

Reliability of selected table tennis performance indicators

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Abstract: Over the last few years, scientific research in sport has focused in detail on a branch of performance analysis, namely notational analysis. Notational analysis allows the collection of interesting data about matches and also provides good feedback information to improve technical and tactical aspects. However, the analysts have to select the most important performance indicators and first of all, they must evaluate the reliability of the data. The aim of this study is to evaluate the intra and inter-observer reliability of some of the most important performance indicators in table tennis. Inter-observer reliability: 10 highly experienced coaches (third national level, high level) have analysed the first set of men's table tennis singles final of the 29th Olympic Games in China. They collected data about: players, different strokes and efficacy (5 values: #, +, 0, - and =). Intra-observer reliability: an observer (table tennis coach) watched the full match three times and noted: player, footwork/step, stroke modality and impact point of the ball on the table (6 areas). Intra and inter-observer reliability have been evaluated by Krippendorff's Alpha, calculated through the statistical software R. Krippendorff's Alpha could range from 1 (perfect reliability) to -1 (total disagreement). A good reliability is attained for Alpha = 0.8.

Concerning the inter-observer reliability, the values of Alpha were 0.894 for different kinds of stroke, and 0.469 for efficacy (3 levels: +, 0 and -). The intra-observer reliability analysis showed the following values: Alpha=0.992 for strokes, Alpha= 0.99 for different kinds of step and Alpha= 0.997 for impact point of the ball on the table.

The only performance indicators without good reliability were connected with the evaluation of the efficacy of intermediate strokes. The other indicators, assessed by inter and intra-operator comparisons, showed very good reliability. These results allow us to state that the selected performance indicators can be taken into account in table tennis notational analysis.

Keywords: reliability, performance analysis, performance indicators, table tennis

1. INTRODUCTION

In recent years, scientific research, in the field of sport, has concentrated on a specific area of performance analysis, called notational analysis. Some authors have published articles and books internationally dedicated to notational analysis [1, 2, 3]. This analysis tool allows the collection of a lot of very interesting data about the phases of play in each sport, to provide important information for improving both the technical and tactical aspects of play. O'Donoghue [4] explored match analysis in racket sports and entering the world of table tennis, Baca [5] underlined the importance of tools to aid the feedback of important information to improve both training and competitive results. By analysing the literature, we can find several authors who suggest the use of software or tools for the collection of data during table tennis competition [6, 7, 8, 9, 10]. It is important to remember that before the collection of any data, it is necessary to decide which performance indicators to observe. Choi [11], O'Donoghue [12] and Hughes [13], stressed the importance of the preliminary work, which a performance analyst must carry out in the selection of the most important and interesting indicators. The analysts must first select the indicators and then evaluate the reliability of the data. Wilson [14] has studied this subject, evaluating the reliability and validity of data collection in notational analysis in table

tennis, performed with a software system.

It is important to stress that the reliability of the data collection can be measured as both inter-observer and intra-observer and that there are many interesting indicators (shots, steps, impact position of the ball, efficacy, results, rally time, etc.).

The aim of this study is to assess intra and inter-observer reliability of some of the most important performance indicators in table tennis.

2. METHODS

As far as the study of inter-observer reliability is concerned, the subjects used in the study were 10 highly experienced Italian coaches, members of the third national level (the highest level). The subjects were shown the first set of the men's singles table tennis final, at the 29th Olympic Games in China (2008). The video was taken from television footage and was shown twice in slow motion. The 10 subjects were asked to perform a written notational analysis, noting in sequence for each action: the player's name, type of stroke and efficacy evaluation.

Players: the two athletes were easily distinguished by the colour of their shirts. The analysts were asked to only note the athlete's initials, to speed up the data collection (L.M.: number 2 in the world ranking and H.W.: number 1, at the time of the match.)

The strokes were recorded and identified, following the classification most widely used at international level. Tepper [15] and Molodzoff [16] classify the strokes, distinguishing between forehand and backhand:

- service
- push
- topspin
- topspin counter topspin
- block
- flick or flip
- drive
- smash
- lob

The 10 coaches were asked to express their opinion of the efficacy of the stroke, using symbols they were previously shown. Each stroke was given a symbol, corresponding to a precise meaning [17], shown in the table below:

Symbols	Description
#	perfect execution, winning stroke, assigns the point
+	good execution of the stroke, creating a favourable situation
0	neutral stroke, transition action, without advantages
-	negative execution of the stroke, creating a better situation for the opponent
=	error, mistake, losing stroke (out, net, etc.), assigns the point to the opponent

It is important to note that the extreme symbols (# and =) are directly connected to the awarding of the point, whilst the other symbols are based on personal opinion.

From the methodological standpoint it should be noted that the video was shown at half speed, using the Kinovea software.

