Journal of Personality and Social Psychology
2002, Vol. 83, No. 2, 434–450

0022-3514/02/$5.00 DOI: 10.1037//0022-3514.83.2.434

Patterns of Emotion-Specific Appraisal, Coping, and Cardiovascular Reactivity During an Ongoing Emotional Episode

Mary M. Herrald and Joe Tomaka
University of Texas at El Paso

The authors examined emotion-specific patterns of appraisal, coping, and cardiovascular reactivity during real ongoing emotional episodes. In this study, 109 participants performed a neutral opinion-expression task, where a confederate elicited anger, shame, or pride using verbal and nonverbal behavior. The authors assessed cognitive appraisals, emotional reactions, coping, outcomes (state self-esteem and outcome satisfaction), and cardiovascular reactivity. Results indicated substantial and theoretically consistent differences between the 3 emotions (and differences from a nonemotion condition) for cognitive appraisals, self-reported coping, behavioral coping, self-esteem, and cardiovascular reactivity. The results are discussed in relation to their implications for emotion theory and for psychological and physical health. Overall, the results suggest that researchers can study emotion-related issues using authentic emotional reactions.

Although most people experience emotions every day, frequent or persistent emotional experiences can affect psychological and physical health (Baum, 1990; Leventhal & Patrick-Miller, 1993; O'Leary, 1990; Taylor, 1990). Negative emotions contribute to anxiety disorders (Barlow & Cerny, 1988), depression, low self-esteem (Dua, 1993), cardiovascular disease, cancer, and immune system suppression (Leventhal & Patrick-Miller, 1993; O'Leary, 1990; Taylor, 1990), whereas positive emotions contribute to subjective well-being (Myers & Diener, 1995), increased self-esteem, self-efficacy, morale, and may reduce the harmful effects of negative emotions (Fredrickson & Levenson, 1998; Lazarus, 1991; Stein, Folkman, Trabasso, & Christopher-Richards, 1997; Taylor, 1990).

Although emotional reactions have been related to psychological and physical health, much of this research has examined these relations at the level of affect or mood (i.e., valenced states of long duration and low intensity that occur gradually without a specific immediate cause), and not at the more specific level of discrete emotions (i.e., states of short duration that occur immediately and involve strong feelings related to a specific event; Schwarz & Clore, 1996). As such, there is relatively little research elucidating how discrete emotions affect health-related outcomes (e.g., Lazarus, 1991; C. A. Smith & Pope, 1992).

Discrete Emotions, Appraisal, and Coping

Several arguments support the rationale that discrete emotion, rather than mood or affect, is the more appropriate level of analysis for examining emotion-health relationships. First, each discrete emotion is thought to represent a unique person–environment interaction—one with its own adaptational significance for the individual—and its own unique pattern of cognitive appraisal, physiological activity, and action tendency (see Frijda, 1986, 1987; Lazarus, 1991; C. A. Smith & Lazarus, 1993; Scherer, 1984).

A second, more applied reason is that discrete emotions have been related to psychological health and emotional well-being (Taylor, 1990). For example, anger can lead to low self-esteem, negative self-concept, interpersonal conflict, and aggression (Kassinove, 1995). Conversely, pride can lead to greater morale, positive attitudes, high self-esteem and increased self-efficacy (Lazarus, 1991; Stein et al., 1997). Moreover, Taylor (1990) suggested that positive emotions may combat the harmful psychological impact of negative emotions.

Third, epidemiological research has suggested that discrete emotions relate to specific health outcomes (Leventhal & Patrick-Miller, 1993; Taylor, 1990). For example, anger has been linked to coronary heart disease (Booth-Kewley & Friedman, 1987; Dembroski & Costa, 1987; Matthews, 1988), whereas sadness has been linked to cancer and reduced immunological functioning (e.g., Irwin, Daniels, Smith, Bloom, & Weiner, 1987). Conversely, positive emotions such as amusement have been associated with more rapid cardiovascular recovery compared with sadness (Fredrickson & Levenson, 1998; Levy, Lee, Bagley, & Lippman, 1988).

Fourth, we know that people cope differently with different discrete emotions, and these coping mechanisms may link discrete emotions to specific psychological and physical health outcomes. For example, Tangney (1995; Tangney, Wagner, Hill-Barlow, Marschall, & Gramzow, 1997) has documented that people cope differently with guilt than they do with shame, with the former being associated with active attempts to rectify a bad situation and the latter associated with avoidance and the motivation to disap-

Mary M. Herrald, Department of Psychology, University of Texas at El Paso; Joe Tomaka, Health Science Program, College of Health Sciences, University of Texas at El Paso.

This study served as Mary M. Herrald's doctoral dissertation and was funded in part by National Institutes of Mental Health Grant MH 47167. We thank Rebecca Palacios and Patricia Castiglia for their helpful comments on earlier versions of this article. We also wish to thank Erika Medina who acted as the confederate in this study.

Correspondence concerning this article should be sent to Joe Tomaka, College of Health Sciences, 1101 North Campbell, University of Texas, El Paso, Texas 79902. E-mail: jtomaka@utep.edu or mmherrald@aol.com

pear. Similar arguments apply to coping with other emotions such as extreme sadness (suicide) and anger (violence).

A final reason for suggesting discrete emotions as the appropriate level of analysis is that discrete emotions may have distinct patterns of physiological response. Such research is important because it examines biological pathways linking distinct psychological states (i.e., emotions) to health-related physiological processes. Evidence supporting the idea of emotion-specific patterns of physiological response comes from research on psychological stress and from research on discrete emotions.

Regarding the former, many researchers have documented the existence of distinct patterns of autonomic nervous and cardiovascular system adjustments to stress (Dienstbier, 1989; Krantz & Manuck, 1984; Lovallo, Pincomb, Brackett, & Wilson, 1990; Manuck, Kamarck, Kasprowicz, & Waldstein, 1993; Mason, 1975; Obrist, 1981; Saab & Schneiderman, 1993; Williams, 1986). In social psychology, Tomaka and Blascovich and their colleagues have investigated differences between threat and challenge (Blascovich, Mendes, Hunter, Lickel, & Kowai-Bell, 2001; Mendes, Blascovich, Major, & Seery, 2001; Tomaka & Blascovich, 1994; Tomaka, Blascovich, Kelsey, & Leitten, 1993; Tomaka, Blascovich, Kibler, & Ernst, 1997; Tomaka & Palacios-Esquivel, 1997; Tomaka et al., 1999). Overall this research has shown that individuals who appraise potentially stressful events as challenges show a distinct pattern of cardiovascular reaction consisting of high cardiac activation coupled with low or reduced vascular resistance. Individuals who appraise the same events as threats, in contrast, show a pattern of low to moderate cardiac activity coupled with high vascular resistance. Although others have described similar patterns of physiological activation (Dienstbier, 1989; Manuck et al., 1993; Williams, 1986), researchers have only recently related these patterns to discrete emotions (Tomaka, Herrald, Medina, Penley, & Palacios, 2000).

The second line of evidence comes from direct attempts to examine emotion-specific autonomic nervous system reactivity. Although showing somewhat less consistency relative to the stress-related work described above, this research also suggests that discrete emotions produce specific patterns of autonomic reactivity (Ax, 1953; Levenson, Ekman, & Friesen, 1990; Roberts & Weerts, 1982; Schwartz, Weinberger, & Singer, 1981). For example, this research suggests that anger is associated with increased heart rate (HR) and finger temperature, whereas fear is associated with increased HR and electrodermal activity, and decreased digit temperature. In contrast, disgust is associated with a decreased HR and increased electrodermal responding (for a review, see Cacioppo, Klein, Berntson, & Hatfield, 1993). Theoretically, these patterns provide physiological support for the unique action tendency associated with each discrete emotion (Frijda, 1987; Lazarus, 1991; Scherer, 1984).

Empirical Inconsistencies and Methodological Difficulties

Unfortunately, the autonomic specificity research does not always replicate, and the findings across studies—sometimes by the same investigators—are not always consistent. For example, using facial configurations to elicit emotion, Levenson et al. (1990) found that fear was associated with increased HR, whereas, using film segments to elicit emotion, Fredrickson and Levenson (1998) found that fear was associated with decreased HR.

Problems associated with the methods used to elicit emotional reactions have almost certainly contributed to the inconsistencies that characterize emotion-specificity research. Emotion-elicitation methods have included asking participants to (a) recall or relive past emotional experiences (e.g., Ellsworth & Smith, 1988; Folkman & Lazarus, 1988a; Frijda, Kuipers, & ter Schure, 1989; Mauro, Sato, & Tucker, 1992; Reisenzein & Hoffman, 1993; Roseman, Spindel, & Jose, 1990; C. A. Smith & Ellsworth, 1985), (b) read scenarios or vignettes (e.g., Roseman, 1991; C. A. Smith & Lazarus, 1993; Weiner, Amirkhan, Folkes, & Verette, 1987), (c) view emotional film segments (e.g., Ekman, Friesen, & O'Sullivan, 1988; Fredrickson & Levenson, 1998; Gross & Levenson, 1995), or (d) contort their faces in positions that match specific facial expressions associated with discrete emotions (e.g., Ekman, Levenson, & Friesen, 1983; Levenson et al., 1990). The obvious difficulty is that these methods may or may not elicit anything resembling an actual emotional experience, let alone elicit an emotional reaction strong enough to arouse the autonomic nervous system. For example, an individual "reliving" a prior incident in which he or she felt angry may experience only a memory of the emotion, experience a trace or diminished version of the emotion, or *experience* nothing at all. The same applies to watching emotion-laden films, reading or listening to scenarios, or contorting one's face.

