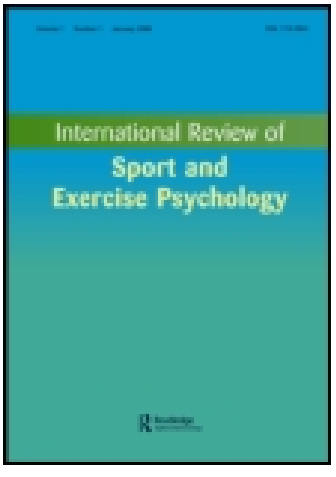

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Dueling in the penalty box: evidence-based recommendations on how shooters and goalkeepers can win penalty shootouts in soccer

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Dueling in the penalty box: evidence-based recommendations on how shooters and goalkeepers can win penalty shootouts in soccer

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In soccer, penalty kicks can decide the outcome of a match and in recent years, much effort has been invested in trying to identify the factors that influence successful performance. This overview presents some of the most important findings in order to compile a reliable set of facts that can improve the probability of success for either penalty takers or goalkeepers. Particular attention is paid to various strategic aspects in the shooter–goalkeeper interaction as previous research suggests that the chances of success on both sides may be greatly enhanced by applying findings from research in sport psychology. The article ends with a checklist that goalkeepers and penalty takers may use to improve their chances of success alongside recommendations to continue and intensify the efforts to carry out ecologically valid experiments in future research.

Keywords: penalty shootout; goalkeeper; penalty taker; choking

Penalty shootouts in the knockout stage of important tournaments like the World Cup remain in the memories of many soccer fans. Examples include Roberto Baggio's missed penalty in the final between Italy and Brazil in 1994 or David Trézéguet's miss in the 2006 final between France and Italy, which both led to the opposite team winning the match. The enormous pressure on the players can be felt in front of television screens across the world. There is no doubt that the extreme significance of this situation also influences the players.

There are countless anecdotal examples of how goalkeepers and penalty takers appraise the pressure. For example, before the shootout in the quarter-final game against Argentina in the 2006 World Cup, the German national goalkeeper, Jens Lehmann, was given a 'cheat sheet' by an assistant coach listing the probable direction in which different shooters would kick the ball. During the penalty shootout, Lehmann glanced at the sheet repeatedly before stuffing it in his sock and successfully saving the shots from Roberto Ayala and Estéban Cambiasso – thus helping Germany to advance to the semifinal. As we shall see, however, research in sport psychology has shown that such individual information tends to be of little use to a goalkeeper (Palacios-Huerta, 2003).

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Sport science has generated numerous studies containing detailed analyses of different aspects of the soccer penalty (for a recent review of the biomechanics of kicking in soccer, see Lees, Asai, Andersen, Nunome, & Sterzing, 2010). Here, we provide a comprehensive review of the literature by summarizing research on penalty kicks. Certainly, there are already reviews available addressing the perceptual process of penalty shootouts (e.g. Dicks, Uehara, & Lima, 2011; Savelsbergh, Versloot, Masters, & van der Kamp, 2010). However, the current work represents the first review that chronologically takes up a penalty kick in four different phases: the jersey colors of a team; the selection of a penalty taker; his or her run-up; and the goalkeeper's attempt to save a penalty. While recent reviews have primarily focused on players' visual perception and anticipation (e.g. Dicks et al., 2011; Savelsbergh et al., 2010), we examine a variety of different psychological aspects (e.g. coping with stressful situations, non-verbal behavior, motivational fit, anxiety, color effects, strategic effects, and penalty kick direction) that were identified as potential determinants of the performance of both players involved in the penalty situation. Similar to the approach of Savelsbergh et al. (2010), we report evidence from both a penalty taker's and a goalkeeper's perspective. In addition, we give consideration to the fact that the penalty situation is an *insitu* task that is regarded by many scientists from various domains a suitable means to examine a variety of different research questions (e.g. goalkeeper-independent vs. goalkeeper-dependent strategy; anxiety conditions; promotion vs. prevention instructions). Consequently, there has been an increase in the number of studies on the topic of soccer penalty kicks in the recent years.

An electronic literature search was conducted for articles published in the last 30 years, between January 1982 and March 2012, on the online databases SPORT Discus with Full Text and ISI Web of Knowledge All Databases. Among others, combinations of the following terms were used: 'goalkeeper', 'keeper-dependent', 'keeper-independent', 'kick', 'penalty', 'pressure', 'save', 'spot', 'shooter', 'shootout', 'soccer', 'taker'. A total of 275 articles from the databases Sport DISCUS and ISI Web of Knowledge were analyzed. We included all articles that met the inclusion criteria (a total of 84) and excluded all articles that were the same in both databases.

Scientific evidence on penalties from the shooter's perspective

Before a match – selection of jersey color

Colors are associated with different meanings: red, for instance, is associated with anger (Elliot & Maier, 2012). Accordingly, recent research on color effects on performance in martial arts suggests that combatants who wear red are more likely to win a fight than their opponents wearing blue colored jerseys, particularly when both competitors are of roughly equal strength (Hill & Barton, 2005). Likewise, an analysis of jersey color and team success in English soccer revealed that wearing a red jersey was associated with better team performance for home matches (Attrill, Gresty, Hill, & Barton, 2008). Furthermore, Greenlees, Leyland, Thelwell, and Filby (2008) reported that English goalkeepers estimated their chances of saving a penalty to be lower when the penalty taker wore a red jersey (compared to a white jersey) in a condition in which the penalty taker only made a small amount of eye contact with the goalkeeper (only 10% of trial duration). Although this finding has yet to be tested

in a transfer study – the study of Greenlees and colleagues was a video-based task – it is plausible that color might have an impact on the goalkeeper's subsequent performance. For the sake of completeness, however, Furley, Dicks, and Memmert (2012) did not find an advantage in wearing red compared to white in a sample of German goalkeepers. Rather, they found that penalty taker's body language (i.e., positive in comparison with negative) was a more reliable indicator of a goalkeeper's perceived likelihood of success. Whether the effect of red clothing is due to performers having a higher level of aggression when dressed in red, or opponents facing red-dressed performers being intimidated, or red-dressed performers being perceived as more aggressive by judges who award points to the competitors is still open to debate (Hagemann, Strauss, & Leißing, 2008).

