Psychophysiological Reactivity to Stress

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BACKGROUND

Stress involves a multidimensional mobilization of energy to meet environmental demands. Individual experiences of stress can be influenced by cognitive appraisals [1] and physiological arousal through activation of the sympathetic nervous system [2]. Within the theoretical framework of the Biopsychosocial Model of Challenge and Threat (BPSM-CT), the presentation of a stimulus results in appraisal states of challenge and threat which are characterized by differing patterns of autonomic activity, and influence stress [3].
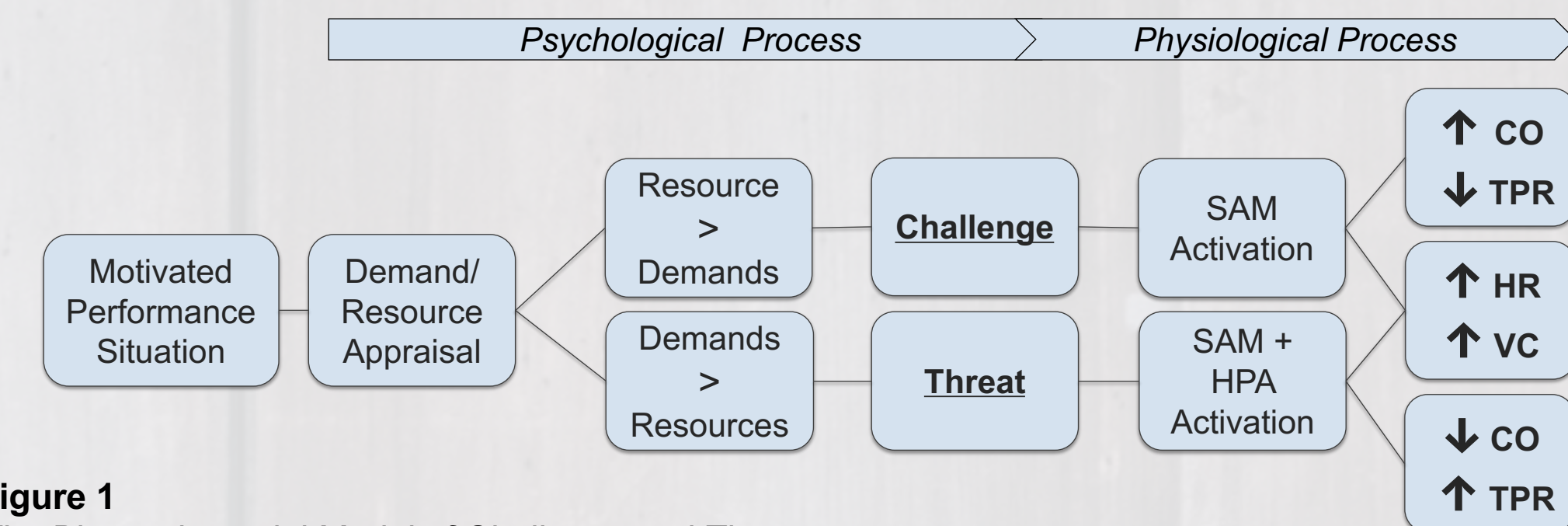

Figure 1
The Biopsychosocial Model of Challenge and Threat

PURPOSE

The researchers explored how pre-existing attitudes interact with arousal states (high or low) to influence physiological reactions and subjective evaluations of an active coping stress task (mock job interview). The researchers used a quasi-experimental design in which participants' feelings towards job interviews in a pre-screen assessment determined their placement into a positive or negative attitude group. 20 Participants were randomly placed under a high or low arousal condition and underwent arousal, and an active coping stress task. Physiological and Psychological measures were assessed throughout the experiment.

HYPOTHESIS

It was hypothesized that residual arousal would polarize subjective evaluations of a mock job interview stress task, based on pre-existing positive or negative attitudes. Further, the positive attitude group would present challenge-like cardiovascular reactivity as indicated by increased heart rate (HR), increased cardiac output (CO), and decreased total peripheral resistance (TPR) from baseline, while the negative attitude group would present threat-like cardiovascular reactivity indicated by increased HR, unchanged CO, and unchanged TPR.

METHODS

MEASURES

Pre-Existing Attitude toward Job Interviews . A one-item pre-screening measured participants' pre-existing attitudes towards job interviews on a 7-point Likert scale (-3 to 3)

Beck Anxiety Inventory. The 12-item BAI-3 [4] was administered to assess baseline anxiety levels.

Anxiety Sensitivity Index-3. The 18-item ASI-3 [5] was administered to assess degree of fear of anxiety sensations.

Cardiovascular Measures. Electrocardiography (ECG) and impendence cardiography (ICG) were recorded throughout the experiment; the data were used to compute HR and CO. An automatic blood pressure cuff was used to record blood pressure (SBP/DBP).

Arousal manipulation. Participants pedaled a stationary exercise bicycle for five minutes at a high arousal condition (185% above resting HR) or low arousal condition (135% above resting HR).

