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Attention towards the goalkeeper and distraction during penalty shootouts in association football: a retrospective analysis of penalty shootouts from 1984 to 2012

Philip Furley, Benjamin Noël and Daniel Memmert

Institute of Cognitive and Team/Racket Sport Research, Deutsche Sporthochschule, Köln, Germany

ABSTRACT

In the present study, we tested the consequences of attention towards goalkeepers in association football penalty shootouts that have exclusively been derived from laboratory experiments. We conducted a retrospective analysis of all penalty shootouts during FIFA World Cups (1986–2010) and UEFA European Football Championships (1984–2012). We linked key variables of previous laboratory research to observable behaviour in the field that was coded by two independent coders. The following hypotheses were tested: first, attention towards goalkeepers results in more saves/better goalkeeper performance; second, goalkeepers can deliberately distract penalty takers by drawing attention towards themselves which results in less accurate penalty kicks/better goalkeeper performance. Results were in line with previous laboratory analyses as they showed that attention towards goalkeepers resulted in more saves/better goalkeeping performance. Further, if goalkeepers distracted penalty takers this also resulted in better goalkeeping performance. The applied implications of these findings are discussed for both goalkeepers and penalty takers in association football.

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KEYWORDS

Penalty kicks; performance analysis; attentional control theory; field study

An everlasting problem within science is whether findings derived from the laboratory transfer back to the field to which scientists want to generalise their findings (e.g., Brunswik, 1956). Unfortunately, experiments sometimes do not transfer back to the field researchers want to generalise their findings to (e.g., List, 2006; Voors, Turley, Kontoleon, Bulte, & List, 2012), a point that has also been made in the context of association football penalty kicks (Dicks, Button, & Davids, 2010a). Therefore, the present research attempts to test whether findings from studies on association football penalty kicks (Wilson, Wood, & Vine, 2009; Wood & Wilson, 2010a) that have been derived from the laboratory generalise towards the field.

Previous laboratory studies on association football penalty kicks have used attentional control theory (ACT, Eysenck, Derakshan, Santos, & Calvo, 2007) as an underlying theory to test how performance can break down in high-stakes situations due to attentional disruptions. Attention can be defined as an umbrella term subsuming all the cognitive processes responsible for increasing or decreasing the level of activation of internal or external representations (e.g., Pashler, Johnston, & Ruthruff, 2001). ACT's main tenet is that human behaviour is controlled by two attentional systems: a top-down system that is guided by activated contents in working memory (goals, expectations, knowledge) and a bottom-up system that is guided by salient stimuli in the environment. A further important assumption of ACT is that anxiety or performance pressure causes an imbalance between these two systems in favour of the bottom-up system, which can probably be

considered a mechanism intended to detect threatening stimuli (Eysenck et al., 2007). That is, with increasing anxiety attention for the threatening stimuli increases, probably in order to allow rapid reactions to escape any potential negative consequences for one's well-being. In support of this theorising, Wilson et al. (2009) showed that anxious individuals showed an attentional bias (i.e., gaze behaviour) towards the goalkeeper (which can arguably be considered a threatening stimuli). Of particular relevance to the present study, the increased gaze towards the goalkeeper led anxious penalty takers to place their penalty kicks significantly closer to the goalkeeper (i.e., more centralised). This finding supports research suggesting that penalty takers should align their gaze with aiming intention in order to shoot an accurate penalty kick (Bakker, Oudejans, Binsch, & van der Kamp, 2006; van der Kamp, 2006). Pertinent to this theorising, Wood and Wilson (2010b) demonstrated that constraining penalty takers gaze to the centre of the goal resulted in shots significantly more centralised despite the participants' striving to hit distal locations. In addition, Navarro, van der Kamp, Ranvaud, and Savelsbergh (2013) showed that the mere presence of a goalkeeper impaired shot accuracy as shots were more centralised, i.e., biased towards the goalkeeper – even in the absence of anxiety. If gaze is directed towards the goalkeeper prior to and at the moment of foot–ball contact, then accuracy is likely to decrease because goal-directed movements have been shown to profit from accurate and timely information derived from the foveated target (Land, 2009; van der Kamp, 2006). Following from this finding,

