

Perceiver Threat in Social Interactions With Stigmatized Others

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The extent to which stigmatized interaction partners engender perceivers' threat reactions (i.e., stigma-threat hypothesis) was examined. Experiments 1 and 2 included the manipulation of stigma using facial birthmarks. Experiment 3 included manipulations of race and socioeconomic status. Threat responses were measured physiologically, behaviorally, and subjectively. Perceivers interacting with stigmatized partners exhibited cardiovascular reactivity consistent with threat and poorer performance compared with participants interacting with nonstigmatized partners, who exhibited challenge reactivity. In Experiment 3, intergroup contact moderated physiological reactivity such that participants who reported more contact with Black persons exhibited less physiological threat when interacting with them. These results support the stigma-threat hypothesis and suggest the utility of a biopsychosocial approach to the study of stigma and related constructs.

Many theorists argue that bearers of stigmas cause perceivers to feel a sense of uncertainty, discomfort, anxiety, or even danger during social interactions (Crocker, Major, & Steele, 1998; Goffman, 1963; Jones et al., 1984). Although some past research has examined social interactions between stigmatized and nonstigmatized persons (e.g., Frable, Blackstone, & Scherbaum, 1990; Miller, Rothblum, Felicio, & Brand, 1995; Word, Zanna, & Cooper, 1974), relatively little research has directly examined the extent to which nonstigmatized persons feel threatened during such social interactions. As Crocker et al. (1998) noted, this scarcity of empirical data on stigma effects during ongoing social interaction points to a somewhat surprising gap in the stigma literature.

The paucity of research examining the effects of stigma during social interactions is not surprising, given the methodological obstacles confronting such research. Because of a prevailing cultural zeitgeist for tolerance, specifically the endorsement of egalitarian beliefs (Gaertner & Dovidio, 1986) and motivation to appear nonprejudiced (Dunton & Fazio, 1997), self-reported attitudes may differ from actual attitudes (e.g., Vanman, Paul, Ito, & Miller, 1997). Adding to the difficulty of ascertaining veridical reactions to stigmatized others is the possibility that the discrep-

ancy between expressed and actual reactions may operate unconsciously (Greenwald & Banaji, 1995).

Psychophysiological measurements may provide a means to circumvent distortions in perceivers' responses to stigmatized others. Guglielmi (1999) concluded that the limitations of self-report instruments may be overcome by the use of appropriate physiological indices in studies of prejudice and intergroup relations. Historically, however, physiological measurement has been limited by the lack of specificity with regard to the psychological meaning of the physiological responses (Blascovich & Kelsey, 1990). Meaningful physiological indices are ones in which the physiological responses share a one-to-one correspondence with a psychological construct (Cacioppo & Tassinari, 1990). Physiological markers that index the psychological states of challenge and threat have been identified and validated (see Blascovich & Tomaka, 1996, for a review), and these markers provide a means of assessing perceivers' responses during interactions with stigmatized others.

Challenge and Threat as Motivational States

We (e.g., Blascovich & Mendes, 2000; Blascovich & Tomaka, 1996; Tomaka, Blascovich, Kelsey, & Leitten, 1993) have investigated challenge and threat as motivational states resulting from individuals' evaluations¹ of situational demands and personal resources in motivated performance situations—that is, goal-relevant

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¹ Previously (e.g., Blascovich & Tomaka, 1996), we used *appraisal* to refer to an individual's assessment of available demands and resources. We now use *evaluation*, because we believe that *appraisal* implies only a conscious cognitive assessment of demands and resources. Most recently (e.g., Blascovich & Mendes, 2000), we asserted that both cognitive and affective and unconscious and conscious assessments of demands and resources occur. Also, readers often confused our meaning of *appraisal* with Lazarus's (e.g., Lazarus & Folkman, 1991). Although Lazarus's work strongly influenced our challenge and threat model, we believe that we extend the meaning of demands and resources from a purely conscious, cognitive perspective to one including unconscious and affective processes. Hence, we believe *evaluation* is a better term.

task performance situations requiring instrumental cognitive-behavioral responses. Examples of motivated performance situations include speech making, test taking, interpersonal negotiations, and cooperative and competitive task performance. Motivated performance situations may be metabolically (e.g., requiring large muscle movements) or minimally metabolically demanding. We have focused on the latter.

Generally, when individuals evaluate demands as outweighing resources, threat results; when individuals evaluate personal resources as approximating or exceeding demands, challenge results. According to our theoretical model, demand evaluations involve perceptions and judgments of the *danger*, *uncertainty*, and *required effort* in a motivated performance situation. Resource evaluations involve perceptions and judgments of *knowledge* and *abilities* relevant to situational performance, *dispositional characteristics*, and *external support* in the situation. Perceptual cues such as visible stigmas may contribute independently to demand and resource evaluations in motivated performance situations involving stigmatized and nonstigmatized individuals. As we have discussed in detail elsewhere (Blascovich, Mendes, Hunter, & Lickel, 2000), multiple mechanisms by which stigmas engender perceiver threat may exist.

Stigmas may serve during interactions as cues that increase demand evaluations of nonstigmatized individuals, including heightened evaluations of danger, uncertainty, and required effort. Many theories, including terror management (Pyszczynski, Greenberg, & Solomon, 1997), social dominance (Sidanius & Pratto, 1993), evolutionary (Barkow, Cosmides, & Tooby, 1992), and other theories involving intergroup anxiety (Stephan & Stephan, 1985), converge to suggest that stigmas elicit perceptions of psychological or physical danger on the part of nonstigmatized individuals. Demand evaluations also may increase during ambiguous or uncertain situations. The uncertainty of an interaction involving stigmatized others may increase, as Jones et al. (1984) suggested, with the presence of novelty and unpredictability. Finally, the presence of a stigma may affect required effort by increasing requirements on the part of perceivers to suppress automatically activated negative emotional states (Devine, Evett, & Vasquez-Suson, 1996) and negative stereotypes about stigmatized partners (Devine, 1989; Macrae, Bodenhausen, Milne, & Wheeler, 1996). In addition, persons interacting with stigmatized partners may exert more effort to ensure smooth interactions (Frable et al., 1990). Thus, several factors may independently or additively increase the perceived demands of an individual interacting with a stigmatized person.

Stigmas may also serve as cues to lower resource evaluations of the nonstigmatized during interactions with the stigmatized. First, stigmas may decrease knowledge and ability evaluations of nonstigmatized individuals, because interactions with stigmatized individuals require more attentional demands that may tax task-relevant abilities. Second, the nonstigmatized may perceive the lack of communicative schemata necessary to effectively interact with the stigmatized (Gundykunst, 1984). Third, some dispositional characteristics (e.g., racism and authoritarianism) may negatively influence resource evaluations. To the extent that stigmas raise negative performance stereotypes, expectations regarding success may be lowered. Finally, perceptions of external support may be lessened by a lack of similarity, mutual knowledge, and shared reality between the nonstigmatized individual and the stig-

matized individual. In summary, interactions involving stigmatized others should prove threatening to nonstigmatized performers, because demand evaluations should increase and resource evaluations should decrease.

Physiological Markers

As other researchers have argued (Cacioppo & Tassinary, 1990), psychophysiological indices can provide continuous, covert, on-line, and unambiguous measures of psychological states during interpersonal interaction. These indices are particularly convincing, relative to self-reports, because they are substantially unaffected by self-presentational motives that may operate during interactions with stigmatized individuals (Guglielmi, 1999). Application of appropriate physiological markers can provide unambiguous and on-line empirical evidence regarding threatening effects of stigmas on perceivers within the context of motivated performance situations.

Challenge and Threat

Drawing largely from Dienstbier's (1989) work, we have identified and validated physiological indices of threat and challenge on the basis of patterns of neurally and hormonally controlled cardiovascular responses (see Blascovich & Tomaka, 1996, for a review). Specifically, challenge is marked by activation of the sympathetic-adrenal-medullary (SAM) axis, enhancing cardiac performance, particularly left ventricular contractility, and decreasing systemic vascular resistance. Threat is marked by activation not only of the SAM axis but also by activation of the pituitary-adrenal-cortical (PAC) axis, inhibiting decreases in systemic vascular resistance.

Three cardiovascular responses are used to differentiate challenge and threat responses.² Specifically, we examine left ventricular contractility (VC), which is indexed by a decrease in preejection period (PEP)—the time from the initiation of left ventricular contraction until the aortic valve opens. (To indicate increased contractility, we multiply preejection period reactivity by -1 .) We also examine changes in cardiac output (CO), which is the amount of blood being pumped by the heart expressed in liters per minute. The third cardiovascular response is total peripheral resistance (TPR), which is the amount of overall vasoconstriction or vasodilation occurring in the periphery.

