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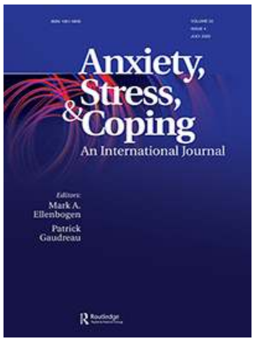

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REVIEW

Threat-related motivational disengagement: Integrating blunted cardiovascular reactivity to stress into the biopsychosocial model of challenge and threat

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ABSTRACT

Background: The biopsychosocial model of challenge and threat specifies a challenge-threat continuum where favorable demand-resource evaluations, efficient cardiovascular responses, and superior performance characterize challenge; and maladaptive outcomes like clinical depression characterize threat states. The model also specifies task engagement, operationalized as heart rate and ventricular contractility increases, as a prerequisite for challenge and threat states. The blunted cardiovascular reactivity to stress literature describes reductions of these increases and associates them with problems like clinical depression.
Objectives: To determine whether blunted cardiovascular reactivity to stress has implications for challenge and threat theory.
Methods: We review and synthesize the literatures on blunted cardiovascular reactivity to stress and the biopsychosocial model.
Results: Blunted cardiovascular reactivity appears not to reflect a physiological inability to respond to stress. Rather, it reflects a contextually dependent motivational dysregulation and reduced reactivity to stress consistent with deficient task engagement in the biopsychosocial model.
Conclusion: We argue that blunted cardiovascular reactivity represents deficient task engagement, and more generally, motivational disengagement due to threat states. Our biopsychosocial model-based approach conceptualizes this motivational disengagement as a tendency to avoid motivated performance situations. This tendency may represent a defense mechanism against subsequent threat and might explain associations with disorders like clinical depression.

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Cardiovascular responses; demand-resource evaluations; task engagement; motivational disengagement; clinical depression

There are many demanding situations in which individuals compete for desirable outcomes, including sport competitions, university exams, and job interviews. Although some individuals may often enjoy success in such situations, many individuals are confronted with failure in at least some situations. Having faced failure, individuals may persist and seek future success, or disengage from the situation at hand. Examining psychological and behavioral responses and understanding why some individuals disengage when others persist in these situations is an important task for psychologists and health practitioners. Therefore, this article integrates the biopsychosocial model of challenge and threat (BPSM; Blascovich, 2008a) and the phenomenon of blunted cardiovascular reactivity (CVR) to stress (e.g., Phillips et al., 2013) to propose a new explanation for specific psychophysiological responses to demanding situations.

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Precisely, we argue that adverse experiences in these situations may trigger motivational disengagement that is reflected in blunted CVR to stress. Moreover, we argue that this motivational disengagement may generalize to other situations and contribute to the development of various pathologies, such as clinical depression. In doing so, we highlight how blunted CVR and its association with clinical depression have implications for the BPSM, and vice versa. To do this, we begin by describing the main tenets of the BPSM and the theory-practice gap that inspired the current article. We then summarize the phenomenon of blunted CVR, the relevant literature around it, and its implications for the theory-practice gap in the BPSM literature. The implications are presented for the possibility that blunted CVR reflects a true deficit in psychological task engagement and for the possibility that blunted CVR reflects something other than deficient task engagement. We then examine evidence for these two potential explanations for blunted CVR and, based on the most convincing of these, integrate the phenomenon into the BPSM. Having proposed that blunted CVR reflects a motivational disengagement from BPSM-relevant situations, we then discuss potential functions, consequences, and risk factors for this motivational disengagement. We close with methodological recommendations for BSPM-based research and practical recommendations for practitioners in various fields.

The BPSM

The BPSM (Blascovich, 2008a) describes psychophysiological responses and performance variation under pressure. In particular, it specifies that challenge and threat states occur in motivated performance situations. A motivated performance situation occurs when an individual believes that the situation they are in is goal-relevant, evaluative, and requires adequate performance for their continued well-being or growth, thereby implying self-relevance and evoking task engagement (Blascovich & Mendes, 2000). It should be noted that this situation is consistent with an active coping stressor, and contrasts those involving passive stressors (Blascovich, 2008a; Obrist, 1981). Contrary to alternative approaches (e.g., Lazarus & Folkman, 1984; Uphill et al., 2019), the BPSM specifies that an individual can respond to a motivated performance situation with a psychophysiological response falling somewhere along a bipolar continuum from a challenge to a threat state. On a psychological level, this response is defined by (conscious or subconscious) cognitive evaluations of personal

