

Running head: TEMPORAL LINKS IN PENALTY SHOOTOUTS

Temporal links to performing under pressure in international soccer penalty shootouts

Geir Jordet, Esther Hartman and Einar Sigmundstad

Revised March 3, 2009

Abstract

Objectives: This study examined the temporal characteristics of performing under pressure in a high-stakes real world sport situation.

Design: Behavior observation analyses were conducted of televised soccer games.

Methods: Videos were obtained from all penalty shootouts ever held in three major international soccer tournaments (World Cup, European Championships, and UEFA Champions League). In these events, 296 players performed 366 penalty kicks. The time periods that were analyzed in relation to shot-outcomes were: walking, ball placement, back-up, signal-waiting, signal response, and run-up.

Results: Several time intervals were linked to performance. For example, longer times to respond to the referee's ready signal were related to more goals and shorter times were related to more misses. A similar weak trend was found for ball placement. Time to wait for the referee signal went in the other direction, with shorter times giving more goals.

Conclusions: Shorter self-imposed times were linked to worse performance than longer times. Plausible reasons for this result may be the extreme levels of pressure that are induced by major penalty shootouts, causing performers to attempt escaping the emotional distress by getting the situation "over with" as soon as possible. These results are consistent with a model of choking as a case of self-regulatory breakdown.

Key words: reaction time, avoidance, attention, football

Temporal links to performing under pressure in international soccer penalty shootouts

*Elizondo's whistle went, and the teams gathered in two tense groups in the centre-circle. Jesus, I wish I was first up. Get it out the way. The wait's killing me. (...). I was ready. Elizondo wasn't. Blow the whistle! F***ing get a move on, ref! Why the wait? I'd put the ball on the spot, Ricardo was on his line. Why do I have to wait for the bloody whistle? Those extra couple of seconds seemed like an eternity, and they definitely put me off.* (Steven Gerrard, 2006, p. 419-420, about the time before his missed shot in the 2006 World Cup penalty shootout).

Choking under pressure can be defined as performing more poorly than expected given one's skill level, in response to a high-pressure situation (based on Beilock & Gray, 2007). Two major set of theories have been advanced to explain this phenomenon. In the explicit monitoring hypothesis it is argued that pressure induces athletes to attempt consciously monitoring and controlling movements that normally are executed without conscious control (Baumeister, 1984). This process disrupts natural skill execution that otherwise would be automatically run, and tasks that do not require online attentional control are sensitive to these disruptions (e.g., Beilock, Carr, MacMahon, & Starkes, 2002). Another set of theories is represented by the distraction hypothesis. According to this view, pressure induces worry that consumes working memory resources that otherwise would be used to focus on the task, and performance suffers as a result. Studies have shown that tasks that rely on working memory are particularly susceptible to this type of performance failure (e.g., Beilock, Kulp, Holt, & Carr, 2004). Some of the research reported to support the explicit monitoring hypothesis has revealed that athletes who choke often spend longer times preparing and/or moving while performing, which is

thought to reflect the additional information processing involved in explicitly monitoring one's performance. For example, in laboratory tasks where movement time is unlimited, performers take longer time completing the task under pressure conditions than under no-pressure conditions (e.g., Masters, 1992; Pijpers, Oudejans, Holsheimer, & Bakker, 2003) and in tasks where performers are instructed to act as quickly as possible, experts perform better and novices worse, suggesting that the automatic skills of experts benefit from conditions that limit attention to execution (Beilock, Bertenthal, McCoy, & Carr, 2004). However, in a recent study, Vickers and Williams (2007) showed that elite biathlon shooters performed better with limited external focus time only at moderate levels of physiological arousal. At maximum levels of physiological arousal, longer focus times gave better performance and insulated the athletes from choking. It was concluded that under extreme distress, withholding attention to external task information allows elite athletes to maintain performance.

A complementary conceptual view can be derived from Baumeister's (1997) model that was presented to explain a wide variety of self-defeating behaviors. Based on this model, it can be hypothesized that choking under pressure can be a form of self-regulatory breakdown under high levels of ego threat. Specifically, Baumeister (1997) holds that people feel threatened when favorable views about themselves (egotism) are called into question by others and one likely response to this ego-threat is emotional distress (described by Baumeister, 1997, as general negative affect such as anxiety and depression). When experiencing these emotions, sometimes one's systems for self-regulation break down and people search escape from the emotional distress rather than attempt to solve the task optimally. The distress is experienced as so salient that people

self-regulate by assigning top priority to ending the unpleasant state. Although this may provide initial relief, it also may undermine other types of self-control and harm performance, thus ultimately becoming self-defeating. One typical case of self-regulatory breakdown is when people speed up their preparation to get an unpleasant situation over with as soon as possible. This self-regulatory desire may be stronger the longer a threat lingers (as in long waiting periods), because one has to endure longer the unpleasant states that come with the possibility of losing self-esteem. Research conducted in non-sport settings suggests that some of these processes run as predicted. For example, people with high self-esteem who under-perform in pressure situations sometimes show signs of self-regulatory breakdowns, where they favor speed over accuracy (Baumeister, Heatherton, & Tice, 1993) and people who are emotionally distressed seem to adopt a narrow focus where they act impulsively without considering the risks of their decisions, which ultimately leads to poor outcomes (Leith & Baumeister, 1996). Moreover, in a recent study, the participants dreaded some expected negative stimulus so much that when given a choice, they would prefer to receive a higher unpleasant stimulus rather than to wait longer (Berns, Chappelow, Cekic, Zink, Pagnoni, & Martin-Skurski, 2006). In the current study, we wanted to test some of these predictions in high-pressure sport tasks, by examining the preparation times associated with performing in major soccer penalty shootouts.

