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Coping as a Moderator of Relations Between Reactivity to Interpersonal Stress, Health Status, and Internalizing Problems

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Coping moderation of relations between involuntary stress-reactivity, health status, and internalizing problems was tested in sociotropic college students responding to a standardized laboratory interpersonal stressor. Coping moderated relations between heart rate reactivity and health status, with primary control engagement coping, secondary control engagement coping, and disengagement coping all serving as buffers. Primary control also buffered the link between self-reported arousal and health status, and secondary control coping buffered the link between self-reported arousal and health status and internalizing problems. Coping and involuntary responses to the standardized laboratory stressor were correlated with measures of naturalistic coping and involuntary stress-reactivity. Benefits of linking laboratory and naturalistic coping research are highlighted, along with implications of the interaction of involuntary stress-reactivity and coping.

KEY WORDS: coping; social stress; internalizing problems; heart rate; physical health.

Although stressful events are strong predictors of physical illness and psychopathology, many people show remarkable resilience in the face of serious stressors. One approach to explaining variation in outcomes has focused on individual differences in involuntary emotional, physiological, and cognitive responses, which are temperamentally based or conditioned, and initiated without conscious control or intent. A second approach has emphasized the coping techniques individuals choose to employ. Substantial evidence indicates that both high involuntary stress-reactivity (Carver & White, 1994; Clark, Watson, & Mineka, 1994) and poor coping predict health problems and psychological distress (e.g., Compas, Connor-Smith, Saltzman, Thomsen, & Wadsworth, 2001). However, little is known about the interplay between involuntary stress-reactivity and voluntary coping in predicting adjustment, despite

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the fact that many coping strategies are actually directed toward regulation of involuntary reactivity, serving either to tame or exacerbate emotional and physiological arousal. This study explores ways in which involuntary arousal and voluntary coping interact to predict health status and internalizing problems in individuals responding to a standardized interpersonal stressor.

Involuntary responses to stress, such as emotional arousal, cardiovascular changes, and intrusive and ruminative thoughts, have been linked both to poor health status and to emotional distress. Emotional and physiological stress-reactivity predict changes in endocrine and immune functioning (see review by Kiecolt-Glaser, McGuire, Robles, & Glaser, 2002; Marsland, Cohen, Rabin, & Manuck, 2001), frequent minor health problems (Boyce, Barr, & Zeltzer, 1992), and risk for serious problems such as hypertension and heart disease (Manuck, 1994; Markovitz, Raczynski, Wallace, Chettur, & Chesney, 1998). Involuntary emotional and cognitive stress-reactivity predict distress (e.g., Creamer, Burgess, & Pattison, 1992; Koslowsky, Solomon, Bleich, & Laor, 1996), with intrusive thoughts predicting future symptoms of depression and anxiety in disaster survivors (Joseph, Yule, & Williams, 1994) and women diagnosed with cancer (Primo et al., 2000). In men recently notified of HIV seropositivity, intrusive thoughts were related to greater anxiety and depression, and increases in intrusive thoughts over time predicted poor immune functioning (Lutgendorf, Antoni, Ironson, Fletcher, & Schneiderman, 1997).

Volitional coping efforts are also strong predictors of physical and mental health outcomes. Although a multitude of coping dimensions and categories exist, and coping researchers have not reached consensus regarding key dimensions, several studies using confirmatory factor analytic techniques have supported a distinction between engagement and disengagement coping (see Compas et al., 2001 and Skinner, Edge, Altman, & Sherwood, 2003 for reviews). *Engagement coping* responses, which are directed toward a stressor or related thoughts and emotions, typically predict better adjustment than *disengagement coping* strategies, such as avoidance, denial, and withdrawal, which involve orienting oneself away from the stressor and related thoughts and emotions (Compas et al., 2001). Engagement coping responses can be further distinguished as *primary or secondary control strategies*. Primary control coping (also referred to as active coping; Walker, Smith, Garber, & Van Slyke, 1997) involves attempts to directly change a negative situation or related emotional and physiological responses through strategies such as problem solving, emotional expression, and emotional regulation, whereas secondary control coping (also referred to as accommodative coping; Walker et al., 1997) involves efforts to adapt to current conditions through strategies such as distraction, acceptance, and positive thinking (Connor-Smith, Compas, Thomsen, Wadsworth, & Saltzman, 2000; Weisz, McCabe, & Dennig, 1994). Primary control coping predicts lower levels of internalizing problems in self-report studies (Connor-Smith et al., 2000; Wadsworth & Compas, 2002), and emotional expression predicts decreased distress and better physical health and immune functioning in experimental studies (see review by Pennebaker, 1997). Secondary control coping is associated with better health status and lower levels of depression and anxiety in self-report studies, and appears to be particularly beneficial in uncontrollable situations (Compas et al., 2001; Connor-Smith & Compas, 2002; Weisz et al., 1994).

The impact of *disengagement coping* strategies, such as cognitive and behavioral avoidance, wishful thinking, or denial, is less clear. Disengagement coping is associated with greater emotional distress in samples as diverse as seriously ill adults, (Fukunishi, 1996), divorced mothers (Zautra, Sheets, & Sandler, 1996), infertile couples (Morrow, Thoreson, & Penney, 1995), and sexually assaulted women (Santello & Leitenberg, 1993). Disengagment coping is also linked to poor health status (Davey, Tallis, & Hodgson, 1993) and to cancer progression (Epping-Jordan, Compas, & Howell, 1994). However, disengagement coping has not proved uniformly harmful, as it predicts better marital adjustment in parents of children with cancer (Dahlquist et al., 1993), less grief in the 2 years after bereavement (Bonanno, Znoj, Siddique, & Horowitz, 1999), less distress following an abnormal Pap smear (Miller, Combs, & Kruus, 1993), and fewer days in bed for HIV-positive adults (Miller et al., 1993). These mixed findings may be the result of different conceptualizations and measures of disengagement coping, or of situational differences in the impact of disengagement coping.

