



New technologies applied to tactical analysis in tennis.

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ABSTRACT

The process of sports coaching aims to take a player to his/her maximum performance level. This goal - which involves a multi-disciplinary team (coach, trainer, medical doctor, physiotherapist, psychologist, family...) - must be carefully supervised and sequenced. Sport performance is determined by the optimal relationship between the physical, tactical, technical, and also the psychological components of the player (Sanz, 2011). Related to these components, a key guiding element in a player's development process is the analysis and evaluation of any or all of these areas. Technological tools should be used to access as much information as possible, which can later be interpreted by the coach or team. This article presents new technologies that are being used to analyse tennis tactics and reviews the different papers that have been published in this field.

Key words: Tactics, Analysis, Measurement instruments, New technologies.

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INTRODUCTION

The evaluation and analysis of tennis tactics is one of the least developed disciplines of analysis when compared to physiological analysis, kinematic and technical analysis among others. The "analyst" joined professional sport some time ago and as suggested by Reid (2011), this member will become more and more involved in the multidisciplinary teams that accompany and advise both the player and the coach.

The systems that analyse tennis tactics can be divided into two main categories, direct, which are applied during the game situation and indirect, the ones that are obtained after the analysis of the actions recorded in audio-visual systems. In both cases, observational methodology, as a method to record and analyse, is one of the main pillars of the process.

As Sanz (2011) pointed out, observation is a process that provides measurable and quantifiable information about what is being evaluated. Observation must be objective, using a number of observation tools and/or techniques that provide information for diagnosis and intervention.

Usually, the observation by the technician depends on the coach's vision of what he intends to study, that is, the "clinical eye" of the coach. This system has a very important intrinsic value, given the knowledge of the coach about the situations

that need to be evaluated and analysed. However, as regards accuracy in the evaluation, the sensory constraints of our capturing systems may leave information gaps in those observation processes and, therefore, the result can be biased, conditioned and not fully systematic. With regard research, as stated before, it will be the observational methodology that will provide the background to design investigations and analysis. Some research work on tennis tactics using rigorous observation methodologies includes (Gorospe, G.1999; Gorospe et al., 2005; Garay, O. 2003). Anguera, (1990; Anguera et al., 2000) describes the methodological procedure to provide scientific rigour to observation as a measurement tool.

The main systems to analyse tactics using tools or supporting instruments will be discussed below. They will be described and grouped in different blocks.

RECORDING TOOLS FOR TACTICAL ANALYSIS

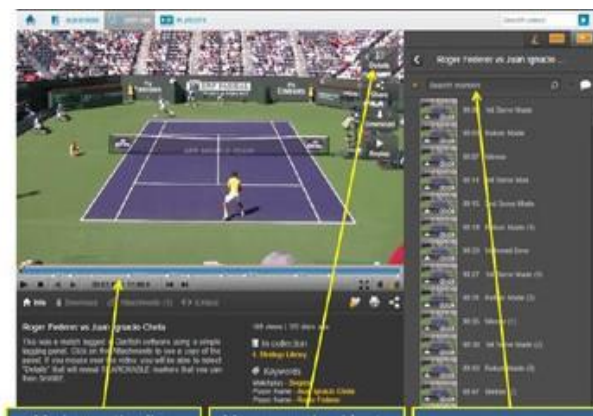
Manual recording systems

As opposed to the old 'copybook', where the coach would jot down the player's strengths and weaknesses, and analyse movement and behaviour in specific situations, there are now smartphone based applications and tools to record sets of relevant information or even just the score of a tennis match in real time. It is in this category that we find programmes like

Protracker (<http://www.fieldtown.co.uk/>) or Tennis Trakker (<http://www.tennistrakker.com/>). Even though these programmes are useful to gather global data, they are limited in that they do not associate images nor do they make any careful analysis of strokes.

Video capturing systems

Until not long ago, the main objective when analysing tennis videos was to carefully observe the players' technique and to refine minor defects in the biomechanics of the stroke. However, the currently used computer programmes to label different times or situations in a match have also begun to contribute to tactical analysis and have helped to identify behaviour patterns from those video sequences.



Screen shot image of Dartfish analysis software.

