

A More Advanced Method of Setting Disc Golf Par from a Scoring Distribution

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The definition of par in disc golf is

As determined by the Director, the score an expert disc golfer would be expected to make on a given hole with errorless play under ordinary weather conditions, allowing two throws from close range to hole out.

Predecessor Method

An earlier method for translating the definition into an algorithm that could be applied to a scoring distribution resulted in “4/9ths” par. The algorithm was simply to pick the smallest score on each hole that at least 4/9ths of the 1000-rated players scored or beat.

The parameter of 4/9ths was picked so that total par for a typical course would be equal to a round that would be rated higher than 1000. This level of par is consistent with the definition; errorless play for a 1000-rated player would be rated higher than average play. Also, the resulting par was the most useful level for informing contending players of how well they were doing in a tournament.

The 4/9ths method worked fairly well, because most holes are par 3 and it was therefore set to correctly identify enough par 3 holes. However, it seemed to set too many holes to par 2.

This paper presents a refinement of the 4/9ths method, based on the following insight: Hole scores are made up of several throws in a row. (Duh!) The chance of stringing together 5 errorless throws on a par 5 is lower than the chance of executing three errorless throws on a par 3.

It would seem fewer players should get a 5 (or better) on a par 5 than the percent of players that will get a 3 (or better) on a par 3.

New Advanced Method

Instead of just one cutoff point (4/9ths) where that percent of players need to get that score to be par, there should be a different cutoff percentage for each level of par. The cutoff percentages will be higher for lower pars.

The simplest way to do this is to set a single probability that 1000-rated players will execute a throw errorlessly. Then, cutoff for calling a hole a Par 3 would be set where enough 1000-rated players have made a 3 to indicate that it only takes three errorless throws to finish the hole. This would be the probability raised to the third power.

The minimum probability can be calibrated by again referencing the definition. A par round should be rated higher than 1000 (errorless play by an expert). Based on the results from 2015 Pro Worlds, a minimum probability of 72.25% produces the desired level of total par.

The algorithm is

If at least 52.20% (72.25% * 72.25%) of 1000-rated players score a 2, the hole is a par 2.

If 37.71% get a 3, par 3.

If 27.25% get a 4, par 4.

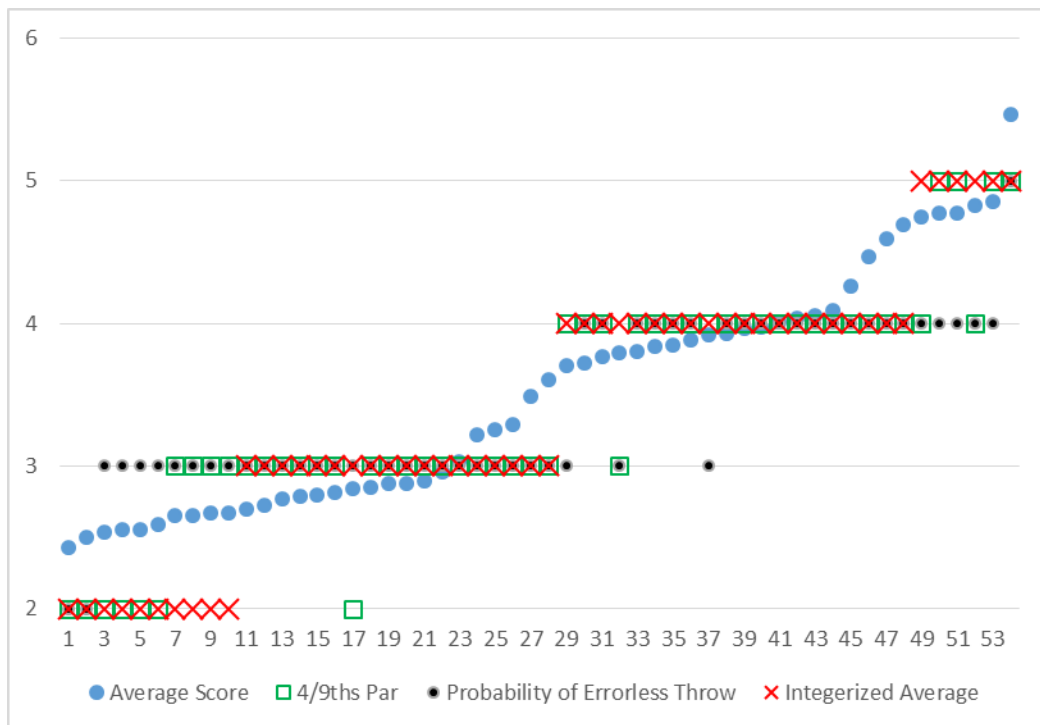
If 14.22% get a 5, par5.