Because coping researchers have traditionally focused on consciously employed, effortful processes, limited consideration has been given to ways in which coping influences involuntary emotional and physiological arousal. Primary control engagement strategies such as relaxation or seeking social support result in lower blood pressure (Albright, Andreassi, & Brockwell, 1991) and decreased heart rate reactivity and cortisol levels (Thorsteinsson & James, 1999). In laboratory settings, secondary control coping strategies, such as distraction, predict lower levels of intrusive thoughts (Clark, Winton, & Thynn, 1993; Salkovskis and Campbell, 1994) and decreases in the intensity and duration of depressed and anxious mood (Blagden & Craske, 1996; Nolen-Hoeksema, Morrow, & Fredrickson, 1993). In contrast, disengagement coping, which is intended to distance individuals from distress and arousal, can paradoxically increase the intensity of involuntary, intrusive thoughts. Self-reported cognitive and behavioral avoidance are associated with intrusive thoughts in cross-sectional studies (Creamer et al., 1992; Epping-Jordan et al., 1994; Joseph et al., 1994), and predict future intrusive thoughts in prospective studies (e.g., Lawrence, Fauerbach, & Munster, 1996; Primo et al., 2000). Although relations between avoidance and intrusive thoughts may be bidirectional, experimental studies demonstrate that cognitive avoidance triggers an increase in the frequency and intensity of intrusive thoughts (Wegner, 1994, 1997). Thus, coping may play an important role in moderating involuntary arousal, with effective coping attenuating relations between reactivity and poor outcomes, and ineffective coping amplifying the negative impact of involuntary reactivity.

Understanding interactions between involuntary and voluntary responses to stress has been difficult, as most coping research has relied upon retrospective self-reports from individuals coping with a diverse array of stressors or in different stages of coping with a specific event. Although this naturalistic approach has been essential to understanding the impact of major stressors such as poverty and divorce, it has three key limitations. First, because involuntary responses are influenced by the nature and intensity of the stressor, aggregating across stressors or over time will obscure relations between involuntary arousal, coping, and adjustment. Second, specific coping responses are unlikely to be either universally beneficial or detrimental

across all situations. Third, retrospective self-report may be biased by poor recall, limited awareness of involuntary responses, or the degree of problem resolution at the time of assessment (e.g., Ptacek, Smith, Espe, & Rafferty, 1994; Stone et al., 1998). These problems can be minimized through use of a standardized laboratory stressor, because controlling for stressor type and intensity ensures that differences in the intensity of involuntary arousal and the impact of coping represent individual, rather than event-specific differences. Laboratory research also facilitates immediate, rather than retrospective reports.

Standardized social stressors involving the potential for evaluation by others, such as giving a speech (Barger, Kircher, & Croyle, 1997), watching a video of oneself singing in front of others (Harris, 2001), and preparing and delivering debate responses (Smith, Ruiz, & Uchino, 2000), elicit reliable individual differences in physiological reactivity. For individuals high in sociotropy, social stressors tend to elicit greater reactivity than nonsocial stressors (Ewart, Jorgensen, & Kolodner, 1998). Responses to laboratory social stressors also predict arousal in naturalistic settings (Ewart et al., 1998; Ewart, Jorgensen, Suchday, Chen, & Matthews, 2002), suggesting that laboratory responses are useful examples of typical responses to stress. Stressors requiring active responses, such as giving a speech, lead to increased heart rate, whereas stressors requiring passive tolerance, such as viewing disturbing images or facing physical discomfort, typically lead to decreased heart rate (Krantz & Falconer, 1995; Sherwood & Turner, 1992).

This study explored the interaction of involuntary arousal and voluntary coping by exposing participants to a standardized interpersonal stressor (anticipation of critical feedback about one's personality and social abilities). Involuntary and voluntary responses to the standardized interpersonal stressor were expected to correlate with naturalistic responses to everyday interpersonal stressors. Coping was expected to moderate relations between heart rate reactivity and physical health, between self-reported arousal and physical health, and between self-reported arousal and internalizing problems. Primary and secondary control engagement strategies were expected to diminish the link between involuntary responses and poor outcomes. Although past findings for disengagement coping have been mixed, disengagement was expected to amplify relations between involuntary responses and health and internalizing problems, because of the strong link between avoidance and intrusive thoughts.

METHOD

Participants

Participants were introductory psychology students invited to earn research credit for a 2-session study of coping and involuntary responses to social evaluation. To ensure social evaluation would be a meaningful stressor, students were recruited from a larger survey sample because they fell above the mean on a measure of concern about social relationships and social evaluation. Participation took place within 2 months of the initial survey ($M = 35$ days, range 1–54 days).

A total of 68 students attended the first session. One student was dropped because of a nonstandard administration of experimental procedures, and two because of equipment failure. Two students asked to withdraw after the first session, and two failed to attend the second session. Noncompleters fell at or below sample means on measures of internalizing problems, health problems, and sociotropy, suggesting that Session 2 data were not biased by the selective loss of distressed participants. The final sample of 61 students was 67% female and ranged in age from 17 to 24 ($M = 18.5$; $SD = 1.1$). Typical of the undergraduate population at this site, the sample was 95% Caucasian.