We have developed two analytic approaches to identify and differentiate challenge and threat reactivity. The first approach

² We do not include heart rate (HR) as a specific component for at least two reasons. First, HR contributes little to the differentiation of challenge and threat, although HR increases significantly during both. This is not surprising, given the complexity of neural sympathetic and parasympathetic as well as endocrine controls affecting HR. Second, HR is a determinant of cardiac output ($CO = HR \times \text{Stroke Volume}$), which is already a component of the challenge and threat markers. Nevertheless, HR itself is informative within our motivated performance situation paradigm. On the basis of Obrist's (1981) work, we assume that HR increases index task engagement and, hence, goal relevance. Therefore, we conduct univariate tests to confirm that our motivated performance situations are goal relevant using tests of increases in HR reactivity from zero. In all experiments reported in this article, HR increased significantly from zero in all tasks, and, thus, we assume goal relevance.

specifies the expected relative differences in the cardiovascular reactivity patterns previously described when marking challenge and threat. The second approach specifies objective or absolute standards of reactivity (or changes from baseline) to identify challenge, threat, or habituation on a measure-by-measure basis (i.e., VC, CO, and TPR).

Relative Patterns

The first approach typically includes comparisons of groups within a multivariate framework. Relative differences between challenge and threat include significant differences in CO, with challenge reactivity producing more blood ejected from the heart per minute than threat reactivity, and significant differences in TPR, with less resistance (vasodilation) occurring in challenge reactivity than in threat reactivity. In most cases, VC also differs between challenge and threat, with challenge reactivity producing greater ventricle contractility than does threat reactivity. However, this relative difference is not consistently observed and need not be present to differentiate between challenge and threat patterns.

Absolute Differences

Absolute differences in challenge and threat reactivity can also be specified.³ These are tested with univariate tests of each reactivity measure (i.e., VC, CO, and TPR) to determine differences from zero (i.e., significant increases or decreases from the baseline). Challenge reactivity, obtained with continuous blood pressure monitors, includes significant increases in VC and CO and a significant decrease in TPR. Threat reactivity includes significant increases in VC from the baseline, no changes in CO, and no changes or increases in TPR.

Habituation, or lack of significant increase in physiological reactivity, is determined by examination of VC and HR. If no significant increases from the baseline occur in VC and HR, then we conclude that the task does not or no longer represents a motivated performance situation. For example, in Blascovich, Mendes, Hunter, and Salomon's (1999) research, participants in the control group of a social facilitation experiment exhibited no significant increases in HR and VC when performing either the well-learned or the novel task alone. In addition, challenge and threat reactivity are believed to represent anchors on a continuum of cardiovascular reactivity ranging from efficient recruitment of cardiovascular responses to malignant and inefficient recruitment. It is important to note that the midpoint of this continuum does not represent habituation but rather less threat or less challenge than is observed at the extremes of the continuum.

We and others have used these markers successfully to investigate challenge and threat responses in many areas, including attitude functionality (Blascovich et al., 1993), social facilitation (Blascovich et al., 1999), emotional disclosure (Mendes, Reis, Seery, & Blascovich, 2000), and dispositions (Quigley, Feldman Barrett, & Weinstein, 2000; Tomaka et al., 1999).

Stigma-Threat Hypothesis

We conducted three experiments testing the general hypothesis that perceivers interacting with stigmatized others experience threat (i.e., the stigma-threat hypothesis). All experiments in-

involved similar procedures. In the first two studies, we examined the effects of a physical stigma on an interaction partner by applying facial birthmarks (i.e., "port-wine stains") to confederates. In the third study, we examined the effects of racial and socioeconomic stigmas on an interaction partner. We manipulated racial stigma by employing Black and White confederates. We manipulated socioeconomic stigma by varying the background of the confederates. We hypothesized that participants would experience greater threat, indicated by the threat pattern of cardiovascular reactivity, when interacting with stigmatized confederates than with nonstigmatized confederates across all studies, independent of the type of stigma. In addition, we predicted that participants interacting with nonstigmatized partners would outperform perceivers interacting with stigmatized partners. We were reluctant to predict stigma-threat effects on self-report measures, because of possible self-presentational contamination (see Guglielmi, 1999, for a lucid review).

Experiment 1

Overview

Experiment 1 used a one-factor (partner's physical stigma: birthmark, no birthmark), between-subjects design to test the stigma-threat hypothesis. The procedures were designed to mimic a possible meeting between strangers. That is, a participant and confederate met and exchanged some limited but informative background information, spoke about a common topic, and then interacted during a cooperative and interdependent task. To accomplish this type of meeting, this experiment consisted of three phases: (a) information exchange—during which the participant and her partner (the confederate) met face-to-face and exchanged background information, (b) speech delivery—during which the participant prepared and delivered a videotaped speech on "working together" that the partner would supposedly review later, and (c) word-finding task—during which the participant and the confederate engaged in a cooperative word-finding task using an intercom. Throughout the experiment, confederates either bore or did not bear a port-wine stain birthmark. Participants' physiological responses were recorded during Phases 2 and 3.

³ Caution should be observed when comparing across laboratories because of differences in instrumentation. For example, continuous blood pressure readings may yield very different TPR results from readings obtained with a noncontinuous blood pressure monitor. Typically, a decrease in vasodilation is expected during tasks evaluated as challenging (see Blascovich, Mendes, Hunter, & Salomon, 1999; Tomaka & Blascovich, 1994; Tomaka et al., 1993). However, in an article by Tomaka and his colleagues (1999), they reported only relative differences in TPR between challenged and threatened groups rather than decreased TPR. In this article, the authors relied on a noncontinuous blood pressure monitor, which requires repeated use of occlusive blood pressure cuffs that can temporarily compress vascular tissue underneath the cuff, causing less than normal vascular elasticity. The repeated sampling of blood pressure might cause greater constriction than may have occurred if continuous recordings were obtained.

Method

Setting and Participants

A social psychophysiology laboratory in the department of psychology at the University of California, Santa Barbara, served as the experimental setting. This laboratory contains separate control, participant preparation, and recording rooms as well as physiological recording, audiovisual, and computer equipment. We recruited female participants⁴ from the university; they received either course credit or \$10 for their participation. This group included 43 participants (36 White, 5 Asian, 1 Latina, and 1 Indian) whose mean age was 20.24 years ($SD = 1.35$).

Measures

Physiological measures. Cardiac and hemodynamic measures were recorded noninvasively using equipment meeting commercial and hospital safety standards and following guidelines established by the Society for Psychophysiological Research (e.g., Sherwood et al., 1990). A Minnesota Impedance Cardiograph (Model 304B, Instrumentation for Medicine, Greenwich, CT), a Cortronic continuously inflated blood pressure monitor (Model 7000, Cortronic, Kings Park, NY), and a Coulbourn ECG amplifier/coupler (Model S75-11, Coulbourn Instruments, Lehigh Valley, PA) provided physiological signals. The impedance signals were conditioned using Coulbourn amplifiers (Model S79-02).

Impedance cardiographic (ZKG) and electrocardiographic (ECG) recordings provided continuous measures of cardiac performance. The former uses a tetrapolar aluminum/mylar tape electrode system to provide basal transthoracic impedance (Z_0) and the first derivative of basal impedance (dZ/dt). Two pairs of ZKG electrodes completely encircle the participant. Inner electrodes are placed at the base of the neck and at the thoracic xiphisternal junction; outer electrodes are placed on the neck and abdomen. The impedance cardiograph passes a 4mA AC 100 kHz current through the two outer electrodes and measures Z_0 using the two inner electrodes. A Standard Lead II configuration (right arm, left leg, and a right leg ground) provided the input to the ECG amplifier. The Cortronic blood pressure monitor provided continuous noninvasive recordings of blood pressure. An interactive software program (Kelsey & Guethlein, 1990) was used to record and later score the cardiac and hemodynamic data.

We differentiated challenge and threat on the basis of cardiovascular reactivity (i.e., changes from resting levels) measures, focusing on cardiovascular measures: VC, CO, and TPR. TPR is derived from blood pressure and cardiac output using the formula (mean arterial pressure / cardiac output) $\times 80$ (Sherwood et al., 1990). TPR is expressed in resistance units, and a formal description of these units can be found in Sherwood et al. (1990).

Behavioral measures. During the third phase, the participant and the confederate engaged in a word-finding task similar to the game of Boggle. The task stimulus consisted of a randomly generated 8×8 matrix of letters presented on a computer monitor. The goal of the task was to generate words by linking adjacent letters to form words. The participant and the confederate alternated finding words and saying them aloud. During this task, we recorded participant responses, tracking number and accuracy of these responses.

Self-Report Ratings

Participants' ratings. The participants completed two posttask questionnaires. The first questionnaire followed the speech delivery task and included three questions regarding how stressful the task was, how much effort the participants exerted, and how well they performed. The second questionnaire followed the word-finding task. In addition to the previous questions, participants also responded to several questions regarding their partner in the study. The participants answered several questions regarding how unfriendly, attractive, likable, trustworthy, unhelpful, creative, inde-

pendent, and unintelligent they thought their partner was and how well they believed their partner performed on the word-finding task. All responses ranged from -4 (*strongly disagree*) to 4 (*strongly agree*).

