Love at first try? How reliable is a first impression for selecting a golf putter?

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Abstract

In the game of golf the putter is used for 40 to 50 percent of all strokes during a round. Therefore, it is important for a golfer to find the putter that suits the own game best and that promises the most success on the green. Compared to all their other golf clubs, average recreational golfers usually select their putter relatively fast - the main criterion for choosing a specific putter being the first impression after a few practice strokes. The purpose of this paper therefore is to find out whether this first impression is reliable in the process of finding a putter, a study was completed. The study was conducted with ninety test subjects of varying skill levels and experience. This study used three different types of putters. The putting accuracy of each test subject with every test putter was recorded. The subjects had to twice fill in a questionnaire about their perception of the putters' properties before (Q1) and after (Q2) the putting sequences. The results of Q1 and Q2 were set in relation to the analysis of putting accuracy resulting in low number of successful identifications for Q1 and more than twice the number of successful identifications of Q2. An analysis of the handicap and the playing experience of the test subjects indicates that golfers of all skill and experience levels are able to find the best putter through the first impression. However, the results showed that the identification rate is still low. The paper therefore concludes that a golfer should not rely on the first impression alone.

1. Introduction

The game of golf is currently played by roughly 60 million people around the world [1]). At its most basic level, it is a game in which a player, using a club, tries to hit a small, round ball into a small, round hole in as few shots as possible.[1] From all the different types of golf strokes (e.g. drive, chip, pitch) the putt is the one most frequently used while playing a round of golf. Putting can be described as: A simple series of physical motions using a flat-faced stick to roll an almost-round, fairly well-balanced ball into a hole on a relatively smooth surface, under the essentially unknown scientific influences of gravity, slope, green speed, and footprints. [2, pp.4-6] In theory, the game of golf consists of 50% putts (2 putts per hole, 36 putts for a round on a PAR 72 golf course). In reality about 43% of all shots are putts [2, p.1]. Hence, the putter is the

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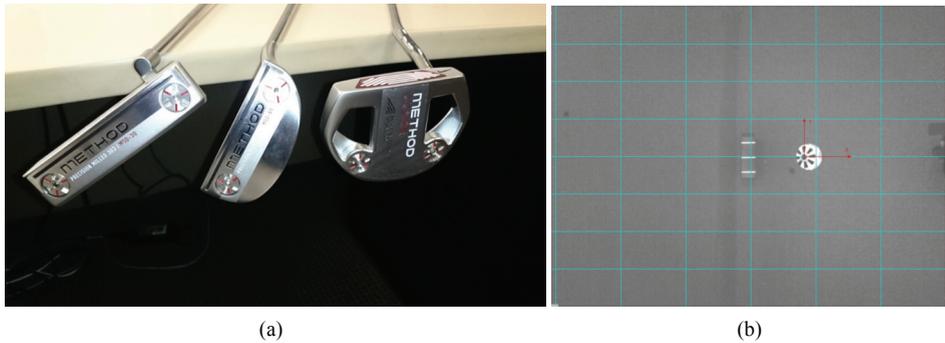*Emailaddress:* litzenberger@technikum-wien.at (Stefan Litzenberger)

Fig. 1. (a) Putters used study (from left to right) Nike Method Mod 30 (Blade Putter), Nike Method Mod 60 (Mallet Putter) and a Nike Method Core MC11w (Stability Putter) (b) Camera picture for the assessment of the balls' end position. The coordinate-origin is located in the hole's center.

most important club a golfer carries in the bag and thus should be chosen carefully to ensure good putting accuracy. However, recent research on putting accuracy has been focussing on kinematics [3, 4] or putting style [5], but not on the influence of different putter-types. Subjective perception was also identified to be a major influence on deciding for or against a golf club and influencing shot parameters [6, 7, 8].

Whereas the average leisure golfer usually puts a lot of effort in finding the right driver, woods and irons - clubs used for long and approach shots - through professional club fitting, the selection of a putter is in most cases based upon the first impression of a club after a small number of practice putts, although a number of different putter-types exist all having different moment of inertia or club faces influencing the swing itself and rolling behavior of the ball. But how reliable is this first impression?

It was expected that (1) subjects' subjective rating of a putter (best, worst) matches the results of putting accuracy better after performing more strokes with the given putter than after the first impression, that (2) subjects with higher skill levels (i.e. lower handicap), and (3) subjects with longer playing experience are better able to successfully identify putters as the best or the worst for their individual playing style.