Even researchers who use these methods have recognized their limitations. For example C. A. Smith and Pope (1992, p. 57) have suggested that "the reliance on remembered and hypothetical experiences necessarily entails some interpretive ambiguity concerning whether subjects are describing actual emotional reactions or whether they are describing their intuitive theories of emotion." They further suggest that "such ambiguities can only be resolved by moving away from the study of remembered and hypothetical experiences and moving toward an examination of individuals' appraisals and emotional reactions during ongoing meaningful experiences" (p. 57). Prominent emotion researchers including Lazarus (1995), Scherer (1995), and Salovey and Sanz (1995) have repeated this call.

We designed the present study with this particular concern in mind and our methods differed in significant ways from prior emotion studies. Our overall aim was to examine emotion-specific patterns of (a) cognitive appraisal, (b) self-reported and behavioral coping (i.e., task performance), (c) emotional well-being (e.g., self-esteem, self- and outcome satisfaction), and (d) patterns of emotion-related cardiovascular reaction during an *ongoing emotional episode*. Specifically, this experiment elicited real emotions during a social-interaction task in which participants expressed their attitudes towards various mundane topics to a confederate. This situation was engaging, goal relevant, and required attention and cognitive action. During the task, a carefully trained confederate elicited emotional reactions in participants by responding to their opinions with verbal and nonverbal behavior scripted to elicit one of three emotions (i.e., anger, shame, or pride) or remained neutral (i.e., no emotion elicitation).

Theoretical and practical concerns directed our choice of these emotions. First, as discussed earlier, these emotions have been related to psychological and physical health (Booth-Kewley & Friedman, 1987; Dua, 1993, Matthews, 1988; Tangney, 1995; Tangney et al., 1997). In addition, our use of these emotions, and the neutral condition, are a direct response to Cacioppo et al.'s

(1993) suggestion that emotion-specificity researchers include both positive and negative emotions, and neutral conditions for baseline comparisons. Finally, because these three emotions have clear definitions (i.e., core relational themes), and relations to social interaction, they were more practical to elicit in the given context relative to other emotions. Overall, the experiment was high in realism and impact, both of which contributed to participants actually experiencing the emotion.

Because we examined appraisal, coping, well-being outcomes, and autonomic reactivity, we had many hypotheses (see Table 1). In general, we expected participants to report appraisals and emotions (the latter as manipulation checks) that were theoretically consistent with the manipulated emotions (see C. A. Smith & Lazarus, 1993). For self-reported coping, we expected anger and shame participants to report more emotion-focused coping, whereas we expected pride participants to report more problem-focused coping. We expected pride participants to perform better than anger and shame participants.

Because of conflicting stress-related and emotion-specificity research, the physiological hypotheses were less direct. For example, on the basis of stress research, we thought that pride might be associated with appetitive motivation and challenge-like responses, including high cardiac reactivity coupled with low total peripheral resistance (TPR). However, on the basis of emotion-specificity research (Levenson, 1992), we also thought that pride might be associated with low cardiac and vascular reactivity. Similarly for anger, we first thought that anger might be associated with flight or fight responses, including high cardiac reactivity (i.e., high HR and cardiac output [CO]). Alternatively, we thought that anger might be associated with vigilance/threat responses (Williams, Barefoot, & Shekelle, 1985) and be reflected by increased vascular resistance. Lastly, we expected shame to be associated with aversive motivation and threat responses including moderate cardiac reactivity coupled with high vascular resistance.

Method

Participants

Seventy-six female and 33 male introductory psychology undergraduates participated in the study for course credit (mean age = 20.99 years, *SD* = 5.79 years). Seventy-four percent were Hispanic, 15% were Anglo, 5% were African American, and 6% selected "other."

Setting and Apparatus

The setting for the study was the Health Psychophysiology Laboratory at the University of Texas at El Paso. The laboratory included separate control and participant rooms. The control room housed computers for data acquisition and experiment control, a Minnesota Impedance cardiograph (Model 304B, Instrumation for Medicine, Old Greenwich, CT), a Critikon automated blood pressure monitor (Dinamap Model 8100, Critikon, Inc., Fort Lauderdale, FL), and a Coulbourn physiological monitoring system (Coulbourn Instruments, Allentown, PA). The control room also contained a video monitor, a VCR, a tape recorder, and an intercom system. The participant room housed a video monitor, computer mouse, audio speakers, a hidden video camera, and the electrodes and transducers needed for physiological monitoring.

Measures

Affective state. We assessed general affective state using the profile of Positive and Negative Affective Schedule (PANAS; Watson, Clark, & Tellegen, 1988). The PANAS was used only to assess preexperiment levels of mood/affect.

Manipulation checks. Participants rated the extent to which they experienced the three target emotions along 9-point scales ranging from 1 (*very little*) to 9 (*extremely*) after completing all other measures in the study.

Cognitive appraisals. Cognitive appraisal measures included emotion- and stress-related appraisal dimensions, and core relational themes (see Appendix). Consistent with previous investigations (C. A. Smith & Lazarus, 1993) we assessed seven emotion-related cognitive appraisal dimensions and two stress-related dimensions. Emotion-related dimensions included *goal relevance*, *goal congruence* or *incongruence*, *blame* or *credit*, *emotion-focused coping potential*, *problem-focused coping potential*, *future expectancy*, and *perceived justice*. Stress-related dimensions included *perceived task demands* and *perceived threat* (see Tomaka et al., 1999).

Because Lazarus and Smith (Lazarus, 1991; C. A. Smith and Lazarus 1993) asserted that appraisals along these dimensions combine to determine the central emotional meaning of each particular person–environment relationship in what they call a core relational theme (CRT), we also assessed appraisals of three CRTs including failing to live up to personal standards (shame), a demeaning offense (anger), and self-satisfaction

Table 1
Hypotheses for Appraisal Dimensions, CRTs, Coping, Task Performance, Self-Esteem, and Outcome Variables

	Dependent variables															
	Dimensions									Coping			Self-esteem		Outcome satisfaction	
Emotion	GC	BC	PFCP	EFCP	FE	SD	ST	Inj	CRT	PF	EF	TP	SSE	PSE	Things	Self
Anger	↓	other	—	—	neg	↑	↑	↑	demeaning offense	↓	↑	↓	↓	↓	↓	↓
Shame	↓	self	—	—	neg	↑	↑	↑	fail personal standards	↓	↑	↑	↓	↓	↓	↓
Pride	↑	self	↑	↑	pos	↓	↓	↓	self-satisfaction	↑	↓	↑	↑	↑	↑	↑
Neutral	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Note. A dash indicates no specific hypothesis. Arrows represent low/lower versus high/higher. CRTs = core relational themes. GC = goal congruence; BC = blame or credit; PFCP = problem-focused coping potential; EFCP = emotion-focused coping potential; FE = future expectancies; SD = situational demand; ST = situational threat; Inj = perceived injustice; PF = problem-focused coping; EF = emotion-focused coping; TP = task performance; SSE = social self-esteem; PSE = performance self-esteem; Things = satisfaction with how things turned out; Self = satisfaction with self; neg = negative; pos = positive.

(pride). Following C. A. Smith and Lazarus's (1993) operations and Lazarus's (1991) discussion, we assessed or created five additional CRTs, including uncertain threat (anxiety), failing to live up to societal standards (guilt), irrevocable loss (sadness), goal consistency (happiness), and worthlessness (self-disgust). Using C. A. Smith and Lazarus's (1993) assessment method, the computer monitor presented three statements describing each CRT (see Appendix) along with a single, appropriately anchored 9-point Likert scale.

Participants rated cognitive appraisals twice, once after instructions for, but just prior to, task performance and again at the end of the task, when they believed they were halfway through the task. Appraisals were assessed the second time to examine the degree to which the appraisal measures reflected the emotion manipulation. Thus, the first set assessed baseline appraisals, whereas the second set assessed appraisals after the emotion manipulation.

Emotional reactions. For emotional reactions, participants rated how much they experienced each of 12 distinct emotions (see Lazarus, 1991) including anger, fear, anxiety, sadness, guilt, shame, disgust with situation, self-disgust, happiness, pride, relief, and hope. Similar to cognitive appraisals, participants rated their emotional reactions twice, once after instructions for the task, and again after the emotion manipulation. The computer monitor presented these items individually, along with separate 9-point scales ranging from 0 (*not at all*) to 8 (*very much*).