One serious limitation of the research on choking under pressure is the lack of real-world research (Beilock & Gray, 2007). With regard to the links between pressure, preparation times and performance in real world sport tasks, there are only a few studies and they have produced inconsistent results. For example, Wrisberg and Pein (1992)

found no effect of pressure on neither pre-throw routine times nor on performance in a group of college basketball players, although the better players tended to have longer pre-shot routine times than the less skilled players. In a study of elite rugby goal kickers, Jackson (2003) discovered that in high-pressure situations, the players had shorter physical preparation times (time spent walking back from the ball to prepare the kick), but longer concentration times (time spent standing still after the walk back) and there were no differences between the best and the worst players. Similarly, a recent study of temporal characteristics involved in the free throw routines of basketball players during high-stakes play-off games in the NBA found no links between routine duration and success rate (Lonsdale & Tam, 2008). Note that the length of all these time intervals is controlled by the performer; the times are self-imposed. Another type of preparation time occurs when waiting periods are externally imposed on the performers. This can occur when opponents or game officials delay the initiation of the action causing the performer to involuntarily have to wait. The effect of opponents stalling was nicely demonstrated in a study of 2,003 field goal attempts in the National Football League, NFL (Berry & Wood, 2004). It was first found that the success rate dropped from regular kicks to high-pressure kicks (with an even game and 3 minutes or less remaining), but the drop was even more substantial in situations where the opposing teams called a timeout immediately before the kick. The researchers argued that this so called “icing” of the kicker would give the performer more time to dwell on his kick, which could produce negative effects on performance. However, these results can also indicate that the kickers were negatively affected by the enduring emotional distress, indicating the general problem of inferring

from behavioral data to underlying psychological processes. We have not seen any studies on the effects of game officials' timing decisions in such situations

A suitable real-world task through which different temporal predictions about performing under pressure can be examined is the soccer penalty shootout. This task is used to identify a winner when two teams are tied in soccer tournaments. Given that this event is known as a vast pressure situation where shooters typically are assumed to have an advantage over the keeper (e.g., Bakker, Oudejans, Binsch, & van der Kamp, 2006), the shooters' failure to live up to expectations of scoring may indicate that choking has taken place. Subsequently, there is some evidence that performers in penalty shootouts are vulnerable to under-performing under pressure. First, in interviews with performers who took part in a European Championships penalty shootout, all players reported experiencing anxiety (Jordet, Elferink-Gemser, Lemmink, & Visscher, in press), and a considerable number of them experienced little control over the outcome, which was linked to both high anxiety intensity and negative directional interpretation of anxiety symptoms (Jordet, Elferink-Gemser, Lemmink, & Visscher, 2006). Second, there is evidence that the number of misses increases with elevated shot importance (Jordet, Hartman, Visscher, & Lemmink, 2007; McGarry & Franks, 2000) and the number of misses becomes even higher on shots with negative valence (i.e., shots where a miss instantly produces a loss) as compared to shots with positive valence (i.e., shots where a goal instantly produces a win) (Jordet & Hartman, 2008). Third, players with high public status (potentially higher ego-threat if one were to fail; Baumeister, 1997) score fewer goals than players with less status (Jordet, in press), suggesting that high egotism can precipitate choking on this task. Interestingly, in these latter two studies, players in both

threat-situations responded with shorter response times to the referees' ready signal than players under less threat. This would be in line with the self-regulatory breakdown model, that players experience high levels of ego threat and emotional distress, that they then attempt to escape by ending the situation as soon as possible.

The purpose of this study was to provide a comprehensive description of temporal links to performance in soccer penalty shootouts. Furthermore, we distinguished between those preparation time intervals that were under the control of the performer (i.e., self-imposed) and time intervals that were outside the control of the performer (i.e., externally imposed). The role of the referees' behaviors (e.g., timing of the whistle signal) was also examined. Following the model of choking as self-regulatory breakdowns, according to which high levels of pressure compel people to attempt escaping the situation, thus acting faster, we generally hypothesized that self-imposed preparation times (such as response time and ball placement time) would be positively linked to performance, with longer times related to more scored shots. For missed shots (hypothesized to follow short times) this would fit the pattern of self-defeating behaviors (Baumeister, 1997). In contrast, given that extended periods of enduring threat can produce intense emotional distress (Berns et al., 2006), we hypothesized that externally imposed time intervals (such as waiting for the referee signal or having to take time complying with the referee correcting one's ball placement) would be negatively related to performance, with short times related to more scored shots than long times.

Methods

Data

Video images were obtained from all penalty shootouts ever held in the World Cup ($n = 20$, 1982 to 2006), European Championships ($n = 11$, 1976 to 2004), and UEFA Champions League ($n = 6$, 1996 to 2007). This gave 37 penalty shootouts and 366 kicks from 296 players. The players' mean age was 26.6 years ($SD = 3.6$, range 18 to 36). Most players (80.4%) took one shot, 15.9% took 2 shots and 3.7% took 3 or 4 shots.

