

# Comparison of historic (1964-1966) tournament performance data with its modern equivalent

## 1. Executive summary

The Golfing Society of Great Britain's Scientific Working Group (GSGB SWG) conducted a large amount of scientific research around the golf swing in the 1960's, which was eventually summarised in the seminal book on golf science: 'The search for the perfect swing' (Cochrane and Stobbs, 1968). Included in this research was a detailed analysis of tournament performance in four competitions, some of the most detailed analysis of the time. This paper compared modern tournament performance to the performances recorded by the GSGB SWG. However, it should be noted that the four competition analyses were of varying detail; the first of these analyses, of professional golfers at the 1964 Dunlop Masters tournament, was the most in depth and most overall conclusions are based primarily on this study. Data from the other studies is included to provide an indication of the likely spread of data in that time period.

The most striking performance difference was in driving, with modern professionals showing an increase in average driving distance of approximately 30 yards with only a 6% drop off in driving accuracy. Performance by modern professionals was also slightly better for par 3 tee shots, with a greater fraction reaching the green, and approach shots, with generally fewer strokes required to hole out from most distances. Overall, this suggests that the distance hit by modern professionals is greater than that of their 1960's counterparts, but performance did not differ greatly in short approach shots or putting. These trends were reflected in overall analyses, with the GSGB SWG calculating the relative importance of the various facets of the game in a manner which can be compared with modern 'shots gained' analyses. In this regard, the analyses suggest that the greatest difference in performance is in putting, which was calculated as being relatively more important in historical analyses. Both analyses emphasised the importance of long approach shots for performance, but modern analyses suggest that driving performance is relatively more important than suggested by the historical analysis. Modern amateurs performed generally worse in all aspects of the game when compared to both modern professionals and the golfers studied in the 1960's but there was greater variability in the modern amateur data, suggesting that skill level was more varied in this dataset.

It is important to note the context of these analyses, which compare the results of a four tournament analyses conducted in the 1960's to 16 years of modern professional performance and 5 years of modern amateur performances. The most complete analysis, that of the Dunlop Masters Tournament in 1964, could be representative of general professional performance in the 1960's, but may be an example of above or below average performance for the era. The true differences in performance between modern golfers and golfers in the 1960's might be smaller or greater than those indicated in the report as a result.

# Contents

- 1. Executive summary ..... 1
- 2. Introduction ..... 3
- 3. Data collection ..... 3
- 4. Results and discussion ..... 5
  - 4.1 Putting..... 5
  - 4.2 Approach..... 8
  - 4.3 Driving..... 12
  - 4.4 Relative importance of different facets of performance..... 14
- 5. Conclusion and limitations..... 15
- 6. References ..... 15
- Appendix A - Data ..... 16
  - Data storage..... 16
  - Raw data Data tables ..... 16
    - Putting..... 16
    - Approach..... 19
    - Driving..... 20
    - Estimated distance by club used..... 21
- Appendix B - List of Figures..... 22
- Appendix C - List of Tables ..... 22

## 2. Introduction

Understanding how golfers arrive at a final score is an important part of understanding what separates the best performing golfers from their higher scoring counterparts. This was identified by the GSGB SWG in the 1960's, who completed several investigations into on course performance. Tournament scoring analyses are abundant in the modern era, with detailed statistics of golfing performance widely available, but the work of the GSGB SWG included some of the first analyses of this type. Despite the gap in years, the methods employed by the GSGB SWG were fundamentally like those employed today, making performance comparison relatively straight forward. The aim of this paper is to compare the tournament performance statistics presented by the GSGB SWG to modern day equivalents and to investigate how tournament scoring may have changed since this original work.

## 3. Data collection

Four archived reports were obtained from the GSGB SWG documents, including: 'An analysis of play at the Dunlop Masters Tournament, Royal Birkdale, June 1964' (P102), 'An analysis of putting and approaching at the Schweppes PGA Tournament, Sandwich, 1965' (P107), 'An analysis of play at the Penfold and Swallow Tournament at Little Aston, Sutton Coldfield, May 1966' (P127) and 'An analysis of play at the English Ladies Golf Championship, Hayling Island, May 1966' (P128). The interpretation and analysis of this data in 'The search for the perfect swing' was also examined, but data in the book was taken from these original reports. The first two reports examined the tournament performance of professional male golfers and the latter two reports examined amateur male golfers and female golfers respectively. The reports vary in their depth and in the analyses included, with the most complete analysis undertaken for the Dunlop Masters tournament. The Dunlop Masters tournament was played exclusively with the 1.68 inch 'American standard' golf ball, which is equivalent in diameter to a modern golf ball, but there is no record as to which ball was played for the other historical tournaments studied.

The reports contained results data, but corresponding raw data was not included in the archive, so no further analysis could take place; although in some cases alternative statistics could be calculated or estimated from the values provided. As such, modern data was processed to produce results which could be compared to the results presented in these reports. The analysis completed by the GSGB SWG was mainly descriptive in nature and primarily involved calculating the average of relevant quantities; modern analyses are more sophisticated in this regard.

Modern data was obtained from ShotLink measurements, including performance of male professional golfers on the PGA Tour between 2003 and 2018 and performance of male amateur golfers at the World Amateur Handicap Championships (WAHC) between 2006 and 2010. Amateurs competing at the WAHC have a handicap of between +4 and -39.1, representing a wide range of golfing skill. The mean performance across these time periods was calculated to compare to the historic data and the standard deviation was calculated to give an indication of the range of skill levels.

Historic data was collected using either the position estimates of two observers, aided by detailed hole plans and distance posts hammered at 10-yard intervals around the fairway, or two dial sights,

essentially a telescope with a horizontal angular scale, mounted on either side of the fairway and used to triangulate the ball position. This second method bears much resemblance to method used to collect the modern-day dataset provided by ShotLink. ShotLink uses approximately 350 volunteers per event to score a tournament and the exact starting and finishing location of each shot is recorded using laser rangefinders positioned at known locations to triangulate ball position.

## 4. Results and discussion

### 4.1 Putting

In the case that the golfers required a putt to hole out, professional golfers in the Dunlop Masters tournament in 1964 holed more putts in one shot than golfers at the Schweppes PGA championships in 1965 and the Penn and Swallow tournament in 1966. This was also associated with a slightly lower proportion of shots requiring two or more putts to hole. The performance of modern professional players appears to be better than all historic data, one putt being 7.9% more common than in the Dunlop Masters. The performance of professional golfers in the 1965 Schweppes PGA Championships was closer to the performance of the amateur golfers studied in 1966, than to the professional golfers studied in 1964. Finally, the performance of modern amateur golfers is most like the performance at the Schweppes PGA Championships and at the Penfold and Swallow tournament for greens with one putt, but with less putts made in two and proportionally more needing three or more putts (Table 1). As noted by Cochran et al. (1965), the number of putts per green is not a reliable measure of putting performance, since it can also indicate better performance of approach shots. Modern analyses, such as strokes gained (Broadie 2012), are likely to be superior in this regard.