Wood and Wilson (2010a) conducted a further study in which goalkeepers deliberately distracted penalty takers in order to draw attention towards them in the hope of inducing shots closer to the goalkeeper. Importantly, a specific hypothesis of ACT states that the attentional bias to threat (Eysenck et al., 2007) should be exacerbated if the threat-related stimuli are distracting in nature, instead of merely posing a potential threat. This is precisely what was found: a distracting (moving) goalkeeper led to an attentional bias towards the goalkeeper that resulted in a decrease in shooting accuracy and more saved shots.

Pertinent to the present research, Wood and Wilson (2010a, p. 944) stated that “caution must be taken when attempting to transfer these findings to penalty kicks from professional football”: first, threat/pressure is a lot higher in actual penalty kick situations as compared to laboratory situations; second, the skill level of participants in professional association football is a lot higher than in the conducted studies and therefore they might show greater resistance to the negative effects of threat and/or distraction; third, in actual penalty kick situations the penalty taker only has one crucial attempt and not a series of shots as in the conducted laboratory studies; fourth, goalkeepers were prevented from making anticipatory movements in the attempt of saving penalty kicks which might have influenced the number of saves; and fifth, in actual penalty kick situations there are far more variables interacting that impact on performance than the few variables isolated in the laboratory studies (e.g., knowledge of previously missed important penalty kicks, experience with the opposing goalkeeper, etc.). Therefore, it is feasible that effects reported in the laboratory would not show in the setting to which researchers aimed to generalise their findings due to the complex interplay of numerous variables affecting performance in association football penalty shootouts. Following from this line of reasoning, there is a solid rationale for investigating if the decreased penalty-taking performance that resulted from attention towards the goalkeeper and/or a distracting goalkeeper found in the laboratory (Wilson et al., 2009; Wood & Wilson, 2010a) would also be evident in penalty shootouts during FIFA World Cups (1986–2010) and UEFA European Football Championships (1984–2012).

We conducted a retrospective analysis of all penalty shootouts during FIFA World Cups (1986–2010) and UEFA European Football Championships (1984–2012). As direct measurement of some of the constructs reported in the laboratory experiments would have been both logistically and methodologically impossible, efforts were made to link key variables to measurable variables that can be derived from the available video recordings of the penalty shootouts. In this respect, the greatest challenge was to operationalise the attentional/gaze focus of penalty takers.¹ However, there is a large body of evidence highlighting that humans are very sensitive and efficient at picking up another person’s direction of attention

(Emery, 2000; Langton, 2000; Moore & Dunham, 2014). These findings are in line with Baron-Cohen’s (1995) proposal that encoding of another person’s attentional focus is an integral part of a theory of mind and therefore humans have evolved a specialised neural structure facilitating this skill (the superior temporal sulcus; e.g., Allison, Puce, McCarthy, 2000). Therefore, it is common practice to have independent coders rate direction of attention in social interactions (Harrigan, Rosenthal, & Scherer, 2008). Similarly, distraction by goalkeepers was coded as any kind of behavioural attempt of goalkeepers to distract penalty takers and draw attention towards themselves and away from executing the penalty kick. Although attention has been studied extensively using varying methodological approaches (eye-tracking paradigms, cueing paradigms, occlusion paradigms, response time paradigms, etc.; see, e.g., Memmert, 2009, for a review), there is currently a lack of research of attention in representative performance contexts.