2. Methods

To answer the research questions a study with a large group of test subjects ($n = 90$, handicap: -14 $\pm$ 12.9, experience: 26 $\pm$ 16.94 years, age: 45 $\pm$ 15.71 years, rounds per month: 5 $\pm$ 3.99, practice sessions per month: 5 $\pm$ 5.47) was chosen and a test protocol designed which focused on certain parameters related to putting. All subjects were informed of the test protocol and the aims of the study and gave their consent to participate.

In order to complete the putting test for the study, each test subject hit 20 putts with each of the three putters from a distance of 6.4 m on a flat artificial putting green. The subjects could freely choose the order of the putters. Before performing any putts they were asked three specific questions about the putter they chose (Q1). (1. How do you like the putter optically?, 2. How do you like the feeling of this putter?, 3. How do you think you will perform with this putter?).

The golf equipment used in this study included twelve Nike RZN Platinum golf balls (Nike Inc., Beaverton, OR, USA). The study used three different types of golf putters which were provided by Nike Golf (Nike Method Mod 30 (Blade Putter), Nike Method Mod 60 (Mallet Putter) and a Nike Method Core MC11w (Stability Putter)). The main differences between these three putters is the shape of the club head and hence different moments of inertia (Figure 1a).

The study was conducted under controlled laboratory conditions at the Nike Golf main facility The Oven (Fort Worth, TX, USA). The measurements were carried out using an artificial green located indoors. The velocity of the artificial green was 4.51 m according to the measurement using a stimpmeter according to the guidelines of the United States Golf Association [9].

The questions were answered with a rating from 1 (terrible) to 7 (excellent), with the rating 4 representing

neutral. Following these questions about the first impression of the putter the test subjects were given the opportunity to hit up to ten practice putts before given 20 tries to hole the ball. The balls end positions were acquired using a camera setup placed perpendicular to the surface of the artificial putting green. The used camera was a Phantom v7.1 high-speed video camera (Vision Research, Wayne, USA) with a resolution of 800 by 600 pixels covering an area of 152 cm by 114 cm (Figure 1b). The hole location was defined as the coordinate origin, hence a putt that dropped into the hole had the end position 0/0.
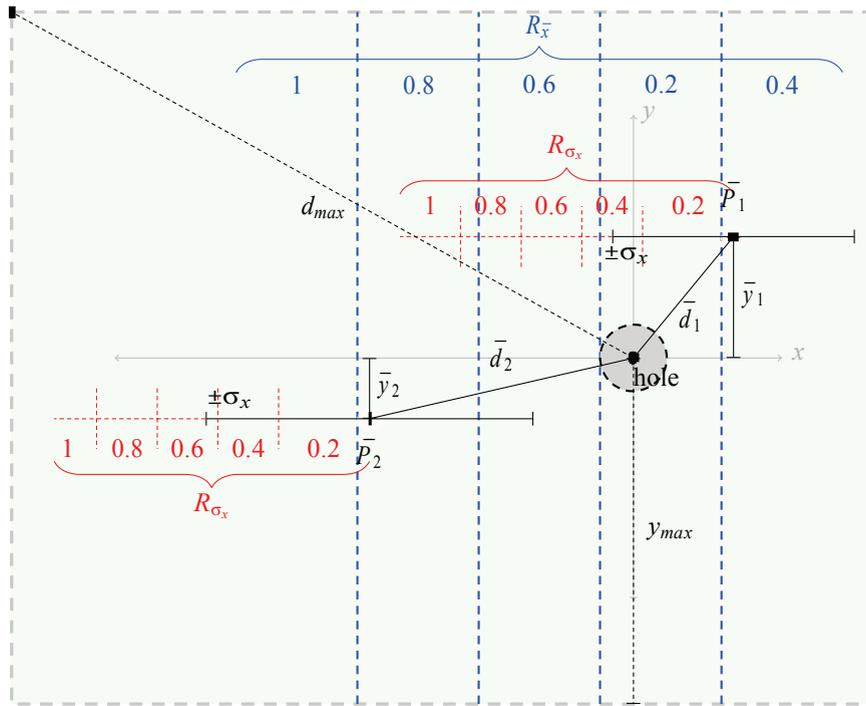

Fig. 2. Schematic display of putting accuracy calculation, two mean ball positions after 20 shots are shown: $\bar{P}_1(22cm/20cm)$ and $\bar{P}_2(-38cm/-10cm)$, according to (1) this yields $Putt_{accuracy}(P_1) = 0.4 + 0.4 + \frac{29.73}{112.4} + \frac{20}{57} = 1.42$ and $Putt_{accuracy}(P_2) = 0.8 + 0.6 + \frac{39.29}{112.42} + \frac{10}{57} = 1.92$.