Coping. We assessed self-reported coping after the task using an instrument based on coping questionnaires designed for field studies (e.g., Ways of Coping Questionnaire; Folkman & Lazarus, 1988b; the COPE Scale; Carver, Scheier, & Weintraub, 1989) but modified for use in laboratory settings. The 48-item measure assessed multiple forms of problem- and emotion-focused coping. Participants rated each item along 4-point scales ranging from 0 (*didn't do this at all*) to 3 (*did this a lot*).

We reduced the coping items into scales using factor analysis. Principal axis factoring, examination of eigenvalues and scree plots, and an oblimin rotation revealed three factors accounting for 30.18% of the variance in coping ratings. The first factor, Seeking Social Support, accounted for 14.85% of the variance and consisted of items regarding seeking emotional and instrumental support from friends and religion (e.g., "I wished that I had a friend here for support") and emotional awareness (e.g., "I thought about how nervous or embarrassed I was"; $\alpha = .85$, 13 items). The second factor, Active Coping, accounted for 9.64% of the variance and consisted of items regarding planning and focusing on performance (e.g., "I concentrated on performing the task") and positive reappraisal (e.g., "I took a positive attitude towards the task"; $\alpha = .84$, 14 items). The third factor, Defensive Coping, accounted for 5.69% of the variance and consisted of items regarding passive endurance (e.g., "I was just waiting for it to be over"), distraction and denial (e.g., "I stopped myself from thinking about the task or experiment"), and resignation (e.g., "I gave up trying to do well"; $\alpha = .81$; 15 items). These three factors were consistent with prior studies using the same scale (Penley, Tomaka, Goldsmith, Herrald, & Palacios-Esquivel, 1997).

Psychological outcomes. We also assessed state self-esteem and outcome satisfaction after the emotion manipulation. For postemotion self-esteem, we used the 20-item State Self-Esteem Scale (SSE; Heatherton & Polivy, 1991). The SSE has three subscales including performance self-esteem ($\alpha = .82$, 7 items), social self-esteem ($\alpha = .77$, 7 items), and appearance self-esteem ($\alpha = .80$, 6 items). Two items assessed outcome satisfaction including "How satisfied are you with the way things are going in this situation" and "How satisfied are you with the way you are handling the situation?" ($\alpha = .90$). Participants rated these last two items after the task along a 9-point scale ranging from 0 (*not at all*) to 8 (*very much*).

Behavioral measures. We assessed the videotaped task performances for emotional reactions (as a manipulation check) and behavioral performance (as a behavioral outcome). For emotional reactions, assistants blind to experimental condition indicated what emotion (i.e., anger, shame, pride, or none) they thought participants were experiencing during each of three task periods (i.e., neutral task, emotion-manipulation, and postmanipulation periods). For behavioral performance, assistants rated the subjective quality of responses along a scale ranging from 1 (*very low*) to 5 (*very high*). Quality of response was based on a composite of several performance indicators including evaluations of poise, eye contact, confidence, and the quality of response. For emotion ratings, interrater reliability was .86 for the neutral task period, .77 for the emotion-manipulation period, and .72 for the postmanipulation period. For behavioral performance, interrater reliability was .69 for the neutral task period, .62 for the emotion-manipulation period, and .76 for the postmanipulation period.

Physiological measures. Electrocardiography (EKG) and impedance cardiography (ZKG) assessed cardiac activity (i.e., preejection period [PEP], stroke volume [SV], HR, and CO) continuously during the experiment. All physiological measures were assessed using guidelines established by the Society for Psychophysiological Research (Fowles et al., 1981; Shapiro et al., 1996; Sherwood et al., 1990). EKG was assessed using standard electrodes in the Lead I configuration, whereas aluminum/mylar tape electrodes in a band configuration assessed ZKG. The band configuration included two measurement electrodes, one at the base of the neck and the other at the thoracic xiphisternal junction, and two current electrodes, also placed at the neck and upper abdomen, but outside their respective measurement electrodes by a distance of at least 3 cm. The ZKG records variation in thoracic impedance while passing an AC current of 4 mA at 100 kHz across the chest cavity. Resulting measures include basal transthoracic impedance (Z0) and the first derivative of basal impedance (dZ/dt). The dZ/dt waveform reflects the mechanical activity of the heart (see Sherwood et al., 1990). A laboratory computer stored the EKG and ZKG data together on-line. An interactive MS-DOS-based computer program (Kelsey & Guethlein, 1990) assisted in waveform scoring.

Finally, the Dinamap monitor assessed mean arterial, systolic, and diastolic blood pressure (BP) using a cuff positioned on the arm above the brachial artery. To minimize discomfort from repeated occlusions of the arm, we recorded individual BP measurements during minutes 1, 3, and 5 of the rest period, but took BP measurements during each minute of the 8-min task period.

The study included four measures of cardiovascular activity for the primary analysis including (a) PEP, a measure of cardiac contractile force; (b) TPR, a measure of overall systemic vascular resistance derived with the following formula: mean arterial pressure/CO $\times$ 80 (Sherwood et al., 1990); (c) HR, a measure of cardiac rate; and (d) CO, a measure of the volume of blood pumped out of the heart over time calculated by multiplying HR by SV.

Procedure

On arrival at the laboratory, participants completed consent, demographic, health history, and PANAS questionnaires. Participants then entered the laboratory where an assistant blind to emotion condition attached the sensors needed for physiological recording. After ensuring signal integrity, participants sat quietly for a 5-min baseline rest period. To assess baseline levels of emotion and to familiarize the participants with the computer interfacing, participants then rated their current emotional state along the 12 discrete emotions described above.

All participants then listened to the same general audio-taped instructions describing the upcoming task. These instructions told participants that they would be expressing their opinions on a variety of college-related topics, such as "Do you prefer large or small classes and why?," to a laboratory assistant. They were further told that they would receive a new topic every 30 s and that the computer monitor and tape recorder would tell them (a) their opinion topic, (b) when to give their responses, and (c) when to stop. Each 30-s trial consisted of a topic presentation, a 15-s verbal response period, and a 15-s quiet period, after which they were given the next topic. The instructions asked participants to speak clearly and to direct their responses to the laboratory assistant.

After listening to the instructions, participants completed the initial set of appraisals (i.e., prior to the emotion induction). While participants answered these questions, the experimenter randomly assigned the participant to an emotion condition. After participants completed the appraisals, the confederate entered the room and sat across from the participant. The computer and tape recorder then began presenting the opinion topics. The 8-min task presented two topics per minute (30 s per topic). The topics for this task were fairly neutral in content so as to be fairly nonemotional (e.g., What are the differences between high school and college?, Do you prefer large or small classes and why?).

During the first two task minutes (i.e., neutral task period), the confederate remained neutral for all participants. Beginning with the third minute (sixth topic), and continuing for 3 min, the confederate elicited one of the three target emotions using verbal and nonverbal behavior based on the CRT for each target emotion (i.e., manipulation period) or continued to remain neutral in the neutral condition. Beginning with the sixth task minute, and continuing for 3 min, the confederate returned to neutral behavior.

The confederate's remarks and behavior were carefully scripted and practiced. The anger manipulation was based on the CRT for anger, which is the appraisal of an undeserved and demeaning personal offense (see Lazarus, 1991). To accomplish this, the confederate made several demeaning remarks and gestures during the participant's presentation. For example, the confederate made hostile demeaning remarks about the participant's views, such as "Are you kidding?" and "Where did you get that idea?" She also rolled her eyes, suppressed mild laughter, and showed the participant little respect.

The shame manipulation was based on the CRT for shame, which is the appraisal of failing to live up to personal standards (see Lazarus, 1991). To accomplish this, the confederate expressed sincere disappointment in the participant's comments and suggested that he or she could do better (i.e., that he or she is not living up to his or her own personal standards). For example, the confederate commented in a sincere tone, "I don't think you're doing as well as you can, can you try a little harder?" and, "I think you can do better on the next issue."

Finally, the pride manipulation was based on the CRT for pride, which is the appraisal of being responsible for favorable outcomes (see Lazarus, 1991). To accomplish this, the confederate made several praising remarks and gestures during the participant's presentation of his or her views. For example, the confederate remarked in a friendly approving tone about how well the participant was performing, such as "You're doing a lot better than the other students" and "You're doing great, you brought up a lot of interesting points," smiled, nodded, and made other approving gestures. In the neutral condition, the confederate did not make any comments and did not display any approving or disapproving gestures.

After the 3-min emotion-manipulation period, the experimenter used the intercom to call out the confederate under the guise that she was needed in the laboratory. The experimenter then informed participants to continue with the task even though the confederate was no longer present. Participants continued performing the task in solitude for 3 min (i.e., postmanipulation period), allowing for assessment of habituation of emotional reactions. Afterward, participants heard another tone and the instruction tape informing them that the task was halfway over and that before continuing, the experimenter wanted to assess what they were thinking and feeling "right now." At this point participants completed the second set of appraisals and emotional reactions, and outcome satisfaction (on the computer), and completed coping, state self-esteem, and manipulation check questionnaires. We then told participants that the experiment was over, explained the nature of the study, debriefed and released them.

