Explorative Study of a Reaction Time Comparison between Professional Athletes and Novices Using a Hand-Eye-Coordination Board

Ernst-Abbe-Fachhochschule Jena
University of Applied Sciences Jena

B.Sc. Ulrike Rattunde; Prof. Wolfgang Sickenberger , M.Sc. Optom. (USA), Dipl-Ing. (FH)
Ernst-Abbe-University of Applied Sciences, Jena, Germany

Introduction:

There are a lot of sports vision tests to estimate the visual performance of athletes e.g. contrast sensitivity, dynamic visual acuity or peripheral vision, which could be used appropriately to receive a good evaluation. With hand-eye-coordination boards reaction time and accuracy of movements can be estimated by central and peripheral flashing lights.[1] In many sport disciplines a proficient hand-eye coordination has great influence on the success of athletes.[2] It is reasonable to use this parameter in sports vision analysis and trainings.

Purpose:

The aim of this study was to determine whether professional athletes of dynamic reactive sports (soccer) or novices are better at transforming visual information into motoric components. A comparison was made between both groups to determine differences in the hand-eye coordination performance with the novel coordination board *twall® 64 Premium (IMM Holding GmbH*) (Fig. 1).

Fig. 1: Five out of 64 flashing fields of the hand-eye-coordination board

Methods:

Nineteen female novices (24.7 ± 2.1 years) were included in this study and data were collected by one observer. These prospective results were compared to the retrospective results (multi-observers at *Vision@Sports*, January 10-11th, 2011) of 17 female athletes of the German women's national soccer team (24.1 ± 4.6 years).

During the test the coordination board was divided into two fields. Consequently, every participant had to act on an area which included 32 possible flashing positions. Two participants, each at one field, were doing a challenge at the same time, deactivating only one color (blue or yellow) at their part of field (Fig. 2). All in all, 175 targets appeared at each field during the challenge. The order of flashing positions was identical for both sides but the velocity of target-changes depended on the test person's reaction time. To avoid a learning effect every test person participated only once.

Fig. 2: Female novices doing the challenge

Results:

The total testing period time which was needed for deactivating 175 targets as well as the number of mistakes were analyzed and compared.

The professional female athletes completed the challenge in an average time of 91.706 ± 6.049s, whereas female novices needed 98.053 ± 7.699s (Fig. 3). On average novices finished the test 6.347s slower than athletes. Differences between the non-normally distributed data of each group were tested statistically by means of *Mann-Whitney-U test*. In comparison to the novices, the professional athletes achieved significantly better results in the testing period time (p = 0.007).

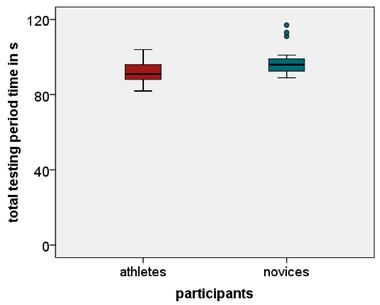

Fig. 3: Boxplot of the average total testing period time between athletes (n = 17) and novices (n = 19)

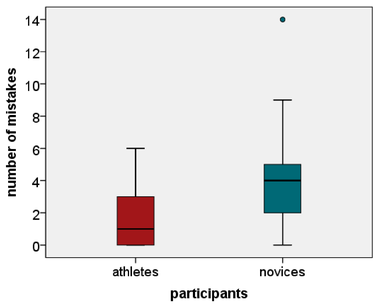

Fig. 4: Boxplot of the average number of mistakes between athletes (n = 17) and novices (n = 19)

Furthermore, the average error rate of the athletes with 1.7 ± 2.1 mistakes was significantly lower (p = 0.011, *Mann-Whitney-U test*) than of the novices (4.2 ± 3.4 mistakes). This result shows that novices made on average more than twice as many mistakes than professional athletes did (Fig. 4). Of all n = 17 athletes, eight of them made no mistakes (47.1%). They predominantly completed the challenge without mistakes. In contrast, only two (10.5%) of all n = 19 novices finished without any mistakes. Most novices made three to five mistakes (Fig. 5).

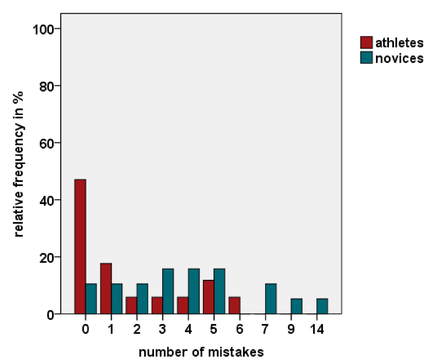

Fig. 5: Relative frequency of mistakes between athletes (n = 17) and novices (n = 19)

Discussion:

Differences between athletes and novices concerning visual ability have been determined in several studies.[3-5] Some visual aspects for higher performance with the *twall®* could be e.g. a better fixation of objects. Furthermore, athletes have a larger peripheral field of view [6], which also explains the accurate and fast deactivation of the flashing targets. It is also assumed that athletes have a better visual perception because of longtime sports performance and continuous training. They use their experience and cognition to handle visual information more efficiently.[2] [7] [8] The significant differences of the total period time between both groups of participants corresponds to studies which also determined shorter reaction times for athletes,[9] [10]

Another crucial aspect is the duration of being in motion at the challenge. The result depends on mental and physical fitness. Therefore, the better performance of the female athletes could be explained by better endurance and condition. Even the fact of being faced to a competition could have led to nervousness and inattention of some novices.

Conclusion:

The athlete-novice comparison suggests that female professional athletes have a better hand-eye coordination. To evaluate the performance parameter, the coordination board *twall®* is a useful device for sports vision examinations.

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contact: ▪ Ulrike Rattunde ▪ E-Mail: uratt@gmx.de ▪ Ernst-Abbe-University of Applied Sciences, Carl-Zeiss-Promenade 2, 07745 Jena, Germany ▪ Phone: +49 3641 205 448