3. Challenge and Threat Appraisals

The Role of Affective Cues

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Introduction

In their well-known debate that took place nearly two decades ago, Zajonc (1981, 1984) and Lazarus (1981, 1984) discussed the primacy of affect versus cognition. These arguments foreshadowed a continuing lack of integration between purely affective and cognitive mechanisms and processes in social psychological theories on a wide range of topics (e.g., coping, persuasion, prejudice, motivation).

Until recently, our own theoretical perspective on challenge and threat (e.g., Blascovich, 1992; Blascovich & Tomaka, 1996) had much in common with Lazarian appraisal theory emphasizing (albeit not exclusively) the operation of usually conscious cognitive processes. However, recently we have become convinced that affective cues influence the experience of challenge and threat not only indirectly, via their influence on cognitive processes (see Smith and Kirby, this volume), but also directly and noncognitively in ways quite compatible with Zajonc's arguments and evidence (see Zajonc, this volume), as well as those of LeDoux (1996).

This chapter represents our initial attempt to integrate purely affective and cognitive processes into our biopsychosocial model of challenge and threat. We present our current theorizing on the appraisal component of our more general biopsychosocial model of challenge and threat (cf. Blascovich & Tomaka, 1996; Blascovich, 1992), and we

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briefly review our research validating the cardiovascular indexes of challenge and threat that we have developed. We then turn to the role of affective stimuli on challenge and threat appraisal processes and discuss research suggestive of that role. The first order of priority, however, is to define what we mean by *challenge* and *threat*.

Challenge and Threat

For us, challenge and threat represent person/situation-evoked motivational states that include affective (or emotional), cognitive, and physiological components. To consider these solely as emotional, cognitive, or physiological states undermines their richness and intricacy. Thus, challenge and threat represent the complex and likely simultaneous interplay of affective, cognitive, and physiological processes. Affectively, they involve positive and negative feelings and emotions; cognitively they form what Lazarus (1991) termed "core relational themes"; and physiologically they relate at least loosely to approach/avoidance or appetitive/aversive states.

As elucidated more fully in the next section, challenge occurs when the individual experiences sufficient or nearly sufficient resources to meet situational demands. Threat occurs when the individual experiences insufficient resources to meet situational demands. Because of the idiosyncratic nature of these reactions one individual may experience challenge in a particular situation (e.g., a final exam, a championship tennis match), whereas another may experience threat. Furthermore, the same individual may experience challenge in a particular type of situation at one time (e.g., taking a first exam in a course) but threat at another time (e.g., taking a second exam).

We have limited the context of our theoretical and empirical work nearly exclusively to nonmetabolically demanding performance situations, that is, those situations high in psychological demands relative to physical demands (but see Rousselle, Blascovich, & Kelsey, 1995; Blascovich et al., 1992). Furthermore, within the category of nonmetabolically demanding situations, we have limited ourselves to those involving active performance (e.g., speech giving, verbal and mathematical problem solving, game playing) rather than passive performance (e.g., viewing a scary film, listening to rousing music). We do not mean to imply that our work is irrelevant either to metabolically demanding or to passive performance situations, only that we limit its generalizability at present to the nonmetabolically demanding, active

performance context. We believe that such contexts abound in everyday life (including home, work, and recreational contexts) and provide an important opportunity to better understand and explain the interplay of affective and cognitive processes.

The Biopsychosocial Model of Challenge and Threat

Our biopsychosocial model of challenge and threat rests on the *identity thesis*. Psychophysiologists and other neuroscientists embrace this thesis, the fundamental assumption of which is in sharp contrast to Descartes's notion of mind/body dualism that all psychological phenomena are embodied (Cacioppo & Tassinary, 1990). Paying more than lip service to the identity thesis, psychophysiologists, including social psychophysiologists, seek answers to questions generated from psychological theory, in part, by pursuing, developing, and validating physiological indexes of psychological constructs. Investigators have used physiological indexes to assess a plethora of psychological processes and constructs, including affective, cognitive, and motivational ones (Blascovich, in press).

Our own investigation of what we term "challenge" and "threat" has relied heavily on cardiovascular response patterns indicative of these states. We believe that these indexes enable us to identify challenge and threat *in vivo* and thus make it possible to examine the influence of psychological and social factors on challenge and threat experiences.

We describe our full arousal-regulation model elsewhere (Blascovich & Tomaka, 1996). Here we focus on the key initial process in our model (depicted in Figure 3.1), the situation-physiological response component.[1]

Performance Situations

The challenge and threat process begins in a situation in which a person expects to perform. For challenge and threat processes to commence, the person must perceive the performance situation as *goal-relevant* and *evaluative*. Specifically, the individual must believe that adequate performance is necessary to his or her continued well-being or growth. The individual must also believe that he or she will undergo evaluation in this situation, either by others or by oneself, on some important self-relevant domain. Academic examinations for col-

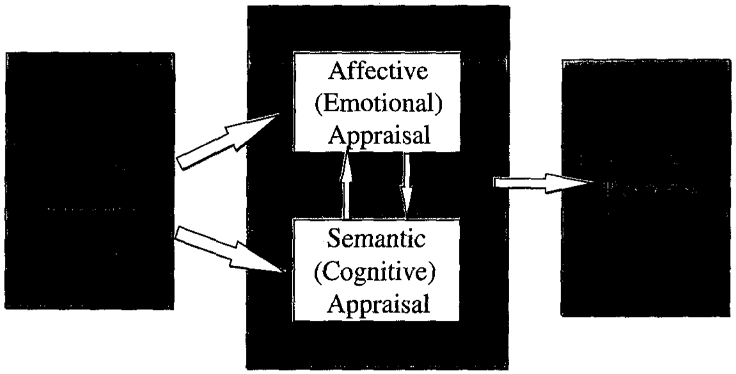

Figure 3.1. Situation-physiological response component.

lege students, lectures for college professors, and counseling sessions for clinicians provide examples of such performance situations.

