

## The Differential Performance of Tennis Professionals of Different Levels in Serve and Return Games

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### Abstract

This study investigates the results of various skill performances of professional male tennis players of different rankings, levels and periods in serve and return games. A total of 35 players were divided into 7 groups. One-way analysis of variance was employed to analyse the relationship between the differences in skills performance between the players of various groups in serve and return games. Results of this study indicated that there were significant differences between the skill performances in dominance ratio, ace rate, double faults rate, 1st serve rate, winning on 1st serve rate, winning on 2nd serve rate, receiving point won rate and receiving break point. Significant differences were also found in return games in relation to the skill performances in total point rate, receiving break point won and receiving break point. This study found that either in serve or return games, only Level I players were significantly better than the players of other levels, but no significant differences prevailed in receiving point won among players of all levels. Thus, if one is to compete with top-notch players, one cannot just have single skill performance, but must have more proactive ones in both serve and return games.

**Keywords:** tennis; analysis; performance; big data; skill; game

## 1. Introduction

At present, the following professional male tennis tournaments prevail—in hierarchical order—the four Grand Slams of the International Tennis Federation, three-level competition systems of the Association of Tennis Professionals (ATP, 2018), which include World Tour Masters 1000, ATP 500 and ATP 250, and the ATP Challenger Tour and Future; all these tournaments possess statistical data on various skills. Moreover, Wu, Chen, Ho and Huang (2015) noted that more about the trend in tennis development can perhaps be understood through big data analysis, for example, Joachim Loew, a German football coach of the winners of the FIFA World Cup of 2014, said that the winning of the championship had to be attributed to SAP, a software company, that had developed a system for analysing football players' conditions and the game habits of the opponent teams, enabling him to make the most appropriate tactical decisions in accordance with their data (Kang, 2014). Tennis as a sport requires complex skills and skill performances. Winning or losing on the tennis court generally depends on serve, receiving of the serve, forehand and backhand groundstrokes, forehand and backhand volleys, smash, lob shot, drop shot and passing shot (Chiang, Chang and Tsai, 2014; Chien and Huang, 2017). The aforementioned skills determine the outcome of a match, and hence, subjecting-related statistical data for technical analysis has already become one of the effective methods (Chien and Huang, 2017). The above literature indicates that sports skill analysis has become a trend; with the aid of technology, data analysis has become an important assistance tool for coaches to determine winning and losing in competitions.

Tennis is a ranking-based sport, i.e., the ATP awards weekly points to players according to their performance and ranks them in accordance with the points they have accrued. Moreover, these rankings are seen as an important indicator of their career achievements. A young player will participate in professional tournaments after turning professional. Reid Morgan, Churchill and Bane (2014) analysed the data of 11,396 male players with rankings 250, 100, 50, 20 and 10 as the indicator points from 1973 to 2011 and found that the first 10 players in their second year after turning professional or at the age 17 already had very good rankings. Scholars also highlighted that in a comparative study of young people turning professional, the performance of all the players in the top 100 rankings differed significantly from that of those who took part in tour tournaments in their fourth year without even entering the first 100. At the same time, Machar, Darren and Miguel (2010) revealed that the target expectation for professional male tennis players was to maintain their rankings in the first 100. This exhibits that being in the top 100 world rankings is an important indicator for measuring their capabilities. Machar, Darren and Miguel (2017) even pointed out that most professional tennis tours provide statistical data of the tournaments and found that the winning on 2<sup>nd</sup> serve rate could be used to predict the rankings of the players in the first 100 world rankings. It can be understood from the above literature that many scholars have pointed out the differences between the

ranking before and after 100. Moreover, several scholars investigated the differential comparison between various skill factors of the winners of the four Grand Slams and conducted an analysis with respect to these skills (Chiu, 2010; Liu and Chang, 2011; Chien, 2013; Chien and Huang, 2017). Although the influence of each skill factor of top-notch players on the outcomes in both serve and return games has been known, a more detailed investigation of the differences between players of different rankings is still needed. Therefore, by collating the performance data of players of different levels and by means of data analysis, this study aims at understanding the differences between the performances of the players at various competitions with the aid of technology so as to provide coaches, parents, or players with a guide for more effective training and planning their tennis tactics.

