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Nonverbal behavior accompanying challenge and threat states under pressure

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ABSTRACT

Objectives: This study examined if challenge and threat states predicted nonverbal behavior during a pressurized soccer penalty task.
Design: A predictive design was employed.
Method: Forty-two participants (M_{age} = 24 years, SD = 7) completed the task. Before the task, challenge and threat states were assessed via demand resource evaluations and cardiovascular reactivity. During the task, nonverbal behavior was recorded, and later used to rate participants on six scales: (1) submissive–dominant, (2) unconfident–confident, (3) on edge–composed, (4) unfocused–focused, (5) threatened–challenged, and (6) inaccurate–accurate.
Results: Participants who evaluated the task as a challenge (coping resources exceed task demands) were deemed more dominant, confident, composed, challenged, and competent from their nonverbal behavior than those who evaluated it as a threat (task demands exceed coping resources). Cardiovascular reactivity did not predict nonverbal behavior.
Conclusions: Athletes' challenge and threat evaluations might be associated with nonverbal behavior under high-pressure.

1. Introduction

Competitive sport can hinge on a single pressurized moment, such as the final penalty to win a major soccer tournament. According to the biopsychosocial model of challenge and threat (Blascovich, 2008), performance in these key moments is partly determined by athletes' psychophysiological responses. First, athletes' evaluate the demands of a stressful situation and their coping resources, causing them to evaluate the situation as more of a challenge (resources exceed demands) or threat (demands exceed resources).[1] Second, these evaluations trigger distinct cardiovascular responses, with a challenge evaluation leading to a cardiovascular response characterized by relatively higher cardiac activity and lower vascular resistance. Thus, challenge and threat states can be measured via cognitive evaluations and/or cardiovascular responses, and both have been shown to predict sports performance (Blascovich, Seery, Mugridge, Norris, & Weisbuch, 2004; Moore, Wilson, Vine, Coussens, & Freeman, 2013; Turner et al., 2013). For example, while Moore et al. (2013) found that evaluating a golf competition as a challenge was linked to lower scores, Turner et al. (2013) found that a challenge-like cardiovascular response was associated with more runs in a cricket task. Despite their effects on performance, challenge and threat states are difficult to assess in real high-pressure situations due to issues associated with both self-report (e.g., social desirability bias) and cardiovascular (e.g., limited portability of equipment) measures. Thus, new and complementary methods are needed to help identify athletes' who are experiencing these states.

Importantly, influential scientists have argued that an individual's response to the perception of stressful environmental demands is characterized by an integrated physiological and nonverbal response (Cannon, 1915; Darwin, 1872). Hence, observers could theoretically be able to detect challenge and threat states from athletes' observable nonverbal behavior (NVB). Indeed, while limited, research in social psychology has partially supported this notion, indicating that challenge and threat states might show in divergent NVB (Mendes,

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[1] In contrast to the cognitive appraisal theory (Lazarus & Folkman, 1984), which views challenge and threat as two distinct types of primary (stressful) appraisals, challenge and threat are therefore conceptualized as the end result of what corresponds to Lazarus's primary and secondary appraisals (Blascovich, 2008).

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Blascovich, Hunter, Lickel, & Jost, 2007; O'Connor, Arnold, & Maurizio, 2010; Weisbuch, Seery, Ambady, & Blascovich, 2009). For instance, Mendes et al. (2007) found that responding to a social interaction with a threat-like cardiovascular response (lower cardiac activity and higher vascular resistance) was linked with less positive NVB (smiling, giggling, and positive affirmations) and greater freezing (less feet, hand, and head movement). However, in contrast, Weisbuch et al. (2009) found that participants who responded to a speech with a threat-like cardiovascular response attempted to mask a lack of ability (low vocal confidence) by appearing more confident (high facial confidence). Despite these interesting results, to date, no research has examined the relationship between challenge and threat states and NVB in a pressurized sporting context.

To address this gap in the literature, the context of soccer penalties seems ideally suited due to its highly pressurized, one-on-one nature. In addition, growing research has highlighted the importance of NVB during soccer penalty preparation (e.g., Furley, Dicks, & Memmert, 2012a; Furley, Dicks, Stendtke, & Memmert, 2012b), showing that observers and athletes use NVB to infer internal states of opponents and team-mates. While research has shown that observers of athletes' NVB can make accurate inferences based on this NVB (e.g., current score; Furley & Schweizer, 2016), little research has explored the factors that influence athletes' NVB (e.g., stress appraisals). Thus, this study examined if challenge and threat states predicted NVB during a pressurized soccer penalty task. Specifically, this study tested if untrained observer ratings of NVB corresponded with self-report and cardiovascular measures of challenge and threat states, and if these states were predictive of the impressions formed of the penalty takers. It was predicted that demand resource evaluations (coping resources exceed task demands) and cardiovascular reactivity (higher cardiac activity and lower vascular resistance) associated with a challenge state would be related to more positive impressions of NVB (more dominant, confident, composed, focused, and challenged) and expected performance (greater accuracy).