Table 1. Putts required per green.

Putts per green	Dunlop Masters '64 Professional	Schweppes PGA '65 Professional	Penfold and Swallow '66 Amateur	Shotlink 2003-2018 Professional	Shotlink 2006-10 Amateur
0	0.6 %	0.5 %	0.8 %	-	-
1	31.5 %	25.3 %	23.2 %	39.4 %	25.3 %
2	63.6 %	65.4 %	68.9 %	57.5 %	60.6 %
3+	4.3 %	8.8 %	7.1 %	3.1 %	14.4 %
Average	1.716	1.826	1.823	1.637*	1.887*

\*Average calculated from percentage values, not including shots which were holed without a putt and assuming that no more than 3 putts were taken.

The number of putts holed from a given distance (Figure 1) is reliant on the golfer judging both the strength and direction of the putt. The modern data regarding the fraction of putts holed from a given distance is like the historical data and does not suggest any change in performance in this regard. The data does suggest that professional golfers from both eras made slightly more putts from all distances than their amateur counterparts, although the differences are small. Cochran et al. (1965) modelled the number of expected holed putts based on a normal distribution of direction error and found that the model matched the experimental data until around 4 yards. Above 4 yards, the model over-estimated the number of holed putts, suggesting that the strength of the putt was not a consideration up until 4 yards, but became more important for putts over 4 yards. The similarity of modern data suggests that this remains the case. It should be noted that the historic and modern amateur data fluctuates for longer putts; most likely due to the smaller number of putts of this distance which were observed.

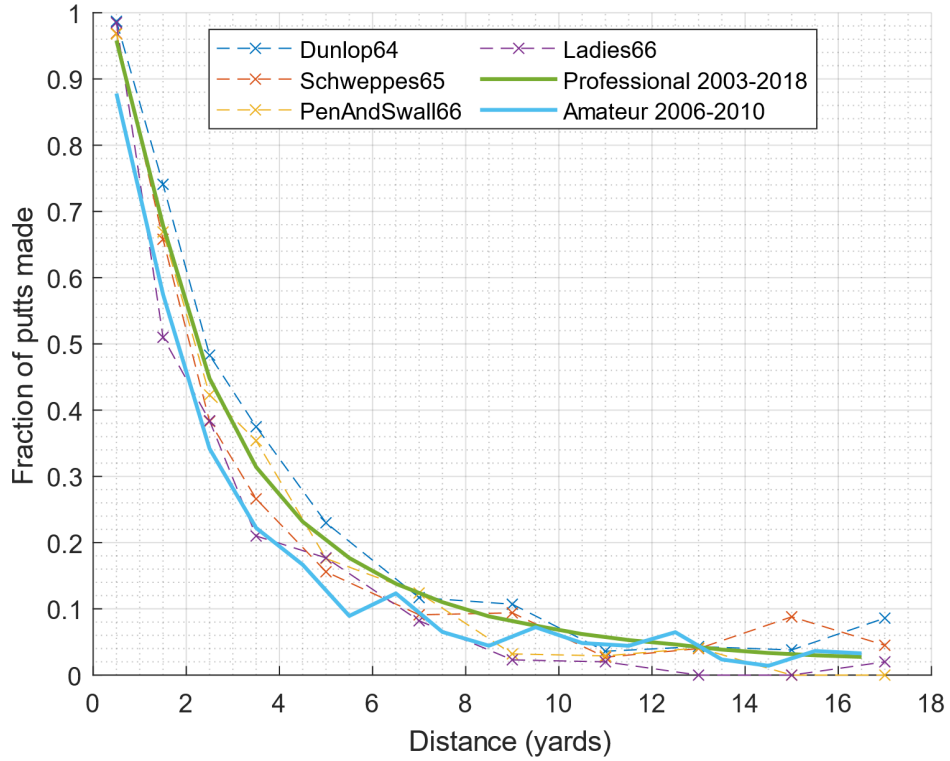


Figure 1. Fraction of putts made for different starting distances from the hole.

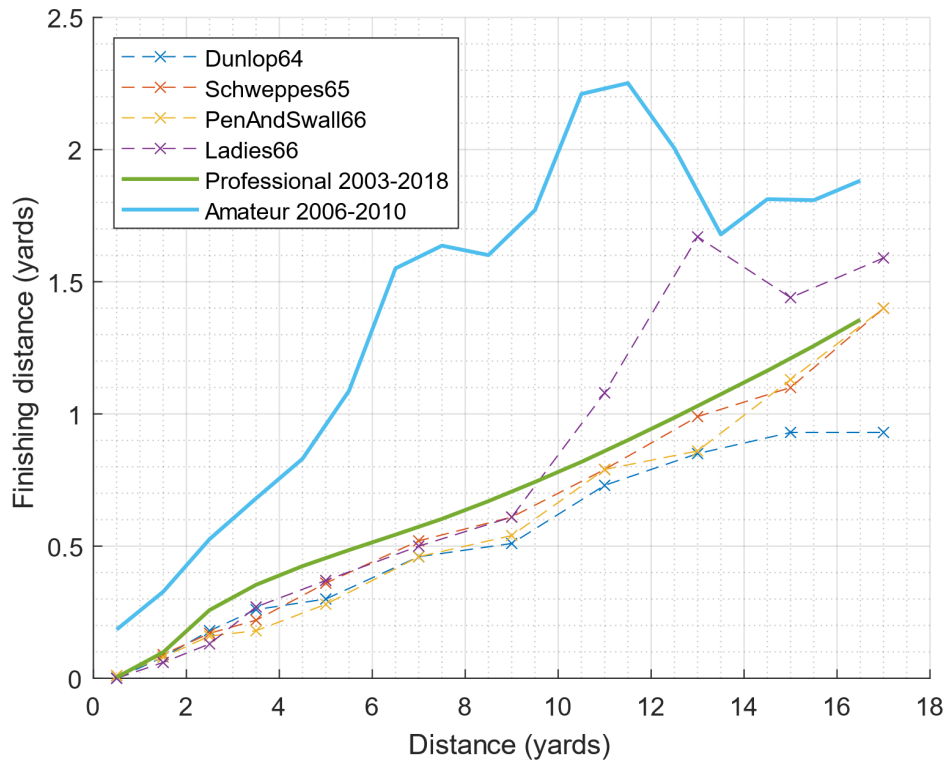


Figure 2. Average finishing distance from the hole for different starting distances. Modern amateur data processed with a moving average filter with a window length of 3.

