

# AN ANALYSIS OF THE FIRST 100 YEARS OF WIMBLEDON TENNIS FINALS

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*The Wimbledon tennis tournament began in 1877 when the first men's singles final was played. In 1879 men's doubles were introduced and 1884 saw the advent of women's singles. Using elementary probability theory a comparison is made between the observed and expected number of sets that each match lasted under the hypothesis that the players were of equal ability. Consideration is also made of a "back-to-the-wall" effect which favours the player(s) trailing in the match.*

## Introduction

An effective aid in teaching statistical theory is the use of data from areas with which students are familiar. To this end, sporting data provide an excellent avenue for demonstrating the fundamentals of probability by searching for any "underlying pattern" of results. In particular there are a wealth of sporting data on football, cricket, baseball and hockey (to name but a few) readily available, much of which readily lending themselves to simple statistical analyses. In this paper the results of the men's and women's finals during the first 100 years of Wimbledon tennis provide the data which will be used.

During the first 100 years of Wimbledon tennis there were finals in 89 men's singles and 83 women's singles. The men's singles were played over the best of five sets whereas the women's singles were the best of three sets. The questions of interest considered here are whether the premises hold that, in general, finalists were evenly matched and whether the player trailing in a match demonstrated an unusual fighting spirit. With the aid of only elementary probability, these aspects were recently investigated for U.S. baseball (Simon, 1971) where a "back-to-the-wall" effect was found to exist in the 68 World Series confrontations between 1905 and 1975. The World Series is played over the best of seven games, and it was found that of 31 post-war games 22 had gone to the sixth game. Moreover, in only four of these cases had the team which was ahead going into the sixth game won the sixth game. (For evenly matched teams the probability of this latter event is about 0.002.) This back-to-the-wall effect, however, was not evident prior to World War II.

A similar analysis to that made by Simon can be easily made on the tennis data. Each of the men's and women's finals are considered separately.

#### MEN'S SINGLES FINAL

Of the 89 men's singles finals, 44 were won in straight (three) sets, 21 in four sets and 24 in five sets. For equally matched players,

the probabilities of matches lasting three, four or five sets can be calculated as below. (The outcomes of each set are assumed to be independent and the probability for either player winning a particular set is 0.5.)

Let the two players be A and B. Then the probability that the match is over in a specified number of sets may be demonstrated by writing out all possible ways in which this can happen and their corresponding probabilities. This is done for three and four sets in Tables 1 and 2, respectively. A similar table for five sets can easily be constructed and this is left to the reader.

TABLE 1  
Probability of a match lasting three sets

Winner of set			Prob.
1	2	3	
A	A	A	0.125
B	B	B	0.125
Total			0.250

TABLE 2  
Probability of a match lasting four sets

Winner of set				Prob.
1	2	3	4	
B	A	A	A	0.0625
A	B	A	A	0.0625
A	A	B	A	0.0625
A	B	B	B	0.0625
B	A	B	B	0.0625
B	B	A	B	0.0625
TOTAL				0.3750

With the aid of a similar table the probability that a match lasts five sets can also be shown to be 0.375. The 'expected' number of matches finishing in a specified number of sets is found by multiplying the above probabilities by the total number of matches played. In Table 3 these figures are compared to those observed, these calculations being shown for both pre and post-war.

TABLE 3  
Men's singles finals 1877-1976

No. of sets	Prob.	1877-1939		1946-1976		Total	
		Obs.	Exp.	Obs.	Exp.	Obs.	Exp.
3	0.250	28	14.500	16	7.750	44	22.250
4	0.375	12	21.750	9	11.625	21	33.375
5	0.375	18	21.750	6	11.625	24	33.375
TOTAL		58	58.000	31	31.000	89	89.000

From Table 3 it seems clear that, for the most part, players were not of equal ability since many more matches than expected finished in straight sets. The percentage of such victories is similar for both pre-war (48.3%) and post-war (51.6%).