Results

Dependent variables included (a) baseline affect, baseline emotion, and premanipulation cognitive appraisals; (b) manipulation checks, including observer coded and postmanipulation self-reported emotional reactions; (c) postmanipulation cognitive appraisals; (d) self-reported coping; (e) observer coded task performance; (f) emotional outcomes (i.e., SSE and outcome satisfaction); and (g) cardiovascular reactions.

Baseline and Manipulation Checks

Baseline affect, baseline emotion, and premanipulation appraisals. Analyses of these variables revealed no preexisting or baseline differences between our emotion groups for the PANAS, discrete emotions, or appraisal variables (all $ps > .30$; see Tables 2, 3, and 4).

Manipulation checks. Overall, the manipulation check analyses showed the manipulation to be effective and emotion specific. First, planned contrasts comparing each individual emotion with the other three conditions showed that coders blind to the experimental condition could reliably determine whether participants appeared to be experiencing each of the three target emotions (see Table 5). These contrasts were significant during the emotion-manipulation period, all $ts(100) > 6.93$, $p < .01$, and postmanipulation periods, all $ts(100) > 3.20$, $p < .01$.

Using posttask self-report emotions, similar contrasts showed that anger participants reported higher levels of anger compared with the other three conditions, $t(102) = 4.22$, $p < .01$, and that pride participants reported higher levels of pride than the other conditions, $t(102) = 2.90$, $p < .01$ (see Table 2). Although shame participants did not report higher levels of shame compared with all three conditions, $t(102) = 1.17$, $p = .25$, they did report higher shame compared with the pride and neutral conditions, $t(102) = 1.84$, $p = .05$.

Finally, within-subjects analyses comparing baseline and postmanipulation emotion ratings separately for each emotion showed that anger participants increased their ratings of anger, $t(27) = -3.48$, $p < .01$; pride participants increased their ratings of pride, $t(24) = -2.88$, $p < .01$; and shame participants marginally increased their ratings of shame, $t(25) = -2.00$, $p = .057$. In summary, data from independent observers and from participants both suggest that the emotion manipulation effectively elicited anger, shame, and pride in the appropriate conditions.

Effects Related to the Emotion Manipulation

Postmanipulation cognitive appraisals. To examine between-group differences in cognitive appraisal dimensions, we used planned contrasts (see Table 1) with emotion condition as the sole between-subjects factor and the appraisal dimensions as the dependent measures.[1] As shown in Table 3, individuals in the anger condition reported lower goal congruence, $t(102) = 2.47$, $p = .015$, $p < .01$, higher situational demands, $t(102) = -3.74$, $p < .01$, higher situational threat, $t(102) = -3.01$, $p = .01$, and lower

[1] Where predictions overlapped for anger and shame, the emotion not under examination by the analysis was assigned a contrast weight of zero. For example, in the analysis of goal relevance as it relates to anger, the shame condition was assigned a contrast weight of zero. Anger received a contrast weight of zero in the shame analysis. Preliminary examination of the data revealed no reliable gender or ethnic differences. Thus, these factors were excluded from the analyses.

Table 2
Means and Standard Deviations for Ratings of Emotions Experienced at Baseline (Base) and During the Task

	Emotion condition								
	Anger (n = 28)		Shame (n = 26)		Pride (n = 25)		Neutral (n = 27)		
Emotion	*M*	*S*	*DM*	*SD*	*M*	*S*	*DM*	*S*	*D*
Anger									
Base	1.25	.52	1.42	1.24	1.28	.84	1.37	1.11	
Task	3.18	2.70	2.12	1.93	1.16	.47	1.30	1.07	
Shame									
Base	1.43	1.10	1.58	1.03	1.24	.52	1.48	1.09	
Task	2.86	2.32	2.38	2.08	1.36	.76	1.56	1.31	
Pride									
Base	3.39	2.13	4.15	2.01	3.20	2.08	3.41	2.32	
Task	2.68	1.66	3.04	1.75	4.20	2.33	2.81	2.35	
Happiness									
Base	4.04	1.95	4.62	1.50	4.00	1.96	3.67	1.98	
Task	2.71	1.67	3.00	1.81	4.44	2.26	3.11	1.95	
Anxiety									
Base	3.54	1.97	3.85	2.17	2.80	1.87	3.11	1.89	
Task	4.54	2.19	4.69	2.17	3.16	2.23	3.22	2.36	
Fear									
Base	2.39	1.99	1.92	1.65	1.76	1.16	2.26	2.18	
Task	3.14	2.53	2.35	1.65	1.60	1.19	1.89	1.67	
Guilt									
Base	1.36	1.03	1.58	1.06	1.24	.60	1.48	1.25	
Task	1.86	1.67	1.73	1.56	1.12	.44	1.37	1.11	
Sad									
Base	2.54	1.99	1.88	1.86	1.88	1.48	2.30	2.09	
Task	2.36	2.00	1.85	1.59	1.60	1.50	1.37	1.08	
Self-disgust									
Base	1.82	1.31	1.77	1.61	1.80	1.08	1.59	1.34	
Task	2.61	2.01	2.00	1.90	1.28	.79	1.44	1.15	
Situational-disgust									
Base	1.89	1.47	1.62	1.42	1.72	.94	1.67	1.52	
Task	3.18	2.70	2.69	2.04	1.20	.58	1.59	1.31	
Relief									
Base	3.43	1.85	3.85	1.85	3.08	1.75	3.44	2.14	
Task	2.64	1.81	3.31	2.11	3.92	2.38	3.81	1.94	
Hope									
Base	4.00	2.33	5.04	2.25	2.84	2.12	3.70	2.32	
Task	2.21	1.64	3.12	2.32	3.56	2.33	3.04	2.24	

Note. Participants rated emotions along a 9-point scale ranging from 0 (*not at all*) to 8 (*extremely*). Base = baseline emotions prior to instructions for the task.

future expectancy, $t(102) = 4.53$, $p < .01$, compared with neutral and pride participants. Anger individuals did not report higher injustice, $t(102) = -1.56$, $p = .12$, or other-blame, $t(102) = -0.85$, $p = .39$, compared with the pride and neutral conditions. Of importance, and as shown in Table 4, anger participants had higher ratings of the CRT for a demeaning offense compared with pride and neutral, $t(102) = 3.82$, $p < .01$.

Individuals in the shame condition reported marginally lower goal congruence, $t(102) = 1.77$, $p = .08$, and significantly higher situational demands, $t(102) = -3.28$, $p = .01$, situational threat, $t(102) = -2.07$, $p = .04$, and lower future expectancy, $t(102) = 2.71$, $p = .01$, compared with neutral and pride participants (see Table 3). Shame participants did not report higher injustice, $t(102) = -0.91$, $p = .37$, compared with neutral and pride, nor did they report higher self-blame, $t(102) = -0.14$, $p = .89$, compared with anger. As shown in Table 4, shame participants reported marginally higher ratings of the CRT of failing to live up to a personal standards compared with neutral and pride, $t(102) = 1.76$, $p = .082$.

Participants in the pride condition reported higher ratings of goal congruence, $t(102) = -2.85$, $p = .01$, high emotion-focused coping potential, $t(102) = -2.86$, $p = .01$, lower situational demand, $t(102) = 2.81$, $p = .01$, lower situational threat, $t(102) = 2.20$, $p = .03$, more positive future expectancies, $t(102) = -3.68$, $p < .01$, and marginally lower injustice, $t(102) = 1.86$, $p = .06$, compared with anger and shame (see Table 3). Pride participants did not report higher problem-focused coping potential, $t(102) = -1.70$, $p = .09$, compared with anger and shame. Finally, as shown in Table 4, pride participants had higher

Table 3
Means and Standard Deviations for Cognitive Appraisal Dimensions at Baseline and During the Task

	Emotion condition								
	Anger		Shame		Pride		Neutral		
Appraisal dimension	*M*	*S*	*DM*	*S*	*DM*	*S*	*DM*	*S*	*D*
Goal relevance									
Baseline	5.50	2.41	5.08	2.26	5.08	1.93	5.44	1.76	
Task	6.00	2.26	5.54	2.42	5.88	2.29	5.70	1.81	
Goal congruence									
Baseline	6.07	1.67	6.06	1.49	6.08	1.76	6.28	1.92	
Task	5.59	2.06	5.88	1.76	7.08	1.68	6.35	2.22	
Blame/Credit									
Baseline	1.07	0.26	1.27	.53	1.12	.33	1.22	0.42	
Task	1.25	0.65	1.27	.53	1.08	.28	1.22	0.42	
Emotion-focused coping potential									
Baseline	6.70	1.61	6.87	1.53	6.54	2.06	6.69	1.62	
Task	6.09	1.83	6.58	1.89	7.10	1.75	6.80	1.97	
Problem-focused coping potential									
Baseline	7.91	1.16	7.60	1.52	7.60	1.44	7.52	1.43	
Task	6.00	2.20	6.46	1.65	7.46	1.43	7.19	1.69	
Future expectancy									
Baseline	6.75	1.52	6.60	1.64	6.80	1.78	6.67	1.35	
Task	5.43	2.16	6.15	1.64	7.36	1.33	7.24	1.76	
Perceived injustice									
Baseline	1.75	1.18	1.90	1.31	1.78	1.21	2.07	1.63	
Task	2.79	1.53	2.56	1.42	1.98	1.23	2.46	1.89	
Situational demand									
Baseline	3.77	2.24	3.62	1.72	3.78	1.55	3.30	1.57	
Task	4.20	2.16	4.04	1.79	2.92	1.66	2.39	1.29	
Situational threat									
Baseline	2.29	1.42	2.33	1.58	2.40	1.68	2.17	1.47	
Task	2.50	1.61	2.21	1.66	1.62	1.18	1.43	0.94	

Note. Participants rated appraisal dimensions (except blame/credit) along a 9-point scale ranging from 0 (*not at all*) to 8 (*extremely*). Participants rated the blame/credit dimension along a 4-point scale ranging from 1 (*I am completely responsible*) to 4 (*someone else is responsible*).

ratings of the CRT for self-satisfaction compared with anger and shame, $t(102) = 2.28$, $p < .03$.