Compared to the historic data, the average finishing distance for a putt appears to be greater for putts which start more than 2 yards away from the hole in modern players, although the difference is smaller in modern professionals than amateurs (Figure 2). This may reflect putts which finish short, long or have an error in direction and may indicate that modern players are more aggressive in their approach. The differences displayed by the professional golfers are small whereas the greater average finishing distance reflects poorer performance by the modern amateurs in comparison to the golfers studied by Cochrane and colleagues. Data for the modern amateur golfers fluctuated for longer putting distances so a moving average filter with a window length of 3 was used to filter the data presented in Figure 2 to estimate the true performance, assuming that the fluctuations are due to noise from the low number of measurements. This filter has been applied to modern amateur data in several analyses and is indicated in the figure captions, but raw data is included in the appendices in all cases.

When considering the average number of strokes to hole out from a given starting position, the modern professional data appears to closely resemble the data collected at the Dunlop Masters tournament in 1964, with fewer strokes required to hole out for a given starting distance than the professional golfers at the Schweppes PGA tournament in 1965 and the amateur golfers at the Penfold and Swallow tournament in 1966 (Figure 3). In contrast, the modern amateur data suggests worse performance than modern professionals and the historical data especially considering the similar variability of the two groups of golfers; average standard deviations of 0.39 and 0.38 strokes for professional and amateur golfers respectively.

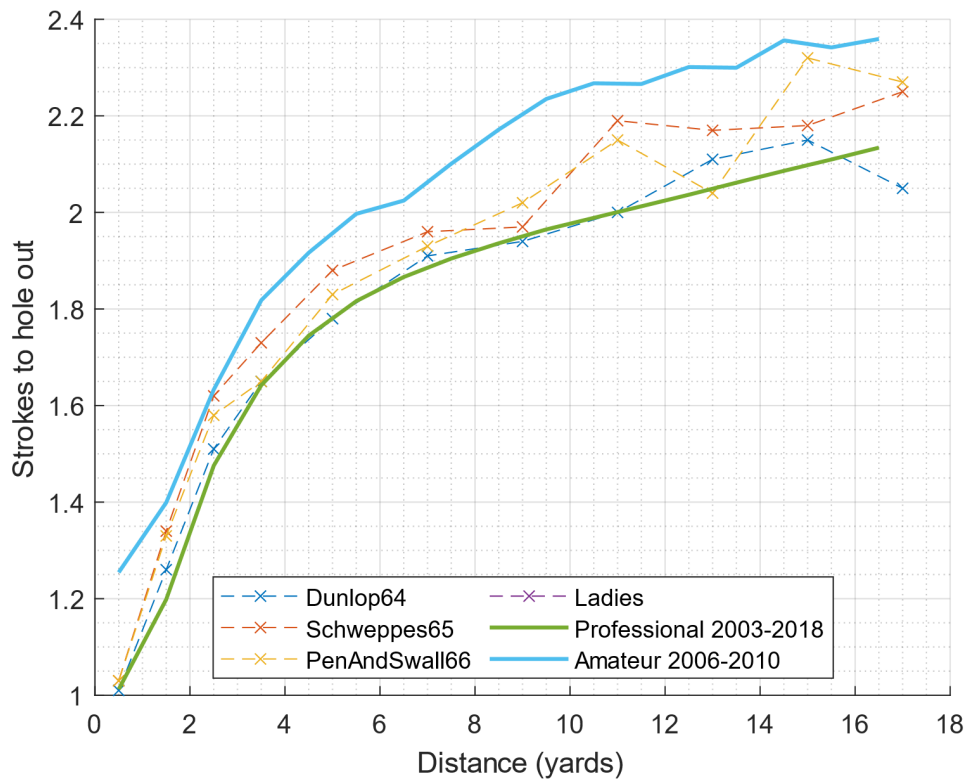


Figure 3. Average number of strokes required to hole out for different starting distances from the hole. Modern amateur data processed with a moving average filter with a window length of 3.

## 4.2 Approach

Approach shots were defined as shots which were after the initial tee shot but prior to the golfer reaching the green. On approach shots with a starting location on the fairway, the median finishing position reported in the Dunlop Masters tournament was 7.5% of the starting distance. Modern professional golfers are similar in this regard, with the average median finishing distance between 2003-2018 being 7.4% of the starting distance. However, included in the Dunlop Masters report was a provision of typical shot lengths with different clubs, which can be compared to modern Trackman data. This comparison suggests that modern professionals hit shots of greater distance with all clubs (Appendix 9.2.4), but this should be interpreted with caution considering data was only available from one historical tournament.

Linear regression of the strokes to hole out ( $y$ ) on the distance to the hole ( $x$ ) for approach shots by modern professional golfers gives:  $y = 0.0044x + 2.32$  ( $r^2 = 0.97$ ); very similar to the regression equation calculated from the results from the Dunlop Masters in 1964:  $y = 0.0044x + 2.35$ . The slope of these two equations indicate that average score increases by 0.44 strokes for each additional 100 yards of approach distance. As the slope of each equation is equal, the intercept indicates that modern professional players display slightly better performance in approach shots from all distances. However, despite the high  $R^2$ , a linear regression may not be an adequate fit to the data at all distances (Figure 4) and analysis is further complicated because the GSWG SWG did not collect data for approach shots from between 70 and 120 yards (Figure 5). The regression model may not adequately reflect approach shots from all distances as a result.

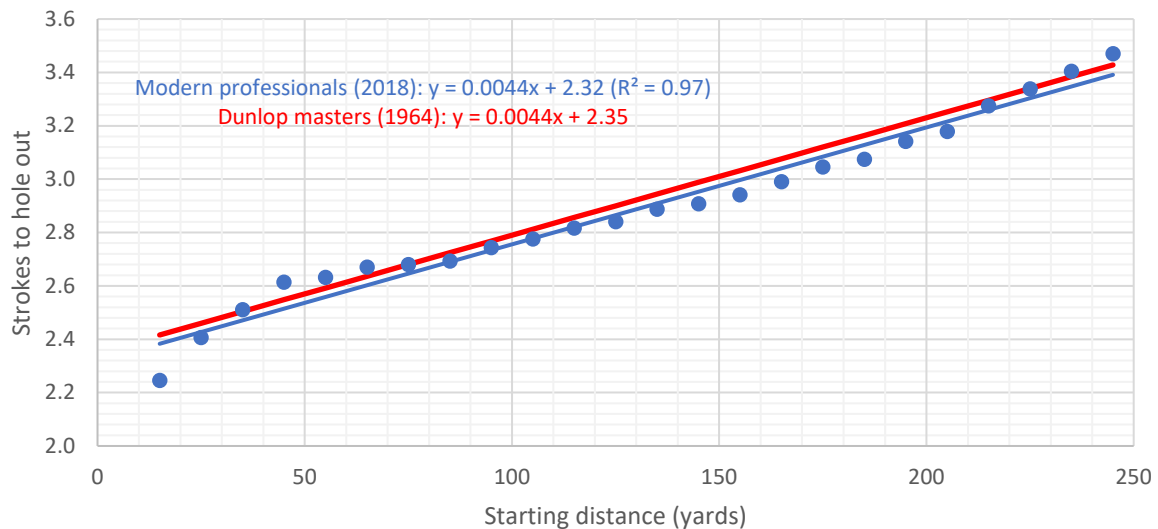


Figure 4. Comparison of regression equations for approach shots from modern and historic data.

