

Impact of Game Elements on Tennis Match Outcome in Wimbledon and Roland Garros 2009

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ABSTRACT

The aim of the study was to assess the correlation among particular tennis game elements and match outcomes specifically at Wimbledon and Roland Garros tournaments 2009. Study results showed the winners to differ statistically significantly from the losers in total sample including players from both tournaments in all variables except for those describing service speed. Like the sample in total, the winners at Wimbledon were superior in all variables, which was most pronounced in the percentage of points won to the opponent's service, percentage of points won by first and second service, percentage of break points, percentage of net points, and number of aces and winners. The winners at Roland Garros may be efficient due to the high quality of play to their own and the opponent's service. In conclusion, Wimbledon winners are characterized by the variables related to service which the players rely on, while Roland Garros winners are characterized by baseline play predominated by basic strokes.

Key words: *situation efficiency, tennis match, Grand Slam tournament*

Introduction

Every tennis match offers an opportunity to record a great body of data suitable for interpretation of the quality of a particular player type performance. Such statistical parameters are good indicators of contest efficiency of each individual tennis player¹. Yet, the evident lack of statistical indicators, which generally included analysis of particular tennis matches, did not enable generalization of results that could eventually lead to the creation of an individual model of performance in defense and attack. Therefore, there are several concepts, as follows: (A) a tennis player is as good as his second service is; (B) on grass court surface, matches are more easily won by players with a high quality service; (C) on clay court surface, matches are more easily won by players with superior performance of long exchanges; (D) elite tennis players are capable of best performance at most important points; and (E) play tactics on clay surface differs substantially from the play tactics on grass surface, etc.^{2,3}.

Improvements in technical aspect of tennis can be achieved by use of video and biomechanical analyses, whereas proper choice of tactical solutions and understanding of tennis game require statistical analyses that define the impact of particular strokes and game elements on a particular tennis match outcome.

Four main Grand Slam tennis tournaments take place every year, all four on different court surfaces. Wimbledon is played on grass court as the fastest surface, Roland Garros on clay court as the slowest surface, US Open on Deco Turf, and Australia Open on Rebound Ace.

Tennis players prefer different surfaces, depending on their play style. In 2007, Barnet and Pollard⁴ investigated the effect of the type of tennis court surface on performance of 187 top ATP tennis players and found clay surface to be most preferred (40.6%), followed by grass (35.8%) and hard surface (23.5%). Tennis players preferring clay surface won 53.6% of matches on this type of surface, 39.8% on hard surface, and 23.3% on grass. Those preferring grass surface won 58.1% of matches on this surface, 45.5% on hard surface, and 34.6% on clay surface. Accordingly, different types of tennis players prefer particular surface types, raising the question of optimization of the contest system in which nearly 50% of tournaments take place on hard surface, 40% on clay surface, and 10% on grass surface, thus obviously depriving the players preferring the playing style appropriate for grass tournaments.

Barnet and Pollard⁴ have reported summarized statistical indicators for 2004 Wimbledon and Roland Garros, confirming the hypothesis that on hard surface service-volley play predominates over baseline play, the latter being predominant on a slow surface. It is evident that a higher number of aces, net play, points after first service and overall service points are scored in Wimbledon, whereas Roland Garros is characterized by more efficient play to opponent's service, which is manifested by a higher number of breakpoints.

Investigating differences between playing tennis on grass and clay surfaces, Morante (2006)⁵ found the game intensity to be comparable irrespective of the fact that points last shorter on fast surfaces because the frequency of shots on grass and clay surface was 44.6 ± 1.2 and 42.6 ± 9.6 strokes/min, respectively.

In their review, Fernandez et al. (2006)⁶ systematically analyzed studies comparing tennis games on fast and slow surfaces and confirmed the hypothesis that points take longer on slow surfaces, while being terminated much faster on grass due to the fast surface and more frequent net play.

Service is one of the most extensively investigated tennis elements. Initially, service was conceived as a stroke launching the ball to play, however, with time it has evolved into a powerful tool to achieve direct points or used to take initiative within a point. Various serving tactics have been employed, depending on the opponent and type of court surface.

