p-values from the t-tests performed, there is no significant difference in the averages of the 15-24-foot putts.

DISCUSSION

There was no correlation between the handicap and putts made; however, this can be explained because the maximum handicap allowed for the experiment was four, which is still a very high caliber player. There would not be very much differentiation between a four-handicap and a plus-three-handicap. In addition, handicap may not be the best predictor of the level of putter that someone is. For example, a player can be a good putter and a poor striker of the golf ball or vice versa. If this experiment had used more participants of different calibers of play,
Effects on Perception and Accuracy of Live Putting when Leaving the Flagstick in the Hole

there might have been more of a differentiation and it might have shown that better players make more putts than worse players.

Generally, there is a trend of more putts made with the flagstick out for the shorter putts (twelve feet and under) and more putts made with the flagstick in for longer putts (fifteen feet and more). This is plausible because leaving the flagstick in for shorter putts may influence the mindset and perception that players have had their whole lives. Players have taken the flagstick out for shorter putts their whole lives until the past year when they were finally given the option. On longer putts, however, sometimes players used to have the flagstick tended because the hole was more difficult to see at a longer distance. In addition, if there was a lot of slope on a green, a player may have had the flagstick tended as well. For these reasons, players would have been more used to having the flagstick out for shorter putts and tended for longer putts. This perception would probably not have changed much in the last year, so it is understandable that participants would have made more of the shorter putts with the flagstick out than with it in and vice versa with the longer putts.

One anomaly in the data was the fifteen-foot putt. Participants who preferred the flagstick in had results that were different than what would have been expected because of an outlier. The current results of those who preferred the flagstick in show that the average for the participants was closer to the hole with the flagstick out with an average of 49 inches than with the flagstick in with an average of 64.3 inches. There was an outlier of 138 inches from one of the participants skewed the data. This data would show the opposite if this outlier were taken out. The average distance away from the hole would be 18.3 inches with the flagstick in and 35.3 inches from the hole with the flagstick out. The p-value would still not be significant, but the averages would be more in-line with what was predicted.
Effects on Perception and Accuracy of Live Putting when Leaving the Flagstick in the Hole

It was also surprising that the eighteen-footer did not show any significant difference. The eighteen-foot putt for this experiment broke very hard to the left. A player trying to lag the putt would have played the maximum amount of break and then had the minimum speed to reach the hole. Then, if the player were to miss the hole, the ball would be somewhat close to the hole. A player trying to “ram” the ball into the hole would have played the least amount of break possible and put a lot of speed on the ball. The, if the player were to miss the hole, the ball should be much further from the hole. It would be expected that players would try to lag putts with the flagstick out for this putt and “ram” putts with the flagstick in. This was not the case though; there was no significant difference between the flagstick in and out because even a ball with a slow speed continued to trickle past the hole.

LIMITATIONS

Some limitations in this experiment included using an indoor artificial putting green. Although it was great for convenience, there were some things that could have been better if the experiment had been performed on real outdoor greens. The indoor green, however, did provide several benefits such as the ability to do the experiments over an extended period of time. If the experiment had been performed on an outside green, it would have had to been done all in the same day, which would have been nearly impossible with eighteen participants taking between thirty to forty minutes with each test. The reason that the experiment would have had to been done in one day is because outdoor conditions change from day to day. The green speeds are different, the dew points are different in the morning compared with the afternoon or evening which affects green speed, the wind is constantly changing, and the hole positions on practice greens are usually changed daily. For these reasons, it was beneficial to perform the experiment
Effects on Perception and Accuracy of Live Putting when Leaving the Flagstick in the Hole indoors. However, the indoor putting green is different than a normal green in that its putts cannot be “read.” Instead, the breaks must be memorized because simply looking at the green does not give an indication of how a putt is going to break. This may give participants who have putted on this green more than others some advantage.

Another limitation of the experiment is the shadowing of the hole. On a real golf course, the sun makes a shadow appear on the opposite side of the flagstick. In the indoor facility, there are several lights that project light from different directions, giving the allusion of “several suns.” In other words, the shadowing of the flagstick looks like it has multiple shadows instead of just one. None of the participants mentioned anything about this during testing, but it was something that is different compared with the outdoors.