Though *performance* required by the situation on the part of the actor may take either an *active* or *passive* form, or both, we focus on the former, as just mentioned. Active performance requires instrumental cognitive responses in the individual. Without these responses, the performance aspects of the situation (e.g., giving a speech, taking an exam, playing a game) cease, and the nature of the situation changes radically. Though not instrumental to task continuation, active performance situations generally also include emotional responses (e.g., anxiety, confidence) and behavioral responses (e.g., vocalizations, muscle movement). In contrast, passive performance may include responses noninstrumental to task continuation. These may be cognitive responses (e.g., mentally distracting oneself while watching a scary film), behavioral responses (e.g., closing one's eyes), and emotional ones (e.g., fear).

Finally, the situation may be metabolically (e.g., require large muscle movements) or nonmetabolically demanding. We have focused on nonmetabolically demanding performance situations largely because the expected cardiovascular responses differ under metabolically demanding and nondemanding situations.

Appraisal

Our recent model specified *cognitive* appraisal as the initial mediator in the challenge and threat process. In our previous theoretical state-

ments (e.g., Blascovich & Tomaka, 1996), we posited a fairly simple cognitive appraisal process consisting of "primary" appraisals (of situational demands) and "secondary" appraisals (of the individual's resources). This simple model served us well initially. However, it has become apparent that the cognitive appraisal rubric does not capture the nature of appraisal processes fully. Here we expand and reframe these earlier notions.

Demand Appraisal. The appraisal process consists of the interplay between demand and resource appraisals. Demand appraisals involve the perception or assessment of danger, uncertainty, and required effort inherent in the situation. At this time, we choose not to specify an exact calculus for demand appraisals using these dimensions. They may be additive. They may be interactive or synergistic. Or, perceptions of high demand on any one of these dimensions may trigger high overall demand appraisals. Perceptual cues associated with danger, uncertainty, and required effort undoubtedly contribute to demand appraisals.

Resource appraisals involve the perception or assessment of knowledge and skills relevant to situational performance. Again, we cannot specify an exact calculus for resource appraisals. They may be additive, synergistic, or such that appraisal high on one dimension triggers high overall resource appraisals. Perceptual cues associated with knowledge and skills undoubtedly contribute to resource appraisals.

As stated earlier, *challenge* occurs when the individual experiences sufficient or nearly sufficient resources to meet situational demands. For example, playing chess against an opponent perceived as worse or slightly better than oneself results in a state of challenge. Threat occurs when the individual experiences insufficient resources to meet situational demands. In the chess example, playing against a player who is clearly superior to oneself results in a state of threat. The cases of extremely high levels of resources compared to demands or extremely high demands compared to resources are likely to make the situation nonevaluative for the performer. Hence, challenge and threat states do not occur (e.g., when playing chess against an inexperienced young child, playing chess against Bobby Fisher).

Apart from their substance, appraisals vary on at least two important psychological dimensions: self-consciousness and consciousness. Neither demand nor resource appraisal need be self-conscious. Individuals may make conscious appraisals without being aware that they are engaging in an appraisal process. The poker player, for example, may weigh or compare various strategies consciously without being aware that she or he has engaged in such a comparison process. More important, neither demand nor resource appraisals need even be conscious. The individual may make nonconscious demand or resource appraisals, or both, arriving at a state of challenge or threat without any awareness of the appraisals themselves. Conscious and nonconscious appraisals may occur in parallel. The more conscious the appraisal, the more elaborate and time consuming the process. However, even conscious appraisals such as those in familiar motivated performance situations can be quite fast.

In addition, appraisals may involve affective (i.e., feeling) processes, cognitive (i.e., semantic) processes, or both. Early and continuing work by Zajonc and his colleagues (see Zajonc, this volume) clearly demonstrates that affective processing can occur independently of cognitive processing. Recent work by LeDoux (1996) confirms and extends Zajonc's notions in this regard. LeDoux suggests that affective and cognitive processing systems, though independent, may actually communicate with one another. Figure 3.1 illustrates the appraisal link in the situation-physiological response component of our model to incorporate the conscious and nonconscious, affective and cognitive processing possibilities described here. In our view, nonconscious appraisals may be reflexive or learned.

Finally, we must note the iterative nature of the appraisal process. Before and during actual task performance, individuals continuously reappraise the situation. What may begin as a threatening situation for an individual may become less threatening or even challenging, and vice versa. For example, a student may be more threatened by some questions on an exam than others. A lecturer may become more challenged by positive audience feedback. Neither the situation nor the individual remain perfectly static during performance situation episodes. Both act upon the other, and external events may intervene.

Physiological Responses

Cardiovascular. Among physiological systems, the cardiovascular system appears particularly attuned to challenge and threat. Whether this specific "tuning" resulted evolutionarily from some sort of adaptive advantage inherent to early development of the "visceral" brain (i.e., midbrain and the medial cortex) and its role in "fight or flight" responses, though interesting, remains incidental to our arguments here.

We have devoted much work to the delineation of cardiovascular response patterns evoked during goal-relevant, active performance situations. Drawing on the early psychophysiological theorizing of Paul Obrist (1981) and the more recent theorizing of Richard Dienstbier (1989), we have developed indexes of challenge and threat on the basis of patterns of autonomically and endocrinologically controlled cardiovascular responses.

Accordingly, increased activity of the sympathetic-adrenomedullary (SAM) axis marks the challenge pattern. Specifically, sympathetic neural stimulation of the myocardium occurs, thereby enhancing cardiac performance. Such enhanced cardiac performance occurs by means of sympathetically enhanced ventricular contractility, thereby increasing stroke volume, which together with increased heart rate enhances cardiac output. At the same time, adrenal medullary release of epinephrine causes vasodilation in the large skeletal muscle beds and bronchi, which results in a general decline in systemic vascular resistance. This pattern generates relatively unchanged hemodynamic (i.e., blood pressure) responses. As Figure 3.2 shows, the challenge pattern (represented by the white bars) is characterized by

