Journal of Sports Sciences, 2013
Vol. 31, No. 9, 921–929, http://dx.doi.org/10.1080/02640414.2012.762602

Routledge
Taylor & Francis Group

The mere presence of a goalkeeper affects the accuracy of penalty kicks

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(*Accepted 20 December 2012*)

Abstract
The keeper-independent strategy, in which a football penalty kicker selects a target location in advance and ignores the goalkeeper's actions during the run-up, has been suggested to be the preferable strategy for taking a penalty kick. The current in-field experiment investigated the question of whether the goalkeeper can indeed be ignored. Ten intermediate-level football players were instructed to adopt a goalkeeper-independent strategy and to perform penalty kicks directed at one of two targets located in the upper corners of the goal under three conditions: without a goalkeeper, in the presence of a goalkeeper (who tried to save the ball), and in the presence of a goalkeeper who was informed by the penalty kickers where they intended to direct the ball. The mere presence of a goalkeeper impaired shot accuracy. The shots were more centralised, that is, biased toward the goalkeeper. The effects were enhanced for the condition in which the penalty kicker knew the goalkeeper was knowledgeable about ball direction. The findings were consistent with the response activation model that holds that aiming at a target can be biased toward salient visual non-targets. The implications for adopting and practising goalkeeper-independent strategies are discussed.

Keywords: *penalty kicking, far aiming, keeper-independent strategy, response activation model, ironic effects*

Introduction

The study of penalty kicks in football has become an increasingly popular research topic that attracts interest not only from areas that are directly sports-related, such as biomechanics (Graham-Smith, Lees, & Richardson, 1999; Lees & Owens, 2011) and (sport-) psychology (Jordet, Hartman, & Vuijk, 2012; Navarro et al., 2012, Wood & Wilson, 2011), but also from areas as diverse as economics (Bar-Eli, Azar, & Lurie, 2009; Bar-Eli, Azar, Ritov, Keidar-Levin, & Schein, 2007; Coloma, 2007) and mathematics (Vars, 2009). Since the outcomes of important football matches are progressively more likely to be decided by penalty kicks (e.g., most recently 2 out of 7 matches in the knock-out stage of the Union of European Football Association (UEFA) EURO 2012), many of these studies primarily focus on delineating the most favourable strategy for taking a penalty kick (van der Kamp, 2011; Wood & Wilson, 2011). Considering that penalty kickers are supposed to have an overwhelming advantage over goalkeepers, adopting and training the more favourable strategy (or one that is superior to the kicker's current strategy) may significantly improve success rate, which on average seems conspicuously low (i.e., approximately 20–25% of the shots are missed or saved, Jordet, Hartman, Visscher, & Lemmink, 2007).

Kuhn (1988; see also Morya, Ranvaud, & Machado-Pinheiro, 2003) was the first to investigate the strategies that penalty kickers adopt. He distinguished two strategies that are now identified as the 'keeper-independent' (i.e., originally dubbed 'open loop' by Kuhn) and 'keeper-dependent' (i.e., first called 'closed loop') strategies (van der Kamp, 2006). In the former strategy, the penalty kicker chooses where to aim the ball before the run-up and holds to that choice during the run-up and kick. Any action of the goalkeeper during the run-up is ignored. Alternatively, in the second strategy, the penalty kicker intends to kick the ball to the side

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opposite to which the goalkeeper dives. To this end, he or she tries to anticipate the direction of the goalkeeper dive by obtaining information from the goalkeeper's action during the run-up.