Confederates' ratings. To gauge any overt reactions of the perceiver, confederates completed two identical rating forms, pre- and postinformation exchange, that consisted of three questions regarding the reactions of the participant. They included the extent to which the participant made eye contact with the confederate and how friendly and positive the participant was. Again, all responses ranged from -4 (*strongly disagree*) to 4 (*strongly agree*).

Procedures

Prior to the participant's arrival, we applied makeup to the confederate's face. In the physically stigmatized condition, we applied opaque (red and blue) makeup to the confederate's left cheek in an oblong shape approximately 4 cm wide and 6 cm high. In the not physically stigmatized condition, we applied translucent powder to the same area on the confederate's face. We kept the confederate unaware of the condition by applying the makeup to her face while her eyes were closed. This strategy was adopted to control for between-condition behavioral differences by our confederates (see Kleck & Strenta, 1980). We employed four female confederates who wore similar clothes and hairstyles.

Initial interaction. Each participant and confederate arrived and waited in front of separate doorways approximately 10 m apart in the hallway outside of the laboratory. The confederate ensured that no interaction took place in the hallway. Two experimenters greeted the participant and the confederate and explained to them that the study involved interpersonal styles and working together. The experimenters then confirmed that the participant and the confederate did not know each other and explained that they would go to separate rooms to fill out forms but would see each other later.

One of the experimenters escorted the confederate to a preparation room, and the other escorted the participant to a separate room. In addition to obtaining consent for the experimental procedures, the experimenter took a Polaroid picture of the participant. The experimenter then explained that each participant needed to fill out a background information sheet and left the participant alone to complete it. The background information sheet queried the participant about her age, hometown, college major, parents' occupations, siblings, hobbies, sports, and extracurricular activities. At this time, the confederate completed the preinformation exchange rating form.

Information exchange. The experimenter escorted the participant to the confederate's preparation room, instructed the participant and the confederate to describe their backgrounds to each other (using the background information sheet as a guide), and left the room. The confederate spoke first. The confederate's background information was designed through pilot testing to represent the typical female undergraduate at the university.⁵ Following the information exchange, the experimenters came back into the room; one experimenter escorted the participant to her preparation room, and the other experimenter stayed with the confederate. At this time, the confederate completed the postinformation exchange rating form.

Speech delivery. We then applied the sensors necessary for physiological recording. The participant was seated in an upright, comfortable upholstered chair with a small tray across her lap. She was given the computer mouse and the confederate's background information sheet with a Polaroid picture of the confederate attached to it facedown. The experimenter instructed the participant to sit quietly and relax for several

⁴ Participants were screened for a heart murmur, pregnancy, and cardiac medication.

⁵ According to the fictitious background we created, the confederate's name was Alicia, she was 20, a psychology major. She swam and played volleyball, and her hobbies included reading and hiking.

minutes. A 5-min baseline period began once the experimenter left the room. Cardiovascular responses collected during this period served as baseline levels of physiological responses. Physiological recording continued for the duration of the experiment.

Next, the participant received audiotaped instructions to review the confederate's background information sheet and photograph for 1 min. Subsequently, she received instructions explaining that she would deliver a speech on the topic of working together that would be videotaped for her partner (the confederate) to review later. She was told she had 1 min to prepare and 3 min to deliver the speech. The participant was instructed to discuss how well she had worked with people in the past, how well she thought her partner worked with people, and how well she thought the two of them would work together. These speech topics were then displayed on the video monitor for the participant's reference. The participant was cued by the experimenter by intercom when to begin preparation and delivery and when to end the speech. The participant received prompts to elaborate on the speech themes if she stopped talking before the 3-min period expired. Following the speech, the participant completed the postspeech questionnaire and then sat quietly for a 5-min recovery and rest period.

Cooperative task. The final task began when the experimenter informed the participant and the confederate that the rooms would be connected by intercom so that they could communicate with one another. They then received instructions that they would be working together on a word-finding task by alternating finding words and saying them out loud. They were informed that they would each receive a \$5 bonus if together they could find 26 words in 4 min.

The participant and the confederate received game instructions by audiotape and computer animation displayed on their monitors. After the instructions, an ostensibly randomly generated matrix of letters appeared on the monitor, and the participant and the confederate began to generate words. The participant always generated the first word. The confederate's responses came from a list of over 60 valid words in the matrix and were guided by timed prompts provided by an unheard assistant in her room. The timing was devised from extensive pretesting to represent a typical performance.⁶ After 4 min, the experimenter informed the dyad that the task was completed, disconnected the intercom system, and entered the recording room with the postword-task questionnaire.

After the participant completed the questionnaire, the experimenter removed the sensors and probed for suspicion. The experimenter subtly determined what the participant thought was the origin of the mark on the confederate's face. She then fully debriefed, paid, and thanked the participant.

Results

Participant Attrition

We excluded 2 participants because of suspicion. We lost data from 5 participants because of equipment failure. This attrition left a total of 37 participants with usable physiological data: 21 in the birthmarked condition, and 16 in the nonbirthmarked condition.

Cardiovascular Measures

Scoring and analytic strategy. We calculated mean VC, CO, and TPR values for each minute within each rest and task period. We transformed univariate outliers by assigning the deviant raw score to a value one unit larger or smaller than the next most extreme score (Tabachnick & Fidell, 1996). Our analytic strategy included four steps. First, we tested for baseline resting differences between conditions. Second, we confirmed that the tasks were goal relevant by testing HR reactivity against zero (see Footnote 2). Third, we performed multivariate analyses of variance

(MANOVAs) to examine the effect of partner's stigma on the relative pattern of the three cardiovascular reactivity markers of challenge and threat (VC, CO, and TPR) for each task. Last, we examined measure by measure absolute reactivity (i.e., differences from zero) using univariate analyses to determine absolute challenge and threat reactivity, as described previously.

We also calculated two types of effect sizes. We report η^2 squared along with each significant multivariate effect as an estimation of the strength of association between independent and dependent variables. Also, we calculated Cohen's d for an estimated effect size by stigma for each cardiovascular variable and data from the cooperative task.

Baseline differences. A multivariate (VC, CO, and TPR) test for differences in baseline physiological levels by stigma condition revealed no significant main effect ($F < 1$). As is typical when baseline responses do not differ among levels of between-subjects factors, we used reactivity scores (differences from the baseline) as the primary dependent variables (Kamarck et al., 1992). We calculated reactivity scores for each cardiovascular measure by subtracting the average value for the last minute of the rest period from the average value for the first minute of the speech delivery and word-finding tasks.

Challenge and threat: Speech delivery. We conducted a MANOVA to determine whether the predicted patterns of cardiovascular responses across cardiovascular reactivity measures occurred as a result of our stigma manipulation. The MANOVA using the reactivity values (VC, CO, and TPR) as dependent variables from the first minute of speech with one independent variable (partner's physical stigma: birthmark, no birthmark) yielded a marginal main effect consistent with the predicted pattern, $\eta^2 = .20$, $F(3, 32) = 2.61$, $p < .07$. Follow-up univariate analyses revealed a significant TPR contribution but nonsignificant VC and CO contributions: For VC, $F(1, 35) = 2.71$, $p < .11$; for CO, $F(1, 35) = 2.94$, $p < .10$; for TPR, $F(1, 35) = 7.37$, $p < .01$.

We conducted univariate tests against zero to verify absolute reactivity for each cardiovascular measure. Participants interacting with stigmatized partners exhibited the predicted threat pattern (i.e., significant increases in VC, a nonsignificant increase in CO, and a significant increase in TPR). In contrast, participants interacting with nonstigmatized partners exhibited the challenge pattern (i.e., significant increases in VC, significant CO increases, and significant TPR decreases). Table 1 provides means and p values associated with these analyses with predicted direction indicated.

Challenge and threat: Word-finding task. Again, we predicted that stigmatized partners would elicit a threat response pattern. We conducted a MANOVA using cardiovascular reactivity values (VC, CO, and TPR) from the first minute of the word-finding task. This analysis yielded a significant multivariate main effect, $\eta^2 = .33$, $F(3, 32) = 5.24$, $p < .005$. Follow-up univariate tests indicated that only VC did not contribute to the main effect: VC, $F < 1$; CO, $F(1, 35) = 8.33$, $p < .01$; TPR, $F(1, 35) = 11.33$, $p < .002$.

⁶ The first two words the confederate identified were called out 2 s after the participant said her words, the third and fourth words were called out after 3 s, the fifth and sixth words were called out after 4 s, and the remaining words after 7 s. To control for performance similarity, the confederate said words of a length equal to that of the participants' words.

