

In search of the signature of perceptual-motor expertise in 4x100 m relay

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The 4x100 m relay is a very demanding sport as performance depends on the ability of athletes to run at the highest possible speed of course, but also and above all to pass the baton at a high speed in a constrained space. The coordination between runners is one of the main determinants of performance and requires highly developed anticipation skills in athletes. Indeed, success presupposes for the receiver to pick-up information early on their running partner to be able to initiate their race at the right time. In this context, the go-mark's placement on the ground is supposed to help receivers to initiate their run at the right time (i.e., when the partner passes over of the go-mark). The ambition of the present study is twofold. The first one is to better understand the perceptual-motor mechanisms allowing athletes to successfully perform this highly constrained synchronization task. The second one is to analyze the way expertise shapes the implemented mechanisms.

The participants were equipped with a virtual reality headset to be immersed in a virtual stadium at the receiver's position. Three groups were formed according to their level of expertise: beginner, intermediate (regional level) and expert (national/international level). They were instructed to initiate their race when the avatar of their partner, who could arrive in a straight line or in a bend, passed over the go-mark. They performed 3 blocks of 10 trials (5 trials per condition). Their perceptual-motor strategies have been characterized according to several levels of analysis: the timing error, the temporal sequence of remarkable events (athlete's preparatory movement initiation, end of taking information on the avatar, initiation of the race...) and the information sampling strategies employed.

The results revealed that the strategies implemented depended on the level of expertise: the timing error was lower for experts and performance was more stable. Interestingly, the time sequence of the remarkable events was more efficient for the experts, reflecting the importance of the movement preceding the initiation of the race in the process of anticipation. In the same way, the analysis of the eye tracking data also revealed specific strategies for taking information according to the level of expertise, with experts spending more time scrutinizing the most information-rich areas.

Taken together, these results provide a first insight regarding the effect of expertise on athletes' anticipatory behavior during the initiation of the race while approaching the partner. Even if new studies are necessary to provide more information about the involved mechanisms, our study already underlines the close links between perception and action in the anticipation process of experts and the extreme sophistication of the implemented mechanisms.

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