Another limitation of the study was the number and order of putts. There were three putts at each distance with the flagstick in and three putts with the flagstick out for a total of 48 putts. The order was randomized to prevent people from getting into a rhythm, learning a putt well, and making the same putt three times in a row. However, although there were not the same two putts in a row, many of the participants played putts differently based on how the last putt they hit was; in other words, they learned from their previous putts. This may have also affected the speed that they hit their putts.

FUTURE RESEARCH

If I were to do this experiment again, I would want another research partner so that during the experiment, I could record the distance away from the hole while someone was measuring the distance, or vice versa. In addition, if I had another research partner, I would have had more different putts. Instead of only eight spots to putt from, I would have had three footers
Effects on Perception and Accuracy of Live Putting when Leaving the Flagstick in the Hole
from three different positions on the green, six footers from three different positions, and so on.
This would have been twenty-four putts with the flagstick in and twenty-four putts with the
flagstick out still, but the twenty-four putts would all be different.

In addition, if I were to do the experiment again, I would perform it on outdoor greens.
Although I would not be able to complete the experiment on the same day and hole positions
might change, I would note these differences, but it should not make a difference in a
participant’s individual test. There may be variety between tests because of this but the
conditions would all be the same for each individual participant. I would try to keep conditions
as similar as possible but there may be small differences; for example, I would not make one
participant putt on a seventy-degree sunny day and another when it is fifty degrees and raining.

Finally, I would try to determine if the green speed influences whether or not participants
would perform better with the flagstick in or out. For example, on faster greens, golfers need a
shorter stroke for the ball to get to the hole. On slower greens, golfers need a longer stroke and
must hit the ball with more force to get the ball to the hole. This may also affect a golfer’s
preference for having the flagstick in or out.

CONCLUSION

In conclusion, based on the results of this experiment, it is hard to conclude that there is a
difference for participants when they leave the flagstick in and when they take it out. There may
not be a straight-forward answer for golfers wondering if they should leave the flagstick in or
take it out. But based on this study, it seems imperative that golfers should do what they feel
comfortable with while putting. Golf is a very psychological game and if a player is not
comfortable with how the hole visually looks, it will affect their putt.
Effects on Perception and Accuracy of Live Putting when Leaving the Flagstick in the Hole

The goal of this study was to extend and compare to research that already has been done by other researchers on the physics of leaving the flagstick in the hole. Prior to this study, many golfers were unsure of what to do with the flagstick. Some believed that physics makes it beneficial to leave the flagstick in the hole due to the coefficient of restitution while others simply were used to having the flagstick out and would prefer to keep it that way. Researchers such as Dave Pelz believe that it is an advantage to leave the flagstick in based on his testing (Pelz, 1990). However, another researcher, Mike Stachura, believes that it is a definite disadvantage “in 99.9% of situations” based on his study (Stachura, 2019). After examining the results of this study, a golfer’s preference plays an important role in determining what they should do with the flagstick before they putt. There seems to be a general trend with the participants that they were closer to the hole, on average, with the flagstick out from short distances like three, six, nine, and twelve feet. In addition, there seems to be a trend where participants were closer to the hole, on average, with the flagstick in from longer distances like fifteen, eighteen, twenty-one, and twenty-four feet. However, when examining the data, it seems evident that a golfer’s personal preference of how they like the flagstick plays a major role in their success in making a putt or getting closer to the hole.
Effects on Perception and Accuracy of Live Putting when Leaving the Flagstick in the Hole

REFERENCES


Appendix A

A copy of the survey as presented to the participants:

PUTTING PREFERENCE SURVEY

Circle Yes or No to indicate your answer:

Do you usually putt with the flagstick in from 3 feet and in?  
Yes  No

Do you usually putt with the flagstick in from 3–6 feet?  
Yes  No

Do you usually putt with the flagstick in from 6–9 feet?  
Yes  No

Do you usually putt with the flagstick in from 9–12 feet?  
Yes  No

Do you usually putt with the flagstick in from 12–15 feet?  
Yes  No

Do you usually putt with the flagstick in from 15–18 feet?  
Yes  No

Do you usually putt with the flagstick in from 18–21 feet?  
Yes  No

Do you usually putt with the flagstick in from 21–24 feet?  
Yes  No

Do you usually putt with the flagstick in from outside 24 feet?  
Yes  No

Do you think putting with the flagstick in is an advantage?  
Yes  No

Why?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Are there any other circumstances when you would putt with the flagstick in?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Are you Right-handed or Left-handed? Please circle one.

