



## Dispositional behavioral activation: Relationships with cardiovascular activity during anger and sadness



Holly R. Weisberg<sup>a,b</sup>, Amoha Bajaj<sup>a,c</sup>, Richard J. Contrada<sup>a,\*</sup>

<sup>a</sup> Department of Psychology, Rutgers, The State University of New Jersey, Piscataway, NJ 08854-8040, USA

<sup>b</sup> Department of Psychology, The Graduate Center, City University of New York, 365 5th Avenue, 6th Floor, New York, NY 10016, USA

<sup>c</sup> Department of Psychology, University of Pittsburgh, 210 S. Bouquet St., Pittsburgh, PA 15232, USA

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### ABSTRACT

Anger arises when goals are thwarted, but remain potentially attainable, and can motivate persistent engagement in goal pursuit. Sadness occurs when goals appear beyond reach, often leading to disengagement. Variations in engagement, or motivational intensity, are reflected in cardiovascular reactivity. Motivational intensity in goal-relevant situations is subject to regulation by individual differences in dispositions involving behavioral activation (BAS) and inhibition systems (BIS). This study examined whether cardiovascular responses indicative of motivational intensity are influenced by attributes measured by Carver and White's (1994) BAS Drive, BAS Reward Responsiveness, and BIS scales. Anger and sadness were induced on a within-subjects basis using an autobiographical recall task. Cardiovascular measures were systolic and diastolic blood pressure (SBP and DBP) and heart rate (HR). Post-task affect ratings indicated that the anger–sadness manipulation was successful. As expected, BAS Drive was positively associated with SBP and DBP (but not HR) elevations while participants related an anger-inducing event. Also as expected, this pattern was reversed for sadness, where Drive scores were inversely related to SBP and DBP elevations. Neither Reward Responsiveness nor BIS were associated with cardiovascular reactivity. These findings contribute to understanding of dispositions that influence physiologic activity reflective of motivational intensity in emotional situations.

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### 1. Introduction

The Carver and White (1994) Behavioral Inhibition/Behavioral Activation System (BIS/BAS) scales measure dispositional constructs grounded in the work of Gray (1990) (for a review see Smillie, Pickering, & Jackson, 2006). Behavioral activation concerns energization and engagement in goal pursuit, or *motivational intensity*, with facets including persistence (Drive), positive responses to goal attainment (Reward Responsiveness), and desire for new rewards (Fun-Seeking). However, whereas Drive and Reward Responsiveness appear to be components of BAS, Fun-Seeking seems primarily to involve impulsivity (Smillie, Dalgleish, & Jackson, 2007). Behavioral inhibition is an avoidant disposition, reflecting sensitivity to aversive events. This article examined Drive, Reward Responsiveness, and BIS in relation to motivational intensity reflected in cardiovascular reactivity (CVR) accompanying anger and sadness.

*Abbreviations:* BAS, Behavioral Activation System; BIS, Behavioral Inhibition System; CVR, cardiovascular reactivity; SBP, systolic blood pressure; DBP, diastolic blood pressure; HR, heart rate.

\* Corresponding author at: Department of Psychology, Rutgers, the State University of New Jersey, Piscataway, NJ 08854-8040, USA.

E-mail address: [contrada@rci.rutgers.edu](mailto:contrada@rci.rutgers.edu) (R.J. Contrada).

As dispositions linked to goal-related activity, the BIS/BAS constructs have relevance for states of anger and sadness. Emotion theorists argue that negative emotions arise when situations are cognitively appraised as unfavorable for goal attainment (Moors, Ellsworth, Scherer, & Frijda, 2013). A similar conclusion has been reached in theory that construes emotions as states elicited by rewards and punishers (Rolls, 2005). In these frameworks, both anger and sadness are approach-related emotions because they are responses to impediments to efforts to secure goals or incentives (Carver & Scheier, 2013). However, because of differences in the extent and context of goal blockage, anger and sadness are accompanied by different action tendencies and therefore differ in motivational intensity. Anger arises when goal thwarting is judged unfair, a responsible agent has been identified and, most relevant from a motivational standpoint, corrective action appears possible and urgent. Energy is mobilized to support efforts at removing the obstacle, reflecting increased motivational intensity. In sadness, by contrast, goals appear out of reach. Therefore, corrective action is not possible, and urgency, motivational intensity, and energy mobilization are diminished.

Action tendencies and physiologic activity are major components of emotions (others include subjective feelings and behavior) (Moors et al., 2013). Variations in preparation for behavioral engagement, which distinguish anger and sadness but also may vary within each of

these states, are marked by corresponding neuroendocrine changes that regulate CVR (e.g., Cannon, 1929; Lang & Bradley, 2010; Obrist, 1981; Wright & Barreto, 2012). Therefore, by influencing motivational intensity in states of anger and sadness, dispositional BAS should be related to alterations in CVR that accompany these emotions.

It has been suggested that individual differences in BAS are associated with variations in motivational intensity that occur in response to impediments to goal pursuit (Carver & Scheier, 2013). When goals are thwarted, but not entirely lost, it might be expected that resulting anger is accompanied by greater motivation to reassert goal pursuit in higher BAS individuals than in lower BAS individuals. We hypothesized that under these conditions BAS will be positively associated with CVR. By the same reasoning, when goals are blocked and attainment is infeasible, sadness in higher BAS individuals should be accompanied by greater reductions in motivational intensity and greater disengagement than in those lower in BAS (Carver & Scheier, 2013). This should be accompanied by dampened CVR, bringing about an inverse relationship between BAS and CVR.