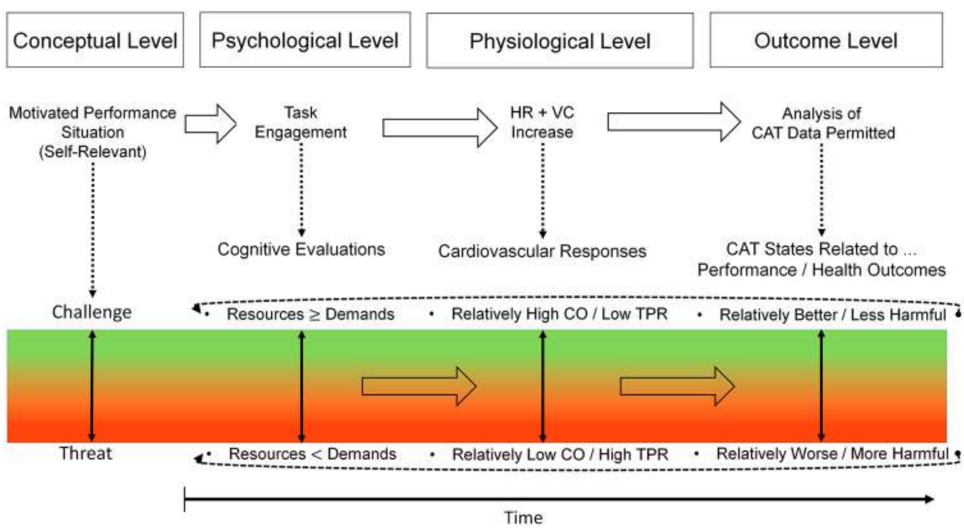

Figure 1. Key tenets of the BPSM.

Note. CAT = Challenge and threat. CO = Cardiac output. HR = Heart rate. TPR = Total peripheral resistance. VC = Ventricular contractility.

coping resources relative to situational demands. On a physiological level, these cognitive evaluations trigger neuroendocrine and cardiovascular responses. Figure 1 presents the key tenets of the BPSM.

Importantly, the BPSM specifies that task engagement is a prerequisite for challenge and threat states to be experienced (Blascovich, 2008a). Task engagement is operationalized as an increase in heart rate and ventricular contractility during, or in anticipation of, a motivated performance situation (Blascovich, 2008a). Hence, according to the model, one should not evaluate challenge and threat states when heart rate or ventricular contractility did not increase.

A *challenge* state represents the adaptive end of the bipolar continuum. It is characterized by a cognitive evaluation that personal coping resources match or outweigh situational demands. This evaluation activates the catecholamine-mediated sympathetic-adrenomedullary axis, which in turn results in increased cardiac output (i.e., blood volume ejected by the heart per minute) and decreased total peripheral resistance (i.e., relative vasodilation; Blascovich, 2008a; Tomaka et al., 1993). A *threat* state represents the maladaptive end of the continuum. It is defined by a cognitive evaluation that personal coping resources fall short of situational demands (Blascovich, 2008a). This evaluation not only activates the sympathetic-adrenomedullary axis, but also the pituitary-adrenocortical axis. This triggers the release of cortisol, which counteracts the effects of sympathetic-adrenomedullary activation on the cardiovascular level. Thus, compared to a challenge state, a threat state elicits a relatively lesser cardiac output increase and no change or even increases in total peripheral resistance (Blascovich, 2008a; Tomaka et al., 1993). However, it should be noted that the predictions of the BPSM have been criticized because the pituitary-adrenocortical axis does not react quickly enough to elicit immediately measurable CVR (Wright & Kirby, 2003). Thus, the neurological predictions of the BPSM may require further examination. Blascovich (2008b) proposed that the chronic experience of a threat state could lead to negative somatic (e.g., cardiovascular disease, weakened immune function) or psychiatric (e.g., depression, anxiety) health outcomes.

The BPSM (Blascovich, 2008a) specifies that once an individual is engaged in a motivated performance situation, there is a continuous feedback loop determining cognitive evaluations and physiological responses (see Figure 1). Real-time information about the situation, such as partial success or failure, can change the balance of resource and demand evaluations as the individual performs the task. Further, if the balance is tilted too strongly toward either side, task disengagement occurs. For example, if failure seems inevitable and demands extremely outweigh resources, the task will lose goal relevance and the individual will consequently disengage from the task. Likewise, if success is extremely certain (i.e., resources extremely outweigh demands), disengagement should also occur. Thus, some uncertainty about the outcome of the motivated performance situation is required for task engagement to occur and be sustained, and for challenge and threat states to follow. The BPSM also predicts that a challenge state leads to better performance than a threat state, which a recent meta-analysis and a systematic review have supported (Behnke & Kaczmarek, 2018; Hase et al., 2019). The reviews found most studies to support the superiority of a challenge state on various outcome tasks and in various research designs, although Behnke and Kaczmarek (2018) noted a small average effect size for associations based on a cardiovascular measure.

The BPSM was central to the development of the theory of challenge and threat states in athletes (Jones et al., 2009). This theory adopted the predictions of the BPSM regarding challenge and threat states and their effects on performance, and applied them to the sporting context. However, even though the theory of challenge and threat states in athletes agrees with the physiological constituents of challenge and threat states, it does not mention the prerequisite of task engagement, a core component of the BPSM. Hence, the main discussion in the present article will be guided by the BPSM, although the theory of challenge and threat states in athletes may add some relevant predictions. For example, the theory proposes that the experience of a threat state results in avoidance strategies and task disengagement.

The vast majority of the BPSM-based challenge and threat research has measured and analyzed task engagement on the physiological level by collecting cardiovascular data. Psychological measures of task engagement have not been commonly used. In comparison, challenge and threat states have been measured and analyzed both on the cognitive (via self-reports) and on the physiological level (via cardiovascular data), although only a few studies have included both measures (Hase et al., 2019). Studies typically assess task engagement as changes in heart rate/ventricular contractility from a resting baseline period to a post-instructions task anticipation period, or to task performance itself (e.g., Moore et al., 2015; Scholl et al., 2017). This has commonly been statistically tested at the group level (e.g., by testing a mean difference with a paired t-test), which does not provide information about how many individual participants actually exhibited task engagement. Specifically, a significant group-level test result only implies that the mean heart rate/ventricular contractility change is sufficient to indicate task engagement (i.e., there was a significant increase). Some participants may still exhibit a decrease, no change, or only a weak increase in heart rate/ventricular contractility. Due to the strong increases of other participants, the group can still pass the check for task engagement. Cognitive and cardiovascular challenge and threat measures are then analyzed at the group level, even though the BPSM highlights the importance of task engagement at the individual level. Thus, there is a potential conflict between the specifications of the BPSM and common research practice, which could bias challenge and threat research toward attenuated relationships between challenge and threat and other variables.