Selection of players

In a soccer team, there are no restrictions concerning the selection of the penalty taker. Therefore, once a team is awarded a penalty, the crucial question is which player should be selected to take the kick. The selection of good penalty takers could be improved by screening members of the team with self-regulation (Brown, Miller, & Lawendowski, 1999) or regulatory focus (e.g. Lockwood, Jordan, & Kunda, 2002) questionnaires. For example, research indicates that it may be helpful for a coach to know which player has a chronic promotion or prevention focus. According to Higgins (1997) – who proposed two modes for self-regulating pleasure and suffering in his regulatory focus theory – a prevention focus is characterized by an individual's focus on responsibilities, obligations, and duties whereas individuals with a focus on aspirations and accomplishments are deemed to have a promotion focus. Following this approach, performance may depend on the fit between an individual's regulatory focus (promotion or prevention) and chronic regulatory orientation (promotion or prevention; Higgins, 2000). With regards to the penalty kick, Plessner, Unkelbach, Memmert, Baltes, and Kolb (2009) found that chronic-prevention-focused players have a significantly higher probability of scoring a penalty than chronic-promotion-focused players. This is because people with a chronic prevention focus perform better in prevention situations, whereas people with a chronic promotion focus perform better in promotion situations (Higgins, 1997). Since scoring a goal in a penalty shootout is generally considered as an obligation to fulfill (i.e., prevention situation) rather than as a chance to excel (i.e., promotion situation), chronic-prevention-focused players should be more successful.

Psychological skills

Geisler and Leith (1997) stressed the importance of psychological skills (e.g. coping with pressure to perform) in penalty performance. Any player in a professional team has the motor skills required for a successful kick, but not necessarily the mental toughness. Perceived pressure can have an impact on mental performance prerequisites by, for example, increasing the level of fear. Horikawa and Yagi (2012) recently investigated how the level of trait anxiety can influence state anxiety and penalty shootout performance. They found that higher trait anxiety tends to result in higher state anxiety and, in addition, that higher state anxiety interferes with goal kicking performance (see also Wilson, Wood, & Vine, 2009). Such an anxiety

effect might also help explain the 'choking under pressure' phenomenon (Beilock & Carr, 2001; Beilock, Carr, MacMahon, & Starkes, 2002), which can occasionally be observed when highly skilled athletes fail to successfully accomplish a well-trained and easy task in highly stressful situations (e.g. penalty shootout in a world championship final; see the above examples of Roberto Baggio or David Trézéguet) (Jordet, 2009a).

Another widely discussed reason for choking under pressure is an increase in an athlete's self-attention which causes him or her to no longer perform an action automatically but to become consciously aware of their performance (Lewis & Linder, 1997). One source that is considered responsible for choking under pressure is distraction (e.g. Beilock & Carr, 2001; Lewis & Linder, 1997). That is, players may become so distracted by perceived pressure that they can no longer concentrate sufficiently on their action but focus their attention on irrelevant stimuli and lose themselves in performance-impairing thoughts. To exemplify, Wilson et al. (2009) recorded penalty takers' gaze behavior under low and high threat conditions. Among other things, they found that players performing under high threat fixated considerably longer on the goalkeeper and directed balls more centrally toward the goalkeeper, which resulted in a reduced kicking accuracy. Whether domain-specific gaze-training interventions may help circumvent such anxiety-induced performance decrement in the long run has yet to be convincingly shown (Wood & Wilson, 2011, 2012). In addition, Jordet and Hartman (2008) found that avoidance motivation, not looking at the goalkeeper (which seems contradictory to the previous suggestions) or an overly quick execution of the penalty led to poorer kicking performance. In situations that require coping with pressure, the authors proposed using individual pre-performance routines to prevent a drop in performance (see also Jackson & Baker, 2001; Jordet, Hartman, & Sigmundstad, 2009).

Such routines should be practiced particularly by home teams for two reasons: first, because home teams are awarded penalties more often than away teams (e.g. Dohmen, 2008; Harari, 2009; Sutter & Kocher, 2004). For example, Sutter and Kocher (2004) analyzed referee bias in awarding penalties in the German Bundesliga. They found a bias in the penalties given in favor of the home team: in 50 out of 62 cases (i.e., 81% of the time), the home team was awarded a penalty kick correctly. In contrast, in 20 out of 39 cases (i.e., 51% of the time), the visiting teams were awarded a correct penalty kick. Harari (2009) also examined the degree of home team advantage in the awarding of penalty kicks in Major League Soccer from 1999 to 2009. The analysis revealed a number of 59%, the lowest percentage of calls in favor of the home team in 2004, and with 71% the highest percentage of sanctions in favor of the home team in 2005. In total, it was found that the home team received 63% of all penalties. The second reason is that the probability of missing a penalty is slightly higher in front of a home crowd (26.41% vs. 24.17%; see Dohmen, 2008). Therefore, Dohmen (2008) suggested that the home situation increases pressure on the players and thus enhances the likelihood of a choking-under-pressure effect.

