

# R22-02 Laboratory and player testing with a limited distance golf ball

United States Golf Association, R&A Rules, Ltd.

December 2021

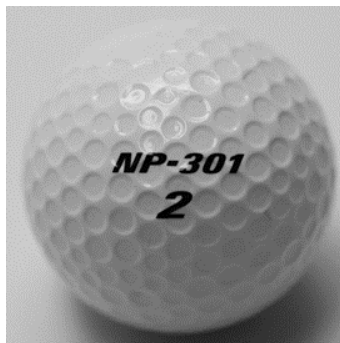
## 1 Abstract

Reduced distance golf balls were tested in the laboratory and on course, with professional and recreational golfers. The performance of these golf balls and the perceptions of the golfers studied were of primary interest.

For the balls studied, it was found that laboratory and testing with golfers agreed, but that the degree of distance change was reduced for shorter clubs (i.e., irons). Playing rounds with the ball, nearly all professional golfers identified that the distance was shorter or much shorter, while recreational golfer responses were mixed. The plurality of male professional and recreational golfers would agree to use a ball of similar performance if other players had to as well. Among all player groups (professional and recreational, female and male), a substantive percentage of participants, including a majority of female professional golfers, would not play with a ball like this in the future, even if everyone had to play with a ball having similar performance.

## 2 Golf ball description

The NP-301 is a solid-core golf ball manufactured in response to a public request from the USGA and R&A Rules, Ltd. for an experimental reduced-distance golf ball. The ball design was based on the construction of an existing, higher-spin consumer model, modified with an increased drag dimple pattern resulting in shorter distance (Figure 1).



*Figure 1: NP-301 reduced distance golf ball having higher-drag aerodynamics.*

## 3 Laboratory and test range results

Initial testing under laboratory conditions showed that the distance under the Overall Distance Standard at a swing speed of 120 MPH was 286 yards, 23 - 30 yards shorter than the most popular contemporary balls used on the professional tours (8.5% on average). This distance loss is not uniform: for example, where a golfer or setup with a 310-yard drive might lose about 8.5%, one with a 220-yard drive would experience about 7% reduction.

Spin for this ball was higher than typical balls used in elite level competition (3,400 RPM vs 2,500-2,700 RPM) under test conditions as detailed in the Overall Distance Standard. However, this was not responsible for its reduced distance: this ball had lower sensitivity to high spin compared to leading, contemporary ball types, with a less than three-yard difference in total distance over the range 2,200-3,600 RPM, as shown in Figure 2.

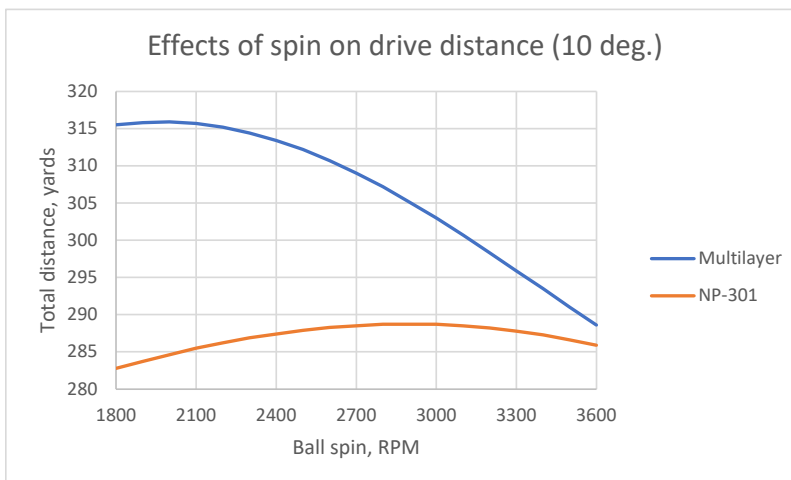


Figure 2: The sensitivity of distance to spin for the NP-301 reduced distance golf ball at constant speed and angle.

Instrumented range testing using a mechanical golfer was conducted at conditions approximating those of average PGA TOUR players to directly compare distance to other ball types. Measured carry distance results are shown in Figure 3, noting that by the time of this test, the wound golf balls in the comparison were approximately 11 years old at the time of testing.

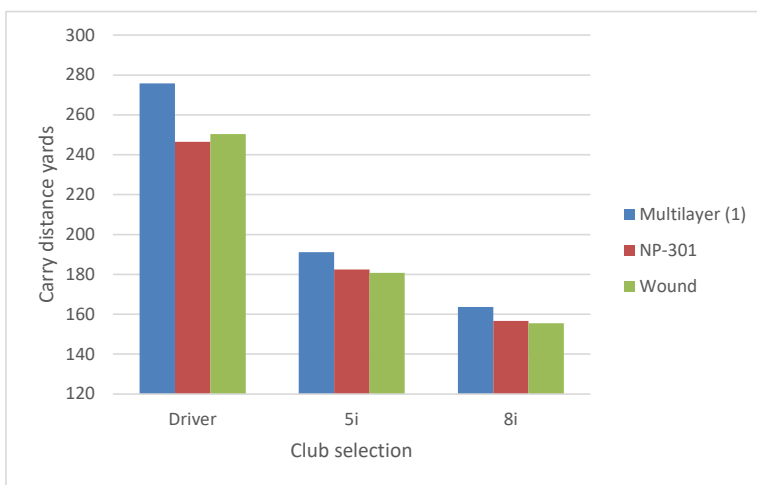


Figure 3: Results of testing using a mechanical golfer set to nominal PGA TOUR launch conditions for each club type (2011).

