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Skilled players' and novices' difficulty anticipating left- vs. right-handed opponents' action intentions varies across different points in time

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ABSTRACT

A left-handers' performance advantage in interactive sports is assumed to result from their relative rarity compared to right-handers. Part of this advantage may be explained by athletes facing difficulties anticipating left-handers' action intentions, particularly when anticipation is based on kinematic cues available at an early stage of an opponent's movement. Here we tested whether the type of volleyball attack is predicted better against right- vs. left-handed opponents' movements and whether such handedness effects are evident at earlier time points in skilled players than novices. In a video-based experiment volleyball players and novices predicted the type of shot (i.e., smash vs. lob) of left- and right-handed volleyball attacks occluded at six different time points. Overall, right-handed attacks were better anticipated than left-handed attacks, volleyball players outperformed novices, and performance improved in later occlusion conditions. Moreover, in skilled players the handedness effect was most pronounced when attacks were occluded 480 ms prior to hand-ball-contact, whereas in novices it was most evident 240 ms prior to hand-ball-contact. Our findings provide further evidence of the effect of an opponent's handedness on action outcome anticipation and suggest that its

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occurrence in the course of an opponent's unfolding action likely depends on an observers' domain-specific skill.

1. Introduction

Previous research has consistently demonstrated skilled athletes' superiority over their less skilled or novice counterparts in predicting an opponent's intentions (Mann, Williams, Ward, & Janelle, 2007). This skill effect was demonstrated for a number of different tasks such as prediction of outcome direction (Loffing, Schorer, Hagemann, & Baker, 2012), identification of type of action (e.g., Goulet, Bard, & Fleury, 1989) or detection of deceptive actions (e.g., Cañal-Bruland & Schmidt, 2009). Extensive experience with domain-specific actions (e.g., through practice and competition) rather than a skilled athlete's more sophisticated perceptual system per se seems to primarily explain these effects (Yarrow, Brown, & Krakauer, 2009). While there is on-going debate as to the contribution of motor and visual experience to anticipatory judgments (Aglioti, Cesari, Romani, & Urgesi, 2008; Cañal-Bruland, Mooren, & Savelsbergh, 2011; Güldenpenning, Steinke, Koester, & Schack, 2013), evidence of the effectiveness of perceptual training interventions (e.g., Abernethy, Schorer, Jackson, & Hagemann, 2012; Hagemann, Strauss, & Cañal-Bruland, 2006; Memmert, Hagemann, Althoetmar, Geppert, & Seiler, 2009; Schorer, Cañal-Bruland, & Cobley, 2010) indicates that visual experience plays a crucial role in the development of perceptual-cognitive expertise in sports.

In this regard, an observer's lack of perceptual familiarity with specific actions may result in reduced prediction performance. Handedness is a potential factor eliciting differently developed perceptual familiarity because left-handers form a clear minority for a range of different (non)-sport-related tasks in any culture studied to date (e.g., Gilbert & Wysocki, 1992; Loffing, Sölter, & Hagemann, 2014; Peters, Reimers, & Manning, 2006). More specifically, the considerable imbalance in handedness distribution is likely to result in an imbalanced exposure to, and thus imbalanced perceptual familiarity with, left- and right-handed actions. Indeed, recent work has suggested that being confronted with left-handed opponents may result in inferior outcome direction anticipation in tennis (Hagemann, 2009), team-handball goalkeeping (Schorer, Loffing, Hagemann, & Baker, 2012), and volleyball (Loffing, Schorer, et al., 2012), as well as in maladaptation in decision-making in tennis (Loffing, Hagemann, & Strauss, 2010). To exemplify, Loffing, Schorer, et al. (2012) presented skilled players and novices with videos of left- and right-handed volleyball attacks. The sequences were occluded at three different time points (i.e., moment of an attacker's hand-ball-contact and 80 ms and 160 ms prior to this event) and the participants' task was to predict the directional outcome of the attacks. While there was an overall effect of lower performance against left- compared to right-handed opponents, the left–right difference was most pronounced at early temporal occlusion conditions with skilled players suffering earlier (−160 ms) than novices (−80 ms). Thus, anticipation of left-handed actions may be particularly difficult some time before the incidence of a critical event (here: hand-ball-contact), possibly because observers then are not able to detect anticipation-relevant kinematic cues equally well in unfamiliar left- as opposed to familiar right-handed opponents' actions. In addition, the observer's skill seems to moderate this effect in that difficulties appear to occur earlier in skilled compared to novice observers, which makes sense if we recall that skilled players make more accurate predictions than novices at early stages of an opponent's action. However, evidence in support of these assumptions is limited. Therefore, in the present study we confronted skilled players and novices with left- and right-handed volleyball attacks under six different temporal occlusion conditions.

Interestingly, the difference in anticipation performance against left- and right-handers seems unaffected by an observer's manual preference for the actions presented (Hagemann, 2009).