## 2. Methods

This study collated website data and the data from the ATP's official website. The data from the Tennis Abstract's website were also collected, and the statistical items analysed included serve games: dominance ratio, ace rate, double faults rate, 1<sup>st</sup> serve rate, winning on 1<sup>st</sup> serve rate, winning on 2<sup>nd</sup> serve rate, break point won, serve face break point, total point rate, receiving point won rate, receiving ace rate, receiving 1<sup>st</sup> serve won rate, receiving 2<sup>nd</sup> serve won rate, receiving break point won and receiving break point. A total of 35 players whose ATP rankings were 1–5, 51–55, 101–105, 201–205, 301–305, 401–407 and 501–505 were observed from January 1 to May 21, 2018. However, as no data were found for the players ranking 404 and 405, 2 other players ranking 406 and 407 were selected instead. These players were then sequentially divided into 7 groups, namely, I, II, III, IV, V, VI and VII, as the subjects of analysis of this study. The players' list is shown in Table 1.

Table 1.  
*Players' List*

Level	Player name	Ranking	Level	Player name	Ranking
I	Rafael Nadal	1	II	Andreas Seppi	51
	Roger Federer	2		Mischa Zverev	52
	Alexander Zverev	3		Daniil Medvedev	53
	Marin Cilic	4		Alexandr Dolgoplov	54
	Grigor Dimitrov	5		Andreas Seppi	51
III	Horacio Zeballos	101	IV	Nino Serdarusic	201
	Cameron Norrie	102		Andrey Kuznetsov	202
	Laslo Djere	103		Uladzimir Ignatik	203

	Cedrik-Marcel Stebe	104		Noah Rubin	204
	Dudi Sela	105		Facundo Bagnis	205
	Pedro Cachin	301		Karue Sell	401
	Elliot Benchetrit	302		Yannick Vandebulcke	402
V	Tim Puetz	303	VI	Christian Lindell	403
	Maxime Janvier	304		Pedro Sakamoto	406
	Joao Souza	305		Benjamin Hassan	407
	Ronald Slobodchikov	501			
	Maxime Chazal	502			
VII	Jonathan Kanar	503			
	Jurabek Karimov	504			
	Jan Mertl	505			

Source: ATP's official website. (<http://www.tennisabstract.com/cgi-bin/leaders.cgi?f=s100o1>、<https://www.atptour.com/en/stats>)

### 3. Results

In this study, difference in the serve game of different levels of players (Table 2), reveal dominance ratio, ace rate, double faults rate, 1<sup>st</sup> serve rate, winning on 1<sup>st</sup> serve rate, winning on 2<sup>nd</sup> serve rate, receiving point won rate, receiving break point, are significant ( $p < .05$ ). After Scheffé's Dominance ratio comparison, I > V > IV > II > VI > III > VII or 1.48 > 1.17 > 1.14 > 1.12 > 1.08 > 1.02 > 0.94; ace rate comparison, I > II > IV > III > VI > VII or 8.66 > 8.23 > 7.58 > 4.79 > 4.49 > 3.37; double faults rate comparison, VII > III > I > V > II or 5.61 > 4.53 > 3.31 > 3.20 > 2.32; 1<sup>st</sup> serve rate comparison, I > II > V > VI or 62.85 > 59.42 > 58.69 > 57.55; Winning on 1<sup>st</sup> serve rate comparison, I > IV > V > VI > III > VII or 75.67 > 70.65 > 70.48 > 68.47 > 67.80 > 63.64; Winning on 2<sup>nd</sup> serve rate comparison, I > V > VI > II > IV > III > VII or 57.04 > 51.64 > 51.14 > 50.43 > 49.85 > 48.29 > 46.52; Receiving point won rate comparison, III > I or 4.89 > 3.19; Receiving break point comparison, VII > III > II > I or 8.52 > 8.03 > 6.92 > 5.02.

Table 2  
*Difference in the serve game on different levels of players*

Project	Level	Mean	Std. Deviation	ANOVA						
				Between Group	Sum of Squares	df	Mean Square	F	Sig.	Comparison
Dominance ratio	I	1.48	0.76	Between Group	16.762	6	2.794	9.07	0.000*	I > V > IV > II > VI > III