Overall, these data show a high degree of consistency with theoretical predictions. Moreover, given the strong divergence in the emotion-elicitation methods used in the present study, they provide strong converging evidence for appraisal models of emotion.

Self-reported coping. Results for self-reported coping are shown at the bottom of Table 5. Planned comparisons showed that anger and shame participants reported greater emotion-focused coping including greater social support seeking, $t(105) = -3.56$, $p = .01$, and greater defensive coping, $t(105) = -2.88$, $p = .01$, than pride and neutral participants. Similar analyses revealed that pride participants did not report greater problem-focused coping (i.e., *active coping*) than anger and shame participants, $t(105) = -1.21$, $p = .23$. Overall, the results were consistent with our predictions for emotion-focused coping.

Task performance/behavioral coping. Because observers coded task performance, at three points in time (premanipulation, manipulation, postmanipulation), we used a mixed model 2 × 3 analysis of variance (ANOVA) with emotion condition as the between-subjects factor, time periods as the within-subjects factor, and performance ratings as the dependent measures. This analysis revealed a significant Emotion Condition × Time Period interaction, $F(6, 210) = 4.27$, $p < .01$ (see Table 6). Post hoc tests examining the within-subjects change over time separately for each emotion were significant for anger, $F(2, 54) = 4.73$, $p < .02$, and pride, $F(2, 50) = 11.10$, $p < .01$. Within-subjects contrasts showed that for anger participants, performance significantly declined, but only during the postmanipulation period ($p < .01$). Similar contrasts showed that performance for pride participants increased during the manipulation period and remained elevated during the postmanipulation period ($p < .01$). Thus, pride participants immediately increased and maintained high performance levels, whereas anger participants showed a decline in task performance, but only after the confederate had left the room.

Outcome variables. For SSE, planned contrasts showed that anger and shame participants reported lower performance self-esteem, $t(105) = -2.58$, $p < .02$, and social self-esteem, $t(105) = -1.96$, $p = .05$ (see Table 6), compared with pride and neutral participants. Although pride participants (alone) reported higher performance and social SSE compared with the negative emotion conditions, both ts$(105) > 2.07$, $p < .02$, they did not differ from neutral ($p > .20$).

For outcome satisfaction, similar planned contrasts showed that anger and shame participants reported lower satisfaction with how

Table 4
Means and Standard Deviations for Core Relational Themes (CRTs) at Baseline and During the Task

	Emotion condition								
	Anger		Shame		Pride		Neutral		
CRT	*M*	*S*	*DM*	*S*	*DM*	*S*	*DM*	*S*	*D*
Demeaning offense (anger)									
Baseline	1.86	1.80	1.30	.90	1.48	.92	1.52	1.48	
Task	2.39	2.30	1.31	1.19	1.16	.55	1.15	.60	
Self-blame (shame)									
Baseline	2.32	2.26	2.54	2.08	2.48	1.83	2.07	2.25	
Task	3.04	2.62	2.58	2.18	1.36	1.25	1.52	1.50	
Self-satisfaction (pride)									
Baseline	5.61	2.36	5.85	2.01	5.68	2.32	5.93	1.86	
Task	4.89	2.86	5.54	2.12	6.44	1.96	6.15	1.75	
Uncertain threat (anxiety)									
Baseline	2.04	1.50	2.42	2.27	2.40	1.80	2.04	1.95	
Task	2.89	1.97	2.65	2.43	1.52	1.05	1.48	1.01	
Failing to live up to society's standards (guilt)									
Baseline	2.43	1.87	2.00	1.67	2.32	1.84	1.74	1.40	
Task	3.11	2.10	2.54	2.40	1.52	1.19	1.67	1.47	
Failing to live up to personal standards (shame)									
Baseline	4.36	2.25	3.65	2.46	3.56	2.62	3.37	2.71	
Task	3.89	2.45	3.31	2.53	2.24	1.96	2.44	2.14	
Irrevocable loss (sadness)									
Baseline	2.11	1.59	1.92	1.38	1.76	1.39	2.22	1.95	
Task	1.75	1.27	1.58	0.99	1.16	0.47	1.22	0.97	
Goal consistency (happiness)									
Baseline	5.79	1.95	5.81	2.32	5.60	2.45	6.07	1.75	
Task	4.46	2.36	5.19	1.92	5.88	1.92	5.81	2.18	
Feeling worthless (self-disgust)									
Baseline	1.36	0.99	1.77	1.48	1.84	1.49	1.26	0.98	
Task	1.93	1.63	1.38	1.13	1.12	.33	1.26	1.02	

Note. Participants rated CRTs along a 9-point scale ranging from 0 (*not at all*) to 8 (*extremely*). The emotion that the CRT refers to is in parentheses.

things turned out, $t(102) = -3.86$, $p < .01$, and lower ratings of satisfaction with self, $t(102) = -3.82$, $p < .001$, compared with pride and neutral participants (see Table 6). Again, although pride alone differed from anger and shame, both $ts(102) > -3.03$, $p < .01$, it did not differ from the neutral condition (both $ps > .31$). Overall, the results suggest that anger and shame are associated with poor emotion-related outcomes.

Physiological Reactions

Baseline and neutral task period analyses and analysis strategy. All participants engaged in a 5-min baseline period and a 2-min neutral task period—periods that were identical for all participants regardless of the experimental condition. ANOVAs with emotion group as the between-subjects factor and the physiological variables as the dependent measures showed no significant differences among the four conditions at baseline (all $ps > .15$) or the neutral task period (all $ps > .20$). Because there were no between-group differences during the neutral task period, we computed emotion-manipulation period and postmanipulation period reactivity scores by subtracting the average value for each participants' neutral task period from his or her manipulation period average and postmanipulation average (see Table 7 and Figure 1). Computing reactivity scores in this manner (vs. traditional differences from rest) allowed us to examine the *additional reactivity* associated with the emotional experience itself, and its aftereffects, above the metabolic demands of performing the task under a neutral backdrop. Figure 1 displays the average within-subjects additional reactivity during the emotion-manipulation and postmanipulation periods.[2]

Emotion-manipulation effects. Because we had competing predictions for anger and pride, we used less-theory-driven analysis, including omnibus analyses of covariance (ANCOVAs) with post hoc tests, to examine the effects of emotion condition on PEP, TPR, CO, and HR. In each analysis, reactivity for the

[2] It is important to note that although some of these changes associated with the emotion manipulation appear very small when compared with the zero point of the scales, they reflect activity above that needed to perform the task itself. As such, they must be considered against the expected pattern of habituation shown in the neutral condition. For example, although there appears to be only a 2 bpm increase in the shame condition during the postmanipulation phase, the actual effect relative to neutral condition is closer to 5 bpm.

Table 5
Means and Standard Deviations for Coder's Ratings of Emotional Reactions During the Emotion-Manipulation and Postmanipulation (Post) Periods, and for Self-Reported Coping Subscales

	Emotion condition								
	Anger		Shame		Pride		Neutral		
Emotion and period	*M*	*S*	*DM*	*S*	*DM*	*S*	*DM*	*S*	*D*
Coder's ratings									
Anger									
Emotion	0.78	0.42	0.15	0.37	0.00	0.00	0.00	0.00	
Post	0.50	0.51	0.20	0.41	0.00	0.00	0.00	0.00	
Shame									
Emotion	0.15	0.36	0.58	0.50	0.04	0.20	0.00	0.00	
Post	0.18	0.39	0.28	0.46	0.00	0.00	0.00	0.00	
Pride									
Emotion	0.00	0.00	0.08	0.27	0.83	0.38	0.00	0.00	
Post	0.04	0.19	0.12	0.33	0.40	0.50	0.07	0.27	
Neutral									
Emotion	0.07	0.27	0.19	0.40	0.13	0.34	0.97	0.01	
Post	0.29	0.46	0.40	0.50	0.60	0.50	0.93	0.27	
Coping subscale									
Active coping	2.10	0.50	1.89	0.47	1.84	0.54	1.73	0.63	
Defensive coping	1.08	0.48	0.98	0.55	0.66	0.41	0.88	0.42	
Seeking social support	0.95	0.66	0.70	0.60	0.47	0.31	0.51	0.25	

