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

Methods

Participants

- Ten non-soccer players (Mage = 26.2 ± 3.1 years), eleven soccer field players (Mage = 24.4 ± 5.1 years), and eight soccer goalkeepers (Mage = 24.0 ± 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)

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)

Results

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(2,27) = 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(2,26) = .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

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


Contact: Johannes Kurz | nemolab | johannes.kurz@sport.uni-giessen.de | Funding: IRTG – The Brain in Action | International Conference on predictive vision, 10-13 June, 2019, Toronto, Ontario, Canada