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DIFFERENCES IN SITUATIONAL EFFICIENCY PARAMETERS BETWEEN WINNING AND LOSING TENNIS PLAYERS AT THE AUSTRALIAN OPEN

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ABSTRACT

The Australian Open, together with Wimbledon, Roland Garros and the US Open, is one of the four biggest tournaments known as Grand Slams. As the first major tournament of the year, it is a very important and prestigious event. Since it is held immediately after the preparation period, players are expected to show a high level of physical, technical-tactical and psychological preparedness. It is played on a hard surface, which additionally increases the physical demands placed on tennis players. The aim of this research is to determine whether there is a statistically significant difference in the "winner" points achieved between winning and losing tennis players at the 2024 Australian Open. The study analyzed situational efficiency parameters between winners and losers. The sample of variables consisted of 246 players in 123 matches played at the 2024 Australian Open. All matches that were completed were included in the research; four matches ended with the retirement of one of the players and were therefore not included in order to obtain valid data in the final statistical analysis. The results were obtained based on the analysis of points won during the match, using seven (7) different tennis strokes. Discriminant analysis of the obtained data showed that there are statistically significant differences between winning and losing tennis players in certain tennis strokes. The results showed that the greatest difference was in the "overhead" stroke, in favor of the winners.
Keywords: tennis, tennis strokes, situational efficiency parameters, Australian Open, discriminant analysis.

INTRODUCTION

One of the four biggest tournaments known as Grand Slams is the Australian Open, together with Wimbledon, Roland Garros and the US Open. The Australian Open is the first in the series of Grand Slam tournaments in the calendar year and is played in January on the courts of Melbourne Park. The Australian Open begins in mid-January and lasts two weeks, coinciding with the Australia Day holiday. It includes men's and women's singles, men's, women's and mixed doubles, junior championships, championships for players with disabilities, legends matches and exhibition events. It is played on a hard surface, or as we also like to say, on a "fast surface". Under the nickname "the Happy Slam", the Australian Open is the most visited Grand Slam event, with more than 1,100,000 people attending the 2024 tournament, including the qualifying rounds. It was also the first Grand Slam tournament to feature play in closed or indoor conditions during rainy weather or extreme heat, with its three primary courts – Rod Laver Arena, John Cain Arena and the renovated Margaret Court Arena – equipped with retractable roofs. This year, the 112th edition of the tournament in Australia was held. All the big names in the world of tennis took part, such as Novak Djokovic, Jannik Sinner, Alexander Zverev and Carlos Alcaraz. In the women's competition the participants included Iga Swiątek, Coco Gauff, Aryna Sabalenka and many others.

The winners of the 2024 edition of the Australian Open were:

- Men's singles: Jannik Sinner
- Women's singles: Aryna Sabalenka
- Men's doubles: Rohan Boppana / Matthew Ebden
- Mixed doubles: Hsieh Su-wei / Jan Zielinski.

We can see the magnitude of this tournament when we look at Jannik Sinner's road to the title. Already in the first three rounds, he had to overcome promising

Sport SPA Vol. 22 Issue 2: 16-22
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players such as Botic Van de Zandschulp and Sebastian Baez. This was followed by names such as Karen Khachanov, Andrey Rublev and Novak Djokovic. In the final he defeated Daniil Medvedev, who did not have an easier path to the final either, having faced Zverev, Hurkacz and Auger Aliassime.

In this research, the differences in situational efficiency parameters between winning and losing tennis players in the main draw of the 2024 Australian Open were analyzed. Statistical processing of the data will show whether there are differences in "winner" points scored with respect to seven different tennis strokes between winners and losers. In tennis, a "winner" is a stroke where the opponent cannot reach the ball, and the player who hit the ball wins the point. There is also the so-called service winner, which represents a serve where the opponent manages to reach the ball but is not able to return it. Statistical processing of the data aims to determine whether the playing style that best suits playing on the hard surface of the Australian Open increases the chance of winning at the 2024 Australian Open.

In theory, the style of play that best suits a fast surface would be the "serve-and-volley player". A player who serves well knows how to use a good serve to immediately come to the net, or, after a few exchanges, use an approach shot to move towards the net and then look for a volley or overhead shot to win the point (Barnett & Pollard, 2007). By processing and analyzing the obtained data, correlations between seven tennis strokes and the surface on which the match is played – in this case a fast surface – were established. The aim of this research was to determine whether there is a statistically significant difference in the "winner" points achieved between winning and losing tennis players at the 2024 Australian Open.

The intention was to see whether the style of play that in theory best suits a fast surface, namely the serve-and-volley game, can increase the chances of winning at the 2024 Australian Open.

RESEARCH AIM

The main aim of the research was to determine whether there are differences in situational efficiency parameters between winning and losing tennis players at the 2024 Australian Open.

