

Predicting the action outcome of left- and right-footed penalties in a representative experimental setting in soccer

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Introduction

Perceiving and anticipating the movements of an opponent in interceptive sport tasks (e.g., tennis or soccer penalties) is crucial for performance. Predicting right-sided actions is significantly better compared to left-sided actions (McMorris & Colenso, 1996). One could assume that these differences result from a lower perceptual familiarity of left-sided actions which causes less efficient gaze behavior compared to right-sided actions. Loffing et al. (2015), however, showed that gaze behavior does not differ between either side. Due to limitations (e.g., “ball-in-the-hand”-effect, static testing environment, and stimulus presentation) Loffing et al. suggested to replicate the experiment and to execute it in a more representative experimental setting. Therefore, the aim of the present study was to investigate whether prediction accuracy and gaze behavior of left- and right-sided penalty kicks in soccer differ from each other in the context of a more representative experimental setting.

- We expected
- (1) significant better prediction performance for right- compared to left-sided actions
 - (2) no significant differences in gaze behavior between left- and right-sided actions

Methods

Participants

- Ten non-soccer players ($M_{age} = 26.2 \pm 3.1$ years), eleven soccer field players ($M_{age} = 24.4 \pm 5.1$ years), and eight soccer goalkeepers ($M_{age} = 24.0 \pm 3.3$ years) participated in this study.

Design & Procedure

- Participants had to ...
 - ... predict shot direction (left/right) of 40 right-footed and 40 left-footed penalty kicks from a goalkeeper’s perspective
 - ... predict shot direction as fast and as accurately as possible
 - ... perform a full-body movement to the respective side
- Right-footed penalty kicks were mirrored to create the left-footed penalty kicks (equal kinematic information in both conditions)



Figure 1. Screenshots of right-footed (right) and left-footed (left) penalty kicks at the moment of ball contact.

Experimental Setting

- Stimuli were presented as life-sized avatars (Loper et al., 2014) on a large screen (3.2 x 2.1 m)
- Gaze behavior was recorded with a mobile eye tracker (SMI, SensoMotoric Instruments, Germany) at 60 Hz
- Participants’ response was recorded using the horizontal ground reaction force from a force plate (1000 Hz; Kistler, Sindelfingen, Germany) which had to exceed a threshold of 12.5 N

Data Analysis

- Prediction accuracy was defined in terms of the correct response of the participants relative to the shot direction
- Percentage viewing time was defined as the percentage of time gaze was directed toward different locations on the screen (head, upper body, hip, shooting leg, supporting leg)

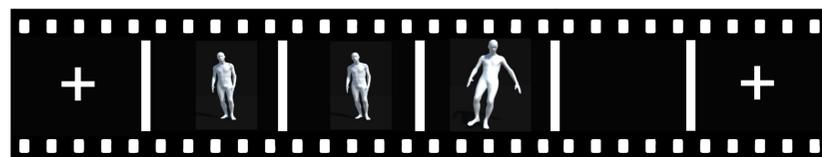


Figure 2. Experimental procedure.

Results

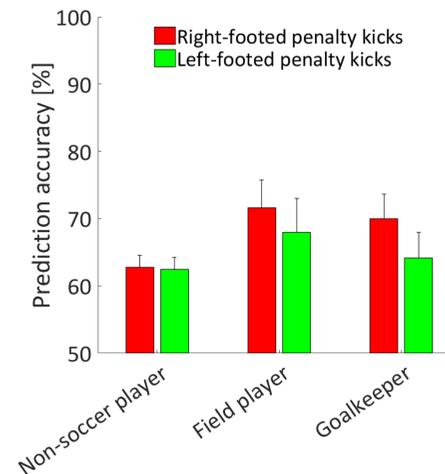


Figure 3. Mean accuracy scores (and standard errors).

Prediction accuracy

- A 3 (group) × 2 (condition) mixed design ANOVA was applied
- Prediction accuracy for right- compared to left-footed penalty kicks was significantly higher, $F(1,27) = 5.3$, $p < .05$
- The main effect of group, $F(2,27) = 1.1$, $p = .34$, and the Condition × Group interaction, $F(2,27) = 1.3$, $p = .29$, did not attain significance

Percentage viewing time

- A 3 (group) × 2 (condition) × 5 (areas) mixed design ANOVA was applied
- A significant main effect of area, $F(4,104) = 4.0$, $p < .05$, revealed that participants directed their gaze mostly toward the shooting leg
- Main effect of condition, $F(1,26) = .10$, $p = .83$, and main effect of group, $F(2,26) = .74$, $p = .49$, did not attain significance
- All other interactions did also not attain significance

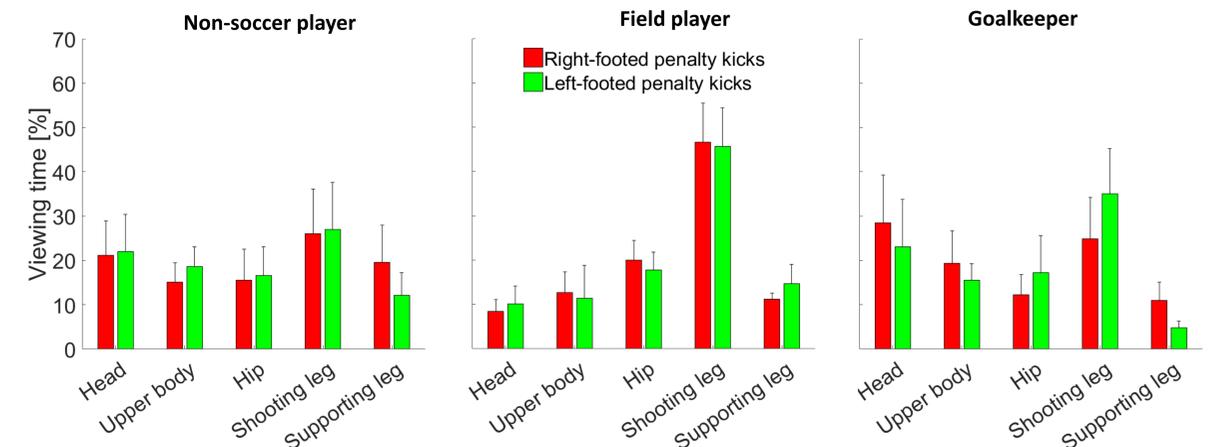


Figure 4. Percentage viewing time (means and standard error) on the five areas of interest: head, upper body, hip, and legs for the three groups (non-soccer player, field player, and goalkeeper).

Conclusion

The present results replicate previous findings that prediction accuracy is higher for right- compared to left-sided penalty kicks. However, and in line with Loffing et al. (2015), gaze behavior did not differ between left- and right-sided penalty kicks, although, the present study used a more representative experimental setting. Therefore, it is suggested that the kinematic information picked up, are processed differentially for right- compared to left-sided actions. Future studies have to investigate which causes these differences.

- References
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