Shooting strategies

A penalty taker might be dressed in the most distracting color and be identified as the most psychologically stable player, but this is of little help if he or she does not 'know' how or where (i.e., which goal area) to kick a penalty. Research (see Table 1)

Table 1. Probability of the goalkeeper saving the ball by direction of Penalty Taker's kick.

		Horizontal direction			
		Left	Centre	Right	All
Vertical direction	High	0.00	0.00	0.00	0.00
	Middle	0.13	0.08	0.16	0.13
	Low	0.17	0.19	0.24	0.20
	All	0.14	0.13	0.17	0.15

Note: Data based on 286 penalties in different soccer leagues taken from Bar-Eli and Azar (2009).

indicates that the goalkeeper's chance of saving a penalty kick directed toward the upper third of the goal is 0%; nevertheless, only 13% of penalty kicks reach this area (Bar-Eli & Azar, 2009). The main reason for avoiding kicks to the upper part of the goal might be the increased chance of missing the entire goal frame (Bar-Eli, Azar, & Lurie, 2009). To decrease the likelihood of this occurring, the authors recommended that the missing rates at the upper third of the goal could be reduced with proper training.

Besides shooting to the left or right, penalty takers can also choose to kick the ball straight toward the center of the goal. Leininger and Ockenfels (2008) estimated that the chance of scoring a goal was at around 50% when considering only the possibilities of left or right. Since goalkeepers often decide on one corner before the shot, the given probability can be explained by the goalkeeper's decision: it is either correct and the penalty is saved, or it is wrong and the shooter scores a goal (goalkeepers remain static and try to save the ball by staying in the center in only 6% of cases; Bar-Eli, Azar, & Lurie, 2009). Of course, diving into the correct corner does not necessarily mean saving the ball (in this case, the chances of saving a penalty are about 60%; Palacios-Huerta, 2003), so the probability of scoring is slightly higher than one in two. On the other hand, penalties that miss the goal or hit the post need to be taken into account as well (Leininger & Ockenfels, 2008). The Dutchman Johan Neeskens was the first penalty taker in an international match (World Cup final between Germany and the Netherlands in 1974) to choose the third option and kick the penalty straight toward the center of the goal. Currently, there is a controversial discussion on whether this is the safest option.

Chiappori, Levitt, and Groseclose (2002) reported that, in the keeper-independent strategy (the shooter chooses the target location in advance and ignores all movements by the goalkeeper before and during the run-up), on average, kicks in the middle of the goal have the highest probability of scoring (81% compared to 70% for the right corner and 77% for the left corner). However, we suggest that it is largely not possible to determine which shooting strategy will be the most successful. Rather, it is dependent on the shooter's technical ability (e.g. it is typically easier for a player to score when aiming to the opposite side of his or her strong foot) as well as the goalkeeper's ability. However, what is certain is that a penalty taker should take all possible shooting directions into account (for a comprehensive discussion, see, e.g. Bar-Eli & Azar, 2009; Bar-Eli, Azar, Ritov, Keidar-Levin, & Schein, 2007; Bar-Eli et al., 2009; Berger, 2009; Berger & Hammer, 2007).

Before deciding on one of the three possible kicking directions, the penalty taker is thought to choose between one of two general strategies: a keeper-independent or

a keeper-dependent strategy (van der Kamp, 2006). On the one hand, it is possible to set one's mind on a certain action and carry it out consistently, irrespective of the goalkeeper's reaction (i.e., totally ignoring the goalkeeper's movements) (open loop or keeper-independent strategy; see Kuhn, 1988). On the other hand, penalty takers may try to react to the goalkeeper's movements (closed loop or keeper-dependent strategy; see Kuhn, 1988) and choose their shooting direction accordingly. Using a computer task, Morya, Ranvaud, and Pinheiro (2003) have reported that people can successfully change their movement direction when a graphic on the screen (simulating the goalkeeper) moves approximately 400 ms before the execution of the player's movement. Further to this finding, research indicates that goalkeeper's actions less than 150 ms before foot–ball contact increase the chance of a less accurate penalty kick and thus a missed penalty. The longer a goalkeeper waits to initiate a movement, the less time remains for a penalty taker during the run-up to change the direction of the upcoming kick (see also Bowtell, King, & Pain, 2009; van der Kamp, 2006). Importantly, Navarro et al. (2012) showed that the minimum time required for responding to a goalkeeper's movement (in a simulated penalty kick task) increases for at least some penalty takers under pressure. Hence, it might be helpful to react to very early actions by the goalkeeper; however, doing so might be risky since the goalkeeper might know about such a strategy and perform deceptive movements at early stages of the penalty. As a consequence, the keeper-independent strategy seems more promising (Wood & Wilson, 2010). Additionally, according to van der Kamp (2006), a penalty taker's kicking accuracy is higher if he or she employs a goalkeeper-independent strategy because, in contrast to the goalkeeper-dependent strategy, it always allows enough time to execute the kicking action.

Another benefit of the goalkeeper-independent strategy is that penalty takers can exclusively focus on target location instead of aiming to anticipate the goalkeeper's movement at the same time (van der Kamp, 2011). Noël and van der Kamp (2012) compared the gaze behavior of penalty takers adopting a goalkeeper-dependent or goalkeeper-independent strategy for low and high anxiety conditions. Performance advantages were found for the goalkeeper-independent strategy over the goalkeeper-dependent strategy because kicks were placed further away from the goalkeeper and fewer saves were made. In the keeper-independent strategy, the penalty taker spent longer time looking at the target location of the goal and towards the ball, and shorter looking time to the goalkeeper. Although anxiety did not affect gaze behavior and performance, the authors were able to show that the benefits of the goalkeeper-independent strategy result from more optimal gaze patterns.