Measures

Sociotropy

Vulnerability to interpersonal stress was assessed using the 48-item Personal Style Inventory (PSI; Robins et al., 1994), which assesses agreement or disagreement with statements about personal characteristics on a 6-point scale. The measure consists of two broad Sociotropy and Autonomy scales, each comprised of three specific subscales. Study eligibility required scoring above the mean on the sociotropy subscale "concern about what others think." The cutoff was based on data from 474 students collected at the same university during the previous academic year, as the original PSI measure development paper did not provide normative subscale means.

Physiological Arousal

Continuous heart rate readings (beats per minute) were obtained via a photoplethysmograph transducer attached to the index finger of the nondominant hand. Baseline heart rate for each day was defined as the average heart rate over the last 5 min of the 10-min relaxation period. Other key periods included TAT story telling and videotape viewing from the first session and the anticipatory thought report period from the second session. Artifacts due to hand movement were edited from the data, and mean heart rate scores were obtained for each key period by averaging heart rate from the beginning to the end of each task. Because participants showed the expected pattern of elevated heart rate during stressors requiring active responses and suppressed heart rate while watching the videotape, heart rate reactivity was defined as the difference between heart rate change for their highest reactive period and the videotape viewing period.

Responses to Stress Questionnaire (RSQ)

Responses to interpersonal stress were measured using the RSQ, a 57-item measure designed to assess both coping and involuntary responses to stress (Connor-Smith et al., 2000). The RSQ is comprised of 19 primary scales grouped into five factors. Coping factors include *Primary Control Engagement Coping* (problem solving, emotional regulation, and emotional expression scales); *Secondary Control Engagement Coping* (distraction, positive thinking, cognitive restructuring, and acceptance scales); and *Disengagement Coping* (avoidance, denial, and wishful thinking scales). Involuntary response factors include *Involuntary Engagement* (emotional

arousal, physiological arousal, impulsive action, intrusive thoughts, and rumination) and *Involuntary Disengagement* (emotional numbing, involuntary avoidance, cognitive interference, and inaction). Confirmatory factor analyses have validated the structure of the RSQ in multiple samples of adolescents and young adults (Connor-Smith et al., 2000; Connor-Smith & Calvete, 2003), and similar structures have been identified in confirmatory analyses of other measures (Ayers, Sandler, West, & Roosa, 1996; Walker et al., 1997). The RSQ shows solid test–retest reliability and good convergent validity with other coping questionnaires (Connor-Smith et al., 2000).

Participants completed two versions of the RSQ. The *general interpersonal version*, completed during the recruitment survey, assessed responses to social stressors experienced during the past 6 months. The *evaluation-related version*, completed during the second lab session, assessed responses related specifically to anticipation of the personality evaluation. On the evaluation-related version, four additional questions assessed expectations that the evaluation would be stressful, rewarding, threatening, or challenging. RSQ factors can be scored as simple sums or proportionally (factor score divided by total responses) to help control for individual differences in base rates of item endorsement. For this study, raw scores were used to facilitation combination of RSQ scales with other measures which could not be scored proportionally. All five factors from both versions of the RSQ were used in analyses, with internal consistency ranging from .79 to .86 ($M = .81$) for the general interpersonal version and from .71 to .86 ($M = .77$) for the evaluation-related version.

Impact of Events Scale

Participants reported their responses to the anticipated evaluation on the Impact of Events Scale (IES; Horowitz, Wilner, & Alvarez; 1979), a 15-item measure assessing avoidance and intrusive thoughts in response to a specific stressor. Internal consistency of the subscales was good, at .81 for intrusion and .72 for avoidance.

Anticipatory Thought Reporting

A 5-min stream-of-consciousness report was used to assess thoughts during the anticipatory period before the evaluation was to begin. On the basis of directions adapted from previous studies (e.g., Wegner, Schneider, Carter, & White, 1987), participants were given the following instructions: "You might talk about things such as ideas, memories, feelings, plans, sensations, observations, images, daydreams, or things in the room that catch your attention. Please do your best to keep talking continuously and to say everything that goes through your mind. There are no restrictions on what you say and complete sentences are not expected." Participants were also asked to keep a *thought report tally* of every evaluation-related thought, even if it just popped briefly into their head. Tally marks were summed to determine the number of self-reported thoughts about the evaluation.

Statements from transcribed thought reports were coded as *experiment related* or *nonexperiment related*, and then classified by emotional tone. Emotional tone codes were *positive emotion* (e.g., "It's exciting to be part of an experiment, to think that you're helping somebody out" or "I absolutely love skiing, I can't wait to go this weekend"), *negative emotion* (e.g., "It's kind of a scary thing to think about, finding

out about your personality" or "I just got in a fight with someone who's very close to me and I'm really upset right now"), and *neutral* (e.g., "I declared my psychology major last semester"). Half of the transcripts were coded by two raters, with a kappa of .86 for the experiment versus nonexperiment related distinction, and a kappa of .79 for the combination of experiment related and emotional tone ratings. The broad experiment-related code and the negative experiment-related emotion code were used in analyses.

Young Adult Self-Report

(YASR; Achenbach, 1997). During the recruitment study, participants completed the 119-item YASR, which assesses emotional and behavioral problems over the past 6 months. The measure is comprised of two broad Internalizing and Externalizing scales and eight syndromes (Anxious/Depressed, Withdrawn, Somatic Complaints, Attention Problems, Thought Problems, Intrusive Behavior, Aggressive Behavior, and Delinquent Behavior). Syndromes and scales are based on principal components analysis in a sample of 1,455 young adults, have excellent reliability and validity, are linked to *DSM* diagnoses, and predict referral for mental health services (Achenbach, 1997). This study uses data from the broadband Internalizing scale (comprised of the Anxious/Depressed and Withdrawn syndromes) and the Somatic Complaints syndrome, which assesses the frequency of symptoms such as headaches, nausea, and pain. Youth with physical problems, such as peptic disease, recurrent abdominal pain, and chronic fatigue score higher on somatic complaints than do youth with psychiatric disorders (Gray et al., 2001; Walker, Garber, & Green, 1993). Raw YASR scores, rather than *t* scores, were used in all analyses because they have greater variance.