	II	1.12	0.49	Within Group	188.409	612	0.308		>VII
	III	1.02	0.40	Total	205.171	618			
	IV	1.14	0.52						
	V	1.17	0.56						
	VI	1.08	0.34						
	VII	0.94	0.44						
	I	8.66	5.70	Between Group	1566.478	6	261.080		
	II	8.23	4.85	Within Group	15733.569	612	25.708		
Ace	III	4.79	3.41	Total	17300.047	618		10.16	0.000* I > II > IV > III > VI > VII
	IV	7.58	5.89						
	V	6.73	5.42						
	VI	4.49	4.19						
	VII	3.37	3.35						
	I	3.31	2.66	Between Group	266.661	6	44.443		
	II	3.17	2.32	Within Group	4217.605	612	6.892		
Double Faults Rate	III	4.53	2.80	Total	4484.265	618		6.45	0.000* VII > III > I > V > II
	IV	4.28	2.57						
	V	3.20	2.37						
	VI	4.0	2.71						
	VII	5.61	4.24						
	I	62.85	7.35	Between Group	1789.849	6	298.308		
	II	59.42	7.70	Within Group	33633.996	612	54.958		
1 <sup>st</sup> Serve Rate	III	61.81	7.36	Total	35423.845	618		5.43	0.000* I > II > V > VI
	IV	61.01	7.61						
	V	58.69	6.47						
	VI	57.55	8.21						
	VII	61.40	8.86						
	I	75.67	9.12	Between Group	5382.783	6	897.131		
	II	71.80	9.81	Within Group	60266.818	612	98.475		
Winning on 1 <sup>st</sup> Serve Rate	III	67.80	10.16	Total	65649.602	618		9.11	0.000* I > IV > V > VI > III > VII
	IV	70.65	9.45						
	V	70.48	10.53						
	VI	68.47	10.59						
	VII	63.64	11.74						
	I	57.04	13.22	Between Group	50714.975	6	8452.496		
	II	50.43	11.65	Within Group	89959.130	612	146.992		
Winning on 2 <sup>nd</sup> Serve Rate	III	48.29	10.98	Total	140674.105	618		57.50	0.000* I > V > VI > II > IV > III > VII
	IV	49.85	12.80						
	V	51.64	13.08						
	VI	51.14	10.49						
	VII	46.52	1.11						
Break	I	3.19	3.16	Between	198.988	6	33.165	3.54	0.002* III > I

Point Won				Group Within Group	5728.443	612	9.360			
	II	4.29	2.81	Total	5927.431	618				
	III	4.89	3.25							
	IV	3.74	3.18							
	V	3.71	2.86							
	VI	3.66	3.01							
	VII	4.67	3.45							
Serve face Break point	I	5.02	4.32	Between Group	625.781	6	104.297			
	II	6.92	3.75	Within Group	10238.558	611	16.757			
	III	8.03	4.36	Total	10864.338	617	6.22	0.000*	VII>III>II> I	
	IV	6.28	4.07							
	V	6.42	3.90							
	VI	6.53	4.00							
	VII	8.52	4.57							

\* $p < .05$

In this study difference in the return game of different levels of players (Table 3), Reveal Total point rate, Receiving break point won, Receiving break point, are significant ( $p < .05$ ). After Scheffé's reveal Total point rate comparison,  $I > V > IV > III > VII$ , or  $54.42 > 51.03 > 50.80 > 49.55 > 47.36$ ; Receiving break point won comparison,  $I > IV$  or  $3.48 > 2.74$ ), Receiving break point comparison,  $I > IV > VII$  or  $8.17 > 6.66 > 5.76$ .

Table 3  
Difference in the return game on different levels of players

Project	Level	Mean	Std. Deviation	ANOVA					
				Sum of Squares	df	Mean Square	F	Sig.	Comparison
Total Point Rate	I	54.42	5.86	Between Group	2063.495	6	343.916		
	II	50.44	6.92	Within Group	27623.232	612	45.136		
	III	49.55	6.59	Total	29686.726	618	7.62	0.000*	I > V > IV > III > VII
	IV	50.80	7.32						
	V	51.03	7.05						
	VI	50.46	5.63						
	VII	47.36	8.18						
Receiving Point Won Rate	I	41.25	8.41	Between Group	936.444	6	156.074		
	II	37.77	8.80	Within Group	50986.680	612	83.312		
	III	38.20	9.72	Total	51923.124	618	1.87	0.083	
	IV	39.12	10.15						
	V	39.54	8.54						
	VI	39.61	7.81						
	VII	38.28	12.62						
Receiving Ace Rate	I	5.43	4.91	Between Group	228.946	6	38.158	1.61	0.142