Table 1
Means and Univariate Tests From Zero (Baseline) of
Cardiovascular Reactivity in Experiments 1 and 2

Task and measure	Birthmark (threat)	No birthmark (challenge)
Experiment 1		
Speech		
VC	↑ 11.40**	↑ 23.54**
CO	∅ 0.22	↑ 1.36*
TPR	∅/↑ 51.91	↓ -185.70**
Word-finding task		
VC	↑ 19.80**	↑ 23.21***
CO	∅ 0.36	↑ 2.27**
TPR	∅/↑ 69.95	↓ -249.61***
Experiment 2		
Word-finding task		
VC	↑ 8.36***	↑ 19.50***
CO	∅ -0.02	↑ 1.27*
TPR	∅/↑ 54.20*	↓ -52.69

Note. All condition means were tested against zero to determine significant increases or decreases from the baseline. All values except TPR in the no-birthmark condition of Experiment 2 were consistent with predicted reactivity. VC = ventricular contractility; CO = cardiac output; TPR = total peripheral resistance; ↑ = significant increase from baseline; ↓ = significant decrease from baseline; ∅ = no significant increase or decrease from baseline.

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

The reactivity data depicted in Figure 1 demonstrate that participants interacting with stigmatized partners exhibited the predicted threat pattern (i.e., increases in VC and TPR and little or no change in CO). Participants interacting with nonstigmatized partners exhibited the predicted challenge pattern (i.e., increases in VC and CO coupled with TPR decreases).

Again, univariate tests for absolute reactivity demonstrated support for the predicted effects. Participants interacting with a stigmatized partner exhibited significant increases in VC and TPR and no change in CO. Consistent with the challenge pattern, participants cooperating with a nonstigmatized partner exhibited significant increases in ventricle contractility and CO and significant decreases in TPR (see Table 1).

Performance

Participants' responses on the word-finding task, tallied across the 4-min task, ranged from 4 to 34 and were normally distributed (skewness = .59), and the mean number generated was 15.3 ($SD = 6.6$). The number of words generated by the participant was submitted to an analysis of variance (ANOVA) to determine the effect of the partner's physical stigma on the participant's performance. Because we had specific predictions regarding the direction of stigma effects on performance, we used a one-tailed t test to examine the effects of a stigmatized partner on the participants' performance. We observed a significant main effect for stigma condition, Cohen's $d = .65$, $t(36) = 1.96$, $p < .05$. Participants interacting with a nonstigmatized partner generated more words ($M = 17.2$) than did participants interacting with a nonstigmatized partner ($M = 13.1$).

Self-Report Ratings

Participants' ratings. Only two significant findings emerge from the self-report ratings. After performing the word-finding task, participants interacting with stigmatized confederates rated their own verbal abilities better than did participants interacting with nonstigmatized confederates, $t(38) = 2.00$, $p < .05$. In addition, participants interacting with stigmatized confederates rated their partners' performance on the word-finding task more positively than did participants interacting with nonstigmatized confederates, $t(38) = 2.18$, $p < .025$.

Confederates' ratings. Both the preinteraction and the postinteraction rating questionnaires yielded reliable indices (Cronbach's $\alpha = .92$ and $.91$, respectively) of the positivity of participants' attitude and behavior during the experiment, as rated by the confederate. Neither index differed significantly by confederate's stigma. Confederates did not rate their interaction partner significantly more positively as a function of stigma.

Discussion

The results from Experiment 1 confirm our hypothesis that individuals interacting with stigmatized others exhibit threat relative to individuals interacting with nonstigmatized others. Both the speech and the word-finding tasks yielded similar cardiovascular reactivity data by stigma condition. Participants interacting with stigmatized partners exhibited the threat pattern of cardiovascular reactivity, whereas participants interacting with nonstigmatized partners exhibited the challenge pattern. Performance data were consistent with the physiological data. Participants partnered with stigmatized partners generated fewer words than did participants paired with nonstigmatized partners.

We believe this is the first confirmation of the stigma-threat hypothesis using physiological responses independently validated as markers of threat. The post hoc self-report data were generally uninformative. Similar to Guglielmi (1999), we believe that social desirability concerns may have motivated participants to suppress or censor their beliefs and feelings about themselves as well as their evaluations of physically stigmatized partners. For example, though participants interacting with stigmatized others objectively performed more poorly than did those interacting with nonstigmatized others, their self-reports indicated that members of the former group rated their verbal skills better than did members of the latter.

The findings of this experiment notwithstanding, we conducted a second experiment for two major reasons. First, we believed a replication desirable. Second, because our procedures forced a specific ordering of tasks (i.e., making a speech about working together before actually working together), we wanted to establish the independence of the effects obtained during the task involving actual interaction (i.e., word finding) from any possible contributions of the preliminary implied interaction task (i.e., speech).

Experiment 2

Overview

Experiment 2 used a one-factor (partner's physical stigma: present or absent), between-participants experiment. Basically, we replicated Experiment 1 without the speech delivery phase. Thus,

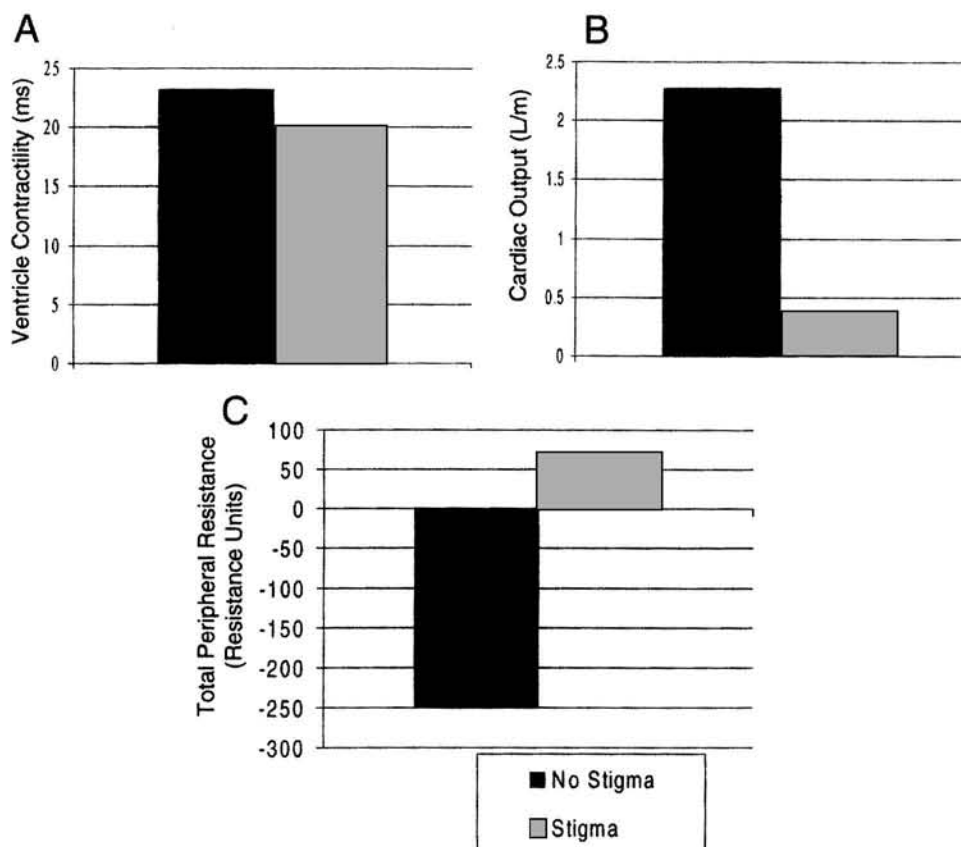


Figure 1. Cardiovascular values from the first minute of the word-finding task by partner's stigma. All variables are expressed as change scores from resting levels of response.

Experiment 2 consisted of two phases: (a) information exchange and (b) the cooperative word-finding task.

Method

Participants

We recruited female participants from the university, none of whom had participated in Experiment 1. Students received course credit or \$10. The sample included 53 women (36 White, 11 Asian, 4 Black, 1 Latina, and 1 other) whose mean age was 19.78 years ($SD = 1.50$).

Procedure

The differences between Experiments 1 and 2 are as follows. After the participant reviewed the confederate's background information sheet and photo, we instructed her that we would connect the two rooms so that she and the confederate could hear each other over the intercom system. We then instructed the dyad that they would work together on a cooperative word-finding task and presented the instructions as in Experiment 1. Experiment 2 employed four female confederates.

Results

Participant Attrition

We lost 2 participants' data because of equipment failure. In addition, we excluded 12 participants because they had prior

knowledge and suspicion regarding the confederate's authenticity.⁷ This resulted in 39 participants with usable physiological data: Seventeen interacted with nonstigmatized partners, and 22 interacted with stigmatized partners.

Cardiovascular Measures

Baseline differences. We tested baseline physiological responses by condition to determine any effects of partner's stigma. The multivariate (VC, CO, and TPR) main effect for partner's physical stigma at the baseline was not significant ($F < 1.50$).