Given the difficulty to apply labels automatically, most of the programmes need an operator to organize those entries manually. This is the case of Dartfish (<http://www.dartfish.com>), a programme that not only studies the mechanical aspect of the stroke but also permits to label for further study. So, at the end of a match, the player can see those sequences that he is interested in, without having to watch the whole match, whilst also combining qualitative and quantitative analysis of the number of repetitions of certain important actions. Over time, more and more programmes are emerging in the market that will help coaches to make these records for further analysis (InterplaySports: <http://www.interplay-sports.com>; GPSports: <http://www.gpsports.com>; NACSport: <http://www.nacsport.com>; Sportscode: <http://www.sportscode.com>; Gamebreaker: <http://www.sportstec.com> among others).

At the same time, the technological community has been studying different and totally automatic alternatives for several years (Almajai et al. 2010, Christmas et al. 2005). One of the advantages of these systems is that apart from allowing intelligent labelling of tennis sequences, they provide a number of kinetic data sets such as the players' average speed, acceleration, kilometres run, etc. And all this can be achieved without the player carrying a sensor, however the use of

sensors will inevitably lead to much more accurate analysis. With technological advances, devices are getting smaller and smaller, and can record information about the different physiological (heart rate) and kinematic (accelerometers, GPS) variables together with spatial information.

Using statistical analysis

One of the aims of researchers and IT application developers for tactical analysis tools is to yield both precise and immediately available information in such a way that it is useful for both the coach and the player. A number of applications and records for statistical analysis have followed one another, as for example the model of Markov chains set by Schutz (1970), with a probability constant of winning a given point. Another example is the Klaassen & Magnus IT programme (2003) called TENNIS PROB, which quickly and automatically calculated the probability of winning a tennis match. There is a line of statistical and probabilistic analysis studies like those of Gale, 1971; Norman, 1985; George, 1973, y Barnett, 2005, among others.

Data mining and artificial intelligence

Data mining has long existed in other fields like biomedicine and customer relationship management to name just two. Its main objective is to discover data patterns and possible relations that can result in new knowledge. These relations can then also be used to predict future results. The sport world today sees a great number of statistics for each player, team and season etc, and the use of data mining in sport has progressively increased. The main targets are scouting new players, predicting the results and measuring performance. However, there is relatively little existing research whereby data mining is used to analyse tactical patterns (Terroba et al. 2010, Vis et al. 2010).

Paradigm shift

Regardless of the technical advances to associate manual or automatic labels and video sequences, and whether it is possible to get tactical information from huge databases with statistical information, the main issue is to set key criteria to make an analysis. Some authors point out that it is necessary to select the information that is really interesting and useful to a particular player or coach, out of the information available, (Barnett & Clarke, 2005; Barnett et al., 2008; Gillet et al., 2009; O'Donoghue, 2001; Pollard et al., 2010; Reid et al., 2010, Over, & O'Donoghue, 2008; 2010).

From this point of view, the authors can make a tactical analysis on the basis of situations where a player is off-balance, or stressed, instead of taking the standard classifications such as winners/ forced errors/ unforced errors.

This provides a much more real vision about what is happening on court and can help us to understand why a player is winning or losing. It seems reasonable to think that the regular statistics we get, or even some IT programmes provide biased information, since they lack what any measuring instrument must provide: validity, reliability, discriminability and objectivity.

It is on this aspect that tactical analysis for the future needs to shed more light, breaking down actions not when they are over but from the moment the player changes his situation from balanced or unbalanced (dominating or being dominated), so as to provide the coaches and players with the information necessary to drive the work or the strategy for future matches.

CONCLUSIONS

We believe that the near future will see an important increase in the time devoted to tactical analysis of our sport, with the help of new technologies and the increasingly portable devices (Tablets, Smartphones,...), but, no doubt, we will have to bear in mind that what really matters is not the information we get but the interpretation of really relevant and useful data that will later be applied to coaching and competition.

In this sense, and as Crespo and Sanz (2011) have remarked, we agree with Norton and Clarke (2002) who state that it is necessary to improve the way we retrieve information as well as the depth of the information to continue to make a deeper analysis. This will help us to disregard and demystify some deeply rooted tennis theories like the existence of a "momentum" in the sequence of the points won in a match. As O'Donoghue and Brown (2009) state in connection with the sequence of singles service points, they conclude that there is no momentum in the sequence of points analysed in singles and, that the belief of players, coaches, sport journalists and spectators that there is momentum in tennis is mistaken.

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