Pick the lowest par. For example, if the scoring distribution is 40% 3s and 30% 4s, and 20% 5s, the hole is a par 3.

Comparisons to Other Methods

For the 4/9ths par method, cutoff points of 37% to 49% were found to be effective in setting par to the proper size. Total par did not vary by very much within this range. The new method's cutoff for par 3 is therefore about the same as it was for 4/9ths par.

Below is a chart that shows the new method alongside some comparable methods of setting par. *All of these methods are calibrated to generate the same total par.* These are set against a backdrop of average scores for 1000-rated players on the 54 holes the Open players played at Pro Worlds.



Par 3s

The lowest-scoring hole that the new method (labeled probability of errorless throw) sets to Par 3 is the 276 foot, slightly uphill Hole 5 at Moraine Gold. This hole averaged just 2.54. Its scoring distribution is below. The number of players that got a 2 falls just under the cutoff to call this hole a par 2, so it's a 3.

2	51%
3	44%
4	5%

The low average is partly because there weren't many 4s.

The highest-scoring hole that the new method calls a par 3 is the 552 foot, 25 feet downhill hole 18 at Moraine Gold. This hole has many OB areas and requires a drop zone when the tee throw goes OB – adding some distance to the penalty. Its scoring distribution is

2	1%
3	37%
4	37%
5	21%
6	4%
7+	1%

If we ignore tree hits, OBs, and distance penalties, with the downhill elevation this hole – when played errorlessly – should play like a 477 foot flat hole. Just barely enough players did get a 2 or 3 to justify saying that 3 is the score players can expect with errorless play. This is equivalent to saying 72% of players made an errorless first throw, and 72% of those players also made an errorless second throw, and 72% of those players also made their putt.

Par 2s

With a single cut-off point for all pars, the cutoff point needed to be set where there were enough par 2s to properly offset the par 4s (and higher). This seemed to result in a surfeit of par 2s.

This surplus of par 2s that came from the 4/9ths method may also be an artifact of any method of setting par that uses the same rule for all par values.

For example, the highest scoring hole that the 4/9ths method would have called par 2 is the 336 downhill over a lake 15 at Deer Lakes Blue. There is a not-very-punishing drop zone for tee throws into the lake. The scoring distribution is:

2	46%
3	30%
4	19%
5	4%
6	0%
7+	1%

The new method sets a higher threshold for calling a hole a par 2; this hole would be par 3. Only two holes are labeled par 2 under the new method.

Par 4s and up

Here is a comparison of the highest-scoring par 4 and the only par 5, both on Moraine. Hole 16 is 663 feet with a 49 foot rise through what seems to be a narrow winding fairway. Hole 6 is 1026 feet with no net elevation and trees scattered along the wide fairway.

	16	6
2	0%	1%
3	1%	0%
4	36%	10%
5	46%	42%
6	14%	36%
7+	4%	12%

More About the Probability Parameter

The parameter of 72.24% means that on the most difficult-to-par holes, up to 27.76% of players can make an error on each throw and still achieve par. However, that is the borderline case. Only the very toughest holes will have players experiencing just a 72.24% a chance of each throw being good enough to achieve par. These would also be holes where there is less opportunity for a follow-up throw to recover from a less-than-perfect throw.

For most holes, the number of players that do NOT make an unrecoverable-from error on each throw will be higher. Overall, a minimum cutoff of 72.24% translates into the average 1000-rated player having a 91% chance (on each throw) of making a good enough throw to achieve par across all holes.

From the 2015 Pro Worlds:

- 🏌️ On the two par 2s, the percent of players that achieved par was 75% and 78%.
- 🏌️ On par 3s, 81% of players achieved par (or better), ranging from a minimum of 38% on the hardest par 3, to a maximum of 97% on the easiest.
- 🏌️ On par 4s, 68% of players achieved par (or better), ranging from a minimum of 36% to a maximum of 91%.
- 🏌️ On the par 5, 53% of players got a 5.

The probability parameter can also be easily adjusted up or down to achieve a desired total par. This could be used for tournament series that repeatedly use the same layouts.

Conclusion

The new method

- 🏌️ Is easily applied when the scoring distribution of 1000-rated players is known.
- 🏌️ Has a single parameter which can be adjusted to set par to the correct level.
- 🏌️ Reduces the number of par 2s compared to other score-based based methods.