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Examining the antecedents of challenge and threat states: The influence of perceived required effort and support availability

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ABSTRACT

To date, limited research has explicitly examined the antecedents of challenge and threat states proposed by the biopsychosocial model. Thus, the aim of the present study was to examine the influence of perceived required effort and support availability on demand/resource evaluations, challenge and threat states, and motor performance. A 2 (required effort; high, low) × 2 (support availability; available, not available) between-subjects design was used with one hundred and twenty participants randomly assigned to one of four experimental conditions. Participants received instructions designed to manipulate perceptions of required effort and support availability before demand/resource evaluations and cardiovascular responses were assessed. Participants then performed the novel motor task (laparoscopic surgery) while performance was recorded. Participants in the low perceived required effort condition evaluated the task as more of a challenge (i.e., resources outweighed demands), exhibited a cardiovascular response more indicative of a challenge state (i.e., higher cardiac output and lower total peripheral resistance), and performed the task better (i.e., quicker completion time) than those in the high perceived required effort condition. However, perceptions of support availability had no significant impact on participants' demand/resource evaluations, cardiovascular responses, or performance. Furthermore, there was no significant interaction effect between perceptions of required effort and support availability. The findings suggest that interventions aimed at promoting a challenge state should include instructions that help individuals perceive that the task is not difficult and requires little physical and mental effort to perform effectively.

1. Introduction

Individuals from a range of contexts (e.g., sport, surgery, military, and aviation) are often required to perform important tasks under extreme stress. As individuals do not respond to stress in a uniform manner, it is interesting to consider what factors cause these different stress responses. One theoretical framework that offers a vital insight into how individuals respond to stress is the biopsychosocial model (BPSM) of challenge and threat (Blascovich, 2008a). Despite recent research examining this model, particularly the consequences of challenge and threat states (e.g., Moore et al., 2012), limited research has explicitly examined the antecedents that are proposed by this model to influence these states. Thus, the present study examined the impact of two antecedents of challenge and threat states proposed by the BPSM; perceived required effort and support availability.

Rooted in the work of Lazarus and Folkman (1984) and Dienstbier (1989), the BPSM contends that an individual's stress response during a motivated performance situation (e.g., exam, speech, competitive task) is determined by their evaluations of situational demands and personal coping resources (Blascovich, 2008a). These evaluations are said to be dynamic, relatively automatic (i.e., unconscious), and only occur when an individual is actively engaged in a situation (indexed by increases in heart rate and decreases in the cardiac pre-ejection period; Seery, 2013). The BPSM specifies that when evaluated personal coping resources match or exceed situational demands, a challenge state occurs. Conversely, when evaluated situational demands outweigh personal coping resources, a threat state ensues (Blascovich, 2008a). Despite their discrete labels, challenge and threat are considered two anchors of a single bipolar continuum such that relative differences in challenge and threat (i.e., greater vs. lesser challenge or threat) are meaningful and commonly examined by researchers (Seery, 2011).

According to the BPSM, the demand/resource evaluation process triggers distinct neuroendocrine and cardiovascular responses (Blascovich, 2008a; Seery, 2011). During challenge and threat states, sympathetic–adrenomedullary activation is elevated. This activation increases blood flow to the brain and muscles due to higher cardiac activity and vasodilation of blood vessels via the release of catecholamines (epinephrine and norepinephrine). Importantly, during a threat state, pituitary–adrenocortical activation is also heightened. This dampens sympathetic–adrenomedullary activation and decreases blood flow due to reduced cardiac activity and diminished vasodilation (or even

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vasoconstriction). Consequently, compared to a threat state, a challenge state is characterized by relatively higher cardiac output and lower total peripheral resistance, a cardiovascular response considered more efficient for energy mobilization and action (Seery, 2011). These cardiovascular markers have been extensively validated in the literature (see Blascovich, 2008a for a review).

The BPSM suggests that a challenge state should lead to better task performance than a threat state (Blascovich, 2008a). Indeed, a number of predictive and empirical studies have offered support for this assumption using academic (e.g., Seery et al., 2010), cognitive (e.g., Gildea et al., 2007; Mendes et al., 2007; Turner et al., 2012), and motor (e.g., Blascovich et al., 2004; Moore et al., 2012, 2013; Turner et al., 2013) tasks. For example, Vine et al. found that evaluating a novel (surgical) motor task as more of a challenge was associated with a cardiovascular response more indicative of a challenge state and superior performance (i.e., quicker completion times) compared to evaluating the task as more of a threat. Furthermore, after being trained to proficiency, the participants performed the same motor task under stressful conditions. The results revealed that evaluating the task as more of a challenge was again associated with better performance than evaluating the task as more of a threat (Vine et al., 2013).