	II	6.26	5.25	Within Group	14500.513	612	23.694		
	III	6.33	5.30	Total	14729.459	618			
	IV	5.55	4.84						
	V	4.65	4.04						
	VI	5.81	5.21						
	VII	4.77	3.87						
Receiving 1 <sup>st</sup> Serve won Rate	I	34.08	9.27	Between Group	1093.990	6	182.332		
	II	30.52	9.75	Within Group	60121.664	612	98.238		
	III	30.81	11.44	Total	61215.654	618		1.86	0.086
	IV	31.33	10.24						
	V	32.76	9.31						
	VI	31.83	8.21						
	VII	31.30	11.86						
Receiving 1 <sup>st</sup> Serve won Rate	I	52.58	11.99	Between Group	1214.764	6	202.461		
	II	48.78	10.83	Within Group	90270.841	612	147.501		
	III	49.68	11.61	Total	91485.604	618		1.37	0.223
	IV	50.73	13.78						
	V	50.40	11.74						
	VI	51.88	10.94						
	VII	53.25	17.87						
Receiving Break Point won	I	3.48	1.87	Between Group	45.401	6	7.567		
	II	2.83	1.83	Within Group	2162.366	612	3.533		
	III	2.86	2.12	Total	2207.767	618		2.14	0.047*
	IV	2.74	1.81						I > IV
	V	3.02	1.67						
	VI	3.24	1.87						
	VII	2.76	2.47						
Receiving Break Point	I	8.17	4.14	Between Group	244.528	6	40.755		
	II	7.13	3.58	Within Group	10345.229	612	16.904		
	III	6.66	4.34	Total	10589.758	618		2.41	0.026*
	IV	6.61	3.99						I > IV > VII
	V	7.15	4.39						
	VI	7.79	3.98						
	VII	5.76	4.88						

\* $p < .05$

#### 4. Discussion

##### a. Differential comparison of the performance of players of different levels in serve games

This study found that in the differential performance in players of different levels in serve games,

there were significant differences among factors such as dominance ratio, ace rate, double faults rate, 1<sup>st</sup> serve rate, winning on 1<sup>st</sup> serve rate, winning on 2<sup>nd</sup> serve rate, receiving point won rate and receiving break point. From the Scheffé post-hoc test, it was known that Level I players were significantly better than the players of other levels in all the aforementioned aspects. The results of this study correspond to that of Chang and Chen (2009)—three skill factors, namely, number of aces served, winning on 1<sup>st</sup> serve rate and winning on 2<sup>nd</sup> serve rate, were the key factors that determined the outcome of a match. At the same time, in previous studies on the Grand Slam tennis matches, it was revealed that big serve was undoubtedly the most powerful offensive skill, as well as an important striking skill that affected the outcome of a tennis competition (Johnson & Mchugh, 2006; Liu, 2017). Thus, this indicates that to compete with top-notch players, one has to possess the above factors to perform better than the other level players; only then can one seize the opportunity to compete with elite tennis professionals within the sphere of professional tennis, which is so competitive, and secure a position in it. The post-hoc comparison of the serving skills at different levels in the above factors exhibited that only the 1<sup>st</sup> serve rate significantly followed the order I > II > V > VI (62.85 > 59.42 > 58.69 > 57.55). Compared to other skill factors that were not arranged according to levels, this indicated that except for the performance of Level I players, which was more stable, there were relatively more fluctuations and unstable factors involved in the performance of the players of the other levels. This is in line with Nicholas, William and Demetris (2012) study that pointed out the following: the ranking systems of ATP and Women's Tennis Association tournaments generally matched the rankings of front-ranked tennis players, but differences were predominantly noticed in players further down the rankings; from this, it can be inferred that for players further down the rankings, there might be some disparity between their capabilities and rankings, indicating that their capabilities could either be higher or lower than their current rankings. Further, with respect to the serve winning rate, the post-hoc comparison indicated that the order of the data on the performance of various levels of players in the winning on 1<sup>st</sup> serve rate was I > IV > V > VI > III > VII (75.67 > 70.65 > 70.48 > 68.47 > 67.80 > 63.64) and that in the winning on 2<sup>nd</sup> serve rate was I > V > VI > II > IV > III > VII (57.04 > 51.64 > 51.14 > 50.43 > 49.85 > 48.29 > 46.52). This is close to the data mentioned in the studies of Wang, Lin and Chao (2005) and Chang and Chen (2009). The former emphasised that the winning on 1<sup>st</sup> serve rate and winning on 2<sup>nd</sup> serve rate were 71.75% and 50.05%, respectively, while the latter revealed that these 2 winning rates for male winners were 70.66% and 57.26%, respectively. Therefore, players must maintain their winning on 1<sup>st</sup> serve rate at about 70% and winning on 2<sup>nd</sup> serve rate above 50%, as this will improve their probability of winning. The data of this study are close to those of the above literature, but the order of these two factors did not confirm with the levels. The researcher predicts that such discrepancy resulted due to the participation of lower-ranked players in different levels of tournaments or their selection of [different] tournaments in the same time slot. Further, the result of the post-hoc comparison of the break point won was III >