Challenge and threat: Word-finding task. To test for pattern differences, we conducted a MANOVA using cardiovascular reactivity values (VC, CO, and TPR) from the first minute of the word-finding task. This analysis yielded a significant multivariate main effect for partners' stigma, $\eta^2 = .20$, $F(3, 35) = 2.83$, $p < .05$. Follow-up univariate analyses indicated that all cardiovascular variables contributed significantly to the main effect: VC, $F(1, 38) = 6.74$, $p < .01$; CO, $F(1, 38) = 5.76$, $p < .02$; TPR, $F(1, 38) = 6.34$, $p < .02$.

⁷ We conducted Experiments 1 and 2 during consecutive quarters within the same academic year. Because of the novelty of the experiment (i.e., a partner with a birthmark), it is not surprising that a few participants had heard about our experiment.

Univariate testing for absolute effects revealed, as in Experiment 1, that participants interacting with stigmatized partners exhibited VC increases, no change in CO, and increases in TPR—the threat pattern. In contrast, participants interacting with nonstigmatized partners exhibited large cardiac increases and a decrease in TPR—the challenge pattern. Table 1 provides appropriate means and *p* values resulting from these analyses.

Consistent with the threat pattern, participants interacting with stigmatized partners exhibited significant increases in VC, no change in CO, and significant increases in TPR. In contrast, participants interacting with nonstigmatized partners exhibited significant increases in VC and CO and a significant decrease in TPR.

Performance

Performance scores on the word-finding task ranged from 5 to 28 and were normally distributed (skewness = .38), with a mean of 15.0 (*SD* = 6.0). As predicted, participants interacting with stigmatized partners generated fewer words (*M* = 13.3) than did participants interacting with nonstigmatized partners (*M* = 17.3), Cohen's *d* = .69, *t*(34) = 2.03, *p* < .025.⁸

Self-Report Ratings

Participants' ratings. Consistent with the stigma-threat hypothesis, participants interacting with a stigmatized partner post hoc reported exerting more effort (*M* = 2.3) than did nonstigmatized partners (*M* = 0.9), *t*(39) = 2.73, *p* < .01. Participants also rated the task as more competitive with a stigmatized (*M* = 0.3) than a nonstigmatized partner (*M* = -1.2), *t*(38) = 2.08, *p* < .03. In addition, participants rated their own performance better when interacting with a nonstigmatized partner (*M* = 2.3) than a stigmatized partner (*M* = 0.3), *t*(39) = 3.45, *p* < .001. This last finding is somewhat inconsistent with the results in Experiment 1, in which participants rated their own verbal abilities (not performance) better after interacting with stigmatized than nonstigmatized partners.

As expected, some self-report data ran counter to the stigma-threat hypothesis. Participants' trait ratings of the confederates revealed trends consistent with positive reactions to stigmatized partners relative to nonstigmatized partners. Specifically, participants interacting with stigmatized partners tended (though nonsignificantly) to rate their partner as more likable (*M* = 3.0) than did participants interacting with nonstigmatized partners (*M* = 2.4), *t*(38) = 1.62, *p* < .07. A marginal effect was also observed with ratings of how hard-working the participants perceived their partner to be. Participants interacting with stigmatized partners tended to rate their partner as harder working (*M* = 2.2) than did participants who rated their nonstigmatized partners, (*M* = 1.2), *t*(38) = 1.58, *p* < .07.

Confederates' ratings. The preinformation exchange ratings yielded a reliable index (Cronbach's α = .91), as did the postinformation exchange ratings (Cronbach's α = .96). The preinformation exchange ratings did not differ by the stigma condition of the confederate, *F* < 1. However, following the extended interaction, confederates bearing birthmarks perceived the participants' behavior toward them more positively (*M* = 1.4) than did confederates who did not bear the facial birthmark (*M* = 0.8), *t*(37) = 2.04, *p* < .05.

Discussion

The results of Experiment 2 replicate the physiological and behavioral findings of Experiment 1. During actual interactions with physically stigmatized partners, participants exhibited the cardiovascular threat pattern and performed worse than did individuals interacting with physically nonstigmatized others.

The results of the post hoc self-report data yield a more inconsistent picture. Some subjective data support the negativity of interactions with stigmatized partners. That is, participants interacting with stigmatized partners rated the interaction as more competitive and reported exerting more effort than did those interacting with nonstigmatized partners. In contrast, other self-report measures appear to reflect some sort of compensation, given what arguably are the demand characteristics inherent in asking such questions about a stigmatized target. For example, participants interacting with stigmatized confederates tended to rate their partner as more likable and harder working than did participants interacting with nonstigmatized confederates. In addition, the confederates rated participants' behavior toward them more positively when the confederate was stigmatized compared with when she was not stigmatized. These data are not surprising, given the problems associated with self-reported responses in experiments examining stigma or prejudice (Guglielmi, 1999; Vanman et al., 1997).

Experiment 3

Overview

Because we experimentally manipulated physical stigma, the results of the first two experiments provide strong causal evidence for the stigma-threat hypothesis. However, we also want to extend our investigation to examine possible stigma-threat links involving those associated with socioeconomic status and race.

Consequently, we used a 2 × 2 between-subjects design with two factors: race (Black vs. White) and socioeconomic status (SES; advantaged vs. disadvantaged). Similar to Experiment 1, Experiment 3 consisted of three phases: (a) information exchange, (b) speech delivery, and (c) cooperative word finding. However, we revised the procedures to ensure that both performance tasks involved actual ongoing social interaction. Because of technological improvements in the lab, this was accomplished by having participants deliver the "working together" speech and cooperate on the word-finding task live by video such that the participant and confederate could see and hear each other.

In addition, we used a pretest measure to examine the relationship between contact with Black persons and cardiovascular reactivity. We adapted this contact measure from Islam and Hewstone (1993). Earlier work (e.g., Stephan & Stephan, 1985) suggests that increased contact with members of a stigmatized group (e.g., Black persons) may reduce the perceived threat over time. The current study represents the first effort to examine the relationship between intergroup contact and physiological markers of threat. We hypothesized that the frequency of contact with Black people that participants reported prior to the laboratory interaction would

⁸ We lost an additional 5 participants' performance data because of equipment problems.

moderate the extent to which participants exhibited the threat pattern of cardiovascular reactivity during interactions with Black confederates. Specifically, we predicted that greater contact would be associated with less threat.

Method

Participants

We recruited healthy non-Black female participants from the university who received either course credit or \$10. The sample included 70 participants (58 White, 8 Asian, 3 Latina, and 1 Indian) whose mean age was 18.81 years ($SD = 1.07$) and ranged from 17 to 23 years.

Prescreening Questionnaire

During an independent mass testing session conducted several weeks prior to the experiment, participants completed a questionnaire, specifying the frequency and quality of their interactions with Black persons on a 7-point scale ranging from 1 (*none at all*) to 7 (*a great deal*). Questions were adapted from an intergroup contact scale (Islam & Hewstone, 1993). Items included "How much contact have you had with African-Americans at college," "How much contact have you had with African-Americans as neighbors," "How much have you visited African-American homes," "How much contact have you had with African-Americans as close friends," and "How often do you engage in informal discussion with African-Americans." For the mass-testing group ($N = 356$), the scale reliability of these items was high (Cronbach's $\alpha = .86$).

Manipulation Checks

We added two questions to the participants' postword-finding task questionnaire as manipulation checks. The first ascertained the perceived race and ethnicity of the participant's partner, and the second ascertained the perceived SES of her partner—that is, how poor or wealthy participants perceived their partner to be—on a 9-point scale anchored at -4 (*poor*) and 4 (*wealthy*).

Procedures

Prior to the experiment, participants were randomly assigned to interact with a Black or White female confederate. We employed 4 Black and 4 White female confederates. Experiment 3 began exactly as Experiment 1 did until the experimenter brought the participant to the confederate's preparation room for the information exchange.

Information exchange. The experimenter explained that the participants were to describe their background to each other using the information sheet that they had just completed. The confederate, "Sharon," began by describing her background. We manipulated SES through this description. The SES description (high vs. low) was based on data collected during pretesting sessions using the same participant population. The advantaged Sharon was from Palo Alto, her father was an international lawyer with his own practice, her mother was a Stanford history professor, and her younger sister attended UCLA. In her spare time, she enjoyed shopping with her friends. Furthermore, she explained that during the summer she was going to Europe for a few months. The disadvantaged Sharon was from Oakland, her father "wasn't around," her mother worked in a factory but had recently been laid off, her older brother drove a taxi, and she had three siblings who lived at home. She enjoyed watching television with her friends, and her summer plans included going home to get a job to help her mother out with her siblings.

Speech delivery. Next, the participant and confederate were returned to their preparation rooms, and we applied physiological sensors to each

(although those applied to confederates were never actually connected to recording equipment). After a 5-min baseline period, we connected the two chambers with audiovisual equipment so the participant and the confederate could see and hear each other live through video monitors. They then received instructions that one of them would be randomly assigned to give a speech on the topic of working together and that the other would listen to the speech. The computer then appeared to randomly choose the participant to give the speech and the confederate to listen to it. We then provided the participant with speech instructions, exactly as in Experiment 1. After the speech, we disconnected the audiovisual equipment, and the participant completed a postspeech questionnaire.

