Experimental Design for the Testing of a New Golf Ball

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As a company who is increasingly focused on amateur golfers, Titleist are interested in understanding the performance of their new ball relative to their existing ball, especially for high handicap players[1]. As such, the following research question was developed: *Does Titleist's new ball design improve spin rates around the green for players who currently play the standard Titleist ball?* Since low handicap players are highly skilled, we hypothesise that the new design would make a more marked improvement in spin rates for high and mid handicap players who are more reliant on technology to aid performance.

Participants

A minimum of two hundred and fity golfers who are players of the current Titleist ball will be recruited via marketing emails from the official Titleist account, meaning they will comprise a relative convenience sample. Demographic data collected about the participants will include their handicap (numeric and grouping), age (integer measured in years), sex (categorical factor with three levels: Male, Female, Other/Intersex), stiffness of golf club shaft (categorical factor with four levels: Seniors, Regular, Stiff, Extra Stiff), grip strength measures with a dynamometer (numeric measures in kilograms), and sit-and-reach flexibility (numeric measures in centimetres). Participants will be required to have hit no other balls on the testing day.

Materials

- 25x current golf ball (5 for warm-up) per player
- 25x new golf ball (5 for warm-up) per player
- 1x 60 degree lob wedge per player
- GC Quad ball tracker with TrackMan software

Procedure

Each participant will hit ten balls that are distributed in a random order (which is the same for all participants), where five are the current Titleist ball and five are the new ball. Following the warm-up, the computer will then randomly dispense forty balls from a single bucket, where twenty are the current Titleist ball and twenty are the new ball. Again, this randomly-determined order will be the same for all participants to avoid any potential equipment biases. All balls will be electronically marked so that the computer software will be able to detect ball type. The response variable *spin rate* will be measured in revolutions-per-minute via a launch monitor which can accurately track spin (and other statistics) for each shot. Testing will occur over the course of one week and even numbers of players from all three handicap groupings will be recruited for each day to counterbalance any methodological effects.

Statistical Analysis

It is proposed that a generalised linear model with a gamma or lognormal link function (due to spin values only being positive) will be fit to the data, with ball type, handicap grouping, a set of control variables (age, sex, shaft stiffness, grip strength, flexibility), and an interaction term between ball type and handicap grouping will be included as predictors. Hypothetically, if the research question is supported, results similar to the simulation with 95% confidence intervals presented in Figure 1 would be expected. Evidently, the relative gain in spin rate for the new ball (after controlling for other variables) is much lower for high handicappers, but is quite substantial for mid and especially low handicappers. More simply, the new ball's technology may help high handicappers to experience performance closer to those with higher skill.

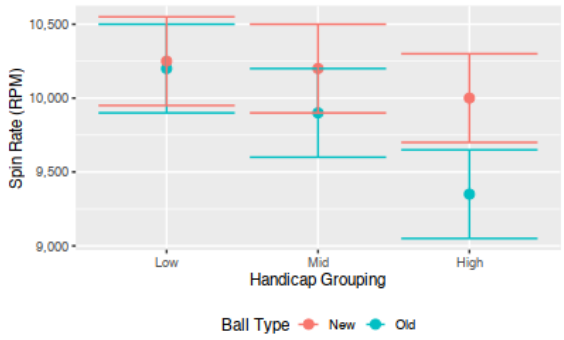

Figure 1: Hypothesised relationship between ball type and handicap grouping

[1]The golf handicap system in Australia ranges from 0 to 36, with tiers for "low handicap" including 0-10, "mid handicap" including 11-20, and "high handicap" including 21 and above.