

Creating and Validating Point-Light Displays as a Tool to Study Anticipation in Penalty Kicks

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The penalty kick situation in association football is a prospective action sport situation that, since the study of Franks and Harvey (1997), has received increasing attention. Much research in this paradigm presents stimuli with video techniques (Ryu, Kim, Abernethy, & Mann, 2013). An important shortcoming of video techniques is that it is difficult to manipulate the information. The information in the penalty taker's actions is easier to manipulate if stimuli are presented with point-light displays. This has led to the ubiquitous use of point-light displays in the study of actions such as the anticipation of tennis shots (Huys, Smeeton, Hodges, Beek, & Williams, 2008), but less so in studies concerning the penalty kick.

The here-presented experiment is based on penalties that were recorded in a study by Lopes, Jacobs, Travieso, and Araújo (2014). Those penalties were shot by professional and semi-professional players, from the reglementary 11 m, with a standard size goal, and in the presence of a goalkeeper. These aspects may provide an advantage in terms of representative design with regard to a previous point-light display study on the penalty kick (Diaz, Fajen, & Phillips, 2012). On the basis of the selected penalties we programmed point-light displays to-be-observed from the perspective of the goalkeeper (Figure 1). To validate the displays we performed a two-alternative forced choice (2AFC) psychophysical study, with participants indicating the perceived direction of the penalty kicks.

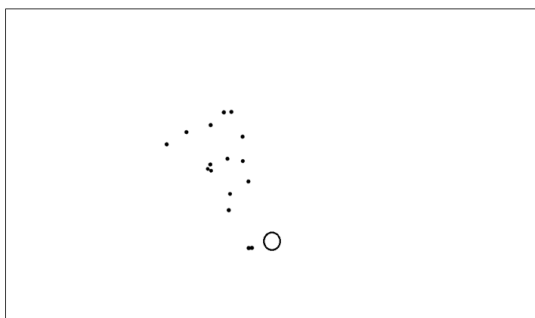


Figure 1. Single frame of a stimulus used in the experiment. Shown is a left-footed kicker near the moment of ball contact.

The effects of two independent variables were analyzed: first, whether the penalties were shot with the intention to deceive the goalkeeper in terms of the side to which the penalty was shot; second, whether the penalties were presented in a fully randomized order or in an order that was blocked per penalty taker. Thirty-four undergraduate students were divided in two equally sized groups. The first group observed the penalties in a completely randomized order and the second group observed the same penalties blocked by penalty taker (8 penalties per kicker).

Results and discussion

We performed a two-way ANOVA on the percentage of correctly judged sides with deception (no deception vs. deception) as within-subjects factor and blocking (without vs. with blocking) as between-subjects factor. The effect of deception was significant: $F(1,32)=11.5$, $p=.002$, $\eta^2p=.27$. The effect of blocking ($F[1,32]=.03$, $p=.86$) and the interaction ($F[1,32]=.95$, $p=.34$) were not significant.

The overall percentage of correctly judged sides was 60.0% for the non-deceptive penalties and 54.3% for the deceptive penalties. These percentages were significantly higher than chance (i.e., 50%): $t(33)=7.4$, $p<.001$, for the non-deceptive penalties; and $t(33)=2.9$, $p=.007$, for the deceptive penalties.

In sum, we have shown that, based on a single point-light presentation, participants without experience with point-light displays are able to judge the side of a penalty kick better than chance. In addition, the intention of the penalty takers to deceive the goalkeeper led to significantly lower percentages of correct judgments. We believe that these results validate the applied point-light technique for further use in a research program on anticipation in the penalty situation.

Acknowledgments

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