The goal of the present research was not to test the primary prediction from ACT, i.e., that “high stakes situations cause an imbalance favouring bottom-up attention towards threatening stimuli over top-down goal-directed attention”, as all the analysed penalty kicks can be considered extremely high stakes (Baumeister & Steinhilber, 1984). Instead, we tested the proposed performance consequences that result from directing attention towards the goalkeeper and from deliberate distraction attempts by the goalkeeper (Wilson et al., 2009; Wood & Wilson, 2010a). Specifically, we tested the following hypotheses derived from previous laboratory evidence in association football penalty kicks (Wilson et al., 2009; Wood & Wilson, 2010a): first, attention towards goalkeepers results in more saves/better penalty-taking performance (Hypothesis 1); second, goalkeepers can deliberately distract penalty takers (Wood & Wilson, 2010a) by drawing attention towards themselves which results in less accurate penalty kicks/better goalkeeper performance (Hypothesis 2).

Method

Stimuli

All penalty kicks from penalty shootouts during FIFA World Cups (1986–2010) and UEFA European Football Championships (1984–2012) were used as stimuli, amounting to a total of 322 penalty kicks.² The clips of the penalty kicks were obtained through various sources (e.g., Youtube.com and a private collection of TV broadcasts). The camera perspective (behind the goal or behind the penalty taker perspective) and recordings of the penalty takers varied between the recordings but both, goalkeeper and penalty taker, were always visible. Typically the recordings started after the ball had been placed on the penalty mark. The study was approved by the Ethics Board of the German Sport University Cologne.

¹Though overt and covert attention are clearly distinguishable, we expect that gaze direction and allocation of visual attention are highly correlated in the current study. There are several eye-tracking studies on penalty kicking that are based on the same assumption (e.g., Noël & van der Kamp, 2012; Wilson et al., 2009).

²There were several rule changes between 1984 and 2012 that potentially could have impacted on the current dependent variables. To rule out any effects of these, we tested if earlier penalty kicks differed from later penalty kicks but found no effects of time (all $ps > .096$).

Procedure and measures

All penalty kicks were rated by two independent coders (ages 25 and 24 with 16 and 14 years of experience, respectively, in association football at an amateur level) who were blind to the aim of the study and the hypotheses. Behavioural coding of *in situ* behaviour is a widely used approach in non-verbal behaviour research and was based on recommendations of Harrigan et al. (2008). Previous research on association football penalty kicks has adopted this research methodology (Jordet, 2009; Jordet & Hartmann, 2008; Moll, Jordet, & Pepping, 2010) and revealed important insights. The inter-rater reliability (Cohen's kappa) was above 0.84 for every variable. Both coders were instructed that a high accuracy and objectivity of their ratings was of utmost importance. The following variables were derived from the video material (29 fps).

Penalty kick outcome

This variable described if a penalty kick was scored, missed or saved.

Goalkeeping performance

Goalkeeping performance was assessed in accordance with previous research (Dicks et al., 2010a; Furley, Dicks, Stendtko, & Memmert, 2012). To provide greater sensitivity of our goalkeeping performance measure, each penalty kick was scored on a 0–5 point scale: five points were warranted if the goalkeeper successfully saved the kick; four points when the goalkeeper dived in the correct direction and contacted the ball without saving it; three points when the goalkeeper dived in the correct direction but failed to make contact with the ball; two points when the goalkeeper made a movement in the correct direction but did not dive and failed to make contact with the ball; one point if the goalkeeper did not move from the centre of the goal; and zero points if the goalkeeper made any final movement to the side of the goal opposite to the final ball location. We computed a penalty-saving performance score for every penalty kick taken.

Movement initiation time of the goalkeeper

We computed the movement initiation time of the goalkeeper relative to foot–ball contact of the penalty taker in a frame-by-frame analysis by counting the video frames forwards and backwards from the time the foot of the penalty taker touched the ball. This measure has been used in previous penalty-taking research (e.g., Dicks et al., 2010a; Furley et al., 2012) and was operationalised in accordance with Dicks et al. (2010a) as the first observable movement made by the goalkeeper when attempting to save the ball relative to the moment of foot–ball contact by the penalty taker.

Attention towards the goalkeeper

In order to code this dichotomous behavioural variable, the independent coders got the following instructions: please indicate if the penalty taker predominantly gazes at the goalkeeper or away from the goalkeeper prior to and during the run-up. Of relevance to this retrospective measure of attention, a large body of research has shown that people are well

equipped for registering what other people are attending to (see Harrigan et al., 2008; Moore & Dunham, 2014; for a review).