Examining the average finishing distance from the hole for different starting distances, for fairway (Figure 5), rough (Figure 6) and bunker shots (Figure 7), suggests that modern professional golfers perform somewhat similarly to the players studied by the GSWG SWG whereas modern amateurs perform worse. For both professional and amateur golfers, there appears to be a relative flattening of the starting distance to finishing distance curve at around 50 - 150 yards. Relatively large decreases in



starting distance in this region result in relatively small decreases in average finishing distance. Again, the modern amateur data showed greater variability than that of the professionals, an average standard deviation of 34.9 yards compared to 12.0 yards for shots on the fairway; reflecting the range of ability in the data.

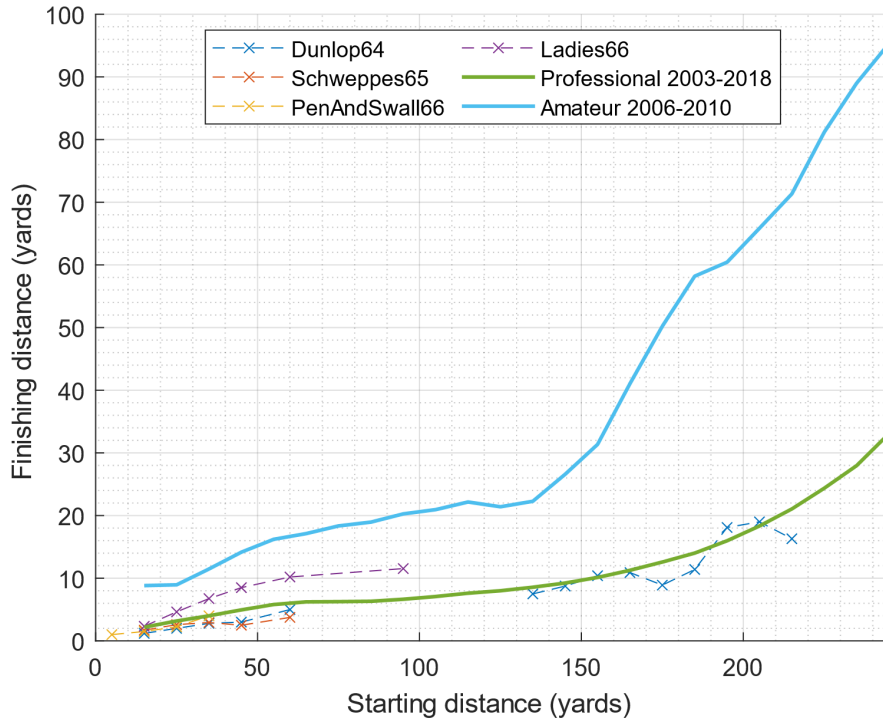


Figure 5. Starting and finishing distance for approach shots from starting positions on the fairway. Modern amateur data processed with a moving average filter with a window length of 3.

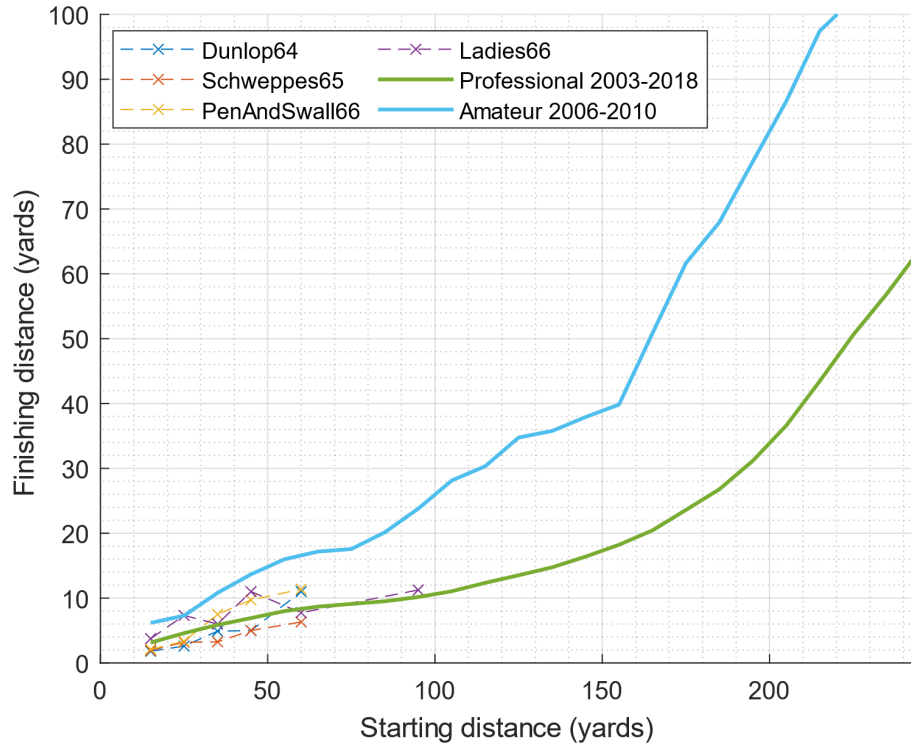


Figure 6. Starting and finishing distance for approach shots from starting positions in the rough. Modern amateur data processed with a moving average filter with a window length of 3.