What is your handicap? ________________

What is the average amount of time a week that you spend practicing putting?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Thank you for your time in taking this survey and your participation in this experiment. It is greatly appreciated!
Appendix B

<table>
<thead>
<tr>
<th>Code Number:</th>
<th>Randomly Generated Order of Putts</th>
<th>Distance from Hole:</th>
<th>Randomly Generated Order of Putts Cont.</th>
<th>Distance from Hole:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>15 foot flagstick out</td>
<td>25</td>
<td>3 foot flagstick out</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>12 foot flagstick in</td>
<td>26</td>
<td>24 foot flagstick in</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>21 foot flagstick out</td>
<td>27</td>
<td>18 foot flagstick out</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>12 foot flagstick in</td>
<td>28</td>
<td>21 foot flagstick out</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>3 foot flagstick in</td>
<td>29</td>
<td>3 foot flagstick out</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>12 foot flagstick out</td>
<td>30</td>
<td>18 foot flagstick in</td>
<td></td>
</tr>
<tr>
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<tr>
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</tr>
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<td></td>
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<tr>
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<td>9 foot flagstick in</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>24 foot flagstick in</td>
<td>35</td>
<td>6 foot flagstick in</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>21 foot flagstick in</td>
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<td>3 foot flagstick in</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>12 foot flagstick out</td>
<td>36</td>
<td>21 foot flagstick in</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>18 foot flagstick in</td>
<td>37</td>
<td>6 foot flagstick out</td>
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</tr>
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<td>15</td>
<td>9 foot flagstick out</td>
<td>39</td>
<td>18 foot flagstick in</td>
<td></td>
</tr>
<tr>
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<td>15 foot flagstick out</td>
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<td>9 foot flagstick out</td>
<td>41</td>
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<td>19</td>
<td>24 foot flagstick out</td>
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<td>18 foot flagstick out</td>
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<tr>
<td>20</td>
<td>9 foot flagstick in</td>
<td>44</td>
<td>6 foot flagstick out</td>
<td></td>
</tr>
<tr>
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<td>12 foot flagstick out</td>
<td>45</td>
<td>21 foot flagstick out</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>15 foot flagstick in</td>
<td>46</td>
<td>24 foot flagstick out</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>18 foot flagstick out</td>
<td>47</td>
<td>12 foot flagstick in</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>15 foot flagstick in</td>
<td>48</td>
<td>3 foot flagstick out</td>
<td></td>
</tr>
</tbody>
</table>
Effects on Perception and Accuracy of Live Putting when Leaving the Flagstick in the Hole

Office of Research Administration
Akron, OH 44325-2102

NOTICE OF APPROVAL

Date: 9/11/19
To: Danielle Nicholson
From: Katie Watkiss
IRB Number: 20190907
Title: Effects of Perception and Accuracy of Live Putting when Leaving the Flagstick in the Hole

Approval Date: 9/10/19

Thank you for submitting your Request for Exemption to the IRB for review. Your protocol represents minimal risk to subjects and qualifies for exemption from the federal regulations under the category below:

☐ Exemption 1 – Research conducted in established or commonly accepted educational settings, involving normal educational practices.

☒ Exemption 2 – Research involving the use of educational tests, survey procedures, interview procedures, or observation of public behavior.

☐ Exemption 3 - Research involving the use of educational tests, survey procedures, interview procedures, or observation of public behavior not exempt under category 2, but subjects are elected or appointed public officials or candidates for public office.