At first glance, a shot to the side opposite to the goalkeeper's dive prevents the goalkeeper from intercepting the ball and lessens the requirement for kicking accuracy. After all, the ball is shot to the empty half of the goal. Yet, research has indicated that the keeper-dependent strategy can only be successful if the information about the direction of the goalkeeper's dive can be picked up relatively early in the run-up. Van der Kamp (2006, 2011; see also Morya, Ranvaud, et al., 2003) showed that if goalkeepers make their first move within approximately 400 ms prior to foot-ball contact, kickers are less likely to succeed in placing the ball to the empty half of the goal and furthermore kick accuracy tends to be poor. In other words, penalty kickers need a minimum amount of time to be able to determine the side to which to kick the ball and accurately perform the kicking action. Navarro et al. (2012) suggests that these effects are further exacerbated under high-pressure. The keeper-dependent strategy may also be challenging due to constraints related to visual attention. It is well-established that focusing on and fixating a target prior to and during the movement is essential in far aiming tasks in general (Vickers, 2007). Fixation not only allows the pickup of visual information necessary for accurate control of movement parameters such as direction and force of the aiming action (e.g., Vickers, 1996), but eye movements also makes non-visual information available (e.g., efference copy, or eye muscle propriocepsis) that can be exploited for accurate spatial control of the aiming action (Land & Hayhoe, 2001; Land, Mennie, & Rusted, 1999; Wilson, Stephenson, Chattington, & Marple-Horvat, 2007). In penalty kicking a focus on (or eye movements toward) the goalkeeper rather than the target area jeopardises accuracy (Bakker, Oudejans, Binsch, & van der Kamp, 2006; Noël & van der Kamp, 2012; van der Kamp, 2011; Wilson, Wood, & Vine, 2009). Notwithstanding the risks associated with the keeper-dependent strategy, it is likely that penalty kickers at times adopt it, and according to some authors more often than not (Kuhn, 1988; Wood & Wilson, 2010a).

In contrast to the keeper-dependent strategy, the keeper-independent strategy seems the more cautious and powerful approach for taking penalty kicks. First, descriptive analyses from international competitions reveal that goalkeepers never saved shots that are directed at one of the two upper corners of the goal (Armatas, Yiannakos, Papadopoulou, & Galazoulas, 2007; Morya, Bigatão, Lees, & Ranvaud, 2003), suggesting that aiming at these areas is favourable for achieving success. Moreover, a few biomechanical studies (Graham-Smith et al. 1999; Kerwin & Bray, 2006) measured the time that goalkeepers take to dive and reach different areas of the goal. Based on these measurements it is clear that if penalty kickers choose to kick at one of the upper corners with moderate force (i.e., with a speed $> 22\ m \cdot s^{-1}$), then it would be impossible for a goalkeeper to intercept the ball. This is true, even if the goalkeeper anticipates the direction of the ball with a movement onset as early as 300 ms before the kicker's foot-ball contact. Finally, the goalkeeper independent strategy permits a more adaptive pattern of gaze fixations (Noël & van der Kamp, 2012; Wood & Wilson, 2011), a prerequisite to be successful in aiming tasks. Without focusing on the goalkeeper, penalty kickers can direct their attentional focus to areas that are more important for the accurate execution of the kick, such as the target and the ball (Noël & van der Kamp, 2012).

Although it seems clear that to adopt a keeper-independent strategy is the more favourable choice, it may be difficult for penalty kickers to completely ignore the goalkeeper. Penalty kickers can be influenced unwillingly by the actions (and possibly the mere presence) of a goalkeeper, with performance suffering as a consequence. Masters, van der Kamp, and Jackson (2007) demonstrated that if goalkeepers simply stand marginally off-centre, even if the penalty kicker is not consciously aware of this, there may be an influence on the kicker's shot direction. Furthermore, van der Kamp and Masters (2008) demonstrated that a goalkeeper's posture influences the perception of their size, resulting in subtle influences on the location to which the penalty kicker shoots the ball. Finally, Wood and Wilson (2010b) showed that if a goalkeeper waves his arms, this attracts visual attention of the penalty kicker, leading to sub-optimal gaze patterns and impaired shot accuracy.

