A Novel On-Field Training Intervention Improves Novice Goalkeeper Penalty Kick Performance

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Research in the visual anticipation literature has revealed that differences in the performance accuracies of expert and less-skilled performers can be reconciled by variations in the locations of information pick-up and timing of actions (Triolet, Benguigui, Le Runigo, & Williams, 2013). For instance, when anticipating the direction of an opponent's deceptive movements, elite rugby players outperformed novices by attending to *honest* (center of mass) information and waiting later before initiating their movement response (Brault, Bideau, Kulpa & Craig, 2012). In contrast, the earlier response time of novices did not negatively affect performance for nondeceptive movements, where both experts and novices achieved ceiling levels of anticipation accuracy (97%; see also, Jackson, Warren & Abernethy, 2006). These findings are corroborated by football penalty kick research, where results indicate that penalty takers' use of deception ensures that early kinematic information (e.g., approach angle) is incongruent with kick direction (Lopes, Jacobs, Travieso & Araújo, 2014). However, if goalkeepers attend to kinematic information (e.g., nonkicking foot placement) that unfolds when the penalty taker is approximately 1.2m from the ball, this increases the likelihood of success when facing deceptive kicks (Dicks, Button, & Davids, 2010).

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Differences in anticipation between expert and less-skilled performers, have led perceptual learning researchers to explore the benefits of different training methods (see Farrow, 2013, for a review). Recently, perspectives in ecological psychology have proposed that variability in practice conditions may be particularly effective in improving anticipation accuracy (see Dicks, van der Kamp, Withagen & Koedijker, 2015; Smeeton, Huys & Jacobs, 2013). For example, Smeeton and colleagues (2013) revealed that the prediction of tennis serve direction can be improved through the implementation of *reduced usefulness training*, which has the aim of directing novice (learners) search to more reliable information through changes in practice conditions. It is thought that variable practice conditions reduce the availability of variable or less useful information (e.g., early run-up information from a penalty taker), while information with minimal variability (e.g., the orientation of the penalty taker's nonkicking foot) (Dicks, Button et al., 2010; Lopes et al., 2014) remains present. Thus, variable practice which leads to a reduction in the availability of less useful (variant) information is thought to force learners to search for alternative, more reliable information (Smeeton et al., 2013).

The aim of this study was to examine whether a novel on-field training intervention improves the anticipation performance of novice football goalkeepers for deceptive and nondeceptive penalty kicks. Participants were allocated to either a one-player training group (OP) or a three-player training group (TP). The OP group faced "traditional" practice, with one penalty taker running up to execute the kicks. The TP group faced three players running-up to the ball, with only one of the three players continuing the run-up to execute the kick. The

other two players stopped their run-up approximately 1.2m from the ball (cf. Dicks, Button et al., 2010). The rationale for choosing this distance, and subsequently the aim of TP, was to orient goalkeeper attention toward the more reliable information that unfolds toward the end of the run-up. Following Smeeton et al. (2013), we rationalized that TP would act as a form of reduced usefulness training, by minimizing the availability of early penalty taker information. If TP achieves this aim, we hypothesized that the TP group would learn to attend to reliable information in the kicking action of penalty takers (e.g., nonkicking foot placement) and perform significantly better than OP, leading to better posttest anticipation performance in deception and nondeception trials.

Method

Participants

Eighteen novice goalkeepers ($Mage = 20.89 \pm 0.96$ years) participated in the study. All participants were male and had at least three years' football playing experience at a competitive recreational level but no specific experience as a goalkeeper. Five penalty takers ($Mage = 21.17 \pm 0.98$ years) were recruited to execute penalty kicks. All penalty takers had between five and ten years' experience at a competitive recreational level and experience of taking penalties in competition. The players had no previous experience of taking penalties against any of the goalkeepers. Ethical approval was obtained from the local University ethics committee and all participants provided written informed consent.

Apparatus and Procedure

The pretest and posttest, consisted of 30 penalty kicks executed by three different players. All participants faced kicks from the same three players in the pretest and posttest. The penalty takers approached the ball from a distance of 4m and followed a script that determined the angle of run-up to the ball, which side of the goal to aim for (bottom left, bottom right) and whether to use deception or no deception (see Dicks, Button et al., 2010). During deception trials, players executed kicks as though they intended to aim to one side of the goal, before shooting at the opposite side. In nondeception trials, the penalty taker shot directly at the desired goal location without any deceptive intent (Lopes et al., 2014). The script ensured that the three penalty takers executed 10 penalties each (five deception, five nondeception) that were directed evenly to the bottom corners of the goal. In addition to the 30 penalties, a further six kicks were executed to various predetermined goal locations to remove participants' awareness of the task procedure (cf. Dicks, Button et al., 2010). Each player took two of these kicks and goalkeeping performance was not analyzed for these trials. All penalty kicks were executed at a full size goal (7.32 × 2.44 m), using a Size 5 football from the regulation distance (11m) on an outdoor Astroturf pitch.

Training. Following the pretest, performances were ranked based on the number of saves for deception and nondeception trials, before allocating participants to one of two training groups to ensure an equal range of visual anticipation performance at baseline for the two groups (cf. Hopwood, Mann, Farrow, & Nielsen, 2011). The two training groups were as follows: one-player training (OP) and three-player training (TP). Participants in both groups faced a total of 80 kicks distributed equally across four training sessions during the intervention (Smeeton, Williams, Hodges & Ward, 2005). The OP training consisted of "traditional" kicks in which one player ran-up from a distance of 4m and executed the penalty. The TP training consisted of three players running up to the ball from 4m, side-by-side, at three different orientations to the ball (left, central, right), with only one of the three players executing the penalty. The ordering of when each of the three players executed the kick was randomized. The other two penalty takers stopped their run-up 1.2m from the ball (Dicks, Button et al., 2010). It was prearranged which player was going to take each penalty although goalkeepers were not aware of this arrangement. Different markers were placed along the approach to the ball, and unknown to the goalkeepers, one pair of markers denoted 1.2m from the ball. Penalty takers in TP and OP training did not follow a script but checks were made to ensure an even distribution of kicks to either side of the goal.

Dependent Measures and Analysis

Goalkeeper performance for deception and nondeception trials was assessed by recording the number of dives to the correct side of the goal and the number of saves in each condition. Tests of normality indicated the data to be normally distributed. For dives, one sample t tests were performed on posttest performance to determine if training led to performance that was greater than chance. Number of saves were analyzed using a two (group: OP, TP) × two (testing phase: pretest, posttest) analysis of variance (ANOVA). Pretest performance was analyzed using an independent samples t test to ensure there were no differences between the OP and TP group before training. Effect sizes are reported using η^2 for ANOVA and Cohen's d for posttest comparisons.

Results

For the TP group, the number of dives to the correct side of the goal was statistically greater than chance (7.5) for both deception ($M = 10.33$, $SD = 2.06$) and nondeception ($M = 10.78$, $SD = 2.86$), ts(8) = 4.12 and 3.44, respectively, $ps < .01$. In contrast, for the OP training group, there was no difference between the number of dives to the correct side of the goal and chance for both deception