Using the *temporal presentation paradigm*, Dicks and colleagues compared the impact of deception and non-deception penalty kick strategies on the goalkeeper's performance (Dicks, Davids, & Button, 2010; Dicks et al., 2011).[1] Applying a deception kick, the penalty taker first fakes a kick to one side and then shoots into the opposite corner. In a non-deception strategy, the penalty taker directly shoots at the desired side of the goal without any deceptive intentions. Results indicate that goalkeepers' performance can improve when they ignore early information (e.g. angle of the run up) that is available up until the penalty taker initiates the kicking action. That is, the goalkeepers should make use of late information (approximately 450 ms before foot–ball contact) that is being presented shortly before the initiation of the penalty taker's kicking action (see also van der Kamp, 2006). This late information could help the goalkeeper to not be deceived so easily. Furthermore,

Dicks et al. (2011) revealed that individual differences in action capabilities influence the goalkeeper's performance insofar as quicker goalkeepers can move closer to ball contact when facing penalty kicks. The authors propose to practice goalkeepers' movement speed as well as introducing visual anticipation training.

Finally, certain instructions may also impact upon penalty kick performance. For example, the sole instruction of "not to fail" can lead to the exact opposite effect and increase the probability of missing a penalty (Bakker, Oudejans, Binsch, & van der Kamp, 2006). Likewise, negatively formulated statements such as 'don't miss the goal' or 'don't shoot the ball so that the goalkeeper can block it' may make players focus on the goalkeeper or the space outside the goal, which more often leads to failure. Therefore, players should not focus their visual attention on the goalkeeper (Wilson et al., 2009; Wood & Wilson, 2010), but concentrate on the opportunity to score, that is, on the open spaces in the goal. In order to ensure this strategy is effective, the player should take enough time to aim toward these areas (see also Binsch, Oudejans, Bakker, Hoozemans, & Savelsbergh, 2010; Binsch, Oudejans, Bakker, & Savelsbergh, 2010).

The penalty shootout

The penalty shootout is a special situation in two ways. Not only will it decide the match – unlike a penalty during regular playing time – but it also involves several penalty takers (generally five per team). This makes it necessary to ask not only who should be selected but also in what order they should shoot. First of all, it does not make any difference which team kicks first. Statistically, the chances of winning are the same irrespective of kicking order (Kocher, Lenz, & Sutter, 2004).

Order of the penalty takers

According to the procedure recommended by McGarry and Franks (2000), players should kick penalties in the reverse order of their abilities and skills. That is, the fifth-best striker should kick the first penalty, the fourth-best player the second penalty, and so on. However, analyses of the effect of the sequence on the probability of success show a different trend: shots that were performed closer to the end of the shootout revealed a lower probability of success. This rate is lowest (64.3%) for additional shots if the score is level after the first five kicks (Jordet, Hartman, Visscher, & Lemmink, 2007). While this finding can be attributed to the greater pressure at the end of the penalty shootout, it should also be taken into account that players who take a team's sixth (seventh, eighth, ninth . . .) penalty may not belong to the best penalty takers, because otherwise, they most likely would have been selected as one of the first five players.

Public appraisal

Jordet (2009b) proposed that highly favorable public appraisals of a team are linked to displays of escapist self-regulation strategies and inferior performance. For example, this suggestion appears rather disadvantageous to the coach of the English national team in a European or World Cup. Following the referee's whistle in the shootout, English players were found to start running far more quickly (after 0.28 s)

than those of other nations, and they mostly avoid direct eye contact with the goalkeeper during penalty kick preparation (56.7% of English players turn their backs on the goalkeeper during the run-up; see also Jordet, 2009a).

Temporal preparation for the penalty kick

Jordet et al. (2009) analyzed the different time intervals related to kicking performance for penalty shootouts in three major international soccer tournaments. One of their findings was that players who wait a bit longer after the referee's whistle have a greater probability of success. In another study, Jordet (2009b) showed that teams from countries with many international club titles or many internationally decorated players – that is, teams with high public status like England or Spain – spent less time preparing their shots (see also Jordet, Hartman, & Jelle Vuijk, 2012, for evidence of a historical dependency effect on a team's penalty shootout performance). In a recent experiment, Furley, Dicks, Stendtke, and Memmert (2012) extended the finding of time spent preparing the shot. They showed that a penalty taker's hastening – i.e., not taking one's time after the referee's whistle – and hiding – i.e., turning one's back towards the goalkeeper – led to an increased confidence the goalkeepers likelihood of saving the subsequent penalty. In addition, Furley et al. (2012) demonstrated that goalkeepers initiated their movement later following the observation of hastening and hiding behaviors during the penalty preparation. On the other hand, however, it seems disadvantageous for the penalty taker if he or she has to wait too long for the referee's permission to shoot. This is in accordance with an explanation of choking that occurs following failed self-regulation (Jordet et al., 2009). Players with high current status seem to engage more in certain escapist self-regulatory behaviors than penalty takers with future status (Jordet, 2009a). Hence, coaches may benefit from not selecting players that have the highest public status or most inflated public expectations. These individuals benefit from additional psychological interventions as they are likely to experience extra performance pressure (Jordet, 2009a).

