

# HOW THE TENNIS COURT SURFACE AFFECTS PLAYER PERFORMANCE AND INJURIES

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## **Introduction**

There are four major Grand Slam tennis events played each year, all played on different surfaces. Wimbledon is played on grass, the French Open on clay, the US Open on DecoTurf and the Australian Open on Rebound Ace. The court surfaces used in other ATP and WTA tour events played throughout the year reflect the surfaces used in Grand Slam events. Until the early 1970s, many tennis tournaments were played on grass, including three out of the four grand slams. By 2006 there were only 6 ATP and 4 WTA tournaments played on grass, compared to 30 ATP and 37 WTA tournaments played on hard court, and 25 ATP and 15 WTA tournaments played on clay. The relatively small number of grass court tournaments now played on the tour raises the question as to whether this is fair on players who play their best tennis on grass courts. It also raises the question as to whether the higher percentage of matches played on hard courts and clay courts has contributed to player injuries.

Based on the data presented in this paper it would appear that the lack of grass court tournaments today is unfair on players who are suited to the faster surfaces. It would also appear that this lack of grass court tournaments relative to earlier times has contributed to an increase in player injuries. Further, the type of surfaces used at the Masters Cup (neither grass nor clay) favour those players who are best suited to the particular surfaces used. Methods that are arguably fairer for allocating court surface selection at the Masters Cup and the Olympic Games are presented.

## **Uncompleted matches in grand slam tennis**

Cross [1] collected statistics of the percentage of incomplete matches at all four Grand Slam events for three selected five or ten-year periods. These statistics are presented in Table 1. He concluded from this table that grass courts lead to fewer injuries than other surfaces. The argument might go something like this. The Australian Open changed from grass to hard courts in 1988. Note that for Wimbledon Men's Singles, the percentage of uncompleted matches for the period 1978-1982 is 0.3%, which is less than for the period 1995-2004 of 2.0%. It can also be seen from the table that the percentage of uncompleted matches at Wimbledon is less than the other three grand slams for the corresponding periods. For example, for the grand slam men's singles in the period 1995-2004, the percentages were...Wimbledon on grass (2.0%),

the Australian Open on Rebound Ace (3.1%), the French Open on clay (3.6%), and the US Open on DecoTurf (4.3%). This provides some evidence that grass court surfaces produce the least number of uncompleted matches, and probably player injuries. Further to the findings of Cross [1], it would appear that the lack of grass court tournaments now on the tour contributes to an increase in the number of player injuries.

Period	Event	Wimbledon	Australian Open	French Open	US Open
1978-1982	Men	0.3%	0.8%	1.2%	2.2%
1995-2004	Men	2.0%	3.1%	3.6%	4.3%
2001-2005	Women	0.6%	1.9%	0.6%	0.8%

Table 1: Percentage of incomplete matches in Grand Slam Singles.

### Analysis of player performance

The ITF keep an online database of the percentage of matches won by each player on all surfaces, categorized by hard court, clay, grass and carpet. Wimbledon is played on grass, the French Open on clay, and the US and Australian Open on hard court. In recent years the latter two tournaments have been played on different types of hard courts; the US Open is played on DecoTurf and the Australian Open is played on Rebound Ace. Since carpet is not used in grand slam tennis, this surface is not considered in the following analysis.

A player's optimal surface is defined as the surface from {grass, hard court, clay} on which they win their highest percentage of matches. Based on matches played since August 2003, the optimal surfaces for the top 187 men and top 155 women are given in Table 2. Note that initially the top 200 men and women were used in the sample, but those players with no matches played on grass were excluded.

Optimal Surface	Men	Women
Grass	67 (35.8%)	42 (27.1%)
Hard Court	44 (23.5%)	41 (26.5%)
Clay	76 (40.6%)	72 (46.5%)
	187 (100%)	155 (100%)

Table 2: Player's optimal surface categorized by gender

From Table 2, it can be seen that 67 (35.8%) men have their optimal surface as grass. We can also tabulate from the data the percentage of wins that these 67 men have on grass, hard court and clay courts respectively. Further, we can tabulate the corresponding percentages for the other five categories in Table 2. Table 3 gives these results.

