

Is Going First an Advantage in Cribbage?

Paul R. Yarnold, Ph.D.

Optimal Data Analysis, LLC

To assess if going first is an advantage in the card-game cribbage, an experienced human cribbage player competed against a computer for 100 games. When findings were analyzed using non-directional chi-square analysis there was no statistically significant effect. However, analysis using confirmatory UniODA revealed that the first move is a marginally significant ($p < 0.08$) predictor of winning a cribbage game, and is a statistically significant ($p < 0.04$) predictor if weights that are used by rule to indicate the magnitude of win (win = 1 point; skunk = 2 points; double-skunk = 3 points) are applied in analysis.

Invented in the seventeenth century, cribbage is a favorite card game of the English-speaking world, and of mariner's.¹ While sites describing game rules and chat groups discussing cribbage strategies² are readily available, no statistical studies modeling outcomes in cribbage could be found. Accordingly this study assesses if going first is an advantage in two-player cribbage.

Because being the first player to amass the criterion number of "points" wins a cribbage game, the first *a priori* alternative hypothesis is that there is a weak-to-moderate^{3,4} ($ESS \leq 37.5$) advantage of moving first in predicting winning the game. Cribbage rules define three categories of wins: first to achieve the criterion score by a modest degree (weighted 1 point, called a *win*), by a moderate degree (2 points, a *skunk*), or by a large degree (3 points, a *double skunk*). Thus the second *a priori* alternative hypothesis is there is a weak-to-moderate advantage of moving first in predicting winning weighted by the number of points scored. The null hypothesis is there is no (weighted) advantage of moving first in terms of predicting winning the game.

Data were obtained vis-à-vis competition between a computer program⁵ and an experienced human cribbage player. The player moving first was decided randomly for each game by drawing the lowest-valued card from the deck. The player moving first (computer, coded as 0; or human, coded as 1), the winner (human or computer, coded via the same convention), and number of points scored (win = 1, skunk = 2, and double skunk = 3) was recorded for each game. Using exact minimum precision power analysis⁴, for a weak-to-moderate effect $N \geq 32$ observations are needed in each class category for 90% power and generalized $p < 0.05$ for a confirmatory test. A total of 100 games were played to ensure adequate statistical power to test the alternative hypotheses. The results of the 100 games are summarized in Table 1.

For expository purposes chi-square analysis was used to assess if winning and moving first are associated (only exploratory, non-directional tests are possible using chi-square³). Here chi-square ($df=1, N=100$)=2.61, $p < 0.107$. Thus, chi-square analysis accepts the null hypothesis

that there is no statistically reliable association between moving first and winning in cribbage.

Table 1: Findings for $N = 100$ Games

<u>First Move</u>	<u>Winner</u>	<u>Points</u>	<u>Frequency</u>
Computer	Computer	1	22
Computer	Computer	2	7
Computer	Computer	3	1
Computer	Human	1	19
Computer	Human	2	4
Human	Computer	1	17
Human	Computer	2	2
Human	Human	1	25
Human	Human	2	3

The following UniODA and MegaODA software syntax obtained the UniODA model for predicting winning versus losing a game:

```
OPEN cribbage.dat;  
OUTPUT cribbage.out;  
VARS first winner points;  
CLASS winner;  
ATTRIBUTE first;  
CAT first;  
DIR < 0 1;  
MCARLO ITER 25000;  
GO;
```

The UniODA model was: if computer moves first, then predict that the computer wins; otherwise if human moves first, then predict that the human wins. This model correctly classified 30/49 (61.2%) of the computer wins, and 28/51 (54.9%) of the human wins. Consistent with the *a priori* hypothesis, this level of classification accuracy is a relatively weak effect: $ESS = 16.1$. The exact confirmatory $p < 0.079$ indicates a statistically marginal tendency for going first to predict winning in cribbage.

The UniODA model for predicting weighted winning versus losing was obtained by adding one additional line of syntax:

WEIGHT points;

The structure of the weighted UniODA model predicting weighted winning (points) was the same as the structure of the unweighted model predicting wins. The weighted sensitivity of the model for computer wins was 65.0%, and for human wins was 53.4%. Consistent with the *a priori* hypothesis, this weighted classification accuracy represents a relatively weak effect: weighted $ESS = 18.4$. The exact confirmatory $p < 0.031$ reveals a statistically significant effect of going first on predicting weighted winning—that is, total number of points won, in cribbage.

References

- ¹Aubrey J (1898). *Brief Lives chiefly of contemporaries set down John Aubrey between the years 1669 and 1696, Volume II*. Gloucestershire, UK: Clarendon Press.
- ²<http://boardgames.stackexchange.com/questions/670/optimal-leading-card-in-cribbage>
- ³Yarnold PR, Soltysik RC (2005). *Optimal data analysis: A guidebook with software for Windows*. Washington, DC: APA Books.
- ⁴Yarnold PR, Soltysik RC (In Review). *Obtaining statistical models that maximize predictive accuracy*. Chicago, IL: ODA Books.
- ⁵<http://www.disabled-world.com/entertainment/games/cribbage.php>

Author Notes

The study analyzed de-identified data and was exempt from Institutional Review Board review. No conflict of interest was reported.

Mail: Optimal Data Analysis, LLC
6348 N. Milwaukee Ave., #163
Chicago, IL 60646
USA