

# A Rarity in Tennis

By  
Tristan Barnett

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The author worked for Infoplum 2019-2012 as a statistician in live prediction modelling across a range of popular Australian sports (tennis, cricket, soccer, basketball, netball, Australian Rules Football, rugby league and rugby union). The prediction model used for tennis is documented on p159 'The Mathematics of Tennis' and takes into the different court surfaces of grass, hard court and clay. Whilst analysing the predictions in men's tennis in 2011, a rather unusual scenario occurred where Roger Federer was the favourite against Novak Djokovic and Rafael Nadal on a grass court surface, Djokovic was the favourite against Federer and Nadal on a hard court surface and Nadal was the favourite against Federer and Djokovic on a clay court surface. Note that the author cannot recall the actual chances of players winning across the different surfaces. However, how can this rather unusual scenario be explained? Firstly, you need to look at the physics behind the court surface.

The physics is defined by when the ball interacts with the court surface for a split second that affects court speed. The factors that affect court speed as outlined in 'The Physics and Technology of Tennis' by Howard Brody, Rod Cross and Crawford Lindsey are the coefficients of friction and restitution, the angle of incidence and the spin of the incident ball. Wimbledon is played on grass, the US Open is played on court hard (known as DecoTurf), the Australian Open on hard court (known as Plexicushion – although from 1988 to 2008 was played on a Rebound Ace hard court surface) and the French Open is played on clay. The main factor that distinguishes between different grand slams is the court surface. It is documented in Furlong (1995) that Wimbledon on grass is a fast surface and the French Open on clay is a slow surface. It may be that the speed of the court has an influence on various match statistics, in particular the percentage of points won on serve, since a fast surface would make it more difficult for a player to return serve. Table 1 represents the percentage of points won on serve for the four grand slams from 2000-2005, along with the averages for each grand slam. There is clear evidence that men are winning a higher percentage of points on serve compared to women. There is some indication that the speed of the surface at the Australian Open was faster in the year 2000 compared to the following years. Overall there is some indication that on average the US Open is faster than the Australian Open. The statistics are even more

significant on the winning percentage on the 1<sup>st</sup> serve as indicted on p111 ‘Mathematical Modelling in Hierarchical Games with Specific Reference to Tennis’. There is also a fundamental ordering of courts (grass, hard court, clay), such that if a player performs best on a particular surface, then their next best surface will be in terms of court speed. For example, if a player performs best on grass or clay, then their next best performance is expected to be on hard court. If a player performs best on hard court, then their next best surface could be either on grass or clay. This is explained in more detail from p107 ‘Mathematical Modelling in Hierarchical Games with Specific Reference to Tennis’.

Tournament	Year	Men (%)	Women (%)
French Open	2001	60.1	54.1
	2002	60.4	
	2003	60.1	53.4
	2004	59.4	53.0
	Average	<b>60.0</b>	<b>53.5</b>
Australian Open	2000	63.8	57.0
	2001	61.9	54.9
	2002	61.7	54.4
	2003	61.7	54.9
	2004	63.0	55.3
	2005	62.2	54.8
	Average	<b>62.4</b>	<b>55.2</b>
US Open	2002	62.6	55.9
	2003	63.6	56.1
	2004	62.1	56.2
	Average	<b>62.8</b>	<b>56.1</b>
Wimbledon	2001	64.5	57.1
	2002	63.8	57.0
	2003	64.4	58.0
	2004	65.6	57.2
	Average	<b>64.6</b>	<b>57.3</b>

Table 1: Percentage of points won on serve for grand slams from 2000-2005

## Grand Slams

Table 2 represents the number of grand slams won by Federer, Djokovic and Nadal from the end of 2019. The dominance of Federer winning Wimbledon (8 grand slams) indicates that Federer plays best on grass, the dominance of Djokovic winning the Australian Open (7 grand slams) indicates that Djokovic plays best on hard court and the dominance of Nadal winning the French Open (12 grand slams) indicates that Nadal plays best on clay. Note also that these three players all competing in the same era have won more singles grand slams than any other player (the next being Pete Sampras winning 14 singles grand slams).

	Federer	Djokovic	Nadal
Wimbledon	8	5	2
US Open	5	3	4
Australian Open	6	7	1
French Open	1	1	12
	<b>20</b>	<b>16</b>	<b>19</b>

Table 2: Number of each grand slam won by Federer, Djokovic and Nadal from the end of 2019

### Match Statistics

The ATP Tour provide individual match statistics for the top 200 players for a particular year conditioned by the surfaces of grass, hard court and clay. The statistics include 1<sup>st</sup> serve %, 1<sup>st</sup> serve won, 2<sup>nd</sup> serve won, Service Games won, 1<sup>st</sup> Serve Return Points Won, 2<sup>nd</sup> Serve Return Points Won and Return Games Won. The formula to calculate:

% of points won on serve = 1<sup>st</sup> serve % \* 1<sup>st</sup> serve won + (1-1<sup>st</sup> serve %) \* 2<sup>nd</sup> serve won

The formula to calculate:

% of points won on return of serve = average 1<sup>st</sup> serve % \* 1<sup>st</sup> Serve Return Points Won + (1-average 1<sup>st</sup> serve %) \* 2<sup>nd</sup> Serve Return Points Won

<https://www.atptour.com/en/stats/>

Table 3 represents the grand slam singles winners and runner-up in 2011.