It is noteworthy that some research has taken a stricter approach (Hase et al., 2019; Seery et al., 2009), and only analyzed challenge and threat data of participants who displayed task engagement at an individual level (i.e., displayed a heart rate increase, Hase et al., 2019; displayed a heart rate increase and a pre-ejection period decrease, Seery et al., 2009). Between these studies, the proportion of cases without task engagement varied considerably, with Seery et al. (2009) excluding 4% of participants, and Hase et al. (2019) excluding 40% and 49% of cases on their two outcome tasks, respectively. In short, the BPSM implies that participants not exhibiting task engagement on the cardiovascular level should be excluded from the analysis of challenge and threat data, but few researchers have actually done this. The next section presents a phenomenon that has implications for whether it is justifiable to include participants without cardiovascular task engagement in challenge and threat research: blunted CVR to stress.

Blunted CVR to stress

Blunted CVR to stress is typically understood as a cardiovascular response to a psychological stressor that is lower than the typical change observed during normal homeostatic function in the same situation (Phillips et al., 2013). Blunted CVR has been demonstrated in between-groups comparisons (e.g., blunted CVR in depressed individuals than in healthy controls; Salomon et al., 2013) and in within-person comparisons (e.g., blunted CVR in tasks with extreme, relative to medium, difficulty; Richter et al., 2008); and has often been studied in the context of active coping tasks consistent with motivated performance situations in the BPSM (e.g., mental arithmetic; Ginty et al., 2015).

Blunted CVR to acute psychological stress has been associated with several unfavorable physical and mental health outcomes. The main focus of this article is clinical depression (e.g., de Rooij, 2013; Phillips, 2011; Salomon et al., 2013), but other outcomes include poor performance (Dixon et al., 2019), anxiety symptoms (Yuenyongchaiwat & Sheffield, 2017), low cognitive ability (Ginty et al., 2012), eating disorders (Ginty et al., 2012; Koo-Loeb et al., 1998), obesity, poor self-reported health, poor lung function (de Rooij, 2013; Phillips, 2011), disability status (Phillips et al., 2011), smoking (Wiggert et al., 2016), study disengagement (Ginty et al., 2015), and type D personality (Kelly-Hughes et al., 2014). Given the chronicity of many of these outcomes, blunted CVR itself might be a chronic phenomenon in some cases. However, the chronicity of blunted CVR has not been widely researched.

Implications of blunted CVR to stress for the BPSM

Heart rate and ventricular contractility are very commonly examined indices of blunted CVR, and the most relevant to the integration of blunted CVR into the BPSM. In a BPSM framework (see Figure 1), blunted heart rate and ventricular contractility responses are interpreted as a physiological indicator of missing task engagement if the responses are fully blunted (i.e., no change or a decrease in heart rate/ventricular contractility). In case of partial blunting (i.e., a heart rate/ventricular contractility increase that is weaker than the typical response observed in normal homeostatic function in the same situation, thus still meeting the blunted CVR definition of Phillips et al., 2013), the BPSM does not describe a specific threshold for insufficient task engagement. Nevertheless, the BPSM emphasizes that the analysis of heart rate/ventricular contractility responses still allows for the examination of relative differences in task engagement even when absolute values cannot be compared (Blascovich et al., 1999; Blascovich et al., 2003). It should also be noted here that the BPSM views task engagement primarily as a psychological process, a position we also adopt in this article. This will be relevant later in the article when interpreting findings from different task engagement measures, and when discussing potential explanations for blunted CVR.

Thus, blunted CVR to stress is consistent with reduced or absent task engagement in the BPSM, at least on the surface. If blunted CVR were due to a physiological abnormality and not due to reduced or absent task engagement, then blunted CVR would pose a challenge to the BPSM. In this case, the model would need to specify blunted CVR as a boundary condition for its prediction that psychological task engagement triggers a cardiovascular response. The practical implication of this would be that another measure (e.g., psychological self-report) of task engagement would be needed to supplement or replace the cardiovascular measure. In contrast, if blunted CVR were actually indicative of reduced or missing task engagement, then the cardiovascular measure would be tenable and, more importantly, the blunted CVR literature would have important implications for the BPSM. In both cases, the usual approach of testing task engagement with a group-level test might be problematic, as non-engaged participants would be erroneously included in subsequent analyses if task engagement were sufficient at the group level. The next section will review research that may explain blunted CVR to stress.

Potential explanations for blunted CVR to stress

This section will review five potential explanations for why blunted CVR occurs, namely general physiological function, invested effort, task difficulty, motivation, and stress perceptions (Phillips et al., 2013). We eventually argue that the last two best explain blunted CVR to stress and describe how they can be integrated into BPSM-based theories.