	Optimal surface: grass		Optimal surface: hard		Optimal surface: clay	
	Men (%)	Women (%)	Men (%)	Women (%)	Men (%)	Women (%)
Grass	58.1	57.5	31.4	33.8	23.3	27.0
Hard	45.5	46.4	47.8	50.7	39.8	38.7
Clay	34.6	43.2	32.4	36.0	53.6	53.5

Table 3: The percentage of matches won on different surfaces conditional on the players' optimal surface

A player's next best surface is defined as the surface on which they win their second highest percentage of matches. The next best surface for men and women is given in Table 4. Thus, of the 67 men who had grass as their optimal surface, 51 (76.1%) had hard court as their next best surface.

Optimal Surface	Next best surface	Men	Women
Grass	Hard Court	51 (76.1%)	27 (64.3%)
	Clay	16 (23.9%)	15 (35.7%)
Hard Court	Clay	21 (47.7%)	23 (56.1%)
	Grass	23 (52.3%)	18 (43.9%)
Clay	Hard Court	68 (89.5%)	48 (66.7%)
	Grass	8 (10.5%)	24 (33.3%)

Table 4: Player's next best surface categorized by optimal surface and gender

The following can be deduced from Table 4 using statistical testing:

*There is a fundamental ordering of courts - grass, hard court, clay. A player's next best surface is likely to be adjacent to their optimal surface.*

For example, if a player's optimal surface is grass or clay, their next best surface is likely to be hard court. If a player's optimal surface is hard court, their next best surface could be either grass or clay. Note that the linkage to the adjacent surface appears to be stronger for men than it is for women.

A major difference between the various grand slam tournaments is the court surface, and it would appear that the speed of the court has an influence on various match statistics. Tables 5 and 6 give various match statistics for men and women at the 2004 French Open, 2005 Australian Open, 2004 US Open and 2004 Wimbledon Championships, where \* stands for: as a proportion of total points played.

Progressing from left to right in both tables, shows an increase in the winning percentage on first serve, an increase in the serving points won (with one exception), an increase in aces\* (with one exception) and an increase in net approaches\*. Correspondingly, the statistic Break point conversions has a decrease (with one exception). It is documented in Furlong [2] that Wimbledon on grass is a fast surface and the French Open on clay is a slow surface. Thus, it would seem reasonable to conclude that the Australian Open and the US Open are somewhere between the French Open and Wimbledon in terms of court speed. Further, it would appear from this data that the US Open in 2004 was probably a slightly faster court surface than the Australian Open in

2005. By observing the various match statistics from year to year at (say) the Australian and US Open, one can get some indication of the court speed for that year. Table 7 gives the percentage of points won on serve for these Grand Slam Championships from 2002 to 2005. There is some indication that the speed of the surface at the Australian Open was faster in 2004 than in the other years tabled. Overall there is some indication that on average the US Open is slightly faster than the Australian Open.

	French 2004	Aust 2005	US 2004	Wim 2004
Win percent on 1 <sup>st</sup> serve (%)	67.0	70.2	71.6	73.3
Serving points won (%)	59.2	62.2	62.1	65.2
Aces * (%)	4.7	7.2	8.5	8.8
Break point conversions (%)	44.5	41.0	41.5	36.4
Net approaches * (%)	26.4	28.3	30.4	33.4

Table 5: Grand slam match statistics for men 2004-2005

	French 2004	Aust 2005	US 2004	Wim 2004
Win percent on 1 <sup>st</sup> serve (%)	59.2	61.7	63.3	65.5
Serving points won (%)	52.5	54.8	56.2	57.9
Aces * (%)	3.0	3.9	3.8	4.6
Break point conversions (%)	51.0	48.7	48.3	44.3
Net approaches * (%)	17.6	18.1	21.4	21.9

Table 6: Grand slam match statistics for women 2004-2005

Tournament	Year	Men (%)	Women (%)
Australian Open	2002	61.7	54.4
	2003	61.7	54.9
	2004	63.0	55.3
	2005	62.2	54.8
	Average	<b>62.2</b>	<b>54.9</b>
US Open	2002	62.6	55.9
	2003	63.6	56.1
	2004	62.1	56.2
	2005	63.8	56.1
	Average	<b>63.0</b>	<b>56.1</b>

Table 7: Percentage of points won on serve for Australian and US Open Men's Singles tournaments, 2002-2005

Based on the observations from the above tables and the earlier conclusion, it would seem reasonable to make the following conclusion: *There would appear to be a fundamental ordering of court speeds - grass, DecoTurf, Rebound Ace, clay. A player's next best surface is likely to be adjacent to their optimal surface.*

For example, if a player's optimal surface is grass (i.e. Wimbledon) their next best grand slam performances are likely to occur on DecoTurf (i.e. US Open). If a player's optimal surface is DecoTurf, their next best grand slam performances are likely to occur on grass (i.e. Wimbledon) or on Rebound Ace (i.e. Australian Open).

