The Modern Face of Prejudice and Structural Features That Moderate the Effect of Cooperation on Affect

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Facial muscle activity and self-reports were examined for racial bias in 3 studies. In the first 2 experiments, White participants imagined cooperating with a Black or White partner. Experiment 1 manipulated reward structure in the context of cooperating with a deficient partner. Experiment 2 manipulated partner deficiency and willingness to expend compensatory effort. On both facial EMG and self-report measures, joint rewards produced more negative affect than independent rewards. However, all partners were liked more when they were willing to try to compensate for their deficits. In addition, more liking was reported for Black partners, but EMG activity indicated bias against Blacks. Experiment 3 investigated individual differences in prejudice. Again, a greater preference for Blacks than Whites occurred on self-report measures, but in their facial muscle activity, high-prejudiced participants exhibited bias against Blacks.

In the years following the 1954 ruling by the U.S. Supreme Court in favor of the plaintiff in *Brown vs. Board of Education,* institutionalized racial desegregation, particularly in schools, became a fact of life. At the same time, although cooperative team learning interventions were shown to be highly effective in improving the mastery of curriculum materials (e.g., Johnson, Maruyama, Johnson, Nelson, & Skon, 1981; Sharan et al., 1984; Slavin, 1983), they also came to be advocated as useful interventions for improving intergroup relations within ethnically heterogeneous settings such as desegregated schools. Specific interventions include Teams Games Tournament (Edwards, DeVries, & Snyder, 1972), Learning Together (Johnson & Johnson, 1975), Student Team Learning Divisions (Slavin, 1978), Jigsaw (Aronson, Blaney, Stephan, Sikes, & Snapp, 1978), and Group Investigation (Sharan & Hertz-Lazarowitz, 1980). Despite important differences in the ways in which these interventions structure the team task and rewards, their proponents uniformly recommend that in racially heterogeneous settings teams be constructed to be heterogeneous with respect to the social category memberships of its members. The theoretical foundation for arguing that these inventions can improve intergroup relations is the contact hypothesis, which posits that direct interpersonal interaction with members of a disliked social category will lead to more positive behavior and attitudes toward them.

Meta-analyses of the extensive field and laboratory research on these cooperative interventions show that they do increase interpersonal attraction toward out-group members (Johnson, Johnson, & Maruyama, 1984; Miller & Davidson-Podgorny, 1987). More specifically, a cooperative task structure leads to greater out-group liking than does a competitive or individualistic setting (Johnson et al., 1984). In conjunction with other sociostructural changes in society over the last three decades, the widespread use of these cooperative procedures presumably has contributed to the more positive feelings about members of disadvantaged groups seen in current, as compared with previous, generations of Whites. Nationwide polls, for example, indicate a shift among Whites away from strongly negative feelings toward Blacks (Schuman, Steeh, & Bobo, 1985).

To examine this apparent improvement in attitudes toward disadvantaged groups, however, it is important to measure the involuntary, as well as the voluntary, affective reactions of Whites. Most dependent measures in studies of cooperative interaction have been of the voluntary kind: nomination and roster-rating sociometric measures, Likert-type items assessing liking, attitude scales indicating perceptions of being liked, and so on. At this point in time, however, it is unclear how to interpret

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such measures. In today's society, norms dictate that one should not express negative attitudes about others on the basis of their ethnicity, even though one might truly harbor such evaluations (Dovidio & Fazio, 1992; Gaertner & Dovidio, 1981; McConahay, Hardee, & Batts, 1981). Therefore, when evidence from measures under voluntary control indicates positive feelings on the part of Whites toward Blacks, it may reflect social desirability concerns. Moreover, individuals who exhibit such responsiveness to normative constraints may not even be aware of their true sentiments (Greenwald & Banaji, 1995; Nisbett & Wilson, 1977).

In response to these concerns about voluntary expressions of attitudes, researchers have turned to the use of more involuntary measures of intergroup bias and stereotyping. These latter assessments are believed to tap into the automatic processes involved in such reactions (Devine, 1989a, 1989b; Dovidio & Gaertner, 1993; Fazio, Sanbonmatsu, Powell, & Kardes, 1986). For example, Fazio, Jackson, Dunton, and Williams (1995, Study 1) used a priming task developed by Fazio et al. (1986) to examine ethnic attitudes by assessing automatic evaluations of attitude objects. Photographs of White, Black, and other (i.e., Asian and Hispanic) faces, each presented for 315 ms, were followed 135 ms later by either a positive or negative adjective. Participants pressed a key labeled *good,* or one labeled *bad,* to indicate their judgment of each word. The latency of their judgments served as the dependent measure. Whereas White participants had shorter latencies to positive words that were preceded by White photos as compared with those preceded by Blacks, Black participants had shorter latencies to negative words that were preceded by White photos than those preceded by Blacks. Moreover, the variability among the latency measures of White participants predicted individual differences in their behavior toward the Black experimenter and their attributions of responsibility for the riots that followed the announcement of the verdict of the Rodney King beating trial.

In a similar study, Judd, Park, Ryan, Brauer, and Kraus (1995, Study 1) used a priming task in which either the prime word *Blacks* or *Whites* was presented for 2 s, followed by a probe word (Dovidio, Evans, & Tyler, 1986). The latency of the participant's judgment about whether the probe word could ever be true of the prime word was the dependent variable. Their results, however, contrast sharply with those of Fazio et al. (1995). Although Black participants showed evidence of ethnocentrism on this measure, White participants did not. Yet on nearly every other more voluntary measure, the White participants evidenced more positive views of the Blacks at their campus than of the Whites. In another study in which the exposure time of the prime was reduced to 500 ms (Judd et al., 1995, Study 3), White participants exhibited outgroup favoritism, an effect opposite in direction to that of ethnocentrism. That is, they responded with shorter latencies to negative traits when primed by *Whites* than when primed by *Blacks* and slightly shorter latencies for responding to the positive traits when primed by *Blacks* than when primed by *Whites.* The authors concluded that the apparent positive responses of White participants to Blacks in these two studies are genuine, arguing that the data from the priming task are inconsistent with a social desirability explanation, and that, in fact, "White American participants showed a marked reluctance to treat ethnicity as a valid basis for organization" (p. 477).

The data from Fazio et al. (1995) and Judd et al. (1995) thus provide a conflicting picture of the attitudes of White college students toward Blacks in the past decade. It should be noted, however, that these studies involved the presentation of primes at exposure times in which participants are aware of the prime. Moreover, in Study 1 Judd et al. explicitly told participants that the primes referred to Whites and Blacks at the University of Colorado. Likewise, in Study 2 they told participants that the primes referred to Whites and Blacks in the United States as a whole. Consequently, because of their awareness of the meaning of the primes, participants may have been motivated to control their initial automatic propensity, and thereby inhibit their expression of spontaneous negative feelings (Dovidio & Fazio, 1992).

In response to this possibility, some researchers (Devine, 1989b; Locke, MacLeod, & Walker, 1994; Wittenbrink, Judd, & Park, 1997) have used primes of shorter duration in which the prime is hypothesized to be processed without entering the participant's awareness. Devine (1989b) showed that when social category labels or stereotypic descriptors serve as primes, the priming of the stereotype associated with Blacks leads White participants to rate ambiguous behavior by a target person as more hostile, regardless of the participant's score on the Modern Racism Scale (McConahay et al., 1981). However, Locke et al. (1994) showed Australian participants either the word *Aborigines* or *yourself,* followed 240 ms later by a 20-ms presentation of a trait word that was immediately masked by a colored pattern of letter fragments. On the *Aborigines* trials, highly prejudiced (as indicated by Modern Racism Scale scores) White Australians exhibited more color-naming interference when the trait was stereotypic of Aborigines than when it was not, whereas those low in prejudice showed no differential color-naming interference. Similarly, Wittenbrink et al. (1997) presented in a priming study the words *black* or *white* for 15 ms, followed by a letter string, for which participants were instructed to indicate whether it was a word or nonword. Among these strings were positively and negatively valenced words that were stereotypical of either Whites or Blacks in the United States. Shorter reaction times occurred when positive, white-stereotypical words were preceded by the *white* prime, and when negative, black-stereotypical words were preceded by the *black* prime. Moreover, this implicit prejudice effect was also found to correlate with participants' scores on a variety of self-report measures of racial attitudes. Thus, both the findings of Locke et al. and Wittenbrink et al. make the model offered by Devine (1989b), that high- and low-prejudiced individuals do not differ in their automatic level of processing, somewhat implausible.

In sum, involuntary measures of cognitive processes in intergroup responding have yielded mixed findings. They have indicated that Whites' "automatic" responses to Blacks can be characterized as (a) biased against Blacks (Devine, 1989b; Wittenbrink et al., 1997), (b) altogether eliminated (Judd et al., 1995, Study 1), (c) biased in reverse so as to favor Blacks (Judd et al., 1995, Study 3), and/or (d) moderated by individual differences (Augustinos, Ahrens, & Innes, 1994; Fazio et al., 1995; Locke et al., 1994; Wittenbrink et al., 1997). Whatever

the case, all of these studies have focused on cognitive processes underlying prejudice.

Other researchers have argued that measures that are affectively based are more likely to be consistent and strong predictors of racial and ethnic attitudes (e.g., Stangor, Sullivan, & Ford, 1991; Vanman & Miller, 1993). This view is in accord with that of some attitude theorists who have proposed that emotions predict some behaviors better than more cognitively based measures of attitudes (Breckler & Wiggins, 1989; Zanna & Rempel, 1988). For example, participants' specific emotional feelings (e.g., hopeful, afraid) about different national, ethnic, and religious groups are more predictive of their responses to a modified version of the Bogardus (1925) social distance scale than are individual or consensual stereotypes (Stangor et al., 1991). Similarly, Judd et al. (1995) found that Whites did express ethnocentrism on one measure—a thermometer-like *feeling* scale. Ignoring the issue of why (in light of our previous discussion about the constraining effect of contemporary social norms) Judd et al.'s participants might be motivated to express, rather than mask their negative feelings, it is clear that both Stangor et al.'s questionnaires and Judd et al.'s thermometer scale elicit voluntary responses. More generally, Epstein (1994) argued that of the two cognitive systems, the affective–experiential system is more dominant than the rational system in most situations, being more efficient and less effortful. By contrast with the rational system, which manifests itself primarily through the medium of language and requires justification by means of logic and evidence, the affective system operates more crudely and processes information automatically and rapidly. Thus, on the basis of these considerations, along with our previous arguments, *involuntary affective measures* are most likely to reflect uncontrolled, automatic reactions to outgroup members. On the basis of this reasoning, in our research we used psychophysiological measures to assess involuntary affective reactions to individual members of social categories.

