

STUDY OF PUNCHES PERFORMANCE IN BOXE WITH INETIAL SENSORS

J Favre, Y Mass, and K Aminian

Ecole Polytechnique Fédérale de Lausanne (EPFL), Laboratory of Movement Analysis and Measurement (LMAM)

Lausanne, Switzerland

email: julien.favre@epfl.ch

INTRODUCTION

Though the boxe is an Olympic discipline and a wide practiced sport, currently the most valuable evaluation of a boxer's performance or progress is realized qualitatively by his coach. The aim of this study was to realize an easy-to-use system able to objectively evaluate the performance of a boxer completing a jab and to investigate the existence of an ideal execution.

METHODS

Eight young boxers (range 17-34 years old) with different level (from European champion to beginner) were included in this study. They were equipped with three sensor units: the first included a gyroscope measuring the angular velocity of the pelvis in the transverse plan, the second included two gyroscopes measuring the angular velocity of the thorax in the sagittal and transverse plan, and the third included three accelerometers measuring the acceleration of the fist. The boxers were asked to fight a punchingball with what they thought to be their most efficient jab (without indication of execution speed or power) as quickly as possible after a start signal and to return to guard. The start signals were optical (a red LED was fixed on the head of the punching ball) or acoustic. The measurements were repeated six times for both type of signal. Three accelerometers and three gyroscopes were fixed on the punchingball to record its movement. The twelve sensors were connected to an acquisition card and sampled @ 1000Hz. A software was designed in LabVIEW environment (NI, USA) to handle the acquisition and the generation of the start signals.

Based on the accelerations and angular velocities measured on the sportsmen and on the punchingball, four parameters were evaluated: *reaction* and *touch time*, *timing* and *coordination*. The *reaction time* was defined as the duration between the start signal and the first movement (pelvis, thorax or fist) of the boxer. The *touch time* was defined as the duration between the start signal and the beginning of the punchingball's movement. Then, based on the angular velocity of the pelvis four time intervals were determined: reaction, backing, advancing and guarding. The *timing* of the movement was defined as the percentage of each interval in regard to the total duration of the movement. Finally, the *coordination* between the pelvis and thorax transverse rotations was defined as the temporal difference between the two angles of rotation.

RESULTS AND DISCUSSION

Figure 1 displays the *reaction* and *touch times* of the eight boxers for a visual start signal. There was no significant difference between the *reaction* and *touch times* measured with a visual or an audio signal. Figure 2 shows the *timing* obtained with the visual signal. These *timings* were similar to that measured for the audio signal. The *coordination* (not represented here) was repeatable intra-boxer, but different inter-boxers.

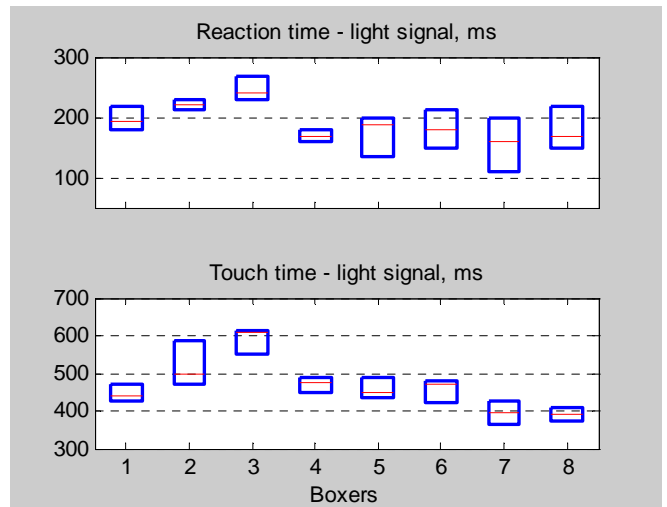


Figure 1: The fine lines correspond to the median values calculated on six measurements and the boxes to the mean values enlarged of one standard deviation. Boxers are classified according to their level (coach evaluation): the first (#1) corresponds to the best performer.

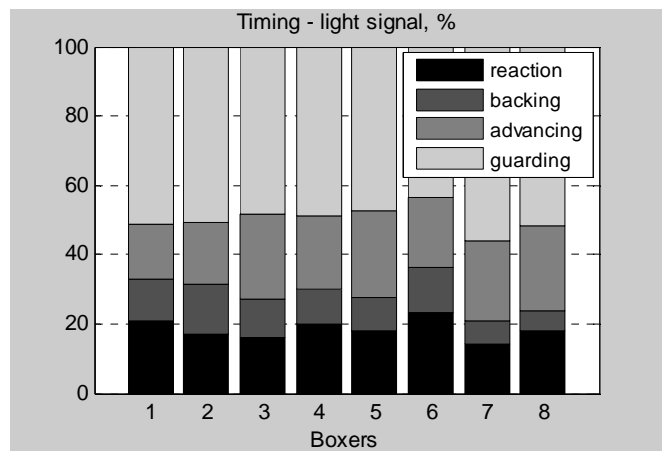


Figure 2: Timing values averaged on six measurements. Boxers' classification is similar to Figure 1.

The *reaction time* was of comparable value as that reported in the literature. None of the four considered parameters was found to be correlated to the level of the boxers. These results need to be confirmed with more athletes. Nevertheless, the absence of difference between beginner and champion level leads one to believe that the scenario used during these measurements was too distinct from a real fight. We think that further studies assessing the performance of boxers should consider a movie representing an adversary as start signal or better be realized during a fight.

ACKNOWLEDGEMENTS

We wish to thank the members of the 'National Sporting Club' (www.nsc-warriors.com) and specially Jérôme Canabate for their contribution to this study.