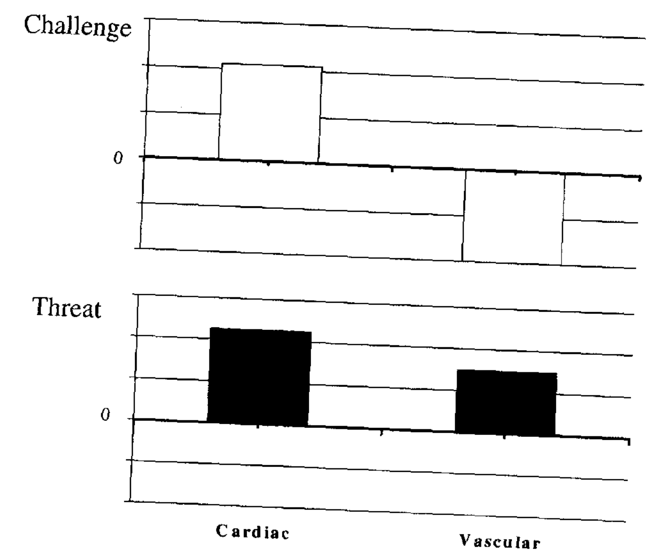

Figure 3.2. Cardiovascular patterns of challenge and threat.

increases in cardiac activity coupled with decreases in peripheral resistance, or vasodilation. This pattern mimics cardiovascular performance during aerobic exercise and represents the efficient mobilization of energy for coping.

Increased activity of the SAM axis together with increased activity of the pituitary-adrenal-cortical (PAC) axis marks the threat pattern. This PAC activity serves to inhibit the SAM-generated release of epinephrine from the adrenal medulla. Consequently, contractility and stroke volume, heart rate, and cardiac output increase, but without accompanying decreases in systemic vascular resistance (i.e., vasodilation). Rather, vasomotor tone does not change and may even increase slightly. This pattern results in relatively large increases in hemodynamic responses (i.e., blood pressure). In Figure 3.2 the threat pattern (represented by the black bars) is characterized by increases in cardiac activity coupled with no change or increases in peripheral resistance, or vasoconstriction.

Expressive. To the extent that appraisals resulting in challenge and threat carry hedonic tone, we expect activation of expressive physiological responses sensitive to affect. Prototypically, somatic responses constitute such expressive physiological responses, particularly facial somatic activity (Blascovich, in press). Thus, we expect greater activity in the region of the corrugator supercilii muscles (brow) region during threat than during challenge and greater activity in the region of the zygomaticus major muscles (cheek) during challenge than during threat.[2]

Physiological versus Subjective Responses. We take the position that physiological, particularly cardiovascular, responses to appraisal outcomes provide relatively unambiguous evidence of challenge and threat states within the individual. These responses provide continuous, on-line information in this regard and sensitivity to changes in appraisal over time.

Whether or not individuals can veridically articulate their appraisals during (or after) a performance situation depends on the degree to which they are conscious of the appraisal process, the extent to which such appraisal processing occurs consciously, and the extent to which self-presentation concerns predominate. Much more room for error exists when one tries to capture appraisals via self-report than physiologically, though such reports can provide important information to investigators, and we must sometimes still rely on them for our purposes.

Research Validating Cardiovascular Indexes of Challenge and Threat

As just mentioned, we devoted much of the early empirical work on our model to the validation of cardiovascular response patterns as indexes of challenge and threat appraisals. Toward this end, we conducted three types of studies: free appraisal, manipulated appraisal, and manipulated physiology studies.

Free Appraisal Studies. In three separate studies (reported in Tomaka, Blascovich, Kelsey, & Leitten, 1993), we created nonmetabolically demanding active performance situations. We believe that participants perceived these situation as goal-relevant and evaluative in large part because they were "psychology experiments" (cf. Rosenberg, 1965). We used verbal arithmetic operations (i.e., serial subtraction) as the actual performance tasks in the psychology experiment situation.

We assessed baseline cardiovascular responses before participants received task instructions, after task instructions, and throughout task performances. After the instructions but before commencement of the tasks, we assessed participants' self-reported demand and resource appraisals for the upcoming task. From these, we calculated the relationship between these two assessments (i.e., demand in relation to resources). Following the tasks, we assessed self-reported post-task stress ratings. We also recorded performance data on the math tasks themselves.

We obtained the expected results in all three studies.[3] Physiologically, the patterns of cardiovascular responses associated with challenge (resources > demands) and threat (demands > resources) were as follows (see also Figure 3.3): Challenged participants exhibited increased cardiac performance coupled with reduced total peripheral resistance (i.e., vasodilation), while threatened participants exhibited increased cardiac performance coupled with slightly increased total peripheral resistance (i.e., vasoconstriction). Not surprisingly, as a consequence of these patterns threatened participants exhibited higher levels of blood pressure (i.e., mean arterial pressure). Subjective post task reports of stress during task performance indicated greater stress

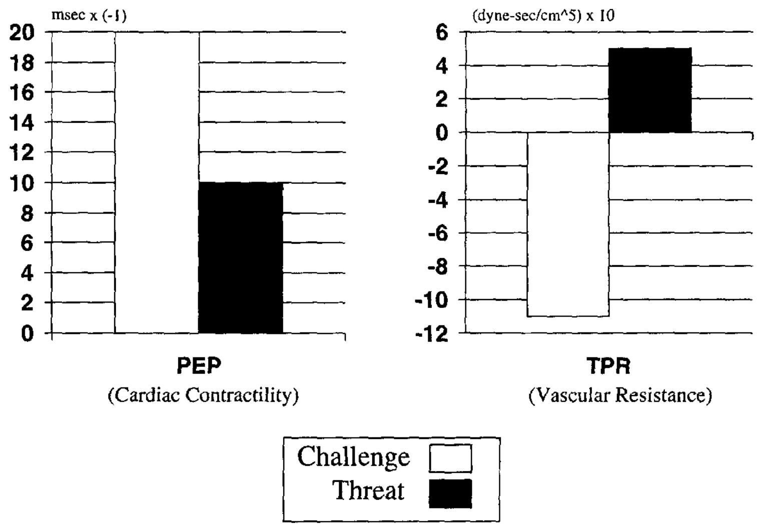

Figure 3.3. Cardiac and vascular patterns (adapted from Tomaka, Blascovich, Kelsey, & Leitten, 1993).

for threatened as opposed to challenged participants. Finally, challenged participants outperformed threatened participants not only in attempted subtractions but also in accurate subtractions.