Previous researchers in intergroup relations (e.g., Cooper, 1959; Porier & Lott, 1967; Rankin & Campbell, 1955; Tognacci & Cook, 1975; Vidulich & Krevanick, 1966) similarly have looked for an involuntary psychophysiological marker of ethnic prejudice by measuring electrodermal activity. These studies used photographs of targets, written descriptions of groups, or the presence of confederates whose ethnicity was either the same as or different from the participant's. Some participants in these studies indeed showed "increased arousal" to members of the out-group in comparison with targets from the in-group (e.g., Rankin & Campbell, 1955). Most of this research, however, either failed to show a relationship between the valence of the participant's reported racial attitudes and EDA or suffered from other methodological concerns. Instead, the most consistent finding was that increased EDA sometimes accompanied attitude intensity, whether favorable or unfavorable toward the out-group target (Cacioppo & Sandman, 1981).

In contrast, facial electromyography (EMG) is a better response system for differentiating the valence and intensity of affective reactions. In particular, the *zygomaticus major* (the muscle in the cheek that pulls up the lip corner) and the *corrugator supercilii* (the muscle above the eye that pushes the brows together) reliably exhibit increased activity during times at which the participant later reports having experienced positive or negative affect, respectively, even though the face showed no overt expression at the time (Cacioppo, Petty, Losch, & Kim, 1986; Fridlund, Schwartz, & Fowler, 1984; McHugo, Smith, & Lanzetta, 1982). And, consistent with our previous argument, EMG typically is not susceptible to some of the problems associated with traditional self-report measures, such as socially desirable responding. This is especially true when participants are unaware that their facial muscles are being recorded (McHugo & Lanzetta, 1983). Therefore, in the research we report herein, we used measures of facial EMG to assess nonvoluntary affective reactions of Whites to Blacks.

To investigate the potential utility of facial EMG as an involuntary affective measure of intergroup attitudes, we examined it in the context of specific features of cooperative interventions that moderate negative attitudes toward teammates. As we have noted, cooperative team learning procedures have been a widely used and apparently effective way to ameliorate intergroup bias and ethnocentrism in desegregated and ethnically heterogeneous school settings. Recommendations regarding the details of their implementation, however, differ. Some researchers have strongly advocated team-based, rather than individual, rewards (Cohen, 1986; Johnson & Johnson, 1992). Inherent in team-based rewards is common-fate, which is viewed by some (Gurin & Townsend, 1986; Rabbie & Horwitz, 1988; Rabbie, Schot, & Visser, 1989) as the critical theoretical ingredient for a sense of shared identity. Even such seemingly trivial shared experiences as having the same birthday, can produce a sense of bonding and identification (Prentice & Miller, 1992). Thus, advocates of team-based rewards expect that their use will break down the effect of category distinctions. By contrast, however, others (e.g., Fiske & Ruscher, 1993; Harrington & Miller, 1992; Slavin, 1992) have contested the wisdom of imposing a joint reward structure within the context of cooperative team learning. Instead, they have advocated the retention of the individual reward structure that characterizes more standard pedagogical practice.

In assessing the effect of reward structure it is important to study it in an ecologically valid context. In ethnically heterogeneous school settings, White students frequently approach cooperative situations with the expectancy that their Black classmates are deficient in the skills required for successful completion of the task (Cohen, 1982). Recent analyses of stereotypes in contemporary U.S. society (e.g., Devine, 1989b; Dovidio & Fazio, 1992) and in Great Britain (Lepore & Brown, 1997) have revealed that many Whites continue to view Blacks as lazy, less intelligent, and irresponsible—characteristics that are certainly not desirable ones in a partner for a school-related task. Consequently, in attempting to fine-tune the structure of cooperative interventions so as to maximize their ability to increase the acceptance of Blacks by Whites, it is ecologically more valid to study the effects of reward structure in laboratory contexts in which the White actors perceive that they exceed their teammate in their relevant task competence. Therefore, in Experiment 1 we examined the potential negative effects of cooperative dependence by using scenarios describing cooperative situations in which the participants' own task competence exceeded that of their imagined partners.

Another feature relevant to ecological validity is that in school

settings cooperative teams typically are formed on an ad hoc basis, with little use of team building activities that produce team loyalty and commitment prior to the team's attempt to master the curriculum unit. Although joint rewards or common fate may be an important contributor to team loyalty under some circumstances, it is important to recognize that it has adverse consequences as well. It reduces one's control over one's own outcomes. Such loss of control is aversive (e.g., Brehm, 1966; Fiske & Neuberg, 1990; Kelley, 1971; Langer, 1975; Swann, 1990). Moreover, when a joint reward structure is combined with an inequality in the resources that team members bring to the task, the more proficient members can only anticipate a poorer outcome than that which they can expect under an individual reward structure. Whereas expectations of poor, as opposed to good, outcomes increase attraction toward teammates in the context of strong group loyalty, by contrast, when there is little prior commitment to the team the anticipation of a poor outcome produces strong distaste for one's teammates (Turner, Hogg, Turner, & Smith, 1984).

In sum, under the ecologically valid boundary conditions that characterize the introduction of cooperative team learning into classrooms that contain Black and White children, namely, the perceived presence of a deficient partner and the absence of a strongly established team identity, we expect that evaluations of a teammate under a joint reward structure will be more negative than evaluations produced by an individual reward structure.

Experiment 1

In Experiment 1, we hypothesized that the reward structure of a cooperative interaction task will affect participants' acceptance of their partner. Specifically, participants will express more favorable attitudes toward their partner when the reward outcome following task completion is independent of their partner's performance, as compared with situations in which there is a joint reward based on a composite measure of team performance. In addition, on paper and pencil self-report measures we expected White participants to be reluctant to report any actual (involuntary negative) attitudes they might hold about working with Black partners, and instead, report liking Black targets more than Whites. However, because facial EMG ordinarily is not susceptible to concerns about social desirability in situations wherein participants are unaware of the relevant EMG-affective relationships or unaware of the fact that the face is of interest to the experimenter, we expected participants to exhibit greater negative affect toward Blacks (viz., increased brow and decreased cheek activity) and greater positive affect toward Whites (viz., increased cheek and decreased brow activity). Likewise, we anticipated differentiation of facial EMG as a function of the reward structure. Specifically, we expected more negative affect (viz., increased brow activity and decreased cheek activity) in joint outcome conditions and more positive affect (viz., increased cheek activity and decreased brow activity) in conditions in which reward outcomes were independent.

We used a scenario methodology for two reasons. First, the reliability of psychophysiological measures is markedly improved with the use of multiple recording epochs (Fridlund & Cacioppo, 1986). Thus, within-subject designs are routinely used in psychophysiological research (McHugo & Lanzetta, 1983) and scenario methodology is a good vehicle for implementing a research design that incorporates multiple recording epochs. Second, scenario methodology more efficiently provides an opportunity for examining the effects of the independent variables across an array of tasks and situations.

Some have argued that the role-playing procedures implicit in scenario methodology are invariably invalid (e.g., Cialdini & Fultz, 1990). Elsewhere, however, we have strongly countered this view (Miller & Carlson, 1990). We do recognize the appropriateness of researchers' skepticism about whether there is convergence between participants' estimates of their behavioral responses to the situations depicted in scenarios and their own (or others) actual behavior in similar real-life settings. As often as not, judges who served in role-playing replications of research were unable to predict the behavior of the participants in the original study (A. G. Miller, 1972). Moreover, in a meta-analytic assessment of this issue, Miller, Lee, and Carlson (1991) failed to provide evidence supporting the validity of judges' predictions of the behavior of study participants.

By contrast with this outcome for the prediction of behavior, however, and most important for our purposes here, we have shown that judges can reliably predict the affective states and the cognitions induced in research participants by experimental manipulations. Meta-analytically confirming the convergent validity of judges' ratings of study participants' affect, their ratings were positively and reliably correlated with the magnitudes of the manipulation check effect sizes that reflected the strength of each of two types of experimental inductions of affect. Similarly, such convergent validity was also reliably confirmed for their judgments regarding each of two experimentally manipulated cognitions (Miller et al., 1991). In addition, other meta-analytic research has yielded over 20 instances in which judges' inferences about study participants' emotional and cognitive states, based on their reading of method sections, have reliably evidenced theoretically predicted construct validity. These confirmations span such diverse affective and cognitive states as anger, anxiety, frustration, fear of retaliation, global negative affect, guilt, happiness, inhibition–conflict, interpersonal similarity, irritation or provocation, objective self awareness, perceived psychological cost, responsibility, self-focus, and sadness (Bettencourt & Miller, 1996; Carlson, Charlin, & Miller, 1988; Carlson & Miller, 1987, 1988; Ito, Miller, & Pollock, 1996; Miller & Carlson, 1990; Urban & Miller, 1997). Moreover, in some of this research evidence was provided of discriminative construct validity for judges' assessments of such closely related emotional states as sadness and guilt, self-focus and objective self-awareness, anxiety and objective-self awareness, and anger and frustration. Likewise, other researchers have provided similar confirming evidence regarding the construct validity of judges' assessments of the affect and cognitions experienced by study participants (Bowers & Clum, 1988; Eagly & Carli, 1981; Eagly & Crowley, 1986; Eagly & Steffen, 1986; Hull & Bond, 1986; Johnson & Eagly, 1989; Mullen et al., 1985; Steele & Southwick, 1985).

On the basis of this array of evidence attesting to both the convergent and construct validity of judges' assessments of the emotional experiences and cognitions of study participants, we had strong reason to believe in the appropriateness of our use

of scenario methodology for examining our own participants' affective reactions to the scenarios in which we asked them to imagine themselves. That is, in the previous meta-analytic research it was the judges' ratings of how they themselves would respond affectively to the experimental conditions described in the method sections (scenarios) that they read, which were reliably correlated with actual participants' manipulation check effect sizes. Thus, in this prior research judges' affective reactions to scenarios (method sections) were shown to be valid. Consequently, without denying that the individual characteristics of particular research settings may well have distinctive moderating effects, nevertheless, the voluntary affective reactions given by our participants in the current research regarding their liking toward the person described in each scenario are likely to correspond in a general sense to the degree of liking that they would have expressed on voluntary response measures, were they actually in the situation depicted in each scenario.

Method

Participants and design. Twenty-seven White, non-Hispanic students (14 men and 13 women) enrolled in an introductory psychology course at the University of Southern California (USC) participated for extra credit in a 2 (reward structure: independent, joint) × 2 (race of partner: White, Black) within-subject design that, when combined with type of scenario, resulted in 162 observations for each of the dependent measures in each experimental condition.