Each of the highly experienced coaches was asked to watch the video twice and to record the requested information. At the end of this exercise, all the data were transferred in an Excel sheet and for each observer three columns were created, into which the following data were recorded: player, type of shot and efficacy.

As far as intra-observer reliability is concerned, a highly experienced coach of national level observed the entire men's singles table tennis final, at the 29th Olympic Games in China (2008). The video was viewed three times, with 3 days between each viewing. The video was taken from television footage and was shown in slow motion, at half speed with the Kinovea software. The observer was asked to perform a written notational analysis, distinguishing for each action, in chronological order: player, type of step, shot and impact point of the

ball on the table (6 areas).

The strokes were identified using the same classification described in the inter-observer analysis: service, push, topspin, topspin counter topspin, block, flick or flip, drive, smash and lob [15, 16].

Movement and footwork were identified using the classification proposed by Malagoli Lanzoni [18]:

1. One step
2. Short and medium steps
 - a. side to side or "chassé"
 - b. slide step
 - c. pivot
3. Crossover

This classification is based on a right-handed player and it could also be applied to a left-handed one in perfectly symmetric way. The following is a brief description of the various types of movement:

One step: a small step, starting from the ready position or during other game phases, keeping one foot still and moving the other towards the ball. The foot that plays the movement should immediately return to the ready position. This type of step is mainly used to return short services or balls played very close to the net [18].

Short and medium steps: these steps allow players to cover short or medium distances very quickly towards the ball for playing strokes.

Side to side or "chassé": if the movement is on the right side, the left foot moves first and has to get close to the right one, which will move on the right side. So that, at the end of the movement, the player will get back to the ready position.

Slide step: if the movement is on the right side the right foot moves first, followed by the left one which will slide in the same direction. So that, at the end of the movement, the player will get back to the ready position.

Pivot: is the movement by a player who wants to play a forehand stroke from the backhand corner. This step could be done following the chassé or slide step technique. It is especially useful for playing the forehand topspin stroke from the backhand corner.

Crossover: is used when the player has to cover a long distance in a short time. Crossover footwork should not be used for short distances.

As far as the impact position of the ball on the table is concerned, Leser [19], Baca [5, 6] and Kornfeind [20] have studied the equipment and methods needed to detect, with precision, the impact zone of the ball on the table. This study is based on the distinction proposed by Wu Xiao [21], which suggests dividing each half of the table into 6 equal parts, 3 close to the net and 3 at the end of the table. The zones were numbered from 1 to 6 and the following diagram (Fig. 1) was used as a reference for data collection:

1	6	5
2	3	4
4	3	2
5	6	1

Fig. 1 The 6 areas taken into account

The observer watched the video in the same way as previously described and the data was transferred in an Excel sheet, to allow further analysis.

It is important to note that in both the inter-observer and intra-observer analysis, the various indicators were carefully illustrated and a training session was held, before conducting the data collection.

Once the data collected was compiled in Excel, an evaluation of its reliability was conducted using Krippendorff's Alpha Coefficient [22, 23], calculated by the statistical software R.

3. RESULTS

Before showing the results of the data analysis, it is fundamental to underline that the Krippendorff's Alpha Coefficient could range from 1 (perfect reliability) to -1 (total disagreement). A good reliability is attained for Alpha = 0.8. It is possible to consider all Alpha values, equal to or greater than 0.8, as good reliability results.

Results referring to inter-observer reliability:

- different kinds of stroke, Alpha=0.894
- efficacy (+, 0 and -), Alpha=0.469

Results referring to intra-observer reliability:

- different kinds of stroke, Alpha=0.992
- different kinds of step, Alpha=0.990
- impact point of the ball on the table, Alpha=0.997

We must not forget to stress the fact that in all the analyses carried out, both the 10 coaches and the single observer always correctly recognised the player executing the action, without making any mistakes.

4. DISCUSSION

The inter-observer analysis showed that a good reliability exists in distinguishing the different strokes used in table tennis (Alpha=0.894). On the contrary, the reliability of the evaluation of the efficacy of the strokes is low (Alpha=0.469). These results indicate the need to improve and standardise the capacity, on the part of the technicians, to interpret the efficacy of the strokes in table tennis, or to simply limit the interpretations to a clear result (# or =). The calculation of the reliability could be considered, in the future, as a tool for assessing the preparation of the coaches.

Looking at the results from the data collected from the intra-observer analysis, we can see a good reliability for all the preselected performance indicators (type of stroke, different kinds of step and impact point of the ball on the table). This shows good preparation on the part of the observer and the possibility to consider the preselected indicators as good.

The results of this study allow us to know which performance indicators can be used safely and which can be used with caution.

This allows performance analysts to obtain a more reliable analysis, which allows the collection of data for improving training and competitive results.

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