Variables and procedures

Based on the video images, the penalty shootout was divided into 6 functionally meaningful and mutually exclusive time phases that cover the time from the players start walking from the mid-circle to the shots are taken. We excluded shots where the start or end point defining a specific variable could not be seen (for the final n for each variable, see Table 1). Each of the variables was initially measured in seconds/tenths of a second with a stop watch. A second independent observer assessed a random sample of 60 shots and the two corresponding values for each shot were correlated to produce interobserver reliability. The variables, in the order that they occur in the penalty shootout, are:

Walking time was indirectly assessed from when the ball was struck by the player performing the preceding shot until the player whose walking time was assessed started placing the ball on the penalty mark. Although there was no way to ascertain the extent to which the players indeed were “walking” for the entire duration of this time, we still think “walking time” is a good name for this variable as the players necessarily have to walk towards the penalty mark at some point within the defined interval. The interobserver reliability was high ($r = .98$, $p < .001$).

Ball placement time was the time that the player used to place the ball on the penalty mark, from the moment the ball touched the mark until the hands let go off the

ball. In the main analysis, we excluded those shots ($n = 29$) where the referee verbally intervened with the ball placement, for example by telling the player to re-place the ball. These shots produced extra long placement times ($M = 10.4$, $SD = 8.6$, $Mdn = 8.0$) compared to shots with no referee involvement ($M = 2.3$, $SD = 1.7$, $Mdn = 1.7$) (Mann Whitney $U = 641.00$, $p < .001$). The interobserver reliability for placement time was high ($r = .97$, $p < .001$).

Back-up time was the time from the hands let go off the ball and the players started walking back to prepare the run-up until the walk back stopped. The interobserver reliability was initially somewhat low ($r = .80$, $p < .001$). Thus, all response times were assessed again by counting the frames between the start and end points (using the video processing utility *VirtualDub*). For this variable, two independent observers then coded all shots and the inter-observer agreement became acceptable ($r = .90$, $p < .001$). We also distinguished between those shots where the referee gave his signal while the player was backing up (signal during back-up) and where the referee gave his signal after the back-up had stopped (signal during wait).

Signal waiting time was assessed from the player stopped his back-up to when the referee gave a signal (by whistle or hand) that the shot could be initiated. Thus, only shots where the referee signal was given during the wait were analyzed. We analyzed the first shot in each penalty shootout ($n = 37$) separately, as the referee almost always delayed this shot, while setting the procedures for the event. This typically creates a unique situational and behavioral dynamics where we often see that the players engage in some other behavior in stead of “just” standing there, such as walking back and forth, turning their back to the goalkeeper, talking to the referee and so fort. The waiting times for those

first shots ($M = 4.5$, $SD = 3.7$, $Mdn = 4.3$) were longer than for the rest of the shots ($M = 2.0$, $SD = 3.2$, $Mdn = 0.7$) (Mann Whitney $U = 474.50$, $p = .001$), which justified the separate analysis. The interobserver reliability for this variable was satisfactory ($r = .90$, $p < .001$).

Signal response time was defined as the time spent standing still after the referee has signaled a go for the shot until beginning the run-up (first step towards the ball) (identical to Jordet, in press). The times were also assessed based on when the referee signal was given, during the back-up or during the wait. Possibly because these times on average were lower than the times for the other variables, our interobserver reliability scores were low ($r = .69$, $p < .001$). Thus, also for this variable we assessed all shots again using *VirtualDub*. Two independent observers coded all shots and adequate interobserver agreement was obtained ($r = .86$, $p < .001$).

Run-up time was assessed from the first step was initiated towards the ball until the ball was struck with the foot. The run-up times were also assessed with the two different referee signal types: signal during back-up and signal during wait. The interobserver reliability was satisfactory ($r = .85$, $p < .001$).

Most of the time intervals covered by these variables (walking time, ball placement time, back-up time, signal response time, and run-up time) can be considered self-imposed, while signal waiting time and the extra time it takes to comply to a referee correcting the ball placement are externally paced.

Performance was primarily assessed from the shot outcomes; goal or miss.

Data analysis

Statistical analysis was done using SPSS (version 14.0). Non-parametric Mann Whitney tests were used to assess differences in time variables under various situational conditions and univariate logistic regression was performed to investigate the relationship between time variables and performance. For the logistic regression analyses, the continuous variables were checked on linearity of the logits. If the logits were not linear, the continuous variables were split into 5 categories, in a way that created as equal numbers of kicks per category as possible (some uneven category sizes occurred because some shots were registered with exactly the same times and these could not be split up). Odds Ratios and p-values were calculated per category. The categories with the shortest times were defined as the reference category (Odds Ratio = 1.0), which was based upon the method of Noordhuizen, Frankena, van der Hoofd, and Graat (1997) and because we expected most Odds Ratios to increase with increasing time. We set the level of significance at $p = .05$.

Results

Descriptive results

The descriptive results for all primary time variables are presented in Table 1 and the results for the time variables that were assessed under two different referee signal conditions are presented in Table 2. The results show that the back-up times were shorter when the referee signal was given during the back-up than when the signal was given during the wait ($U = 3808.00, p = .055$) and so were the response times ($U = 7511.00, p < .001$), but the run-up times were longer when the signal was given during the back-up ($U = 8518.50, p = .030$).

Relationships between time and performance

The players scored on 73.8% ($n = 270$) of the shots, and missed on 26.2% ($n = 96$). Thus, the base $OR = 73.8/26.2 = 2.82$. The relationships between the time variables and performance are presented in chronological order (see overview in Figure 1 and 2).

Walking time was related to performance, with quick walking times and slow walking times giving more goals than medium quick walking times (see Figure 1a).