Materials. Stimuli consisted of written scenarios presented on a computer monitor and color slides that appeared on a screen mounted on the wall 3 m in front of the participant. Seven general scenarios, each approximately 150 words long, described a distinct cooperative task with one partner: (a) a team running race, (b) a debate team competition, (c) a "bag-off" team competition at a grocery store, (d) a work team performing auto detailing at a carwash, (e) a team research project for a sociology class, (f) a work shift making sales at the university bookstore, and (g) a team on a game show solving crossword puzzles. The partner was always described as being deficient in the abilities required for the task. For example, the game show scenario stated that "Bob (Jill) has never seen this show before, nor does he (she) regularly do crossword puzzles. You, on the other hand, watch the show often and can solve such puzzles quite easily." In none of the scenarios was there any indication that the team had a history of existence as a team or that its members had previously practiced together as a team.

Each scenario was presented four times, with two presentations depicting rewards based on individual performance and two depicting a joint reward structure. For example, the description of the team research project was always the same, except for the last two sentences. For the independent reward structure, participants read, "Your final grade will be determined by how well just you do on your part of the task." For the joint reward structure, they read, "The two of you will receive the same grade, which will be based on how well the entire project is done."

The 28 slides were photographs of students (7 White men, 7 White women, 7 Black men, and 7 Black women) taken on the campuses of USC and University of California, Los Angeles 2 years before. The photos showed individuals smiling slightly in a variety of outdoor and indoor settings, none of which could be identified as being taken on a particular campus. All slides were chosen from a larger sample of slides that had been rated for attractiveness and familiarity by participants from an introductory psychology class from a previous semester. Slides rated extremely attractive or extremely unattractive were not chosen for inclusion in this study, nor were any slides of individuals that a pilot participant recognized.

Procedure. The participants first attended a group introductory session in which they were shown a slide presentation about the procedures to be used at the second session. They were not told that facial muscle movements were to be recorded, but instead were told the electrodes on the head measured involuntary neural impulses that emanate from the head. For each experimental session, a Black, female undergraduate or a White, male graduate student served as the experimenter.[1] When the participant appeared at the experimental session, he or she was seated in a large, comfortable recliner. The participant first filled out an informed consent document and a short health questionnaire. For the remainder of the session the chair was reclined. To reduce noise disturbances from outside the room, a recording of a soft continuous rainfall was presented from two speakers mounted behind the participant.

Surface EMG activity was recorded using Ag–AgCl electrodes (4 mm in diameter) placed in pairs over the brow (*corrugator supercilii*), cheek (*zygomaticus major*), and lower lip (*orbicularis oris*) regions on the right side of the face. Lower-lip EMG activity was recorded because it has not typically been found to vary as a function of the affective significance of a stimulus (Petty & Cacioppo, 1983), and thus it was not expected to vary as a function of the independent variables. The exact locations for electrode placement for each recording region followed previous recommendations and parametric studies regarding these sites (Fridlund & Cacioppo, 1986; Tassinary, Cacioppo, & Geen, 1989; Tassinary, Vanman, Geen, & Cacioppo, 1987). To reduce participant awareness of the experimental hypotheses, dummy electrodes were placed on the back of the neck to divert attention from the face as the site of interest.[2] In addition, heart rate was recorded from two electrodes (1 cm in diameter) using a Lead I configuration (i.e., one electrode placed on each forearm).

The participant was then instructed to rest for 5 min with eyes closed. Following this resting period, the participant began the experimental trials. Each trial began with the presentation of the slide of the target. One second later the scenario appeared on a computer screen. The participant then read the scenario, and was instructed to press a key on a keypad when he or she was ready to begin imagining the scenario. If the participant took longer than 45 s to press the key, the trial was aborted, the participant made no ratings for that trial, and the next trial began after the specified intertrial interval. The following instructions always appeared at the bottom of the screen below the scenario description: *When you think you are ready to imagine being in the scenario, press the button to begin the imagine period.* When the participant pressed the key, the computer screen cleared and the words *Imagine Period* appeared. It was at this point that the participant imagined being in the cooperative situation with the target for 5 s. Following the imagine period, the slide was turned off, and the computer screen cleared. The participant then made ratings on four 9-point scales that measured liking for one's partner (1 = *dislike very much,* 9 = *like very much*), happiness in the situation (1 = *very unhappy,* 9 = *very happy*), likelihood of success (1 = *very unlikely,* 9 = *very likely*), and the difficulty of imagining oneself in the situation (1 = *very difficult,* 9 = *very easy*). The scales were anchored only at the endpoints. High scores indicated a greater magnitude of response. Following the completion of the last rating, the participant pressed a key and the 15-s intertrial interval began.

The 28 trials were presented in seven blocks of 4 trials, with each trial in the block representing one of the four conditions (i.e., independent–White, independent–Black, dependent–White, dependent–Black).

[1] We originally intended to hold the race of the experimenter constant (i.e., Black) across participants in both Experiments 1 and 2, but practical considerations (e.g., the length of time to conduct each experimental session) made it impossible to use only one experimenter.

[2] In postexperimental interviews and debriefing, no participant in the three experiments reported in this article expressed any awareness of the true purpose of the EMG recordings.

In addition, a restriction was made in the ordering of the trials so that each of the seven main scenarios yielded each of the four conditions. Thus, seven trials for each condition were presented, with one trial in each condition representing one of the seven scenarios. The first trial block was treated as practice and the reported results are based on means of the remaining six trials per condition. The order of the trials was randomly ordered within each block and the blocks themselves were randomly ordered in two between-subjects orders.

Data acquisition and reduction. EMG signals were relayed through a shielded cable to a Grass 7P3 wideband preamplifier/integrator using a pass band of 10 Hz to 5 kHz. The preamplifiers were calibrated to yield a full-scale deflection of a 100 μV signal. The signals were full wave rectified and smoothed using a contour-following integrator with a time constant of 0.05 s. One second after the imagine period began on a trial, each channel of EMG was transmitted on-line to a laboratory computer, digitized at a rate of 100 samples per second for 5 s, and stored on a hard disk. In addition, during the experimental session the rectified and smoothed EMG recordings were continuously displayed on a polygraph, and participants were monitored and videotaped using a videocamera housed unobtrusively in a "message box" slightly above and directly in front of the participant. Data in which artifacts (e.g., coughing) were detected and for which the responses exceeded full-scale deflection (i.e., 100 μV) resulted in the deletion of approximately 5% of all trials. Mean amplitude of EMG activity over each recording site was computed for all trials, and these mean amplitudes were averaged across trials within a condition (other than the initial practice trial) and within participants to obtain more reliable and normally distributed estimates of treatment effects.[3] Of the 27 participants included in this experiment, the cheek EMG data of 3 participants and the brow EMG data of 2 others were not analyzed because of technical difficulties with data collection. Heart rate was obtained by recording the electrocardiogram (ECG) signal with a Grass 7P4 preamplifier and tachograph. The ECG record was hand scored and the heart rate calculated by counting the number of R spikes that occurred during the 5-s epoch and then converting the count into beats per minute (BPM).

Results

Repeated measures multivariate analyses of variance (MANOVAs) were performed for all dependent measures. An alpha level of .05 was used for all statistical tests. Trial order was first treated as a between-subjects variable, but no interactions with this variable were found. Therefore, subsequent analyses collapsed the data across this variable. Analysis of the participant's sex revealed neither main effects nor interactions, leading us to collapse across this variable as well in subsequent analyses. Finally, we also analyzed the effect of the experimenter's race, but found no significant interactions or main effects for this variable on any measure. After these preliminary analyses of the effects of any of the between-subjects variables, participants' individual scores were then converted to within-subject z scores to increase power for the remaining within-subjects analyses (Bush, Hess, & Wolford, 1993). On the basis of our theorizing, two composite measures for each participant were computed from these z scores: (a) self-report of affect (i.e., the sum of the liking, happiness, and likelihood of success scores, such that more positive scores indicate more positive affect)[4] and (b) facial activity (i.e., the difference of the cheek and brow activity scores, such that more positive scores indicate more positive affect).

Multivariate analysis. To test the hypothesized divergence between the affective responses exhibited in self-reports and that seen in facial EMG activity in response to the partner's race, we performed a doubly multivariate analysis (Tabachnick & Fidell, 1996), in which the type of composite measure (i.e., self-report vs. facial activity) was treated as a variable. In support of this hypothesis, the analysis revealed a disordinal interaction of Measure × Race, $F(1, 22) = 27.38$, $p < .001$, indicating that participants reported more positive affect for Black partners than for Whites on the self-report measures, but in their facial activity they exhibited greater negativity toward Blacks. In addition, the main effect of reward structure, $F(1, 22) = 38.20$, $p < .001$, indicated more positive affect for the independent reward structure conditions. Finally, a Measure × Reward Structure interaction, $F(1, 22) = 5.13$, $p = .034$, reflected the fact that the main effect found for reward structure was stronger on the self-report measure than on the measures of facial activity. To further explore these interactions with measure, each composite measure was subsequently analyzed separately.

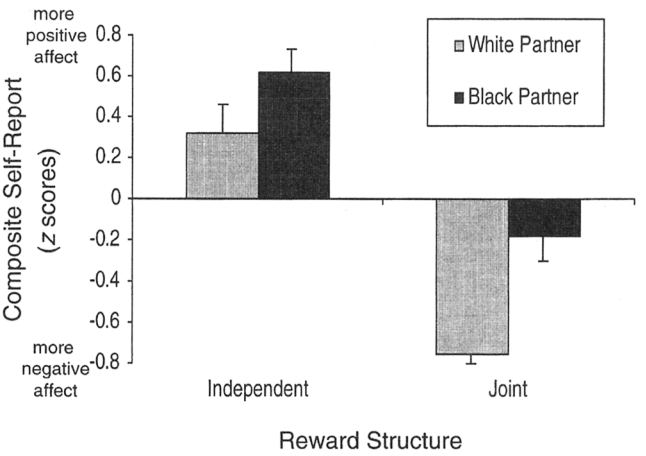

Figure 1. Means of the composite self-report measure as a function of race of partner and reward structure in Experiment 1. Standard errors are represented by the error bars.

Self-report measures. Means and standard errors for the composite self-report measure are depicted in Figure 1. Main effects of race, $F(1, 26) = 10.65$, $p = .003$ and reward structure, $F(1, 26) = 37.14$, $p < .001$, were observed, with participants reporting more positive affect for Black partners and for partners with independent reward structures. Additional post hoc analyses on each individual self-report measure were performed and are presented in Appendix A. Inspection of these means reveals a similar pattern of results for all three measures. There were no significant Race × Reward Structure interactions for any of these variables, either when combined as a composite measure or analyzed separately.