We note that for shorter irons, the carry distance differences between the balls is much smaller than with the driver.

In further experiments, the driver was additionally set up with a 5° open face presentation to induce a slice trajectory. The resulting off-line dispersion of the NP-301 was similar to other ball

types in the comparison (Figure 4) with the inclusion of a comparatively low spin modern multilayer ball(Multilayer (2)).

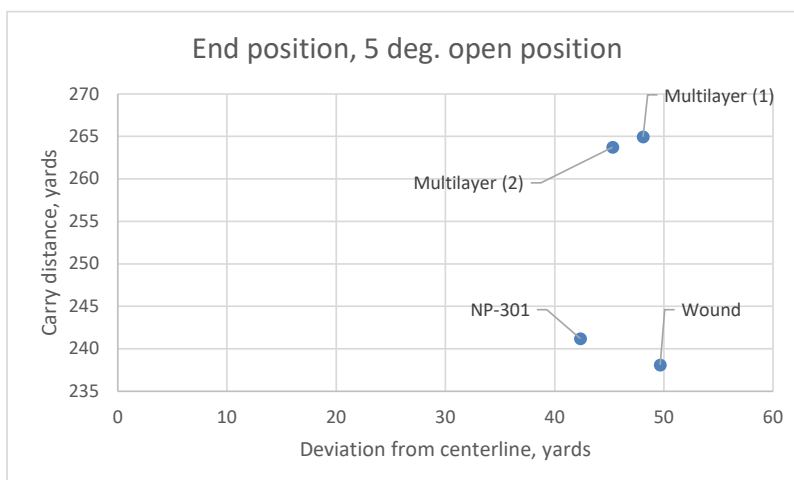


Figure 4: Effects of intentional slice trajectories using a robot golfer and a 5° open 360cc driver.

## 4 Player test descriptions

The NP-301 golf ball was used by over 100 elite professional golfers at four test events, two with male professional golfers (from the Canadian Tour and European Challenge Tour) and two with female professional golfers (from the Ladies European Tour and the Symetra/ Futures Tour). For all tests, the participants provided feedback of their experiences of using the NP-301 ball. In addition, distance and club use data was collected at some of these events. The survey results are presented alongside the equivalent data for recreational participants, Section 5.

### 4.1 Male professional golfers – Canadian Tour

Twenty-four professional golfers on the Canadian Tour were monitored playing the first two rounds of the 2010 Jane Rogers Clublink Championship at Greystone Golf Club in Ontario, Canada. Carry distances were monitored on three holes (1, 10, and 18) using a TrackMan RADAR system. Participants filled out club selection cards indicating which clubs were used off the tee and for approach shots during their rounds. On the Monday following the completion of the Canadian Tour event, these same players competed for a small purse using the NP-301 golf ball on the same course using the same hole and tee locations that were used in the final round.

Drive distances were shorter when using the NP-301 compared to using participants' own balls. Participants carried the NP-301 21 yards shorter than their own ball on the measured holes (Figure 5).

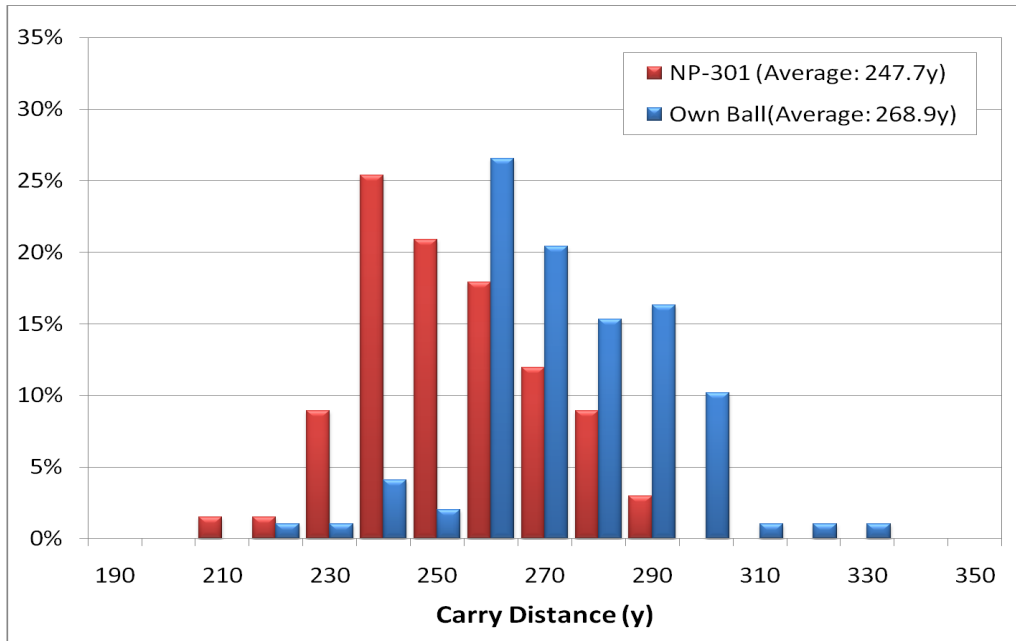


Figure 5: Measured carry distance change.

Driver selection increased significantly between the own ball (normal) rounds and the reduced-distance round with overall driver usage increasing from 50% to 80%, Table 1.

Table 1: Driver selection on measured holes for Round 1 and Round 2 (using own ball) and the round using the reduced distance NP-301.