Dispositional BIS involves sensitivity to aversive stimuli (Carver & Scheier, 2013; Cooper, Gomez, & Aucote, 2007). It is therefore associated with anxiety and fear or, with successful avoidance, relief/calmness. However, anxiety or fear may co-occur with anger or sadness if aversive consequences are expected, such as harm (anger) or loneliness (sadness). Possible implications suggested in the literature include reduced motivation and CVR (Tomaka & Palacios-Esquivel, 1997), approach-avoidance conflict that increases CVR (Stanley & Contrada, 2012), vigilance leading to decreased CVR (Obrist, 1981), and active avoidance and CVR augmentation (Wright & Barreto, 2012).

The foregoing line of thought was tested using an autobiographical memory task. Participants recalled and described aloud one recent event that provoked anger and one that induced sadness. Use of personally-relevant events was intended to induce homogeneous levels of these states (Labouvie-Vief, Lumley, Jain, & Heinze, 2003). Cardiovascular measures were obtained throughout.

Systolic and diastolic blood pressure (SBP, DBP) and heart rate (HR), were the focus as they reflect neuroendocrine processes activated by motivationally significant situations (Berntson, Quigley, & Lozano, 2007; Obrist, 1981). Elevations in SBP reflect increased myocardial contractility and, to a lesser extent, increased vascular resistance, both resulting from sympathetic nervous system (SNS) activity and circulating epinephrine produced by the adrenal medullae (Berntson et al., 2007; Obrist, 1981). Sympathetic activation mobilizes energy in preparation for vigorous efforts to respond to situational demands. It was predicted that, in the anger condition, dispositional BAS would be positively associated with CVR, especially SBP, reflecting greater motivational intensity. With sadness, the opposite was expected: dispositional BAS was expected to be inversely associated with CVR, reflecting less motivational intensity.

Drive was the focus of predictions because it involves pursuit of goals, and anger and sadness are responses to obstacles that prevent goal attainment. By contrast, Reward Responsiveness is more relevant when goals are attained. No directional predictions were made regarding BIS.

## 2. Methods

### 2.1. Participants

The sample, 117 undergraduates (60.7% female), ranged in age from 18 to 28 ( $M = 18.9$ ,  $SD = 1.5$ ). All were enrolled in General Psychology and received course credit.

#### 2.1.1. Measures

**2.1.1.1. BIS/BAS scales.** Participants completed Carver and White's (1994) Drive, Reward Responsiveness, and BIS scales, which possess desirable

psychometric properties and show evidence of construct validity (Carver, 2004; Cooper et al., 2007; Harmon-Jones, Price, Peterson, Gable, & Harmon-Jones, 2013).

**2.1.1.2. Other self-report measures.** A brief questionnaire assessed demographic factors. Participants periodically rated their "anger," "sadness," and "distress" on a 5-point scale.

**2.1.1.3. Cardiovascular measures.** Measures of SBP, DBP, and HR were obtained with a DINAMAP Pro 100 (GE) monitor. Blood pressure was ascertained oscillometrically in millimeters of mercury (mm Hg), and HR was based on pressure pulses in beats per minute (bpm). Readings were recorded at 60-s intervals during an initial 8-min rest period from which baseline measures for SBP, DBP, and HR were derived as the mean of the last 2 readings. They also were recorded at 60-s intervals during the two speaking tasks.

**2.1.1.4. Procedure.** Participants were instructed to refrain from caffeine, nicotine, alcohol, other drugs, and exercise for at least 2 h prior to the session. After informed consent was obtained questionnaires were administered by PC. An inflatable cuff then was placed on the non-dominant arm, the experimenter left the room, and baseline readings recorded. The participant then completed the affect scales.

The experimenter returned to initiate the task. Like other autobiographical techniques (Berntsen & Rubin, 2002; Labouvie-Vief et al., 2003), memories of a recent emotional event were activated. In the anger condition, participants recalled a life event that occurred within the past 6 months and caused anger. Instructions for the sadness condition were identical, except participants recalled and related an event that caused them to feel depressed.<sup>1</sup> During a 2-min task preparation phase, subjects were asked to concentrate on thoughts, feelings, and sensations experienced at the time of the event, to recreate the incident mentally, and to describe it aloud when prompted. The focus on sensory and motor cues was based on a previous research on emotional imagery (Lang & Bradley, 2010). In the ensuing, 3-min task phase, speaking was used to take advantage of its ability to amplify affect and its physiological concomitants (Kirschbaum, Pirke, & Hellhammer, 1993). Order of administration of anger and sadness task versions was counterbalanced. The experimenter left the room before the task commenced.

An 8-min recovery period was interposed between experimental conditions. Immediately following each speaking phase, participants provided affect ratings. Following task completion the experimenter returned, disconnected the cuff, and debriefed participants.

## 3. Results

### 3.1. BIS/BAS scores

The BIS/BAS scales showed adequate internal consistency (Cronbach's  $\alpha = .85$  for Drive,  $.84$  for Reward Responsiveness, and  $.76$  for BIS). The correlation between Drive and Reward Responsiveness was  $.27$  ( $p < .01$ ). Relationships of BIS to Drive and Reward Responsiveness were weaker,  $r_s = .03$  (*ns*) and  $.20$  ( $p < .05$ ).

### 3.2. Affect ratings

There were no significant associations between BIS/BAS scores and baseline affect ( $ps > .50$ ). Paired-samples *t*-tests showed that the manipulations had the intended effects: anger recall induced a significant increase in anger ratings comparing baseline ( $M = 1.82$ ,  $SD = 0.90$ ) to post-task values ( $M = 2.29$ ,  $SD = 1.3$ ),  $p < .001$ . Similarly, sadness recall

<sup>1</sup> Although task instructions asked participants to recall and describe a recent event that caused them to feel "depressed," we refer to this as the *sadness* condition to be explicit about the fact that it was intended to cause *sad* feelings, or depressed *affect*, but not a state or condition of depression in any clinical sense.

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