[3] Because we averaged across trials within a condition and there were so few trials per condition, we were unable to conduct additional analyses on the effects of individual scenarios. Future research might address the specific type of scenario (e.g., sports vs. academic) as an independent variable.

[4] As a measure of scale reliability, the alpha coefficient of the composite measure of liking, happiness, and likelihood of success was .781.

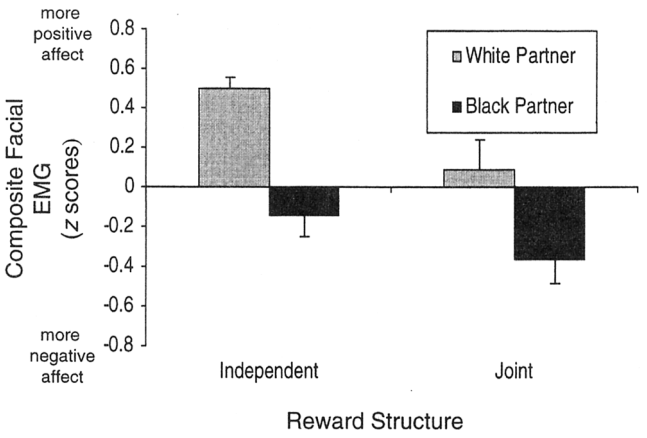

Figure 2. Means of the composite facial EMG measure as a function of race of partner and reward structure in Experiment 1. Standard errors are represented by the error bars.

Facial activity. Means and standard errors for the composite facial activity measure are depicted in Figure 2. Analyses revealed a main effect of race, $F(1, 22) = 15.11$, $p = .001$, with more positive affect for White partners. In parallel with the outcome on self-reports, there was also a main effect of reward structure, $F(1, 22) = 7.35$, $p = .013$. Participants exhibited less positive affect in joint reward structure conditions. Post hoc analyses were performed on each facial EMG measure separately and are presented in Appendix A. No significant Race × Reward Structure interactions were found for these variables, either when combined as a composite measure or analyzed separately.

Other measures. Means and standard errors for heart rate are presented in Figure 3. Only a marginal main effect of reward structure was found, $F(1, 22) = 3.91$, $p = .061$. Heart rate was greater for joint reward structure conditions. Analyses of lip EMG activity revealed no effects, as expected. Finally, analyses of the difficulty (to imagine the scenario) variable revealed no effects.

Discussion

When imagining working with target partners, both voluntary (i.e., self-report) and involuntary (i.e., facial EMG) measures differentiated participants' affective reactions on the basis of their partner's race and the task reward structure. However, confirming our predictions, a discrepancy between participants' self-reports and the EMG data was found with regard to the race variable. Participants reported liking Black targets more than targets of their own race. They also reported more happiness and greater likelihood of success when imagining working with Blacks. By contrast, analyses revealed EMG activity indicative of more positive affect toward White targets (i.e., higher cheek and lower brow activity) and more negative affect toward Blacks (i.e., higher brow and lower cheek activity). Although this discrepancy between the EMG activity and the self-report data is consistent with other recent reports documenting a dissembling of self-reports of racial attitudes (Gaertner & Dovidio, 1981; McConahay et al., 1981; Sears, 1988), the extension to automatic affective responding is an important unique feature of our outcomes.

In the introduction, we noted that when cooperative team learning interventions are introduced into classrooms containing both Black and White students, the White students are likely to have expectations that their Black teammates will be deficient in relevant abilities. In addition, even though such arbitrary groupings can produce some sense of team identity (Tajfel, Billig, Bundy, & Flament, 1971; Tajfel, Nemeth, Jahoda, Campbell, & Johnson, 1970), at the outset of the team activity no such loyalty exists. In its absence, poor outcomes produce a rejection of teammates (Turner et al., 1984). Consistent with our predictions, within the ecologically valid context of having a deficient partner with whom no prior team commitment or history previously had been established, participants reported feeling more negative about the target and the situation when the scenario described a joint reward structure.

It is important to note that the obtained divergence of the self-report and facial EMG measures that we obtained as a function of race did not occur as a function of reward structure. This latter result was expected in that facial EMG patterns typically parallel self-reports of affective responses to emotional stimuli that are not associated with social categories (e.g., Cacioppo et al., 1986; Jäncke, 1994). Therefore, it seems reasonable to assume that the facial EMG responses in this study, wherein participants were not made aware that their facial muscles were of interest, served as involuntary measures of affective response. That is, the more voluntary processes involved in self-reports converged with the involuntary measure only for that variable for which concern about social desirability was low. At the same time, in repeated measures scenario designs it is always possible that despite perfect counterbalancing, some feature of the scenarios cues the hypothesis to the participants. In the face of competing theoretical positions within the cooperative learning literature regarding joint versus individual reward structure, a clear directional bias regarding hypothesis guessing on the part of participants may be less likely. Nevertheless, the parallel

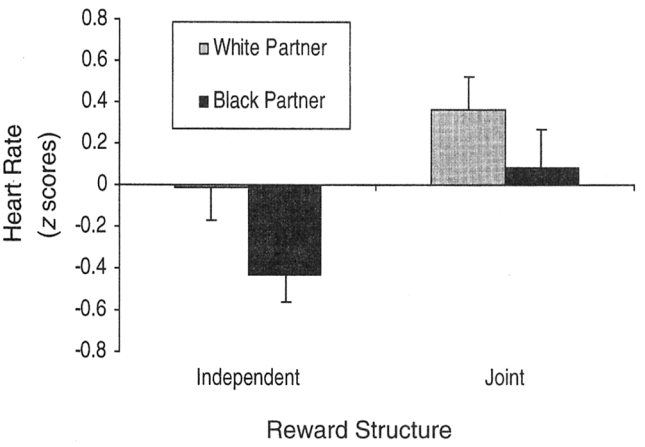

Figure 3. Mean heart rate as a function of race of partner and reward structure in Experiment 1. Standard errors are represented by the error bars.

outcome found for EMG and self-reports regarding a preference for individual reward structures quells any residual concern regarding a demand interpretation of the reward structure manipulation.

We made no predictions regarding heart rate because previous researchers have failed to demonstrate that measures of autonomic nervous system activity reliably index racial basis. Indeed, on the basis of our results, it appears that heart rate does not serve as a marker of racial bias. The increase in heart rate for the joint conditions probably reflects greater anticipated effort in such situations (Smith, 1989). Participants probably assumed that they would have to work harder to compensate for their partners' shortcomings in those conditions. A similar increase in heart rate occurs when participants appraise a situation as challenging, rather than threatening (Tomaka, Blascovich, Kelsey, & Leitten, 1993). However, as Smith (1989) has pointed out, heart rate should not necessarily be interpreted as an index of anticipated effort; other factors (e.g., increased general somatic activity, annoyance about likely failure) that influence it may have contributed to these data.

Experiment 2

In Experiment 1, we explicitly made it clear to our participants that their partner in each scenario was relatively poor at the task. We made this a constant feature of each team activity because we thought it important to examine the effect of joint versus individual reward structures within this context. Our reasoning was that this was the ecologically valid boundary condition for the use of cooperative team learning procedures as an intervention for increasing intergroup acceptance within many racially heterogeneous school settings. That is, the stereotypes or expectations that White Americans hold toward African Americans, as well as group-level average differences in academic performance, typically imply that the task performance of Blacks in school settings will be poorer than that of Whites. Experiment 1 showed, as predicted, that within a context in which one anticipates relatively poor performance from one's partner and in which there is no strongly established team loyalty or identity, both Black and White partners are liked better when one's own reward outcome is not linked to that of one's partner. That is, irrespective of race, with a deficient partner an individual reward structure produces more positive affect.

Experiment 1, however, did not manipulate partner deficiency. In Experiment 2, we explicitly manipulated whether the partner was deficient to show that this variable does indeed contribute importantly to the adverse effect produced by joint rewards.

In Experiment 2 we also sought to better understand why the joint outcome reduced positive affect toward one's partner. One component of any mediational explanation is evidence showing that experimental manipulation of a variable postulated to serve a mediational function (either fully or partially) evidences the predicted effect. The ultimate attribution error specifies not only that negative attributes are more likely to be ascribed to out-group than to in-group members, but also, that such out-group attributions are likely to be seen as stable, enduring characteristics of the out-group member. Stereotypical characterizations of Blacks as lazy represent an instance of such stable negative depictions with respect to a motivational attribute. We suspected that such attributions of laziness can explain why a joint reward structure can have adverse effects when one's partner is deficient. Therefore, in Experiment 2 we also explicitly manipulated the amount of effort that a team member who was deficient at the team task was willing to expend on behalf of the team to improve the likelihood of team success. Specifically, we manipulated whether a deficient member of the team was willing to make special efforts to compensate for his or her inadequacy at a team task. Thus, in one half of the imagery scenarios, one's partner was deficient, whereas in the other half, self was deficient. Crossed with this manipulation of which team member was deficient, was a manipulation of whether the deficient member of the team was willing to undertake compensatory actions to make up for his or her deficiency.

We expected that an unwillingness on the part of a task-deficient partner to take remedial steps to improve the team outcome explains (at least in part) the deleterious effects of outcome interdependence within the context of cooperation. When a deficient partner is willing to take steps in advance so as to improve his or her performance, the effects of joint reward structures in reducing liking of the partner are likely to be mitigated. By contrast, when self is the deficient member of the team, one's willingness or lack of motivation to improve one's level of performance prior to the team task is unlikely to moderate affect toward one's teammate. Finally, we also manipulated the race of the partner in the expectation that we would replicate the racial bias findings of Experiment 1.

In our analyses of Experiment 1, we combined three verbal measures into a composite index because we had no reason to anticipate different outcomes for liking of one's partner, happiness or positivity with respect to the cooperative situation, and expectation of success. For Experiment 2, however, our prediction was constrained to the liking measure. It seemed inappropriate to expect the interaction between reward structure, who is deficient, and whether the deficient team member was willing or unwilling to make needed remedial efforts, to affect happiness in the situation and expectations of success in the same manner as these combinations of factors affect liking of one's partner. For example, if self were described as deficient, but the partner were not, participants might feel negative about the situation, but express no dislike toward their partner. In contrast, if the partner were described as deficient, participants may feel comparably negative about the situation, but might particularly dislike their partner in that condition.

Method

Participants and design. Thirty-seven White, non-Hispanic university students (18 women and 19 men) enrolled in two psychology courses participated for extra credit in a 2 (race of partner: White, Black) × 2 (source of deficiency: self, partner) × 2 (effort: deficient person willing to make effort, deficient person not willing to make effort) within-subject design. When combined with the five scenarios, the design yielded for each dependent measure a total of 185 observations within each condition.