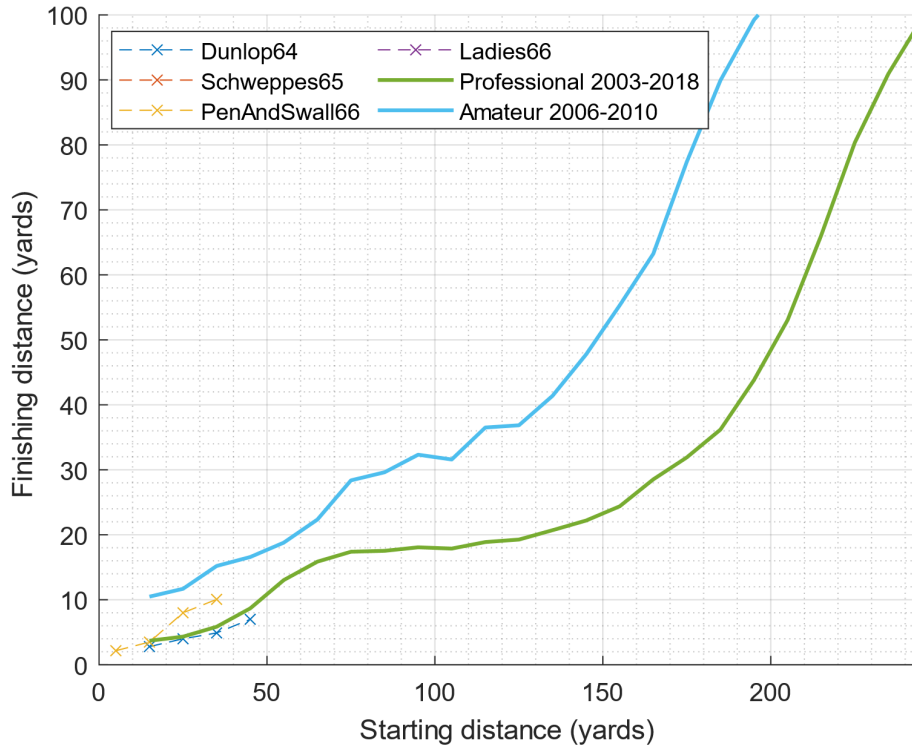


Figure 7. Starting and finishing positions for approach shots starting from positions in a bunker. Modern amateur data processed with a moving average filter with a window length of 3.

In the GSGB SWG reports, shots from the rough or from a bunker were only reported for the Dunlop Masters tournament in 1964 and only for short approaches of between 10 and 50 yards. The professionals studied at the Dunlop Masters were similar in performance of short approach shots from all three lies to modern professionals and both groups were better than modern amateurs (Table 2).

*Table 2. Average number of shots to hole out from different starting positions.*

	Starting distance (yards)	Dunlop Masters '64 Professional	Shotlink 2018 Professional	Shotlink 2006-10 Amateur
Fairway	10-20	2.33	2.25	2.61
	20-30	2.37	2.41	2.80
	30-40	2.52	2.51	2.68
	40-50	2.60	2.61	2.99
Rough	10-20	2.34	2.36	2.67
	20-30	2.51	2.53	2.89
	30-40	2.71	2.64	3.09
	40-50	2.77*	2.69	3.26
Bunker	10-20	2.50	2.47	3.12
	20-30	2.68	2.53	3.31
	30-40	2.68	2.69	3.42
	40-50	2.79*	2.88	3.34

\*Data highlighted in report as potentially unreliable due to low number of measurements

### 4.3 Driving

Modern professionals performed better on par-3 holes than the golfers studied by the GSGB SWG, with a higher percentage of tee shots reaching the green and a shorter average distance to the hole.

However, the modern amateur data suggests that these golfers perform worse on short tee shots than all historic groups except for the English Ladies in 1966 (Table 3).

Table 3. Performance in tee shots on short holes.

	Dunlop Masters '64 Professional	Tee shots at par three holes Schweppes PGA '65 Professional	Penfold and Swallow '66 Amateur	English Ladies '66 Ladies	Shotlink 2003-2018 Professional	Shotlink 2006-10 Amateur
Fraction reaching green	0.577*	0.519*	0.601	0.352	0.667	0.331
Average distance from hole	13.63*	15.82*	12.5	18.5	10.5	34.2

\*Mean of measured par three holes at tournament (Dunlop = 3 holes, Schweppes = 2 holes, Penfold and Swallow = 2 holes and Ladies = 3 holes).

Considering overall driving distance, on long par-4 and par-5 holes, the mean length of modern professional drives is just under 30 yards longer than the golfers studied at the Dunlop Masters championships in 1964. This increase in distance is accompanied by slightly worse driving accuracy; 63% of shots finishing on the fairway compared to 69%. Modern amateur golfers displayed similar accuracy to their modern professional counterparts, but overall driving distance is much lower; driving the ball slightly further than the golfers studied at the English Ladies Championships in 1966, but shorter than all other groups of golfers studied (Table 4). The distribution of driving distances, for shots finishing on the fairway and rough, is roughly normally distributed for the three data sets where a detailed breakdown was possible; the Dunlop Masters tournament, modern professional golfers and modern amateur golfers (Figure 8). The modern amateurs appear to vary in skill than the other two populations, with a greater spread of measured driving distances, but comparable historic data was not available to compare to.

Table 4. Average performance of driver tee shots.

	Dunlop Masters '64 Professional	Schweppes PGA '65 Professional	Penfold and Swallow '66 Amateur	English Ladies '66 Ladies	Shotlink 2003-2018 Professional	Shotlink 2006-10 Amateur
Mean drive length (yards)	253	-	237	188	281.6	206.5
Fraction on fairway	0.69	-	0.66	0.71	0.63	0.62