Word-finding task. After a second baseline period, we again connected the audiovisual equipment so that the women could see and hear each other. We then instructed them in how to play the cooperative word-finding task and introduced the monetary incentive. Again, the confederate was prompted when to say each word by an experimenter positioned out of camera range. After 4 min, the experimenter instructed them that the task was over, and the rooms were disconnected. The experimenter then brought the postword-finding task questionnaire to the participant to be completed. On completion of the questionnaire, the participant was probed for suspicion, debriefed, thanked, and paid.

Results

Participant Attrition

We excluded 3 participants because they had suspicion of the authenticity of the confederate. Data from 7 participants were lost because of technical problems related to the physiological equipment, and data from an additional 2 were lost because of audiovisual problems. This attrition rate resulted in 58 participants with usable physiological data: Fifteen interacted with a Black advantaged confederate, 14 interacted with a Black disadvantaged confederate, 14 interacted with a White advantaged confederate, and 15 interacted with a White disadvantaged confederate.

Manipulation Checks

None of the participants misidentified their partner's race. In addition, we were successful at manipulating the perceived socioeconomic background of the confederates. Advantaged confederates were rated significantly above the midpoint of the economic background scale, $M = 3.0$, $t(29) = 19.4$, $p < .0001$, whereas disadvantaged confederates were rated significantly below the midpoint on the scale, $M = -1.2$, $t(29) = -5.80$, $p < .0001$.

Cardiovascular Measures

Baseline differences. We tested baseline physiological responses by condition to determine any effects of partner's race or SES. We did not observe any significant multivariate main effects for race or SES of the partner, nor was the interaction significant (all $ps > .20$).

Challenge and threat: Speech delivery. The MANOVA testing relative pattern differences using reactivity values from the first minute of speech yielded a nonsignificant main effect for race and for the Race \times SES interaction. A significant main effect for

Table 2
Means and Univariate Tests From Zero (Baseline) of Cardiovascular Reactivity in Experiment 3

Task and measure	Race		Status	
	Disadvantaged (threat)	Advantaged (challenge)	Black (threat)	White (challenge)
Speech				
VC	↑ 19.61***	↑ 14.62***	↑ 19.26***	↑ 14.78***
CO	∅ 0.91*	↑ 1.22***	∅ 1.18**	↑ 0.97**
TPR	∅/↑ -50.32	↓ -126.04***	∅/↑ -82.87*	↓ -97.35**
Word-finding task				
VC	↑ 14.67***	↑ 9.64***	↑ 11.28***	↑ 12.96***
CO	∅ 0.33	↑ 0.56**	∅ 0.11	↑ 0.80**
TPR	∅/↑ 64.97	↓ -2.89	∅/↑ 100.82*	↓ -42.59

Note. All condition means were tested against zero to determine significant increases or decreases from the baseline. Boldface indicates values that are consistent with predicted reactivity. VC = ventricular contractility; CO = cardiac output; TPR = total peripheral resistance; ↑ = significant increase from baseline; ↓ = significant decrease from baseline; ∅ = no significant increase or decrease from baseline.
* $p < .05$. ** $p < .01$. *** $p < .001$.

SES was observed, $\eta^2 = .16$, $F(3, 49) = 2.99$, $p < .04$.⁹ None of the follow-up univariate analyses were significant; VC, $F(1, 54) = 1.49$, $p < .22$; CO, $F < 1$; TPR, $F(1, 54) = 2.14$, $p < .15$.

The absolute tests of each cardiovascular reactivity measure during the speech were consistent with the predictions. Participants delivering a speech to advantaged partners exhibited increases in VC, increases in CO, and decreases in TPR. Participants delivering speeches to disadvantaged partners exhibited less strong threat response (see Table 2).

Challenge and threat: Word-finding task. The MANOVA testing relative pattern differences using reactivity data from the first minute of the word-finding task yielded two significant main effects and no interaction¹⁰ (main effects are depicted in Figure 2). The multivariate main effect for SES was significant, $\eta^2 = .15$, $F(3, 49) = 2.78$, $p < .05$, as was the main effect for race, $\eta^2 = .18$, $F(3, 49) = 3.51$, $p < .02$. Consistent with predictions, participants interacting with disadvantaged partners and Black partners exhibited threat reactivity. In contrast, participants interacting with advantaged partners and White partners exhibited challenge reactivity.

The follow-up univariate analyses to the SES main effect yielded no significant effects, VC, $F(1, 54) = 2.32$, $p < .13$; CO, $F < 1$; TPR, $F(1, 54) = 1.95$, $p < .17$. However, regarding absolute reactivity for each measure, univariate analyses indicated that all but one of the predictions were confirmed (see Table 2). Participants interacting with disadvantaged partners exhibited threat reactivity, increased VC, and no change in CO and TPR. Participants interacting with advantaged partners exhibited increased VC and CO (consistent with challenge reactivity), but the decrease in TPR was not significant.

The multivariate main effect for race was further examined with univariate analyses, which revealed that CO and TPR contributed to the multivariate effect but that VC did not: VC, $F < 1$; CO, $F(1, 54) = 5.89$, $p < .01$; TPR, $F(1, 54) = 7.57$, $p < .01$. In addition, absolute reactivity for each measure indicated that all predictions regarding the direction of cardiovascular reactivity were confirmed. Participants interacting with White partners exhibited the challenge pattern, significant increases in VC and CO and de-

creases in TPR. In contrast, participants interacting with Black partners exhibited reactivity consistent with the threat pattern, increased ventricle contractility, no change in CO, and increased TPR (see Table 2).

Intergroup contact as a moderator of cardiovascular reactivity. A subsample of our participants completed the racial contact prescreening scale (Cronbach's $\alpha = .91$). Of the 35 participants with usable cardiovascular data, 22 interacted with Black partners and 13 with White partners. To test the prediction that intergroup contact would moderate perceivers' cardiovascular threat reactions, we conducted three multiple regressions predicting VC, CO, and TPR from the word-finding task with the intergroup contact index, partner's race, and the Contact \times Race interaction. The regression equation predicting VC was significant and accounted

⁹ An additional participant's data were lost because of loss of the ECG signal during the speech.

¹⁰ We conducted two contrasts to test whether no stigma differed from a single stigma, and then whether a single stigma differed from a double stigma. Because these contrasts are not orthogonal, we set the alpha level at .025 per contrast. The first analyses compared cardiovascular reactivity between participants who interacted with nonstigmatized partners (White and advantaged) and participants who interacted with singly stigmatized (Black and advantaged or White and disadvantaged) partners. This analysis yielded a nonsignificant multivariate effect ($p > .30$). The trend in the TPR reactivity was consistent with the hypothesized effect. Participants interacting with nonstigmatized partners exhibited greater TPR decreases ($M = -61.1$) than did participants interacting with singly stigmatized partners ($M = 12.4$); however, the univariate test of TPR was not significant, $F(1, 41) = 1.82$, $p < .18$. The multivariate effect comparing the reactivity of participants who interacted with singly stigmatized partners with the reactivity of those who interacted with doubly stigmatized partners (Black and disadvantaged) did yield a significant multivariate effect, $\eta^2 = .24$, $F(3, 38) = 4.04$, $p < .01$. CO and TPR contributed significantly to the multivariate main effect, but VC did not: For VC, $F < 1$; for CO, $F(1, 41) = 6.51$, $p < .01$; for TPR, $F(1, 41) = 5.50$, $p < .025$. Participants interacting with doubly stigmatized partners exhibited lower CO ($M = -.03$) and higher TPR ($M = 162.3$) than did participants interacting with singly stigmatized partners (CO: $M = 0.67$; TPR: $M = 12.4$).