Materials. Forty slides and five general scenarios constituted the stimuli of this experiment. Twenty-eight slides were the same ones used in Experiment 1. An additional 12 were selected from a larger pool of slides that were previously rated for attractiveness by a sample of participants from a similar population at USC, and were thus comparable in attractiveness to the 28 we used previously.

Five of the seven scenarios used in Experiment 1 were again used: (a) a team running race, (b) a debate team competition, (c) a "bag-off" team competition at a grocery store, (d) a group research project for a sociology class, and (e) a team on a game show solving crossword puzzles. In contrast with Experiment 1, all scenarios described a joint reward structure. Their endings, however, were varied to reflect the source of deficiency and effort variables. Using the team running race scenario as an example, in which two members of a physical education class are assigned as team members to both run a mile and have their times averaged in a competition among other classes, in the self-deficient/not-willing-to-make-the-effort condition the scenario stated

> Jeff is very athletic, having participated in sports all during high school and winning various trophies at local events. You are slightly overweight and avoid the simple act of walking. You are unwilling at this time to spend additional time to get into better shape. In your estimate, your team's chance of success in this competition is unlikely.

In the partner-deficient/willing-to-make-the effort condition, the scenario stated

> You are very athletic, having participated in sports all during high school and winning various trophies at local events. Bill is slightly overweight and avoids the simple act of walking. He has started a program of vigorous physical activity. You believe that this extra effort should be sufficient to give your team a good chance of winning the competition.

Procedure. The two experimenters (i.e., a Black woman and a White man) in Experiment 1 were also the experimenters in this study. The procedures of Experiment 1 were replicated, with the following exceptions. Forty trials were presented to participants in five blocks of 8, with each trial representing one of the eight conditions formed by the 2 × 2 × 2 factorial. Each general scenario was presented eight times, yielding one instance of each of the conditions. Thus, 5 trials for each condition were presented. As in Experiment 1, the first trial block was treated as practice, leaving the results based on means of the remaining four trials per condition. The order of the trials was random within each block and the blocks themselves were randomly ordered in two between-subjects orders. Data acquisition and reduction procedures were identical to Experiment 1, with the exception that heart rate was not recorded. Artifacts resulted in the deletion of approximately 6% of all trials. Of the 37 participants included in this experiment, the cheek EMG data of 4 participants and the brow EMG data of 6 others were not analyzed due to technical difficulties with data collection.

Results

Again, repeated measures MANOVAs were conducted on all dependent variables. The effects of trial order, participant's sex, and race of experimenter were analyzed separately and were again not found to interact with any of the main independent variables, so all subsequent analyses collapsed across these variables. Individual scores were then converted to within-subject z scores. As in Experiment 1, a composite measure of facial activity (i.e., the difference of the cheek and brow activity scores) was computed. However, as we have noted, in contrast to Experiment 1, we computed a composite self-report of affect for the situation (i.e., the sum of the happiness and likelihood of success scores) that did not include the liking variable. We expected that as a function of the independent variables, participants might report feelings about the scenario situation that were independent of their liking for the partner.[5]

Multivariate analysis. As in Experiment 1, we conducted a doubly multivariate repeated measures MANOVA, in which the type of measure (i.e., facial activity, liking of partner, and situational affect) was treated as a variable to test for the divergence of the facial EMG and self-report measures with respect to race. Indeed, this analysis also revealed a disordinal Measure × Race interaction, $F(2, 24) = 6.09$, $p = .007$, wherein participants displayed more positive affect for White partners on the facial activity measure, but did not confirm this bias for Whites in their self-reports of liking and situational affect. However, when those participants who were originally excluded from the main analyses because they were missing either cheek or brow EMG data were retained for the analysis of the liking measure, this second augmented analysis of the liking measures reliably confirmed the self-report of more positive affect toward Black partners, as found in Experiment 1, $F(1, 36) = 3.94$, $p = .05$. That is, in correspondence with the outcome of Experiment 1, participants' self-reports indicated more liking for Black partners ($M = 0.066$, $SE = 0.033$) than for Whites ($M = -0.065$, $SE = 0.033$).

In addition, the main effect of source of deficiency, $F(1, 25) = 15.27$, $p = .001$, reflected more positive affect when self was deficient. A main effect of effort, $F(1, 25) = 305.80$, $p < .001$, indicated more positive affect when the deficient person was willing to make the effort. Ordinal interactions of Measure × Effort, $F(2, 24) = 143.80$, $p < .001$, and Measure × Source of Deficiency, $F(2, 24) = 18.29$, $p < .001$, revealed that effort and source of deficiency had smaller effects on the facial EMG measure than on the self-report measures. The interaction between source of deficiency and effort, $F(2, 24) = 13.09$, $p < .001$, reflected a stronger effect of effort when the partner, as opposed to self, was deficient. Additionally, this interaction pattern was stronger for the self-report measures (liking and situational affect) than for the facial measures of affect, as shown by an ordinal interaction of Measure × Source of Deficiency × Effort, $F(2, 24) = 13.09$, $p < .001$. Each measure was subsequently analyzed separately to explore further these effects.

Liking for partner. Means and standard errors for liking are presented in Figure 4. For the liking measure, two main effects were observed: source of deficiency, $F(1, 26) = 32.84$, $p < .001$, and effort, $F(1, 26) = 122.75$, $p < .001$. Participants reported more liking for their partners when self was deficient and when the deficient person was willing to make the effort. A Source of Deficiency × Effort interaction, $F(1, 26) = 52.55$, $p < .001$, showed that effort had a greater effect on liking when the deficient person was the partner than when it was self. There were no other interactions.

Self-reports of situational affect. Means and standard errors for the composite measure of situational affect are presented in

[5] The mean interparticipant correlation between the happiness and likelihood of success scores was $r = .560$, whereas between happiness and liking $r = .478$, and between success and liking $r = .460$. Although correlations with liking are slightly smaller than the correlation of happiness and likelihood of success, as we report later in the *Results*, the anticipated a priori difference between liking and the other two measures was supported by a main effect of source of deficiency for the liking measure that was not found for the composite situational affect measure.

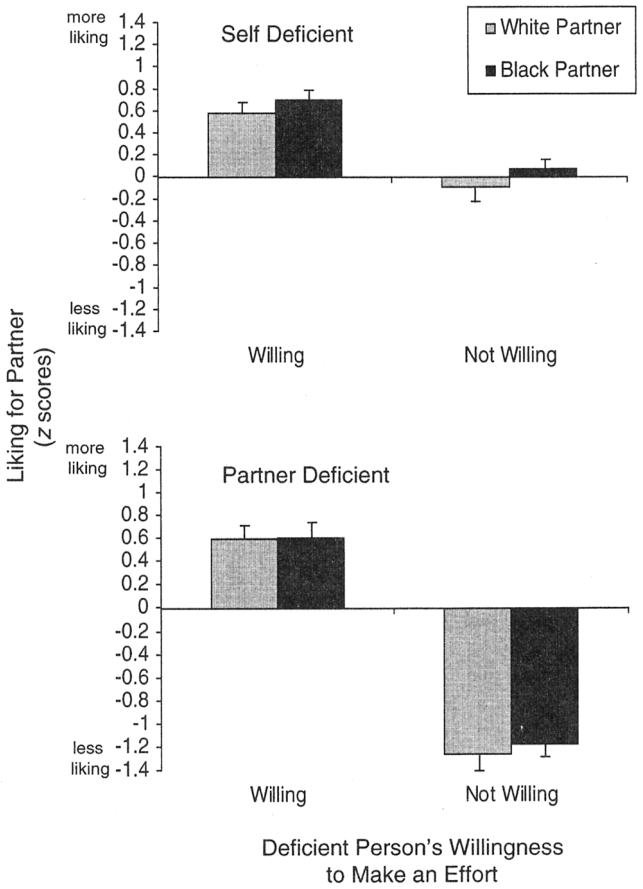

Figure 4. Mean liking as a function of race of partner, source of deficiency, and effort in Experiment 2. Standard errors are represented by the error bars.

Figure 5. Analysis of the situational affect measure revealed a main effect for effort, $F(1, 26) = 941.95$, $p < .001$, with participants reporting more positive situational affect when the deficient person was willing to make the effort. A Source of Deficiency × Effort interaction, $F(1, 26) = 19.65$, $p < .001$, showed that when the partner was deficient, participants evidenced a greater differentiation in affect as a function of the effort variable, as compared with those conditions where self was deficient. Further separate post hoc analyses on the success and happiness variables are presented in Appendix B.

Facial activity. Means and standard errors for the composite facial EMG measure are presented in Figure 6. Main effects of race, $F(1, 26) = 10.41$, $p = .003$, and effort, $F(1, 26) = 13.26$, $p = .001$, were found. Participants displayed more positive facial affect for White partners compared to Black partners and more positive affect when the deficient person was willing to make the effort. There was also a Source of Deficiency × Effort interaction, $F(1, 26) = 7.92$, $p = .009$. In parallel with the effects found on the self-report measures, when the partner was deficient, participants' facial affect showed greater differentiation as a function of the effort variable, compared to those situations in which self was deficient. Further post hoc analyses on each separate EMG measure are presented in Appendix B.

Other measures. Again, as expected, lip EMG activity did not vary as a function of any of the variables. However, analyses of the difficulty (to imagine the scenario) variable did reveal main effects for effort, $F(1, 26) = 9.43$, $p = .005$, and source of deficiency, $F(1, 26) = 5.07$, $p = .033$. Means and standard errors for the difficulty measure, collapsing across the race variable, are presented in Figure 7. Participants reported that it was easier to imagine those scenarios in which the deficient person was willing to make the effort, and those scenarios in which the deficient person was the partner. The Effort × Source of Deficiency interaction, $F(1, 26) = 12.45$, $p = .002$, appears to reflect a type of egocentric or self-aggrandizing bias. Participants reported the most difficulty in imagining those scenarios in which the deficient person who was not willing to make the effort was the self, but the most ease in imagining scenarios in which the self was deficient but willing to expend the needed effort.