Distraction by the goalkeeper

In order to code this behavioural variable, the independent coders got the following instructions: please indicate if the goalkeeper attempts to distract the penalty taker in any way (including delay of game and any kind of movements that distract the penalty taker).

Data analysis

Proportions of scored/missed penalty kicks as a function of attention towards the goalkeeper or distraction attempts of goalkeepers were analysed with χ^2 tests. When analysing goalkeeping performance with the performance index (Dicks et al., 2010a) or movement initiation times as the dependent variables, we used independent sample *t*-tests. One-tailed tests were used when we were able to derive a clear directional hypothesis from previously published laboratory tests. Otherwise, two-tailed tests with a significance threshold of 0.05 were used.

Results

Preliminary analyses

Taken together approximately three out of four penalty kicks resulted in a goal (73.3%) which is comparable with previous studies (Hughes & Wells, 2002; Morya, Bigatão, Lees, & Ranvaud, 2005), although one study reported success rates of up to 80% (Lopez-Botella & Palao, 2007).

Hypothesis 1. Attention towards goalkeeper results in more saves.

Of the 322 penalty kicks, 16 (5%) could not be classified in regards to whether the penalty taker was predominantly gazing at the opponent goalkeeper or not. In 174 penalty kicks (54%), penalty takers were not rated as gazing predominantly towards the opponent goalkeeper, whereas in 132 penalty kicks (41%) penalty takers were rated as gazing predominantly towards the goalkeeper.

Figure 1 shows an increase of over 11% saved penalty kicks when the penalty taker gazed predominantly towards the goalkeeper during the preparation of the penalty kick (χ^2 (1, $N = 276$) = 6.026; $p = .01$, one-tailed, *odds ratio* = 2.13 [1.16, 3.93]; this analysis remained significant when also including the missed penalty kicks and not only the saved vs. the scored penalty kicks χ^2 (2, $N = 306$) = 11.406; $p = .001$, one-tailed). When taking the performance index (Dicks et al., 2010a) as the dependent variable, goalkeepers performed better when the penalty taker predominantly gazed towards them during the penalty kicking process, $t(304) = -2.103$, $p = .018$, one-tailed, $d = 0.66$ [0.43, 0.89] (see Figure 2).

Hypothesis 2. Goalkeepers can deliberately distract penalty takers in their penalty performance.

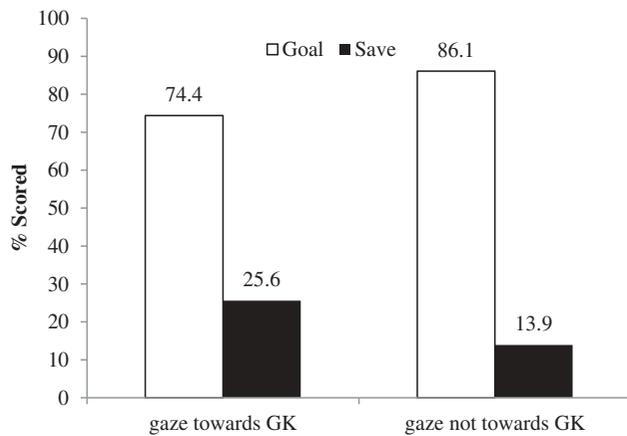


Figure 1. Percentages of scored versus saved penalty kicks as a function of whether the penalty taker was rated as gazing towards the opponent goalkeeper.

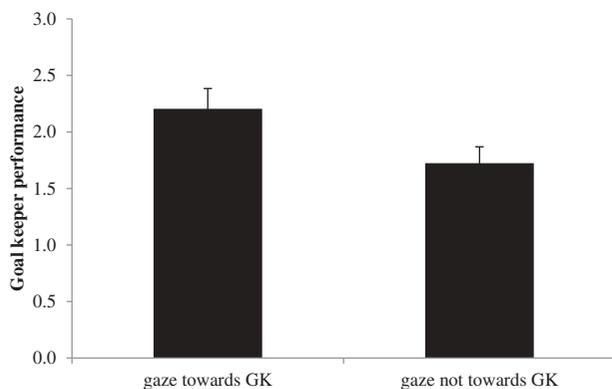


Figure 2. Goalkeeping performance as a function of whether the penalty taker was rated as gazing towards the opponent goalkeeper. Error bars represent standard errors of the mean.