Hole	Length (y)	Rd 1 (%)	Rd 2 (%)	Reduced-Dist (%)
1	488	100	100	100
2	213	-	-	-
3	435	91	96	100
4	541	100	100	100
5	430	4	4	78
6	186	-	-	-
7	436	0	0	13
8	363	17	4	74
9	404	39	26	96
10	536	96	96	100
11	189	-	-	-
12	405	4	4	43
13	409	48	26	74
14	150	-	-	-
15	301	22	17	74
16	405	48	39	78
17	417	65	70	96
18	529	96	100	100
<b>Average</b>		<b>52</b>	<b>49</b>	<b>80</b>

Club use on approach shots was also monitored: during the Canadian Tour event, use of six irons and longer represented 17.8% of approach shots. However, with the NP-301, that percentage increased to 37.1%.

## 4.2 Male professional golfers – European Challenge Tour

Twenty-five professional golfers on the European Challenge Tour participated in a tournament using the NP-301 golf ball ahead of the 2012 Scottish Hydro Challenge at the Spey Valley course in Aviemore, Scotland. Participants received a nominal fee to participate and there was a modest prize fund for the tournament. The tournament was played over holes 1-8 twice with the players using their own ball during the first 8 holes and the NP-301 for the second time of playing to facilitate a direct comparison between ball types. Hitting distances were not measured as a part of this trial.

Table 2: Hole lengths for the course used for the competition.

Hole	Par	Length (y)
1	4	363
2	4	377
3	4	468
4	3	168
5	5	513
6	3	205
7	4	432
8	4	396
<b>Total</b>	<b>31</b>	

## 4.3 Female professional golfers – Ladies European Tour

Thirty-three professional golfers from the Ladies European Tour competed in an eighteen-hole competition at Archerfield Links, prior to the commencement of the 2012 Ladies Scottish Open. The event was played twice over holes 10 to 18 of the Fidra Links using the NP-301 ball. They were first played from the tees to be used at the tournament and then replayed using forward tees (where possible, Table 3). Hitting distances were not measured as a part of this trial.

Table 3: Course length change between normal rounds and reduced-distance round.

Hole	Tournament	Reduced Distance
10	433	394
11	495	460
12	363	345
13	152	142
14	350	350
15	364	334
16	352	351
17	189	168
18	518	486
<b>Total</b>	<b>3216</b>	<b>3030</b>

A high percentage of drivers were in use for tee shots during both for the normal competition rounds and the reduced distance rounds. The main difference of note was on hole 15 which saw an increase in the percentage driver usage when switching to use the NP-301 but this subsequently reduced to levels similar to that seen in the tournament when the course had been shortened to accommodate the reduced-distance golf ball.

Table 4: Driver use on all holes of the LET event.

Hole	Tourn tees, own ball (%)	Tourn Tees NP301 (%)	Short Tees NP301 (%)
10	100	100	100
11	96.7	100	100
12	93.3	100	100
13	-		
14	73.3	87.9	87.9
15	26.7	66.7	30.3
16	96.7	97	100
17	-		
18	100.0	97	100

There were significantly more approach shots hit using fairway woods when using the NP-301 as well as an increase in the number of wedges used, Figure 8. This is understood to have been influenced by the weather conditions on the day of the test (high wind speeds).



Figure 6: Approach shot club selection, LET event.

#### 4.4 Female professional golfers – Futures Tour

Twenty-one professional golfers on the LPGA’s Futures Tour were monitored playing the first two rounds of the 2012 Credit Union Challenge at Capital Hills in Albany, NY using similar methodology as the Canadian Tour event.

On the Monday following the completion of the Futures Tour event, the same participants competed on the same course for a purse using the NP-301 golf ball. The course was shortened for the NP-301 round, as shown in Table 5.

Table 5: Hole length change between championship and reduced-distance round. \*Average play length of two rounds.

Hole	Tourn.	NP-301
1	513	501
2	335	320
3	388	354
4	175	166
5	283	261
6	375	348
7	153	141
8	475	456
9	358	348
10	551	516
11	344	341
12	546	489
13	162	155
14	398*	324
15	392	383
16	130	121
17	372	342
18	174	158
<b>Total</b>	6124	5724

Drives were monitored on four holes (3, 8, 10 and 15) using TrackMan Doppler RADAR system, supplemented by laser rangefinder measurements, and participants completed out club selection cards indicating which clubs they used off the tee and for approach shots during their rounds.

Carry distance reductions of 21 yards were experienced on average. Using laser range finders, it was found that *overall* distances were reduced by 29 yards on average (from 245 yards to 216 yards). These differences were greater than expectations given robot testing and may stem from different environmental conditions during the test.

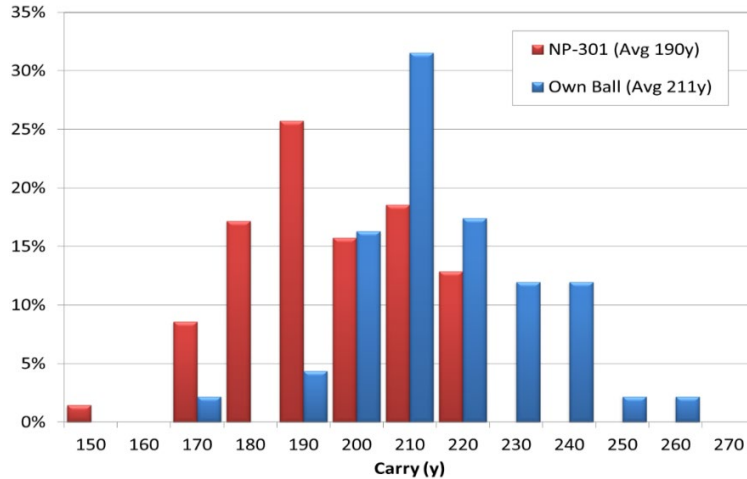


Figure 7: Carry distance for Futures participants using their own balls and the reduced-distance NP-301.

