# RELIABILITY OF A NEW METHOD TO ANALYSE AND TO QUANTIFY ATHLETES' DISPLACEMENT

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This investigation was to assess the accuracy of the local position measurement (LPM) by a semi-auto tracking software (TACTO) using a single video camera. The reconstruction of virtual coordinates into real coordinates was made using DLT-2D (Planar direct linear transformation), with algorithms adapted from the ISB in ‚MATLAB' software. Seventy-eight digitalization's were made by six subjects. Correlation coefficient of Pearson (r), intra-class correlation coefficient (ICC) and the relative technical error of the measurement (ETM) were used to analyze the relationship between coordinates obtained. The ICC was 0.974 for x component and 0.984 for y component. The ETM was 1-1.7% for x coordinate and 0.5-1.0% for y coordinate. The results, demonstrate the intra-operator and inter-operators reliability of the LPM by TACTO.

**KEYWORDS:** TACTO; Reliability; Semi auto-tracking Digitalization; Soccer.

**INTRODUCTION:** Video analysis in sports can be used to estimate a player's displacement. From video analysis is difficult to obtained information in real time, and errors from the process of digitalization process are a important disadvantages of this method (Edgecomb & Norton, 2006). This method uses a semi-automatic tracking and is based on computer mouse position on screen. Using different velocities of video clip is possible to follow the payers on the screen with some accuracy. The evaluation of the reliability of this process is vital; otherwise the results should be utilized with precaution (Dobson & Keogh, 2007). Carling et al. (2008) propose to evaluate intra-user and inter-user reliability of the video images analysis system in different exercises when displacement is measured. Intra-user reliability consists of the analysis of the same athlete displacement by the same user at different times; whereas inter-user reliability consists of the analysis of the same athlete displacement by different users. The methodology used by 'TACTO' and '2D-DLT' is based on algorithms developed in 'MATLAB', which fits-itself in the assembly of systems that lack scientific validation and justifies this study. It also complements the work already published of validation of coordinates obtained by a dGPS receiver.

**METHODS:** Six students volunteered to participate in this study. All the participants made thirteen digitalizations on different days at different hours using the same video clip and the same displacement made by a player in a soccer field. The displacement included an assembly of seven exercises, with and without a ball. The procedure was explained to the participants and they had a minimum break of one hour between sessions of consecutive digitalization. Each user follows the players (tracking) with the computer mouse ('semi auto-tracking') the middle point between both feet. The 'x' and 'y' coordinates of all digitalizations were used to analyse the correlations between operators and intra operators.

**RESULTS:** The Pearson (r) correlation between digitalisations was significant, 0.994 ± 0.005) for 'x' components and 0.948 ± 0.047 for 'y' component from digitalization inter-operators and 0.995 ± 0.002) for 'x' components and 0.924 ± 0.059 for 'y' component from digitalization intra operators. The relative technical error of the measurement (ETM), was 1-1.7% for x coordinate and 0.5-1.0% for y coordinate between operators.

**DISCUSSION:** The lower correlation from novice users (less experience on digitalization technique) emphasises the importance of the experience of digitalization for more consistency and reliability during tracking. The values indicate good intra-user consistency (> 0.900) in agreement with previous studies (Collins & deLuca, 1993; McInnes et al., 1995;

Hopkins, 2000; Squeaked et al., 2000; Carling et al., 2008). The intra-class correlation coefficient (ICC) was 0,995 correspond of a 'excellent consistency' presented by Collins and deLuca (1993) and Squeaked et al. (2000). The dimension of the ETM for the coordinates 'x' and 'y', obtained in the successive digitalisations carried out by each user, and the coordinates obtained in the first digitalization (on average between 1.0 and 1.7% for the coordinate 'x' and between 0.5 and 1.0% for the coordinate 'y') are clearly lower than the 5% defined by McInnes et al., (1995) and MacLeod et al.,(2009) being also lower than the 2,4-3,3% obtained by Edgecomb and Norton (2006) in the evaluation of intra-user consistency.

**CONCLUSION:** The high Pearson's correlation coefficient (r) values, the intra-class correlation coefficient (ICC) and the relative technical error below 2% indicated an excellent intra-user and inter-user consistency. These results highlight the value of this low-cost system for obtaining soccer players' displacements as well as the potential to be applied to other sports and in places such as the inside of buildings where is not possible to use GPS receivers. The elevated correlation reveal a small systematic errors introduced by the different techniques utilized by the users, the eyes - hand coordination, of the visual sharpness and of the standards of concentration don't change the accuracy of tracking from different operators. The excellent intra-user consistency indicates the value of this technology in digitising displacement.

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