In 76.4% of matches the winner of the first set went on to win the match in three, four or five sets, these percentages being 70.0% pre-war and 89.3% post-war. Under the equal ability hypothesis,

$$\begin{aligned}
 P(\text{A wins match} \mid \text{A wins first set}) &= \sum_{j=3}^5 P(\text{A wins in } j \text{ sets} \mid \text{A wins first set}) \\
 &= 0.250 + 0.250 + 0.1875 \\
 &= 0.6875
 \end{aligned}$$

This theoretical probability is consistent with pre-war results but it appears that the winner of the first set has given a more reliable indication of the eventual winner since the war.

If these "one-sided" straight set victories are disregarded, the remaining 45 matches provide some interesting observations. In these matches the player leading two sets to one were the winners on 34 of 45 (76%) occasions which compares favourably with the theoretical

$$P(\text{A wins match} | \text{A leads 2 sets to 1}) = 0.75$$

for evenly matched players.

Also, of the 21 four set matches the winner of the match also won the first set on 14 (66.7%) occasions which is also as expected for evenly matched players since

$$P(\text{A won first set} | \text{A won match in 4 sets}) = 0.667.$$

However, unusual results occurred in the 24 five set matches in which the eventual winner won the first set on only 8 occasions. The theoretical result is

$$P(\text{A won first set} | \text{A won match in 5 sets}) = 0.50$$

Thus there is the suggestion of a back-to-the-wall effect wherein players who lost the first set and recovered to take their opponents to five sets appeared to have the edge in the fifth set. A further breakdown shows

that this happened on 13 of 18 (72.2%) of such matches pre-war and 3 out of 6 (50%) post-war. It would therefore appear that this phenomenon was mainly in evidence pre-war.

Of the 45 matches extending beyond these sets, the player leading two sets to one won the fourth set (and the match) on 23 (51.1%) occasions. Since

$$P(\text{A wins fourth set} | \text{A leads two sets to one}) = 0.50$$

for players of equal ability, this result does not indicate any special effect.

#### WOMEN'S SINGLES FINAL

Since these matches are only the best of three sets, conclusive statements regarding back-to-the-wall effects are difficult to make. The probabilities and observed and expected frequencies of match lengths for evenly matched players are shown in Table 4.

TABLE 4  
Women's singles finals 1884-1976

No. of sets	Prob.	1884-1939		1946-1976		Total	
		Obs.	Exp.	Obs.	Exp.	Obs.	Exp.
2	0.50	38	26	24	15.5	62	41.5
3	0.50	14	26	7	15.5	21	41.5
TOTAL		52	52	31	31.0	83	83.0

For evenly matched players it is, in theory, equally likely that the match will last either of two or three sets. Since 62 of 83 (74.4%) matches were won in straight sets (38/52 or 73.1% pre-war and 24/31 or 77.4% post war) the premise of equal ability seems unjustified. In fact, on 76 (91.6%) occasions the winner of the first set went on to win the match, whereas the expected probability is

$$P(\text{A wins match} | \text{A wins first set}) = 0.75.$$

In those 21 matches which went to three sets, the winner of the match won the first set on 14 (67%) occasions, this breakdown being 64% for pre-war and 71% for post war. Since

$$P(\text{A won first set} | \text{A won in three sets}) = 0.50$$

there does not appear to be any back-to-the-wall effect operating for losers of the first set.

#### REMARKS

There are many difficulties associated with the interpretation of the occurrence of unusual events after the fact and one must be careful of any conclusion drawn. Nevertheless, it is interesting to consider these past events, even though we do not necessarily predict that such sequences will re-occur.



A similar analysis to that undertaken here may be done using the results of the Wimbledon finals in men's and women's doubles as well as mixed doubles. All the necessary data can be found in Tingay (1977) and such a project would be very instructive for students in becoming familiar with probability concepts.

#### REFERENCES

Simon, W. (1971), *Back-to-the-wall effect*, *Science*, 174, 774-5.

Tingay, L. (1977), *100 years of Wimbledon*, Guinness Superlatives Ltd., Middlesex, Eng.