Discussion

As in Experiment 1, participants in this study evidenced a divergence between their self-reports and their facial EMG activity with respect to their evaluations of their partners as a function of his or her race. Participants' facial EMG activity indicated

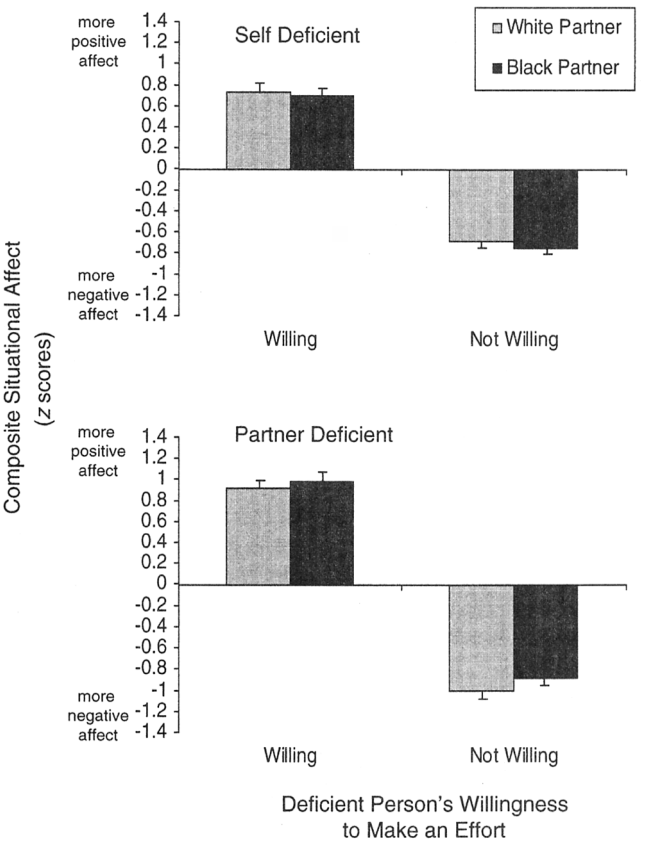

Figure 5. Means of the composite self-report measure of situational affect as a function of race of partner, source of deficiency, and effort in Experiment 2. Standard errors are represented by the error bars.

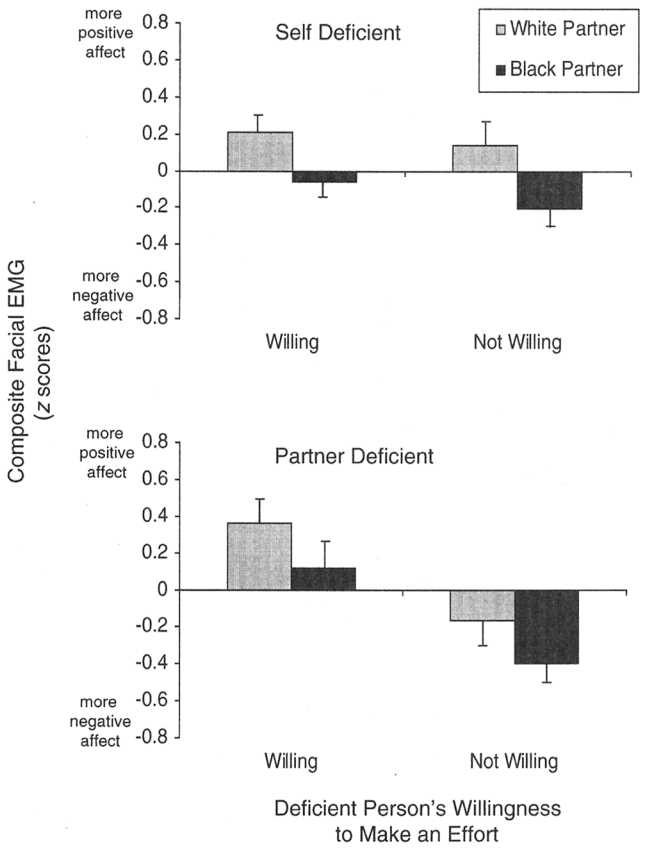

Figure 6. Means of the composite facial EMG measure as a function of race of partner, source of deficiency, and effort in Experiment 2. Standard errors are represented by the error bars.

more negative affect for Black partners, even in those conditions in which self was deficient. This effect was countered in the self-report measures of liking and situational affect, wherein, although the sample means were in the general direction of more positive affect for Black partners, neither effect reached significance. And, in support of our separation of the liking measure from the two situational affect measures, a striking main effect of source of deficiency on the liking measure revealed that participants reported more liking for their partners when they were not the deficient team member. However, the absence of such a main effect on the situational affect measure indicated that general affect in the situation was unaffected by which team member was deficient.

The main effect of effort on the three major dependent variables, in which participants reported more liking for the partner, more positive affect in the situation, and displayed more positive facial activity when the deficient person was willing to make the effort, is important. It supports the view that the negative effects of joint, as compared with individual, reward structures that were documented in Experiment 1 can be mitigated by the willingness of the deficient person to take steps to improve his or her performance. Generalizing to the introduction of cooperative team learning procedures into classrooms with Black and White children, it implies that the effects of negative stereotypes, such as those held by Whites toward Blacks, are not intractable. Behavior that is seemingly motivated by team loyalty, such as special efforts to make up for one's incompetencies and thereby promote team goals, can override the tendency to reject deficient members of newly formed teams. However, some caution must be exerted when making such conclusions about this point on the basis of our results. A possible confound with effort is the description in each scenario of the participant's perceived chances of success. That is, it may be that the positive effects of effort in our experiment are simply due to the explicit manipulation of the description of likelihood of success we added to make the effort variable salient in each scenario. Subsequent research on the deficient partner's effort in cooperative settings should examine the effects of effort and likelihood of success separately.

Nevertheless, the interaction of effort and source of deficiency on all three measures, which indicated that the effects of effort were stronger when the partner was deficient, helps to clarify the relatively negative affect expressed toward partners in joint reward structure situations in Experiment 1. In outcome-dependent situations, people are more likely to make dispositional attributions about their partner (Berscheid, Graziano, Monson, & Dermer, 1976) and to attend more to information relevant to their partner's stable dispositions (Erber & Fiske, 1984). In the absence of information about their partner's willingness to overcome his or her deficiency (as was the case in Experiment 1), participants are likely to assume that their partners are not willing to try to overcome their deficiencies.

Overall, the patterns of facial EMG in Experiments 1 and 2 indicate that for nonsocially sensitive variables (i.e., reward structure in Experiment 1; relative deficiency and effort in Experiment 2), facial activity and self-reports of affect converge. However, for the more socially sensitive variable (i.e., race of target), facial EMG responses diverged from self-reports. Thus, facial EMG appears to be a valid measure of affect in the context

Figure 7. Mean reported difficulty to imagine the scenario as a function of source of deficiency and effort in Experiment 2. Higher z scores indicate greater reported difficulty. Standard errors are represented by the error bars.

of these studies, but the validity of the self-report measures as veridical indicators of underlying attitudes is questionable. Alternatively, however, one might argue that the facial EMG data do not necessarily indicate that the participants actually held negative attitudes about Blacks but instead reflected concerns about doing the "right thing" in interracial interactions. Devine, Evett, and Vasquez-Suson (1996) have proposed that, although low-prejudiced people are motivated to respond without prejudice toward out-group members, they may sometimes act inconsistently with their standards. These failures are typically accompanied with feelings of self-criticism and guilt (Devine, Monteith, Zuwerink, & Elliot, 1991; Monteith, Devine, & Zuwerink, 1993). In contrast, when high-prejudiced people fail to respond consistently with less well-internalized standards of nonprejudice, they are more likely to experience antipathy toward the outgroup (Monteith et al., 1993). Thus, the possibility exists that the negative facial affect displayed in Experiments 1 and 2 during the presentation of Black targets may have reflected generally low-prejudiced participants' concerns about being consistent with their standards, rather than genuine negative attitudes. If this interpretation of the EMG data is correct, then one should expect participants identified as low-prejudiced to exhibit comparable, if not more, negative facial affect relative to high-prejudiced participants when making out-group evaluations.

Experiment 3

To examine whether facial EMG in the context of intergroup evaluations reflects self-directed negative affect of low-prejudiced participants when making such evaluations, or instead indicates genuine other-directed affect, in Experiment 3 we administered the Modern Racism Scale (McConahay et al., 1981) to White participants in a study in which the target's race was explicitly stated as a focus of the research. Facial EMG from the brow and cheek regions was recorded while participants viewed pictures of White and Black students. Unlike in Experiments 1 and 2, no scenarios or other information accompanied the picture. Participants were simply instructed to attend to the duration of pictures of one racial group, but to ignore the duration of pictures of the other group.[6] On the basis of supposition that facial EMG activity can serve as a valid index of intergroup attitudes, we predicted that participants scoring high on the Modern Racism Scale would evidence in their facial activity more bias in favor of White targets than those participants who scored low on the scale.

Method

Participants. Twenty-five White, non-Hispanic university students (15 women and 10 men) enrolled in an introductory psychology course at USC participated for extra credit. Potential participants were told that the study was concerned with physiological processes involved in person perception. Seven undergraduate research assistants, who varied in sex and ethnicity, served as the experimenters under the supervision of Eric J. Vanman.

Procedures. Thirty-six slides (18 Blacks and 18 Whites) used in Experiment 2 formed the set of stimuli for this study. Upon arrival, participants completed a brief health questionnaire and a "student opinion survey," which consisted of items that assessed various political and social attitudes. A subset of these items comprised the Modern Racism Scale. Unlike in Experiments 1 and 2, participants were then told that the experiment was specifically concerned with the effects of target ethnicity in person perception. Facial EMG was recorded from the brow and cheek regions, but an additional pair of electrodes was attached just below the right eye (i.e., the *orbicularis oculi* region) for purposes unrelated to this article (see footnote 6).

After the electrodes were attached, a 5-min resting period occurred, and then participants viewed the entire set of 36 slides once, viewing each slide for 3 s, followed by a 10-s intertrial interval. Following each slide offset during this first viewing, participants were prompted on a computer monitor to make a rating of perceived friendliness of the target on a keypad using a 6-point scale (1 = *very unfriendly*, 6 = *very friendly*). Following the preview, participants were informed that they would view the slides again but this time the presentations would differ in their durations. Most slides, they were told, would be 5 s in duration but some longer than usual slides would be 7 s in duration. Participants were instructed to pay attention to the duration of the pictures of White (or Black) students, and to ignore the duration of the Black (or White) slides. (The slide assignment of attend and ignore was counterbalanced across participants.) Following each to-be-attended-to slide, the participant was prompted on the computer screen to report whether it was longer than usual. This prompt appeared 10 s after slide offset, and the participant responded by pressing one of two keys on the keypad. For the purposes of the attention task, 75% of the slides of each target race were displayed for 5 s and 25% were displayed for 7 s. Intertrial intervals varied between 25 and 35 s.