Manipulated Appraisal Studies. Though our free appraisal studies strongly suggested the validity of the predicted challenge and threat cardiovascular patterns, these correlational studies relied heavily on the self-selection of participants into challenge and threat groups. In a subsequent experiment (reported in Tomaka, Blascovich, Kibler, & Ernst, 1997) in which we used the same basic performance situation as in the free appraisal studies, we manipulated challenge and threat experimentally via instructional set and paralanguage (i.e., tone). Participants randomly assigned to the threat condition heard audiotaped instructions emphasizing the mandatory nature of task performance and the intention of the investigators to evaluate the participants' performance. Participants randomly assigned to the challenge condition heard audiotaped instructions, including a request that they try their best and to think of the task as one to be met and overcome.

The manipulation produced the expected appraisal patterns: Participants in the threat condition reported the task as more demanding and their resources as less demanding than participants in the challenge condition. Cardiovascular patterns demonstrated the predicted threat and challenge patterns (see Figure 3.4). These experimental data provide more powerful support for the validity of our cardiovascular indexes.

Manipulated Physiology Studies. We conducted one additional set of experiments to further validate the challenge and threat patterns. We wanted to determine whether the physiological patterns indexed appraisal or vice versa. Perhaps we had it backwards. By peripheralist reasoning, appraisal should follow from and index the physiological patterns. Accordingly, we attempted to manipulate independently the physiological patterns to see if appraisals followed from the patterns.

In one study, we manipulated the patterns via aerobic exercise (moderate versus rest). Moderate aerobic exercise produces a pattern of cardiovascular response very similar to our challenge pattern. In another, we manipulated the patterns via external pressor (cold vs. warm). Immersion of a hand or foot in nearly freezing water produces a pattern of cardiovascular response similar to our threat pattern, while immersion in warm water produces a pattern similar to our challenge pattern. In both studies, the cardiovascular manipulations preceded and continued during performance task instructions, self-

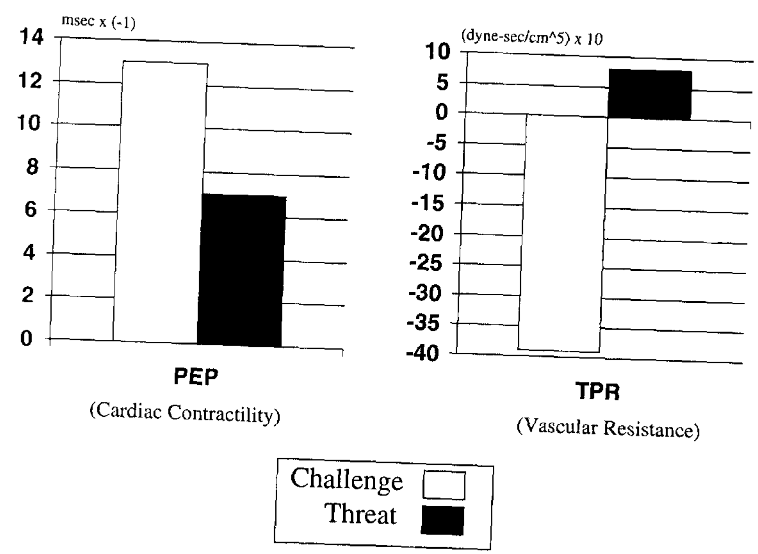

Figure 3.4. Cardiac and vascular patterns (adapted from Tomaka, Blascovich, Kibler, & Ernst, 1997).

reported demand and resource appraisals, and the first two minutes of task performance. Though the cardiovascular manipulations had the desired effects, appraisals did not differ as a function of cardiovascular pattern in either study. Hence they added further, albeit null, evidence to support our cardiovascular indexes of challenge and threat.

The Role of Affective Cues on Challenge and Threat Appraisal Processes

Sometimes by design, sometimes inadvertently, we have employed specific affective stimuli or cues in our manipulations of intrapersonal (e.g., dispositions, attitudes) and interpersonal factors (e.g., presence of others, race, ethnicity) thought to influence the appraisal process. We have performed manipulations using vocal tone, music, and pain. We have included sensory objects potentially laden with affective meaning for participants in our performance situations including attitudinal objects, pets, and physical stigma.

In reviewing and reframing our work in order to consider the role of affective cues in the appraisal process, we have discovered a remarkable consistency in the likely impact of affective cues on appraisals, cues that we (and appraisers) cannot reasonably and rationally relate to the objective performance requirements of participants' tasks. We believe that our work and that of others (LeDoux, 1996) suggests that such cues may lead to challenge or threat appraisals via affective processing or appraisal sometimes independently of, and sometimes together with, cognitive processing or appraisal. Furthermore, affective cues appear to play a role in both demand and resource appraisals.

Typology of Affective Cues

Note that when we speak of affective cues, we mean sensory objects in the situation that may elicit affective responses or meaning. These include animate and inanimate objects, sounds, smells, and touches: for example, a good friend, a doll, a gift, a special song, a room, perfume, a touch on the wrist. We explicitly exclude ongoing or ambient mood from this discussion, though we certainly believe that mood can have important effects on appraisals in performance situations (see Ernst, 1995), both demand appraisals (e.g., depressed individuals may perceive the effort required by a task as relatively high) and resource appraisals (e.g., elated individuals may perceive great confidence for task performance). We acknowledge that affective cues may trigger mood processes that can influence appraisals, but our focus here is more on the acute and direct effects of the cues themselves.

Conscious versus Nonconscious. Sensory objects may elicit both conscious and nonconscious affective processes in the individual. As affective cues, certain sensory objects have affective or emotional meaning for the individual. Though this meaning can certainly reach consciousness, it often fails to do so. However, the failure to reach awareness does not preclude psychological and behavioral effects of affective cues, as Zajonc (this volume) has shown.

Support for both conscious and nonconscious processing of emotion stems from work by neuroscientists and comparative psychologists. The neural systems perspective includes both conscious and nonconscious emotional responses mediated by different neural networks originating in the amygdala (LeDoux, 1995). Defensive responses can elicit both nonconscious and conscious emotional responses.