If blunted CVR were due to a non-psychogenic, general physiological abnormality in cardiovascular function (i.e., an inability of the cardiovascular system to react to any stressor), the phenomenon would not necessitate the exclusion of cases without cardiovascular task engagement in challenge and threat research. However, studies that compared CVR to mental stressors versus CVR to physical stressors have found no support for this explanation. For example, Brindle and colleagues classified participants as blunted or exaggerated responders to a socially evaluative mental arithmetic task (Brindle et al., 2017). In follow-up testing, the blunted CVR group again showed relatively blunted CVR to this type of psychological stress, yet the CVR in response to both a cold pressor task and physical exercise was similar in the two groups, indicating that blunted responders did possess the physiological capacity to respond. Another study of Brindle and colleagues compared the CVR of individuals with sufficient symptoms to indicate a probable depression to that of non-depressed controls (Brindle et al., 2013). Compared to the controls, the high-symptom individuals exhibited blunted CVR to mental stress, but not to a postural challenge. Further, Salomon et al. (2013) found that depressed participants showed blunted CVR to stress, whereas participants with remitted depression did not. Similarly, Schwerdtfeger and Rosenkaimer (2011) demonstrated that blunted CVR to stress appears to be dependent on the self-relevance of the performance situation, and not on the physiologically based idea of alpha – and beta-adrenergic stressors. Hence, Salomon and colleagues concluded that blunted CVR does not reflect "deficits in the physiological integrity of the cardiovascular system" (p. 50; Salomon et al., 2013). We agree and conclude that blunted CVR to stress cannot be explained by a generalized inability of the cardiovascular system to respond to stress.

Another potential explanation views blunted CVR as a reflection of lower invested effort in a motivated performance situation (Phillips et al., 2013). The idea is based on an extension of motivational intensity theory that predicts that the cardiovascular (particularly ventricular contractility and systolic blood pressure) reactivity to an active coping task reflects invested effort, which in turn varies as a function of task difficulty (e.g., Richter et al., 2016). Salomon et al. (2013) provided indirect evidence relevant to this explanation as they compared groups of clinically depressed, depression remitted, and non-depressed participants on cardiovascular responses and markers of effort during a speech task. The depressed group did exhibit relatively blunted CVR compared to the other groups, but with the exception of speech persuasiveness, no markers of effort were significantly different between groups. Moreover, Phillips and colleagues highlighted that some correlates of blunted CVR (e.g., exercise dependency) relate to high expended effort. Thus, we conclude that effort is unlikely to best explain blunted CVR and turn to task difficulty, which according to motivational intensity theory predicts effort as long as success is deemed possible and desirable (Wright, 1998).

Objective task difficulty has been linked with blunted CVR. In particular, both extremely easy and extremely difficult tasks have elicited weaker CVR than medium-difficulty tasks (Richter et al., 2008). This is consistent with the BPSM, which states that task disengagement occurs when a task is evaluated as so easy or difficult that success or failure, respectively, is inevitable (Blascovich, 2008a). However, the seemingly stable part of blunted CVR to stress (i.e., that which is linked to depression and other disorders) cannot be explained with variations in objective task difficulty, as shown by studies keeping difficulty fixed (Ginty et al., 2012). Thus, objective task difficulty is not the best explanation of blunted CVR, although a related variable might be more useful (e.g., subjective difficulty; see section 1.5).

Motivational dysregulation has been proposed as an explanation for blunted CVR, implying a subconscious and potentially mood-dependent problem at the root of the phenomenon (e.g., Phillips et al., 2013; Salomon et al., 2013). This potential explanation is compatible with the BPSM, as the model states that psychological task engagement, which could also be conceptualized as the motivation to engage with and master a motivated performance situation, will be evidenced by increases in heart rate and ventricular contractility. Importantly, the BPSM acknowledges that the cognitive processes it describes are not always consciously accessible and their assessment may be distorted by cognitive biases (Blascovich & Mendes, 2000). Hence, a reduction or absence of heart rate and ventricular contractility increases might indicate a subconscious reduction or absence of psychological task engagement or motivation to engage in the motivated performance situation, despite unchanged conscious self-reports of motivation. This explanation is also consistent with the association between blunted CVR and depression, as depression features anhedonia, a core symptom characterized by reduced sensitivity to and reduced anticipatory motivation to pursue rewards (Ahles et al., 2017; Franzen & Brinkmann, 2016; Treadway & Zald, 2013).

Moreover, the literature offered another noteworthy explanation. Precisely, it was argued that blunted CVR is due to a reduced reactivity to stress and reward stimuli on the neuronal level (Carroll et al., 2017; Ginty, 2013). This hypothesis is supported, for example, by research using brain imaging techniques in combination with cardiovascular monitoring to show that brain areas involved in stress and reward reactivity, and motivated behavior are hypoactive in blunted CVR individuals. The common association of these reductions in stress and reward reactivity with depression also points to a shared neuronal circuitry for responding to stress and reward, which is thought to be primarily dopaminergic (de Rooij, 2013; Salomon et al., 2013; Treadway & Zald, 2013). Thus, a hyporesponsive mesolimbic dopamine system involved in depression and other disorders may also be responsible for blunted CVR (Carroll et al., 2017; Gold et al., 2018). Carroll and colleagues argued that this neurobiological hypo-responsivity relating to stimuli or situations that normally motivate active coping efforts (i.e., motivated performance situations) is the best explanation for blunted

CVR. They also suggested that this hypo-responsivity may stem from stressful life events, gene variants, and interactions thereof.