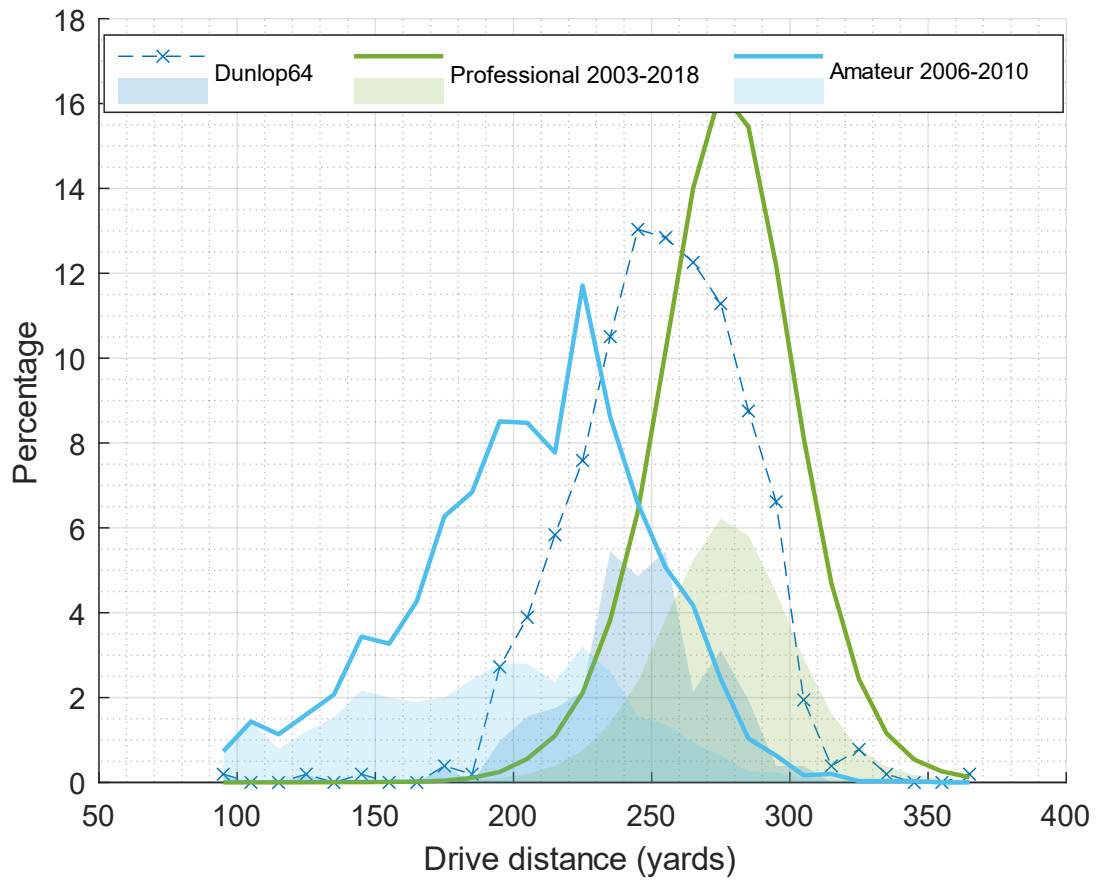


Figure 8. Percentage of drives of a given distance (shaded region indicates drives which landed off the fairway).

#### 4.4 Relative importance of different facets of performance

In modern analyses, the strokes gained metric calculates the difference in the average number of shots to hole out from the starting position and the finishing position, minus one to account for the shot taken, as an indication of the performance of a golfer on a given shot (Broadie, 2012). For example, if the average number of strokes from the starting position is 3.2 and the golfer finishes in a position where the average number of strokes is 2.1, the golfer is said to have gained 0.1 strokes ( $3.2 - 2.1 - 1.0$ ). This information can be used to analyse the performance of individual golfers, but it can also be used to indicate the relative importance of the various facets of tournament play.

Whilst modern analyses are more sophisticated, an improvement facilitated by the increased quality of data available, the GSGB SWG analyses tried to quantify the relative importance of different aspects of tournament play by estimating the performance gains made by improving each aspect. This analysis was performed only for the Dunlop Masters tournament. The method of analysis involved adjusting the curve describing the fraction of putts made from a given distance (Figure 1) so that performance was improved to the level observed at half the distance of the original data. Then, using the distribution of first putt lengths, it calculated that such an improvement would save a golfer 4.2 strokes per round. The same analysis, with the same drastic improvement, was performed for short and long approach shots. For short approach shots, the improvement resulted in an overall improvement of 1.7 strokes per round, which was divided into an improvement of 1.2 strokes per round from the fairway and rough and an improvement of 0.5 strokes per round from bunkers. For long approach shots, the improvement was 5.5 strokes per round, although it was noted that this improvement would depend on the makeup of the course, whereas improvements in short approaches and putting would likely be universal. For driving a separate analysis was performed, separating driving distance and accuracy. An improvement in driving accuracy where all shots landed on the fairway, instead of the measured 70%, resulted in an improvement of 1 stroke per round. An increase in distance of 20 yards would result in an improvement of 1.2 strokes per round. Interestingly, it is possible to use the analysis to calculate the distance that would need to be added to a drive to negate a decrease in accuracy; i.e. if a golfer averaged 20 yards further per round, they could afford to miss 4 more fairways per round.

Using the analysis presented by the GSGB SWG, it could be hypothesised that improvements in putting and long approach shots would have the most effect on overall performance, followed by driving and short approach shots. In comparison, Broadie (2012) reported that the long game and driving explained 72% of strokes gained for modern tour professionals, followed by the short game and putting at 11% and 17% respectively. Since Broadie (2012) did not separate driving and long approach shots in this section of analysis, it appears that the analyses mainly differ in that putting performance is more heavily emphasised by the analysis performed by the GSGB SWG. Calculating rough percentage values from the score improvements provided gives values of 57%, 12% and 31%, for long game and driving, short game and putting respectively. These differences could reflect a change in golfing performance but could also be explained by the larger data set examined in the modern analysis or differences in analysis method.

## 5. Conclusion and limitations

In general, modern professional golfers display similar performance to the golfers studied by the GSGB SWG in the 1964 Dunlop Masters tournament in all areas except distance. Modern golfers hit significantly longer drives off the tee, by around 30 yards. There was also evidence suggesting that approach shots may be slightly longer, but this difference was much smaller than in shots off the tee. However, results should be interpreted with some measure of caution because comparisons between single tournaments, in the case of historical data, and many years of performances, in the case of modern data, may not be valid. Whilst the suggestion of the GSGB SWG is that the performance data collected is representative, there are many factors which may affect performance at a single tournament which might not be immediately evident. The methods employed by the GSGB SWG included observer estimated positions, aided by wooden marking posts, along with more sophisticated dial sight methods. Modern data collection methods are even more sophisticated, using laser range finders to calculate positions with a high degree of accuracy, but there is no reason to suspect that the data presented by the GSGB SWG is of poor reliability compared to the methods available at the time. Despite these limitations, the comparison of modern and historic performance gives an interesting insight into the development of golfing performance.

## 6. References

Broadie, M., 2012. Assessing Golfer Performance on the PGA TOUR. *INFORMS Journal on Applied Analytics* 42, 146–165. <https://doi.org/10.1287/inte.1120.0626>

Cochran, A., Stobbs, J., 1968. *Search for the perfect swing*. Triumph Books, Chicago, IL.

## Appendix A - Data

### Data storage

The historic data contained in this report is contained in the GSGB SWG archive documents (P102, P107, P127 and P129). Modern data is from the ShotLink database.

### Raw data Data tables

Data is presented in an alternative format which more closely matches the data presented in the historical work and used to calculate the figures included in the results and discussion section. Data in parenthesis has been calculated from other data included in the report and may be an approximation.

### Putting

Table 5. Number of putts per green with raw data from GSGB report.

Putts per green	Dunlop Masters '64	Schweppes PGA '65	Penfold and Swallow '66	English Ladies '66	Shotlink 2003-2018	Shotlink 2006-10
	Professional	Professional	Amateur	Ladies	Professional	Amateur
0	6 (0.6%)	5 (0.5%)	5 (0.8%)	-	-	-
1	315 (31.5%)	284 (25.3%)	154 (23.2%)	-	(39.4%)	(25.3%)
2	636 (63.6%)	734 (65.4%)	456 (68.9%)	-	(57.5%)	(60.6%)
3+	43 (4.3%)	99 (8.8%)	47 (7.1%)	-	(3.1%)	(14.4%)
Total	1000	1122	662	-	-	-
Average	1.716	1.826	1.823	-	1.637*	1.887

\*Average calculated from percentage values, not including shots which were holed without a putt and assuming that no more than 3 putts were taken.