I (4.89 > 3.19) and that of another factor, serve face break point, was VII > III > II > I (8.52 > 8.03 > 6.92 > 5.02). This indicated that in the comparison between higher-ranked players and those further down the rankings, the closer the level of the players was to Level I, the lower was the chance of them serve facing a break point. Even while encountering such a situation, they could still score a point, disallowing their opponents from achieving a serve break. This inference is in line with Liu (2017) study, which revealed that the striking style, a combination of offence and defence tactics, is mainstream among top-notch professional male tennis players and is deemed to be a method of striking that is sufficient to affect the outcome of a match. In particular, 5 striking skills, namely, winning on 1<sup>st</sup> serve rate, winning on 2<sup>nd</sup> serve rate, break point won rate, return game winning rate and break point saved rate are important factors that affect the world rankings of the players. This proves that the performance of top-notch players in serve games will disallow their opponents to seize a break point chance and that even in the face of a break point, they can resolve the crisis and hold the serve.

b. *Differential comparison of the performance of players of different levels in return games*

This study found that in the differential performance in different levels of players in their performance in the return games, there were significant differences in the factors of total point rate, receiving break point won and receiving break point. The Scheffé post-hoc test produced the following results: Total point rate I > V > IV > III > VII (54.42 > 51.03 > 50.80 > 49.55 > 47.36), receiving break point won I > IV (3.48 > 2.74) and receiving break point (8.17 > 6.66 > 5.76). From the above factors, it can be discovered that the performance of Level I players was better than that of players of other levels. Players whose total point rate was better than their opponents had a relatively higher chance of winning, and the order of total point skill performance was also not arranged according to the levels. The researcher highlights that similar to serve games, differences appeared when players of different levels participated in different levels of tournaments and chose different tournaments in the same time slot. However, on the basis of numerical values, one could find that the average total point of Level V and IV was above 50.80, while the points Level III players scored were 49.55 on an average. This displayed that there was a difference in the difficulty of scoring points for players of different levels with equivalent skills. Further, the data on break point won and receiving break point revealed that it was easier for players of higher levels to force out a break point in return games. The researcher considers that top-notch receiving players not only can withstand the serving advantage of their opponents but also can overcome it and pressurise their opponents. This is in line with Huang, Liu, Chang and Liu's study (2014), which suggested that Djokovic could continuously and steadily return the serves and extend the number of drives to overcome the serving advantage of the opponent, which correspondingly would also pressurise the server. Only then can top-notch players successfully score a point and break the serve games of their opponents. It was found that in several studies, scholars

focused on different venues. In the studies on the skill performances of professional male tennis players, it was pointed out that the breaking point won rate was an essential factor, determining the outcome of the competitions in three different venues—the Australian Open, the French Open and The Championships, Wimbledon (Chang and Chen, 2009; Liu, 2017)—indicating that their findings are in line with the results of this study.

## 5. Conclusions

1. In serve and return games, Level I players performed better than players of other levels with respect to various skills that affected the outcomes.
2. In receiving point won, there was no significant difference among players of various levels, but difference was observed at receiving break points, with only Level I players as they were able to seize the [serving] advantage to win the serve game.
3. Fetch the situation detail of rally in the future, can help us understand more.
4. With respect to skills, it was easier for Levels II to VII players to exhibit deficiency in skill or less stable performance during competition, but the researcher considers that this might vary due to differences in player levels, tournament levels, or tournament selections.
5. If one is to compete with top-notch players, one cannot just perform well in a single skill but must have good skill performance in both serve and return games.
6. The performance of Level IV, V and VI players was better than that of Level II and III players. In the future, in-depth investigation of the differential performance in players in the same tournament but of different levels can be conducted.

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## 各階段不同層級職業網球選手對戰表現分析

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### 摘要

本研究分析了職業男子網球選手，在發球局和接發球局時不同排名選手，在各種技術表現差異情況。本研究共擷取 35 位職業網球運動選手，並被分為 7 組，使用單因子變異數分析，來了解發球局與接發球局比賽中各層級職業網球選手之間的技術表現差異。研究結果顯示，在發球局時優勢比，ace 率，雙失誤率，第一發球率，第一發球率，第二發球率，接收點勝率和接收破發點之間，技術表現有顯著差異。接發球局時在總得分率，接發球得分率和破發點，這兩項表現也有顯著差異。本研究發現，無論是發球局或是接發球局，只有層級 I 的選手明顯優於其他級別的選手，其他層級職業網球選手並沒有明顯差異。因此，如果要與頂尖的球員競爭，那麼不能僅有單項技術，在發球局和接發球局時都必須有更主動獲得分數的技術。

**關鍵詞：**網球、分析、表現、大數據、技術