$$Putt_{accuracy} = R_{\bar{x}} + R_{\sigma_x} + \frac{\bar{d}}{d_{max}} + \frac{|\bar{y}|}{|y_{max}|} \tag{1}$$

To calculate shot accuracy a rating-system was developed which takes several parameters into consideration: The root mean square error (RMSE) for the overall distance of the balls end-position to the hole ($\bar{d}$) and for the distance in y-direction ($\bar{y}$) were calculated. To obtain an overall assessment of a putting cycle those two values were converted into a ratio of the total possible error (absolute possible total error = 112.42 cm, y-direction possible total error = 57 cm). From the 20 end positions the mean length deviation ($\bar{x}$) and the standard deviation ($\pm\sigma_x$) were calculated and rated using a rating system which takes the probability of ending the putt in the hole into account (i.e. shots too short were rated worse than shorts too long) yielding R_{σ_x} (0 points were given for a successful putt, 0.2 for $0 < \sigma_x \leq 15$ *cm*, 0.4 for $15 < \sigma_x \leq 25$ *cm*, 0.6 for $25 < \sigma_x \leq 35$ *cm*, 0.8 for $35 < \sigma_x \leq 45$ *cm* and 1 for $\sigma_x > 45$ *cm*) and $R_{\bar{x}}$ (0 for a successful putt, 0.2 for $0 < \bar{x} \leq 20$ *cm*, 0.4 for $\bar{x} > 20$ *cm*, 0.6 for $0 > \bar{x} \geq -20$ *cm*, 0.8 for $-20 > \bar{x} \geq -40$ *cm* and 1 for $\bar{x} < -40$ *cm*) (Figure 2). The final value for putting accuracy is represented by the sum of these four ratings/ratios (1). A lower final value means a better putting result for the putter, where the minimum is zero (equalling a successful putt) and the maximum is 4.

After having finished the 20 putts with one putter the subjects were again asked three rating questions about the putter (Q2). (4. How did you like its feedback/sound/feeling?, 5. What do you think of your performance with that putter?, 6. How would you rate that putter overall?). After these questions the subjects changed

Table 1. Number of matches for the different combinations (r.: rating, p.:performance, pre: before putting (Q1), post: after putting (Q2), overall: Q1 & Q2)

	Best r. and p. correct match	Best r., worst p. polar opposite	Worst r., best p. polar opposite	Worst r. and p. correct match
Pre	10	10	16	13
Post	25	5	3	27
Overall	18	8	9	25

the putter and repeated the test until they had used all three provided putters.

The rating questions of Q1 and Q2 were first analysed for themselves. In order to logically combine the club rating with the putting performance later, the answers of the rating questions were inverted (1 = excellent and 7 = terrible) to also result in a lower final rating if the subject rated a putter good. The final rating for Q1 and Q2 was calculated as the arithmetical mean of the three rating questions.

In addition to the separate ratings of Q1 and Q2 a third overall rating was calculated. This rating used the unmodified answers of questions two to five and the inverted answers of questions one and six. The answers of questions two and four as well as the answers to question three and five were used to produce a before-after ratio. These two ratios and the answers to question one and six were again used to calculate the arithmetical mean as the final rating. This rating too, follows the logic of a putter with a lower rating was rated better.

By analysing the putting performance it was possible to identify the best and worst performing putter for each test subject. These results were tested against the rating of the putters acquired through the rating analysis.

To find out whether there were statistically significant differences for different putters for a subject in the putting accuracy calculated, a student's t-test, with the significance level at $p = 0.25$ was performed. Only results with statistical significance were used for further calculations. The significance test reduced the number of subjects from 90 to 51 (handicap: -15.5 ± 15.16, experience: 25.65 ± 17.79 years, age: 45 ± 16.45 years, rounds per month: 5 ± 3.88, practice sessions per month: 5 ± 4.64).

The best and the worst performing putter were checked for accordance with the rating results of the best and worst rated putter and vice versa. This step was done for the Q1, Q2 and overall rating.

Beyond that, the resulting successful matches were set into relation to the handicap and the playing experience of those subjects in order to get an idea of the relationship between the handicap/playing experience of the subject and a successful identification of a putter. Therefore the arithmetical mean and standard deviation were calculated.

3. Results

The data analysis revealed that the subjects had more success in identifying the worst performing putter than the best performing one (Table 1). Furthermore it can be seen that mismatches for the polar opposite (best rated, worst performance and vice versa) are more strongly represented in the pre rating. The highest number of successful matches were achieved in the post rating. Moreover, it is noticeable that the number of successful matches is twice as high in both cases (worst rated, worst performance and best rated and best performance) as in the pre rating (Figure 3a, Figure 3b). The overall rating shows a slight decrease in successful matches concerning the worst performance and worst rating. However, the overall rating reveals a noticeable reduction in successful matches of best performing and best rated putter.