Table 6. Number of shots holed by starting distance from the hole.

Starting distance (yards)	Number of shots holed (percentage of shots holed)				Shotlink 2003-2018	Shotlink 2006-10
	Dunlop Masters '64	Schweppes PGA '65	Penfold and Swallow '66	English Ladies '66		
	Professional	Professional	Amateur	Ladies		
0-1	683 (98.7%)	777 (96.9%)	488 (96.8%)	70 (98.5%)	(95.8%)	(87.8%)
1-2	152 (74.1%)	194 (65.8%)	83 (66.9%)	52 (51.0%)	(67.8%)	(57.5%)
2-3	58 (48.3%)	64 (38.3%)	33 (42.3%)	28 (38.4%)	(44.6%)	(34.7%)
3-4	30 (37.5%)	25 (26.6%)	17 (35.4%)	13 (21.0%)	(31.3%)	(22.2%)
4-6	35 (23.0%)	22 (15.6%)	19 (17.6%)	12 (17.7%)	(20.4%)*	(12.8%)*
6-8	13 (11.7%)	10 (9.1%)	11 (12.4%)	4 (8.2%)	(12.3%)*	(9.4%)*
8-10	10 (10.7%)	10 (9.4%)	2 (3.2%)	1 (2.3%)	(8.9%)*	(5.8%)*
10-12	3 (3.6%)	3 (2.7%)	2 (2.9%)	1 (2.0%)	(5.7%)*	(4.6%)*
12-14	3 (4.3%)	4 (4.0%)	2 (4.1%)	0 (0.0%)	(4.2%)*	(4.4%)*
14-16	2 (3.8%)	5 (8.8%)	0 (0.0%)	0 (0.0%)	(3.1%)*	(2.5%)*
>16	5 (8.6%)	3 (4.5%)	0 (0.0%)	1 (2.0%)	(2.7%)	(3.3%)



\*Shotlink data calculated in 1-yard increments. Value presented is the average of two adjacent distance bins.

Table 7. Mean finishing distance from hole by starting distance.

Starting distance (yards)	Average finishing distance from hole (yards)					
	Dunlop Masters '64 Professional	Schweppes PGA '65 Professional	Penfold and Swallow '66 Amateur	English Ladies '66 Ladies	Shotlink 2003-2018 Professional	Shotlink 2006-10 Amateur
	0-1	0.00	0.01	0.01	0.00	0.00
1-2	0.08	0.09	0.08	0.06	0.10	0.33
2-3	0.18	0.17	0.16	0.13	0.26	0.61
3-4	0.26	0.22	0.18	0.27	0.35	0.64
4-6	0.30	0.36	0.28	0.37	0.45*	0.93*
6-8	0.46	0.52	0.46	0.50	0.57*	1.79*
8-10	0.51	0.61	0.54	0.61	0.71*	1.31*
10-12	0.73	0.79	0.79	1.08	0.86*	2.67*
12-14	0.85	0.99	0.86	1.67	1.03*	1.69*
14-16	0.93	1.10	1.13	1.44	1.21*	1.74*
>16	0.93	1.40	1.40	1.59	1.36	1.94

\*Shotlink data calculated in 1-yard increments. Value presented is the average of two adjacent distance bins.

Table 8. Mean number of strokes to hole out by starting distance from the hole.

Starting distance (yards)	Strokes to hole out					
	Dunlop Masters '64 Professional	Schweppes PGA '65 Professional	Penfold and Swallow '66 Amateur	English Ladies '66 Ladies	Shotlink 2003-2018 Professional	Shotlink 2006-10 Amateur
	0-1	1.01	1.03	1.03	-	1.01
1-2	1.26	1.34	1.33	-	1.20	1.40
2-3	1.51	1.62	1.58	-	1.48	1.69
3-4	1.65	1.73	1.65	-	1.64	1.81
4-6	1.78	1.88	1.83	-	1.78*	1.97*
6-8	1.91	1.96	1.93	-	1.89*	2.04*
8-10	1.94	1.97	2.02	-	1.95*	2.24*
10-12	2.00	2.19	2.15	-	2.00*	2.27*
12-14	2.11	2.17	2.04	-	2.05*	2.29*
14-16	2.15	2.18	2.32	-	2.10*	2.37*
>16	2.05	2.25	2.27	-	2.13	2.29

\*Shotlink data calculated in 1-yard increments. Value presented is the average of two adjacent distance bins.

## Approach

Table 9. Average finishing distance for approach shots from the fairway by starting distance.

Starting distance (yards)	Mean finishing position from hole (yards)				Shotlink 2003-2018 Professional	Shotlink 2006-10 Amateur
	Dunlop Masters '64 Professional	Schweppes PGA '65 Professional	Penfold and Swallow '66 Amateur	English Ladies '66 Ladies		
	0-10	-	-	1.00		
10-20	1.2	1.711	1.50	2.33	2.18	9.68
20-30	2.0	2.595	2.25	4.63	3.18	7.97
30-40	2.8	2.938	4.00	6.75	4.01	9.20
40-50	3.0	(2.50)*	-	8.50	4.95	17.27
50-70	5.0	(3.75)*	-	10.20	6.02	15.68
70-120	-	-	-	11.54	6.79	20.51
130-140	7.5	-	-	-	8.56	21.66
140-150	8.75	-	-	-	9.23	24.37
150-160	10.4	-	-	-	10.13	33.76
160-170	10.9	-	-	-	11.27	35.94
170-180	8.9	-	-	-	12.58	53.45
180-190	11.4	-	-	-	14.01	61.27
190-200	18.1	-	-	-	15.98	59.89
200-210	19.0	-	-	-	18.33	60.15
210-220	16.3	-	-	-	21.06	77.53

\*Approximate mean calculated from data included in table

Table 10. Average finishing distance for approach shots from the rough by starting distance.

Starting distance (yards)	Median finishing position from hole (yards)				Shotlink 2003-2018 Professional	Shotlink 2006-10 Amateur
	Dunlop Masters '64 Professional	Schweppes PGA '65 Professional	Penfold and Swallow '66 Amateur	English Ladies '66 Ladies		
	10-20	1.8	1.933	2.10		
20-30	2.6	3.192	3.34	7.33	4.60	7.11
30-40	4.9	3.250	7.50	6.00**	5.87	9.53
40-50	5.0	5.000	(9.714)*	11.00**	6.92	15.78
50-70	11.0**	(6.313)*	(11.375)*	7.75**	8.34	16.08
70-120	-	-	-	11.25	10.44	24.12

\*Approximate mean calculated from data included in table

\*\*Data highlighted as potentially suspect due to low number of measurements

Table 11. Average finishing distance for approach shots from a bunker by starting distance.