Learned versus Nonlearned. Whether or not cues elicit conscious or nonconscious meaning, affective or emotional meaning imputed to sensory objects (i.e., affective cues) may be learned or innate. No one would argue against the notion that individuals learn the affective or emotional meaning of many objects throughout their lives. Furthermore, few would argue that such learning can take place via semantic and associative processes. The argument that specific sensory cues can elicit nonlearned or innate affective or emotional meaning is somewhat controversial, but suggestive theoretical arguments and empirical evidence exist. For example, evolutionists argue that our own and other species have attached affective meaning to sensory objects (e.g., snakes) that have or have had significance for survival. Jungians describe such objects as archetypes that exist in the collective unconscious.

Certain categories of sensory stimuli appear to elicit affective-type responses, thereby implying the automaticity of at least some affective meaning. Psychophysiologists know quite well that sudden, intense stimuli elicit defensive responses reflexively. Lang, Bradley, and Cuthbert (1990) have theorized and demonstrated convincingly that hedonically toned reflexes such as startle eyeblinks are facilitated or inhibited by affective cues.

More directly, researchers have demonstrated that both visual and auditory objects elicit inborn affective meaning. Infants prefer graphic oval-shaped representations of faces over graphic face-shaped representations incorporating all the same facial features (e.g., nose, lips, eyes), but with such features arranged randomly (Fantz, 1958, 1961). Similarly, infants prefer rhythmic heartbeat sounds to nonrhythmic ones (Salk, 1973). And affective meanings can become automatic through associative learning processes. Whether or not affective meaning evoked by sensory cues is learned or innate poses little problem for our conception of the appraisal processes. Either type can affect appraisals, though one would expect innate affective cues to be much more resistant to modification than learned ones.

Demand Appraisal

Required Effort. Recall that, according to our model, demand appraisals involve assessments of required effort, danger, and uncertainty. Regarding required effort, our current theorizing suggests that affective cues play little role in its assessment. Instead, we believe that perceived task difficulty and task length in large part determine required effort, at least with regard to the inherent performance requirements of active tasks. However, we remain open to evidence that affective cues play a role in the assessment of required effort.

Danger. Affective cues certainly appear to play a role in danger appraisals. We learn the affective meaning of some such cues. Within cultures and subcultures, we may share affective meaning associated with them. Some types of affective cues appear more obvious than others in this regard. For example, a lone customer sporting a skull and cross-bones tattoo and wearing the colors of a motorcycle gang on a black leather vest may well signal danger to a lone clerk in a convenience store. This would make the customer transaction more threatening to the clerk. Conversely a lone customer wearing a police uniform and badge may well signal safety to the same clerk. This would make the transaction more challenging.[4] Other types of learned affective cues appear more subtle but have the same effects. Thus, to a hearing person, a hostile voice or one with a certain accent may

cause threat or challenge appraisal as a function of prior learning of associated affective meaning.

Innate cues should operate similarly. For example, a multiple comparison task or a dissection task involving snakes may prove more threatening than tasks involving butterflies. Indeed, that such danger appraisal occurs forms part and parcel of the evolutionary argument underlying the existence of nonlearned cues.

Uncertainty. Affective cues may play an even larger role in the assessment of situational and task uncertainty. Individuals generally prefer familiar objects, which Zajonc (this volume) has shown to reduce situational uncertainty. For example, the child's security blanket or the child's (or adult's) teddy bear can make even a novel performance environment less uncertain. Absence of familiar objects increases situational uncertainty. If one subscribes to attachment theory (Bowlby, 1988), the secure attachment figure (i.e., the secure base) represents the ultimate affective cue in this regard. Likewise, familiar objects can reduce task uncertainty. For monolingual English speakers, purely spatial manipulations of Chinese ideographs or Russian words composed of letters from the Cyrillic alphabet may engender more uncertainty than spatial manipulations of English words composed of letters from our own alphabet.

Resource Appraisal

The extent to which affective cues affect resource appraisals may at first appear less clear-cut than the extent to which they affect demand appraisals. However, we can make a case for such a role. Certain sensory objects can serve as affect-laden symbols associated with resources or their absence. Objects that form the basis for superstitions provide some good examples. Hence, talismans and good luck charms may cause resource appraisals of confidence or even invincibility while their absence may cause more negative resource appraisals, as in the case of the baseball pitcher who continues to wear the same socks or underwear in each game of winning streak. The resource superstitions behind other objects may not appear so obvious, as in the case of the surgeon who cannot operate well without listening to music, the symphony conductor who cannot direct the orchestra well without a specific baton, the author who cannot write without holding a cigarette, or the woman who cannot flirt without wearing makeup.

Additional Considerations

Finally, we must add a couple of points. First, affective cues may play multiple roles in the appraisal process, both within and between the demand and resource appraisal categories. For example, the presence of a pet dog in a performance situation may decrease danger appraisal, increase situational familiarity (thereby decreasing uncertainty appraisal), and serve as a good luck charm (thereby increasing resource appraisal). A hostile vocal warning by an instructor in an academic testing situation may increase danger appraisal, decrease situational familiarity, and decrease resource appraisal.

Second, many sensory cues carry both affective and semantic meaning, though one or the other may dominate. Thus, in addition to engendering appraisals involving affective meaning, even primarily affective cues may influence cognitive appraisals involving semantic meaning. For example, consider the hostile warning example discussed previously. In addition to a feeling of danger, the vocal (i.e., affective tone) of the warning may cause students to believe that the instructor will grade the exams very strictly, allow them no extra time to complete the exam, and so on. The customer wearing the tattoo and motorcycle gang colors may evoke semantic meanings of danger in addition to fear.

Similarly, cues or information such as specific instructional sets that we expect would clearly influence conscious semantic or cognitive appraisal often, if not always, carry some affective properties directly (e.g., we may not like the content of the instructions). In addition, extrasemantic properties (often nonverbal) usually accompany semantic information (e.g., vocal tone). These extrasemantic properties can serve as affective cues themselves.