Note. Participants rated manipulation check items along a scale ranging from 0 (*not at all*) to 9 (*extremely*). Coders rated each emotion as either *present* (1) or *not present* (0) for participants in each emotion condition. Participants rated coping items along a 5-point scale ranging from 0 (*not at all*) to 4 (*did this a lot*).

specific measure during the neutral task period was included as a covariate. As such, the first analysis was a one-way ANCOVA with emotion condition as the sole between-subjects factor, PEP reactivity during the emotion-manipulation period as the dependent measure, and PEP reactivity during the neutral task period as a covariate. This analysis was significant, $F(3, 95) = 2.58$, $p = .05$, as was a corresponding analysis for HR, $F(3, 95) = 4.24$, $p = .01$ (see Table 7 and Figure 1). Post hoc analyses showed that anger during the manipulation period was associated with greater PEP reactivity than pride ($p < .03$) and neutral ($p < .04$), with shame falling in between anger and pride and neutral, but not differing from either. For HR, anger and shame were associated with greater reactivity than neutral ($ps < .01$); shame participants also experienced marginally

Table 6
Means and Standard Deviations for Quality of Responses, State Self-Esteem, and Outcome Satisfaction

	Emotion condition								
	Anger		Shame		Pride		Neutral		
Variable	*M*	*S*	*DM*	*S*	*DM*	*S*	*DM*	*S*	*D*
Response quality during									
Neutral task period	3.07	0.72	2.96	1.06	2.81	0.90	2.75	0.80	
Emotion manipulation	2.96	1.04	3.22	1.12	3.38	0.90	2.93	0.90	
Postmanipulation	2.50	3.11	3.11	1.28	3.37	0.98	3.04	0.88	
Self-esteem subscales									
Performance self-esteem	2.49	0.94	2.93	0.70	3.07	0.65	3.07	0.59	
Social self-esteem	2.51	0.82	2.74	0.73	3.01	0.69	2.77	0.62	
Appearance self-esteem	2.37	0.67	2.49	0.83	2.53	0.88	2.28	0.72	
Outcome satisfaction with									
How things turned out	5.07	2.28	5.50	1.79	6.80	1.41	6.41	1.34	
Self	4.93	2.52	5.58	1.84	6.80	1.41	6.48	1.42	

Note. Assistants viewed recorded performances for all participants and subjectively rated quality of response along a 5-point scale ranging from 1 (*very poor*) to 5 (*very good*). Change in quality of response values reflects change from the neutral task period. Participants rated State Self-Esteem items along a 5-point scale ranging from 0 (*not at all*) to 4 (*extremely*). Participants rated satisfaction items along a 9-point scale ranging from 0 (*not at all*) to 8 (*extremely*).

Table 7
Mean Physiological Difference Scores (from Neutral Task Period) for Emotion-Manipulation and Postmanipulation Periods

	Physiological variable							
	PEP		CO		HR		TPR	
Condition	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Anger								
Emotion manipulation	−1.13	7.27	−0.19	0.52	1.75	3.77	87.98	245.64
Postmanipulation	−3.77	9.12	0.06	0.65	0.91	5.75	−3.21	291.05
Shame								
Emotion manipulation	−0.58	4.57	−0.30	0.42	2.37	3.06	154.28	232.24
Postmanipulation	−1.85	6.50	−0.08	0.67	2.32	3.40	57.45	281.88
Pride								
Emotion manipulation	2.12	4.41	−0.15	0.54	0.59	3.67	105.60	219.55
Postmanipulation	1.32	3.91	−0.04	0.60	−0.48	2.82	52.92	210.19
Neutral								
Emotion manipulation	2.08	4.07	−0.12	0.36	−0.94	2.97	57.70	212.35
Postmanipulation	3.70	4.56	0.18	0.29	−2.54	4.92	6.81	162.78

Note. PEP = preejection period; CO = cardiac output; HR = heart rate; TPR = total peripheral resistance.

higher HR reactivity than pride ($p = .09$). There were no omnibus emotion effects for CO or TPR (both ps $> .20$).

Postmanipulation effects. Overall, the patterns shown in the manipulation period continued or became more evident during the postmanipulation period. For PEP, an ANCOVA similar to the one above, but with reactivity during the postmanipulation period as the dependent measure, was significant, $F(3, 95) = 7.09$, $p = .01$, as was the corresponding analysis for HR, $F(3, 95) = 4.60$, $p < .01$ (see Table 7 and Figure 1). Post hoc analyses showed that anger participants showed greater PEP reactivity during the postmanipulation period compared with neutral (ps $< .01$) and pride ($p < .01$). Shame participants now showed greater PEP reactivity compared with neutral ($p < .005$) and marginally with pride ($p = .09$). For HR, post hoc analyses indicated that anger participants had greater HR reactivity than neutral ($p < .01$), whereas shame participants had significantly greater HR reactions than neutral ($p < .01$) and marginally with pride ($p < .08$).

Although there were again no omnibus effects for CO and TPR (both ps $> .20$), the specific comparison of TPR for shame—during the emotion manipulation—and anger—during the recovery period—was significant, $F(1, 48) = 4.47$, $p < .05$. Thus, although the timing differed, shame resulted in the most extreme increase in vascular resistance, whereas anger produced the lowest increase.

Because PEP reflects sympathetic nervous system (SNS) influence on the myocardium, whereas HR is dually controlled by the SNS and parasympathetic nervous system, we also conducted ancillary analyses of the HR effects to see if they were redundant or independent of the PEP effects by including PEP reactivity as an additional covariate in the above analyses of HR. If using PEP as a covariate eliminates or reduces the effects of emotion condition on HR, this would suggest that SNS reactivity underlies both the HR and PEP effects. If the HR effects remain significant, however, this would suggest that the HR effects were independent of SNS activity and probably parasympathetically mediated (see Tomaka et al., 1999). Both ANCOVAs supported the latter view of parasympathetic influence on HR, both Fs$(3, 92) > 3.91$, $p < .01$. As such, these data suggest that anger and shame both involve a pattern of increased sympathetic influence coupled with parasympathetic withdrawal.

Discussion

This study examined relationships among discrete emotions (i.e., anger, shame, and pride) and patterns of cognitive appraisal, coping, emotional outcomes, and cardiovascular reactivity. The study differed from prior emotion studies in that it examined these relationships in the context of a real, ongoing emotional experience. Our results revealed similarities as well as important differences among the various emotional experiences. Overall, the results suggest that real emotions can be elicited in the laboratory and that researchers can use such reactions to examine relevant theoretical and empirical issues. Table 8 summarizes the major findings.

The results for pride were largely consistent with theoretical predictions. Pride participants appraised the situation as congruent with what they wanted, fair, low in demand, and low in threat. They also expected things to get better and felt able to cope with the situation. Pride participants also reported higher ratings of the CRT for pride (i.e., self-satisfaction). Moreover, pride participants gave better task performances and reported engaging in less emotion-focused coping than anger and shame. Pride participants also experienced positive emotional outcomes including high SSE and outcome satisfaction. Overall, pride was associated with low cardiovascular arousal during the manipulation and postmanipulation phases.

Not all went as predicted—pride participants did not report high problem-focused coping potential, nor did they report engaging in more problem-focused coping. These findings may reflect the fact that the confederate reinforced that they were already doing the task successfully and that extra problem-focused effort was unnecessary.

The results for anger and shame were also largely consistent with predictions. Anger and shame participants both appraised the

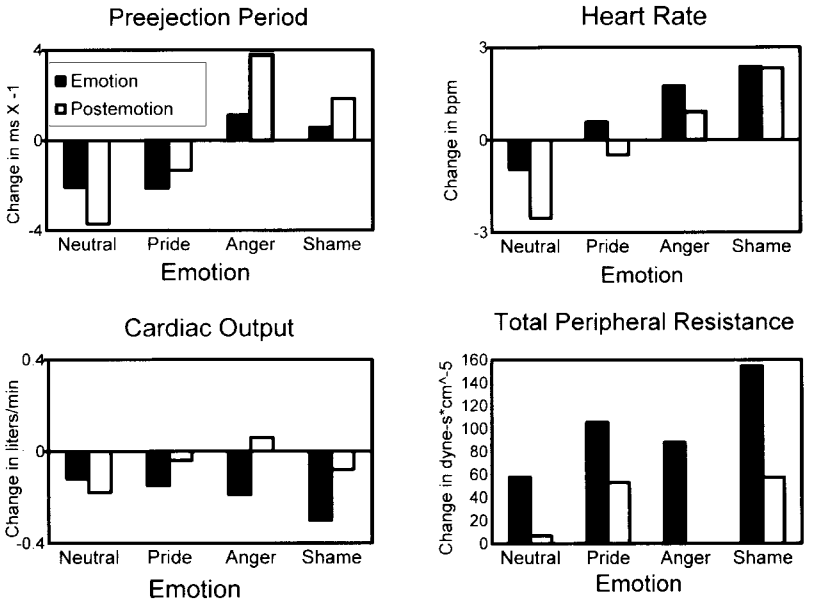

Figure 1. Additional cardiovascular reactivity (within-subjects differences from the neutral task period) for the emotion-manipulation and postmanipulation periods. Preejection period values are reversed so that greater numbers indicate stronger reactions.

situation as goal incongruent, demanding, threatening, and likely to get worse. Of importance, and as expected, anger participants endorsed the CRT for anger (a demeaning offense), whereas shame participants reported the CRT for shame. Regarding coping, anger and shame participants both reported engaging in more emotion-focused coping (i.e., higher social support seeking and defensive coping). Task performance differed between the anger and shame groups, with anger resulting in poor task performance (once the confederate left) compared with shame. This result suggests that anger is more likely than shame to lead to behavioral disengagement. Regarding emotional outcomes, anger and shame were both associated with low performance and social SSE, and both were associated with low outcome and self-satisfaction.