The 32 trials in the second presentation were organized into two trial blocks of 16 trials each. Eight of the 16 trials in each block consisted of slides of Black targets, and the other 8 consisted of White targets. Within each trial block, cheek and brow EMG activity were recorded on 2 of the 8 trials within each target race. (On the remaining trials, brief, 103-dB bursts of white noise were presented at different intervals during the slide presentation to examine their effects on the eye EMG activity, but, as indicated in footnote 6, the data for these trials are not reported here.) The order of the 16 trials within each block was randomly determined and counterbalanced, such that, across all participants, a few viewings of every slide contributed to the cheek and brow EMG activity analyzed here. Data acquisition and reduction procedures for the 4 cheek and brow EMG trials were identical to those in Experiments 1 and 2, with the exception that EMG was recorded for 5 s following slide onset. Artifacts resulted in the deletion of less than 3% of all trials.

Results

Modern Racism Scale scores. Scores on the Modern Racism Scale can range from −14 (low prejudice) to 14 (high prejudice). The mean score was −7.12 ($SE = 0.717$). For subsequent analyses, the median of −7.0 was used to create two groups, high ($n = 12$) and low prejudiced ($n = 13$).

Friendliness ratings. Means and standard errors for the apparent friendliness ratings are presented in Figure 8. Analyses revealed a main effect for Target Race, $F(1, 23) = 31.83$, $p < .001$, in which participants rated the Black targets as more friendly than the White targets. No other effects were found.

[6] The full design of this experiment, which is a variation of the affect-directed attention paradigm (Vanman, Boehmelt, Dawson, & Schell, 1996), mainly examines the effects of temporal parameters on attentional and affective modification of the startle eyeblink response. The results with respect to the startle data are not relevant to the studies we report here and consequently, they are reported elsewhere (Vanman, Ito, Pedersen, & Miller, 1997).

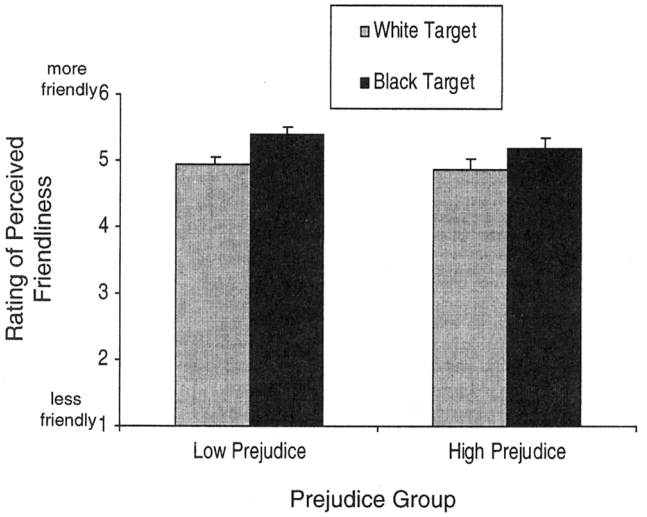

Figure 8. Mean ratings of friendliness of target as a function of target race and prejudice group in Experiment 3. Standard errors are represented by the error bars.

Facial EMG. As a result of the between-subjects variable of prejudice group defined by the Modern Racism Scale scores, it was not appropriate to create within-subject z scores for the cheek and brow EMG measures, as done in Experiments 1 and 2 (Bush et al., 1993). Therefore, actual EMG values were analyzed for each EMG recording site separately. The means and standard errors for the cheek and brow EMG are presented in Figure 9. For cheek EMG, the main effect for target race, $F(1, 23) = 10.63$, $p = .003$, reflects greater activity during the presentation of White targets. However, this effect was qualified by a Target Race × Prejudice Group interaction, $F(1, 23) = 10.48$, $p = .004$. Post hoc comparisons revealed that high-prejudiced participants displayed more cheek activity to White than to Black targets, $t(11) = 3.63$, $p = .004$, but low-prejudiced participants did not, $t(12) = 0.02$, $p = .983$. Similarly, for brow EMG, there was a main effect for target race, $F(1, 23) = 7.20$, $p = .013$, and a Target Race × Prejudice Group interaction, $F(1, 23) = 4.49$, $p = .045$. Brow activity was greater during the presentation of Black targets, but a greater difference between Black and White targets was exhibited by the high-prejudiced participants, $t(11) = -2.34$, $p = .039$. By contrast, low-prejudiced participants merely exhibited a trend in the same direction as the high-prejudiced group, $t(12) = -1.60$, $p = .135$. No other effects, including the attentional instructions (i.e., attend to the duration of Whites or attend to the duration of Blacks) were found.

Discussion

Consistent with the results of Experiments 1 and 2, the facial EMG of participants in this study indicated more negative affect for Black targets, even though the participants rated those targets higher in apparent friendliness. Moreover, the EMG measures appeared to index genuine antipathy toward Black targets, such that those scoring high on the Modern Racism Scale displayed patterns of more facial affect bias against Black targets than did those scoring low on the scale. Therefore, this finding does not support the notion that negative facial affect in our three experiments resulted primarily from participants' concerns about not behaving in a prejudiced manner—an explanation that might be derived, for example, from Devine et al.'s (1996) account of Whites' attempts to manage such race-based responses. In addition, the results of this study also further counter the possibility that the manipulation of target or partner race is confounded with factors such as novelty or other intrinsic characteristics of our set of stimuli. Such a confound would not be expected to interact with the participant's Modern Racism Scale score.

Fazio et al. (1995) suggested that researchers take extreme caution when using the Modern Racism Scale, in that they found it to be both reactive and related to political conservatism. Although it predicted some race-related judgments in one of their experiments, Fazio et al. concluded that the Modern Racism Scale might be better conceptualized as a willingness to express prejudice and conservatism. Moreover, they predicted that those participants willing to express negative attitudes toward Blacks on the Modern Racism Scale should be equally likely to express such negativity on other clearly race-related judgments. Regarding this prediction, we found that those scoring high on the Modern Racism Scale were not more likely to rate Black targets as less friendly. It was only on the more automatic and unobtru-

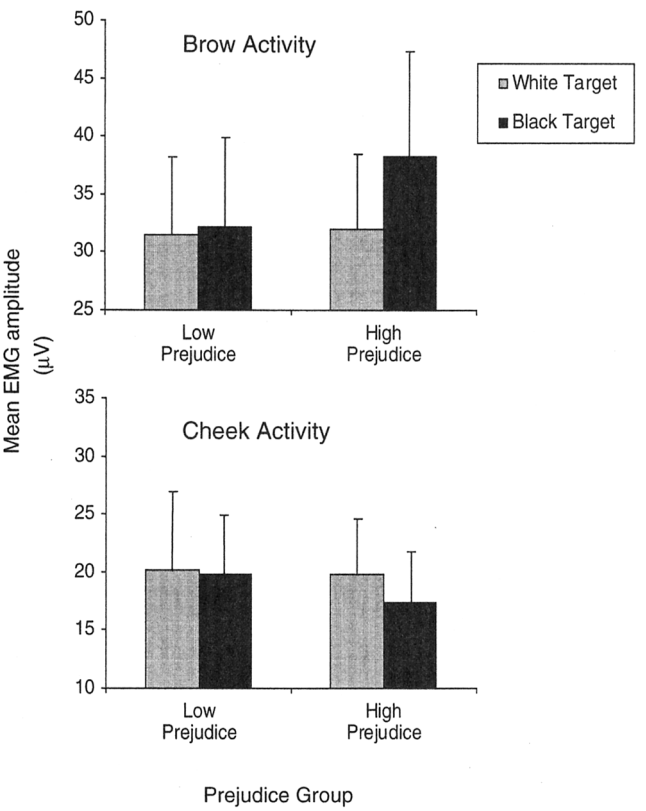

Figure 9. Means of cheek EMG activity and brow EMG activity as a function of target race and prejudice group in Experiment 3. Standard errors are represented by the error bars.

sive facial EMG measures that such scores differentiated responses. Subsequent research therefore might examine further the relation of facial EMG measures of racial bias to the Modern Racism Scale, but also as to how they relate to the recently developed Motivation to Control Racial Prejudice scale (Dunton & Fazio, 1997). On the basis of the results from this study, we predict that facial EMG bias would be correlated with scores on the Modern Racism Scale, whereas self-reports of racial bias, but not facial EMG activity, would be more strongly related to the Motivation to Control Racial Prejudice scale.

General Discussion

Using both voluntary and involuntary measures of affect, we showed that with newly formed teams, cooperative situations with joint reward structures can have negative consequences for interpersonal and intergroup relations, particularly when the partner is deficient in the abilities required for the task. The race of one's partner also had an impact on the affect directed toward that partner, but its direction differed, depending on whether the affective measure was voluntary or involuntary.

Facial EMG as an Affective Measure of Intergroup Attitudes

In all three experiments, White participants rated Blacks more positively than Whites in their self-reports. This finding is consistent with that of Judd et al. (1995, Study 3) who found a similar out-group "preference" among White participants when using a priming paradigm. However, in the first two experiments the use of facial EMG to measure participants' affective responses while they imagined working with their partner, and in Experiment 3 while they simply viewed pictures of Whites and Blacks revealed a pattern of response diametrically opposed to that which participants voluntarily reported. The fact that participants displayed a pattern of facial EMG activity that was more negative when they imagined working with a Black partner than when they imagined a similar situation with a White partner suggests that involuntary affective measures are more likely to reflect bias against racial out-groups in contemporary U.S. society than are voluntary measures of affect. It is important to remember that prior to experimental testing, participants were not made aware that muscles used in facial expression were the targets of the electrode recordings placed on their heads. Instead, they were given a cover story about the ostensible purpose of the electrodes and when debriefed, no participant reported knowledge or suspicion of the EMG-affective relationships. Thus, given the situational parameters of these experiments, it is likely that facial EMG activity from the cheek and brow regions reflected uncontrolled, automatic reactions to out-group members.

It is also important to note that all three experiments were strong tests of the ability of facial EMG to index racial attitudes. At no time did participants actually interact with their partners or targets, yet they consistently exhibited more negative affect toward pictures of Blacks. This was true even in Experiment 2 during those scenarios where the partner was not deficient in the abilities required for the task. Likewise, in Experiment 3, with absolutely no additional social information provided, simply looking at the target's face elicited more negative responses to Blacks compared to Whites.