Pollard (2008)⁷ investigated the justifiability of the most common serving tactics, in which the first service is strong and the second one light, and found it not to be always optimal but should preferably vary, i.e. strong-strong, light-strong, or even light-light service.

MacPhee et al. (2004)⁸ confirmed the hypothesis that the advantage given to servers in a tennis match does not imply advantage for the player serving first in the match.

However, the game is not defined by the elements of service and return alone. Howard (2002)⁹ confirmed the hypothesis that a tennis player would lose more points by errors than taken by the opponent by winners. Yet, does this belief still hold after 8-year time lapse? In recent years, tennis has witnessed an expansion of offensive baseline players as well as of young all-round play representatives. In addition, the players prefer different court surfaces depending on their play style.

Djurović et al. (2009)¹⁰ embarked upon a study of the latent structure of tennis game. The study included 128 matches with normalization of variables *per set*, considering it the best approach. The five retained factors determined by GK criterion explained 83.38% of overall variance. They deny the concept according to which the speed of service does not differentiate won matches from lost matches. In addition, the authors describe play to the opponent's service and consequentially the number of total and realized break points as the essential category differentiating between won and lost matches.

Over and O'Donoghue (2008)¹¹ report on the advantages of tennis statistics analysis. Considering the variable point length and intensity, as well as different play to pause ratio, statistical indicators are necessary to develop quality periodization training according to the court surface, and to select appropriate tactics according to the current score.

Filipčić et al. (2008)¹ analyzed characteristics of men's and women's play at Roland Garros, and differences between the winners and losers. The authors found statistically significant indicators differentiating these two categories. The winners were found to play more aggressively and were characterized by high quality performance of various techniques, while retaining a high level of play throughout the match.

Studies generally confirm the hypothesis that there are game elements that underlie the match outcome, i.e. winning or losing. In line with this concept, the game elements necessary to win the match can be identified by use of players' activities recorded through match statistics. As these analyses apply to elite tennis, they are best performed at Grand Slam tournaments.

There also are differences according to the tennis court surface. The best representatives of fast and slow surfaces are grass and clay, respectively; thus, analysis of players' activities during a tournament (statistical data) provides different patterns of the game, tactical decisions and game elements that lead to winning the match.

In the present study, statistical data on players' activities during matches at Roland Garros and Wimbledon 2009 were analyzed. As these tournaments gather exclusively top world-ranking tennis players, these events should provide the true relationship between playing on grass and clay surface. Relations between the winners and losers at these tournaments, and between the tournaments were analyzed.

Method

Subject sample

The analysis included tennis game elements in male players (N=250) participating in the main Roland Garros (N=124) and Wimbledon (N=126) tournaments, first round matches. Thus, 125 winners and 125 losers were obtained. Matches interrupted for injuries were not included. Data used in the study were collected from the tournament official statistics.

Indicator sample

The following indicators of tennis game elements were analyzed for each tennis player:

- percentage of successful first services (of total first services in the match) (ISER%);
- number of aces won in the match (ACES);
- number of double service fouls in the match (DUBFO);
- number of unforced errors in the match (UNFER);

- percentage of points won by first service (of total points played by first service) (WIP1S%);
- percentage of points won by second service (of total points played by second service) (WIP2S%);
- number of winners (including service) (WIN&S);
- percentage of points won to the opponent’s service in the match (WIPRE%);
- percentage of breakpoint reversal (number of used breakpoints out of realized breakpoints in the match) (WIBRL%);
- percentage of net points (of total net points in the match) (WIPNE%);
- total number of points achieved (WIPTOT);
- highest service speed in the match (km/h) (TOPSER);
- mean speed of first service (km/h) (AS1SE); and
- mean speed of second service (km/h) (AS2SE).

Methods of data processing

Descriptive parameters were presented for all variables (MIN = minimal result; MAX = maximal result; \bar{X} = arithmetical mean; SD = standard deviation; SKEW = coefficient of asymmetry; KURT = coefficient of kurtosis). Normality of variable distribution was assessed by Kolmogorov-Smirnov test at the level of significance of $p < 0.01$.