Ball placement time was not significantly related to performance, although there was a trend that performance was higher with the longest placement times, except for when the placement lasted longer than 3 seconds where we saw slight drops in performance (see Figure 1b). In a separate analysis, we assessed those shots where the times were long because the referee intervened with the ball placement. On these shots, performance was lower (62.1%, $OR = 1$, reference category) than the shots with no referee involvement (74.6%), but this was not statistically different ($OR = 1.79$, $p = .148$).

Back-up time was not related to performance, with about the same number of scored goals for players in each of the five categories (from quick to slow: 68.9%, 72.0%, 68.3%, 77.3% and 71.0%) (all $p > .35$, with the quickest time as reference category) (see Figure 2a and 2b).

Signal waiting time was related to performance, with a trend that shorter waiting times were related to more scored goals than longer waiting times (see Figure 1c). In that analysis, all #1 shots were excluded, as the situational and behavioral dynamics of that shot was very different from the others and the times were longer than for all other shots (see methods). The extra analysis of the #1 shots did not show any difference in performance for longer compared to shorter signal waiting times. However, we also compared shots #1 with shots #2 (i.e., the first shot for one team with the first shot for the

other team). Here we found differences in signal waiting times, with longer times for #1 ($M = 4.5$, $SD = 3.7$, $Mdn = 4.3$) than for #2 ($M = 2.1$, $SD = 3.2$, $Mdn = 0.7$) (Mann Whitney $U = 94.0$, $p = .035$). Further, 73.0% of the #1 shots and 81.1% of the #2 shots were scored, but this was not significantly different ($OR = .63$, $p = .409$, with #2 shots as reference).

Signal response time was related to performance, with few scored goals on the shortest time, then (with the exception for the second shortest time) progressively more goals with increasing times (see Figure 1d). There was also a trend for response times with the referee signal during the back-up (from quick to slow: 59.3%, 75.0%, 71.3%, 72.0% and 80.6%, $p > .079$, with the quickest time as reference category) and for response times with the referee signal during the wait (61.5%, 75.8%, 64.5%, 80.0% and 86.7%). For the latter test, we found an $OR = 4.06$ ($p = .037$) for the slowest time, while all other comparisons only gave weak trends ($p > .13$) (with the quickest time as reference category).

Run-up time was not related to performance, with the same number of goals for players across the different time categories (from quick to slow: 76.5%, 67.9%, 74.1%, 71.4% and 81.0%, all $p > .24$). When signal type was controlled for the results went in opposite directions, with the general tendency of higher performance with slower run-ups (for signal during back-up) and higher performance with quicker run-ups (for signal during wait) (see Figure 2c and 2d).

Discussion

In this study we examined temporal links to performing under the pressure in a real-world high-pressure sport task. Video based data was obtained from all penalty

shootouts ever conducted in the three most prestigious soccer tournaments in the world. The temporal observation analyses showed that one of the self-imposed preparation times (time to respond to the referee's ready signal) was related to performance, with shorter times giving more misses. The same was found for two independent sub-samples of this time interval, based on when the referee signal was given. In addition, there was a weak trend in the same direction for ball placement, with more goals scored after some of the longest times, though with a possible ceiling effect given a drop in performance for the longest time category. The results for walking time were more ambiguous, with most goals for the shortest and the longest times, and less goals for the time categories in between. This could reflect the compounded nature of walking time, where having to walk may be perceived as externally imposed, although the time it takes to walk indeed is self-imposed. For the externally imposed time intervals (signal waiting time and when the referee intervened with ball placement), there was a slight tendency that longer times were associated with more misses (though only significant for one time category of signal waiting time).

When looking at the self-imposed times, the present results oppose some of the results from previous studies on choking under pressure. There, it has been argued that performers who choke take longer times preparing their actions, reflecting the process of explicitly monitoring and controlling one's movements (e.g., Pijpers et al., 2003, Beilock, Bertenthal et al., 2004). In our study, the players who performed below expectations took shorter times and the players who performed better took longer times. Given that so many studies have shown that elite athletes executing self-paced tasks seem to choke as a result of time-consuming explicit monitoring (see review in Beilock & Gray, 2007), it seems

necessary to address potential reasons for why different mechanisms may apply in the international soccer penalty shootout. Most interestingly, it is possible that the levels of perceived threat and emotional distress experienced by the performers in international penalty shootouts are considerably higher than the levels that researchers have been able to induce in most laboratory studies of choking. The mechanisms through which performers choke may be tightly regulated by these levels. This would be consistent with results from recent research showing that field sport competitions induce substantially higher levels of stress than equivalent laboratory simulations (Roehdler, Beulen, Chen, Wolf, & Kirschbaum, 2007) and that choking under extremely high levels of physiological arousal is linked to different temporal attention mechanisms than under moderate levels of physiological arousal (Vickers & Williams, 2007). Our findings are also in line with the hypothesis of choking as a case of self-regulatory breakdown (Baumeister, 1997), where it is argued that performers, under high levels of threat and emotional distress, sometimes primarily focus on obtaining relief and escape from the unpleasant states. The extremely short times that the penalty kickers occasionally imposed on themselves (e.g., the mean response time in the present study was 0.7 s, which is dramatically lower than the equivalent 10 s mean concentration time registered in rugby world cup kickers; Jackson, 2003) may reflect such a desire to end the situation as quickly as possible. That short preparation times can be a reaction to the distress of penalty shootouts is also indirectly supported in statements obtained in elite soccer players' (auto)biographies; for example: "All I wanted was the ball: put it on the spot, get it over and done with." (Gareth Southgate, in Southgate & Woodman, 2003, p. 191) and

“I just wanted it to be over.” (Chris Waddle, in Stein, 1997, p. 1). See also the quote introducing our paper.

