Technology Applied to Soccer

-the Use of GPS to Track Workouts

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Introduction

The main objective of the coach and the athletic trainer is to optimize performance by administering stimuli and adequate recovery periods. This allows physiological adaptations to reach the maximum before a competition. An improvement in performance in only possible through an accurate dosage of training loads (Foster 1998). The administration of random volume, intensity and frequency of training is often the cause of accidents, overtraining, and an unstable psychophysical condition (Williams 1989 Budegett 1998, 2000, 2004 Halsen, Urausen 2002).

Therefore, it is necessary to quantify the exterior and interior load of training through the precise instrumentation. Outside load is assessable and measurable in a tangible way, such as distance traveled or weight lifted. The inside load, on the other hand, refers to stress caused by the administration of a given exterior load. In soccer the internal load can be measured by the heart rate or the Borg scale. The external load is measured with a GPS (Global Positioning System).

GPS (Global Positioning System)

A GPS is a system that uses a network of artificial satellites in orbit to detect the position of an object holding a receiver. The GPS system is operated by the government of the United States of America and is freely accessible by anyone. With adequate sampling rates, this allows us to understand the transitions of moving objects with high accuracy.

This device operates in two-dimensional space (Figure 2) and approximates the location of an object with the projection of its center of gravity on the pitch. The player is considered as a material point that moves in a 2D space. All the parameters that describe the external load (and its relevance) have been known for over 200 years, measuring distance, speed, acceleration, strength, work, and power.

These devices have a sampling rate that starts at 1 Hz and arrives at up to 20 Hz. Therefore, they reveal data up to 20 times per second. Comparing the accuracy of a device at 1 Hz with another 5 devices, the standard error in a test with a zero to 10m linear sprint was respectively 32.4 and 30.9% (Jennings et al., 2010). With a 10 Hz device on a 15m sprint, it comes to 10.9% (Aughey, 2011). Newer units from 10 Hz are able to measure with better precision to a speed change useful for the calculation of positive and negative accelerations, while the unit at 5 Hz is not so accurate (Aughey and Varley, 2012).
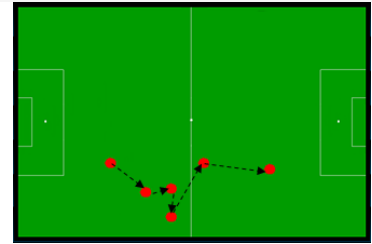

Figure 2 Vision 2D displacements of a player

REPORT

The use of GPS allows one to quantify:

- The training load of each training session for programming and microcycles;
- The load of each individual player in order to compare training with his performance model;
- The load of each exercise on what to coach and what one will not.

Load Control Training

The distance traveled, together with the training time, gives a person an indication of the volume of training that has been done in that session. Of course we can not dwell on the analysis of the distance, since this parameter does not take into account the speed at which one has traveled. Distance, acceleration, and deceleration have a great effect on the efforts of a player. This is why we also analyze the meters a person travels at different speed thresholds (the most important are the meters you above 16 km / h and above 20 km / h) and the number of accelerations and decelerations.

Training Load

	MON	TUE	WED	THU	FRI
		7240	6580	5910	4500
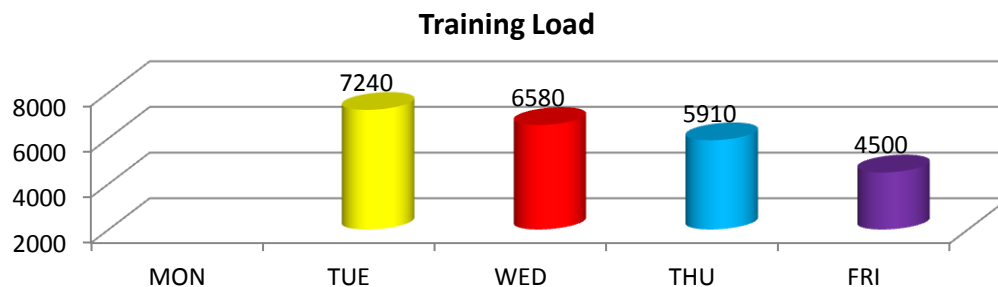
Player control and comparison with its performance model

Unlike other sports, the players involved in a soccer game are different from each other in the same match: a central defender runs on average much less distance than an external. The same external covers more distance than a midfielder but accomplishes less acceleration. Each position involves different amounts of physical work. Occasionally, we can find two players in the same position whose methods, tactically and physically, are very different from one another. This makes it important to know the performance model of each player, and check that one's training is specific to its model.

Training control

The increasing use of the ball in soccer drills allows training more aspects simultaneously. This is a more specific way to the play, but has its cons as this method is less controllable by the coach and the physical trainer. For example: possession 5 vs. 5 – from the physical point of view one cannot understand if all the players reach the desired intensity. Instead, thanks to GPS and cataloging of all exercises, we know each player's distance and speed, as well as how many accelerations and decelerations are made. Therefore, when a coach plans a workout, he or she knows in advance what kind of stimuli will be needed to build up his or her players.

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