Considering the aim of the study, t-test was employed to assess differences between independent groups, i.e. winners and losers in total; winners and losers at Wimbledon and at Roland Garros in separate; Wimbledon and Roland Garros according to losers; Wimbledon and Roland Garros according to winners and losers in separate.

Results and Discussion

Descriptive parameters are presented in Table 1. Kolmogorov-Smirnov test showed normal distribution for all variables, at the level of significance of $p < 0.01$. In comparison with Barnett and Pollard’s statistical study from 2007⁴, an increase was recorded in the following variables: percentage of successful first services (1SER%) from 61.7% to 62.7%; percentage of points achieved by first service (WIP1S%) from 70.6% to 72.12%; and percentage of points achieved by second service (WIP2S%) from 50.5% to 52.8%; and a decrease in the percentage of points achieved to the opponent’s service in the match (WIPRE%) from 37.2% to 35.4%. In their study of 2004 results, Barnett and Pollard report on similar values of arithmetical means of the WIP1S% variable as in their 2007 study⁴. In comparison with previous years, there was evident increase in the number of aces achieved (ACES, from 6.75 to 8.90) and percentage of net points (WIPNE%; from 29.9% to 63.32%).

These results could be interpreted as a greater role of service, its importance being on a rise in recent years, while reducing the opportunities for achieving points to the opponent’s service. Thus, the opportunities for achieving break game have been reduced, which could be

interpreted as tennis game developing into a faster and attacking tennis, so-called modern tennis. However, all results camouflaged in percentages are known to imply a large body of information; therefore, these results should also be taken with caution and perhaps the space of tennis game should be investigated by use of original rather than derived variables in further studies¹⁰.

Differences between winners and losers are shown in Table 2. The winner in a tennis match need not always predominate over the loser in all game elements. In the present study, t-test analysis of the winners and losers in total sample yielded a statistically significant difference in all variables except those referring to the speed of service, i.e. highest service speed (TOPSER), mean speed of first service (AS1SE) and mean speed of second service (AS2SE), indicating that the speed of service is not decisive to win the match (Table 2). However, a combination of service speed and post-service play will certainly be decisive for the match outcome. The integration of service speed and play, in particular after first service, is underlain by the mechanisms that are responsible for the regulation of force and speed^{12,13}, i.e. motor abilities of psychomotor speed, explosive strength and agility/coordination.

The winners have comparable service speed as the losers, however, the former have statistically significantly

TABLE 1
DESCRIPTIVE STATISTICS PARAMETERS OF STUDY VARIABLES

Variable	\bar{X}	MIN	MAX	SD	SKEW	KURT	KS
1SER%	62.74	37	81	7.15	-0.19	0.66	0.050
ACES	8.90	0	55	7.42	1.97	6.84	0.144
DUBFO	3.36	0	13	2.51	1.14	2.00	0.143
UNFERR	28.02	4	70	13.05	0.68	0.18	0.077
WIP1S%	72.12	39	94	10.11	-0.36	0.28	0.050
WIP2S%	52.08	22	86	10.89	0.09	0.08	0.038
WIN&S	37.25	7	97	16.88	0.61	0.18	0.064
WIPRE%	35.38	13	62	9.20	0.18	0.17	0.063
WIBRL%	39.27	0	100	23.56	0.24	0.03	0.080
WIPNE%	63.32	0	94	12.87	-0.71	2.13	0.063
WIPTOT	107.16	24	206	36.86	0.26	-0.48	0.086
TOPSER	207.25	134	229	12.26	-2.48	13.44	0.125
AS1SE	183.20	108	206	12.71	-2.27	11.56	0.105
AS2SE	151.05	106	172	9.99	-0.56	2.66	0.063

\bar{X} – arithmetic mean, Min – minimal result, SD – standard deviation, Max – maksimal result, KS – Kolmogorov-Smirnov test, 1SER% – percentage of first service, ACES – number of aces, DUBFO – number of double service fouls, UNFERR – number of unforced errors, WIP1S% – percentage of points won by first service, WIP2S% – percentage of points won by second service, WIN&S – number of winners including service, WIPRE% – percentage of points won to the opponent’s service in the match, WIBRL% – percentage of break points, WIPNE% – percentage of net points, WIPTOT – total number of points, TOPSER – speed of the fastest service (km/h), AS1SE – mean speed of first service (km/h), AS2SE – mean speed of second service (km/h).

