

## **The role of auditory and visual information in the discrimination of the speed of penalty kicks**

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In recent years, there is a growing interest towards the role of auditory information in sport. The majority of studies in this area focused on the use of sounds deriving from well-executed sport gestures/movements as a mean to improve sport performances, highlighting that such interventions can be even more effective than those based on visual information [1]. On the other hand, there are just a few studies that focused on athletes' response to sounds that do not derive from the self, but that can influence their performances to a significant degree as well [2].

The present study fits the latter perspective, as its aim is to compare the role of visual and auditory information in the discrimination of the speed of penalty kicks. To this purpose, 13 amateur soccer players were asked to discriminate the speed of a soccer ball kicked by another player, according to a two alternative forced choice paradigm. The task was carried out in three conditions: Audio-video, Audio, and Video. Depending on the condition, the stimuli consisted of audio and/or video recordings of penalty kicks from the goalkeeper's perspective; the stimuli were temporally occluded at the moment of foot-ball contact, so that in all the conditions, the information available to the participants concerned the run-up of the penalty taker and the impact between his foot and the ball. Participants were instructed to watch and/or listen to two stimuli presented in a rapid sequence in order to discriminate whether the second shot was faster or slower than the first one, by pressing one of two keys on a keyboard. Participants, who were required to be both fast and accurate, were exposed to 60 pairs of stimuli for each condition; after 30 pairs of stimuli, the response keys were inverted to control for the dominant hand effect. The three sessions (Audio-video, Audio, and Video) occurred in three different days, and the order of the sessions was counterbalanced among participants.

Both the percentage of correct responses (response accuracy) and the average response times were calculated. As concerns response accuracy, a set of one-sample t-tests revealed that participants' accuracy was significantly above the chance level (i.e., 50% of correct responses) in all three conditions, while a repeated measures ANOVA showed no differences between the conditions. As concerns response times, a repeated measures ANOVA revealed a significant main effect of the condition; then, a set of paired samples t-tests highlighted that in the Audio-video and in the Audio conditions participants were significantly faster than in the Video condition.

The results suggest that auditory and visual information associated with penalty kicks is equally reliable for discriminating their speed, whereas the former is processed faster than the latter. This outcome is in line with previous laboratory studies, which highlighted lower

reaction times in response to auditory stimuli in comparison to visual ones [3, 4]. Further research is needed to evaluate if the same applies also to other sport situations. If that would be the case, new training paradigms keeping this aspect into consideration could be developed and tested in order to find out whether they can be effective in improving athletes' performances.

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