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Cost of an unforced error in tennis - A statistical approach

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ABSTRACT

The objective of this paper is to (1) introduce a scientific way of measuring the cost of an unforced error in tennis during various match situations and (2) to provide a basis for players and coaches to choose the right strategy among extremely cautious and adventurous playing styles based on a statistical approach. To do this, we analyzed a total of 2,490 different match situations. The results of this study show that the cost of an unforced error varies greatly depending on the match situation. Players are better served by playing a high percentage, low-risk game in situations when the cost of an unforced error is higher than the median cost and adapt a high-risk approach when it is lower than the median cost.

Key words: unforced errors, performance analysis, professional tennis, statistics.

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INTRODUCTION

Tennis has sometimes been called "a game of errors" (Ferreira, 2020) because unlike in most other sports like basketball or football, errors — your own as well as your opponent's — reflect in the score. When you make an error, your opponent gets a point and vice versa. A point won by hitting a winner counts as much as a point won due to an error of the opponent. On the other hand, your errors also add to your opponent's score. Even the world's best players make "Unforced Errors" in their attempt to hit an adventurous shot that gives them a chance to win a point (Mencinger, 2011).

(Merriam-Webster, n.d.) Unforced Error: a lost point that is entirely a result of the player's own blunder and not because of the opponent's skill or effort

In professional matches, coaches keep a close track of the number of unforced errors that a player is making and use it to finetune their training strategies (Brody, 2006). Players and their coaches work extensively to cut down on unforced errors by emphasizing that unforced errors could "cost you" because tennis matches are always lost on errors and never won on placements (Tilden, 1950) .

That raises some interesting questions:

- How can we scientifically measure the cost of an unforced error?
- Is the cost of an unforced error the same in all match situations or are some unforced errors more costly than others?
- In which match situation should a player attempt a low percentage shot and risk the possibility of an unforced error? And the corollary, when should a player play a high percentage game to absolutely avoid an unforced error?

- Can we model the cost of unforced errors across all match situations and derive some interesting statistical insights?

METHOD

Definitions

The score of a tennis match changes with every point and the score cannot return to the same scenario again . As the objective of the player is to win the game, set, or match (and not individual points) the Cost of Unforced Error (CUE, for short) is measured by the number of additional points that one needs to play due to the unforced error.

Cost of Unforced Error (CUE): the number of additional points that one needs to play due to an unforced error.

Sometimes an unforced error from a player may completely change the complexion of the game. Therefore, we cannot be sure of the actual number of additional points that one needs to play, making it impossible to accurately measure the CUE.

What we can instead measure is the minimum cost of unforced error (MUE, for short), which we define as the minimum number of additional points that one needs to play due to the unforced error.

Minimum Cost of Unforced Error (MUE): the minimum number of additional points that one needs to play due to an unforced error.

Examples

At the beginning of a match, when the score is 0 - 0, the player needs a minimum of 4 points to win the game. If at this stage, the player makes an unforced error, the score becomes 0 - 15 and the player has to play a minimum of 4 more points to win the game. That is, the player has to play a total minimum of 5 points in the game instead of 4 when the score was 0 - 0. So, the MUE in this case is 5 - 4 = 1.

The MUE value changes for an unforced error depending on the match situation and the score of the match, set and game at that time. For example, when the match is still at 0 - 0 in the first set, but the game score is 0 - 30, 15 - 30 or 30 - 30, an unforced error will cause the opponent to reach 40 and at a minimum force the player to first make the score a Deuce and later win it by playing two additional points. In this scenario, the MUE value is 2.

Consider another scenario, when the match is still at 0 - 0 in the first set, but the game score is 0 - 40, 15 - 40, 30 - 40, or 40 - A. An unforced error at this stage will cost the player the game and the player now has to play one additional game or a minimum of 4 additional points, making the MUE value 4 for these scores.

In the same match, consider the scenario when the score is 6 - 5 in the first set, but the game score is 0 - 40, 15 - 40, 30 - 40, or 40 - A. An unforced error at this stage will force the set to get into a tiebreaker and the player now has to play a minimum of 7 additional points, making the MUE value 7 for these scores.

In some scenarios, an unforced error may cause the player to lose a set. The player then has to play an additional minimum of 6 games with a minimum of 4 points in each game, making the MUE value 24.

In some extreme scenarios, an unforced error may end the match and there is no comeback for the player from such loss. While the true cost of such loss is unquantifiable or infinite, we can still find out the MUE value. Let us assume that the player continues in the tournament and can compensate for the loss by winning the next match, which is a minimum of 2 sets (in a best of 3 sets match), making the MUE value 48.

As we examined, the MUE value can be 1, 2, 4, 7, 24 or 48 at different stages of a match depending on the score at the time the unforced error was made.

Data and insights

We have tabulated all possible scenarios for a 3-set tennis match with a tiebreaker at the set score of 6 - 6 in all three sets. The match score during the course of the match can be any of the 4 values, 0 - 0, 0 - 1, 1 - 0 or 1 - 1 indicating the number of sets won by the player and the opponent. The set score can be any of 38 possible values between 0 - 0 to 6 - 6 during the match. During a set, the game score can be any of 18 possible values between 0 - 0 to 40 - A or A - 40. When the set score is at 6 - 6, the match enters a tiebreaker and the tiebreaker score can be any of 51 possible values between 0 - 0 to 6 - A or A - 6.

Table 1

Possible Match scores	4
Possible Set scores	38
Possible Game scores	18
Possible Tie-breakers per match. (1 for each match score)	4
Possible Tie-breaker scores	51
Total match scenarios studied = (4 x 38 x 18) + (4 x 51)	2,940

By enumerating the MUE values for these 2,940 different match situations we generated the raw data and over this data we did standard statistical analysis and derived the following learnings.

Table 2

	Implication of unforced error	MUE value	Number of match situations for this MUE value
1	Additional point	1	1356
2	Game enters Deuce	2	948
3	Game lost	4	496
4	Set enters Tiebreaker	7	16
5	Set lost	24	62
6	Match lost	48	62

We then calculated the statistical averages of MUE values.

Table 3

MUE value statistics		
1	Minimum MUE value	1
2	Highest MUE value	48
3	Median MUE value	2
4	Mean MUE value	3.34

CONCLUSION

While it appears at first glance that an unforced error is just one lost point, on closer examination we find out that the median MUE is 2, and in some match scenarios, the MUE can be as high as 24 or 48. A player can win points either by playing aggressively and trying to hit winners and at other times by playing conservatively waiting for the opponent to make a mistake (Fein, 2016). The player can afford to take more risks for low MUE values (1 or 2) and play conservatively for high MUE values (4 or above). By being aware of the MUE values for different match situations , players can adapt their game during the course of the match in a more scientific manner thereby increasing their overall effectiveness.

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