Taking together the available evidence, we draw the following conclusions. Firstly, blunted CVR to stress is unlikely to represent a purely physiological inability to respond, as individuals with blunted CVR to stress react normally to non-psychological stressors (e.g., postural challenge). Also, blunted CVR to active coping stressors consistent with a motivated performance situation has been found to depend on the self-relevance, rather than on biological characteristics of the stressor (Schwerdtfeger & Rosenkaimer, 2011). Secondly, objective task difficulty is not the best explanation for blunted CVR, but a related psychological variable might be more useful (e.g., evaluations of difficulty; Blascovich, 2008a). Finally, motivational dysregulation and a diminished neurological reactivity to stress and reward stimuli explain blunted CVR well and might reflect the same underlying dysregulation at the biological level. Based on these conclusions, the next section will integrate blunted CVR into the BPSM.

Integrating blunted CVR to stress into the BPSM

The BPSM (Blascovich, 2008a) and the theory of challenge and threat states in athletes (Jones et al., 2009) offer a novel theoretical perspective on blunted CVR to stress that combines previous explanations and finds blunted CVR to be a psychophysiological phenomenon. We argue that this phenomenon represents habitual, pre-emptive motivational disengagement with motivated performance situations as a result of previous threat states. These previous experiences should have been aversive enough to motivate individuals to avoid future motivated performance situations in an attempt to prevent similar outcomes and decrements to personal well-being. If the motivated performance situation is unavoidable, then the motivational disengagement should result in worse performance relative to motivationally engaged individuals.

Although we argue that this threat-provoked motivational disengagement is largely subconscious and akin to a conditioned response, cognitive challenge and threat evaluations could present a partially conscious mediator between a threat state and motivational disengagement (see Figure 2; see also Blascovich & Mendes, 2000 regarding whether evaluations can be accurately and consciously self-assessed). Precisely, the BPSM states that feedback during and after the motivated performance situation is used to update task demand and coping resource evaluations. A recent study supported this prediction, finding that performance in the first part of a motivated performance situation was positively associated with demand-resource evaluations in anticipation of the second part of the motivated performance situation, where better performance predicted evaluations more consistent with a challenge state (Brimmell et al., 2019). The BPSM also states that task disengagement occurs when demand evaluations extremely outweigh resource evaluations (or vice versa). Thus, strong and/or repeated threat states might tilt the balance of demands and resources so strongly in favor of demands that motivational disengagement might occur (see Figure 2, bottom cycle). Indeed, one study found that clinical depression patients exhibiting blunted CVR reported evaluations more consistent with a threat state, and that challenge and threat evaluations were generally associated with heart rate reactivity (Salomon et al., 2009). However, as these results did not allow for testing the causality of the association, future research needs to test the current predictions.

The BPSM also clarifies why objective task difficulty is not the best explanation of blunted CVR to stress (Carroll et al., 2017). Precisely, the BPSM states that individuals are not rational-economic evaluators, and thus some persons may evaluate task difficulty and the resultant situational demands more accurately than others (Blascovich et al., 2003). Thus, a BPSM-based approach emphasizes the importance of *subjective* (as opposed to *objective*) task difficulty in explaining demand-resource evaluations and motivational disengagement.

For example, a depressed individual might exhibit blunted, whereas a non-depressed individual might exhibit relatively normal CVR on the same task (see Ginty et al., 2012). Although objective difficulty would not differ in this situation, subjective difficulty might indeed differ (e.g., via cognitive