Celebration after a goal

The outcome of a penalty shootout can also be influenced by another variable: the way in which penalty takers celebrate after a goal. Moll, Jordet, and Pepping (2010) showed that after a successful penalty, players should celebrate as theatrically as possible because this seems to have an impact the opposing team who then tends to perform worse in their subsequent shots. Concurrently, celebratory behaviors may positively affect kicking performances of one's own teammates. In addition to these effects of post-performance non-verbal behaviors in penalty shootouts, Furley et al. (2012) highlighted the importance of certain pre-performance non-verbal behaviors signaling dominance and submissiveness. Displaying a submissive body language prior to penalty kick execution increases the goalkeepers' confidence in saving the subsequent penalty kick. A dominant penalty preparation had the opposite effect on goalkeepers.

The penalty in the view of the goalkeeper

Use of previous statistics

From the goalkeeper's view, the penalty shootout is a completely different situation. In principle, defending the goal during a penalty kick is a very difficult task. A second look at the earlier statistics shows that the penalty taker has a 74.2% probability of scoring a goal while the goalkeeper can save the ball only in about 18.8% of the cases (Dohmen, 2008).

One reason that saving penalties is so difficult is that the ball travels at speeds from 50 to 100 km/h and thus crosses the goal line an average of 600 ms after football contact (Franks & Harvey, 1997). If we subtract a goalkeeper's reaction time and the time he or she needs to dive to a corner (500–700 ms; Franks & Harvey, 1997), we find that it is inadequate for a goalkeeper to react on ball flight but that he or she has to decide on a corner before the penalty taker even touches the ball (of course, it depends on the agility of the goalkeeper). However, anticipating the correct corner of the goal is only one of the goalkeeper's tasks. The other one so far studied in the literature is determination of the shot's height. For example, in some studies, while only 26% of errors were found to be associated with incorrect predictions of the corner into which the ball is shot, most errors (62%) were observed for incorrect judgment of the height of the shot (McMorris, Copeman, Corcoran, Saunders, & Potter, 1993; Williams & Burwitz, 1993).

To increase the chances of success, goalkeepers can orient themselves toward the previous statistics. It is known in which direction most balls are kicked. For example, penalty takers less frequently aim toward the upper third of the goal (in 12.9% of

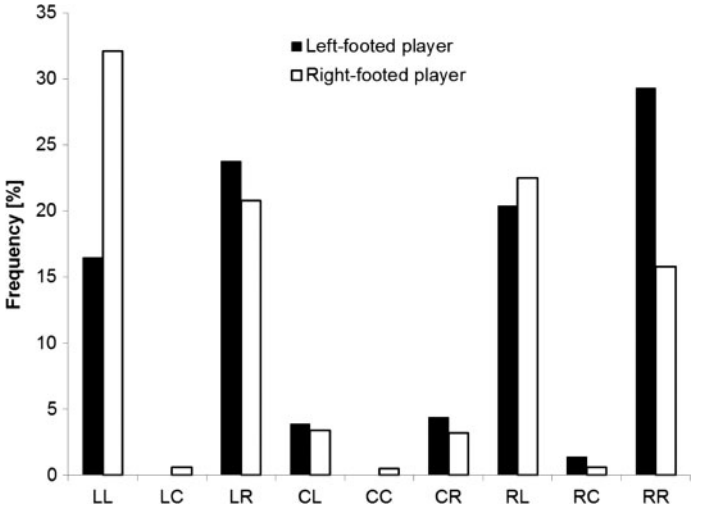

Figure 1. Selected strategies of goalkeepers and penalty takers from the player's perspective (L = left; C = center; R = right) by kicking leg. The first letter gives the direction of the kick by the player; the second, the direction in which the goalkeeper jumps. Example LL: The ball is directed toward the left and the goalkeeper jumps to the left (both from the perspective of the shooter: 32.1% for a right-footed player and 16.5% for a left-footed player). Data are taken from Palacios-Huerta (2003) and based on 1417 penalty kicks between 1995 and 2000 in the first-division leagues of several countries including Spain, Italy, and England.

cases, compared to 30.4% in the middle and 56.6% in the lower third; Bar-Eli & Azar, 2009). Moreover, there is a tendency for right-footed players to kick to the left (from the penalty taker's perspective) whereas left-footed players prefer the right side (see Figure 1). Goalkeepers seem to be aware of these probabilities, because they tend to dive to the left-hand corner (from the penalty taker's perspective) when a right-footer shoots and into the right-hand corner for a left-footer (see Figure 1 and Chiappori et al., 2002; Palacios-Huerta, 2003).

One promising strategy could be to not jump sideways but to remain in the middle. Bar-Eli et al. (2007) found that 29% of the penalty kicks in their sample were directed toward the center of the goal but that the goalkeepers remained in the middle only 6% of the time. A closer look at the goalkeeper's chances of success reveals that these decrease the higher the shot is directed into the upper part of the goal (see Table 1). Horizontal directions, however, reveal no significant differences. Regardless of whether the shot goes to the left, the right, or the middle, the probabilities of stopping the ball are almost the same (Bar-Eli & Azar, 2009).

Anticipating penalty kicks

Alongside the possibility of using general prior information, goalkeepers can also try to anticipate shot direction on the basis of a penalty taker's movement prior to foot–ball contact (Kuhn, 1988; Neumaier, te Poel, & Standtke, 1987). The ability to do so largely determines the accuracy of the goalkeeper's decision. A variety of expert–novice studies employed the temporal occlusion paradigm and showed that experts are much better at predicting the direction of the shot based on early information on the run-up and kicking movement (McMorris, Hauxwell, & Holder, 1995; Neumaier et al., 1987; Savelsbergh, Williams, Van der Kamp, & Ward, 2002; Williams & Burwitz, 1993). Williams and Burwitz (1993), for example, asked 30 expert and 30 novice soccer players to predict the shot direction (one of the four corners of the goal) of 40 temporally occluded penalty kicks. The players watched short video sequences on a screen displaying kicking movements under four temporal conditions: (a) up to 120 ms before ball contact; (b) up to 40 ms before ball contact; (c) up to ball contact; and (d) up to 40 ms after ball contact. Results showed that experienced players performed much better than novices, particularly in the 120 ms condition.