Table 8 gives the number of tournaments played on different surfaces for the 2006 ATP and WTA tour. Since a player can only compete at one tournament at a time, these figures are reduced and represented in brackets in the table. For example for the 2006 ATP, 6 tournaments were played on grass, and any one man could have competed in only 4 tournaments.

	Grass	Hard	Clay
ATP	6 (4)	30 (21)	25 (18)
WTA	4 (3)	37 (26)	15 (11)

Table 8: Number of tournaments played on different surfaces for the 2006 ATP and WTA tour

If all surfaces are equally important to the game of tennis, the lack of grass tournaments could be considered unfair to the players who are best suited to the faster courts. The earnings of such players and their world rankings are at present less than they would be if there were more grass courts. It would be possible to have world rankings for each of grass, hard and clay surfaces. These rankings could be used for seeding players when playing on the respective surfaces. Also, if the surfaces were considered to be of equal importance to the game of tennis, the rankings on the three surfaces could be combined with an equal weighting to give an appropriate overall ranking. Further, there would appear to be a case for adding some additional grass court tournaments to the ATP and WTA calendar so that players who wish to play more than just 4 ATP or 3 WTA tournaments in the year, could do so.

It can be seen from Table 8 that there are more ATP and WTA tournaments on hard courts than on any other type of surface. This is ironical as this is the surface that the least percentage of players have as their optimal surface (see Table 2).

### **Choosing a surface for the Master's Cup and the Olympic Games**

The Tennis Masters Cup was established on December 9, 1999 when the Grand Slam Committee, the ITF and the ATP Tour announced that the ATP Tour World Championship and the Men's Grand Slam Cup would be discontinued and a new jointly owned, end of year men's tournament to be known as the Tennis Masters Cup would be played. It is the season-ending championships for the ATP Singles tour, where the top 8 men who qualify from ranking points and Grand Slam results, compete in a round robin format. The type of surface used for this event clearly affects player performance. The surfaces that have been used in the past have all been synthetic surfaces - indoor hard courts or carpet. Grass and clay courts have never been used at this event. Given the importance of all court surfaces in tennis, the following would appear to be fairer methods of allocating court surface selection for the Masters Cup.

1. Rotate the surface each year with the four grand slam surfaces
2. Rotate the surface each year with grass, clay and hard court

In many sports the Olympic Games is considered to be the event that athletes and countries want to win most of all. Tennis was a founding sport in the first modern Olympics in 1896 but was withdrawn in 1928 over disputes concerning the definition of an amateur. Returning as a demonstration sport in Los Angeles in 1984, it was reinstated as a full medal sport in Seoul in 1988. As is the case for the Masters Cup, the type of surface used at the Olympic Games affects player performance. As the Olympic Games occurs only every 4 years, a player will possibly have the opportunity to play in the Games on just 2 or 3 occasions during a career. A reasonable method of allocating the court surface might be to rotate between grass, hard court and clay.

## **Conclusions**

Data on the highest ranked men and women players indicates that players' performances are affected by the court surface. Players that perform best on the faster surfaces can be considered to be disadvantaged on the tour, due to the lack of grass court tournaments available. It would appear that the decrease in the number of grass court tournaments may have led to an increase in the number of player injuries. It can be argued that the court surfaces used for the Masters Cup and the Olympic Games favour those players who prefer the particular surface selected for the event. For this reason, alternative methods of allocating court surface selection for these tournaments are suggested.

## **References**

- [1] R. Cross, *Grand Slam Injuries 1978 to 2005*. Medicine and Science in Tennis **11(1)** (2006), 5.
- [2] J.D.G. Furlong, *The service in lawn tennis: how important is it?* In Science and Racket Sports, T. Reilly, M. Hughes and A. Lees eds. (1995), London: E&FN Spon, 266–271.