2. Materials and methods

2.1. Participants

Given the medium effect size ($r = 0.45$) reported by Mendes et al. (2007), a power analysis using G*Power software revealed that 33 participants were required to achieve a power of .80, given an alpha of .05. Thus, 42 participants (35 males, 7 females; $M_{age} = 24$ years, $SD = 7$) with at least two years competitive soccer experience ($M_{experience} = 12$ years, $SD = 7$) were recruited.

2.2. Experimental task

Participants completed a task that required them to kick a standard-size indoor soccer ball (diameter = 20.6 cm) from a penalty spot located 5.0 m from the center of a regulation-size indoor goal (height = 1.2 m, width = 3.0 m; JP Lennard, Ltd., Warwickshire, U.K.). Participants were told to begin with the ball in their hands in front of their stomach, then place the ball on the penalty spot, before returning to a pre-defined mark 1.5 m behind the penalty spot, and initiating their run-up. No time pressure was placed on participants during task execution. The same goalkeeper was used throughout testing, and the positioning, movement, and posture of the goalkeeper was standardized given that these factors have been shown to influence soccer penalty performance (e.g., Van Der Kamp & Masters, 2008). Indeed, unbeknown to the participants, the goalkeeper was instructed not to save the penalties, but to stand still in the centre of the goal with their knees bent and arms out to their side.

2.3. Measures

Demand resource evaluations. Two items from the cognitive appraisal[2] ratio were used (Tomaka, Blascovich, Kelsey, & Leitten, 1993), one to assess evaluated demands ("How demanding do you expect the upcoming soccer penalty task to be?"), and another to measure evaluated resources ("How able are you to cope with the demands of the upcoming soccer penalty task?"). Both items were rated on a six-point Likert scale anchored between 1 (*not at all*) and 6 (*extremely*). Consistent with previous research (e.g., Moore et al., 2013), evaluated demands were subtracted from resources to calculate a demand resource evaluation score (DRES) ranging from −5 to +5, with a positive score reflecting a challenge state (coping resources exceed task demands) and a negative score indicating a threat state (task demands exceed coping resources).

Cardiovascular data. A noninvasive impedance cardiograph device (Physioflow Enduro, Manatec Biomedical, Paris, France) estimated heart rate (number of heart beats per minute), cardiac output (amount of blood pumped by the heart per minute), and total peripheral resistance (net constriction versus dilation in the arterial system). Following procedures described previously (Moore, Vine, Wilson, & Freeman, 2012), cardiovascular data was recorded during baseline (5 min) and post-pressure instructions (1 min) while participants remained seated, still, and quiet. Reactivity, or the difference between the final minute of baseline and the minute after the instructions, was examined for all cardiovascular variables. While heart rate reactivity was used to assess task engagement (a pre-requisite for challenge and threat states; Blascovich, 2008), cardiac output and total peripheral resistance reactivity were used to measure challenge and threat states in response to the instructions. Both heart rate and cardiac output were estimated directly by the Physioflow, while total peripheral resistance was calculated (see Moore et al., 2012). Unfortunately, due to signal problems, cardiovascular data could not be recorded for one participant.

Nonverbal behavior. A tripod-mounted digital video camera (GoPro HERO, California, United States) was used to record NVB before the task. The camera was positioned in line with the left hand goal post (from the goalkeepers' perspective), at a height of 1.6 m and a distance of 3.0 m (Furley et al., 2012a). Two general methods can be used to analyze NVB: behavioural coding of videos by trained or untrained coders (Harrington, Rosenthal, & Scherer, 2008). As behavioural studies using trained coders have mainly focused on the face, and reliable coding of the entire body in real life situations (that do not involve staged basic emotion expressions by actors) has proven difficult (Dael, Mortillaro, & Scherer, 2012a), we decided to measure penalty takers' NVB with a large sample of untrained judges. This method, termed the thin slice approach, has proved useful to achieve reliable global assessments of NVB associated with internal states (Carney, Colvin, & Hall, 2007). Thus, following this approach (Furley & Schweizer, 2016), a short video clip was created of each participant ($M_{duration} = 9$ s, $SD = 2$). Seventy-one untrained observers (55 males, 17 females; 29 British, 43 German; $M_{age} = 25$ years, $SD = 7$) watched the videos of each participant in a randomised order, and assessed NVB and expected performance on six 11-point digital semantic differential scales adapted from previous research (e.g., Furley et al., 2012b): (1) submissive–dominant, (2) unconfident–confident, (3) on edge–composed, (4) unfocused–focused, (5) threatened–challenged, and (6) inaccurate–accurate. A higher rating represented a more positive impression of NVB (more dominant, confident, composed, focused, and challenged) and expected performance (greater accuracy). The Cronbach alpha coefficient for the six scales was excellent ($\alpha = 0.98$).

[2] Blascovich and colleagues now tend to use the term 'evaluation' rather than 'appraisal' as they argue it better reflects the predominately subconscious and automatic (rather than conscious and deliberate) nature of psychological responses to stress (Blascovich, 2008).