In addition, discrepancies compared to previous studies may also come from differences in the tasks that were studied. Most tasks in earlier studies of temporal correlates of choking have been of a relatively closed nature, such as golf putting (e.g., Masters, 1992), indoor traverse climbing (Pijpers et al., 2003), and rugby/American football kicking (Jackson, 2003; Berry & Wood, 2004). For the skill in the present study, both the ground surface surrounding the penalty mark (related to ball placement) and the keepers' actions immediately before the shot (related to the response time period) can vary considerably and must be responded to. In addition, the many shot options (e.g., left/right/middle, high/low, power/precision) introduce a decision making element, and this shows that the penalty shot is an open skill with other attentional requirements than closed skills. More controlled experiments of temporal characteristics of choking with complex and dynamic tasks are necessary to better conclude about the role of task.

Another main finding was that the link between signal waiting time and performance went in the opposite direction of the self-imposed times. The outcomes for the shots where the referee intervened with the ball placement, thus imposing extra placement time on the players, seemed also to be lower than for the other shots. This is consistent with the study of NFL-kickers, who underperformed when the opponents took time-outs immediately before high-pressure kicks (Berry & Wood, 2004) and with lab experiments showing that waiting for something unpleasant produces a feeling of dread and sense of urgency (Berns et al., 2006), which might have negative implications for performance. In addition, this effect of waiting may provide an alternative perspective on

why players who perform their shots relatively late in the penalty shootout perform worse than the players who perform early (McGarry & Franks, 2000; Jordet et al., 2007). It has been argued that this can be a result of increased importance of each shot as one progressively gets closer to the final decision, but it may also be that the performers shooting late in the penalty shootout choke simply because they necessarily have waited longer in the mid-circle for their shot, and that this wait has affected them negatively. The exact mechanisms (e.g., cognitive or biomechanical) through which performance suffers from this enduring unpleasant state can not be known from our results though and researchers are encouraged to address this in future experiments. Researchers could also examine more closely the effects of different conditions for waiting or different types of waiting (e.g., do performers engage in activities or just “stand there”).

The results for back-up time and run-up time seemed to go in different directions, depending on whether the referee signal was given during the back-up or during the wait after the back-up (see Figure 2). There can be several explanations for these differences. For example, if the referee signal is given during the back-up, it is possible that the signal itself triggers some players to immediately initiate their run-up, thus giving relatively short back-up and run-up times. The players who are affected by the referee in this way may start running towards the ball before they really are ready to perform, and thus, they perform poorly. On the other hand, the players who remain unaffected by the signal during the back-up may remain in control (given that they do not let the signal dictate the start of their run-up), then get ready, and ultimately perform better. This explanation is supported by the shorter back-up times for signal during back-up than during the wait, suggesting that some players cut the path short when they hear the signal. Similar

reasoning can be used for when the signal is given during the wait (after the back-up has stopped), where it is possible that the players with short back-up and run-up times take control by purposely stopping the back-up before the signal is given. It should be noted that there is no causal basis on which to base these latter interpretations, and they should therefore be viewed more as hypotheses rather than firm conclusions.

The results related to the referee signals (as well as the referee involvement in ball placement) suggest that referees, involuntarily and probably unknowingly, may play a role for the outcome of shots in penalty shootouts¹. We specifically recommend that referees make sure that they offer equal temporal conditions for all shooters, by giving the ready signal at the same points in time for everyone.

In general, there were some methodological limitations in this study. First, some of the variables, particularly those assessing the externally imposed waiting times, had small samples. This reduces the power of those analyses. Second, because only a minority of the players took more than one shot in these events, no intra-performer measurements were conducted. This makes it hard to assess low- and high-pressure situations with the same athlete (as prescribed by Beilock & Gray, 2007) and caution should be shown when interpreting the results as evidence of choking. Third, although the major strength of this study is the high ecological validity of assessing elite performers in a real-world sport competition, the design also is a limitation. We could only report on what we saw and then infer possible reasons for these behaviors. Thus, although we believe that some of our conclusions are logical, they are also speculative. The lack of manipulation checks reflects the same concern, although Jordet et al.'s (2006, in press) interviews with 8 shooters from one of these penalty shootouts (2% of the total

population in this study) provide an indirect check (e.g., showing how typical emotional distress is during these events). Controlled experiments are necessary follow-ups to establish causal links.

In conclusion, this study presents some temporal characteristics of performing under pressure in major soccer penalty shootouts. The results imply that short self-imposed times and long externally imposed waiting times accompany low performance. This is interpreted in line with a model of choking as failed self-regulation. Most interesting is that performers may attempt to escape unpleasant emotional distress precipitated by extreme levels of performance pressure by hurrying up their preparation. However, this self-regulatory process is self-defeating, in that performance ultimately seems to suffer.