Therefore, in contrast to evidence interpreted otherwise (e.g., Judd et al., 1995), Whites (to the extent that our participants are representative of the non-Hispanic, White population in the United States) do evidence immediate and automatic bias against Blacks. This finding is consistent with results obtained with more cognitive measures of automatic stereotype activation when those measures used substantially shorter presentation times than those used by Judd et al. (e.g., Devine, 1989b; Fazio et al., 1995; Wittenbrink et al., 1997). The participants' reports of more positivity toward Blacks may reflect what Devine (1989a, 1989b) proposed as a controlled, correction-like stage in intergroup responding. One can only speculate as to whether participants in our studies were aware of their more automatic, negative attitudes toward Blacks and were trying to mask them with the self-report measures. On this point, Devine has argued that, for truly low-prejudiced persons, this controlled response is not merely the product of socially desirable responding, but represents genuine, nonprejudiced responding.

Experiment 3 examined such individual differences in racial prejudice. Devine et al. (1996; see also Devine, 1989b) have argued that it is too simplistic and rather pessimistic to conclude that all majority group members are prejudiced toward the minority group. Indeed, the results of Experiment 3 indicate that high-prejudiced individuals exhibit greater facial bias against Blacks than do low-prejudiced participants. However, we raise two further considerations regarding this finding. First, the high-prejudiced participants in this experiment actually had fairly low Modern Racism Scale scores (-7 to 1 on a -14 to 14 scale) due to our use of a median-split design, and thus, compared to other studies' samples, might be considered not very prejudiced at all. Second, although the low-prejudiced participants showed no reliable bias on the facial EMG measures, they did exhibit a trend of such bias, albeit small, in their brow activity. Given that there were only 13 participants in that group, with greater power it is possible that such bias would be significant at an alpha level of .05. Thus, whereas the individual differences approach to studying prejudice advocated by Devine et al. is both less simplistic and more optimistic, the main effects of target race observed in all three experiments might indicate that the number of Whites who do not evidence bias against Blacks is rather small.

We believe that our facial EMG data as they pertain to manipulations of target race reflect automatic affective responses that occur as a consequence of the presentation of out-group members. Thus, we do not implicate the automatic activation of stereotypes as necessary for such effects to occur. In support of this notion, recent research (Fazio et al., 1995; Lepore & Brown, 1997; Wittenbrink et al., 1997) has demonstrated that high- and low-prejudiced people differ in their automatic responses when the category, but not the stereotype, is primed. Fazio et al. proposed that it is stored evaluations and not socially shared, cultural stereotypes, that are automatically activated from memory upon the presentation of out-group members. Indeed, category activation does not lead to the unintentional activation of stereotypes in an all-or-none-fashion (Lepore & Brown, 1997). We have argued that involuntary affective measures are stronger predictors of racial bias than cognitive measures. Although we

did not directly test this comparison of measures in our experiments, future research that includes both involuntary affective and cognitive measures to predict racial discrimination should bear direct support for our argument.

Further, whereas the White participants in our experiments, as well as those in other studies (e.g., Devine 1989b; Judd et al., 1995), now report more positive feelings toward Blacks compared with research participants in earlier decades, Fazio et al. (1995) found that automatic, race-based responding predicted a Black experimenter's evaluation of the participant's behavior better than their reported attitudes. In that study, such negative affect may have leaked through the participant's nonverbal behaviors. Although the experimenter attended to factors such as eye contact, spatial distance, and body language, on the basis of the results of the present experiments, we propose that it was the participant's facial behavior (e.g., smiling) that was particularly revealing in the Fazio et al. study. That is, Whites with negative attitudes toward Blacks may leak their feelings through their facial expressions, and thus circumvent their more controlled verbal responses (cf. Ambady & Rosenthal, 1992; Word, Zanna, & Cooper, 1974). Future investigations of racial prejudice that use the facial EMG methodology described here may be especially advantageous in detecting this leakage than are other cognitively based methods, such as measuring reaction time. Another advantage of the facial EMG methodology over other involuntary measures, which is clearly demonstrated by our first two experiments, is that facial EMG is not limited to measuring the affect elicited solely by the presentation of racial categories, but rather, also measures affect aroused by other situational variables (e.g., reward structure, relative deficiency of partner) that might change over time in actual intergroup encounters.

Cooperative Team Learning Interventions and Race

As we stated in the introduction, cooperative team learning interventions are widely used and promoted as a means to ameliorate intergroup bias in ethnically heterogeneous settings, with some researchers strongly recommending that such interventions include joint reward structures (Cohen, 1986; Johnson & Johnson, 1992). The present research demonstrates that in newly formed teams, joint reward structures can lead to aversive consequences when team members have disparate abilities relevant to the task, a situation that might be common in real settings. Even when actual abilities do not differ, some individuals may perceive differences in abilities due to stereotype-based expectancies. Our results are consistent with the correlational meta-analytic outcomes reported by Miller and Davidson-Podgorny (1987). In their meta-analysis of factors that moderate the beneficial effects of cooperative team learning interventions on intergroup acceptance, an interdependent reward structure, by comparison with an individualistic reward structure, directionally reduced ($p < .10$) the typical increase in intergroup acceptance that is produced by cooperation. The results of Experiment 2, however, also suggest that perceptions that a deficient partner is trying to overcome his or her deficiencies may decrease the negative affect otherwise directed toward the partner. The negative impressions that such situations create still may be difficult to avoid. According to Neuberg and Fiske (1987), when participants are involuntarily committed to interdependent situations (such as those described in the scenarios used in our experiments), they may be motivated to form more negative impressions of their partner to avoid creating a discrepancy between their prior beliefs and a more hopeful reality. For example, White males rated a Black woman more negatively when they had to date her exclusively than when they expected merely to interact with her briefly (Borgida & Omoto, 1986).

Although more negative facial affect occurred when Blacks were partners, this last point might at first thought cause one to ponder about the absence of any interactions with race, given the experimental design we used in the first two experiments. That is, with the negative stereotypes that Whites have about Blacks, should race of the partner have interacted such that the greater negative affect toward partner under joint rewards was further augmented when the partner was Black as opposed to White? Likewise, in Experiment 2, should the deleterious effects both of deficiency and unwillingness to exert compensatory effort have been even greater when exhibited by a Black as opposed to a White partner?

Our answer to these questions is no, they should not. Our point is that these expectations and attributions are the features that produce negative affect toward one's partner. In everyday school contexts they are likely to arise stereotypically and naturally with respect to Blacks (perhaps because of group level differences in average performance on academic tasks). Confirming their explanatory role in this latter context, however, when these same perceptions are explicitly induced with respect to one's White partner, the same negative outcomes emerge.

At the same time, it is important to note that there are circumstances under which interactions with race can be expected. The scenario methodology we used in the present research did not provide an opportunity for the occurrence of the minor negative triggering behaviors on the part of the partner that will characteristically emerge in real face-to-face interactions and induce reactions of anger or irritation. Such triggering behavior can function to justify amplified expression of hostility toward low-status out-group members. In accord with our own data, Baron's (1979) White participants displayed a type of reverse racism toward Black targets, expressing less aggression toward them than toward White targets. When angered by an insult, however, although the level of aggression expressed toward a White in-group member did not increase significantly, aggression toward a Black was reliably greater in the insult condition than in the no-insult condition. Similar results were obtained in a group setting (Rogers & Prentice-Dunn, 1981). A provocation did not affect the levels of aggression that a group of White participants expressed toward another White, but it did augment their aggression toward a Black target. Thus, were the current experimental designs conceptually replicated in a paradigm that required direct interaction between the participant and the partner, the emission of a triggering provocation from the partner (such as expressing impatience or irritation about helping the participant perform part of the task) can be expected to elicit stronger dislike or hostility toward a Black as opposed to a White partner (Dollard, 1938).

Although the scenario methodology we used in the present research produced effects consistent with our predictions, our conclusions regarding the use of joint reward structures in in-

tergroup settings in which participants have discrepant abilities are likely to be even more strongly supported in an experimental paradigm that requires face-to-face cooperative interactions. In the context of real social interaction, disparities in task competence and the consequences of a teammate's disinterest in making extra efforts in behalf of team goals are likely to be even more salient and frustrating to the more competent teammate. Finally, our results also suggest that the voluntary expressions of intergroup acceptance and the suppression of ethnocentrism that result from applications of cooperative interventions will paint a somewhat misleading, albeit rosier, picture of intergroup relations than the picture that emerges from involuntary affective measures. Failure to acknowledge the existence and nature of this underlying negative affect will necessarily result in a failure to anticipate the consequences of its potential for interacting with other variables. We suspect that in real-world settings it sets the stage for justifying and augmenting intergroup bias and prejudice in response to triggering provocations.

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Appendix A

Means, Standard Errors, and Effects of Individual Measures in Experiment 1

	White				Black				
	Independent		Joint		Independent		Joint		
Measure	*M*	*SE*	*M*	*SE*	*M*	*SE*	*M*	*SE*	Effects
Cheek	0.383	0.045	0.310	0.188	−0.251	0.176	−0.240	0.147	1
Brow	−0.632	0.127	0.155	0.180	0.020	0.166	0.456	0.150	1, 2
Liking	0.141	0.167	−0.591	0.107	0.430	0.134	0.020	0.192	1, 2
Success	0.349	0.145	−0.893	0.065	0.751	0.079	−0.208	0.159	1, 2
Happiness	0.459	0.138	−0.784	0.067	0.680	0.082	−0.355	0.175	1, 2

Note. Effects were evaluated using an alpha of .05: 1 = *main effect of race,* 2 = *main effect of reward structure.*

Appendix B

Means, Standard Errors, and Effects of Individual Measures in Experiment 2

	Self deficient								Partner deficient								
	Willing to make effort				Not willing to make effort				Willing to make effort				Not willing to make effort				
	White		Black		White		Black		White		Black		White		Black		
Measure	*M*	*SE*	*M*	*SE*	*M*	*SE*	*M*	*SE*	*M*	*SE*	*M*	*SE*	*M*	*SE*	*M*	*SE*	Effects
Cheek	0.348	0.172	0.034	0.162	0.179	0.136	−0.055	0.170	0.283	0.172	−0.088	0.146	−0.299	0.165	−0.389	0.140	1, 2, 3
Brow	−0.002	0.168	0.003	0.136	−0.047	0.115	0.245	0.158	−0.484	0.142	−0.115	0.140	0.081	0.193	0.317	0.177	1, 3
Success	0.795	0.088	0.730	0.090	−0.685	0.069	−0.677	0.070	0.878	0.067	0.955	0.067	−1.09	0.085	−0.906	0.073	3, 2 × 3
Happiness	0.663	0.082	0.649	0.092	−0.686	0.078	−0.789	0.089	0.970	0.081	1.01	0.076	−0.946	0.082	−0.873	0.079	3, 2 × 3

Note. Effects were evaluated using an alpha of .05: 1 = *main effect of race,* 2 = *main effect of source of deficiency,* 3 = *main effect of effort,* 2 × 3 = Source of Deficiency × Effort interaction.

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