It may be that the mere presence of the goalkeeper affects shot accuracy. An analogy can perhaps be found in the literature on the role of visual non-target objects (that are not necessarily physical obstacles) in reaching and grasping tasks (Howard & Tipper, 1997; Tipper, Howard, & Jackson, 1997; Welsh, Elliott, & Weeks, 1999). These studies have reported that visual non-target objects that surround the target influence the trajectory of the target-directed hand movement by either veering away from (Howard & Tipper, 1997; Tipper et al., 1997) or towards the visual non-target object (Welsh et al., 1999; Welsh & Elliott, 2004). To explain these effects, the response activation model (Welsh & Elliott, 2004; for an alternative explanation, see Howard & Tipper, 1997) proposes that prior to the execution of an action attention is distributed *throughout* the environment. As a result, both target

and non-target objects activate automatic independent and parallel action response processes. Both action response processes race toward activation (see McGarry & Franks, 1997). It is the resulting combined activation of these independent processes that in the end determines the details of the action response directed to a target object. Inhibitory processes are responsible for eliminating competing action responses to non-target objects. The influence of the inhibitory processes is dependent on the moment (relative to the onset of the action response) that the visual non-target is presented and on its salience. In the case of a visual non-target object that is present very early and is indistinct, inhibitory processes will result in negative activation, affecting the combined activation such that the movement veers away from the non-target object. However, the response activation process for a visual non-target object that is presented late and/or is very salient is much more difficult to inhibit. The response toward the non-target object will be incorporated in the combined final action response, resulting in the movement being attracted toward the non-target object. In the penalty kick, if the kicker adopts a goalkeeper-independent strategy, the goalkeeper may be considered as a visual non-target object. In this scenario, the response activation model predicts that even the mere presence of the goalkeeper can affect, unconsciously, the placement of the ball relative to the target (i.e., corner). The direction of this effect (i.e., away from or closer to the goalkeeper) will depend, in large part, on the degree of salience of the goalkeeper (e.g., arm waving may make the goalkeeper more salient, resulting in closer shots, Wood & Wilson, 2010a). The mere presence of the goalkeeper may affect ball placement, even when a goalkeeper-independent strategy is adopted.

We examined whether penalty kickers are able to adopt a strategy in which they totally ignore the goalkeeper. Although previously researchers have shown that this is the more favourable strategy, the question of whether the simple presence of a goalkeeper may jeopardise kicking accuracy and speed has not been addressed. This effect may be present even though kickers are fully aware that a goalkeeper is incapable of intercepting a ball directed to one of the two upper corners (at least when the kick is sufficiently powerful). Thus, in the current study, participants were required to shoot the ball hard enough, aiming at a specified area of the goal, located in the upper corners, with and without the presence of a goalkeeper. Comparing shot accuracies in these conditions should uncover whether the presence of a goalkeeper can be ignored (as is presumed with a goalkeeper-independent strategy) or whether his or her presence as a visual non-target object affects shot placement along the lines suggested by the response activation model. In addition, a third condition was created to enhance any effect that might be present by increasing the salience of the goalkeeper. To this end, the kicker informed the goalkeeper of the intended target before taking the kick. Knowing that the goalkeeper is aware of the target location should not be relevant to the outcome, if kickers shoot with sufficient accuracy and power, but it may increase the goalkeeper's salience or threat. On the one hand, if a kicker can ignore the presence of the goalkeeper, as is required for the goalkeeper-independent strategy, then ball placement should not depend on whether or not a goalkeeper is present. This means that the number of target hits and the distance between the target and where the ball intersects the goalmouth should not differ across conditions. On the other hand, if a kicker cannot fully ignore the presence of the goalkeeper, that is, if the presence of a goalkeeper functions as a visual non-target object, then shots may be biased away or towards the goalkeeper, depending on the goalkeeper's salience.

Methods

Participants

Twenty-seven male skilled university footballers, who played competitively in Dutch amateur leagues, volunteered to take part. The pretest consisted of 20 shots aimed at a 1 m by 1 m target straight in front of them, placed on a wall at a distance of 11 m. The pretest was conducted to ascertain that the participants were sufficiently skilled to aim the ball in one of the two top corners during the main experiment. The first 10 participants (mean age = 19.1 years, s = 1.9) who hit the target at least 18 times (i.e., 90% success) were selected to participate in the main study. In addition, two amateur goalkeepers (26 and 29 years in age) participated in the experiment. The approval of the local ethical committee was obtained before the experiments were carried out, and participants provided informed consent prior to testing.