☐ Exemption 4 – Research involving the collection or study of existing data, documents, records, pathological specimens, or diagnostic specimens.

☐ Exemption 5 – Research and demonstration projects conducted by or subject to the approval of department or agency heads, and which are designed to study, evaluate, or otherwise examine public programs or benefits.

☐ Exemption 6 – Taste and food quality evaluation and consumer acceptance studies.

Annual continuation applications are not required for exempt projects. If you make changes to the study's design or procedures that increase the risk to subjects or include activities that do not fall within the approved exemption category, please contact the IRB to discuss whether or not a new application must be submitted. Any such changes or modifications must be reviewed and approved by the IRB prior to implementation.

Please retain this letter for your files. This office will hold your exemption application for a period of three years from the approval date. If you wish to continue this protocol beyond this period, you will need to submit another Exemption Request. If the research is being conducted for a master's thesis or doctoral dissertation, the student must file a copy of this letter with the thesis or dissertation.

☒ Approved consent form/s enclosed

The University of Akron is an Equal Education and Employment Institution
Title of Study: Effects on Perception and Accuracy of Live Putting when Leaving the Flagstick in the Hole

Introduction: You are invited to participate in a research project being conducted by Danielle Nicholson, a student in the College of Education and Dr. Ronald Otterstetter, a professor in the College of Health Professions.

Purpose: The purpose of this study is to compare the effects on perception and accuracy of live putting when leaving the flag stick in the hole in highly skilled golfers.

Procedures: All the testing will take place at the indoor golf facility at the University of Akron. This allows for the holes to remain in the same position all the time so each experiment will be exactly the same and easily repeatable. The subjects will do the experiment at different times so that their results are not skewed by watching each other. Before doing the experiment, you will fill out a survey that discusses your preferences between flag stick in and out, the caliber of player you are, and whether or not you think putting with the flag stick in or out is an advantage. There will be 6 puts each at the following distances (3 with the pin in and 3 with the pin out): 3 feet, 6 feet, 9 feet, 12 feet, 15 feet, 18 feet, 21 feet, and 24 feet. This will be a total of 24 puts with the pin in and 24 puts with the pin out of varying lengths. To try to eliminate subjects from knowing the break and learning, a random generator will be used to vary the order that players put in. For example, the first putt could be a 6 footer with the flag stick in and the second putt could be a 21 footer with the flag stick out. Once a player putts, a tape measure will be used to record the distance that each putt rests away from the hole. At the end of the test, the average distance away from the hole for each distance with the flag stick in and compare those numbers with the average distances for the putts with the flag stick out.

Limitations to Participation: To participate in this study, the participant must have an 18-hole handicap of 4 or less.

Risks: There are no known risks associated with participation in this study.

Benefits: You will receive no direct benefit from your participation in this study, but your participation may help the understanding of the impact of keeping the flag stick in during putting.

Right to Refuse or Withdraw: Participation in this study is voluntary. Refusal to participate or to withdraw from the study at any time will involve no penalty.

The University of Akron is an Equal Education and Employment Institution

Approved
IRB 9/10/19

Date
Confidential Data Collection: All data collected will be kept confidential. Only minimal identifying information will be included in the data you provide (handicap, flagstick preference, right or left-handed, etc.). Individual identification will not occur in the research procedures or in any formal publication. Only the researchers will have access to the data. The only data collected will be in the form of written questionnaires and observation of the putting. No data will be reproduced, duplicated, or further used beyond this study. Your signed consent form will be kept separate from your data, and nobody will be able to link your responses to you.

If you have any questions: Questions may be emailed to Danielle Nicholson at dnmn31@zips.uakron.edu or call Dr. Ronald Otterstetter at 330-972-7738. This project has been reviewed and approved by The University of Akron Institutional Review Board. If you have any questions about your rights as a research participant, you may call the IRB at (330) 972-7666.

Acceptance: I have read the information provided and all of my questions have been answered. I voluntarily agree to participate in this study. My completion and return of this questionnaire will serve as my consent. I may print a copy of this consent statement for future reference.

Participant Signature ___________________________ Date ___________________________