Although all test subjects were able to rate a putter in all three rating steps outright as the best or the worst, only a small number of the test subjects were able to rate the same putter best or worst through all three rating steps. In addition, only one, out of all 51 relevant test subjects, was able to accomplish this in both cases (best rating and best performance: 6 players, worst rating and worst performance: 8 players, both: 1 player).

Table 2 shows that the average handicaps of the successful matches of all categories in general does not deviate too much from the average handicap of all test subjects. However, it is noticeable that especially test
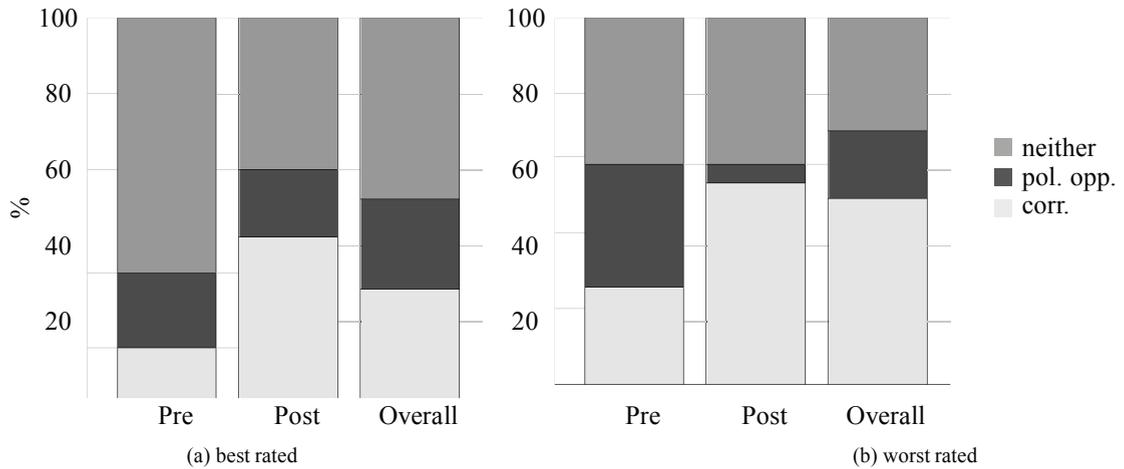
Fig. 3. Matches between individual rating and performance in percent (a): best rated putter performed: best (light gray, corr.: correct match), worst (black, pol. opp.: polar opposite), neither (medium gray); (b) worst rated putter performed: worst (light gray, corr.: correct match), best (black, pol. opp.: polar opposite), neither (medium gray).

Table 2. Player's handicaps (mean ± SD) for the different combinations (r.: rating, p.: performance, pre: before putting (Q1), post: after putting (Q2), overall: Q1 & Q2, category: mean of all conditions (pre, post, overall))

	Best r. and p. correct match	Best r., worst p. polar opposite	Worst r., best p. polar opposite	Worst r. and p. correct match
Pre	−14.4 ± 15.5	−14.9 ± 8.6	−13.5 ± 13.7	−16.7 ± 16.1
Post	−17.1 ± 18.6	−15.6 ± 6.0	−18.0 ± 7.0	−15.5 ± 16.2
Overall	−18.0 ± 20.1	−10.6 ± 5.3	−8.8 ± 5.8	−19.8 ± 19.3
Category	-16.5	-13.7	-13.4	-17.3

subjects with a better handicap tend to produce mismatches of the polar opposite, particularly in the case of the overall rating.

The data evaluation versus the playing experience of the test subjects (Table 3) revealed that successful matches of the best and the worst performing putter are in the same range and display similar standard deviations for all three ratings (pre, post, overall). In the cases, where putters were rated as the polar opposite of their performance (best r., worst p. and vice versa), the average experience has a larger standard deviation. Furthermore, the standard deviations, in the case of best performing putter is rated the worst, are not located within the same range for the three rating cases, while the standard deviations in the case of worst performing putter rated best are within the same range.