Apparatus

Participants took penalty kicks on an official grass pitch. The size of the goal, the distance of the penalty spot from the goal and the ball were all in accordance with FIFA laws. Two pieces of orange PVC canvas measuring 1.8 m in width and 1.6 m in height were attached between the crossbar and each goalpost, indicating the two target areas (Figure 1). The size and location of these target areas were chosen based on descriptive analyses from international competitions, showing that in these areas it is very difficult if not impossible for goalkeepers to save a

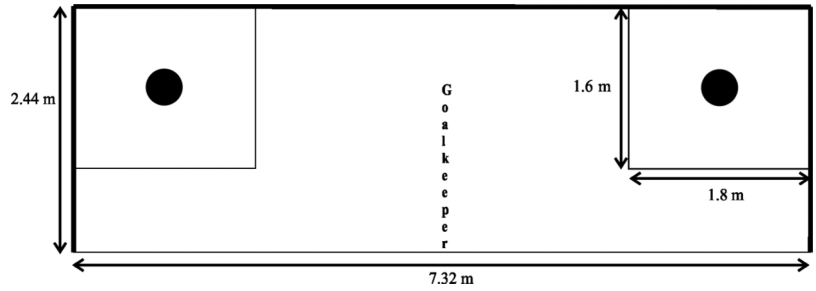

Figure 1. Schematic representation of the experimental set-up showing a front view of the goal with a PVC canvas in the goalmouth with the two target areas.

penalty. At the centre of each PVC canvas, there was a target, consisting of black circle 22 cm in diameter (i.e., the same as the ball diameter). Participants were explicitly instructed to aim for the circle (although all kicks landing within the target area were counted as a success, see below). The placement of the target was to preserve the difficulty for the goalkeeper to defend the shot, but reduce the risk of missing the goal altogether. The centre of the target areas (i.e., at 0.8 m from the crossbar and 0.9 m from the goalpost) was considered optimal for aiming a penalty kick: it is beyond a goalkeeper's reach, but reasonably safely within the goalmouth in the where case kicking accuracy is somewhat jeopardised.

A CREATIVE VADO digital video camera (25 Hz) was positioned 1 m behind and 1 m to the side of the penalty mark, and recorded the goalmouth. The video recordings were analysed off-line for shot accuracy. To measure ball flight times, a pinhead microphone was placed 50 cm to the right of the ball to register the foot-ball contact, while two microphones were attached to the PVC canvas to register the impact of the ball. The continuous signals of the microphones were amplified and fed into a computer (1000 Hz). A LabVIEW software package was used to synchronise the signals of the microphones.

Design

A repeated measures design was used. Participants took six blocks of penalty kicks in three conditions: without the presence of a goalkeeper ('no goalkeeper' condition), with the presence of a goalkeeper who was unaware of the direction of the shot ('goalkeeper' condition), and in the presence of a goalkeeper who was informed by the kicker before taking the penalty kick to which side the ball would be placed ('knowledgeable goalkeeper' condition). Participants performed 20 kicks per condition in two blocks of 10. For each condition there was an equal number of shots to the right and left target areas. The sequence of these shots was randomised. The three first blocks always belonged to different conditions and their order was counterbalanced across participants. The sequence of blocks four to six was identical to the first three blocks. This design allowed for taking any effects of fatigue or learning during the last blocks into account. However, no differences were observed between the first three blocks and the last three blocks, which indicated that participants did not get fatigued or were otherwise affected in the course of the experiment.