References

- Bakker, F.C., Oudejans, R.R.D., Binsch, O., & van der Kamp, J. (2006). Penalty shooting and gaze behavior: Unwanted effects of the wish not to miss. *International Journal of Sport Psychology, 37*, 265-280.
- Baumeister, R.F. (1997). Esteem threat, self-regulatory breakdown, and emotional distress as factors in self-defeating behavior. *Review of General Psychology, 1*, 145-174.
- Baumeister, R.F., Heatherton, T.F., & Tice, D.M. (1993). When ego threats lead to self-regulation failure: Negative consequences of high self-esteem. *Journal of Personality and Social Psychology, 64*, 141-156.
- Beilock, S. L., Bertenthal, B. I., McCoy, A. M., & Carr, T. H. (2004). Haste does not

- always make waste: Expertise, direction of attention, and speed versus accuracy in performing sensorimotor skills. *Psychonomic Bulletin & Review*, *11*, 373-379.
- Beilock, S.L., Carr, T.H., MacMahon, C., & Starkes, J.L. (2002). When paying attention becomes counterproductive: Impact of divided versus skill-focused attention on novice and experienced performance of sensorimotor skills. *Journal of Experimental Psychology: Applied*, *8*, 6-16.
- Beilock, S.L., Kulp, C.A., Holt, L.E., & Carr, T.H. (2004). More on the fragility of performance: Choking under pressure in mathematical problem solving. *Journal of Experimental Psychology: General*, *133*, 584-600.
- Beilock, S.L. & Gray, R. (2007). Why do athletes choke under pressure? In G. Tenenbaum & R.C. Eklund (Eds.), *Handbook of sport psychology* (3rd ed., pp. 425-444). Hoboken, NJ: John Wiley & Sons.
- Berns, G.S., Chappelow, J., Cekic, M., Zink, C.F., Pagnoni, G., & Martin-Skurski, M.E. (2006). Neurobiological substrates of dread. *Science*, *312*, 754-758.
- Berry, S., & Wood, C. (2004). The cold-foot effect. *Chance*, *17*, 47-51.
- FIFA (1997). A selection of amendments in the last 20 years (Available at: <http://www.fifa.com/newscentre/news/newsid=71963.html>; accessed April 9, 2008).
- FIFA (2007). Laws of the Game 2007/2008 (Available at: <http://www.fifa.com/worldfootball/lawsofthegame.html>; accessed April 9, 2008).
- Gerrard, S. (2006). *Gerrard: My autobiography*. London: Transworld publishers.
- Jackson, R.C. (2003). Pre-performance routine consistency: Temporal analysis of goal kicking in the rugby union world cup. *Journal of Sports Sciences*, *21*, 803-814.

- Jordet, G. (in press). When superstars flop: Public status and “choking under pressure” in international soccer penalty shootouts. *Journal of Applied Sport Psychology*.
- Jordet, G., Elferink-Gemser, M.T., Lemmink, K.A.P.M., & Visscher, C. (in press). Emotions at the penalty mark: An analysis of elite players performing in an international penalty shootout. In T. Reilly & A.M. Williams (Eds.), *Science and Football VI*. Oxford: Routledge.
- Jordet, G., Elferink-Gemser, M.T., Lemmink, K.A.P.M., & Visscher, C. (2006). The “Russian roulette” of soccer?: Perceived control and anxiety in a major tournament penalty shootout. *International Journal of Sport Psychology*, *37*, 281-298.
- Jordet, G., & Hartman, E. (2008). Avoidance motivation and choking under pressure in soccer penalty shootouts. *Journal of Sport and Exercise Psychology*, *30*, 450-457.
- Jordet, G., Hartman, E., Visscher, C., & Lemmink, K.A.P.M. (2007). Kicks from the penalty mark in soccer: The roles of stress, skill, and fatigue for kick outcomes. *Journal of Sports Sciences*, *25*, 121-129
- Leith, K.P., & Baumeister, R.F. (1996). Why do bad moods increase self-defeating behavior? Emotion, risk-taking, and self-regulation. *Journal of Personality and Social Psychology*, *71*, 1250-1267.
- Lonsdale, C., & Tam, J.T.M. (in press). On the temporal and behavioural consistency of pre-performance routines: An intra-individual analysis of elite basketball players’ free throw shooting accuracy. *Journal of Sports Sciences*, *26*, 259-266.
- Masters, R.S.W. (1992). Knowledge, knerves and know-how: The role of explicit versus

- implicit knowledge in the breakdown of a complex motor skill under pressure. *British Journal of Psychology*, 83, 343-358.
- McGarry, T., & Franks, I.M. (2000). On winning the penalty shoot-out in soccer. *Journal of Sports Sciences*, 18, 401-409.
- Noordhuizen J.P.T.M., Frankena K., Van der Hoofd C.M., & Graat E.A.M. (1997). *Application of quantitative methods in veterinary epidemiology*. Wageningen: Wageningen Press.
- Pijpers, J.R., Oudejans, R.R.D., Holsheimer, F., & Bakker, F.C. (2003). Anxiety-performance relationships in climbing: A process-oriented approach. *Psychology of Sport & Exercise*, 4, 283-304.
- Roehdler, N., Beulen, S.E., Chen, E., Wolf, J.M., & Kirschbaum, C. (2007). Stress on the dance floor: The cortisol stress response to social-evaluative threat in competitive ballroom dancers. *Personality and Social Psychology Bulletin*, 33, 69-84.
- Southgate, G., & Woodman, A. (2003). *Woody & Nord: A football friendship*. London: Penguin books.
- Stein, M. (1997). *Chris Waddle: The authorized biography*. London: Simon & Schuster.
- Vickers, J.N., & Williams, A.M. (2007). Performing under pressure: The effects of physiological arousal, cognitive anxiety, and gaze control in biathlon. *Journal of Motor Behavior*, 39, 381-394.
- Wrisberg, C.A., & Pein, R.L. (1992). The preshot interval and free throw shooting accuracy: An exploratory investigation. *The Sport Psychologist*, 6, 14-23