The demand/resource evaluation process is complex and thus challenge and threat states can be influenced by many interrelated factors (Blascovich, 2014). For example, psychological and physical danger, familiarity, uncertainty, required effort, skills, knowledge and abilities, and the availability of external support have all been proposed to impact upon demand and/or resource evaluations (Blascovich, 2008a; Frings et al., 2014). The cardiovascular indexes of challenge and threat states have been used to test various psychological theories including those related to inter-individual (e.g., social comparison; Mendes et al., 2001) and intra-individual (e.g., social power; Scheepers et al., 2012) processes. While the latter has inadvertently offered some potential antecedents, to date, no research has explicitly examined the effect of any of the antecedents proposed by the BPSM on demand/resource evaluations, challenge and threat states, and motor performance. This is surprising given the potential for such research to aid the development of the BPSM and help identify which factors are most crucial to target during interventions designed to facilitate challenge states in response to stressful tasks. Indeed, by promoting challenge states rather than threat states, these interventions are likely to have beneficial effects on performance and long-term cardiovascular and mental health (see Blascovich, 2008b).

Two of these potential antecedents, perceived required effort and support availability, have been discussed in recent reviews (McGrath et al., 2011; Seery, 2013). Although research has shown that expending greater effort during a task is characterized by increased heart rate and systolic blood pressure (see Wright and Kirby, 2001), no research has examined if perceptions relating to the effort required to successfully complete an upcoming task influence the cardiovascular indexes of challenge and threat. As perceptions of required effort have been proposed to contribute to demand/resource evaluations, with greater perceived required effort leading to higher demand evaluations and lower resource evaluations, greater perceived required effort could cause a cardiovascular response more reflective of a threat state (i.e., relatively lower cardiac output and higher total peripheral resistance; Blascovich and Mendes, 2000; Seery, 2013). Furthermore, despite research demonstrating that cardiovascular reactivity (i.e., systolic and diastolic blood pressure) is reduced when social support is perceived to be available during a stressful task (see Uchino and Garvey, 1997), limited research has investigated the influence perceived support has on the cardiovascular markers of challenge and threat. As perceptions of available support have been proposed to influence demand/resource evaluations, with perceived support availability leading to lower demand evaluations and higher resource evaluations, perceived available support might lead to a cardiovascular response more indicative of a challenge state (i.e., relatively higher cardiac output and lower total peripheral resistance; McGrath et al., 2011).

The aim of the present study was to examine the impact of perceived required effort and support availability on demand/resource evaluations, challenge and threat states, and motor task (laparoscopic surgery) performance. We hypothesized that, compared to participants in the high required effort condition, participants in the low required effort condition would have more favorable demand/resource evaluations (i.e., resources outweighed demands), a cardiovascular response more reflective of a challenge state (i.e., relatively higher cardiac output and lower total peripheral resistance), and superior task performance (i.e., quicker completion time). Furthermore, we hypothesized that, compared to participants in the no support available condition, participants in the support available condition would have more favorable demand/resource evaluations, a cardiovascular response more reflective of a challenge state, and superior task performance. Due to the absence of prior research investigating the antecedents of challenge and threat states, no predictions were made for the interaction effect of perceived required effort and support availability.

2. Methods

2.1. Participants

One hundred and twenty undergraduate students (59 women, 61 male; 109 right-handed, 11 left-handed) with a mean age of 21.57 (SD = 2.99) agreed to participate. All participants reported having no prior experience of laparoscopic surgery. Furthermore, all participants declared that they did not smoke, were free of illness or infection, and had normal or corrected vision, no known family history of cardiovascular or respiratory disease, had not performed vigorous exercise or ingested alcohol for 24 h prior to testing, and had not consumed food and/or caffeine for 1 h prior to testing. Participants were tested individually. The study was approved by the institutional ethics committee and written informed consent was obtained from all participants.

2.2. Measures

2.2.1. Manipulations checks (perceived required effort and support availability)

In order to assess perceptions of required effort and support availability, participants were asked "How much effort do you think will be required to complete the surgical task?" and "How much support do you think will be available during the surgical task?" respectively. Both items were rated using a 7-point Likert scale anchored between *no effort (=1)* and *extreme effort (=7)* for perceived required effort, and *no support (=1)* and *a lot of support (=7)* for perceived support availability.

2.2.2. Demand/resource evaluations

Two items from the cognitive appraisal ratio (Tomaka et al., 1993) were employed to measure demand/resource evaluations. One item assessed task demands ("How demanding do you expect the surgical task to be?") and another assessed personal coping resources ("How able are you to cope with the demands of the surgical task?"). Each item was rated using a 6-point Likert scale anchored between *not at all (=1)* and *extremely (=6)*. Although previous research has tended to calculate a ratio score by dividing evaluated demands by resources (e.g., Feinberg and Aiello, 2010), such a ratio is highly non-linear and is therefore inconsistent with the notion that challenge and threat states are two anchors of a single bipolar continuum (Seery, 2011). Thus, instead, a demand resource evaluation score was calculated by subtracting demands from resources (range: −5 to +5), with a more positive score reflecting a challenge state and a more negative score reflecting a threat state (see Moore et al., 2013; Vine et al., 2013).