TABLE 2
DIFFERENCES BETWEEN WINNERS AND LOSERS IN TOTAL SAMPLE (WIMBLEDON AND ROLAND GARROS)

Variable	$\bar{X}1$	p	$\bar{X}2$	p	t-test
1SER%	63.85	*	61.63		2.48
ACES	10.84	**	6.96		4.28
DUBFO	2.92		3.81	**	-2.84
UNFERR	25.78		30.26	*	-2.75
WIP1S%	77.58	**	66.67		10.11
WIP2S%	58.24	**	45.91		10.84
WIN&S	42.32	**	32.18		4.97
WIPRE%	41.39	**	29.37		13.65
WIBRL%	47.16	**	31.38		5.61
WIPNE%	67.18	**	59.46		4.97
WIPTOT	116.54	**	97.78		4.15
TOPSER	208.52		205.98		1.18
AS1SE	184.22		182.18		0.91
AS2SE	152.26		149.83		1.39

$\bar{X}1$ – arithmetic mean in the group of winners, $\bar{X}2$ – arithmetic mean in the group of losers, t-test – value of t-test between the groups, *p<0.05, **p<0.01.

more aces, points achieved by first and second service, and consequentially a higher rate of net play. The 2001 Wimbledon and Roland Garros winners had more aces than the losers did, whereas an inverse score was recorded at US Open¹.

Study results showed the winners to be more aggressive also in other game elements, and thus having a higher percentage of points achieved to the opponent’s service, more winners and breaks. These findings suggest that aggressive play and taking initiative in the game is a factor that influences efficiency in tennis. The losers have significantly more unforced errors and double service fouls. The same results were recorded in the final matches at US Open 2000, Australia Open 2001 Roland Garros 2001, supporting the hypothesis that play and service precision contributes significantly to win the match¹.

Analysis of differences between winners and losers at Wimbledon and Roland Garros (Table 3) showed the relationship in most variables at Wimbledon to be similar to that in total sample. A difference was recorded in the variable of first service percentage (1SER%), where there was no significant difference between the winners and losers. This means that the winners took more risk at service, which eventually proved to be a more efficient tactics, along with a statistically significantly higher number of aces. Accordingly, the Wimbledon winners had a statistically significantly higher percentage of points achieved by first and second service, which is consistent with the results obtained by analysis of final matches at US Open 2000, Australia Open 2001, French Open 2001 and 2002, Wimbledon 2001 and US Open 2001, where a

higher percentage of points achieved by first service was recorded¹.

Aggressiveness, i.e. taking point initiative at Wimbledon is also manifested by efficient net play because the winners have a statistically significantly greater percentage of this variable as well. Scully and O’Donoghue (1999)¹⁴ analyzed Grand Slam tournaments and concluded that match winners tend to play at the net throughout the match irrespective of the current score being favorable for them or not, whereas the losers abandon this tactics when the score is unfavorable for them. O’Donoghue and Ingram (2001)¹⁵ found the players to more frequently go to the net for service than for returns, indicating the association of service and net points, where the high service quality ensures favorable position for successful net play.

At both study tournaments, the winners have a higher number of points in total and a statistically significantly higher percentage of used breakpoints, suggesting that the winners follow the aggressive tactics also in crucial times, while the losers tend to turn to a defensive tactics¹⁶.