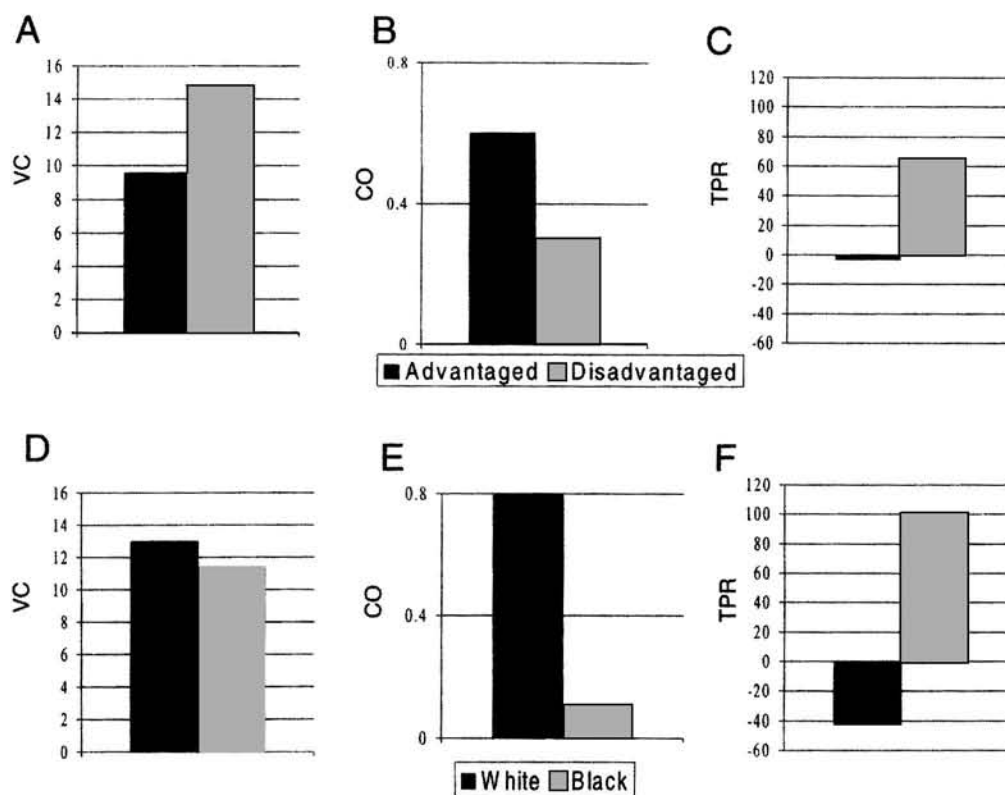


Figure 2. Cardiovascular values from the first minute of the word-finding task. Panels A–C depict reactivity by partner's status. Panels D–F depict reactivity by partner's race. VC = ventricular contractility; CO = cardiac output; TPR = total peripheral resistance.

for 24% of the variance, $F(3, 34) = 3.29, p < .04$, adjusted $R^2 = .17$. The regression equation predicting TPR was also significant and accounted for 22% of the variance, $F(3, 34) = 2.93, p < .05$, adjusted $R^2 = .15$. The regression equation predicting CO accounted for only 14% of the variance and yielded an overall nonsignificant equation, $F(3, 34) = 1.71, p = .18$, adjusted $R^2 = .06$.

It is important to note that the equation predicting VC reactivity yielded a significant Partner's Race \times Intergroup Contact interaction and the equation predicting TPR reactivity yielded a significant intergroup contact effect. The slopes demonstrating the nature of the main effect and interaction are found in Figure 3. The nature of the interaction predicting VC was such that among participants interacting with Black partners, the higher their intergroup contact ratings were, the higher the VC reactivity was ($\beta = .57, p < .001$). In contrast, participants interacting with White partners did not exhibit a significant relationship between VC and intergroup contact ($\beta = -.16, ns$). The regression equation yielded a significant negative relationship between TPR and intergroup contact only among participants interacting with Black participants ($\beta = -.43, p < .05$), and did not yield a significant relationship among participants interacting with White partners ($\beta = -.27, ns$). The regression predicting CO yielded a marginal relationship between CO and intergroup contact among participants interacting with Black partners ($\beta = .36, p < .10$) and no significant relationship among participants interacting with White partners ($\beta = .07, ns$).

The relationships observed among the cardiovascular reactivity variables and the intergroup contact index were consistent with the prediction that as intergroup contact increases, threat attenuates. That is, participants interacting with Black partners who scored high on intergroup contact exhibited higher VC, marginally higher CO, and lower TPR than did participants who interacted with Black partners who scored low on intergroup contact. Among participants who interacted with White partners, these relationships between cardiovascular reactivity and intergroup contact were not observed. Therefore, these analyses suggest that the stigma–threat link can be attenuated or even eliminated as the novelty of the stigma is reduced.

Performance

The number of words generated during the word-finding task ranged from 3 to 22, was normally distributed (skewness = $-.27$), and yielded a mean of 13.1 ($SD = 4.5$). A 2×2 ANOVA with partner's race and SES as the independent variables yielded a significant main effect for partner's race, Cohen's $d = .76, F(1, 57) = 8.07, p < .01$, such that participants interacting with Black partners generated fewer words ($M = 11.5$) than did participants interacting with White partners ($M = 14.7$). The main effect for partner's SES and for the Partner's Race \times SES interaction were not significant.

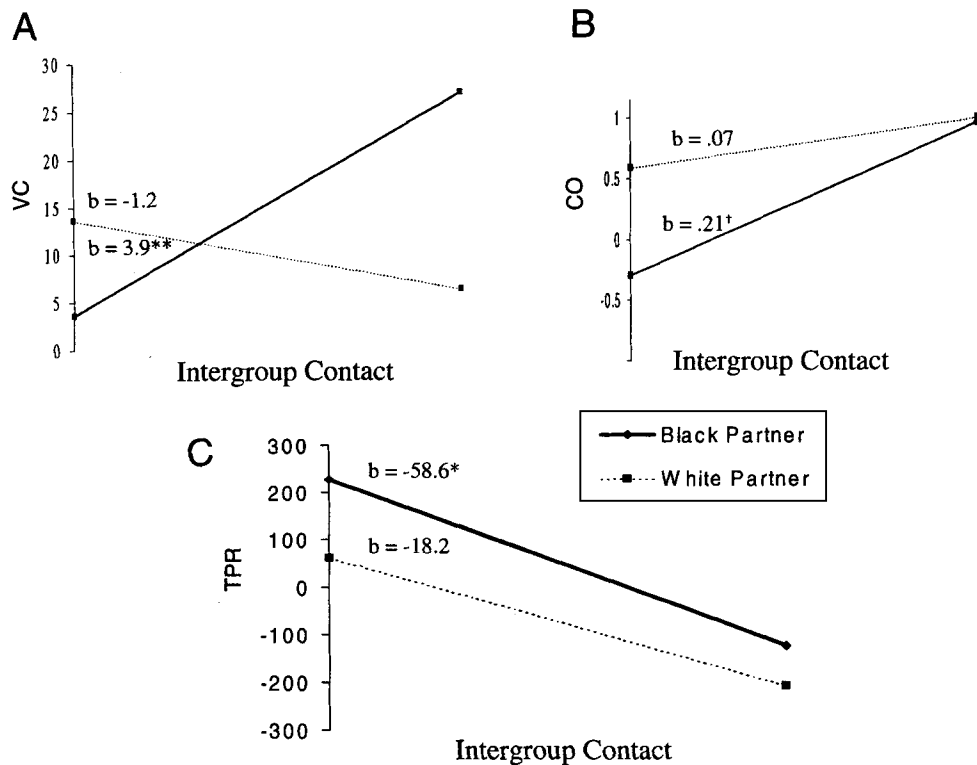


Figure 3. Intergroup contact index predicting cardiovascular responses. The measure of the slope is indicated by the b value. VC = ventricular contractility; CO = cardiac output; TPR = total peripheral resistance. $^{\dagger} p < .10$, marginally significant. $* p < .05$. $** p < .01$.

Self-Report Ratings

Participants' ratings. No significant differences were found among the postspeech evaluation ratings. Following the word-finding task, participants interacting with disadvantaged partners rated their partners' performance on the task better than did participants interacting with advantaged partners, $F(1, 57) = 7.51$, $p < .01$. In addition, participants rated their own verbal skills better after interacting with disadvantaged partners than with advantaged partners, $F(1, 57) = 5.16$, $p < .03$.

Among the trait ratings, two out of eight traits yielded significant (or marginal) main effects for partner's status. In general, participants rated disadvantaged partners more positively than advantaged partners. For example, the participants rated disadvantaged partners as more likable ($p < .06$) and more independent ($p < .002$) than advantaged partners.

Confederates' ratings. Interaction ratings by the confederates yielded two reliable indices of positivity before and after the information exchange. The initial interaction ratings yielded a reliable index (Cronbach's $\alpha = .98$), as did the interaction following the information exchange (Cronbach's $\alpha = .98$). The preinteraction index was used as the dependent variable in a 2×2 ANOVA with partner's race and SES as the independent variables. A nonsignificant main effect for partner's race was observed, $F(1, 51) = 1.69$, $p < .20$. The postinteraction ratings yielded the same effect observed in Experiment 2, although in this experiment the probability value exceeded .05, $F(1, 57) = 2.57$, $p < .11$. Black

confederates tended to rate participants' actions toward them as more positive (Preinteraction: $M = 0.9$; Post-interaction: $M = 1.3$) than did the White confederates (Preinteraction: $M = 0.4$; Post-interaction: $M = 0.7$).

Discussion

The results of Experiment 3 generally replicate those of Experiments 1 and 2. The multivariate main effects on cardiovascular measures as well as those for performance differences obtained for race and socioeconomic status, particularly during the cooperative task, provide evidence that both stigmas can engender threat. We found that the doubly stigmatized partner exhibited stronger threat reactivity than did singly stigmatized partners, suggesting that stigmas can operate additively. Consistent with the physiological findings, performance during the word-finding task paralleled the challenge-threat reactions. Participants interacting with Black partners generated fewer words than did participants interacting with White partners. The confederates' ratings again demonstrate a trend toward Black confederates perceiving their interaction partners' behavior as more positive than did White confederates.