Procedure

After providing informed consent, participants were informed about the characteristics of a keeper-independent strategy, particularly the importance of disregarding the goalkeepers' actions when taking the penalty kick, since it would in any case be impossible for the goalkeeper to defend a well-placed ball. Immediately before the start of the experiment, participants were instructed to aim for the centre of the target with enough power (i.e., ball speed at least approximately 22 $m \cdot s^{-1}$). It was emphasised that with these requirements met, it would be impossible for the goalkeeper to save the ball (Graham-Smith et al., 1999), even if they would correctly anticipate the direction of the kick and dive to the same side that the ball went. Furthermore, participants were instructed that they should ignore the goalkeeper's actions (whenever the goalkeeper was present) and simply kick the ball to the designated target area with enough force. Before each penalty kick, they were told which target area to aim towards (i.e., left or right side of the goal).

Goalkeepers were instructed to try to save the penalty kick as they would normally do. However, they were instructed not to start their dive during the early portion of the run-up. More specifically, they were told not to start moving until the kicker started his last step (which is approximately at 250 ms before kicker foot-ball contact, see Franks & Harvey, 1997; Lees & Owens, 2011). In addition, goalkeepers were required to standardise their posture at the beginning of each trial by standing

directly in the centre of the goal with knees bent, arms by their side and hands in front of their body before each shot (van der Kamp & Masters, 2008).

After instructions, participants warmed up by taking six practice kicks aiming at the target area (three shots to each side) without the goalkeeper. Subsequently, participants started a first block of 10 kicks in one of the experimental conditions, followed by the remaining five blocks.

Data analysis

Penalty-taking performance was assessed from the video recordings. First, each penalty kick was categorised as either a hit (i.e., the ball hit the 1.8 m by 1.6 m target area), a miss (i.e., the ball was shot inside the goal, but missed the target area) or a failure (i.e., the ball was shot wide of the posts or over the crossbar). In addition, shots for the 'goalkeeper' and 'knowledgeable goalkeeper' conditions were categorised as either saved (i.e., the ball was totally blocked by the goalkeeper) or not saved. The frequency of hits, misses and failures per condition, and the frequency of saved shots were submitted to separate chi-square tests. The frequencies of hits and misses saved by the goalkeeper were counted and categorised relative to the criterion speed (equal or above versus below 22 $m \cdot s^{-1}$). The frequencies for these categories were submitted to a chi-square test. Subsequently, screenshots were made for the moment that the ball passed the goal line or was blocked by the goalkeeper. Kinovea Motion Analysis software was used to determine absolute and variable errors (in cm) for the distance between the ball landing location and the centre of the target area as well as the distance between ball landing location and the centre of the goal. Shots that completely missed the goal were not included in this analysis. Ball flight times were determined measuring the interval between the moment of foot-ball contact and the moment of ball-canvas impact, as indicated by sound signals from the microphones. Differences in distance the ball travelled to reach points in the goalmouth were taken into account, and ball speed was calculated dividing this distance by the flight time. The individual absolute error, the variable error and the average ball speed were submitted to separate repeated measures analyses of variance (RM-ANOVA) with condition as within factor. Post hoc pairwise comparisons were conducted using the Bonferroni correction procedure and partial eta squared (η^2_p) was used as the measure of effect size. Finally, the individual correlations between ball speed and absolute error across conditions were calculated to check for speed-accuracy trade-offs.

Results

Initial perusal of the data showed that of 600 shots taken (200 shots in each condition), there were 295 hits, 171 misses and 134 failures. Of the 400 shots in the two goalkeeper conditions, 83 were saved. Notice that hits, misses and failures refer to where the ball entered (or would have entered) the goalmouth, irrespective of whether or not the goalkeeper blocked or saved the ball.

Performance

Table I shows the total number of hits, misses and failures for each of three conditions. Chi-square testing revealed that the number of hits, misses and failures were differently distributed across condition, $\chi^2(4, N = 600) = 26.64$, $P < 0.001$. Post hoc comparisons indicated that in the 'no goalkeeper' condition the number of hits was significantly higher and the number of misses was significantly lower than in the 'goalkeeper' and 'knowledgeable goalkeeper' conditions. The number of failures did not differ across conditions. In sum, the presence of the goalkeeper negatively affected the accuracy of the kicks.