The winners do not have a statistically significantly faster first service, first service percentage or number of aces either at Wimbledon or at Roland Garros, suggesting that first service does not contribute significantly to win the match. There certainly is a higher quality of second service on clay surface, which allows for variations due to the surface, so that the winners at Roland Garros and Wimbledon have faster second service and higher

TABLE 3
DIFFERENCES BETWEEN WINNERS AND LOSERS AT WIMBLEDON AND ROLAND GARROS

Variable	Wimbledon				Roland Garros			
	$\bar{X}1$	$\bar{X}2$	t-test	p	$\bar{X}1$	$\bar{X}2$	t-test	p
1SER%	63.62	61.90	-1.49		64.08	61.35	1.97	
ACES	12.43	7.37	-4.32	**	9.23	6.55	1.96	
DUBFO	3.29	4.38	2.30	*	2.55	3.23	-1.74	
UNFERR	23.03	28.79	2.86	**	28.56	31.76	-1.27	
WIP1S%	79.54	68.08	-8.60	**	75.58	65.24	6.25	**
WIP2S%	57.52	45.63	-7.62	**	58.97	46.19	7.68	**
WIN&S	43.03	32.51	-3.81	**	41.60	31.84	3.22	**
WIPRE%	40.56	28.40	-10.77	**	42.24	30.35	8.84	**
WIBRL%	48.75	26.33	-6.36	**	45.55	36.52	2.09	*
WIPNE%	71.49	60.62	-6.12	**	62.81	58.27	1.85	
WIPTOT	117.86	98.08	-3.15	**	115.19	97.47	2.71	*
TOPSER	204.08	203.20	-0.20		211.30	207.73	1.83	
AS1SE	181.00	181.72	0.16		186.23	182.48	1.67	
AS2S	151.84	154.04	0.62		152.53	147.30	3.07	**

$\bar{X}1$ – arithmetic mean in the group of winners, $\bar{X}2$ – arithmetic mean in the group of losers, t-test – value of t-test between the groups, *p<0.05, **p<0.01.

number of points achieved by second service, then obviously taking initiative¹⁷.

At Roland Garros, there was no statistically significant difference in the percentage of net points between the winners and losers. There was no statistically significant difference in unforced errors either because the players' ability to play with a very low rate of unforced errors is continuously on a rise despite the speed and intensity of the game¹⁸.

Currently, aggressive play leads to successful outcome in tennis and may manifest in several ways: first, in the phase of attack (service, aggressive baseline play, net play), characterized by constant pressure upon the opponent, trying to point by taking initiative, and second, in the phase of defense, where the quality of transition attack is crucial¹⁹. The quality of transition attack implies the ability of efficient transformation of a difficult defensive situation into offensive one, in order to gain winner or incentive to continue the point. At Wimbledon, the points were shorter in duration but more intensive, thus the players making more shots *per* point on clay than on grass surface.

Differences between the winners and losers at both Wimbledon and Roland Garros tournaments are shown in Table 4. The winners at Wimbledon had statistically significantly more aces, first service points, and percentage of net points, confirming again the hypothesis that the criterion of service quality and tactics to use the acquired initiative on subsequent stroke exchange has a major role at this tournament. Although the winners at Wimbledon had more double service fouls and lower per-

TABLE 4
DIFFERENCES BETWEEN WINNERS AT WIMBLEDON AND ROLAND GARROS AND BETWEEN LOSERS AT WIMBLEDON AND ROLAND GARROS

Variable	Winners				Losers			
	$\bar{X}1$	$\bar{X}2$	t-test	p	$\bar{X}1$	$\bar{X}2$	t-test	p
1SER%	63.62	64.08	-0.38		61.90	61.35	0.42	
ACES	12.43	9.23	2.43	*	7.37	6.55	0.67	
DUBFO	3.29	2.55	1.73		4.38	3.23	2.60	*
UNFERR	23.03	28.56	-2.20	*	28.79	31.76	-1.47	
WIP1S%	79.54	75.58	2.81	*	68.08	65.24	1.79	
WIP2S%	57.52	58.97	-0.84		45.63	46.19	-0.38	
WIN&S	43.03	41.60	0.50		32.51	31.84	0.23	
WIPRE%	40.56	42.24	-1.28		28.40	30.35	-1.69	
WIBRL%	48.75	45.55	1.03		26.33	36.52	-2.20	*
WIPNE%	71.49	62.81	4.01	**	60.62	58.27	1.12	
WIPTOT	117.86	115.19	0.47		98.08	97.47	0.09	
TOPSER	204.08	211.30	-2.32	*	203.20	207.73	-1.51	
AS1SE	181.00	186.23	-1.56		181.72	182.48	-0.24	
AS2S	151.84	152.53	-0.28		154.04	147.30	2.62	*