Cognitive Appraisals. A 6-item questionnaire was administered to assess cognitive (challenge and threat) appraisals of the task on a 7-point Likert scale.

Mock Job Interview. After arousal, a mock job interview was used as an active coping task. Participants were given one minute to prepare with a list of interview questions. This was a modified version of the TSST test [6].

Positive and Negative Affect Schedule. A 10-item PANAS [7] was administered after the interview to assess affect during the interview

Cognitive and Somatic Anxiety. The Immediate Anxiety Measures Scale (IAMS) [8] was administered after the interview to assess symptoms of cognitive and somatic anxiety and perceived effects on performance on a 7-point Likert scale.

Perceived Performance. Participants rated their perceived performance on a 7-point Likert scale.

PROCEDURE

Pre-Screen → Baseline 1 → Arousal Manipulation → Baseline 2 → Stress task +Baseline 3 → Post-Task

RESULTS

Table 2 *Physiological Measures Across the Study*

Measure	Baseline		Post-exercise		Interview	
	Positive Attitude	Negative Attitude	Positive Attitude	Negative Attitude	Positive Attitude	Negative Attitude
High Arousal						
HR (BPM)	71.8 (10.9)	85.2 (14.9)	72.3 (16.1)	87.1 (17.0)	83.3 (11.5)	102.3 (17.7)
SBP (mmHg)	124.4 (14.0)	123.2 (24.9)	125.2 (13.4)	134.8 (27.5)	141.2 (10.7)	157.4 (34.0)
DBP (mmHg)	71.2 (11.8)	78.0 (16.9)	73.4 (13.0)	75.6 (6.8)	84.2 (3.1)	98.8 (10.4)
SV (mL)	143.3 (62.6)	130.5 (77.2)	154.7 (52.6)	145.5 (48.7)	160.7 (47.1)	135.8 (53.1)
CO (L/min)	9.9 (3.2)	11.1 (7.4)	10.6 (1.8) 1	13.0 (7.0)	13.0 (3.1)	14.8 (8.2)
TPR (mmHg × min/L)	9.9 (3.6)	10.8 (4.6)	8.9 (2.6)	9.0 (3.9)	8.3 (1.9)	9.8 (3.8)
Low Arousal						
HR (BPM)	72.7 (10.4)	91.4 (5.2)	106.8 (8.7)	117.5 (11.8)	130.5 (13.3)	133.2 (16.6)
SBP (mmHg)	118.2 (5.5)	115.8 (5.9)	131.6 (16.3)	136.2 (8.8)	152.5 (8.2)	130.5 (22.9)
DBP (mmHg)	75.0 (4.2)	75.4 (5.0)	79.4 (7.2)	78.6 (2.7)	115.0 (24.1)	90.5 (19.3)
SV (mL)	114.3 (31.5)	121.2 (38.8)	136.1 (57.7)	104.9 (20.5)	108.1 (51.2)	109.5 (33.3)
CO (L/min)	8.5 (3.0)	11.0 (3.0)	14.3 (5.2)	12.2 (2.0)	14.5 (7.8)	14.9 (5.3)
TPR (mmHg × min/L)	11.9 (4.7)	8.6 (2.5)	7.6 (3.1)	8.2 (1.4)	12.8 (6.5)	8.3 (4.1)

Table 3 *Analysis of Variance for the Self-Reported Variables*

Variable	Attitude (Positive vs. Negative)		Arousal (High vs. Low)		Attitude* Arousal		Anxiety Sensitivity (High vs Low)		Anxiety Sensitivity * Arousal	
	$F_{(1, 14)}$	p	$F_{(1, 14)}$	p	$F_{(1, 14)}$	p	$F_{(1, 16)}$	p	$F_{(1, 16)}$	p
SrCTI	0.47	.504	1.31	.272	0.20	.660	7.93	.012*	1.92	.185
Positive Affect	0.66	.429	8.30	.012*	2.70	.122	5.81	.028*	<0.01	.967
Negative Affect	0.15	.702	0.19	.670	0.01	.922	2.68	.121*	4.35	.053
Anxiety	0.10	.756	0.07	.801	0.01	.919	4.79	.044*	3.98	.063
Performance	0.83	.379	5.71	.031*	0.94	.350	4.05	.061*	0.16	.693