PILL

Physical health was assessed using the PILL (Pennebaker, 1982), a 54-item measure of the frequency of physical symptoms (e.g., runny nose, sore throat, back pain) during the past year. Participants rated each symptom on a 5-point scale ranging from "have never or almost never experienced the symptom" to "experienced more than once a week." High total scores are associated with more visits to physicians, greater aspirin use, and more health-related work absences (Pennebaker, 1992), and the PILL correlates strongly with measures of somatic complaints (Garber, Walker, & Zeman, 1993). The PILL has strong internal consistency and test–retest reliability, with an alpha of .93 in this sample.

Creation of Composite Variables

Several key variables were assessed by more than one measure to provide more reliable measures of constructs and to reduce the possibility that study findings would be unduly influenced by method effects and pertain only to a specific measure. Although it would be possible to conduct separate sets of analyses for each related measure, this would inflate the likelihood of chance findings and fail to take advantage of the increased power available by combining related measures. Because the sample

size was too small for latent variable modeling, composite variables were created based on a priori decisions about which measures assessed similar constructs (see Eisenberg et al., 2002, 2003). Composite variables were created by converting scales to Z scores, and averaging transformed scores. *Arousal* consisted of (a) the evaluation-related RSQ Involuntary Engagement scale and (b) IES intrusive thoughts scale, $r = .80$, $p < .001$, *Disengagement Coping* of (a) the evaluation-related RSQ Disengagement Coping scale and (b) the IES avoidance scale, $r = .81$, $p < .001$, and *Health Status* of (a) the YASR Somatic Complaints scale and (b) the total PILL score, $r = .44$, $p < .001$. Single measures were used to assess *Internalizing Problems* and evaluation-related *Primary Control Engagement Coping* and *Secondary Control Engagement Coping*.

Procedures

Participants attended two laboratory sessions, approximately 24 hr apart, with the first session used to introduce the standardized interpersonal stressor and the second to assess responses to the stressor.

Session 1

During the first session, participants completed measures of temperament and physical health status as they adjusted to heart rate sensors. Baseline heart rate readings were obtained while participants relaxed with a nature magazine for 10 min. Participants were then informed that they would receive feedback about their personality and social abilities during session 2. To enhance the credibility of the planned evaluation, participants were asked to respond to Thematic Apperception Test cards 2 and 10 following standard directions (TAT; Murray, 1943). The theory underlying the TAT was explained, and participants were told that their audiotaped resposes would be evaluated by an expert to judge their social ability and personality. The experimenter then presented a videotape of a staged evaluation. Participants were led to believe that the video came from an earlier session, and that they would be evaluated by the same expert that they saw on the tape. Both the videotape and a false set of blank personality rating scales shown to participants were designed to stimulate mild apprehension about the evaluation, by emphasizing the possibility of critical feedback about one's social competence.

Session 2

The second session was conducted 23–25 hr later to control for diurnal variation in mood and physiological arousal, and to equalize the period of anticipation for each participant. Following collection of baseline heart rate data, participants completed an emotional Stroop task to assess attentional bias (no data from this task were included in the present analyses), and then were told that the evaluator would arrive momentarily. While waiting alone, participants audiotaped their stream-of-consciousness and tallied the number of thoughts they had about the upcoming evaluation. Participants were then told the evaluation would be delayed due to difficulty hearing the tape of their TAT responses, and asked to complete

questionnaires assessing experiment-related coping and arousal. Finally, participants were told the evaluation could not take place because the tape was inaudible, and were interviewed about their responses to the anticipated evaluation. To maintain the integrity of the experiment, participants were informed during debriefing that the experiment consisted of two conditions, one in which participants received the evaluation and one in which they did not. Full and final debriefing occurred when the experiment was explained during a mandatory-attendance class session.

RESULTS

Results are presented in four sections. The first presents descriptive statistics and correlations between key variables. The second presents manipulation checks to demonstrate that anticipation of the evaluation was stressful and that heart rate was influenced by stress. The third compares responses to the anticipated evaluation with responses to general interpersonal stress. The fourth tests coping moderation of relations between arousal and health status and arousal and internalizing problems.

Descriptive Statistics

Means and standard deviations of study variables are presented in Table I, along with correlations between variables. As expected in a sociotropic sample, gender-normed t scores for YASR syndromes were slightly elevated for Internalizing Problems and the Somatic Complaints syndrome, at 58.8 and 57.7, respectively. The three evaluation-related coping variables were strongly intercorrelated, perhaps reflecting the tendency of stressed individuals to report more of all types of coping (Connor-Smith et al., 2000; Sandler, Tein, & West, 1994). Arousal showed strong positive correlations with coping strategies, Internalizing Problems, and Health Status, and was moderately correlated with heart rate reactivity, $r = .29$, $p < .05$. Heart rate reactivity was associated with outcome measures, but was less clearly linked to coping, showing a significant relationship only with Disengagement.

Manipulation Checks

As the purpose of this study was to assess individual differences in responses to a standardized stressor, it was essential to demonstrate that experimental tasks elicited involuntary reactivity.

