

The effect of inertial constraints on anticipation skill

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Abstract

The aim of this study was to systematically investigate the influence of inertial factors on anticipation ability in order to gain a better understanding of the perception process.

Fifteen experienced football players (6 goalkeepers; $M_{\text{age}} = 23.07$ years, $M_{\text{experience}} = 14.87$ years) and fifteen novices ($M_{\text{age}} = 24.13$ years) were asked to determine the shooting direction of penalty kicks occluded 160 ms, 80 ms before, at ball-foot contact, or 80 ms after. Inertial conditions were manipulated by loading the kicking leg with a 2.25 kg weight on the shank. Shot direction accuracy, response time, and decision confidence were recorded for anticipation performance. To ensure representativeness, game-like reaction movements and response times were implemented.

It was found that loaded kick directions were anticipated more accurately ($p < .001$, $\eta^2 = .415$), faster ($p < .033$, $\eta^2 = .134$), and at earlier occlusion points ($p = .008$, $\eta^2 = .283$) than unloaded kicks. The higher accuracy for the loaded kicks was found in the earlier occlusion conditions in experts compared to novices ($p = .003$, $\eta^2 = .267$), as were the positive relationships between accuracy and confidence.

As predicted, the loading of the kicking leg led to greater anticipation of kick direction. Presumably, the perception of the inertial constraints of the shot allowed for earlier anticipation of the direction of the shot. It is suggested that perception of the inertial constraints allows the anticipator to be aware of the reduced possible outcomes of the left/right action as the kick evolves. Radius of gyration in the proximal to distal development of segmental connections is suggested as a potential informational property that may be used to anticipate action outcomes in striking and throwing sports.