

Mixed Partner King's Court Fairness Analysis

Daryl DeFord

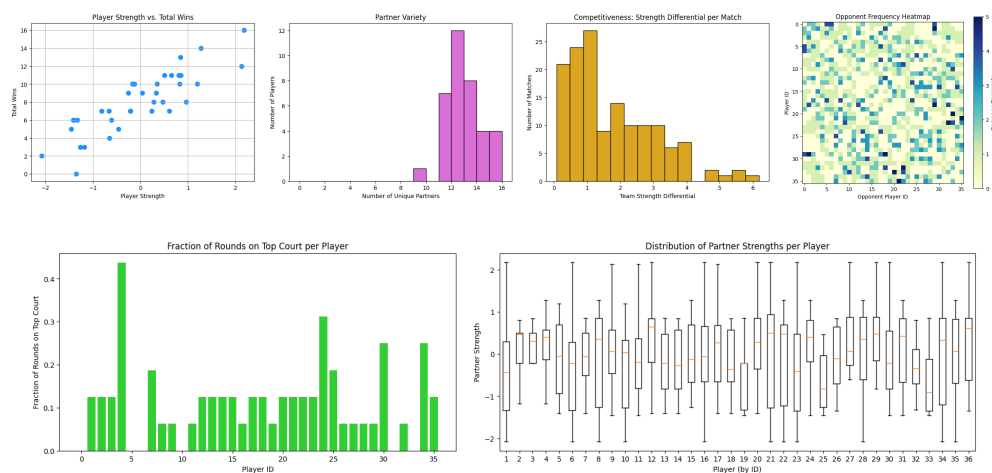
The tables and figures below summarize simulation results for three different approaches to mixing players in King's Court pickleball doubles:

- The 'Full' system has the winners move up a court and the losers move down a court.
- The 'Steve' system has winners remaining in place, losers moving down, and the losers of the bottom court entering on the top court.
- The 'Joe' system has winners moving up, losers staying in place, except for the losers on the top court who are sent to the bottom.

Each tournament consisted of 36 players, initially distributed randomly among the 9 courts. Player strengths were assigned randomly from a standard normal distribution¹ and win probabilities for each match were determined by applying a logistic function to the difference between each team's sum of strengths. All systems performed similarly in terms of allowing stronger players to achieve more wins but the Steve and Joe systems encouraged more mixing of partners. Additionally, the 'Full' system had slightly more balanced games overall and a correspondingly larger proportion of individual games that ended in upsets. The table below summarizes these results across 1,000 simulations per 16-round tournament structure:

System	Strength vs. Win (corr)	Unique Partners	Team Strength Differential	Upset Fraction
Full	0.823 ± 0.045	11.600 ± 0.356	1.330 ± 0.155	0.231 ± 0.035
Steve	0.832 ± 0.041	12.386 ± 0.297	1.667 ± 0.219	0.195 ± 0.037
Joe	0.833 ± 0.042	12.140 ± 0.320	1.621 ± 0.208	0.198 ± 0.038

One large difference not reflected in the table values is that under the 'Steve' and 'Joe' systems most players reach the top court at least once, while under the 'Full' system fewer than half of the players are likely to play on court 1 in a similar setup. Plots representing the results from a single instance of the 'Steve' system are displayed below:



From left to right the top row shows player strength compared to the number of wins, number of partners per player, average strength differential per match, and how often each pair played against each other. The bottom row shows the percentage of the time that each player was on the top court on the left and the average strength of each player's partners on the right.

¹Additional experiments with more structured rankings did not impact the results.