Research that included the tracking of participants' eye movements provided insight into which information goalkeepers potentially rely on when trying to infer shot direction from a kicker's action (e.g. Dicks, Button, & Davids, 2010b; Savelsbergh, van der Kamp, Williams, & Ward, 2005; Tyldesley, Bootsma, & Bomhoff, 1982). For example, in a video task, Savelsbergh et al. (2002) analyzed the gaze behavior of experienced and novice goalkeepers. They found that experts pay more attention to the kicking leg, the non-kicking leg, and the ball, whereas novices fixate on the torso, arm, and hip region. Thus, part of the skill-dependent differences in prediction accuracy might potentially be explained by differences in eye movement behavior (see also Savelsbergh et al., 2005). Dicks et al. (2010b) confirmed this finding for goalkeepers in principle but pointed out that the eye movements of goalkeepers under real-time conditions that require goalkeepers to move and intercept the ball are different to video laboratory conditions. Compared to situations where participants watched videos of penalty kicks without the need to

physically move to try and stop the kick, in the final phase (i.e., from 500 ms before ball contact to 120 ms after ball contact) of the *insitu* interception condition, goalkeepers fixated almost exclusively on the ball but rarely on the kicking or non-kicking leg.

In addition, Williams and Burwitz (1993) named the hips as another important source of information. 'For a right-footed kicker, the "opening" of the hips suggested that the ball was about to be shot to the goalkeeper's left, whereas a penalty directed to the goalkeeper's right was characterized by a more "closed" or central orientation of the penalty taker's hips relative to the goalkeepers' (Williams, 2000, p. 740). Williams and Burwitz (1993) suggest that goalkeepers should make their decision on the *side* before ball contact, but that the decision on how *high* to jump may also be made after ball contact. The lean of the trunk may be an important cue to the shot height (see also Tyldesley et al., 1982).

Lees and Owens (2011) examined the kinematics of penalty kicking in soccer players with the aim of establishing postural visual cues in kicking that may be of use to goalkeepers. In addition to the confirmation of the relevance of previously identified information sources about 200 ms prior to foot–ball contact (e.g. pelvis rotation and hip), they suggest that for goalkeepers whose action capabilities permit a late strategy (i.e., moving at or after ball contact), the orientation of the penalty taker's support foot is best to take into account since the support foot then points toward the direction of the ball (i.e., left or right).

Hence, it appears better for goalkeepers to generally wait as long as possible in order to gather as much information as possible from the run-up and kicking movement (Kuhn, 1988). This has also been confirmed by Savelsbergh et al. (2005) who showed that successful goalkeepers waited longer before initiating a movement for a video task. While the decision of which corner to jump toward has to be made before ball contact (Neumaier et al., 1987), a constraint in giving final recommendations on the timing of the initiation of a dive appears to be the individual goalkeeper's physical ability to move quickly (Dicks et al., 2010). More specifically, Dicks et al. (2010) found a strong correlation between goalkeepers' baseline movement times and the time they initiated an interceptive action relative to a penalty taker's foot–ball contact. The faster goalkeepers waited longer (and thus gathered more visual information) before trying to stop the ball in penalty situations.

Collectively, the movement features that goalkeepers can use to anticipate the direction of the kick are as follows: (1) orientation of the non-kicking foot/toes (see also Franks & Harvey, 1997; McMorris et al., 1995); (2) orientation or turning of torso (Neumaier et al., 1987); (3) positioning of non-kicking foot in relation to the ball (see also Franks & Harnvey, 1997; Savelsbergh et al., 2005); and (4) extremely oblique run-up (see also Franks & Harvey, 1997; McMorris et al., 1995). A recent experimental study by Loffing, Burmeister, and Hagemann (2010) confirmed that goalkeepers' predictions of the direction of the shot are influenced by the run-up direction. Participants performed best when confronted with penalties approached from 20° and 30°, whereas performance was lowest in the 0° and 40° conditions. Overall, it is yet to be identified whether goalkeepers base their decisions on specific local cues and/or on a more global observational approach. Recent work by Diaz, Fajen, and Phillips (2012) suggests that observers predominantly relied on distributed (i.e., global) information, potentially supported by specific local information, when trying to infer shot direction from point-light animated penalty

kicks. However, an essential limitation of this study, besides the usage of an artificial laboratory task, is that only participants without experience in soccer were tested. Future research is warranted to examine whether goalkeepers use similar information pick-up strategies and whether these transfer to real-time performance (Dicks et al., 2010b).

An obvious way of using the above information on potentially relevant advance cues for improving goalkeepers' shot direction anticipation performance could be the design of video-based training interventions (e.g. McMorris & Hauxwell, 1997; Savelsbergh, Van Gastel, & Van Kampen, 2010). Here, goalkeepers are typically confronted with video sequences of penalty shots that stop at certain time points and their task is to predict penalty kick direction. In this regard, providing goalkeepers with a considerable spectrum of different penalty kicks (Dicks et al., 2011) and directing the goalkeepers' attention toward critical movement features in the course of a penalty taker's action may facilitate perceptual learning (Savelsbergh et al., 2010). However, while video-based perceptual training interventions have been reported to significantly improve visual anticipation for laboratory-based tasks (McMorris & Hauxwell, 1997; Savelsbergh et al., 2010), evidence of its relevance for *in-situ* goalkeeping performance is still missing.