Heart Rate Reactivity

Heart rate was expected to increase in situations requiring active responses, and decrease in situations requiring passive tolerance. A repeated measures ANOVA for the first lab session indicated that experimental tasks were associated with heart rate changes, $F(2, 118) = 144.6$, $p < .001$, multivariate $\eta^2 = .71$ (see Table II for descriptive statistics). Follow-up pairwise comparisons with baseline heart rate indicated that heart rate rose significantly during completion of TAT stories, $t(60) = -13.8$,

Table I. Means, Standard Deviations, and Intercorrelations for Key Variables

	M (*SD*)	Arousal	Primary ctrl. coping	Secondary ctrl. coping	Disengagement coping	Heart rate reactivity	Internalizing problems
Arousal							
RSQ involuntary engagement	1.6 (0.4)	—-					
IES intrusive thoughts	5.9 (5.9)						
Primary ctrl. coping		.51***					
RSQ primary control coping	1.5 (0.4)						
Secondary ctrl. coping		.50***	.46***				
RSQ secondary control	2.1 (0.4)						
Interview distraction	0.5 (0.7)						
Disengagement coping		.69***	.44***	.39**			
RSQ disengagement coping	1.5 (0.5)						
IES avoidance	7.3 (6.7)						
Interview avoidance	0.6 (0.6)						
Heart rate reactivity		.29*	.13	.07	.31**		
Heart rate reactivity	11.5 (4.7)						
Internalizing problems	18.6 (8.8)	.41***	.19	.15	.40***	.29*	
Health status		.39***	.13	.09	.17	.40**	.49***
YASR somatic complaints	5.1 (3.6)						
PILL	121.2 (24.1)						

$^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$. (Correlations significant at the .001 level remain significant after Bonferroni correction.)

Table II. Heart Rate for Day 1 and Day 2 Experimental Periods

	Heart rate		Heart rate change from baseline	
	M	*SD*	*M*	*SD*
Day 1				
Baseline 1	78.2	(10.0)		
TAT	85.2	(10.6)	7.0	(4.0)
Video viewing	77.1	(10.3)	−1.1	(3.6)
Day 2				
Baseline 2	78.5	(10.2)		
Anticipation	84.0	(10.4)	5.5	(4.4)

$p < .001$, then dropped significantly below baseline in response to the video depicting the evaluation, $t(60) = 2.3$, $p < .05$. Similarly, the repeated-measures ANOVA for the second session indicated significant heart rate changes, $F(1, 60) = 90.3$, $p < .001$, $\eta^2 = .61$, with heart rate significantly elevated above baseline during the anticipatory thought report period.

Perceived Stressfulness

On the thought report tally form, participants indicated a mean of 6.5 self-reported thoughts about the evaluation during the 5-min anticipatory period (range 0–35, $SD = 6.2$), with only one participant failing to report any evaluation-related thoughts. Stream of consciousness coding indicated a mean of 15.7 experiment-related thoughts (range 0–42, $SD = 11.0$), with a mean of 2.0 negative-emotion experiment related verbalizations (range 0–12, $SD = 2.8$). Perceived stressfulness of the experiment ($M = 2.1$, $SD = .90$) was correlated with Arousal, $r = .42$, $p < .001$, heart rate reactivity, $r = .28$, $p < .05$, and negative-emotion experiment related verbalizations, $r = .30$, $p < .05$. Arousal was also correlated with negative-emotion experiment related verbalizations, $r = .46$, $p < .001$, and self-reported thoughts about the experiment on the thought report tally, $r = .34$, $p < .01$.

Comparisons of Evaluation-Related and General Interpersonal Responses to Stress

Relations between evaluation-related responses to stress and adjustment (see Table III) were expected to be weaker than relations between responses to general interpersonal stress and adjustment, as laboratory responses focused exclusively on a single, brief situation. Accordingly, paired sample *t* tests comparing reports from the evaluation-related and general interpersonal versions of the RSQ indicated that participants reported fewer coping and involuntary responses to the evaluation than to general interpersonal stressors, with $t(60) = 16.7$ for Primary Control Coping, $t(60) = 4.8$ for Secondary Control Coping, $t(60) = 7.5$ for Disengagement Coping, $t(60) = 13.8$ for Involuntary Engagement, and $t(60) = 11.0$ for Involuntary Disengagement, all $p < .001$. Evaluation-related coping was not strongly related to adjustment, with only Disengagement predicting Internalizing Problems.

Table III. Correlations between General Interpersonal and Evaluation-Related Responses to Stress, and Responses to Stress and Adjustment

		Evaluation-Related Coping						
General Coping	*M* (*SD*)	Primary control 2.9 (.57)	Secondary control 2.5 (.50)	Disengagement coping 2.1 (.58)	Involuntary engagement 2.6 (.58)	Involuntary disengagement 2.0 (.52)	Internalizing problems	Health status
Primary control engagement	1.5 (0.40)	.15	.20	−.14	−.18	−.16	−.29*	−.08
Secondary control engagement	2.1 (0.44)	.17	.26*	.14	−.14	−.01	−.26*	−.15
Disengagement	1.5 (0.46)	.09	.03	.34**	.32**	.41	.39**	.40**
Involuntary engagement	1.6 (0.43)	.23	.26*	.17	.39**	.24	.48***	.47***
Involuntary disengagement	1.3 (0.32)	.14	.17	.23	.35**	.40***	.49**	.50***
Internalizing problems		.18	.16	.48***	.40***	.37		
Health status		.13	.09	.17	.36**	.20		

* $p < .05$. ** $p < .01$. *** $p < .001$. (Correlations significant at the .001 level remain significant after Bonferroni correction.)

General interpersonal coping showed clear relationships with adjustment, with Primary and Secondary Control Engagement Coping predicting fewer Internalizing Problems, and Disengagement coping predicting more Internalizing Problems and poorer Health Status.