Figure 2 *Evaluations of the Interview by Anxiety Sensitivity Group and Arousal Condition*
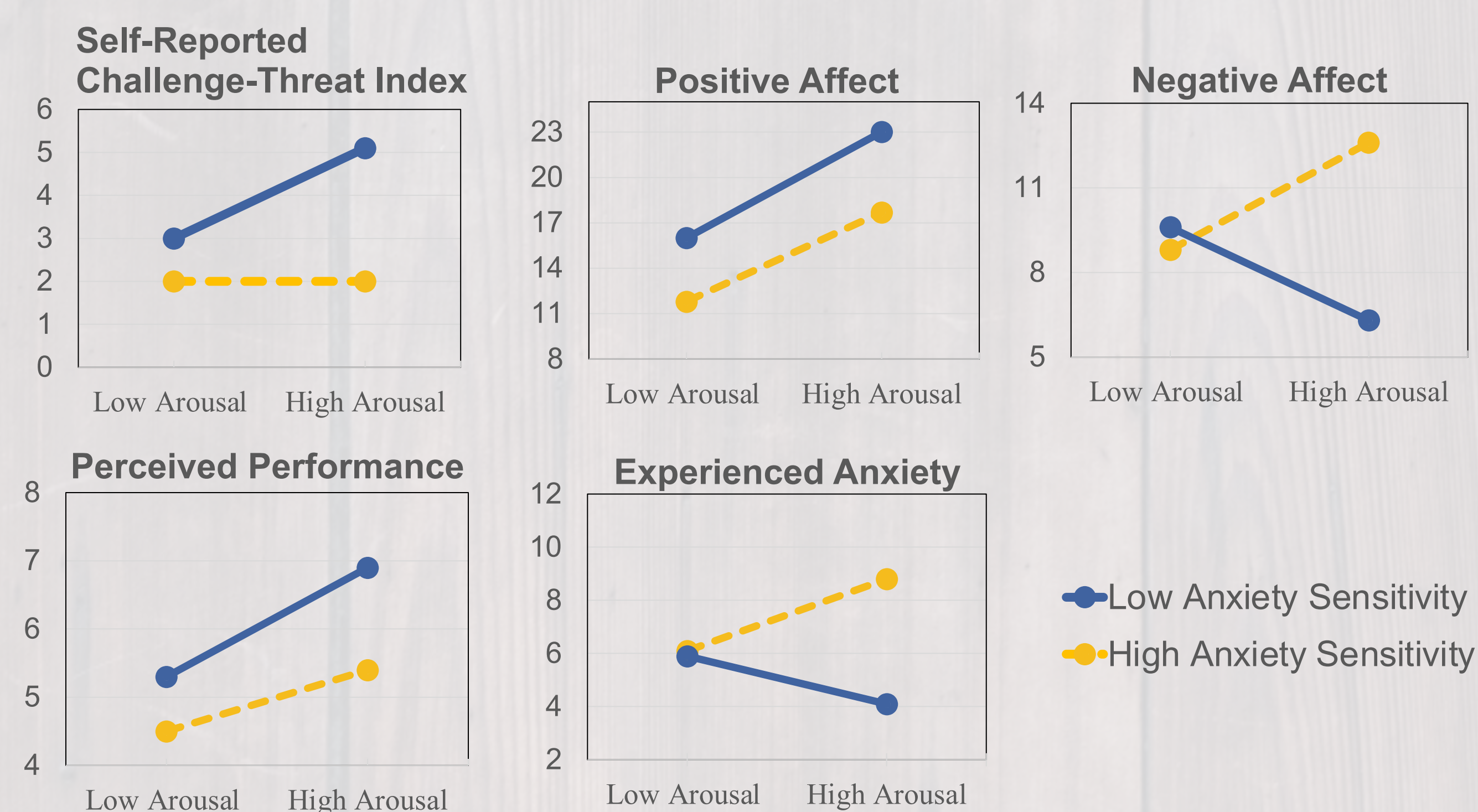
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DISCUSSION

Effects of Pre-Existing Attitude on Physiological Reactivity

There was no significant effect of pre-existing attitude on physiological reactivity to the interview in either group, however, the positive group means showed challenge-like reactivity, while the negative group means showed threat-like reactivity, consistent with our hypothesis, as shown by table 2.

Effects of Pre-Existing Attitude and Residual Arousal on Self-Reported Variables

There was no significant difference between the positive and negative attitude groups in subjective evaluations of the interview. However, the pattern of responses indicated more favorable self-reports by the positive attitude groups, and suggests pre-existing attitude to be influential across emotional, cognitive, and self-perceptive measures.

Arousal did not appear to polarize self-reports of the interview based on pre-existing attitude. However, there was a main effect of arousal on self-reported variables. The high arousal group showed more positive affect and better task performance, regardless of pre-existing attitude. These results align with our previous findings which show that arousal generates more positive ratings of a stimulus. Additional data collection and analysis could result in an interactive effect between attitude and arousal on self-reports.

Effects of Anxiety Sensitivity on Self-Reported Variables

A supplementary analysis was conducted with anxiety sensitivity as an independent variable. High anxiety sensitivity was a predictor of lower challenge-threat appraisals, less positive affect, more negative affect, more anxiety, and worse perceived performance than those with lower anxiety sensitivity. Self-reported measures which were not directly amplified by arousal appeared to further diverge in expected directions based on anxiety sensitivity group, as shown in figure 2.

CONCLUSION

This study demonstrated that pre-existing attitudes can influence physiological reactivity to a stress task, and residual arousal can affect subjective evaluations of the task. This work has implications for the psychophysiology of emotion and the link between stress and health.

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