VISUAL SEARCH BEHAVIOUR AND TIME TO RESPONSE: ARE THEY RELATED IN DECISION-MAKING?

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ABSTRACT: The aim of this study is to examine whether the visual search behaviour in a decision-making test might influence the time to the start of the correct verbal response. The sample comprised 89 male soccer players of the youth teams of a Brazilian first division club. The instrument used to collect and analyse data was the Mobile Eye Tracking – XG. For the assessment of decision-making, a video based test was used. The visual search behaviour was determined by the percentage of the time of fixation on predefined locations in the scenes. In this study, five locations were defined: i) the player in possession of the ball; ii) ball; iii) teammates; iv) defenders; and v) space. Data distribution was analysed through the Shapiro-Wilk test. To compare the groups with faster and slower responses, we used the t test for independent samples. Statistical analysis was performed through SPSS 18.0 software. Results showed that players with faster response spent more time fixating on attackers, defenders, and space when compared to players with slower response. It was concluded that the time for the start of the response in a decision-making test influences the visual search behaviour of youth soccer players.

Keywords: Visual Search Behaviour, Time of Response, Soccer.

INTRODUCTION: Decision-making in sports has been considered an important field of study in order to understand the patterns that involve with high performance achievements (AFONSO; GARGANTA; MESQUITA, 2012). In this sense, the perceptual-cognitive system was proved to play an important role in decision-making of high level athletes (WILLIAMS; ERICSSON, 2005). This system is responsible for gathering and processing the relevant information from the environment, necessary for athletes to make their decision. The visual search behaviour is considered a part of this system and also an important source of information. An important study in this field carried out by Ward and Williams (2003)
demonstrated differences in visual search behaviour comparing players of different levels of expertise levels and also from different ages.

Another variable that seems important for achieving elite level in sports is the time of response. As long the sports evolve, players are required to correctly respond to the environmental stimuli as quick as possible in order to take advantage from their opponents (ROCA et al., 2011). However, up to date few studies were carried out that evaluated the role of visual search behaviour the time of response. Therefore, the aim of this study is to examine whether the visual search behaviour influence the time to the start of the correct verbal response in a decision-making test of youth soccer players.

METHODS

Participants: The sample comprised of 89 male soccer players of the youth teams of a Brazilian first division club, with a mean age of 16.69 ± 3.11 years. As inclusion criteria, all players should participate in systematic training, with at least three weekly sessions of 1 hour and 30 minutes each and participate in national-level and/or international-level competitions.

Participants signed an informed consent, reporting they were aware of their participation in this research. All the procedures were conducted according to the norms established by the Resolution of the National Health Council (466/2012) and by the Declaration of Helsinki (1996) for research with human beings. The project had the approval of the Research Ethics Committee of the Universidade Federal de Viçosa (n. 412.816 - 08/10/2013).

Procedures: For the evaluation of decision-making, we used a video based test proposed by Mangas (1999). The decision-making test evaluates the working memory to recognize certain environmental cues in match situations, and decide what are the best options for action. The test consists of 11 offensive actions scenes video of 11 vs 11 of soccer matches, recorded and watched by a third-person perspective (TV camera), with duration ranging from 5 to 13 seconds each scene. For the application of the test, the scenes were projected on a screen.

During the experiment, 11 video sequences were presented and paused at a time prior to the end of an action. Once the video was paused, the subject was instructed to
respond as quickly as possible to the question "what should the ball carrier do" in each given situation. After recording the test answers, the obtained audio material was transcribed into text. The transcribed data was analysed and compared to the official expert panel test developed by Mangas (1999). Only the right responses were considered for analysis.

**Variables:** The first variable was the “time to correct decision time”, measured in seconds. It was defined as the time from the end of the video to the start of the participant’s verbalization in correct responses. It was divided into three groups: faster, intermediate and slower. Only the faster (n = 30, $M = 1.67$, $SD = .32$) and the slower (n = 30, $M = 5.89$, $SD = 1.83$) groups were considered for analysis. The intermediate (n = 29, $M = 2.66$, $SD = .46$) group was excluded of the analysis.

The second variable was the "percentage viewing time" per location in the scene. The preferred fixation location on the screen is determined by the percentage of the time of fixation on predefined locations in the scenes. In this study, five specific locations were defined for analysis: i) the player in possession of the ball (PiP); ii) the ball (e.g. ball flight); iii) the teammates (attackers); iv) the defenders (opponents); v) and the space (e.g. space areas in the field where no player is located). The fixation was analysed using the Mobile Eye Tracking-XG and was defined as the condition in which the eye has remained stationary for about 1.5 degrees of change of tolerance and for a period equal to or greater than 120ms, or three video frames (WILLIAMS; DAVIDS, 1998).

**Statistical Procedures:** Data distribution was analysed using the Shapiro-Wilk test. To compare the groups with faster and slower responses, we used the t test for independent samples. The analysis of the reliability regarding visual search rates was performed by three trained observers. We used the Cohen's kappa test and a value of 12.72% of fixations compared with the first evaluation. The reliability values of these evaluations were 92.09% for intra-observer, and 88.44% inter-observer reliability. Statistical analysis were performed using SPSS 18.0 software and the significance level was p<0.05.

**RESULTS:** The results displayed significant differences in three categories. The players with faster response spent more time fixating the attackers ($M = 17.35\%$, $SD = 6.49$), t(58) = 1.31, p = .021; defenders ($M = 12.51\%$, $SD = 8.00$), t(58) = .46, p = .003; and space ($M = 25.61\%$, $SD = 7.62$), t(50) = 1.91, p = .018 compared to participants with slower responses.

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These findings showed a difference in visual search behaviour employed between both groups.

Figure 1: Means and SD for percentage of viewing time per location regarding the correct decision time. Significant differences (p<0.05) were indicated by *.

A previous investigation by Roca and colleagues (2011) showed that skilled soccer players employed qualitatively different visual search behaviour compared to the less skilled participants. It was found that the fixation locations that provide more relevant information for a correct decision-making were the attackers and space. These results corroborate with our findings and also indicate that players with faster response are able to acquire more relevant information from the environment with their visual-perceptive system. It is assumed that as they looked more often to those important cues, they therefore made the correct decision faster than players who gathered less relevant information and also had slower response. The group with faster response employed a more purposeful visual search strategy and extracted the relevant information quicker than their counterparts.

In regards to the time to response, a study carried out by Ward and Williams (2003) showed that elite youth players responded significantly quicker than the sub-elite group in a
video based test. It indicates that more knowledge leads to a quicker processing of environmental cues. The results of our experiment, that considered only correct responses for analysis, might suggest that players that take less time to respond have also greater knowledge than those from the slower response group, which enable them to respond quicker. This is suggested because more knowledge enables players to: i) pick up more meaningful information; and/or ii) identify relational information (patterns of play) (NORTH et al., 2011). Both of these advantages might leads to a quicker correct response in such tasks.

CONCLUSION: It is concluded that the visual search behaviour in a decision-making test influence the time to the start of the correct response of youth soccer players. Players with faster response spent more time fixating on attackers, defenders and space compared with the slower response group. This indicates that the group with faster responses employed a more purposeful visual search strategy for decision-making.

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