Overall, anger and shame were associated with the greatest physiological arousal. During the emotion-manipulation and post-manipulation phases, anger and shame were associated with high cardiac contractility and HR. However, anger was also associated with the lowest levels of vascular resistance, whereas shame was associated with the greatest levels of vascular resistance.[3] The differing patterns of vascular activity for anger and shame probably reflect differences in (a) alpha adrenergically mediated vasoconstriction, (b) neuroendocrine (i.e., epinephrine) mediated vasodilation, or (c) both. Because epinephrine also enhances cardiac contractility, the high PEP values for anger do suggest the release of epinephrine by these participants. Indeed, researchers have already documented the role of epinephrine in anger responses (Suarez, Kuhn, Schanberg, Williams, & Zimmerman, 1998; Suarez, Shiller, & Kuhn, 1997). Moreover, this effect is consistent with anger's presumed relation to fight or flight responses (Ax, 1953; Frijda, 1987; Lazarus, 1991).

Similar to pride, not all went as predicted. For example neither anger or shame participants appraised the task as unfair, nor did shame participants report higher ratings of their respective CRT, failing to live up to personal standards.

To summarize, the results suggest considerable differences among the three emotional experiences both among themselves and in comparison with the neutral condition. Although pride differed most from the two negative emotions, there were also important cognitive, behavioral, and physiological differences between anger and shame, differences that are consistent with research and theory on emotion.

Overall, the data support the notion that positive emotions are good for psychological health and physical well-being, whereas negative emotions are not. The present results suggest further that each emotion has potentially independent implications for well-being, even if similarly valenced. For example, the data for pride are consistent with research suggesting that positive emotion is associated with favorable outcomes for coping, task performance, and self-esteem. The data also suggest that pride is related to low

[3] The low levels of vascular resistance in the anger and pride groups must be interpreted within the context of the other physiological measures. Low increases or declines in vascular resistance can result from at least two distinct influences—(a) decreasing vasoconstriction (indicating decreased SNS arousal, habituation and return to homeostasis) and (b) active vasodilation in large muscle beds, coronary arteries, and the lungs and bronchi caused by SNS release of epinephrine (indicating increased SNS arousal). The decline in TPR from the manipulation to the postmanipulation period for anger is accompanied by increased cardiac contractility, HR changes, and CO—all suggesting increased SNS arousal and the possible release of epinephrine. This pattern contrasts with the decline in TPR seen in the pride condition, which is accompanied by contractility values lower than baseline, and no real change in HR or CO—none of which suggest the release of epinephrine.

Table 8
Results Summary

Measure			
Appraisals (dimensions and CRTs)	Coping (reported emotion- and problem-focused coping; observer-rated task performance)	Outcomes (SSE and outcome and self-satisfaction)	Cardiovascular reactivity (across manipulation and postmanipulation periods)
Anger			
Goal incongruence High situational demand High situational threat Negative future expectancy Demeaning offense CRT	Defensive coping Social support seeking Performance decrements	Low performance SSE Low social SSE Low outcome satisfaction Low self-satisfaction	Highest PEP (cardiac contractility) High HR Lowest vascular resistance
Shame			
Goal incongruence High situational demand High situational threat Negative future expectancy Fail standards CRT	Defensive coping Social support seeking Performance maintained	Low performance SSE Low social SSE Low outcome satisfaction Low self-satisfaction	High PEP (cardiac contractility) Highest HR Highest vascular resistance
Pride			
Goal congruence Low situational demand Low situational threat Emotion-focused coping potential Positive future expectancy Low injustice Self-satisfaction CRT	Low defensive coping Low social support seeking Increased performance	High performance SSE High social SSE High outcome satisfaction High self-satisfaction	Low emotional arousal

Note. Anger, shame, and pride are emotions. CRTs = core relational themes; SSE = State Self-Esteem scale; PEP = preejection period; HR = heart rate.

cardiovascular arousal (relative to shame and anger); however because pride was still associated with some increased arousal relative to the neutral condition, the data do not completely support the notion that positive emotions are associated with low physiological arousal (Fredrickson & Levenson, 1998).

Perhaps more theoretically important than differences between pride and the two negative emotions were the differences between anger and shame. Specifically, anger and shame were associated with differences in appraisal, task performance, and cardiovascular reaction. Regarding appraisal, although reacting similarly to appraisal dimensions, anger and shame participants did respond differently to CRTs. Moreover, anger was associated with task performance decrements, whereas shame was not. Such emotion-related performance decrements may have real-world consequences.

In addition to appraisal and behavioral performance differences, we also observed important differences in the nature and timing of cardiovascular arousal attributable to anger and to shame. Although the timing of the responses differed, anger was associated with high cardiac contractility and low vascular resistance, shame was associated with more moderate increases in cardiac contractility, but the highest levels of peripheral vascular resistance. As noted, these patterns may have different implications for physical health, with cardiac reactions relating to coronary disease, and vascular reactions relating to the development of hypertension (Manuck et al., 1993).

Implications for Emotion Research

Perhaps the most important aspect of the present data is that they support cognitive appraisal models of emotion using methods that elicited a real ongoing emotional episode. As described above, the vast majority of past appraisal studies have been conducted using tasks that are dubious in their ability to elicit authentic emotional experiences. Not only was our method theoretically based, but it produced discrete emotional responses that were confirmed by participants' reports on themselves that differed in physiology, and which could be evaluated by coders blind to the purposes of the experiment. Our cognitive, behavioral, and physiological data provide strong support for emotion specificity and suggest that discrete emotional states can be elicited reliably in the laboratory. Although our analysis was limited to a very circumscribed set of emotions, we hope future research will use methods similar to ours to investigate the patterns of appraisal, coping, behavior, and physiology of other discrete emotions.

More generally, these data have implications for models of affect and emotion that differ in whether they conceptualize emotions as multiple discrete categories (Lazarus, 1991; Smith & Kirby, 2000) or conceptualize them as valenced states that fall along a couple of orthogonal dimensions (Larson & Diener, 1992; Watson & Tellegen, 1985). The categorical view posits a finite set of basic or discrete emotions (e.g., joy, fear, anger, sadness, disgust), where each has its own unique emotional meaning or

relationship with the environment, subjective experience, facial expression, and behavioral tendency. The dimensional view, in contrast, suggests that two broad factors constitute the major dimensions of affective experience and these dimensions are usually labeled *negative* and *positive* affect, or *valence* and *arousal*. Dimensional models have important implications for emotion, because they suggest considerable redundancy among what others consider to be unique and discrete psychological states.

Watson, Tellegen, and Clark (Watson et al., 1988; Watson & Tellegen, 1985) have developed a model that integrates these two extremes by proposing a hierarchical structure to describe the report of affective experience. The model suggests two broad higher order factors (negative affect and positive affect) that are composed of several correlated, but ultimately distinct emotional states (e.g., fear, anger, joy, interest). The lower levels of this model reflect the content of the specific affect, whereas the upper levels reflect their valence. The four negative affects in their scheme include fear, sadness, hostility, and guilt, and Watson and Clark (1992) provide evidence for their convergent and discriminant validity.

Overall the current data support some aspects of Watson et al.'s (1988) model quite well. For example, we observed large uniform differences between the one positive and two negative emotions. Moreover, the differentiation between anger and shame supports the general idea of clearly separable negative affects, and they do so using data of a vastly different nature than those used as the basis for the model. The degree of consistency with the more specific aspects of their model, however, depends on the relationship of our shame concept to their guilt concept. If the concepts are synonymous, as some have suggested (Shaver, Schwartz, Kirson, & O'Connor, 1987), then the degree of overlap is high; if they are not synonymous, however, as others have suggested (Tangney, 1995; Tangney et al., 1997), then our data suggest limitations to their conception of lower level negative affects. Of course, by demonstrating important and theoretically consistent differences between anger and shame, our data strongly support a categorical view of emotion—a perspective that we prefer. In either case, critical discussion of this debate is beyond the scope of this article.