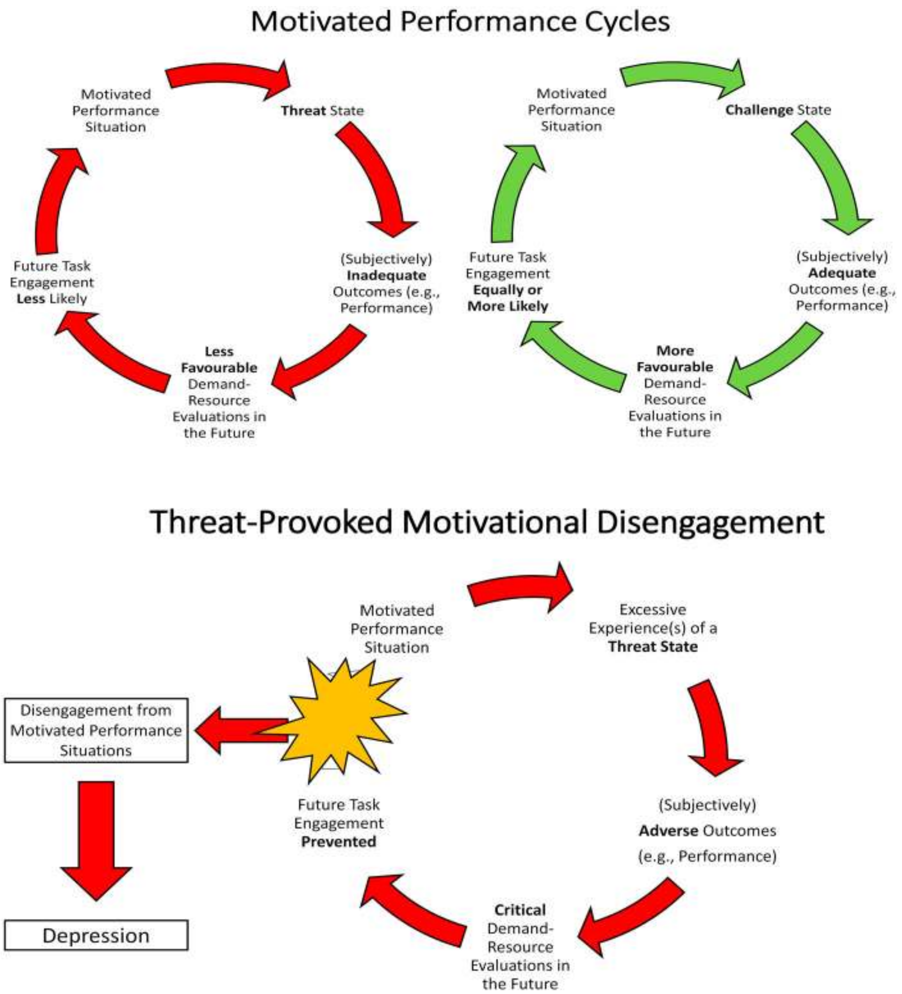

Figure 2. Normal motivated performance situation feedback loops (top) versus threat-provoked motivational disengagement (bottom).

biases like depressive pessimism, Pyszczynski et al., 1987) and explain differences in task engagement and CVR. Salomon and colleagues supported this idea when they found that depressed participants (relative to non-depressed controls) exhibited blunted CVR to a speech and a mirror tracing task (Salomon et al., 2009). Depressed participants also evaluated the tasks as more demanding, threatening, and stressful; and reported less coping ability. They also found that their challenge and threat measure was associated with CVR such that a challenge evaluation was related to greater heart rate reactivity than a threat evaluation, although this association did not mediate the relationship between group and reactivity. Another study comparing a high – and a low-depression symptoms group performing across four difficulty levels found that the high-symptom group exhibited motivational disengagement (relative to the previous level) at the highest difficulty level, whereas the low-symptom group sustained task engagement on the highest difficulty level (Silvia et al., 2016).

In another study, blunted CVR was associated with lower behavioral perseverance on an unsolvable puzzle task, but self-reported perseverance was not associated with CVR (Chauntry et al., 2019). Other research also found no significant differences in consciously self-reported difficulty, task engagement (Brindle et al., 2013; Ginty et al., 2015), and behavioral engagement (Salomon et al., 2013) between relatively blunted and relatively normal CVR participants. Thus, researchers should account for potential biases affecting conscious self-reports by also including physiological and behavioral task engagement variables. However, behavioral engagement measures may also be biased in some cases, which we discuss in the next section.

Additionally, we argue that motivational disengagement and a reduced neurobiological sensitivity to stress and reward are the best explanations for blunted CVR to stress. However, as noted above, it is important to highlight that the motivational processes leading to the task disengagement are not always accurately assessed by the conscious mind, or may be distorted by cognitive biases. Support for the idea that motivational disengagement and a reduced neurobiological sensitivity to stress and reward co-occur in individuals with blunted CVR comes from Treadway and Zald (2013). They suggested that altered neurobiological, particularly dopaminergic, function (e.g., a reduced responsiveness of mesolimbic dopamine neurons) may be tightly linked with the deficits in motivation and reward sensitivity in depression known as anhedonia. As Carroll et al. (2017) mentioned that motivational disengagement may result from gene by environment interactions, it might be that the genetic make-up of susceptible individuals (e.g., at the level of dopaminergic gene polymorphisms) produces a neurobiological potential for motivational disengagement in response to stressful life events. This idea is consistent with a BPSM-based view, in which a threat state (which may constitute a stressful or adverse life event) also produces task disengagement (Jones et al., 2009).

Potential function and consequences of motivational disengagement

It could be that extreme and/or repeated threat experiences result in task disengagement to prevent adverse outcomes in the ongoing and subsequent motivated performance situations, akin to a conditioned response that functions as a psychological defense mechanism. This response, although maladaptive in the modern world, might have evolved to ensure survival over the course of human evolution. This would be similar to the hypothesis that depression confers evolutionary benefits by promoting submissiveness and avoidance of further conflict upon defeat in human social competition (Price et al., 1994). However, an alternative and more short-term explanation would be that task disengagement might be learned as an adaptive coping strategy in childhood, which turns out to be maladaptive in adulthood. The finding that blunted CVR to stress appears to depend on the self-relevance of the stressor supports the idea of a psychological defense mechanism (Schwerdtfeger & Rosenkaimer, 2011). If this were the case, individuals might instinctively and habitually prevent task engagement in situations resembling those in which they previously experienced strong threat (see also Seligman, 1972 for learned helplessness in depression). Thus, individuals would switch from active to passive (i.e., avoidance-based) coping with motivated performance situations.

Consistent with previous interpretations (e.g., Carroll et al., 2013), we hypothesize that the proposed psychological defense mechanism acts largely outside of conscious awareness and reflects central motivational dysregulation. This might also explain why an absence of task engagement on the physiological level (i.e., blunted CVR to stress) has not been consistently associated with an absence of self-reported task engagement on the psychological level (e.g., Brindle et al., 2013; Ginty et al., 2015), although a behavioral measure of task engagement did show an association with blunted CVR (Chauntry et al., 2019). Blascovich and Mendes (2000) noted that for this reason, psychophysiological measures may be favorable over self-report measures of challenge and threat states. This conclusion can be extended to the study of task engagement, where psychophysiological measures can also be preferred over self-reports.

