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Manipulating cardiovascular indices of challenge and threat using resource appraisals

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ABSTRACT

Challenge and threat reflect two distinct psychophysiological approaches to motivated performance situations. Challenge is related to superior performance in a range of tasks compared to threat, thus methods to promote challenge are valuable. In this paper we manipulate challenge and threat cardiovascular reactivity using only resource appraisals, without altering perceived task demands between challenge and threat conditions. Study 1 used a competitive throwing task and Study 2 used a physically demanding climbing task. In both studies challenge task instructions led to challenge cardiovascular reactivity and threat task instructions led to threat cardiovascular reactivity. In Study 1, participants who received challenge instructions performed better than participants who received threat instructions. In Study 2, attendance at the climbing task did not differ across groups. The findings have implications for stress management in terms of focusing on manipulating appraisals of upcoming tasks by promoting self-efficacy and perceived control and focusing on approach goals. Future research could more reliably assess the influence of similar task instructions on performance.

Challenge and threat are two distinct psychophysiological responses to stressors (see Blascovich et al., 2011; Seery, 2011). Challenge is considered an adaptive approach to a motivated performance situation (e.g., a stressor such as competition), occurring when personal resources meet or exceed perceived situational demands. Threat is considered a maladaptive approach to a motivated performance situation, occurring when personal resources do not meet perceived situational demands (Blascovich and Mendes, 2000). Predictably, research has attempted to promote challenge, and many investigations have used instructional sets concerning an upcoming stressor or task to do so (e.g., Tomaka et al., 1997). Research that indicates that challenge can be promoted using challenge task instructions has valuable implications for stress management. This paper reports the use of instructional sets that manipulate individuals' appraisals of personal resources, specifically self-efficacy, perceived control, and achievement goals as proposed within the Theory of Challenge and Threat States in Athletes (TCTSA; Jones et al., 2009). In short, this paper offers a methodological advance in the promotion of challenge states in a sport-related setting.

Challenge and threat are underpinned by cognitive appraisal, proposed by Lazarus (1991) to be the perceptual mediator between stressor and stress response, a notion widely accepted in theory and supported by empirical research (e.g., Holmes and Houston, 1974; Koriat et al., 1971; Nisbett and Schachter, 1966; Speisman et al., 1964). In addition, the idea that differences in stress responses can be indexed via cardiovascular (CV) markers is also widely recognised (e.g., Blascovich et al., 2011; Seery, 2011) and helps to illuminate the relationship between perception and physiological stress responses, by offering objective physiological markers of challenge and threat appraisals. Challenge appraisals are associated with challenge CV reactivity and threat appraisals are associated with threat CV reactivity (Blascovich and Mendes, 2000). The measurement of challenge and threat CV reactivity offers a more objective measure of challenge and threat, which is important because previous research has indicated that self-reported psychological states are sensitive to social desirability (Paunonen and LeBel, 2012), do not always correlate with CV reactivity (e.g., Martinek et al., 2003; Turner et al., 2012), and may not always reflect complex and often unconscious mental processes (LeDoux, 1998).

In the BPS model of challenge and threat (Blascovich and Mendes, 2000) challenge is accompanied by increased catecholamine output (epinephrine and norepinephrine) indicating sympathetic adrenomedullary (SAM) activity, which is reflected in increased heart rate (HR) and cardiac output (CO), attenuated pre-ejection period (PEP),

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and decreased total peripheral resistance (TPR). This challenge CV reactivity pattern represents an efficient physiological response to stressors, where the energy needed for successful performance (e.g., glucose) is released into the blood and can reach the brain and muscles efficiently due to decreased vascular resistance and enhanced blood flow (Dienstbier, 1989, 1992). Threat is also marked by increased SAM activity, but is characterised by increased pituitary adreno-cortical (PAC) activity, resulting in cortisol release (e.g., Jamieson et al., 2012). Thus, increased HR and attenuated PEP occur, which indexes task engagement in both challenge and threat, but with an increase or stabilisation in TPR and a small increase, decrease, or stabilisation in CO. In this threat CV reactivity pattern PAC activity is thought to temper SAM activity, therefore compared to a challenge CV reactivity pattern, efficient energy delivery to the brain and muscles does not occur (Dienstbier, 1989, 1992). A consistent body of evidence supports the BPS model (see Blascovich et al., 2011; Seery, 2011 for reviews). For clarity, challenge CV reactivity is reflected in increased CO and decreased TPR, and threat CV reactivity is reflected in a small increase, stabilisation, or decreased in CO and increased TPR.

Lazarus and Folkman (1984) introduced the concepts of challenge and threat as two possible cognitive appraisals leading to two different stress responses. Threat cognitive appraisals occur when secondary appraisal indicates that an individual's coping potential is not sufficient, thus deeming harm potentially imminent. Challenge appraisals occur when secondary appraisal indicates that an individual's coping potential is sufficient, thus deeming harm less likely. Challenge is considered an adaptive approach associated with superior performance, and threat a maladaptive approach associated with inferior performance in a range of tasks (e.g., Blascovich et al., 2004; Moore et al., 2012; Schneider, 2008; Turner et al., 2012; Turner et al., 2013).