Table II shows the number of saves in the two goalkeeper conditions. Chi-square testing revealed that the number of saves differed by condition, $\chi^2(1, N = 400) = 23.76$, $P < 0.001$. In the 'knowledgeable goalkeeper' condition more shots were saved. In addition, chi-square testing revealed that the number of saved shots for misses (i.e., shots outside the target area) was significantly higher than for hits, $\chi^2(1, 400) = 54.95$, $P < 0.001$. Table II reports the number of hits and misses for penalty kicks that were saved by the goalkeeper as a function of ball speed

Table I. Number of hits, misses and failures, and average ball speed (standard deviation) as a function of condition.

	No Goalkeeper	Goalkeeper	Knowledgeable Goalkeeper
Hits	127[a]	89[b]	79[b]
Misses	37[a]	69[b]	65[b]
Failures	36[a]	42[a]	56[a]
Ball speed ($m \cdot s^{-1}$)	17.5 (2.2)	18.8 (1.5)	18.8 (1.8)

Note: superscripts denote significant effects for condition ([a]$P < 0.01$, [b]$P < 0.05$).

Table II. Total number of saved shots among target hits and misses for ball speeds above and below 22 m · s^{-1}.

	Goalkeeper		Knowledgeable Goalkeeper	
	Hits	Misses	Hits	Misses
Total	5	18	10	50
Below	5	11	10	39
Above	0	7	0	11

(i.e., speeds equal or above versus below 22 m · s^{-1}). For kicks outside the target areas (i.e., misses – but not failures) saves occurred irrespective of ball speed. The chi-square for these kicks revealed a marginally significant difference for saves when ball speed was below 22 m · s^{-1}, $\chi^2(1, N = 68) = 3.71$, $P = 0.054$. Importantly, for the shots within the target area, only kicks with speeds below 22 m · s^{-1} were saved; for kicks with higher speeds no interceptions were made.

Accuracy. As can be seen in Table III, with the goalkeeper present kicks were shot farther from the centre of the target and closer to the centre of the goal (i.e., more centralised). This was confirmed by a significant effect for absolute error relative to target centre $F(2,18) = 7.87$, $P < 0.01$, $\eta_p^2 = 0.49$. Post hoc comparisons revealed a larger absolute error for the 'knowledgeable goalkeeper' compared to the 'goalkeeper' and 'no goalkeeper' conditions, while the latter two conditions did not differ significantly. A significant effect for condition was found for the distance to the goal centre $F(2,18) = 14.68$, $P < 0.001$, $\eta_p^2 = 0.65$. Post hoc comparisons revealed significant differences between conditions, with the 'knowledgeable goalkeeper' condition resulting in the most centralised and the 'no goalkeeper' condition resulting in the least centralised shots.

Variable error. Analyses revealed no effect for condition for variable error relative to target centre, $F(2,18) = 1.08$, $P > 0.05$, $\eta_p^2 = 0.19$, or for the variable error relative to goal centre, $F(2,18) = 2.34$, $P > 0.05$, $\eta_p^2 = 0.22$ (Table III).

Ball speed

The RM-ANOVA on ball speed revealed main effects for condition $F(2,18) = 5.42$, $P < 0.05$, $\eta_p^2 = 0.40$ (Table I). Post hoc comparisons revealed that shots were faster for both goalkeeper conditions in comparison to the 'no goalkeeper' condition. However, correlations between ball speed and absolute error relative to the target area and goal centre were not significant for any participant (all $r^2 < 0.15$, all $P > 0.05$).

Discussion

The risks and limitations associated with the adoption of the keeper-dependent strategy in penalty kicks seem quite substantial (van der Kamp, 2011; for an overview, see Savelsbergh, Versloot, Masters, & van der Kamp, 2010). By contrast, the keeper-independent strategy seems to be the more favourable for scoring a goal. Yet, it is unclear whether penalty kickers are actually able to ignore the goalkeeper, as this is one of the requirements for fully adopting the keeper-independent strategy. We set out to investigate penalty kickers' performances with and without the presence of a goalkeeper. We fully informed amateur footballers about the benefits and requirements of the keeper-independent approach. They were then instructed to adopt the keeper-independent strategy, particularly to aim for the indicated target areas with enough force and to ignore the goalkeeper (if present).

