

Objective Analysis Of Golf

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With the emphasis on who is truly the best increasingly debated, outcomes measurement has finally made its way to sports performance. Many potential applications of outcomes analysis are available: baseball players, college sports polls, competitive figure skating, and almost anything related to sports that currently is evaluated. Some of the more complicated problems may take years of research to arrive at a complete answer, while others, much less difficult, can be analyzed quite simply.

Of all sports measurement problems, those presented by the game of golf are probably the easiest to solve due to its scoring method. This FACETS analysis is of the hole-by-hole scoring of the 1990 United States Open at Medinah Country Club, Medinah, IL in August, as reported by the United States Golf Association (USGA). These data were collected over the four-day tournament as the players turned in their score cards.

Table 1 shows the players in order of ability in this particular championship. The winner, Hale Irwin, is at the top,

| Measure | Error | Persons | |
|---------|-------|--------------------|-------|
| 0.46 | 0.20 | Hale Irwin | BEST |
| 0.46 | 0.20 | Mike Donald | |
| 0.38 | 0.20 | Nick Faldo | |
| 0.38 | 0.20 | Billy Ray Brown | |
| 0.34 | 0.20 | Mark Brooks | |
| 0.30 | 0.20 | Greg Norman | |
| 0.30 | 0.20 | Tim Simpson | |
| 0.30 | 0.20 | Steve Jones | |
| 0.30 | 0.20 | Scott Hoch | |
| 0.26 | 0.20 | Craig Stadler | |
| 0.26 | 0.20 | Tom Sieckmann | |
| 0.26 | 0.20 | Jose M. Olazabal | |
| 0.26 | 0.20 | Fuzzy Zoeller | |
| 0.26 | 0.20 | John Inman | |
| -0.10 | 0.19 | Tom Kite | |
| -0.10 | 0.19 | Blaine McCallister | |
| -0.10 | 0.19 | David Duval | |
| -0.13 | 0.19 | Bob Gilder | |
| -0.16 | 0.19 | Scott Verplank | |
| -0.19 | 0.19 | Ronan Rafferty | |
| -0.23 | 0.19 | Robert Gamez | |
| -0.26 | 0.19 | David Graham | |
| -0.29 | 0.19 | Howard Twitty | |
| -0.33 | 0.19 | Brad Faxon | |
| -0.53 | 0.18 | Michael E. Smith | |
| -0.59 | 0.18 | Randy Wylie | WORST |

slightly, as their measures were only .03 apart. As expected, this analysis shows Sunday the most difficult day by a significant margin.

Table 3 shows the holes in measure order from the hardest hole on which to achieve a low (good) score to the easiest. Holes 12 and 16 were hardest to get scores under par, and Holes 14 and 5 were easiest on which to score well. Reliability is very good for the holes calibrations (bottom of Table 3, .92). This table provides useful data for golf course operators wanting to handicap this course fairly for non-championship use.

but he finished regulation play in a tie with Mike Donald. Irwin won in a subsequent sudden-death playoff, after finishing in another tie following an 18-hole playoff round.

Table 2 shows the days in order of difficulty to achieve a good score from the hardest, Sunday, to the easiest, Friday. In theory, the difficulty order of the days would be Sunday, then Saturday, Friday, and Thursday as the easiest. Sunday should be the most difficult day because psychological pressure is most intense on the final day of scoring, when tournament ends and the championship is decided. This analysis shows that theory to be essentially correct. Thursday and Friday were misordered, but only

| Measure | Error | DAY | |
|---------|-------|----------|---------|
| 0.28 | 0.05 | Sunday | HARDEST |
| -0.01 | 0.05 | Saturday | |
| -0.12 | 0.05 | Thursday | |
| -0.15 | 0.05 | Friday | EASIEST |

Reliability 0.92

| Measure | Error | Holes | |
|---------|-------|---------|---------|
| 0.56 | 0.09 | Hole 16 | HARDEST |
| 0.49 | 0.10 | Hole 12 | |
| 0.32 | 0.10 | Hole 18 | |
| 0.29 | 0.10 | Hole 6 | |
| 0.28 | 0.10 | Hole 9 | |
| 0.27 | 0.10 | Hole 4 | |
| 0.22 | 0.10 | Hole 17 | |
| 0.12 | 0.10 | Hole 15 | |
| 0.02 | 0.10 | Hole 2 | |
| 0.00 | 0.10 | Hole 8 | |
| -0.04 | 0.10 | Hole 3 | |
| -0.04 | 0.10 | Hole 13 | |
| -0.13 | 0.10 | Hole 1 | |
| -0.15 | 0.10 | Hole 7 | |
| -0.34 | 0.10 | Hole 10 | |
| -0.37 | 0.10 | Hole 11 | |
| -0.70 | 0.10 | Hole 14 | |
| -0.80 | 0.10 | Hole 5 | EASIEST |