In the design of this study, responses to the laboratory evaluation stressor were intended to serve as examples of individuals' responses to similar stressful situations in daily life. To determine whether laboratory responses showed promise as analogues of more general responses to interpersonal stress, correlations between scales from the evaluation-related and general interpersonal version of the RSQ were calculated for the five factors (see Table III). Convergent correlations between matched factors (e.g., evaluation-related disengagement coping with general-interpersonal disengagement coping) ranged from .15 to .40, with a mean of .31, suggesting a modest degree of continuity in responses to stress across laboratory and naturalistic settings. The mean of discriminant correlations was .13.

Tests of Coping Moderation

Moderation was tested by constructing regression equations predicting adjustment (Health Status or Internalizing Problems) from involuntary responses (either Arousal or Heart Rate Reactivity), coping (Primary Control, Secondary Control, or Disengagement) and a multiplicative term representing the interaction between involuntary responses and coping. A significant interaction term with a negative β indicates that a coping strategy serves as a buffer, whereas a significant interaction term with a positive β indicates that an ineffective strategy augments relations between involuntary responses and poor adjustment (Aiken & West, 1997). Following standard procedure, predictor variables were centered to maximize interpretability and minimize potential problems with multicollinearity, by subtracting the sample mean from individual scores (Aiken & West, 1997). As composite variables based on Z scores already had a mean of zero, no changes to composite variables were necessary. All regressions controlled for sex, as men reported higher levels of Arousal, $t = 2.3$, $p < .05$. No sex differences were found for Coping, Heart Rate Reactivity, Internalizing Problems, or Health Status.

Health Status

Tests of coping moderation of relations between Heart Rate Reactivity and Health Status are presented in Table IV. The Primary Control Coping model accounted for 29% of the variance in Health Status, $F(4, 56) = 5.5$, $p < .001$, the Secondary Control Coping model accounted for 26% of the variance, $F(4, 56) = 4.7$, $p < .01$, and the Disengagement Coping model accounted for 25% of the variance, $F(4, 56) = 4.5$, $p < .01$. To better understand interactions between coping and Arousal, relations between Arousal and Health Status were tested at different levels of each type of coping (high $= +1\ SD$, low $= -1\ SD$). For all three coping strategies, the simple slope at high levels of coping was not significantly different from zero, indicating that high levels of effective coping had the potential to essentially eliminate relations between Heart Rate Reactivity and poor physical health

Table IV. Coping Moderation of Relations Between Heart Rate Reactivity and Health Status

Step	R^2	β at entry
Primary control coping		
Sex	.04	−.21
Heart rate		.37**
Primary ctrl. coping	.19	.07
Heart Rate × Primary ctrl. coping	.29	−1.27**
Secondary control coping		
Sex	.04	−.21
Heart rate		.38**
Secondary ctrl. coping	.19	.07
Heart rate × Secondary ctrl. coping	.26	−1.22*
Disengagement coping		
Sex	.04	−.21
Heart rate		.38**
Disengagement coping	.19	.02
Heart rate × Disengagement coping	.25	−.25*

* $p < .05$. ** $p < .01$. *** $p < .001$.

(see Fig. 1). For low levels of Primary Control Coping, unstandardized $b = .13$, $p < .001$, for high levels unstandardized $b = .02$, *ns*. At low levels of Secondary Control Coping, unstandardized $b = .12$, $p < .001$, but at high levels, unstandardized $b = .03$, *ns.* Finally, for Disengagement Coping, unstandardized $b = .12$, $p < .001$ at low levels, and unstandardized $b = .02$, *ns* at high levels.

A similar set of analyses demonstrated that Primary Control Coping buffered relations between Arousal and Health Status (see Table V). The Primary Control

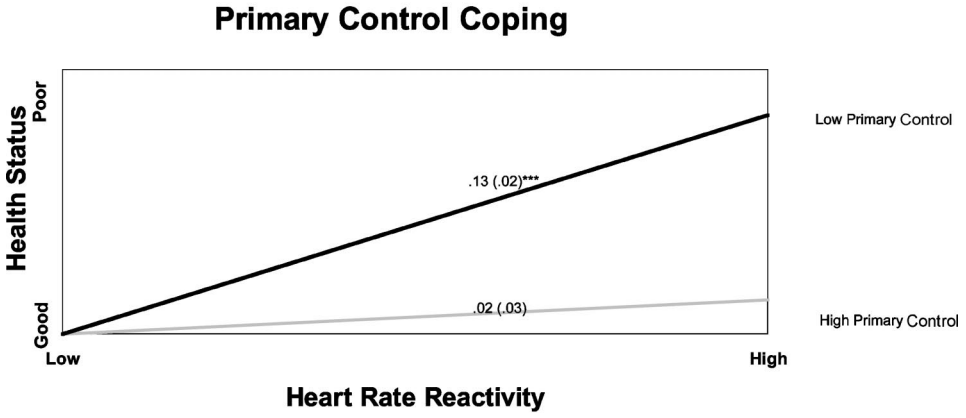

Fig. 1. Simple slopes for Primary Control Coping moderation of relations between Heart Rate Reactivity and Health Status at 1 *SD* above and 1 *SD* below the mean for coping. Values depicted are unstandardized regression coefficients, with standard errors in parentheses, *** $p < .001$.

Table V. Coping Moderation of Relations Between Arousal and Internalizing Problems and Between Arousal and Health Status

	Moderation of health status		Moderation of internalizing problems	
Step	R^2	β at entry	R^2	β at entry
Primary control coping				
Sex	.03	−0.17	.12	−0.34**
Arousal	.41**			0.34*
Primary ctrl. coping	.16	−0.08	.22	−0.00
Arousal × Primary ctrl. coping	.24	−1.34*	.24	−1.31
Secondary control coping				
Sex	.03	−0.17	.12	−0.34**
Arousal		.44**		0.34*
Secondary ctrl. coping	.17	−0.13	.22	−0.01
Arousal × Secondary ctrl. coping	.20	−1.01	.28	−2.06*
Disengagement coping				
Sex	.03	−0.17	.12	−0.34**
Arousal		.50**		0.14
Disengagement coping	.17	−0.19	.27	0.09
Arousal × Disengagement coping	.18	0.09	.27	−0.10

* $p < .05$. ** $p < .01$. *** $p < .001$.