METHODS

For the purposes of the research, statistical indicators of played singles matches in the men's competition of the main draw of the 2024 Australian Open were used. The data were obtained from the official competition statistics, taken from the official tournament website.

Sample of Participants

The sample of participants consisted of a total of 246 players in the main draw of the 2024 Australian Open, who played 123 matches. All matches that were completed were analyzed. Matches that ended with the retirement of one of the players were not processed, in order to obtain valid data after the statistical analysis.

Four matches ended with the retirement of one of the players, namely:

- Jeffrey John Wolf (retired) vs Sebastian Baez – 1/64 finals
- Alex De Minaur vs Milos Raonic (retired) – 1/64 finals
- Terence Atmane (retired) vs Daniil Medvedev – 1/64 finals
- Juncheng Shang (retired) vs Carlos Alcaraz – 1/16 finals

We divided the players into two groups according to the match outcome:

- 123 winners

Sport SPA Vol. 22 Issue 2: 16-22
DOI: 10.51558/1840-4561.2025.22.2.16

- 123 losers

from 123 matches in the main draw of the 2024 Australian Open.

Sample of Variables

The sample of variables consisted of statistical data from played singles matches in the men's competition of the main draw of the 2024 Australian Open. In this research, eight (8) variables were applied: one (1) grouping variable and seven (7) manifest variables. The grouping variable consisted of the winning and losing tennis players. Winners were coded with the number "1", and losers with the number "0".

The manifest variables consisted of situational efficiency parameters in the form of seven different tennis strokes, namely:

- Groundstroke (groundstroke shot)
- Volley (ball hit in the air)
- Approach shot (approach shot)
- Passing shot (passing shot - the ball passes by the player)
- Lob (placing the ball over the opponent's head)
- Overhead (finishing shot - executed above the head and near the net)
- Drop shot (shortened trajectory of the ball)

Data Processing Methods

Statistical analysis of the data was carried out using the *STATISTICA 7* software package. Discriminant analysis was used for data processing. By applying discriminant analysis, the significance of the differences between the two groups of entities measured on seven manifest variables – in this case seven different tennis strokes – was determined, as well as the extent to which individual variables contribute to these differences. The level of statistical significance was set at $p = 0.05$.

RESULTS AND DISCUSSION

The obtained results indicate differences in situational efficiency parameters between winning and losing tennis players at the 2024 Australian Open.

Table 1. Chi-Tests with Successive Roots (RemSquare)

Roots Removed	Eigen-Value	Canonicl R	Wilks` Lambda	Chi-Sqr.	df	p-level
0	0,104578	0,307697	0,905323	23,92101	7	0,001176

In Table 1. we can see the results of the statistical analysis, where the significance of the discriminant function was tested. The error (p-level) is 0.001176, which is less than 0.05, meaning that the discriminant function significantly differentiates between winning and losing tennis players with respect to situational efficiency parameters – in this case, seven different tennis strokes. The canonical R shows the magnitude of the differences between winning and losing tennis players; it is 0.307697. The closer this number is to 1, the larger the differences.

Table 2. Means of Canonical Variables

Sport SPA Vol. 22 Issue 2: 16-22
DOI: 10.51558/1840-4561.2025.22.2.16

Group	Root 1
G_1:0	-0,322068
G_2:1	0,322068

Table 2. presents the arithmetic mean of the groups of entities on the discriminant function, that is, the arithmetic mean of the group on all variables simultaneously. Group 1, code 0, in this case the losers, are marked negatively; their mean is -0.32 standard deviations of the discriminant function. All variables with a negative sign are those in which the losing tennis players have better results. Accordingly, Group 2, code 1 - that is, the winning tennis players - have higher mean values in those variables that have a positive correlation with the discriminant function. The losing tennis players have a negative sign because they have worse results in most variables - in five of them - and are better in only two. Consequently, the winning tennis players have a positive sign for the group mean on the discriminant function.Ultimately, we can conclude that the winning tennis players scored “winner” points better using these seven tennis strokes than the losing players, although the differences are not large. The results of the research indicate that the winning tennis players were better in most variables than the losing tennis players, which is in line with the findings of Sekulić (2015).

In the next part of the results, the relationship of each variable with the discriminant function was analyzed.

