Can Statistical Physics Help You Win an Olympic Medal...in Badminton?

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Badminton is one of the most popular sports in the world, with more than 200 million players [1]. The factors for winning a point in badminton are multiple, revealing the complexity of the sport [2]. In particular, badminton is a high-speed sport characterized by high-intensity actions interspersed by periods of effort and pause. Research has widely described the statistical aspects of the temporal structure of badminton matches [1, 3]: (i) the match duration is about 4565 minutes; (ii) the average duration of a point is approximately nine seconds; (iii) the number of strokes per point is about 810. Additionally, other studies have focused their attention on understanding the differences between these parameters when considering the context, such as gender, modalities, or situational variables (number of sets, intervals of play, quality of opponent, etc.) [4, 5].

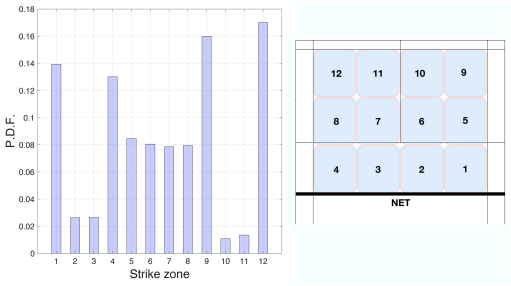

Fig. 1. In the left plot, we have the probability distribution function (PDF) showing the percentages of strokes performed in the 12 predefined zones of the court (see the right plot for the location of each zone).

The aim of the current study [6] was twofold: (i) to investigate the distribution of the strike positions of badminton players while quantifying the corresponding standard entropy and using an alternative metric (spatial entropy) related to winning and losing points and random positions; and (ii) to evaluate the standard entropy of the receiving positions.

With the datasets of 259 badminton matches, we focused on the positions of players strokes and the outcome of each point. First, we identified those regions of the court from which hits were most likely to be struck. Second, we computed the standard entropy of stroke positions, and then the spatial entropy, which also considers the order and clustering of the hitting locations in a two-dimensional Euclidean

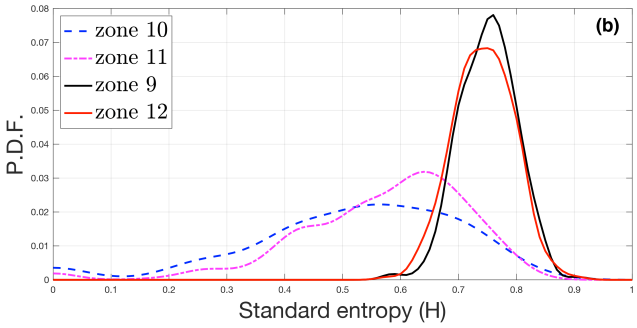

Fig. 2. PDF of the receiving entropy for the most different zones: 9, 10, 11, 12.

space. Both entropy quantifiers revealed high uncertainty in the striking position; however, specific court locations (i.e., the four corners) are preferred over the rest (see Figure 1). When the outcome of each point was taken into account, we observed that the hitting patterns with lower entropy were associated with higher probabilities of winning points. On the contrary, players striking from more random positions were more prone to losing the points (see Fig. 2).

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