For tee shots, a high percentage of drivers were in use both for the normal competition rounds and the reduced distance (Table 6) rounds with no clear difference between them, again noting that the course had been shortened to accommodate the reduced-distance golf ball.

Table 6: Driver use on all holes of the Symetra/Futures event.

Hole	Round 1 (%)	Round 2 (%)	NP-301
1	95	95	95
2	95	95	95
3	91	91	91
4	-	-	-
5	24	24	19
6	86	86	76
7	-	-	-
8	91	91	91
9	91	91	95
10	95	95	95
11	81	91	91
12	95	95	81
13	-	-	-
14	91	86	86
15	95	95	91
16	-	-	-
17	67	52	67
18	-	-	-
<b>Average</b>	<b>84</b>	<b>84</b>	<b>82</b>

As shown in Figure 8, there were fewer approach shots with wedges, and a greater number of long clubs, especially fairway woods and hybrids, used with the reduced-distance NP-301 (despite shortening the course).



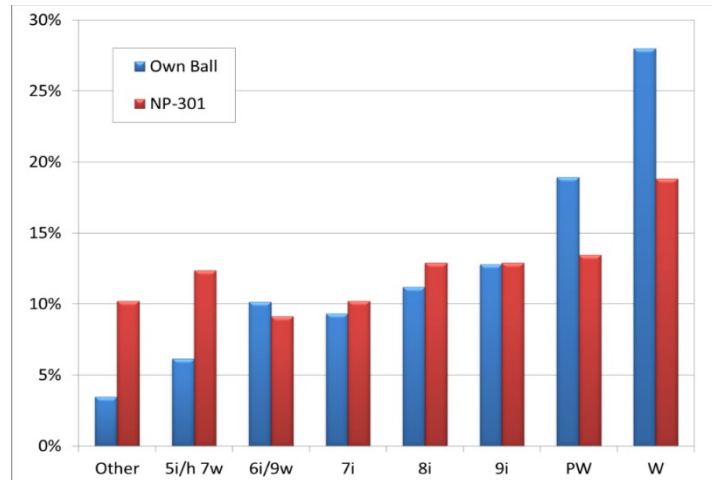


Figure 8: Approach shot club selection, Symetra/Futures event.

#### 4.5 Recreational golfers

Recreational player surveys were conducted after rounds played by nearly 1,000 participants using the NP-301 ball at golf courses in six countries. Most tests were conducted at pre-arranged reduced-distance events. However, at many of the venues staged in the United States, golfers were approached at the first tee and asked to participate by playing with the reduced distance golf ball.

Table 7: Locations and participants in recreational golfer reduced distance ball evaluation. \*Participants were approached at the course for most events in the USA, all other events were pre-arranged.

Location	n
France	36
Hong Kong	48
Japan (multiple courses)	233
Sweden (multiple courses)	95
UK (multiple courses)	263
USA (pre-arranged tournament)	55
USA* (multiple courses)	247
<b>Total</b>	<b>977</b>

Table 8: Recreational participant demographic information. Additional demographic information in Appendix C.

<b>Male/Female</b>	750/197 (30 unreported)
<b>Average Age</b>	56
<b>Median Handicap Category</b>	10-14

## 5 Survey Results

Post-round survey data was acquired from participants of all groups who participated in the research study. The survey questions asked were mainly Likert scale (1-5) questions. Participants were asked to evaluate the round that they played: was it enjoyable, how well did they play, etc. The most pertinent questions for this paper related to perceptions of the ball itself, and whether participants would be receptive to playing with a ball of similar performance again.

Overall, female and male professionals mostly recognized that the ball was shorter or much shorter, 1 or 2 on a 1–5-point scale (responses to other post-round survey questions can be found in Appendix B). However, perceptions were more mixed among recreational golfers, with 74% of male and 48% of female respondents identifying the ball as being shorter, Figure 9 (responses to other post-round survey questions in Appendix D).

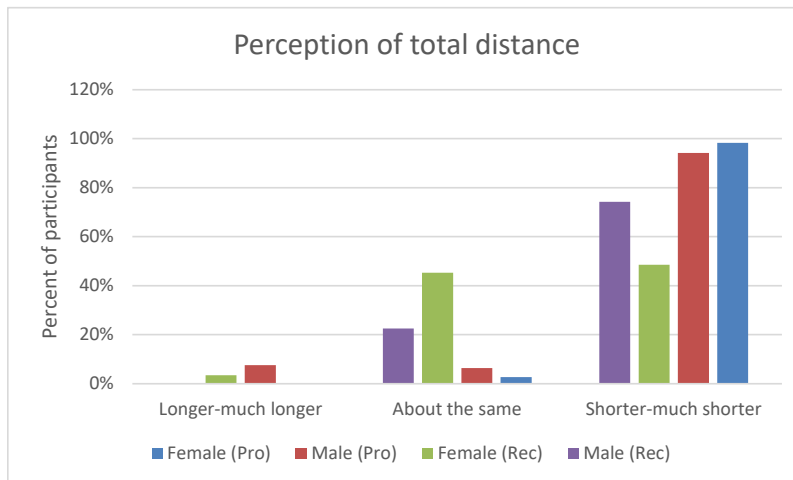


Figure 9: Participant perceptions of distance compared to their own ball.

### 5.1.1 Would participants use this ball again?

Participants were asked about their receptivity to playing with the same ball in the future, as well as whether they would play with such a ball provided that the people they were playing with (or against) used a ball with a similar level of performance. Responses to these questions are shown in Figure 10 and Figure 11.

