THE EVOLUTION OF THINKING IN TACTICAL DECISION-MAKING IN SOCCER
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ABSTRACT: This study aimed to verify the evolution of thinking in tactical Decision-Making in soccer players. The declarative decisions of 90 players evolving in five training categories of a professional club in Brazil were recorded. The statements were distributed into four categories (monitoring, evaluation, prediction, planning) and an inter-age level analysis was performed. Descriptive analysis was performed and the Chi-square (x²) test was used to observe the differences of frequencies of statement types through the categories. A significance level of p<0.05 was adopted. Significant differences were found through age levels. Such differences suggest an evolution of the thinking of the tactical decisions over time.

Keywords: tactics, thinking, decision-making

INTRODUCTION: Visual information perceived during performance has long been studied to understand how experts make better decisions. Though, classical rationales in general study areas may not allow to underpin the elements of tactical decisions. For this reason, sport has been of particular interest due to the representation of thinking in the form of an action (Ericsson & Simon, 1993; Júlio Garganta & Gréhaigne, 1999; Júlio & Araújo, 2005; A. M. Williams & Ericsson, 2005). This study assumes that thinking is part of decision-making process, and that the study of thinking may portray the mechanisms underlying information processing to make a tactical decision in soccer.

Due to difficulties related to the study of decision-making in situ, McPherson (1999a, 1999b) has proposed the utilization of verbal procedures to identify domain-specific information inherent to decisions with methods realized in laboratory. These methods enlighten the cognitive processes solicited by decision-making and allows to identify differences in thinking processes between subjects of different levels of experience (Vaeyens, Lenoir,
Williams, Matthys, & Philippaerts, 2009; Van Someren, Barnard, & Sandberg, 1994; A. M. Williams & Ericsson, 2005). Nevertheless, such studies do not take into account the progression of decision-making through time, that is in training categories (Ford & Williams, 2012; Roca, Ford, McRobert, & Williams, 2011). The analysis of this progression would clarify how decision-making evolves in time and what impact has the gain of experience on tactical decision-making.

The statement types identified by Ward, Williams, and Ericsson (2003) reflect cognitive processes, mainly manifested in executive functions used in the making of a decision. Executive functions are defined as a module that involve “inhibition, working memory, and organizational strategies necessary to prepare a response” (Norman & Shallice, 2000). Accordingly, the brain development during childhood and adolescence is characterized by a major growth in the frontal lobe, where most of problem solving processes such as planning are localized (Stuss & Alexander, 2000).

The aim of this study is to verify the evolution of thinking over age levels, as subjects are asked to make a tactical decision when watching play sequences in soccer, with respect to the dominant statement types in verbal reports.

METHOD: The present work was submitted and approved by the Committee of Ethics in Researches with Human Beings of the Federal University of Viçosa (CEPH: 403.759). The legal tutors of each players signed an informed assent form before the realization of the tests, allowing the participation of the players to the study and the usage of the data for research purposes. The sample was composed of 90 male soccer players of the following categories: Under-11 (n= 18), Under-13 (n= 18), Under-15 (n=18), Under-17 (n=18), and Under-20 (n=18) of a Soccer Club affiliated to the Soccer Federation of the State of Rio de Janeiro in Brazil (Federação de Futebol do Estado do Rio de Janeiro, FERJ), and to the Brazilian Soccer Confederation (Confederação Brasileira de Futebol, CBF).

Each subject was presented the same sequence of eleven video soccer plays of 8 to 12 seconds each, which ended by a frozen image of 2 seconds. The subjects were asked to tell what they would have been doing if they were the player in possession of the ball when the image had fixed. The answers were recorded and analyzed according to Ward’s adaptation (Ward et al., 2003) of the protocol elaborated by Ericsson and Simon (1993).
content of the provided reports were distributed in four main categories of statements: (a) monitoring statements, described as the recalls to current actions or descriptions of current events; (b) evaluations, described as some form of comparison, assessment, or appraisal of events that are situation-, task-, or context-relevant; (c) predictions, described as anticipation or highlights of future or potential future events; and (d) planning statements, described as the decision(s) on a course of action in order to anticipate an outcome or potential outcome of an event (Roca et al., 2011). Each scene was ascribed the dominant statement type amongst the four listed above when analyzing the verbatim of the justification of their tactical decision. Each answer was compared to the four most relevant options determined by the unanimity between a panel of experts. In the present study, the frequency of each dominant statement type was calculated for each subject.