Coping model accounted for 24% of the variance in Health Status, $F(4, 56) = 4.5$, $p < .01$, with Primary Control Coping serving as a buffer ($\beta = -1.34$). Relations between Arousal and Health Status were significant for those using low levels of Primary Control Coping, unstandardized $b = .71$, $p < .001$, but not for individuals using high levels of Primary Control Coping, unstandardized $b = .11$, *ns*, indicating that the effective use of this coping strategy essentially eliminated the link between Arousal and Health Status. The Secondary Control Coping model accounted for 20% of the variance in Health Status, $F(4, 56) = 3.5$, $p < .01$, and the Disengagement Coping model accounted for 18% of the variance, $F(4, 56) = 3.1$, $p < 05$, with neither Secondary Control nor Disengagement Coping moderating relations between Arousal and Health Status.

Internalizing Problems

Results for coping moderation of relations between Arousal and Internalizing Problems are presented in Table V. Only Secondary Control Coping served as a buffer, with the model accounting for 28% of the variance, $F(4, 56) = 5.3$, $p < .001$. Simple slopes for relations between Arousal and Internalizing Problems were significantly different from zero at both low and high levels of Secondary Control Coping, unstandardized $b = .64$, $p < .01$, and $b = .32$, $p < .05$, respectively. This indicates that relations between Arousal and Internalizing Problems were decreased, but not eliminated, by high use of Secondary Control Coping. The Primary Control Coping model accounted for 24% of the variance in Internalizing Problems, $F(4, 56) = 4.5$, $p < .01$, and the Disengagement coping model accounted for 27% of the variance, $F(4, 56) = 5.2$, $p < .001$, but neither served as a moderator.

DISCUSSION

In order for a laboratory stressor to effectively serve as an analogue of naturalistic stressors, three conditions must be met. First, the stressor must be similar to real-world events. Second, participants must find the laboratory task stressful. Third, responses to the laboratory stressor must be related to behavior outside the experimental setting, although correlations between specific laboratory stressors and broad naturalistic stressors should be moderate, as variations in the intensity, duration, and controllability of naturalistic stressors will influence the range of coping and involuntary responses. In this study, anticipation of critical feedback regarding one's social abilities was designed to parallel the social-evaluative demands faced by college students. Because the stressor lasted over a 24 hr period, participants were free to use a wider variety of responses to stress than those available exclusively within a laboratory setting. Results suggest that anticipation of the evaluation was stressful, as participants exhibited both self-reported arousal and heart rate reactivity. Evaluation-related coping and involuntary responses were also correlated with responses to general interpersonal stressors, suggesting that responses to the standardized, laboratory stressor served as examples of naturalistic responses.

Evaluation-related responses were also associated with broad measures of adjustment, with involuntary responses predicting both poor health status and internalizing problems, and disengagement coping predicting internalizing problems. Although the standardized stressor used in this study was clearly not the cause of poor health status or emotional distress, relations between laboratory responses and outcome measures provide further evidence that responses to the standardized stressor served as an analogue of individuals' typical involuntary reactivity and coping in the face of similar stressors. It is these typical responses, repeated across time and events, that are hypothesized to be responsible for health status and emotional adjustment. The stronger predictive ability of evaluation-related involuntary responses when compared with coping suggests that involuntary stress-reactivity may be more stable across situations than volitional coping. As expected, the broader measure of general interpersonal responses to stress was a stronger predictor of internalizing problems and health status than was the experiment-specific measure.

The viability of using laboratory responses to represent typical responses to stress was also supported by moderation of relations between evaluation-related involuntary responses and broad outcome measures by evaluation-related coping. As expected, primary control coping diminished relations between involuntary arousal and poor health for both self-reported and objective measures of arousal, and secondary control coping buffered relations between heart rate reactivity and poor health. Although significance tests did not indicate that secondary control buffered relations between self-reported arousal and poor health, the interaction term accounted for 3% of the variance. As it is difficult to detect moderation in nonexperimental studies, interactions explaining only 1% of the variance are often considered meaningful (McClelland & Judd, 1993), raising the possibility that secondary control coping may have been a significant moderator of relations between arousal and health in a larger sample. Contrary to predictions, relations between self-reported arousal and internalizing problems were buffered only by secondary control coping.

In the present study, the anticipated evaluation was unavoidable and TAT stories had already provided the basis for the evaluation, leaving no clear way to modify the external stressor directly. It may be that once individuals committed themselves to hearing the evaluation of their personality and social abilities, secondary control strategies for adapting to the situation became more viable than primary control strategies, as it was not possible to control the outcome of the evaluation.

Disengagement coping buffered relations between heart rate reactivity and health status, surprising given that reliance on disengagement responses to naturalistic interpersonal stressors predicted poor health status and internalizing problems. It may be that limited use of disengagement coping is beneficial, particularly in the face of uncontrollable stressors. Avoiding thoughts of the evaluation, denying concerns, and engaging in wishful thinking may have been effective short-term strategies. Thus, occasional, limited use of disengagement may be beneficial, with problems stemming from an over-reliance on disengagement to the exclusion of more active responses.