Table 4 represents the match statistics for Federer, Djokovic and Nadal based on the matches played in 2011 for each surface of grass, hard court and clay. To identify performance of a player in a particular year on a particular surface, two measures are considered. Firstly, the combined percentage of points won on serve and return of serve and secondly the combined percentage of service games won and return games won. On grass, Federer won the highest percentage of combined points won on serve and return of serve (114.62%) in comparison to Djokovic (111.93%) and Nadal (106.05%). Also, Federer only played in one tournament on grass in 2011 being Wimbledon and losing in the quarter-finals to Jo-Wilfried Tsonga in 5 sets despite being up 2 sets to 0. The match statistics reveal that Federer won 76% of points on serve compared to Tsonga winning 72% of points on serve, indicating that Federer actually performed better in the match. Also, Federer has won more Wimbledon titles (8 in total) than any other player in history. For hard court, Djokovic won the highest combined percentage of service games won and return games won (126.00%) compared to Federer (119.81%) and Nadal (113.95%). Further, Djokovic only lost 1 match on hard in 2011 (compared to Federer losing 7 matches and Nadal losing 9 matches). As indicated above, Djokovic won both the grand slam hard courts of the US Open and the Australian Open and has won more Australian Open titles (all played on hard court) than any other player in history. On clay, Nadal won the highest percentage of combined points won on serve and return of serve (113.40%) and won the highest combined percentage of service games won and return games won (127.24%) in comparison to Federer and Djokovic. Also, Nadal won the French Open on clay and even further Nadal has won more French Open titles (12 in total) and more grand slam titles on the one event than any other player in history.

	Winner	Runner-Up
Wimbledon	Novak Djokovic	Rafael Nadal
US Open	Novak Djokovic	Rafael Nadal
Australian Open	Novak Djokovic	Andy Murray
French Open	Rafael Nadal	Roger Federer

Table 3: Grand slam singles winners and runner-up in 2011

	Federer	Djokovic	Nadal
	Grass		
1 <sup>st</sup> serve %	69.21%	68.47%	69.48%
1 <sup>st</sup> serve won	82.09%	77.41%	74.09%
2 <sup>nd</sup> serve won	63.76%	59.05%	58.00%
% of points won on serve (a)	76.45%	71.62%	69.18%
Service games won (c)	94.25%	90.60%	86.62%
Average 1 <sup>st</sup> serve % (top 66 players)	66.9%		
1 <sup>st</sup> Serve Return Points Won	33.62%	32.89%	27.62%
2 <sup>nd</sup> Serve Return Points Won	47.37%	55.30%	55.56%
% of points won on return of serve (b)	38.17%	40.31%	36.87%
Return Games Won (d)	23.26%	31.25%	24.84%
a + b	<b>114.62%</b>	<b>111.93%</b>	<b>106.05%</b>
c + d	<b>117.51%</b>	<b>121.85%</b>	<b>111.46%</b>
Total matches won	6	7	8
Total matches lost	1	0	2
% matches won	85.7%	100%	80.0%
	Hard Court		
1 <sup>st</sup> serve	62.47%	64.51%	65.49%
1 <sup>st</sup> serve won	78.73%	73.47%	70.81%
2 <sup>nd</sup> serve won	56.77%	53.85%	56.14%
% of points won on serve (a)	70.49%	66.51%	65.75%
Service game won (c)	89.60%	84.97%	82.10%
Average 1 <sup>st</sup> serve % (top 66 players)	60.09%		
1 <sup>st</sup> Serve Return Points Won	32.70%	36.15%	33.59%
2 <sup>nd</sup> Serve Return Points Won	53.11%	57.86%	54.27%
% of points won on return of serve (b)	40.85%	44.81%	41.84%
Return Games Won (d)	30.21%	41.03%	31.85%
a + b	<b>111.33%</b>	<b>111.32%</b>	<b>107.59%</b>
c + d	<b>119.81%</b>	<b>126.00%</b>	<b>113.95%</b>
Total matches won	30	39	30
Total matches lost	7	1	9
% matches won	81.1%	97.5%	76.9%
	Clay		
1 <sup>st</sup> serve	64.27%	65.72%	70.34%
1 <sup>st</sup> serve won	77.39%	73.89%	70.47%
2 <sup>nd</sup> serve won	56.02%	59.12%	56.67%
% of points won on serve (a)	69.75%	68.83%	66.38%
Service Games won (c)	87.78%	88.10%	83.39%

Average 1 <sup>st</sup> serve % (top 66 players)	62.76%		
1 <sup>st</sup> Serve Return Points Won	33.48%	36.01%	38.56%
2 <sup>nd</sup> Serve Return Points Won	47.32%	57.71%	61.28%
% of points won on return of serve (b)	38.63%	44.09%	47.02%
Return Games Won (d)	24.19%	37.13%	43.85%
a + b	<b>108.39%</b>	<b>112.92%</b>	<b>113.40%</b>
c+ d	<b>111.97%</b>	<b>125.23%</b>	<b>127.24%</b>
Total matches won	12	17	28
Total matches lost	4	1	2
% matches won	75.0%	94.4%	93.3%

Table 4: Match statistics for Federer, Djokovic and Nadal based on the matches played in 2011 for each surface of grass, hard court and clay.

Based on the number of grand slam wins for each tournament from table 2 suggests that Federer is dominant on grass, Djokovic dominant on hard court and Nadal dominate on clay. Therefore, the predictions that the author observed in 2011 could also have occurred in other years prior and post 2011. From table 3, Djokovic won both the US Open and Australian Open (which is played on hard court) and Nadal won the French Open in 2011 which is played on clay.

Due to the different speeds of the court surface from grass, hard court and clay; it is quite likely that two players within a particular era could have an advantage on a particular surface (particularly if one player performs best on the fastest surface on grass and one player performs best on the slowest surface on clay). But to have three players' in a particular era being dominant on each of the three different surfaces (grass, hard court and clay) could be quite a rarity in tennis.

## References

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