Of the 322 penalty kicks, 3 (1%) could not be classified in regards to whether the goalkeeper attempted to distract the penalty taker or not. In 48 penalty kicks (15%), goalkeepers attempted to distract penalty takers, whereas in 271 penalties (84%) goalkeepers did not attempt to distract penalty takers.

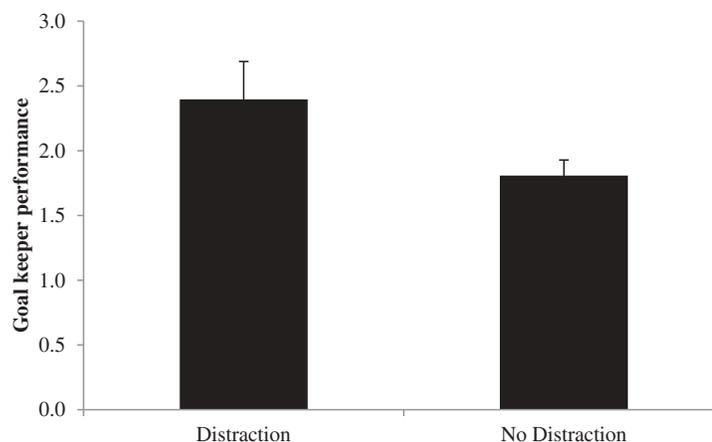


Figure 4. Goalkeeping performance as a function of whether the goalkeeper attempted to distract the penalty taker. Error bars represent standard errors of the mean.

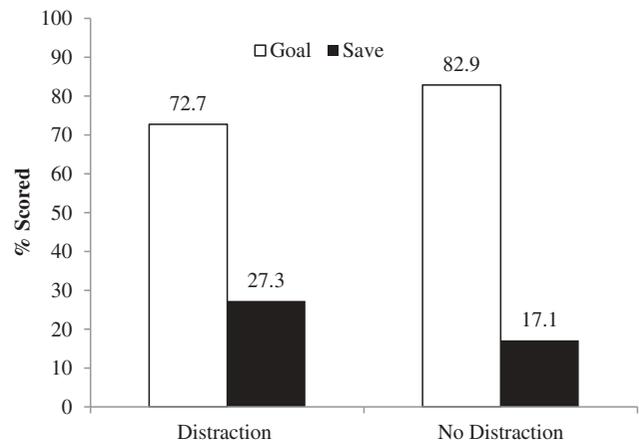


Figure 3. Percentages of scored versus saved penalty kicks as a function of whether the goalkeeper attempted to distract the penalty taker.

Figure 3 shows an increase in over 10% saved penalty kicks when the goalkeeper attempted to distract the penalty taker. However, this comparison was not statistically significant ($\chi^2(1, N = 289) = 2.519; p = .056$, one-tailed, *odds ratio* = 1.81 [0.86, 3.81]). When taking the performance index (Dicks et al., 2010a) as the dependent variable, goalkeepers performed better when attempting to distract the penalty taker in his preparation, ($t(317) = 1.898, p = .029$, one-tailed, $d = 0.83$ [0.52, 1.15], see Figure 4).