Our results indicate that the kickers' performance is affected by the presence of the goalkeeper, and even more so when the kickers are aware that the goalkeeper is informed about where the ball would go. Penalty kickers hit the target significantly less often when the goalkeeper was present compared to an empty goal. In fact, with the goalkeeper present, not only did the number of hits drop, but the shots were more centralised (i.e., closer to the goalkeeper). Although balls were shot more powerfully with the goalkeeper present, the decrement in spatial accuracy was not due to a trade-off between speed and accuracy. Apparently, the presence of the goalkeeper affected ball placement and ball speed

Table III. Mean (and standard deviation) for absolute and variable errors (cm) relative to target centre and goal centre as a function of condition.

	No Goalkeeper	Goalkeeper	Knowledgeable Goalkeeper
Target centre			
Absolute error	125	149	164
Variable error	27	23	24
Goal centre			
Absolute error	249	227	209
Variable error	66	84	86

independently. Moreover, the finding that variable errors were not influenced by goalkeeper presence indicates that the more centralised ball placement is not a by-product of the kicks being less precise, but rather reflects a genuine bias in aiming. These data point to decrements in shot accuracy with the ball directed more centrally (i.e., closer to the goalkeeper). In sum, this shows that even when instructed to aim for a predefined target, penalty kickers are not able to fully ignore the goalkeeper; instead they show a tendency to kick the ball closer to the goalkeeper (not unlike previous findings for the goalkeeper-dependent strategy; Noël & van der Kamp, 2012; Wood & Wilson, 2010a, 2010b).

These findings are in accordance with the predictions of the response activation model (Welsh & Elliot, 2004) for situations in which the visual non-target object is relatively salient. During a penalty kick with the goalkeeper present, two independent parallel action response processes are activated: one for the actual target location in the corner of the goal, and one for the non-target goalkeeper. In fact, Welsh and Elliott (2004) observed with neutral stimuli that if the visual non-target object was present before the onset of action, the inhibitory processes had sufficient time to de-activate the associated action response processes. In the current experiment, the goalkeeper is presented well before the kicker's run-up, however, in all likelihood the goalkeeper is a salient rather than a neutral visual stimulus. Consequently, the action response process toward the non-target goalkeeper is difficult to inhibit entirely, and hence, it is incorporated in the resulting combined action response. As a result, shots are attracted toward the goalkeeper (i.e., further from the target and more centralised). Apparently, salience of the goalkeeper further increased when the kicker had to inform goalkeepers about the intended shot direction. Consequently, the tendency for a more centralised shot was even further enhanced.