Endnote

¹ The referees' actions may also have been influenced by other factors, such as rule changes. In 1997, the international soccer federation (FIFA, 1997) introduced a rule change related to penalty kicks. The phrase "without moving his feet" was deleted, which meant that goalkeepers could now move freely on the goal line. The new text states that "The goalkeeper remains on his own goal line, facing the kicker, between the goalposts until the ball has been kicked" (FIFA, 2007). To control for possible confounds, we investigated the effect of this rule change on the preparation times and found significant changes for back-up time (before 1997: *Mdn* = 5.6 s, after 1997: *Mdn* = 5.0 s, Mann Whitney $U = 4053.00$, $p = .004$) and response waiting time (before 1997: *Mdn* = .34 s, after 1997: *Mdn* = 1.36 s, Mann Whitney $U = 637.00$, $p = .032$). None of these differences seemed to operate as confounds for the performance analyses. We have no plausible explanation for the back-up times, but as regards the response waiting time, this may simply suggest that the referees spent more time after the rule change to get ready for the shot (as indicated by late whistle signal), possibly because the goalkeeper was moving back and forth on the line.

Table 1

Means, standard deviations, minimum values and maximum values (in seconds) for the time variables.

Variable	<i>N</i>	<i>M</i>	<i>SD</i>	<i>Mdn</i>	Min	Max
Walking time	164	32.3	9.4	30.4	16.4	85.3
Ball placement time	171	2.3	1.7	1.7	0.2	10.0
Back-up time	221	5.5	1.3	5.3	2.5	9.8
Signal waiting time	88	2.0	3.2	0.7	0	22.0
Signal response time	289	0.7	0.7	0.5	0	5.1
Run-up time	324	1.8	0.51	1.8	0.5	3.9

Table 2

Means, standard deviations, minimum values and maximum values (in seconds) for the time variables; under two conditions: with the referee signal given during the back-up (signal during back-up) and with the referee signal given during the stationary wait after the back-up (signal during wait).

Variable	<i>N</i>	<i>M</i>	<i>SD</i>	Mnd	Min	Max
Back-up times						
Signal during back-up	102	5.2	1.0	5.1	3.2	8.2
Signal during wait	89	5.6	1.4	5.6	2.5	8.6
Signal response times						
Signal during back-up	139	0.6	0.7	0.4	0	5.1
Signal during wait	150	0.8	0.8	0.6	0	4.9
Run-up times						
Signal during back-up	141	1.9	.44	1.8	1.1	3.2
Signal during wait	142	1.8	.54	1.7	.5	3.4

Figure captions

Figure 1. The relationships between selected time variables and performance, with Odds ratios: (a) walking time, (b) ball placement time, (c) signal waiting time; and (d) signal response time.

Figure 2. The relationships between selected time variables and performance, with Odds ratios: (a) back-up time with signal during back-up; (b) back-up time with signal during wait; (c) run-up time with signal during back up; and (d) run-up time with signal during wait.