Descriptive analysis provided means and standard deviations. To calculate the differences between frequencies of dominant statement types, statistical analysis was conducted with the Chi-square test, using the age categories (Under-11, -13, -15, -17, and -20) as the between-participant factor, and the verbal statement type (monitoring, evaluation, prediction, planning) as within-participant factors. All the statistical procedures adopted the significance level of $p < 0.05$ and were performed on SPSS (Statistical Package for Social Science) for Windows®, version 20.0.

**RESULTS:** Table 1 shows the means and standard deviations of frequencies of the dominant statement types, in each age level. Figure 1 presents the means and the trend lines of the dominant statement types, also for each age level.

<table>
<thead>
<tr>
<th></th>
<th>Under-11 (n = 18)</th>
<th>Under-13 (n = 17)</th>
<th>Under-15 (n = 18)</th>
<th>Under-17 (n = 18)</th>
<th>Under-20 (n = 18)</th>
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<tbody>
<tr>
<td><strong>Monitoring</strong></td>
<td>3.94 (± 2.94)</td>
<td>3.12 (± 1.996)</td>
<td>1.72 (± 1.447)</td>
<td>3.39 (± 1.754)</td>
<td>2.39 (± 1.819)</td>
</tr>
<tr>
<td><strong>Evaluation</strong></td>
<td>3.5 (± 1.917)</td>
<td>4.29 (± 1.312)</td>
<td>4.72 (± 2.445)</td>
<td>4.39 (± 1.65)</td>
<td>3.78 (± 1.437)</td>
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</tbody>
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Table 1 - The means and standard deviations of the frequencies of the dominant statement types, for each age level.

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<tr>
<td><strong>Prediction</strong></td>
<td>1.89 (± 1.844)</td>
<td>2.29 (± 1.404)</td>
<td>2.94 (± 2.578)</td>
<td>2.17 (± 1.618)</td>
<td>2.83 (± 1.823)</td>
</tr>
<tr>
<td><strong>Planning</strong></td>
<td>1.67 (± 1.844)</td>
<td>1.24 (± 1.147)</td>
<td>1.61 (± 2.118)</td>
<td>1.06 (± 0.998)</td>
<td>2 (± 1.815)</td>
</tr>
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Figure 1 - The means and trend lines of frequencies of dominant statement types, for each age level.

Several significant differences were verified through age categories: players provided different dominant statement types as the age level increased. Differences were first found in monitoring statements, where $U_{-11} < U_{-15}$ and $U_{-20}$ (p=0; p=0.009), $U_{-13} > U_{-15}$ (p =
0.016), U-15 < U-17 (p = 0.002). Monitoring trend lines shows a decreasing tendency of that type of statement in time. Second, more differences were found in prediction and planning statements, where U-11 < U-15 in prediction (p = 0.042); U-13 < U-15 (p = 0.047), and U-17 < U-20 in planning (p = 0.022). Trend lines show a general increase of prediction statements and an ascendant curve for the planning statements over time.

According to the trend lines, it also seems that the Under-15 age level is a turning point in the way the subjects verbalize their decisions: the decrease of monitoring statements slows down; evaluation statements start decreasing; prediction statements increase becomes alleviates; and planning statements increases.

Such as mentioned by Mata and collaborators (2011), it is expected that the decision-making skills are not yet developed as much as in their elder parts, and due to the likely proportional amount of practice, young players know less than older players. The increase of prediction statements is in line with the evidence that the accumulation of soccer activity time seems to improve anticipation (Roca, Williams, & Ford, 2012). In that sense, a formal training context features competition that encourages organized practice, that is aimed to make the team win (Ford & Williams, 2012). Plus, this whole process is in concert with the mutual relation between “doing” and “knowing”, thus in this case, to do repeatedly would have enhanced the knowledge of the game (Allard & Starkes, 1991; M. Williams & Davids, 1995). Finally, to observe more planning and less monitoring is in line both with the players’ neuropsychological development and the experience, since more experienced subjects show ability to decide upon likely consequences, and imagine what result could happen beyond one action despite the uncertainty of the course of the events in the play (Deleplace, 1996; Stuss & Alexander, 2000).

**CONCLUSION:** It was verified that players do present different thinking over time, and that these differences allow the player to take more accurate decisions as he undergoes formal training. This implies considerations in recruitment, as for instance, thinking may allow a better understanding of the given tactical directives as well as a better communication with teammates, in order to solve problem and subscribe to a game model (J. Garganta, Guilherme, Barreira, & Rebelo, 2013).
References


Ford, P. R., & Williams, A. M. (2012). The developmental activities engaged in by elite youth soccer players who progressed to professional status compared to those who did not. Psychology of Sport and Exercise, 13(3), 349-352.