Although the response activation model describes the differences in participants' kicking accuracy according to goalkeeper presence rather fittingly, it is not necessarily the only possible account for the present findings. In particular, ironic processing may have enhanced the salience of the goalkeeper. Wegner (1994) claimed that a deliberate attempt to ignore a thought or action may enhance the inclination to exactly the opposite: engage in the very thought or action. Accordingly, Bakker et al. (2006; see also Binsch, Oudejans, Bakker, Hoozemans, & Savelsbergh, 2010; Binsch, Oudejans, Bakker, & Savelsbergh, 2010; cf. Beilock, Afremow, Rabe, & Carr, 2001) required participants to score a goal in lab-based penalty kick task, but using different wordings to convey the same instruction. It was found that a negatively worded instruction *not* to shoot the ball within goalkeepers' reach, resulted, opposite to what was intended, in more centralised shots (i.e., closer to the goalkeeper) than an instruction that told the participants to aim for the empty space. Because the negatively worded instruction was accompanied with increased fixation of the goalkeeper, Bakker et al. (2006) argued that the negative instruction to avoid the goalkeeper ironically increased visual attention to the goalkeeper. This effect was accompanied by a shorter final fixation for the empty goal space (Binsch, Oudejans, Bakker, & Savelsbergh, 2010). In other words, the negative wording (or even simply making reference to the goalkeeper, see Binsch, Oudejans, Bakker, Hoozemans, et al., 2010) may have enhanced the goalkeeper's salience. Clearly, it cannot be ruled out that in the present study a similar ironic effect contributed to a tendency to produce more centralised kicks with the presence of a goalkeeper. The present instruction not only contained a positively worded phrase (i.e., try to hit the target area), but was partly expressed negatively (i.e., ignore goalkeepers' actions). Perhaps, the latter part (ironically) increased the goalkeeper's saliency, making it more difficult to (re-)direct visual attention to the target or ball (Bakker et al., 2006; Binsch, Oudejans, Bakker, & Savelsbergh, 2010). Future work should involve visual search measures to scrutinise this alternative (or additional) account. Moreover, the degree to which instructions regarding the goalkeeper-independent strategy that solely emphasise the *advantages* of attending to the target and ball or only stress the *disadvantages* of not ignoring the goalkeeper would lead to differences in kicking accuracy should be examined. Finally, the goalkeeper may be salient because she or he is perceived by the penalty taker to present a 'threat'. The perceived threat is provoked by the awareness that a weak shot can be saved by the goalkeeper. Consistent with predictions from attentional control theory (Eysenck, Derakshan, Santos, & Calvo, 2007; Nieuwenhuys & Oudejans, in press), recent work by Wilson et al. (2009; Wood & Wilson, 2010b; but see Noël & van der Kamp, 2012) reported that increases in perceived threat (induced by high anxiety) enhanced penalty kickers' visual attention to the goalkeeper at the expense of the target or the ball. This resulted in more centralised shots. Accordingly, scrutinising whether the mere presence of the goalkeeper invokes increments in perceived threat and/or anxiety is an important task for future research, just as it is to assess whether this is further exacerbated when the penalty kicker knows that the goalkeeper knows where the ball will be placed.

In sum, the present consensus is that the advantages for the keeper-independent strategy outweigh

its drawbacks, and relative to the goalkeeper-dependent strategy, it is considered the more secure choice. An important premise is that, by ignoring the goalkeeper, attention can be fully dedicated toward the target and ball, thus allowing for optimal kicking accuracy. Yet, the current study shows that the kicker cannot easily ignore a goalkeeper; even the mere presence of the goalkeeper is likely to adversely affect kicking accuracy. Hence, before adopting the keeper-independent strategy, it seems wise to require penalty kickers not only to automatise the execution of the kick (as they usually do for free and corner kicks, for example), but to further stabilise kicking accuracy in the presence of a goalkeeper (or any other threat-inducing visual non-target). Practice regimes that optimise gaze control should be considered (e.g., quiet eye training, Vickers, 2007; Wood & Wilson, 2011). This should allow penalty takers to learn to direct gaze at the intended target location and at the ball before and during the execution of the shot, rather than looking at the goalkeeper (Wood & Wilson, 2011). Possibly, penalty kickers may benefit from waiting longer before actually performing the shot, providing them more time to inhibit the response process toward the goalkeeper (Furley, Dicks, & Stendtke, 2012). In agreement with this contention, Jordet, Hartman, and Sigmundstad (2009) reported, based on field observations, that penalty kickers who took penalties very soon after the referee's whistle were less likely to score. By contrast, kickers that waited longer were more often successful. In other words, the goalkeeper-independent strategy may still be preferable over a goalkeeper-dependent strategy, but prospective penalty kickers should practice kicking the ball to one of upper corners with sufficient force as well as controlling visual attention.

Acknowledgements

Remco Koopmeiners and Jose Antonio Navia Manzano are thanked for help in carrying out the experiment. Hogeschool van Amsterdam is acknowledged for providing accommodation. This work was supported by National Counsel of Technological and Scientific Development (CNPq) (140765/2008-5 and 480996/2009) and Coordination for the Improvement of Higher Level Personnel (CAPES) (3024/10-5) grants. The editor and reviewers are acknowledged for their valuable comments on an earlier version of the paper.

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