Table 3. Player's experience in years (mean ± SD) for the different combinations (r.: rating, p.: performance, pre: before putting (Q1), post: after putting (Q2), overall: Q1 & Q2, category: mean of all conditions (pre, post, overall))

	Best r. and p. correct match	Best r., worst p. polar opposite	Worst r., best p. polar opposite	Worst r. and p. correct match
Pre	24.20 ± 18.27	21.20 ± 13.74	30.00 ± 17.94	21.62 ± 15.88
Post	24.12 ± 17.18	28.80 ± 13.74	22.33 ± 14.84	23.33 ± 16.59
Overall	23.39 ± 17.85	22.00 ± 13.34	33.78 ± 19.02	21.56 ± 16.35
Category	23.9	24.0	28.7	22.2

4. Discussion

The data analysis of the study showed that a golf player should not rely on the plain first impression in the process of buying a putter. The pre rating revealed that only approx. 20% of the subjects were able to successfully rate a putter the best that turned out to be the best performing putter for an individual after all trials. In the case of identifying the worst putter that rate increased to just beyond 25%. It is most notable that in the case of the pre rating the share of subjects that rated the worst performing putter as the best equaled to that of successful matches, and that, in the case of the worst rated putter turned out to be the best performing one exceeded the value of successful matches.

In the case of the post rating the test subjects achieved the highest success in identifying the best putter as well as identifying the worst performing one. Furthermore the post rating produced the smallest number of mismatches of the polar opposite, which was in accordance with the expectations.

The overall rating produced slightly worse results in the case of identifying the worst performing putter, but led to a noticeable deterioration of identifications of the best performing one. This is most likely due to the high number of mismatches within the pre rating. In addition to that, the overall rating again displays an increase in mismatches of the polar opposite, which is most likely due to the same reason.

Furthermore the results reveal that only a very small number of subjects were able to rate a putter best (6) or worst (8) throughout the evaluation. Beyond that only one single subject achieved this in both cases.

The comparison of the successful matches with the handicap of the subjects shows that the average handicap for post, pre and overall approximately corresponds to the average handicap of all relevant test subjects. This leads to the conclusion that there is no difference in correct matches for different skill levels to find the best performing putter through a rating based on the first impression. This also applies to all other matching categories. However, the average handicap of the test subjects was relatively low which suggests that the subjects in general exhibit a lot of golfing experience. This impression is reinforced by the long average period of time (26.65 years) the test subjects play golf. Furthermore, the explicit analysis of the playing experience of the test subjects validates this. Similar to the results for handicap there is no verifiable difference in correct matches for different experience levels, which was not expected.

The results in general suggest that a player cannot successfully find the right putter through the first impression (i.e. pre rating), but the chances of selecting the correct putter increases with a number of test shots. Furthermore, the data analysis revealed that a combination of the pre and post rating does not necessarily increase the number of successful matches or even confirm them.

References

[1] The Royal and Ancient Golf Club of St Andrews (R&A), Playing Golf, online (2014) [cited 18/07/2014].
    URL   http://www.randa.org/en/Playing-Golf.aspx
[2] D. Pelz, Dave Pelz's putting bible: the complete guide to mastering the green, Vol. 2, Random House LLC, 2000.
[3] M. Sim, J.-U. Kim, Differences between experts and novices in kinematics and accuracy of golf putting, Human Movement Science 29 (6) (2010) 932 – 946. doi:http://dx.doi.org/10.1016/j.humov.2010.07.014.
[4] J. Karlsen, G. Smith, J. Nilsson, The stroke has only a minor influence on direction consistency in golf putting among elite players, Journal of Sports Sciences 26 (3) (2008) 243–250. doi:10.1080/02640410701530902.
[5] R. G. Gwyn, C. E. Patch, Comparing two putting styles for putting accuracy, Perceptual and Motor Skills 2 (76) (1993) 387–390.
[6] M. Burger, V. Senner, Correlation between quality of golf drive and impact sensation in dependence of shaft weight and shaft flexibility, Procedia Engineering 72 (0) (2014) 292 – 297, the Engineering of Sport 10. doi:http://dx.doi.org/10.1016/j.proeng.2014.06.052.
[7] H. Böhm, C. Krämer, V. Senner, Subjective evaluation of sport equipment deriving preference values from pairwise comparison matrices (p162), in: The Engineering of Sport 7, Springer Paris, 2008, pp. 127–133. doi:10.1007/978-2-287-99056-4_15.
[8] J. Roberts, R. Jones, N. Mansfield, S. Rothberg, Evaluation of impact sound on the feel of a golf shot, Journal of Sound and Vibration 287 (45) (2005) 651 – 666. doi:http://dx.doi.org/10.1016/j.jsv.2004.11.026.
[9] United States Golf Association, Stimpmeter Instruction Booklet, online (2014) [cited 08/03/2015].
    URL   http://www.usga.org/content/dam/usga/pdf/imported/StimpmeterBookletFINAL.pdf