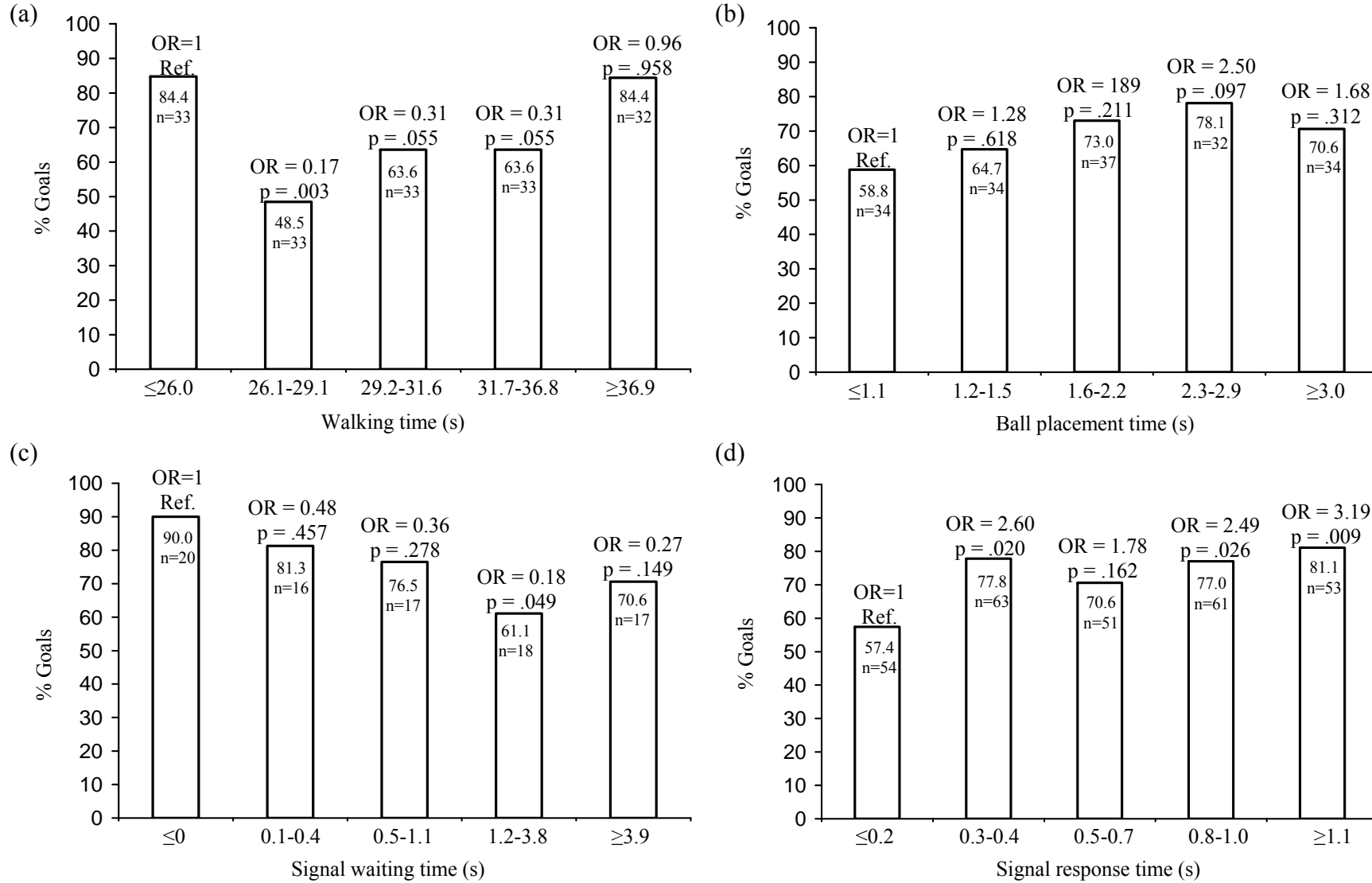


Figure 1.

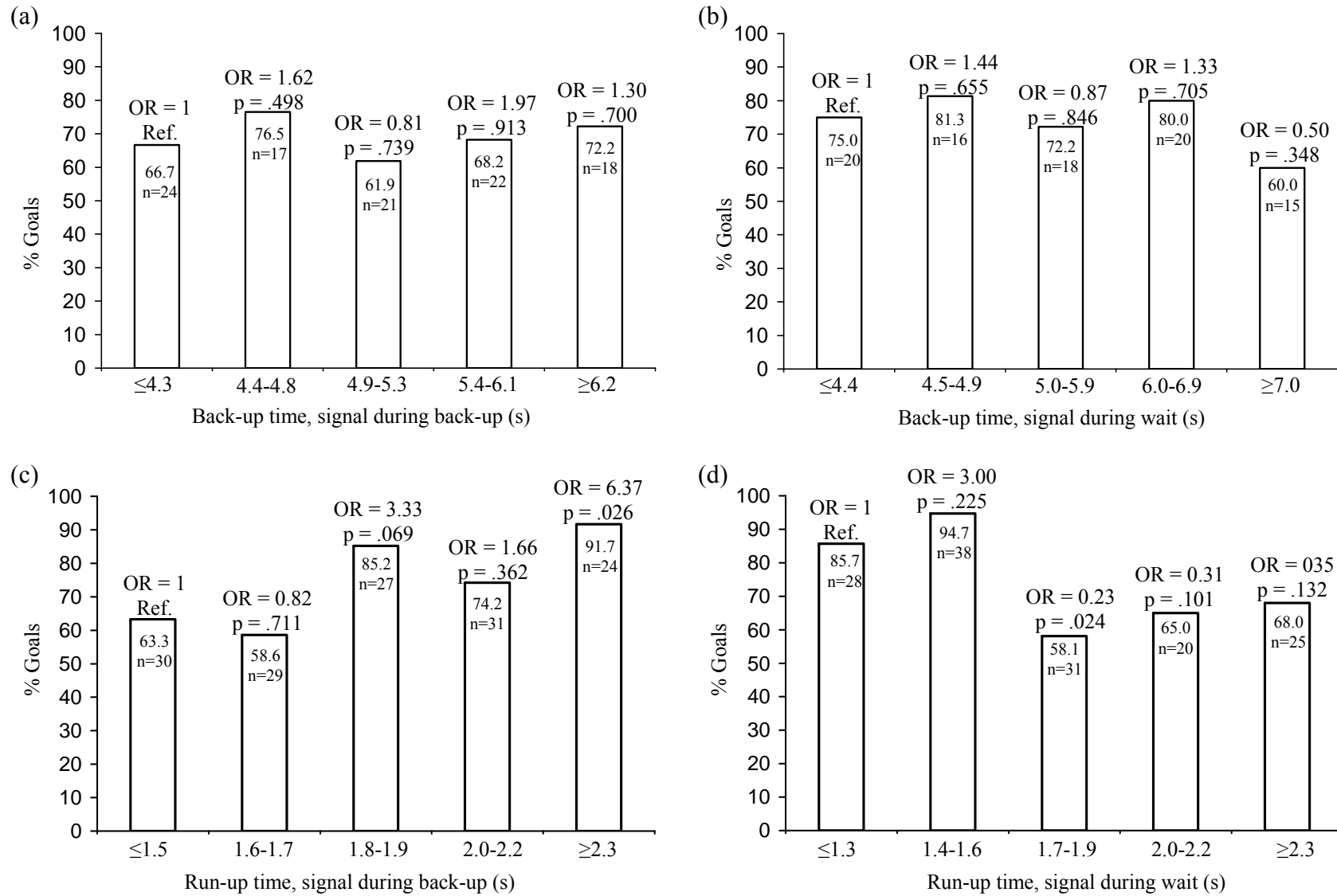


Figure 2.