Does the kicking leg influence the potential success of goalkeepers?

Dohmen (2008) found that 36.24% of penalties in the German Bundesliga are shot with the left foot. Compared to right-footed players, the shots of left-footed players tend to be aimed toward the right-hand corner (from the shooter's view; Chiappori et al., 2002). Also, goalkeepers seem to have more difficulties with predicting shot direction of left-footeed compared to right-footed penalties (Loffing et al., 2010; McMorris & Colenso, 1996). For example, accuracies for the prediction of shot direction (top/bottom x left/right) of left-footed penalties were about 2% inferior to right-footed penalties (Loffing et al., 2010). This observation can be explained by a negative perceptual frequency effect (Baumann, Friehe, & Wedow, 2011; Hagemann, 2009). As right-footed players are considerably more common than left-footed players (Carey et al., 2001), goalkeepers are perceptually less familiar with left-footed actions which, in turn, may make it harder for them to identify shot direction from left-footed kicks. This idea is supported by the higher success rates of left-footed (76.22%) compared to right-footed penalty takers (72.15%) in the German Bundesliga (between 1995 and 2007, $N = 999$ penalty kicks; Baumann et al., 2011), but not in the Italian Serie A (between 1997 and 2000, $N = 459$ penalty kicks; Chiappori et al., 2002; Coloma, 2007).

Further goalkeeper tricks

Another way for goalkeepers to increase their chances of success is to place himself or herself slightly to the left or the right of the center of the goal. Masters, van der Kamp, and Jackson (2007) found that when goalkeepers take a non-central position – that is too slightly off-center for the shooter to perceive consciously – the kicker's shooting behavior is influenced in the direction of the larger side. They confirmed this finding in an experiment where they instructed players to only kick toward the side of their choice when they believed that the goalkeeper was standing exactly in the middle.

These results were replicated and extended in using *in-situ* experimental scenarios (Weigelt & Memmert, 2012; Weigelt, Memmert, & Schack, 2012).

Goalkeepers can also influence penalty takers' behavior by assuming a certain posture. Van der Kamp and Masters (2008) showed that goalkeepers can mimic Müller-Lyer configurations by assuming different arm postures. Goalkeepers who raise their arms above their head are perceived to be bigger than goalkeepers lowering their arms. This difference in perceived height and arm length (see also Shim, Lutz, van der Kamp, & Rigby, 2011; Shim, Masters, Poolton, & van der Kamp, 2010) also affects penalty-taking accuracy. If a goalkeeper looks bigger, penalties are more often directed further away from him, making it more difficult to save such a penalty kick attempt.

In addition, goalkeepers can draw attention to themselves through distracting behavior, thereby impacting upon the player during penalty preparation. Indirect support for the utility of this strategy comes from Wilson and colleagues (Wilson, Chattington, Marple-Horvat, & Smith, 2007; Wilson, Wood, & Vine, 2009). Players who are under pressure look at goalkeepers for longer durations; therefore, goalkeepers may take advantage of this fact to distract players (e.g. by not positioning themselves in the center or by faking a movement). Wood and Wilson (2010) recently showed that a moving goalkeeper (i.e., waving arms up and down) in contrast to a static one attracted more visual attention in penalty takers (in terms of total number of fixations) during the aiming phase. In addition, players directed kicks significantly more centrally toward a moving compared to a static goalkeeper (approx. 32 cm difference), and goalkeepers saved significantly more shots when moving than remaining static until the ball was kicked.

Summary and conclusion

A penalty kick is a highly dramatic event. It often determines the outcome of a soccer match. Therefore, it is not surprising that it has become an interesting research topic for sport psychology. The penalty kick offers a suitable setting to study how numerous psychological variables influence athletic achievement. In recent years, a great deal of knowledge has been accumulated regarding crucial factors from the perspective of both the penalty taker and the goalkeeper. The aim of this article was to list the possible ways in which both players can influence their performance (Dicks et al., 2011; Savelsbergh et al., 2010). Table 2 summarizes promising behaviors from the view of both the penalty taker and the goalkeeper. The list is structured according to the temporal course of a penalty: the selection of players, the run-up, the shot, and behavior after the shot.

As outlined above, the table shows that many factors can influence the outcome of a penalty situation. Nonetheless, it should be considered that many of these findings were obtained in highly controlled experimental settings. Dicks et al. (2010b) showed that some laboratory findings are unlikely to be transferable to real-life situations. A comparison of situations that differed in terms of their representativeness for the natural competitive situation showed, for example, changes in the gaze behavior of goalkeepers across situations. This implies, in turn, that researchers should continue testing whether findings gained exclusively in the laboratory transfer reliably to real-world settings. That is, sport situation scenarios are required which

Table 2. Recommendations for goalkeepers and penalty takers derived from the literature and structured according to temporal phases.