Research

As mentioned earlier, we have employed affective cues in many of our experiments. These cues generally accompanied more semantically meaningful information, but not always. We believe that much of this research supports the roles of affective cues in appraisals delineated in this discussion. Though we cannot unambiguously categorize these studies in terms of the various subtypes of demand and resource appraisals involved, themselves admittedly fuzzy constructs, we be-

lieve the data resulting from these studies speak to issues regarding the role of affective cues in challenge and threat appraisals.

Demand Appraisal: Danger and Vocal Tone. Recall the manipulated appraisal study described previously (reported in Tomaka, Blascovich, Kibler, & Ernst, 1997) to validate our cardiovascular indexes. In that study we manipulated appraisal via instructional set. Our audiotaped "threat" instructions differed from our "challenge" instructions somewhat in content. But they also clearly differed in affective tone such that our "experimenter" delivered the threat instructional set in a staccato and stern tone while he delivered the challenge set in a much more pleasant way. As mentioned, the "manipulation" worked. Threat patterns of cardiovascular response resulted from threat instructions and challenge patterns from challenge instructions. In retrospect, however, we doubt it would have worked without the difference in affective vocal tone.[5]

Demand Appraisal: Danger and Pain. Recall also the studies in which we independently manipulated cardiovascular patterns mimicking the challenge and threat patterns and found that such manipulations did not lead to differences in appraisal. When we manipulated the cardiovascular patterns via cold and warm pressor, we included both pressor conditions in part to control for the participants' perceived pain. We did not want to confound the physiological patterns with different levels of pain. However, we did find within-condition differences in pain perceptions, with high- and low-pain perceivers in each group. As reported by Tomaka et al. (1997), pain across both conditions was related to challenge and threat appraisals such that high-pain perceivers had more threatening appraisals than low pain perceivers.

More interesting still were the effects of pain perceptions on cardiovascular patterns of participants in the cold pressor condition. As Figure 3.5 shows, these participants did not differ during the first minute of the 3-minute cold pressor task in vascular tone. High-pain participants exhibited increased vasoconstriction, low-pain participants exhibited decreasing vasoconstriction, so much so that actual vasodilation occurred and overcame the well-documented vasoconstrictive response to the cold pressor during the actual cold pressor experience. These data (and Figure 3.5) also reveal that the trends in vasoconstriction and vasodilation continue during task performance

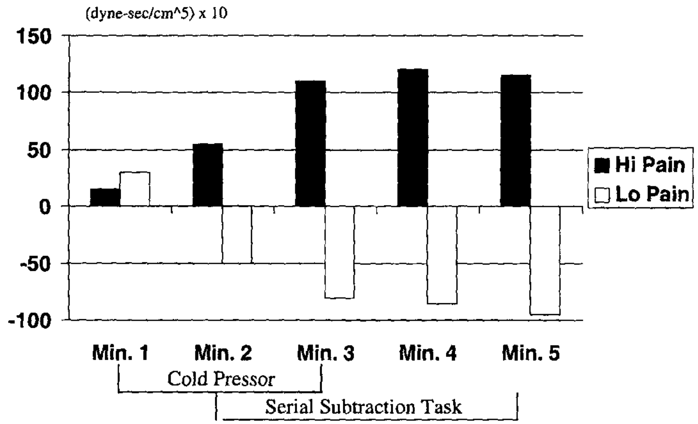

Figure 3.5. Vascular responses as a function of pain (adapted from Tomaka, Blascovich, Kibler, & Ernst, 1997).

after the cold pressor stimulation ceases, but before the performance task ends. These data support not only the notion of affect danger appraisal but also our contention that the pituitary-adrenal-cortical (PAC) axis, which responds to harm and potential harm (Mason, 1975), contributes to the threat pattern.

Demand Appraisal: Danger and Physical Stigma. In a recent exploratory study (Mendes, Hunter, Lickel, & Blascovich, 1998), we set out to test the effects of a partner's physical stigma on challenge and threat during a cooperative interaction. Using female confederates, we randomly assigned our female participants to one of two conditions: stigmatized other or nonstigmatized other. For the stigmatized other condition, confederates bore a large port wine facial birthmark. For the nonstigmatized other condition, confederates bore no birthmark. We kept confederates from knowing whether or not they bore the physical stigma. After introducing the confederate as the other participant and after the confederate and participant exchanged some structured information about themselves,[6] each returned to their own physiological recording rooms. We then informed real participants that they would play a cooperative word-finding game with the other participant via computer and intercom while we assessed their physiological responses. Significant differences in cardiovascular patterns were found, such that participants in the stigmatized other condition

exhibited the threat pattern and participants in the nonstigmatized other condition exhibited challenge.

We think it quite possible that physical stigmas such as facial birthmarks evoke danger appraisals. Indeed, such bodily disfigurements may evoke some sort of nonconscious existential terror or threat to observers. Individuals avoid stigmatized others in part because they bring to mind their own frailty and mortality (Goffman, 1963). Note that individuals often become scared or frightened at the sight of someone wearing a costume mask mimicking facial disfigurement, but not when a mask appears friendly, such as one showing a beloved public character. Facial and other physical stigmas are also likely to increase uncertainty appraisals in addition to danger appraisals.

Demand Appraisal: Uncertainty and Pet Dogs. A few years ago (Allen, Blascovich, Tomaka, & Kelsey, 1991), we observed the effects of the presence of pet dogs on cardiovascular responses during an active performance situation. We asked middle-aged female dog owners, recruited from responses to a newspaper ad, to perform a serial subtraction task. We assigned the women to one of three conditions: alone, in the presence of their pet dog, or in the presence of the best, female human friend.

Participants in the presence of their pet dog exhibited little or no increases in blood pressure during the task (consistent with our later defined challenge pattern). Participants in the alone condition exhibited significant increases in blood pressure (consistent with threat). Participants in the friend condition exhibited even greater increases in blood pressure (consistent with high threat). We believe that the pet dogs, among other things, contributed to decreased uncertainty appraisals, creating sort of a "safe haven" in an attachment sense (Bowlby, 1988). On the other hand, human friends probably increased the evaluation apprehension of participants.