Interestingly, goalkeepers initiated their movement attempt to save the penalty kick approximately one frame later (which corresponds to approximately 35 ms) when initially trying to distract the penalty taker, ($t(316) = 2.188, p = .029$, two-tailed, $d = 0.46$ [0.15, 0.77]) (see Figure 5). This might be regarded as supportive of the finding reported in Wood and Wilson (2010a) that penalty takers show more centralised penalty kicks in response to a distracting goalkeeper and therefore goalkeepers anticipate a more centralised penalty kick and can increase their chances of saving the penalty kick. Importantly, and contrary to findings derived from experimental penalty kick studies (Dicks, Button, & Davids, 2010b) when analysing all the penalty kicks, goalkeepers showed an earlier movement initiation for saved penalty kicks as compared to scored penalty kicks, ($t(119.672) = -3.968, p = .001$, two-tailed,

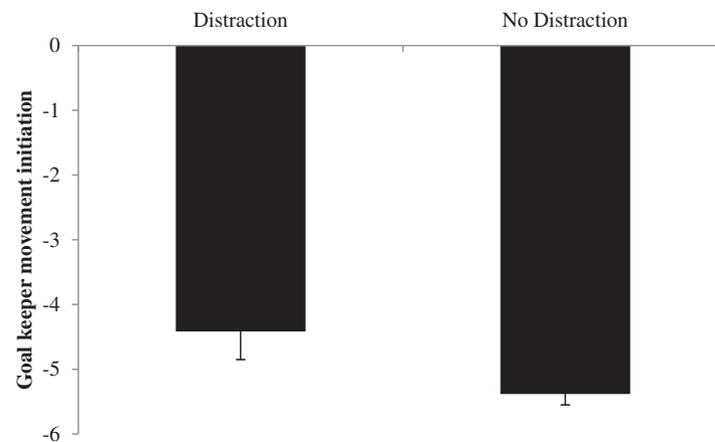


Figure 5. Movement initiation times relative to foot–ball contact (= 0) as a function of whether the goalkeeper attempted to distract the penalty taker. Error bars represent standard errors of the mean.

$d = -1.01 [-1.39, -0.77]$ ($M_{\text{saved}} = 6.3$ frames [approximately 217 ms] prior to foot–ball contact, $SD = 1.9$; $M_{\text{goal}} = 5.0$ frames [approximately 172 ms] prior to foot–ball contact, $SD = 2.9$).

General discussion

The central aim of the present study was to test performance consequences of directing attention towards the goalkeeper in association football penalty shootouts that have exclusively been shown in previous laboratory penalty kick studies (Navarro et al., 2013; Wilson et al., 2009; Wood & Wilson, 2010a). Most importantly, the present analyses showed that kicks that were categorised as predominantly gazing towards goalkeepers resulted in more saves and better performance by goalkeepers. Further, if goalkeepers engaged in behaviours to distract penalty takers this also resulted in more saves and better goalkeeping performance. Further, goalkeepers initiated their movement response later after engaging in distracting behaviour, which fits nicely to the finding of Wood and Wilson (2010a) who reported less accurate – i.e., more centralised – penalty kicks if a goalkeeper engaged in distracting behaviour. If penalty kicks are hit more centrally due to distractive behaviours of the goalkeeper, then the goalkeeper can wait longer to save the shot. Although this explanation is post hoc, it seems feasible that goalkeepers can increase their chances of saving the penalty kick by waiting a little longer before initiating a movement as the upcoming penalty kick has a chance of being more centralised.

A further interesting finding that emerged from the present analysis was that saved kicks were characterised by earlier movement initiation times of goalkeepers in reference to foot–ball contact in comparison to scored kicks. This finding stands in contrast to increasing claims that initiating an earlier movement relative to the penalty takers' ball contact leads to less successful goalkeeping performance and increased susceptibility to deception (Dicks et al., 2010b; van der Kamp, 2006). However, caution is warranted when deriving applied implications from this finding as there is obviously a “too early” just as there is a “too late” for goalkeepers in the penalty kick situation (van der Kamp, 2006). This matter is further complicated by the fact that penalty takers can use different

strategies (e.g., Noël, Furley, van der Kamp, Dicks, & Memmert, 2015); i.e., a keeper-dependent and a keeper-independent strategy. Depending on which strategy a penalty taker adopts, goalkeepers would also have to adjust their movement initiation time to increase chances of saving the ball. While goalkeepers would increase their chances of saving a penalty by initiating a late movement response in a keeper-dependent strategy (as kicks are usually not as powerful), they would decrease their chances in a keeper-independent strategy (as kicks are usually more powerful) – and vice versa.