$\bar{X}1$ – arithmetic mean in Wimbledon players, $\bar{X}2$ – arithmetic mean in Roland Garros players, t-test – value of t-test between the groups, * $p < 0.05$, ** $p < 0.01$.

centage of first service than those at Roland Garros, the difference was not statistically significant. The winners at Roland Garros had a higher service speed and number of unforced errors than those at Wimbledon. The former also had a better percentage of points won to the opponent's service; however, the difference was not statistically significant. The losers at Roland Garros had a higher percentage of break points than those at Wimbledon, which is quite understandable considering that the winners at this tournament were less dominant in service²⁰.

Comprehensive description of the development of the tennis player quality requires factor structure of the indicators of situation efficiency recorded in tennis match to be determined¹⁰, and interactions between basic and specific motor abilities in determination of the player quality development to be identified, as it has been done, for example, in volleyball¹³, handball^{21,22} and karate^{23–25}.

Conclusion

The aim of the study was to assess the correlation among particular tennis game elements and match outcomes specifically at Wimbledon and Roland Garros tournaments 2009. Study results showed the winners to differ statistically significantly from the losers in total sample including players from both tournaments in all variables except for those describing service speed. Like the sample in total, the winners at Wimbledon were superior in all variables, which was most pronounced in the percentage of points won to the opponent's service, percentage of points won by first and second service, percentage of break points, percentage of net points, and number of aces and winners. The winners at Roland Garros may be efficient due to the high quality of play to their own and the opponent's service. A statistically significant difference between the winners at the two tournaments was recorded as a higher percentage of net points, percentage of points won by first service, and number of aces in Wimbledon winners, and as higher speed of the fastest service (km/h) and greater number of unforced errors in Roland Garros winners. In conclusion, Wimbledon winners are characterized by the variables related to service which the players rely on, while Roland Garros winners are characterized by baseline play predominated by basic strokes. Statistical analysis can provide useful information for specific training planning according to the court surface to play on. Obviously, all players modify the pattern of play, i.e. tactical setup of the game elements crucial to win the match, and tend to adjust themselves to the surface to play on. In addition, the game elements influencing the match outcome on grass surface obviously vary from those on clay surface.

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UTJECAJ ELEMENATA IGRE NA ISHOD TENISKOG MEČA NA WIMBLEDONU I ROLAND GAROSU 2009

SAŽETAK

Istraživanje je provedeno s ciljem da utvrdi povezanost između pojedinih elemenata teniske igre i ishod mečeva, posebno na turniru Roland Garrosu i Wimbledonu 2009. Rezultati su pokazali kako se na ukupnom uzorku ispitanika, dakle ispitanika sa oba turnira, pobjednici od poraženih statistički značajno razlikuju u svim varijablama osim u onima koje opisuju brzine servisa. Pobjednici na Wimbledonu bolji su u svim varijablama, a najviše u osvojenim poenima reternom, postotku osvojenih poena prvim i drugim servisom, postotku dobivenih break lopti i postotku osvojenih poena na mreži, te broju aseva i winnera. Pobjednici Roland Garrosa pobjeđuju zahvaljujući činjenici da su bolji posebno u osvojenim poenima reternom i u postotku osvojenih poena drugim i prvim servisom. Zaključeno je da pobjednike Wimbledonu karakteriziraju varijable povezane servisom na koji se igrači oslanjaju, dok pobjednike Roland Garrosa karakterizira igra s osnovne linije u kojoj dominiraju osnovni udarci.