Behavioral measures may also be superior to self-report measures, but it is important to note that some of them can be biased by the same influences (e.g., social desirability) as self-reports. For example, Salomon et al. (2013) found that the speeches of a major depression group were rated as less persuasive than those of a control and a remitted depression group, but the groups did not differ on other measures of behavioral engagement, such as number of words produced, word fluency, and number of experimenter prompts required to continue talking. Not all behavioral engagement measures therefore may effectively measure psychological engagement with the motivated performance situation. Indeed, it makes intuitive sense that most participants would agree to complete a speech task in the laboratory (e.g., due to social desirability concerns), but that those with a general motivational disengagement from motivated performance situations would not be fully psychologically engaged in it, and thus exhibit missing task engagement in other ways (e.g., via physiological responses or speech persuasiveness). For this reason, we agree with Blascovich and Mendes (2000) that psychophysiological measures are likely the least biased measures when examining individuals' responses to a motivated performance situation.

In order to test the hypothesis of motivational disengagement as a defense mechanism against future threat experiences, blunted CVR individuals need to be compared with normal responders on habitual approach or avoidance behaviors of motivated performance situations, potentially using an experience sampling design (e.g., van Winkel et al., 2015). Since a threat state features an avoidance focus (Blascovich, 2008a), we would hypothesize that blunted CVR individuals do not differ from normal individuals in their evaluations of the stressfulness of motivated performance situations, but rather in the frequency with which they seek out such situations. For instance, Ginty et al. (2015) found that blunted CVR was associated with study disengagement in high school students. Participants who exhibited blunted CVR in a baseline testing session were less likely to complete an online follow-up assessment one year later, indicating that blunted CVR participants may have avoided motivated performance situations more than normal responders. When the avoidance of a motivated performance situation is not an option (e.g., due to mandatory assessments in a work setting), we hypothesize that blunted CVR individuals can be distinguished from non-blunted individuals with behavioral variables other than attendance, for example performance quality or perseverance. For example, a recent study found that blunted CVR was associated with lower behavioral, but not self-reported, perseverance on an unsolvable puzzle task (Chauntry et al., 2019).

The threat-provoked motivational disengagement that we hypothesize to be at the root of blunted CVR might have several consequences, the focal one of this article being withdrawal from motivated performance situations and a concomitant build-up of clinical depression. There is considerable evidence suggesting a link between motivational disengagement and depression (in the form of blunted CVR; de Rooij, 2013; Phillips, 2011; Salomon et al., 2013). There have also been theoretical arguments that the chronic experience of a threat state may lead to clinical depression (Blascovich, 2008b); and that depression has a similar function to threat-provoked motivational disengagement. Namely, depression has been hypothesized to reduce the risk of future harm after defeat in social competitions, which might have conferred evolutionary benefits despite appearing maladaptive in the modern world (Price et al., 1994).

Furthermore, clinical depression features pessimism, a cognitive bias consistent with the previously mentioned imbalance of cognitive challenge and threat evaluations provoking motivational disengagement (Pyszczynski et al., 1987). In particular, compared to non-depressed individuals, depressed individuals attribute a greater likelihood to negative events happening to them. Furthermore, depressed individuals attribute a lower likelihood to positive events happening to them than to others. Hence, despite equal objective task demands and coping resources in a motivated performance situation, a depressed individual might evaluate there to be more demands (e.g., due to greater evaluations of danger or subjective task difficulty; Blascovich, 2008a; Jones et al., 2009) and less resources (e.g., due to lower self-efficacy; Tahmassian & Jalali Moghadam, 2011) than a non-depressed individual. This might create enough of a threat state that they would disengage more quickly or avoid participation altogether. However, more research is needed that specifically examines the effect of threat states on clinical depression via motivational disengagement from motivated performance situations.

Threat-provoked motivational disengagement might also have consequences other than depression. For example, early disengagement from motivated performance situations in which intellectual ability is salient (e.g., school classes) might explain the association between blunted CVR to intellectually demanding tasks and low cognitive ability (Ginty et al., 2012). Moreover, motivational disengagement from motivated performance situations in which physical ability is salient might explain the association between blunted CVR and obesity (de Rooij, 2013), although obesity itself might also function as a risk factor for motivational disengagement in response to a threat state. Similarly, anxiety and poor performance might both be a cause and consequence of motivational disengagement, as they should reduce the likelihood of engaging with future motivated performance situations in the same performance domain (Jones et al., 2009), but also result when individuals engage less with situations of the same domain (i.e., invest less in performance preparation). In this dynamic, the corollaries of motivational disengagement like clinical depression and experiential avoidance might also have an exacerbating influence (Roemer et al., 2005). The cynicism facet of burnout might also be a consequence of motivational disengagement, as its definition comprises indifference or a distant attitude toward work (Maslach et al., 1996), which might also translate to other motivated performance contexts. The association between blunted CVR and behavioral impulsivity might also implicate behavioral impulsivity as a risk factor for threat-provoked motivational disengagement (Bibbey et al., 2016). Precisely, behavioral impulsivity, for example via lower frustration tolerance, might increase the risk of disengaging from future motivated performance situations after a threat state.