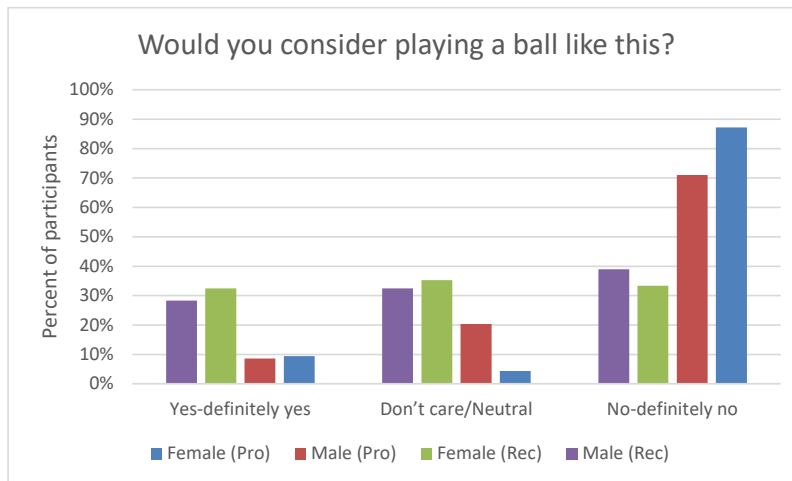


Figure 10: Participant responses to post-round survey. It may be noted that responses by recreational participants were nearly evenly split between 'No'/'Definitely No' or 'Yes'/'Definitely Yes', as will be discussed in the next section.

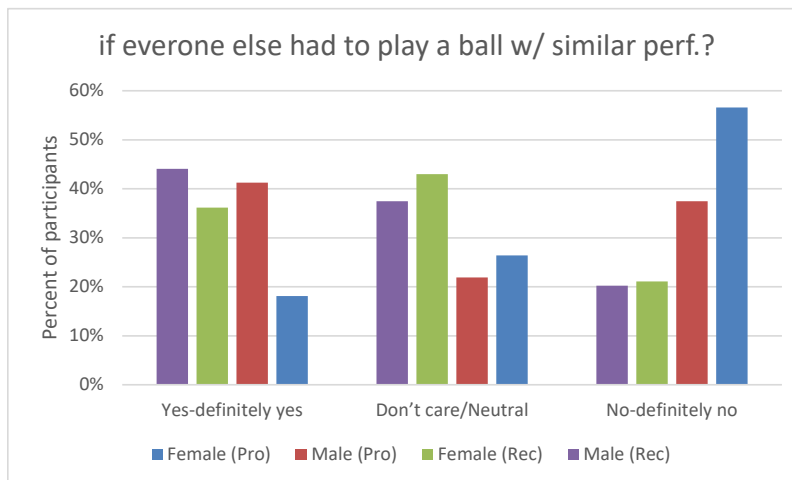


Figure 11: Participant responses to post-round survey. Female professional golfers were the least receptive to using a ball like this, even if other participants had to use balls with similar performance.

Professional golfers (male and female) responded negatively overall when the question was asked without the provision of everyone else playing with the same ball, more than 70% male and 85% female professionals responding 'no' or 'definitely no' on the 1-5-point scale. Recreational golfers (both male and female) were more evenly split across the categories, with the majority responding negatively but a significant proportion responding positively to the question. When the provision of everyone else having to play with a similar ball was added, over 40% of male professionals answered 'yes' or 'definitely yes'. However, the majority of female

professional golfers still responded negatively, indicating that they would still not play with this type of ball.

### 5.1.2 Understanding responses for recreational golfers

As noted, recreational golfers were split on the question of whether they would or would not play a ball like this again, even without the provision that everyone else would be required to play with a ball of similar performance.

With the provision that other golfers would be required to use a ball with similar performance, participants surveyed who were in favour of playing with the reduced-distance ball were in the minority; only twenty percent answered “no” or “definitely no”. This appears to indicate a higher overall level of acceptance by recreational golfers as compared to male professional golfers or, particularly, professional female golfers.

The large number of participants surveyed allows for some analysis of this outcome. There is an opportunity to identify whether players’ perception of distance change influenced their receptivity to the reduced-distance ball.

As shown in Figure 12, responses to a question regarding the distance that the reduced-distance ball went as compared to participants’ own balls varied widely. Though a majority of male recreational golfers identified that distances were shorter or much shorter than the balls that they normally play, 4% indicated that the ball traveled farther, and 22% chose a neutral response. Forty-eight percent of female recreational golfers identified that the ball was shorter, with 45% answering no change and 6% selecting longer or much longer. In contrast, the majority of female and male professional golfers responded that the ball was shorter or much shorter, with no professional golfers identifying it as longer than their usual ball.

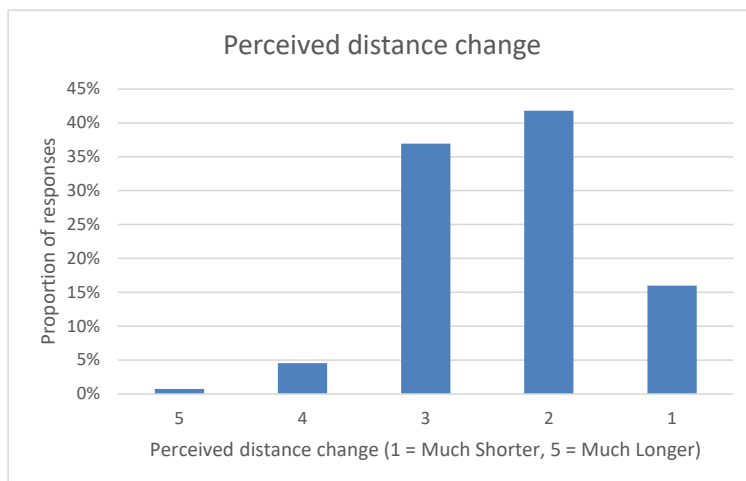


Figure 12: Recreational participant perception of distance change using the NP-301 reduced distance ball.