Phase	Recommendations	References
	Penalty Taker	
Selection of players	- preferable for the player to have a chronic prevention focus	- Plessner et al. (2009)
	- should be left-footed	- Baumann et al. (2011); Dohmen (2008); Loffing et al. (2010); McMorris & Colenso (1996)
	- should have tried and tested pre-performance routines at his/her disposal	- Jackson & Becker (2001); Jordet & Hartman (2008); Jordet et al. (2009)
	- wear a red jersey	- Attrill et al. (2008); Greenless et al. (2008); Hagemann et al. (2008); Hill & Barton (2005)
Run-up	- choose the straightest or most oblique run-up angle	- Loffing et al. (2010)
	- choose the target of the shot in advance	- Noël & van der Kamp (2012); van der Kamp (2011); Wood & Wilson (2010)
	- look at the goalkeeper directly and walk backward facing the goalkeeper when preparing for the run-up	- Jordet (2009a,b)
	- take enough time for the shot	- Binsch et al. (2010); Binsch et al. (2010); Furley et al. (2012); Jordet et al. (2009); Wilson et al. (2009); Wood & Wilson (2010)
Shot	- if technically possible, kick the ball close to but still below the crossbar	- Bar-Eli and Azar (2009); Bar-Eli, Azar, and Lurie (2009)
	- focus gaze on the target when performing the shot	- van der Kamp (2011); Wilson et al. (2009); Wood and Wilson (2010)
	- avoid clear pointing of the non-kicking foot toward horizontal kicking direction	- Lees and Owens (2011)
After the shot	- in penalty shootouts, celebrate a goal as theatrically as possible	- Moll et al. (2010)
	Goalkeeper	
Run-up	- extend the temporal sequence as long as possible so that the referee does not permit an immediate shot	- Furley et al. (2012)
	- draw attention to self (gesticulation, jersey color)	- Shim et al. (2010); Shim et al. (2011); van der Kamp and Masters 2008; Wilson et al. (2007); Wilson et al. (2009)
	- make deceptive moves	- Navarro et al. (2012)
	- offer a corner to the shooter by not standing exactly in the middle of the goal	- Masters et al. (2007); Weigelt & Memmert (2012); Weigelt et al., (2012)
	- exploit advance cues to anticipate the direction of the shot such as position of non-kicking leg, angle of hips/torso	- Dicks et al. (2010b); Franks & Harvey (1997); Kuhn (1988); Lees & Owens (2011); Loffing et al. (2010); McMorris et al. (1995); Neumaier et al. (1987); Savelsbergh et al. (2002, 2005); Tyldesley et al. (1982); Williams & Burwitz (1993)
	- start a defensive reaction shortly before ball contact	- Neumaier et al. (1987); Savelsbergh et al. (2005)
	- move during the aiming phase instead of remaining stationary	- Wood & Wilson (2010)

Table 2 (*Continued*)

Phase	Recommendations	References
Shot	- sometimes remain in the middle of the goal	- Bar-Eli, Azar, and Lurie (2009)
	- move to the left-hand corner (from the shooter's perspective) for a right-footed player and to the right-hand corner for a left-footed player	- Chiappori et al. (2002); Palacios-Huerta (2003); Williams (2000); Williams and Burwitz (1993)
	- focus on the foot–ball contact region during the shot	- Kuhn (1988); Lees and Owens (2011); Neumaier et al. (1987)
	- a slow-moving goalkeeper should react earlier than a fast-moving one	- Dicks et al. (2010)
	- assume a certain posture to 'look small'	- Shim et al. (2010); Shim et al. (2011); van der Kamp and Masters (2008)
After the shot	- celebratory behavior can be expected to be useful after a save	- Moll et al. (2010)

are as realistic as possible and include the relevant features of a competitive situation (Dicks, Davids, & Button, 2009).

Another issue relates to the interaction between shooters and goalkeepers. Most studies pay insufficient attention to this interaction by concentrating on just one perspective – either that of the goalkeeper or that of the shooter – and thus fail to consider that the behavior and movements of these two individuals are likely to be interdependent (Dicks et al., 2010; Kuhn, 1988; Wood & Wilson, 2010). Naturally, players try to influence each other, by distraction as well as the application of self-display techniques to create a self-confident impression (Greenlees et al., 2008). It is precisely this interaction that makes the penalty situation so exciting: it transforms the situation into a thrilling competition. Future research is encouraged to continue and intensify the investigation of this interaction, in order, for example, to better understand whether and how penalty takers' and goalkeepers' deceptive actions affect and shape respective performances in the course of a penalty (Dicks, Button, & Davids, 2010a; Smeeton & Williams, 2012). In addition, more intervention studies would help to develop specific training programs for both penalty takers and goalkeepers (Lidor, Ziv, & Gershon, 2012).

Finally, it still needs to be clarified how far individual information about a specific shooter can actually help the goalkeeper. Previous work suggests that shooters do not display any pattern in their sequence of shots (with slight exceptions) that a goalkeeper can exploit successfully (Palacios-Huerta, 2003). But then, how did Jens Lehmann manage to block the two penalties in the quarter-final match between Germany and Argentina? In subsequent interviews he explained that the cheat sheet had not really helped much because it failed to list the directions in which several players – including Estéban Cambiasso – normally shoot. Nonetheless, Lehmann succeeded. Perhaps it was more the cheat sheet itself which irritated the players and distracted Cambiasso from preparing his penalty. Thus, just pretending to know where a penalty taker will kick the ball (e.g. by looking at a sheet of paper) might be a promising strategy for a goalkeeper. Either way, the cheat sheet served its purpose and was later auctioned at a charity event for 1 million euros.

Note

1. In 1997, a rule change was designed to give goalkeepers a better chance in a shootout by allowing them to move along the line at any time but not forward toward the penalty taker. Before the rule change, goalkeepers had to remain stationary in the center of the goal until the ball was kicked. However, since the introduction of this rule, penalty takers have increasingly turned to a kicking technique first popularized by the soccer legend Pelé in the 1970s and commonly known as the 'Paradinha' (little stop). Using this technique, penalty takers stop their movement as they are about to take the penalty sending the goalkeeper the wrong way with a dummy before aiming the ball into the empty corner of the goal. In response to this behavioral pattern of penalty takers, in 2010 a new rule was introduced prohibiting a stop at the end of the run-up.

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