# A METHOD OF INVESTIGATING MOVEMENT OF TEAM HANDBALL PLAYERS IN THE WHOLE FIELD

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For the training process in team handball it is important to know what a player does during the match and in what part of the field it is done. Through many years this information was gathered based on an 'Observation sheet' filled out during the match. For the detailed characterization of players additional film or video recording is needed (Czerwinski, 1979). If that recording is to serve in obtaining of some mechanical quantities of the movement, it must be executed in a proper manner, regarding some biomechanical needs (Miller & Nelson, 1973; Erdmann, in press).

The aim of this paper is to present a method of movement investigation during a team handball game for the calculation of basic mechanical quantities - displacement, time, velocity obtained by the players over the whole field.

## *RECORDING OF A GAME*

Television technique (videography) is already often used for analyses of sport movement. Using this technique in 1987-1988, the following matches were televised: 1) Games of the National Senior Polish Team during the International Tournament in Eisenach (GDR), 2) Games of the National Junior Polish Team during the International Tournament in Olsztyn (Poland), and 3) Ist League games of the Champion Team of Poland - GKS Wybrzeze Gdansk.

The best place to mount the camera during a general recording of the handball match would be a position above the central point of the field. However, in practice it was impossible; hence a stationary camera was placed obliquely on elevation and some distance from the field in extension of its transverse center line (see Figure 1).

Next, a wide-angle lens was used in order to cover the whole field. For an analysis of the player's technique, a second, parallel TV camera televised the game. This camera was moveable and worked close-range from the same location as the first camera.

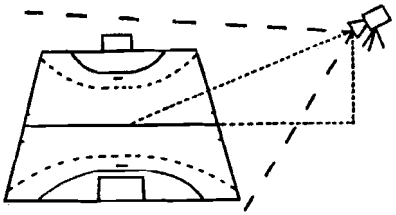

Figure 1. Placing of the camera.

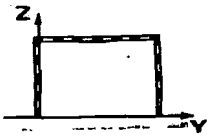


Figure 2. The goal as the system of co-ordinates.

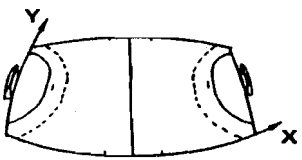


Figure 3. Deformation of the oblique televised field.

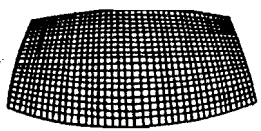

Figure 4. A net of field's co-ordinates.

## *CALCULATION OF DISPLACEMENT*

In a situation where an analysis concerns a movement of not big gabarits, e.g., a movement of goalkeeper, the goal can serve as a fixed system of co-ordinates (see Figure 2), while the field player's movement is analyzed, as the system of co-ordinates can serve the whole field.

When the field was televised obliquely, a deformation of its picture existed (see Figure 3); hence, before the match a 5 cm wide band was put on the field at every 1 m as longitudinal as well as transverse of the field and its position was televised by the camera. During the playback a transparent foil was put on a monitor's screen. On the

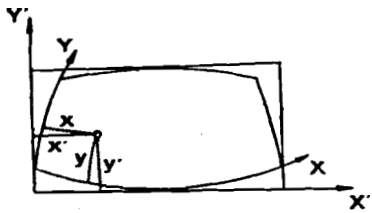


Figure 5. Rounded XY and rectangular X'Y' systems of co-ordinates.

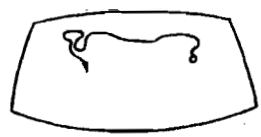

Figure 6. Displacement of a player during a 30 s period.

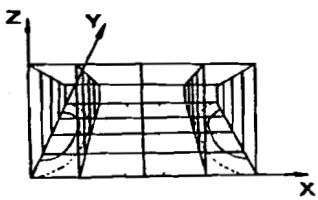


Figure 7. Cage co-ordinates.

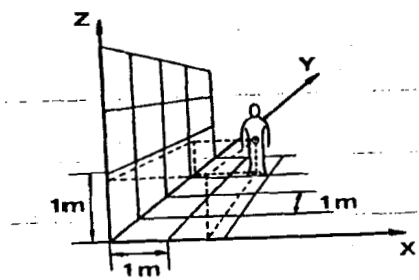


Figure 8. Calculating displacement in spac

foil a contour of the field and positions of the band were reproduced. In that manner a net of co-ordinates was obtained (see Figure 4). With the help of the net a player's position on the field was obtained. A practical accuracy of the positioning was 0.1 m. Using the computer it was possible to shift from the XY system (rounded to the X'Y' system /rectangular) of co-ordinates - see Figure 5.

A position of a player (medium point between feet) was drawn on a separate foils. In that way a series of curves were obtained (see Figure 6). Running with the cursor joined with the computer over the curve, a printout of displacement data was obtained.

For an analysis of a movement in three dimensions cage co-ordinates (see Figure 7) are needed, according to which a space displacement can be discribed (see Figure 8).

## *CALCULATING TIME AND VELOCITY*

Generally, since there were many data points, the basis of time was at first a period of 60 (on the monitor's screen time of every 1 minute was recorded by the camera), and then 30 seconds measured by the stopwatch. Additionally, randomly a movement with a time basis of 3 s was analyzed. In the case of half-minute periods, time was measured with absolute error of 0.2 s. This gave a relative error of less than 1%. In the second case, a measuring of a 3 s period of running during a rush attack with an absolute error of 0.2 s, and the relative error was about 7%.

On the grounds of the above obtained time data, and earlier obtained displacement data, mean values of the velocity for a 30 s period for the whole match were calculated. Since for the velocity of shorter time periods a bigger relative error existed, the velocity could be only estimated.

## *CONCLUSIONS*

The first estimated data show the player covers during a game (60 minutes) a distance of few kilometers using walking, jogging, medium and fast running. Because during a game many periods of inactivity exist, though mean velocity equals 1-2 m/s for longer periods of the match.

Informations obtained from the analysis of a match can serve for planning a training, which should be carried out so the player's actions during a match and training would be similar taking into account mechanical quantities characteristic for a player.

## *REFERENCES*


Czerwinski, J. (1979). ***Training in handball*** (Polish). Sport and Tourism, Warsaw.

Erdmann, W. S. (in press) Assumptions of investigations of player's movement in sport games (Polish). ***Scientific Papers of the Academy of Physical Education in Gdansk.***

Miller D. I. and Nelson R. C. (1973). ***Biomechanics of sports: A research approach.*** Lea and Febiger, Philadelphia.