Demand Appraisal: Uncertainty and Ethnicity/Status Pairings. In another recent exploratory study (Lickel et al., 1998), we followed the same procedures as the facial stigma study described previously. Instead of manipulating physical stigma, however, we employed female confederates so that we could manipulate ethnicity (Latina vs. Anglo). We crossed the ethnicity manipulation with a status (high vs. low) manipulation by means of the demographic information exchanged by confederates and female participants when they met. Significant differences in cardiovascular response patterns emerged such that during the cooperative work-finding task Anglo participants exhibited challenge when their partners' status appeared stereotypically consistent with their ethnicity (high-status Anglos and low-status Latinas) but threat when their partners' status appeared stereotypically inconsistent with their ethnicity (high status Latinas and low-status Anglos). We contend that the more surprising pairings of ethnicity and status contributed to high uncertainty appraisal. Though we had no data, we would not be surprised if prejudice moderated these effects.

Demand Appraisal: Uncertainty and Familiar versus Novel Attitude Objects. In another study (reported in Blascovich et al., 1993), we tested the cardiovascular functionality of attitudes in potentially stressful decision-making situations. In the first phase of this study, all participants viewed and repeatedly rehearsed attitudes (i.e., like/dislike ratings) toward a randomly selected set of 15 novel abstract paintings.

In the second phase, participants viewed short presentations of pairs of paintings and indicated which painting in each pair they preferred while we recorded cardiovascular responses. Participants had two seconds to view the pair of paintings and indicate their preferences. We randomly assigned participants to one of two conditions during the second phase. In one condition, we drew the painting pairs from the set toward which they had rehearsed attitudes. In the second, we drew the painting pairs from a totally novel set.

As expected, participants in the novel painting condition exhibited threat patterns whereas participants in the familiar painting condition exhibited challenge patterns. In retrospect, we believe this study provides an interesting test of the affect-uncertainty appraisal connection because we manipulated familiarity by incorporating affective cues (i.e., paintings) in the actual performance task.

Resource Appraisal: Skills, Abilities, and Music. Another of our studies (Allen & Blascovich, 1994) suggests that affective cues can increase resource appraisals. In this study, we recruited approximately 50 surgeons to participate in an experiment on music and active performance. All of the surgeons listened to music while performing surgery (a not uncommon practice). Using a within-participant design, all surgeons in our study performed a serial subtraction task while listening to their self-selected music (the same as the music they listened to during surgery), another subtraction task while listening to a control musical selection (Pachelbel's *Canon in D*), and another with no music. We completely counterbalanced order.

Surgeons listening to their own music showed little or no increases in blood pressure during the task (consistent with our challenge pattern). Surgeons in the control music condition showed significant increases in blood pressure (consistent with threat). Surgeons in the no music condition showed even greater increases in blood pressure (consistent with high threat).[7] Though the surgeons' own music quite possibly also affected uncertainty demand appraisals, we believe it contributed to resource appraisals based on the association of these musical selections with perceived positive performance on another task (i.e., surgery). Surgeons who played music during surgery typically report they do so because of its affective properties. In addition, although the type of music differed substantially across surgeons, most of them reported playing the same music, or at least selections from a small set across surgeries. This finding makes our contention of their association of music with positive performance more tenable.

Other Research. Other investigators have also conducted research, albeit nonphysiological research, into the mediating role of affective cues in performance situations. For example, Isen and her colleagues have demonstrated that positive affect can have substantial influence on social interactions and thought processes (for a review, see Isen, 1987). Positive affect induced by relatively small manipulations, such as receiving a bag of candy, a coin, or a small gift, demonstrably increases creative problem solving and facilitates retrieval of positive material from memory. We contend that these "tokens" serve as affective cues that facilitate problem solving, either by decreasing the demand appraisals, especially danger appraisals, or by increasing resource appraisals, or both. The well-established link between positive cues and positive affect appears likely in the findings of other researchers who contend that positive affect has positive effects on cognition (Bryan, Mathur, Sullivan, & Pukys, 1995; Deldin & Levin, 1986; Teasdale & Fogarty, 1979; see also chapters by Eich & Macaulay, Forgas, and Martin, this volume).

Summary

We have sought here to address the role of affective cues in challenge and threat appraisal processes. We believe that appraisals, specifically the relationship between demand and resource appraisals, mediate the link between performance situations and physiological responses. Furthermore, we have argued that these component appraisals may involve both affective and cognitive appraisals with and without awareness or consciousness, and they may utilize both affective and semantic or cognitive cues. We contend that affective cues may affect demand appraisals of danger and uncertainty and resource appraisals of skills and abilities. Our review of research employing cardiovascular indexes of challenge and threat is supportive of our notions regarding affective cues and appraisals. As always, more definitive research is needed to fully test our notion, research that we hope is forthcoming.

Notes

1. We do not mean to suggest affective cues play no role in the remaining components of our model. They do. However, space limitations preclude this additional discussion here.
2. We base this contention on the expressive role of facial expressions rather than a causal or social communications role.
3. We used the full set of cardiac and vascular measures only in the last two of the three studies reported in this chapter. However, the first study that included cardiac measures did not deviate from the predicted pattern in terms of those cardiac measures.
4. Of course, in different contexts (e.g., a Halloween party, an illegal casino), the valence of the cues of the others (i.e., the motorcycle gang member, the police officer) may differ from the illustrations portrayed here.
5. Indeed, our own "lab lore" indicates the necessity of such tone to elicit challenge and threat responses.
6. The exchanged information included instant photographs, demographic background, and extracurricular activities.
7. Anecdotal information received from the surgeons in this study indicated that they listened to music to feel good and to avoid distraction.

References

Allen, K. M., & Blascovich, J. (1994). Effects of music on cardiovascular reactivity among surgeons. *Journal of American Medical Association, 272*, 882–884.

Allen, K. M., Blascovich, J., Tomaka, J., & Kelsey, R. M. (1991). Presence of

human friends and pet dogs as moderators of autonomic responses to stress in women. *Journal of Personality and Social Psychology, 61*, 582–589.

Blascovich, J. (1992). A biopsychosocial approach to arousal regulation. Special Issue: Social psychophysiology. *Journal of Social and Clinical Psychology, 11*, 213–237.