To manipulate challenge and threat research has successfully used challenge and threat instructional sets (e.g., Hemenover and Dienstbier, 1996; Feinberg and Aiello, 2010; Taylor and Scogin, 1992; Tomaka et al., 1997). For example, Tomaka et al. (1997) used threat instructions that informed participants that "it is very important that you perform the task as quickly and efficiently as possible" and instructed participants that "you must keep going until the task is completed" (p. 72). It should be noted that the threat instructions do not manipulate demand or resource appraisals but appear to manipulate task importance. Challenge instructions encouraged participants to "try really hard to do your best," to "think of the task as a challenge to be met," and to "think of yourself as someone capable of meeting that challenge" (p. 72). Challenge instructions led to challenge appraisals and challenge CV reactivity and threat instructions to threat appraisal and threat CV reactivity to a mental arithmetic task, demonstrating the influence instructional sets could have on challenge and threat. Tomaka et al. chose to manipulate both demand and resource appraisals in their instructional sets, and also adopted an encouraging and supportive tone in the challenge instructions compared to the threat instructions. That is, threat instructions were delivered in a "staccato and stern tone" while challenge instructions were delivered "in a much more pleasant way" (Blascovich and Mendes, 2000, p. 75). Tomaka et al. show how the content and tone of instructional sets can be important in promoting challenge.

In another paper (Feinberg and Aiello, 2010), challenge instructions informed participants to "try hard to do your best" in an upcoming math/anagram task, to "think of yourself as someone capable of meeting the challenges of this task," and informed participants that "most participants are able to handle the tasks" (p. 2104). Threat instructions informed participants that "many participants have trouble performing well on this task" that "it is important that you perform this task as quickly and efficiently as possible" as "both speed and accuracy of your answers will be examined" (p. 2104). Feinberg and Aiello (2010), like Tomaka et al. (1997), emphasised task demands and offered little encouragement in the threat instructions compared to challenge instructions, offering further support for the notion that challenge can be promoted by altering perceived task demands.

In sum, past research has successfully manipulated challenge and threat using a range of instructional sets that focus either on altering perceived demands of an upcoming task, or in one study, altering perceived task importance, perceived demands, and perceived resources (e.g., Tomaka et al., 1997). In addition, the differing tone in which instructional sets are delivered may have contributed to the manipulation of challenge and threat in some studies (e.g., Tomaka et al., 1997). Because demand appraisals (requirement for effort, uncertainty, and danger to esteem) are usually salient in motivated performance situations, attempts to devalue perceived task demands, while effective in laboratory studies, may be less effective in actual motivated performance situations. Therefore, in this paper we seek to manipulate challenge and threat states using task instructions that alter perceptions of personal resources without altering perceived task demands and are more analogous between task instruction conditions. That is, instead of altering the requirement for effort, uncertainty, and danger to esteem (demand appraisal), or differing the tone of the instructions between conditions, the instructional sets used in the studies comprising this current paper seek to change self-efficacy, perceived control, and achievement goals, collectively known as the resource appraisals in the TCTSA (Jones et al., 2009).

The present paper examines an extension to the cognitive appraisal concepts used in the BPS model as proposed in the TCTSA (Jones et al., 2009). To explain, the TCTSA adopts the demand appraisals from the Biopsychosocial (BPS) model of challenge and threat (Blascovich and Mendes, 2000), but then outlines the resource appraisals, which comprise self-efficacy, perceived control, and achievement goals. On approaching a motivated performance situation high levels of self-efficacy, perceived control, and a focus on approach goals are posited to underpin challenge, while low levels of self-efficacy, perceived control, and a focus on avoidance goals are posited to underpin threat. However, to date research has not consistently shown these resource appraisals to correlate with challenge and threat CV reactivity in the manner predicted by the TCTSA (Meijen et al., 2013; Turner et al., 2012, 2013), but consistent with broader evidence that self-reports may not always relate to physiological reactivity (e.g., Martinek et al., 2003). Although some studies that have manipulated challenge and threat states have reported concomitant changes in self-report measures (e.g., Moore et al., 2012).

By adopting only the resource appraisals to manipulate challenge and threat CV reactivity in the present study, we propose to maintain the perceived demands of the situation, thus offering an alternative method of manipulating challenge and threat states to previous research that may be applicable in situations where the manipulation of task demands is not possible. For example, it may be very difficult to convince a person who has an upcoming interview for a promotion that the situation will not be demanding and difficult, and is not important for her career. In addition, suggesting that she simply do her best may be insufficient to counter the importance of the potential promotion. In fact, it is often precisely the importance of an event that provides the motivation to succeed (e.g., Eysenck and Calvo, 1992). Finding strategies to successfully promote challenge reactivity in motivated performance situations without altering the perceived demands is a valuable endeavour, as a growing body of research reports the association between challenge reactivity and superior performance compared to threat reactivity (e.g., Blascovich et al., 2004; Moore et al., 2012; Seery et al., 2010; Turner et al., 2012, 2013). For example, Turner et al. (2012) found that challenge CV reactivity was associated with increased performance from base levels in both a cognitive (Stroop Test) and a motor (Netball shooting) task, whereas threat CV reactivity was associated with decreased performance from base levels in both tasks.

The current paper presents two studies that examine whether challenge task instructions yield challenge reactivity, and whether threat task instructions yield threat reactivity, when perceived task demands were underpinned by competitive (Study 1) and physically demanding (Study 2) properties. In Study 1 a novel bean-bag throwing