Consideration of the interplay between involuntary arousal and disengagement over time is important, as each may drive the other. Prospective studies suggest that distress leads to increased use of disengagement (Zautra et al., 1996). At the same time, disengagement coping is associated with elevated physiological arousal in response to stressors such as delivering a speech (Kohlmann, Weidner, & Messina, 1996; Mendolia, Moore, & Tesser, 1996), which has been interpreted as evidence of a short-term physiological cost to disengagement coping (Tomaka, Blascovitch, & Kelsey, 1992). Daily diary and prospective studies will be important in disentangling the complex relations between disengagement and arousal over time. It will also be important to clearly distinguish between avoidance and distraction coping, as the two strategies have different relations to involuntary cognitions. This distinction between avoidance and distraction is increasingly common in the child coping literature (Ayers et al., 1996; Connor-Smith et al., 2000), but less visible in the adult literature, perhaps because popular measures of adult coping were developed before evidence suggesting differential relations of avoidance and distraction to involuntary arousal was available, and distraction was originally classified as a disengagement strategy.

Use of a standardized interpersonal stressor in a group of individuals sensitive to social stress made it possible to attribute differences in involuntary arousal and the effectiveness of coping strategies to individual processes, rather than situation-specific factors. However, because participants could not directly influence the outcome of the evaluation, leaving them with limited control over the course of events, these findings are unlikely to apply to the full range of naturalistic social stressors. Failure to use primary control coping and over-reliance on disengagement coping may be most detrimental in the context of controllable stressors. The laboratory setting allowed for intensive assessment of responses during a brief time period, diminishing problems associated with retrospective report and facilitating the use of objective measures, such as heart-rate reactivity. Objective supplements to self-reports are important because measures of involuntary arousal are subject to social desirability effects. Correspondence between self-report and objective measures of arousal is generally moderate (Tomarken, 1995), and tends to be particularly poor for individuals high in the use of disengagement coping (Krohne, 1993). Although the stream-of-consciousness recording was not an entirely objective measure of experiment-related

thoughts, as participants were unlikely to vocalize embarrassing thoughts, it was lower in face-validity than the thought report tally, as participants were unlikely to infer the dimensions along which their statements would be coded.

Of course, it is premature to draw conclusions on the basis of this single study. Given the cross-sectional nature of the data, it is possible that relations between involuntary responses, coping, and reports of emotional and physical health are due to the influence of a confounding variable. For example, current mood or health problems may lead individuals both to over-report symptoms and to under-report the use of active and effective coping. Because reports of internalizing problems over the past 6 months were obtained an average of 5 weeks before the laboratory component of the study, the effect of variables such as current mood on relations between laboratory variables and internalizing problems may have been limited. However, future research will be improved through the use of a prospective design, and through more attention to the potential influence of factors such as current mood and health status. Future studies will also be strengthened through the use of multiple measures of physiological arousal, as heart rate and blood pressure show differential patterns of reactivity depending on the nature of the stressor (Brownley, Hurwitz, & Schneiderman, 2000). Replication across samples will be important, as findings may not generalize beyond the study sample of sociotropic college students. Sociotropic individuals are likely to differ from nonsociotropic individuals in perceptions of both naturalistic and laboratory events, and may rely on different coping resources. College students may have different experiences with and concerns about evaluation than other adult samples, and are likely to have different coping resources (e.g., dorm mates) than other adult samples. Finally, future research should be conducted using larger sample sizes, as latent variable modeling will provide stronger, more accurate measures of key constructs than the composite variables use in this study.

In interpreting results from this study, it is important to note that comparison of findings across studies is complicated by poor consensus regarding the key dimensions and subtypes of coping, and by the fact that constructs with identical names are defined differently across studies and measures (Compas et al, 2001; Skinner et al., 2003). For example, the RSQ defines the Primary Control Engagement coping strategy of "problem solving" narrowly, as the act of generating, evaluating, and implementing plans to fix a specific problem. Other, multidimensional, conceptualizations of problem solving include orientation to the problem and a range of problem-solving styles that may be used to resolve a situation or manage related emotions (e.g., D'Zurilla & Nezu, 1990; Maydeu-Olivares & D'Zurilla, 1995; Nezu, Friedman, Faddis, Houts, 1998). These broader conceptualizations of problem solving include the use of both primary and secondary control strategies. Thus, although primary control coping as assessed by the RSQ failed to moderate relations between arousal and internalizing problems, results may have differed in a study using a broader conceptualization and measure of problem solving.

Mounting evidence suggests that immediate, involuntary stress-reactivity is partially neurologically based and is relatively stable throughout the lifespan, with some temperamental traits serving as an inborn risk factor for both psychopathology and health problems (Clark et al., 1994; Rothbart & Bates, 1998). Temperament can affect the relationship between stressful events and adjustment by influencing the

extent to which events are perceived as stressful, and by modulating the intensity of emotional and physiological responses to stress (Rothbart & Bates, 1998). However, although temperamental traits are linked to neurological structures, environment also influences the development and expression of response tendencies. Extremes of involuntary reactivity appear to require both chronic environmental stress and biological predisposition (Kagan, 1998). If biological tendencies toward threat sensitivity can be enhanced and reinforced by life events, intervention may be able to diminish tendencies toward high stress-reactivity. This study demonstrates that coping strategies have the power to buffer relations between involuntary arousal and poor outcomes, suggesting that susceptibility to involuntary arousal does not lead inevitably to distress or poor health. Developing a stronger understanding of relations between involuntary stress-responses, coping, and adjustment will have important implications for the development of prevention and intervention programs. Given the complicated nature of responses to stress, and the potential for self-reports of coping to be influenced by factors such as personality, current mood, or willingness to self-disclose, we believe that experimental designs including observational measures will be required to begin to disentangle the influence of personality, involuntary responses, and coping on health problems and symptoms of emotional distress.

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