While threat-based disengagement experiences would not need to be limited to early life, we agree with Carroll et al. (2017) model proposing that early life adversity is a likely risk factor for disengagement-related problems later in life. The hypothesis of adverse (i.e., threatening) life events contributing to motivational disengagement from motivated performance situations is supported by studies finding significant early-life adversity in blunted CVR individuals (e.g., Lovallo, 2013; Phillips et al., 2005; Sijtsema et al., 2015). However, not everyone responds to adversity with motivational disengagement, as a growing body of evidence observed a positive adaptation to adverse life events (e.g., Moore et al., 2018; Seery et al., 2013). Thus, potential moderators of the relationship between adverse life events and motivational adaptation should be further explored.

Recommendations for BPSM-based research and practice.

Based on the summarized evidence, we propose the following recommendations for BPSM-based research and practice. In challenge and threat research, we recommend analyzing non-task engaged participants as a separate group. Precisely, we suggest that researchers collect heart rate and/or ventricular contractility data, and then create an indicator of present/absent task engagement by relating reactivity data to a baseline period. When using non-metabolically demanding reference periods, data from participants whose heart rate/ventricular contractility does not increase should be excluded (e.g., Hase et al., 2019). Studies could also explore a potential practical significance threshold at which the heart rate/ventricular contractility increases indicate sufficient task engagement. This threshold should be based on normative cardiovascular data, for example variability at baseline and reactivity to a psychological stressor. When using task performance or any metabolically demanding period as reactivity values, stricter exclusion criteria may be needed. Ideally, a non-self-relevant comparator task should be used to compare CVR intensities. Researchers could also examine the average CVR and prevalence of blunted CVR in different populations (e.g., across professions, experience levels, or health groups). This would help explore whether there is lower CVR in specific groups (e.g., pilots), and whether this reflects specific group characteristics (e.g., physiological adaptation to being trained to stay calm under pressure) or a greater prevalence of motivational disengagement. Similarly, research could test whether experts exhibit different CVR than less experienced individuals.

We acknowledge that the exclusion of blunted CVR participants may reduce the sample size and represent a conservative method of dealing with missing task engagement. A more liberal option could be to only exclude the most extremely blunted CVR cases (e.g., Bibbey et al., 2016), to list both filtered and unfiltered analyses, or to compare blunted and non-blunted responders in moderator analyses. Also, other measures of task engagement could be used to complement the cardiovascular measure, for example behavioral (e.g., eye-tracking) or psychological self-report data. However, Blascovich and Mendes (2000) cautions regarding self-reports of cognitive challenge and threat evaluations also apply to self-reports of task engagement. Just as individuals may be unable to consciously and/or accurately evaluate their demands and resources in a motivated performance situation, they may also be unable to assess the self-relevance of, and their engagement with the situation. Although behavioral measures of task engagement may be appealing because they are unobtrusive, they may also be problematic in BPSM-based research, because behavioral and psychological task engagement need not be strongly associated. For example, individuals might engage in a laboratory task on a behavioral, but not a psychological level (e.g., due to social desirability). Therefore, it is important to scrutinize results from studies considering behavioral measures as indicators of task engagement.

Given the abovementioned problems associated with motivational disengagement, we have the following practical recommendations. Motivational disengagement should be regarded as a potential consequence and cause of poor performance (e.g., Dixon et al., 2019) and ill-health. To avoid pathogenesis or relapse into disorders, psychologists should routinely monitor task engagement to detect motivational disengagement early on and be able to employ interventions in response. This monitoring should include cardiovascular, psychological, and behavioral (e.g., compliance) measures of task engagement to provide more complete and less biased data. The development of suitable long-term monitoring and prevention strategies could make use of new technologies and data collection strategies (e.g., digital applications tracking engagement with selected behaviors via ecological momentary assessment). Furthermore, psychologists employing performance-enhancing or illness-combating interventions (e.g., imagery, mindfulness) should make sure that clients are sufficiently engaged in the selected intervention to ensure compliance and optimize results. For example, clinical psychologists conducting physical exercise programs for depression could increase the self-relevance (and thereby task engagement) of programs by highlighting previously observed benefits of exercise for depression patients. They could also allow patients to select physical activities for the program themselves, which should promote a sense of autonomy and motivation, and thereby task engagement. Finally, maximizing perceived behavioral control and self-efficacy should reduce the likelihood of observing a threat state (Jones et al., 2009), which in turn should reduce dropout rates.

Conclusion

We propose that the phenomenon of blunted CVR to stress is consistent with reduced or absent task engagement in a BPSM framework not only on the surface, but also on a deeper level. Taking together the available evidence, we conclude that blunted CVR is a psychophysiological phenomenon that could be understood as habitual and pre-emptive motivational disengagement with motivated performance situations. This behavior may be the result of previous experiences of extreme or repeated threat states (e.g., stressful life events, childhood adversity) which reduce task engagement with subsequent motivated performance situations. Such pre-emptive task disengagement may represent a psychological defense mechanism to prevent repeated psychological and physical harm. However, given the associations of blunted CVR with various mental and physical disorders (the prominent example here being clinical depression), it appears that this defense mechanism may go too far and result in negative health consequences. Psychologists across various contexts should ensure task engagement is present and, if absent, take measures to prevent noncompliance, pathogenesis, and performance decrements.

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