Blascovich, J. (in press). Using physiological indexes of psychological processes in social psychological research. In C. M. Judd & H. Reis (Eds.), *Handbook of advanced research methods in social psychology*. London: Cambridge University Press.

Blascovich, J., Brennan, K., Tomaka, J., Kelsey, R. M., and others. (1992). Affect intensity and cardiac arousal. *Journal of Personality and Social Psychology, 63*, 164–174.

Blascovich, J., Ernst, J. M., Tomaka, J., Kelsey, R. M., Salomon, K. A., & Fazio, R. H. (1993). Attitude accessibility as a moderator of autonomic reactivity during decision making. *Journal of Personality and Social Psychology, 64*, 165–176.

Blascovich, J., & Tomaka, J. (1996). The Biopsychosocial model of arousal regulation. *Advances in Experimental Social Psychology, 28*, 1–51.

Bowlby, J. (1988). *A secure base: Parent–child attachment and healthy human development*. New York: Basic Books.

Bryan, T., Mathur, S. R., Sullivan, K., & Pukys, K. (1995). The impact of induced positive affect on incarcerated males' learning. *Behavioral Disorders, 20*, 204–211.

Cacioppo, J. T., & Tassinary, L. G. (Eds.). (1990). *Principles of psychophysiology: Physical, social, and inferential elements*. New York: Cambridge University Press.

Deldin, P. J., & Levin, I. P. (1986). The effect of mood induction in a risky decision-making task. *Bulletin of the Psychonomic Society, 24*, 4–6.

Dienstbier, R. A. (1989). Arousal and physiological toughness: Implications for mental and physical health. *Psychological Review, 96*, 84–100.

Ernst, J. (1995). The effect of mood on cognitive appraisal. Unpublished doctoral dissertation. State University of New York at Buffalo.

Fantz, R. L. (1958). Pattern vision in young infants. *Psychological Record, 8*, 43–47.

Fantz, R. L. (1961). The origin of form perception. *Scientific American, 204*, 66–72.

Goffman, E. (1963). *Stigma: Notes on the management of spoiled identity*. Englewood Cliffs, NJ: Prentice-Hall.

Isen, A. M. (1987). Positive affect, cognitive processes, and social behavior. In L. Berkowitz, (Ed.), *Advances in Experimental Social Psychology* (Vol. 20, pp. 203–252). San Diego, CA: Academic Press.

Lang, P. J., Bradley, M. M., & Cuthbert, B. N. (1990). Emotion, attention, and the startle reflex. *Psychological Review, 97*, 377–395.

Lazarus, R. S. (1981). A cognitivist's reply to Zajonc on emotion and cognition. *American Psychologist, 36*, 222–223.

Lazarus, R. S. (1984). On the primacy of cognition. *American Psychologist, 39*, 124–129.

Lazarus, R. S. (1991). *Emotion and adaptation.* New York: Oxford University Press.
LeDoux, J. E. (1995). Emotion: Clues from the brain. *Annual Review of Psychology, 46,* 209–235.
LeDoux, J. E. (1996). *The emotional brain: The mysterious underpinnings of emotional life.* New York: Simon & Schuster.
Lickel, B., Mendes, W. B., Hunter, S., Blascovich, J., Watson, J., Gonzalves, M., & Ramon, C. (1998, May). *Cardiovascular reactivity during interpersonal interactions.* Poster presented at the annual meeting of the American Psychological Society, Washington, DC.
Mason, J. W. (1975). A historical view of the stress field. *Journal of Human Stress, 1,* 6–12.
Mendes, W. B., Hunter, S., Lickel, B., & Blascovich, J. (1998, May). *Cardiovascular reactivity during interactions with stigmatized others.* Poster presented at the annual meeting of the American Psychological Society, Washington, DC.
Obrist, P. A. (1981). *Cardiovascular psychophysiology: A perspective.* New York: Plenum.
Rosenberg, M. J. (1965). When dissonance fails: On eliminating evaluation apprehension from attitude measurement. *Journal of Personality and Social Psychology, 1,* 28–42.
Rousselle, J. G., Blascovich, J., Kelsey, R. M. (1995). Cardiorespiratory responses under combined psychological and exercise stress. *International Journal of Psychophysiology, 20,* 49–58.
Salk, L. (1973). The role of the heartbeat in the relations between mother and infant. *Scientific American, 228,* 24–29.
Teasdale, J. D., & Fogarty, S. J. (1979). Differential effects of induced mood on retrieval of pleasant and unpleasant events from episodic memory. *Journal of Abnormal Psychology, 88,* 248–257.
Tomaka, J., Blascovich, J., Kelsey, R. M., & Leitten, C. L. (1993). Subjective, physiological, and behavioral effects of threat and challenge appraisal. *Journal of Personality and Social Psychology, 18,* 616–624.
Tomaka, J., Blascovich, J., Kibler, J., & Ernst, J. M. (1997). Cognitive and physiological antecedents of threat and challenge appraisal. *Journal of Personality and Social Psychology, 73,* 63–72.
Zajonc, R. B. (1981). A one-factor mind about mind and emotion. *American Psychologist, 36,* 102–103.
Zajonc, R. B. (1984). On the primacy of affect. *American Psychologist, 39,* 117–123.

4. Consequences Require Antecedents

Toward a Process Model of Emotion Elicitation

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Introduction

Humans are multipurpose beings functioning in an uncertain world. We are often faced with complex situations in which we are striving to achieve multiple goals simultaneously. Although most of the stimuli with which we are confronted are not matters of life and death, our response repertoire must enable us to deal with such extreme circumstances as well as with more mundane ones. Emotions prepare and motivate people to respond to situations, allowing them to respond adaptively to the complex world in which they must survive and reproduce (see, e.g., Darwin, 1872/1965).

Emotions have not always been perceived in this way (see Calhoun & Solomon, 1994; and Forgas, this volume, for an overview of the history of perceptions of emotions). To many philosophers emotions represent an interruption to an otherwise logical (and preferred) mode of being. In psychology, following the seminal work of William James and Walter Cannon, behaviorism essentially prohibited the study of emotion – at least as a psychological, as opposed to a behavioral, event. After a long period of neglect, the past two decades have

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