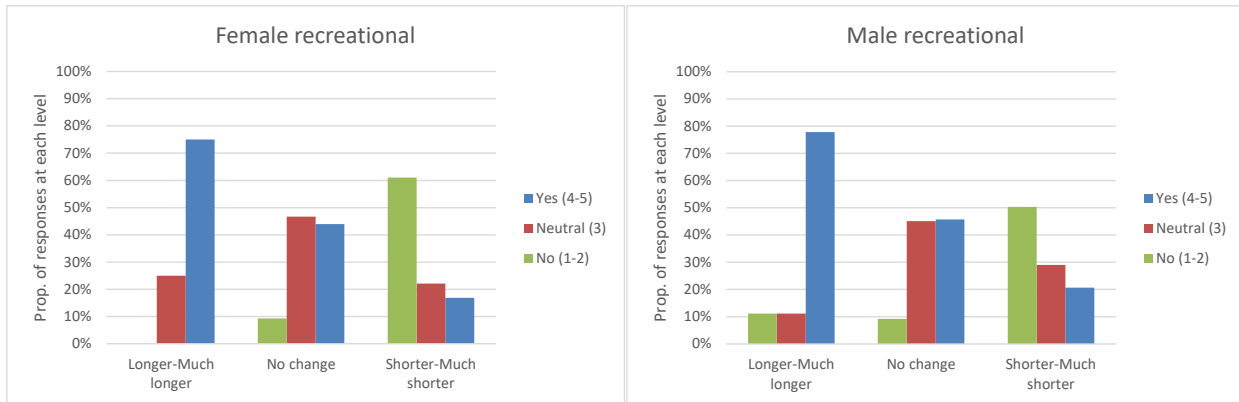


Figure 13: Receptivity to playing the ball again, segmented by perceived distance change. There were differences in receptivity based on perceived distance change.

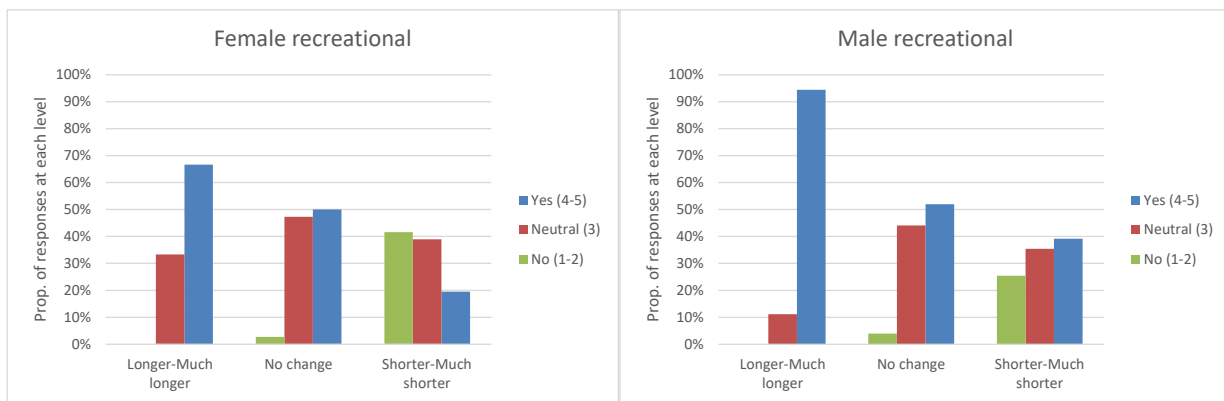


Figure 14: Receptivity to playing the ball again if everyone else had to, segmented by perceived distance change.

The responses according to perceived distance change are shown in Figure 13 and Figure 14. Most golfers who perceived no change to distance (or thought that the ball was longer) were agreed to using a ball like this if everyone else had to.

Twenty-five percent of male recreational golfers and 42% of female recreational golfers who perceived a distance loss would not choose to play with a ball with this level of performance, even if everyone else had to. This contrasts to 39% male and 19% female who replied ‘yes’ or ‘definitely yes’ under the same circumstances.

## 6 Conclusions

Female and male professional participants experienced a significant and perceptible change in total distance. In playing rounds with the NP-301, all professional golfers identified that the distance was shorter or much shorter, while recreational golfer responses were mixed.

Male professional and recreational golfers were more likely to agree to use a ball like the NP-301 (if others players were using a ball of similar performance) than professional female golfers. Among all golfer groups (professional and recreational, female and male), a substantial percentage of golfers, including a majority of female professional golfers, would not play with a ball like this in the future, even if everyone had to play with a ball having similar performance.

## 7 Appendix A: Comparative shot locations for professional golfers



Figure 15: Male professional golfer test: hole 3 tee and approach shot locations (PGA TOUR Canada Round 1 – Green, Round 2 – Blue, Reduced Distance Ball – Red)



Figure 16: Female professional golfer test: Hole 14 tee shot locations (Symetra Futures Tour (Hole length 398 yards) Round 1 – Green, Round 2 – Blue, Reduced Distance Ball (Hole length 324 yards) – Red).