Starting distance (yards)	Median finishing position from hole (yards)					Shotlink	Shotlink
	Dunlop Masters '64	Schweppes PGA '65	Penfold and Swallow '66	English Ladies '66	Shotlink 2003-2018	Shotlink 2006-10	
	Professional	Professional	Amateur	Ladies	Professional	Amateur	
0-10	-	-	2.17	-	-	-	
10-20	2.8	-	3.50	-	3.70	8.43	
20-30	4.0	-	8.00	-	4.33	12.54	
30-40	4.9	-	(10.07)*	-	5.85	14.11	
40-50	7.0**	-	-	-	8.68	18.96	

\*Approximate mean calculated from data included in table

\*\*Data highlighted as potentially suspect due to low number of measurements

## Driving

Table 12. Detailed performance with driver club.

Distance (yards)	Dunlop Masters '64		Length of drives		Shotlink	
	Professional		Shotlink 2003-2018		Shotlink 2006-10	
	On fairway	In Rough	On fairway	In Rough	On fairway	In Rough
90-100	0 (0.00%)	1 (0.19%)	0.00%	0.00%	0.73%	0.70%
100-110	0 (0.00%)	0 (0.00%)	0.00%	0.00%	1.43%	1.43%
110-120	0 (0.00%)	0 (0.00%)	0.00%	0.00%	1.13%	0.80%
120-130	0 (0.00%)	1 (0.19%)	0.00%	0.00%	1.60%	1.20%
130-140	0 (0.00%)	0 (0.00%)	0.01%	0.01%	2.07%	1.53%
140-150	1 (0.19%)	0 (0.00%)	0.01%	0.01%	3.44%	2.17%
150-160	0 (0.00%)	0 (0.00%)	0.01%	0.01%	3.27%	2.00%
160-170	0 (0.00%)	0 (0.00%)	0.02%	0.02%	4.27%	1.90%
170-180	0 (0.00%)	2 (0.39%)	0.04%	0.03%	6.27%	2.00%
180-190	1 (0.19%)	0 (0.00%)	0.11%	0.06%	6.84%	2.44%
190-200	9 (1.75%)	5 (0.97%)	0.25%	0.10%	8.51%	2.80%
200-210	12 (2.33%)	8 (1.56%)	0.56%	0.20%	8.48%	2.80%
210-220	21 (4.09%)	9 (1.75%)	1.10%	0.39%	7.77%	2.37%
220-230	28 (5.45%)	11 (2.14%)	2.11%	0.75%	11.71%	3.20%
230-240	26 (5.06%)	28 (5.45%)	3.83%	1.38%	8.61%	2.60%
240-250	42 (8.17%)	25 (4.86%)	6.39%	2.39%	6.57%	1.57%
250-260	38 (7.39%)	28 (5.45%)	10.17%	3.85%	5.07%	1.37%
260-270	52 (10.12%)	11 (2.14%)	14.01%	5.24%	4.17%	0.93%
270-280	42 (8.17%)	16 (3.11%)	16.30%	6.22%	2.44%	0.63%
280-290	35 (6.81%)	10 (1.95%)	15.45%	5.82%	1.03%	0.27%
290-300	32 (6.23%)	2 (0.39%)	12.19%	4.49%	0.63%	0.23%
300-310	8 (1.56%)	2 (0.39%)	8.12%	2.93%	0.17%	0.10%
310-320	2 (0.39%)	0 (0.00%)	4.70%	1.63%	0.20%	0.10%
320-330	4 (0.78%)	0 (0.00%)	2.43%	0.79%	0.03%	0.03%
330-340	1 (0.19%)	0 (0.00%)	1.16%	0.37%	0.03%	0.03%

340-350	0 (0.00%)	0 (0.00%)	0.54%	0.18%	0.03%	0.00%
350-360	0 (0.00%)	0 (0.00%)	0.26%	0.10%	0.00%	0.00%
360-370	1 (0.19%)	0 (0.00%)	0.12%	0.05%	0.00%	0.00%

### Estimated distance by club used

Table 13. Estimated distance for each club compared to modern day equivalent data.

Club	Estimated total distance (yards)		Carry distance (yards)
	Dunlop Masters '64 Professional	Trackman PGA tour averages Professional	
Driver	250	275	
2 Wood	236	-	
3 Wood	222	243	
4 Wood	208	-	
5 Wood	-	230	
Hybrid	-	225	
2 Iron	208	-	
3 Iron	196	212	
4 Iron	184	203	
5 Iron	172	194	
6 Iron	160	183	
7 Iron	148	172	
8 Iron	136	160	
9 Iron	124	148	
10 Iron	112	-	
PW	-	136	

## Appendix B - List of Figures

Figure 1. Fraction of putts made for different starting distances from the hole. ....	6
Figure 2. Average finishing distance from the hole for different starting distances. ....	6
Figure 3. Average number of strokes required to hole out for different starting distances from the hole. ....	7
Figure 4. Comparison of regression equations for approach shots from modern and historic data. ....	8
Figure 5. Starting and finishing distance for approach shots from starting positions on the fairway. A moving average filter with a window length of 3 was applied to the modern amateur data.....	9
Figure 6. Starting and finishing distance for approach shots from starting positions in the rough. A moving average filter with a window length of 3 was applied to the modern amateur data.....	10
Figure 7. Starting and finishing positions for approach shots starting from positions in a bunker. A moving average filter with a window length of 3 was applied to the modern amateur data.....	10
Figure 8. Percentage of drives of a given distance (shaded region indicates drives which landed off the fairway). ....	13

## Appendix C - List of Tables

Table 1. Putts required per green. ....	5
Table 2. Average number of shots to hole out from different starting positions. ....	11
Table 3. Performance in tee shots on short holes. ....	12
Table 4. Average performance of driver tee shots. ....	12
Table 5. Number of putts per green with raw data from GSGB report. ....	16
Table 6. Number of shots holed by starting distance from the hole. ....	16
Table 7. Mean finishing distance from hole by starting distance. ....	18
Table 8. Mean number of strokes to hole out by starting distance from the hole. ....	18
Table 9. Average finishing distance for approach shots from the fairway by starting distance.....	19
Table 10. Average finishing distance for approach shots from the rough by starting distance. ....	19
Table 11. Average finishing distance for approach shots from a bunker by starting distance.....	20
Table 12. Detailed performance with driver club. ....	20
Table 13. Estimated distance for each club compared to modern day equivalent data. ....	21