Experiment 3 also extends the previous experiments by examining a moderator of the stigma-threat hypothesis. We have demonstrated that experience with stigmatized group members attenuates threat reactions. We believe intergroup contact serves to reduce the novelty or unfamiliarity of the stigmatized group members, which in turn decreases the uncertainty of the situation,

leading to less threat. This is a critical finding for those interested in reducing prejudice and intergroup conflict through increased contact.

General Discussion

Evidence for Stigma–Threat Link

The results reported here provide consistent physiological and behavioral evidence supporting the stigma–threat hypothesis for perceivers, one which many stigma theorists have assumed explicitly or implicitly (e.g., Crocker, Major, & Steele, 1998; Goffman, 1963; Jones et al., 1984). Perceivers interacting with stigmatized partners exhibited cardiovascular patterns associated with threat and performed more poorly than did those interacting with nonstigmatized others. The physiological and behavioral effects occurred across stigma conditions, including physical, racial, and socially constructed stigmas and in both experimental and quasi-experimental conditions.

Significant main effects were found for physiological responses in each experiment, indicating threat reactivity among participants interacting with stigmatized others (a summary of the effect sizes appears in Table 3). A review of Table 3 indicates that the effect of physical stigma yielded medium to large effects for both cardiovascular data and behavioral data (Cohen, 1988) and smaller effects for race and status. However, in seven tests of the stigma–threat hypothesis using cardiovascular reactivity data, six yielded medium to large effects. Predicted differences in performance were also observed in three out of four tests. Only effects of stigma due to status did not yield performance differences.

Additionally, we note that the effects obtained during the word-finding task are more reliable as well as larger in magnitude than the effects observed during speech delivery. The word-finding task differed from the speech task in that the former required cooperative interaction and joint rewards. Thus, the word-finding task was considerably more interdependent than the speech task. Although the tasks differed on dimensions other than interdependence, we believe the cooperative, interdependent nature of the word-finding task contributed considerably to the observed differences between the speech and the word-finding game.

The self-report data yield a less consistent picture than do the physiological and performance data. Little evidence of threat resulted from posttask questionnaires. Indeed, consistent with impression management and self-presentation motives suggested by

others (e.g., Devine et al., 1996; Guglielmi, 1999), the trends in participants' self-reports reveal that stigmatized partners were rated more positively than nonstigmatized partners were. In line with participants' self-report, stigmatized confederates rated participants' behaviors toward them more positively than nonstigmatized confederates did, even when confederates were kept unaware of the condition (Experiment 2). The inconsistency between physiological and self-report data in our experiments recalls similar differences found by Vanman et al. (1997), who reported incongruent results between physiological measures of affect toward racial targets using facial electromyography and self-report.

Results from Experiment 3, in which we manipulated both racial and socioeconomic stigmas, indicated main effects for each type of stigma but no interactions. Further analyses established the additivity of these main effects on cardiovascular patterns, such that participants interacting with doubly stigmatized partners exhibited greater physiological threat than did those interacting with singly stigmatized partners. Those interacting with nonstigmatized partners exhibited physiological challenge. We conclude from these findings that multiple stigmas can operate independently. However, we are cautious not to conclude that they always operate independently.

Moderators of Stigma–Threat Link

Experiment 3 allowed us to test the effects of intergroup contact as a potential moderator of the stigma–threat relationship. Participants who scored high on the prescreening intergroup contact questionnaire exhibited cardiovascular response patterns characteristic of a challenge response while interacting with Black partners, and participants who scored low on this questionnaire exhibited cardiovascular response patterns characteristic of a threat response while interacting with Black partners. Among participants who interacted with White partners, these relationships were not observed (see Figure 3). This represents physiological evidence relevant to the argument that over time, intergroup contact may act to reduce feelings of anxiety and threat in intergroup situations (e.g., Devine et al., 1996; Islam & Hewstone, 1993; Stephan & Stephan, 1985).

The contact moderator is consistent with our biopsychosocial model of challenge and threat and with previous research. One may recall uncertainty as one of our three theoretically specified components of demand evaluations. As Jones et al. (1984) argued,

Table 3
Summary of Effect Sizes

Stigma	Cardiovascular reactivity data		Behavioral data (performance)
	Speech	Word finding	
Experiment 1—physical stigma	.66	.74	.65
Experiment 2—physical stigma		.78	.67
Experiment 3			
Race	.15	.50	.76
Status	.30	.31	.09

Note. Effect sizes are expressed in Cohen's *d*. Effect sizes for the cardiovascular reactivity data were estimated by calculating Cohen's *d* for the three cardiovascular reactivity variables and then averaging those variables. For all values except status behavioral data, the effect size was in the predicted direction.

situations involving stigmatized others may increase uncertainty due to the novelty of these types of interactions. Assuming that increased positive contact with stigmatized others decreases uncertainty, our theory predicts that demand evaluations decrease. Furthermore, increased contact with stigmatized others should also increase resource evaluations involving skills and abilities, particularly the ability to communicate effectively (e.g., mutual knowledge or shared reality). The resultant decreased demand evaluations and increased resource evaluations should result in a relative challenge response. Hence, individuals for whom a particular stigmatized group is familiar rather than novel (i.e., those who have experienced greater frequency and quality of contact with the stigmatized group) should be less threatened than are individuals lacking such familiarity. Indeed, we have experimentally demonstrated that novelty results in threat responses in past experiments in other contexts (e.g., Blascovich et al., 1993; Blascovich et al., 1999; Mendes et al., 2000). Future research should address the precise mechanisms (e.g., uncertainty reduction, evaluations of skills and abilities) through which contact moderates physiological threat during interactions with stigmatized persons.

Our biopsychosocial model of challenge and threat also suggests other as yet untested moderators. These moderators could affect demand or resource evaluations. Regarding manipulating components of the demand evaluations, the perception of danger may increase the extent to which the nonstigmatized individual experiences existential threat (Pyszczynski, Greenberg, & Solomon, 1997). For example, priming mortality salience prior to interactions with stigmatized others may increase danger evaluations, resulting in the increased likelihood of threat responses.

Evaluations of required effort may be influenced in several ways. For example, Frable and colleagues (1990) have shown that nonstigmatized individuals, during interactions with stigmatized others, exert more effort in initiating conversations and ensuring smooth interactions. Hence, decreasing the required effort exerted by the nonstigmatized partner during interactions with a stigmatized partner (e.g., by increasing the effort of the stigmatized partner) may result in less threat. Evaluations of required effort also may increase during interactions with stigmatized others because of deliberate or automatic stereotype suppression (Macrae, Bodenhausen, Milne, & Wheeler, 1996). Somehow allaying the need for suppression or becoming more proficient at it may free task-relevant resources that otherwise would be consumed by stereotype suppression.

Some factors may also moderate resource evaluations. Dispositions provide an obvious example. Dispositionally high-racist or -authoritarian individuals would likely exhibit greater threat responses than would dispositionally low individuals. However, as Devine (1989) has suggested, dispositionally low-racist individuals may use cognitive resources to correct automatically activated negative stereotypes that they may not want to express. We argue that in many cases, dispositionally high-racist individuals also need to suppress expressions of prejudice for impression management purposes. In both cases, fewer cognitive resources remain for task performance. Finally, the presence of similar individuals during an interaction may increase the amount of perceived external support by increasing the amount of perceived available social support, thus resulting in a decreased likelihood of threat responses. On the other hand, the presence of additional stigmatized

individuals may increase the likelihood of threat responses because of the change in assumed majority membership.

Summary and Future Research

This research provides strong physiological and behavioral evidence of perceiver threat during social interactions with stigmatized others across a variety of stigmas. The inconsistency noted between objective (i.e., cardiovascular patterns and performance measures) and subjective indices corroborates problems suggested by others regarding the use of self-report in this type of context. It is important to note that this context is limited theoretically and empirically to motivated performance situations—that is, situations that are goal relevant and are active rather than passive. The real-world counterparts of our laboratory-based motivated performance situations are ubiquitous, including those in domains such as work, play, relationships, and school.

Our general research paradigm incorporating our theoretically based cardiovascular measures affords many opportunities for future research in the general area of stigma, including work on untested moderators of the stigma–threat link, as described previously. In addition, the paradigm can easily incorporate manipulations and procedures designed to examine the operation of cognitive versus affective, learned versus unlearned, and conscious versus unconscious processes linking stigma to perceiver threat. It is important to note that the paradigm also allows for the experimental and quasi-experimental investigation of stigma and threat from the perspective of the stigmatized individual. Finally, the moderating effects of contact suggest that our paradigm allows for testing of other threat-reducing interventions designed to increase the positivity of intergroup interactions.

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