Table 3. Factor Structure Matrix

Variable		Root 1
1.	GSs	0,329217
2.	Vs	-0,220758
3.	As	0,056223
4.	Ps	0,457521
5.	Ls	-0,172376
6.	Os	0,608811
7.	Ds	0,202187

From Table 3. it is possible to determine which variable contributes more and which less to differentiating the groups – the larger the value, the greater the differences. It is noticeable that the groups differ the most in overhead strokes (Os), followed in order by passing shots (Ps), groundstrokes (GSs), volley shots (Vs), drop shots (Ds), and lob shots (Ls). Winning and losing tennis players differ the least in approach shots (As). Approach shots are the variable that creates the smallest difference between the groups. One of the reasons may be that players use this type of stroke in order to successfully approach the net and then, with one of the following shots, finish the point, rather than score a direct winner. Therefore, we do not see large differences in the number of winner points between winning and losing tennis players for this stroke. We also see that variables 2 and 5 have a negative sign. We can

Sport SPA Vol. 22 Issue 2: 16-22
DOI: 10.51558/1840-4561.2025.22.2.16

conclude that the losing tennis players had better results in lob shots and volley shots. Lob shots, together with volley shots, are the only variables in which the losing tennis players had better results. The reason why the losers had better results than the winners may be that the lob is, in most situations, a defensive shot and is played when the opponent comes to the net. Assuming that the tennis players play a serve-and-volley style, they want to get to the net and win the point as quickly as possible, and one of the solutions for the player who is defending may be the lob shot.

Table 4. provides information on whether winning and losing tennis players differ statistically significantly in each variable separately. The error must be less than 0.05 for the differences to be statistically significant.

Table 4. Discriminant Function Analysis Summary

N= 246	Wilks` Lambda	Partial Lambda	F-Remove (1,238)	p-level	Toler.	1-Toler (R-Sqr.)
GSs	0,907397	0,997714	0,54528	0,460981	0,839506	0,160494
Vs	0,933070	0,970262	7,29448	0,007414	0,772735	0,227265
As	0,905649	0,999640	0,08577	0,769883	0,918494	0,081506
Ps	0,925087	0,978635	5,19576	0,023528	0,940566	0,059433
Ls	0,915372	0,989021	2,64193	0,105401	0,921096	0,078904
Os	0,949082	0,953893	11,50392	0,000813	0,809579	0,190421
Ds	0,908712	0,996270	0,89105	0,346152	0,897645	0,102355

It was established that three of the applied variables, out of a total of seven, show statistically significant differences between winning and losing tennis players, namely:

- winner points scored with volley shots (Vs)
- winner points scored with passing shots (Ps)
- winner points scored with overhead shots (Os)

Knowing that the overhead shot is, in most cases, played near the net and that it is a stroke that often finishes the point, we can say that the winning tennis players frequently used a style of play that in theory best suits a fast surface, that is, to hit a good serve and then, with as few shots as possible, come to the net and finish the point.

CONCLUSION

In this research, we wanted to determine whether there are differences between winning and losing tennis players using winner points from seven different tennis strokes as variables at the 2024 Australian Open, and to see whether a style of play that in theory best suits a hard surface – the serve-and-volley game – increases the chances of winning. Analysis of the obtained results showed that differences do exist and, although not large, they are statistically significant. For three variables, the differences between tennis players are statistically significant, namely: overhead, passing and volley shots. The overhead stroke variable contributes the most to the differences between the groups and was the key stroke for scoring winner points for the winning tennis players, while the most surprising finding is that the losing tennis players achieved better results in winner points scored with volley shots. Knowing that the overhead shot is, in most cases, played near the net and that it is a stroke that often finishes the point, we can say that the winning tennis players often used a playing style that in theory best suits a fast surface, that is, to hit a good serve and then, with as few strokes as possible, come to the net

Sport SPA Vol. 22 Issue 2: 16-22
DOI: 10.51558/1840-4561.2025.22.2.16

and finish the point. Lob shots, along with volley shots, are the only variable in which the losing tennis players had better results. The reason why the losing players achieved better results than the winners may be that the lob shot is, in most situations, a defensive stroke and is played when the opponent comes to the net. Assuming that the tennis players play a serve-and-volley style, they want to get to the net and win the point as soon as possible, and one of the solutions for the player who is defending may be the lob shot. Taking into account that winner points scored with overhead, passing and volley shots most often come from net play, we can conclude that a considerable number of players opted for a style of play that implies a fast approach to the net. However, we cannot confirm that players who used the serve-and-volley style of play had a greater chance of winning at the 2024 Australian Open.

Based on the data, we can conclude that the winning tennis players have higher-quality attack construction; in situations when the opponent is at the net, they construct the point better and win the "winner" by playing the ball past the opponent. The game itself, throughout its history, teaches us that tennis is an individual sport and that the final result depends on the tennis player's performance at the moment of the match. Many factors are decisive for success in tennis, and in order to win a match at a tournament such as the Australian Open, abilities must be at a high level. Since the Australian Open is the first major tournament of the year, immediately after the preparation period, all players come with a high level of technical-tactical, cognitive and physical preparation. Therefore, it is even more demanding to win such a tournament.

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