*Figure 17: Female professional golfer test: Hole 15 tee shot locations (Symetra Futures Tour (Hole length 392 yards)  
Round 1 – Green, Round 2 – Blue, Reduced Distance Ball (Hole length 383 yards) – Red)*

## 8 Appendix B: Professional golfer survey responses

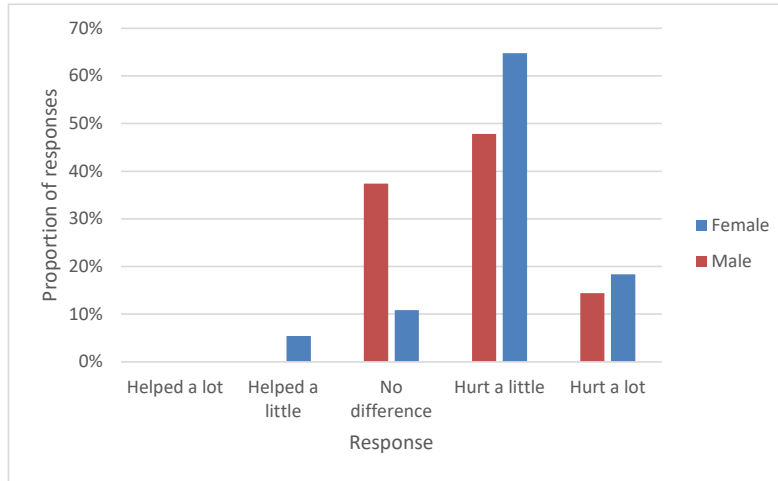


Figure 18: Response to the question “Did the reduced distance ball help or hurt your game?”

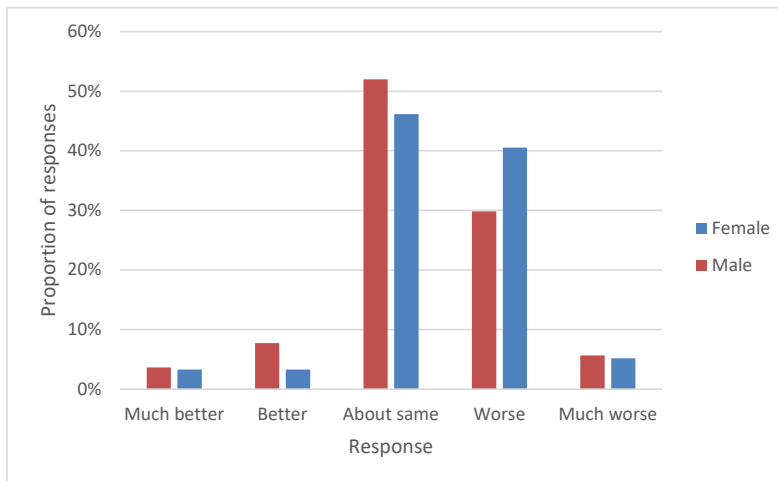


Figure 19: Response to the question “Overall, how did you play compared to your normal round?”

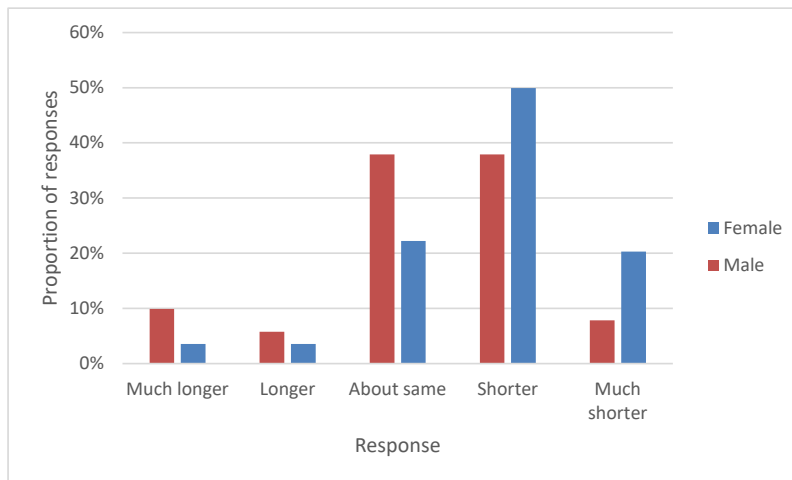


Figure 20: Evaluation of approach shot comparisons between NP-301 and own ball



## 9 Appendix C: Demographic information for recreational golfers

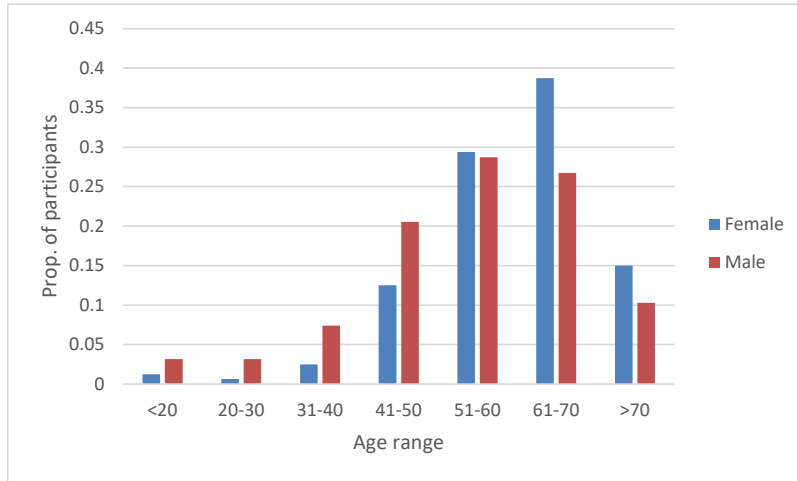


Figure 21: Age range of recreational participants.