Reliability 0.92

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In Table 4, the bolded portion demonstrates the effect performance pressure had on two players. Brad Faxon and Ian Woosnam both shot the same score on the same hole, but on different days. Faxon shot a 3 over par 6 on Sunday, the most difficult day, while Woosnam shot the same on Friday, one of the two easiest days. However, the table shows Faxon with a standardized residual of three and Woosnam with a five. Thus, Woosnam's performance was more unexpected, more of a surprise than was Faxon's. There are two reasons for this difference. First, Faxon placed second from last (13-over par); so a bad score would have been more expected from him than from Woosnam. Second, Faxon shot this on Sunday, the day bad scores were expected more frequently than any other day.

Table 4 - Misfitting ratings

| StRes | DAY | Persons | Holes |
|----------|---------------|---------------------|----------------|
| 3 | Thursday | Jose Maria Olazabal | Hole 17 |
| 3 | Saturday | John Huston | Hole 17 |
| 4 | Saturday | Scott Simpson | Hole 17 |
| 5 | Friday | Ian Woosnam | Hole 17 |
| 3 | Saturday | Ian Woosnam | Hole 17 |
| 2 | Sunday | Chip Beck | Hole 17 |
| 2 | Sunday | Andy North | Hole 17 |
| 2 | Sunday | Lanny Wadkins | Hole 17 |
| 3 | Sunday | Brad Faxon | Hole 17 |

On each of the four tournament days, the pin placement is changed on each green. This is to prevent the players from becoming too familiar with each hole and increasing their knowledge of how best to play the hole. It is done at the discretion of tournament officials; however, there are no daily increments to make one day harder than another. In a pre-Open article in "Golf Magazine" (Golf, June 1990, pp. 114-124), Curtis Strange, two-time defending champion of the U.S. Open, identified five holes which "will play a part in deciding who wins the Open." From this statement we may surmise that these are the most difficult holes in the tournament. He chose Holes 4, 7, 12, 13, and 16. On the FACETS analysis, Holes 12 and 16 came up to be the most difficult. Thus, Strange had predicted only two out of the top five "hardest" holes to play.

However, when looking at actual scores, Strange's forecast was correct to some extent. The second and third place finishers, Mike Donald and Nick Faldo, respectively, both shot a bogey on Hole 16 on Sunday that would have given Donald the championship and Faldo would have qualified for the play-off with Donald and Irwin. On the other hand, tournament champion Hale Irwin parred Holes 4 and 16 and scored birdies the other three holes on Sunday. He shot 5-under for the day, which set him up for the opportunity to win the playoff. Five-under par was the second lowest score over the four days. Thus, Strange was partially correct about his selected group of five holes that would "play a part" in the decision of the winner.

This analysis is simple, but a more detailed analysis is possible. Each golf stroke results in a task done correctly or incorrectly, (e.g., in the fairway or not). Certainly there are varying degrees of "correctness" — but those that digress also

vary for each player, given the different skills each possesses. Long hitters such as John Daly, Fred Couples, and Tiger Woods would have more room for error than a player with the different skill, for instance, of Calvin Peete. He hits the ball short, but accurately. By contrast, long hitters such as Daly, Couples, and Woods are lower in accuracy. They can overcome an errant shot with their length on the next shot. Peete is the PGA Tour's record holder for driving accuracy for a season, hitting 84.6% of fairways played in 1982. A simple dichotomy will suffice for driving accuracy as well as the other statistical categories in golf. Currently, statistics in golf are percentages of driving accuracy, greens in regulation, and saves. These factors and a few more have an impact on the score earned on each hole. These factors in golf could be analyzed to provide a more comprehensive diagnostic view of players' areas of weakness and strength.

This kind of analysis can be helpful to golf course administrators and players. The players could learn more definitively where their weaknesses lie (driving, the short game, putting) and learn how the layout of the course can affect their play. Course officials could be provided with more accurate and detailed data on difficulties of holes existing, or planned for. Such analyses could assist architects in the design of future courses.

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Mr. Fisher earned his Master's from The University of Chicago in 1993. His field of study was Measurement, Evaluation, and Statistical Analysis focusing on sports performance measurement. His Master's paper was on measuring baseball performance. Mr. Fisher is currently employed by the Rehabilitation Institute of Chicago in the Rehabilitation Services Evaluation Unit as a Program Evaluator & Statistician. He is the proud papa of Bradley Patrick and Brandon Michael born on October 10, 1997. E-mail: p-fisher@nwu.edu.