The present research approach has some notable strengths and weaknesses. The main limitation of our research is that the only operationalisation of attention possible was to have coders blind to our hypotheses rate whether a penalty taker was paying attention to the goalkeeper or not. Therefore, it is not entirely clear what penalty takers were in fact paying attention to, although people are known to be well equipped for registering what other people are attending to (e.g., Moore & Dunham, 2014). In this regard, we have to admit that penalty takers could occasionally have attended to certain stimuli without shifting their gaze in the direction of these (i.e., covert attention). On these occasions, it would be difficult for external coders to determine to which stimulus someone pays attention. However, this methodological problem is not limited to our current approach but also concerns other behavioural assessments of attention like eye-tracking. Further, we cannot entirely rule out that coders were familiar with some of the penalty kicks, which might have biased their evaluations. However, it is unlikely that there was any systematic bias in the present analyses in favour of our hypotheses as the coders were blind to our hypotheses, showed a high inter-rater reliability (Cohen's kappa = 0.84) and behavioural coding and analyses were kept strictly separate. We acknowledge this limitation, but want to emphasise that there is always a trade-off between experimental control and representativeness of the research design and therefore consider it important to show that well-controlled experimental findings (Navarro et al., 2013; Wilson et al., 2009; Wood & Wilson, 2010a) were also observable in real-world penalty shootouts.

As findings from psychological experiments have been criticised for not transferring to the contexts to which

scientists aim to generalise their findings to (Brunswik, 1956), also in penalty kick experiments (Dicks et al., 2010a), the present findings are far from trivial and have important applied implications (as an extension of the review by Memmert, Hüttermann, Hagemann, Loffing, & Strauß, 2013). From the perspective of the penalty taker, it is not advisable to pay attention (i.e., gaze) towards the goalkeeper during the penalty kick preparation, even if other experimental studies have indicated that this might be intimidating for the goalkeeper (Furley, Dicks, & Memmert, 2012; Greenlees, Leyland, Thelwell, & Filby, 2008). In this respect, however, the relative timing of the gaze behaviour might be of importance as the penalty taker does want to communicate confidence towards the goalkeeper by looking at him. As our rating of attention towards the goalkeeper was a global assessment that did not distinguish between different time points during penalty preparation (e.g., before commencing run-up, during the run-up), future research is needed to shed light on the advisable timeline of beneficial self-presentation techniques and optimal aiming behaviour. This will help unravel the potential trade-off between signalling confidence (by looking at goalkeeper) and optimal aiming strategies for penalty takers.

From the perspective of the goalkeeper, the present results suggest that goalkeepers are well advised to draw attention towards them by engaging in distracting behaviour as this is likely to result in less accurate penalty kicks (Wood & Wilson, 2010a). Of further relevance to goalkeepers, the movement initiation time analysis suggests that goalkeepers might further increase their chances of saving the penalty kick after engaging in distracting behaviour if they initiate their movement response a little later (as the kick might be more centralised). However, we do not want to encourage behaviour by goalkeepers that can be considered unfair or unsporting. In this regard, the Dutch goalkeeper Tim Krul's behaviour during the penalty shootout against Costa Rica at the FIFA World Cup 2014 was very similar to what we would advise based on the current results (distracting the penalty takers and prioritising defending the right goal side over jumping to one side early in order to have a chance to save a decently placed kick). However, in the aftermath there were discussions if his behaviour constituted unsporting behaviour (<http://www.theguardian.com/football/blog/2014/jul/06/netherlands-keeper-tim-krul-intimidation-tactics>; retrieved on 11.01.2016). Hence, we emphasise that any actions taken by goalkeepers should adhere to the unwritten rules of "gamesmanship" (Potter, 2013).

Disclosure statement

No potential conflict of interest was reported by the authors.

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