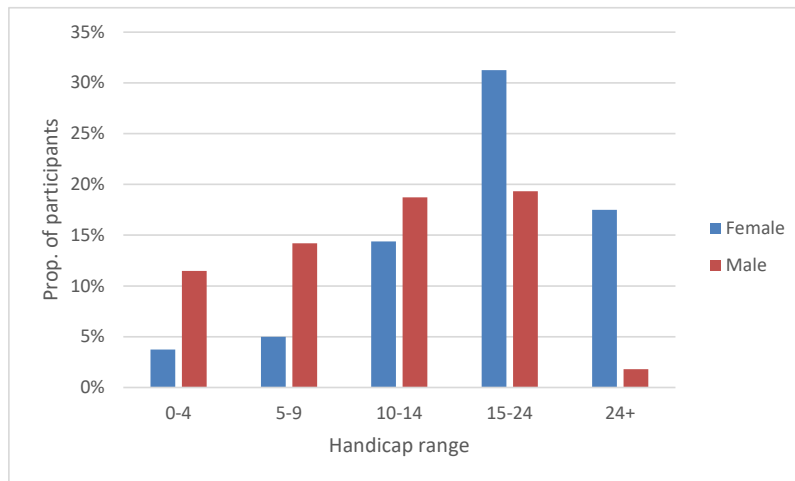


Figure 22: Handicap range of recreational participants.

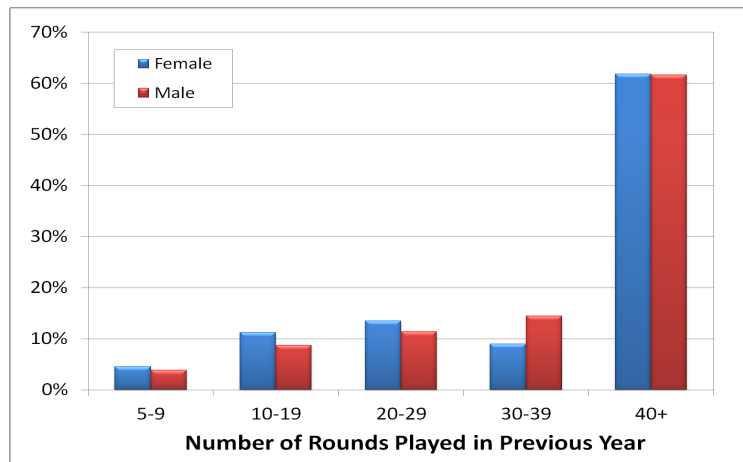


Figure 23: Number of rounds played by recreational participants. (US only)

# 10 Appendix D: Additional survey responses, recreational golfers

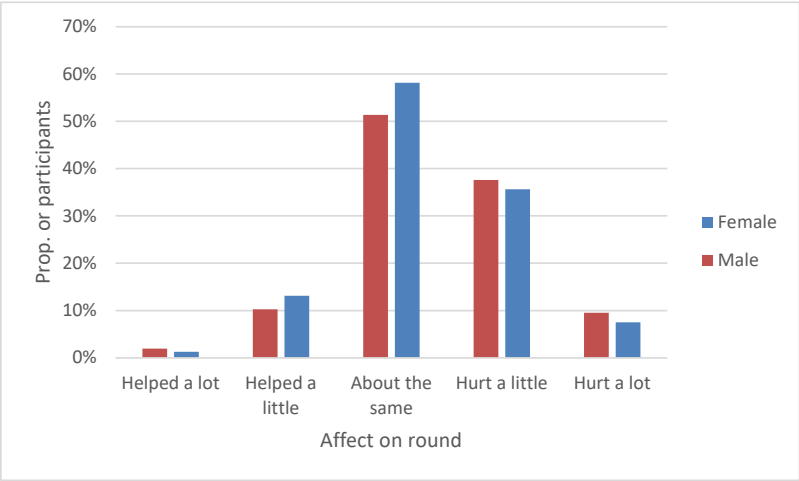


Figure 24: Response to the question “Did the reduced distance ball help or hurt your game?”, recreational golfers

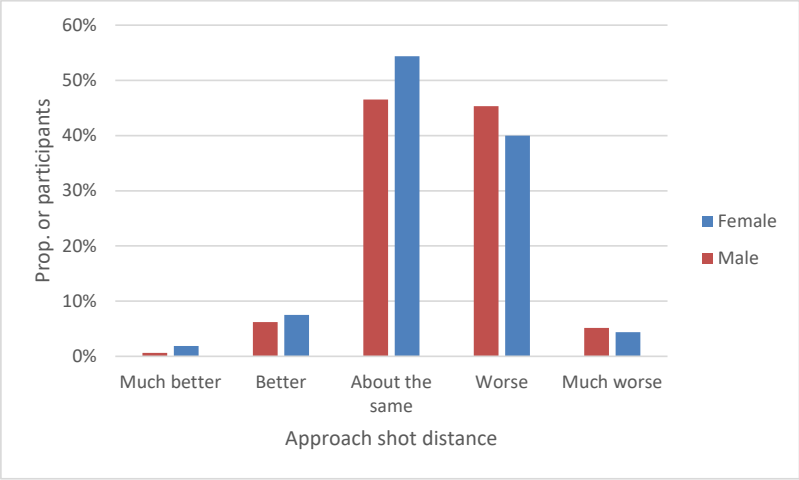


Figure 25: Evaluation of approach shot comparisons between NP-301 and own ball