Implications for Autonomic Specificity and Cardiovascular Reactivity

Overall, the results for emotion-related cardiovascular responses support the idea of autonomic specificity of emotions. Whereas pride was associated with low cardiovascular arousal, results showed that anger and shame were associated with increased cardiac contractility (PEP) and HR reactivity. ANCOVA results indicated independence of the two effects, suggesting both an increase in sympathetic outflow and a withdrawal of parasympathetic restraint. Moreover, the results suggest that anger and shame also differ, with anger being associated with the greatest cardiac reactivity, coupled with low peripheral vascular resistance, and shame being associated with more moderate cardiac reactivity, but coupled with the highest elevations in vascular resistance.

Relation of Anger and Shame to Patterns of Cardiovascular Reactivity

The patterns for anger and shame mirror those found in stress research for the stress-related experiences of challenge and threat (Tomaka et al., 1993, 1997, 1999). Specifically, this research has shown that challenge cardiovascular responses are associated with high cardiac reactivity coupled with low vascular resistance, whereas threat responses are associated with moderate cardiac reactivity coupled with high vascular resistance. As such, anger resembles challenge, whereas shame resembles threat. Although the association between shame and threat responding is straightforward, the similarities between anger and threat stop at the cardiovascular level. Specifically, challenge is associated with low negative affect, low emotion- and high problem-focused coping, successful task performance, and high outcome satisfaction—all the opposite of results for the anger group.

The common denominator between anger and challenge, however, may be activation of the sympathetic adrenomedullary axis and the release of epinephrine. In addition to boosting cardiac contractility and HR, epinephrine also causes active vasodilation in certain vascular beds including the heart, large muscles, lungs, and bronchi (Berne & Levy, 1983), and can result in actual declines in peripheral vascular resistance under stress (Blascovich & Tomaka, 1996). Considering that epinephrine release and circulation around the body takes more time than neurally mediated activation, it is not surprising that we see the trend for anger to become enhanced in the postinduction phase of the experiment. Given the timing of the emotion induction, it is only during the postmanipulation period that we might expect this reaction to exert its full effect. As such, anger and challenge may be similar "energy mobilization responses," but in support of different functions (i.e., readiness to attack vs. instrumental appetitive drive).

The similarity between anger in the present experiment and past research on challenge questions the presumed beneficial long-term health consequences that have been assumed for challenge responses relative to threat responses (Blascovich & Tomaka, 1996). Indeed, on the basis of cardiovascular physiology alone, repeated challenge experiences may be associated with hypertension and cardiovascular disease in much the same way as repeated anger is related to these outcomes (Booth-Kewley & Friedman, 1987; Dembroski & Costa, 1987; Matthews, 1988). As such, it may not be the nature of the individual response that necessarily leads to poor health and disease, but the frequency with which people experience it.

Regarding reactivity during the postmanipulation period, the results showed that anger continued to be associated with high cardiac contractility reactivity, and similarly that shame continued to be associated with high HR reactivity. If nothing else, the postmanipulation data demonstrate that some emotional reactions are relatively enduring.

Consistency With Hypotheses

Although we had three hypotheses for anger, the results were most consistent with the hypothesis that anger is associated with Type I, flight/fight (challenge) responses reflected by increased cardiac activity (Williams et al., 1985) and low vascular reactivity. Our only hypothesis for shame was that it would be associated with threat responses including moderate cardiac activity coupled with high vascular resistance. The results, particularly during the manipulation phase, provided strong support for this hypothesis. Finally, like anger, we also held competing hypotheses for pride: One based on challenge and instrumental/appetitive responding,

the other based on autonomic specificity research, suggesting low arousal. Overall, the results favored the latter, though not entirely. Specifically, although pride was associated with lower cardiac arousal than anger and shame (during the emotion-manipulation and postmanipulation periods), and associated with lower increases in vascular resistance than shame, it was still associated with cardiovascular elevations above the neutral condition. As such, these data only partially support the notion that positive emotions are associated with low physiological reactivity (Levenson, Cartensen, Friesen, & Ekman, 1991; Levenson et al., 1990) or are soothing (Fredrickson & Levenson, 1998). We feel that the nature of the pride manipulation contributed to the data falling more in line with the autonomic specificity hypothesis than the challenge/instrumental motivation hypothesis. Recall that pride participants received positive feedback and praise regardless of their actual performance. As such, they must have felt that they could perform the task well without even trying (i.e., having to exert effort). As such, the task was pleasant and flattering, but not at all challenging.

Conclusions and Limitations

We draw several conclusions from this study. First and foremost, this study demonstrates convincingly that authentic emotions can be elicited reliably in laboratory contexts and that such emotions are associated with reliable patterns of appraisal, coping, and cardiovascular reactivity. Second, the data provide fairly convincing evidence for emotion specificity, enhancing the validity emotions that posit discrete emotions over broad affect dimensions. Third, the results show evidence for psychological and physiological mechanisms whereby negative emotions can have detrimental effects for psychological (e.g., performance, self-esteem) and physical (cardiac and vascular) health; and whereby positive emotions are beneficial for these outcomes. Of course for discrete emotions to have such long-term effects, their experience must be frequent or chronic.

Finally, the results suggest areas of intervention for treating negative emotional syndromes, such as addressing performance withdrawal in frequent anger. Here, knowledge of the appraisals and coping with discrete emotions may provide insight into what people are experiencing, and illuminate what health care providers can address to reduce their negative impact. Thus, these results support the inclusion and assessment of these psychosocial factors in the prevention and treatment of emotional and physical disorders.

The study was of course limited in several respects. First, although we believe we elicited real and fairly intense emotional experiences, the magnitude of our laboratory experiences probably still pales in comparison to some real-life emotions. For example, the pride a parent has for his or her child, the shame a child experiences when he or she fails her first test in school, or the outrage an academic feels when he or she is unfairly denied tenure, are all considerably "hotter" than the present experiences, in part because these latter experiences are not subject to ethical standards.

A second limitation is that we were able to examine only a small set of emotional experiences, and our choices of these were at some level guided by practical concerns at the expense of theoretical ones. For example, our choice of pride, anger, and shame as the target emotions was partially determined by our perceptions of the ease of eliciting these emotions using a confederate trained to do so. Emotions such as hope, disgust, jealousy, and sadness seemed harder to elicit in this context. Regardless, we hope that our work will encourage other researchers to go after real emotional reactions in their own research.

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Appendix

Cognitive Appraisal Items

Emotion- and Stress-Related Appraisal Dimensions

Does it matter to you whether you perform this task well? (goal relevance)

Is performing this task something you want to do or would rather not do? (goal congruence)

Is performing this task a desirable thing or an undesirable thing? (goal congruence)

Who or what is responsible for you having to perform this task? (blame or credit)

1. I am responsible, I chose this experiment myself.
2. I am responsible, but I didn't have much of a choice.
3. Someone else is responsible, but he or she didn't have much of a choice.
4. Someone else is responsible, he or she chose the task.

Is having to perform this task due to fate? (circumstances/no one responsible)

No one is responsible for me having to perform this task, it was just circumstances or fate. (circumstances/no one responsible)

How able are you to cope emotionally with the task? (emotion-focused coping potential)

Are you able to regulate your emotional reactions to the task? (emotion-focused coping potential)

Are you performing the task successfully? (problem-focused coping potential)

Do you think you can perform the task successfully? (problem-focused coping potential)

As things progress in the next few minutes, do you expect to feel good or bad? (future expectancy)

Do you expect the way things are going now to get better or worse? (future expectancy)

Do you feel that having to perform this task is unfair? (justice/fairness)

Having to perform this task is unjust. (justice/fairness)

How demanding is the task you are performing? (situational demand)

Do you think the task is very hard or difficult? (situational demand)

How threatening is the task you are performing? (situational threat)

Are you threatened by the thought of having to perform this task? (situational threat)

Core Relational Themes (CRTs)

A demeaning offense (the CRT for anger)

I feel mistreated.
I feel cheated or wronged.
Someone else is to blame for the rotten situation I'm in.

(*Appendix continues*)

Self-blame (the CRT for shame)

I am to blame for this bad situation.
Things are going bad because of me.
I am to blame for messing things up.

Self-satisfaction (the CRT for pride)

I am responsible for how well things are going.
I am very satisfied with what I am accomplishing.
Things are turning out well because of what I am doing.

Uncertain threat (the CRT for anxiety)

I feel uncertain and threatened by this situation.
I am facing an uncertain threat.

Failing to live up to society's standards (the CRT for guilt)

I am transgressing a moral imperative in this situation.
I feel badly because I am failing to live up to society's standards and expectations.

Failing to live up to personal standards (the CRT for shame)

I am failing to live up to an ego-ideal in this situation.
I am failing to live up to my own personal standards and expectations.
I am not doing as well as I want.

Irrevocable loss (the CRT for sadness)

I am experiencing an irrevocable loss (I can't do anything about it).
I feel a great loss.

Goal consistency (the CRT for happiness)

I feel that I am making reasonable progress toward the realization of a goal.
I am glad about how things are going in this situation.
Things are consistent with my goals.

Feeling worthless (the CRT for self-disgust)

I wish I could be someone else.
I feel worthless.
I feel useless.

Received March 23, 2001
Revision received March 4, 2002
Accepted March 6, 2002 ■