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Imagining Stereotypes Away: The Moderation of Implicit Stereotypes Through Mental Imagery

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Research on implicit stereotypes has raised important questions about an individual's ability to moderate and control stereotypic responses. With few strategies shown to be effective in moderating implicit effects, the present research investigates a new strategy based on focused mental imagery. Across 5 experiments, participants who engaged in counterstereotypic mental imagery produced substantially weaker implicit stereotypes compared with participants who engaged in neutral, stereotypic, or no mental imagery. This reduction was demonstrated with a variety of measures, eliminating explanations based on response suppression or shifts in response criterion. Instead, the results suggest that implicit stereotypes are malleable, and that controlled processes, such as mental imagery, may influence the stereotyping process at its early as well as later stages.

Implicit stereotypes are social category associations that become activated without the perceiver's intention or awareness when he or she is presented with a category cue. Over the past decade, substantial evidence has accumulated for the influence of implicit stereotypes on judgment and behavior (for reviews, see Bargh, 1999; Blair, 2001; Greenwald & Banaji, 1995). With that work has come concern over the controllability of such effects and the implications thereof (e.g., Banaji & Greenwald, 1994; Bargh, 1999; Devine, 1989; Fiske, 1989). If an individual is unaware of the stereotype's influence or does not have the means to control it, is stereotyping inevitable? Should individuals and organizations be held legally responsible for discrimination that results from implicit stereotypes? At the core of these questions is the issue of control. Can people control the influence and expression of implicit stereotypes?

One answer to this question is provided by theories of stereotyping that specify very distinct roles for implicit and explicit processes (see Bargh, 1999; Bodenhausen & Macrae, 1998; Brewer, 1988; Devine, 1989; Fiske & Neuberg, 1990). According to those theories, stereotyping begins with the activation of implicit stereotypes and ends with their application to judgment or behavior. If a perceiver is motivated to avoid stereotyping, he or she may control the application of stereotypes by suppressing them, compensating for their influence, or concentrating on individuating information (Devine & Monteith, 1999; Dunton & Fazio, 1997; Fazio, Jackson, Dunton, & Williams, 1995; Fiske, 1989; Plant & Devine, 1998). What the perceiver is not able to do, according to current theory, is alter the activation of implicit stereotypes.

A different answer to the question of control is provided by recent research that suggests people can moderate the activation of implicit stereotypes as well as control their later application, given the right strategies and conditions (e.g., Blair & Banaji, 1996; Gilbert & Hixon, 1991; Gollwitzer & Schaal, 1998; Macrae, Bodenhausen, Milne, Thorn, & Castelli, 1997). For example, Blair and Banaji (1996) demonstrated that a counterstereotype (CS) expectancy produced significantly weaker implicit stereotypes than a stereotype expectancy, especially under reduced cognitive load. However, the work supporting the moderation of implicit stereotypes has been criticized as either internally or externally invalid (Bargh, 1999).

The goal of the present research is to investigate mental imagery as a new strategy to moderate implicit stereotypes. Mental imagery is the conscious and intentional act of creating a mental representation of a person, object, or event by seeing it with the "mind's eye." We focus on mental imagery for several reasons. First, research over the past several decades has shown that mental imagery has many of the same characteristics as a real experience, including concrete details, causal sequences, logical constraints, concomitant emotional arousal, and similar neurological characteristics (Dadds, Bovbjerg, Redd, & Cutmore, 1997; Kosslyn, 1994, 1995; Taylor & Schneider, 1989). As a consequence, mental imagery has a more powerful impact on learning, decision making, and behavior compared with other methods of processing information (Bower, 1972; Gregory, Cialdini, & Carpenter, 1982; Paivio, 1971; Pham & Taylor, 1999; Taylor, Pham, Rivkin, & Armor, 1998).

Second, mental imagery affects the cognitive system in a manner that makes it a theoretically plausible strategy to moderate implicit processes. In particular, mental imagery increases the

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accessibility of related cognitive, emotional, and behavioral representations (Carroll, 1978; Johnson & Sherman, 1990; Strack, Schwarz, & Gschneidinger, 1985). For example, when one imagines an airplane crash, knowledge of recent accidents, the potential causes and consequences of such an accident, and one's emotional and behavioral readiness for the accident all become accessible. When asked about the future likelihood of such an event, the increased accessibility of these constructs produces an exaggerated estimate of its probability (Carroll, 1978; Gregory et al., 1982; Sherman, Cialdini, Schwartzman, & Reynolds, 1985; Sherman, Skov, Hervitz, & Stock, 1981). In this manner, mental imagery can function much like other sources of priming (see Bargh, 1996; Higgins, 1996; Higgins & King, 1981), though it may be a particularly powerful method of priming because of its similarity to a real experience. As such, mental imagery has the potential to affect implicit processes, such as implicit stereotypes, even though the imagery itself is intentional and controlled (cf. Bargh's, 1996, description of postconscious automaticity).

Finally, mental imagery has been shown to be an effective means of altering judgment and behavior in a variety of domains, from learning and memory to athletic and intellectual performance (Bower, 1972; Dadds et al., 1997; Feltz & Landers, 1983; Hall & Erffmeyer, 1983; Paivio, 1971; Pham & Taylor, 1999; Taylor et al., 1998). As a common human activity, it is an intervention with good external validity (Kosslyn, Seger, Pani, & Hillger, 1990; Taylor et al., 1998). We argue that CS mental imagery can be used to alter implicit stereotypes by increasing the accessibility of CS associations. Integral to this argument is a particular model of stereotype representation, to which we now turn.

Stereotype Representation

The moderation of implicit stereotypes has been a controversial proposal in part because it challenges traditional models of stereotype representation. In particular, both prototype and associative network models conceive of stereotypes as long-term cognitive structures that cannot be easily altered (Bargh, 1999; Hamilton & Sherman, 1994; Smith, 1998). As a consequence, these structures are believed to be relatively stable across both time and situation and impervious to temporary thoughts and goals.

Notwithstanding the power of such models to account for the influence of stereotypes on attention, inference, and the retrieval of information (Fiske & Taylor, 1991; Smith, 1998), they have been called into question by evidence that stereotypes are more fluid and contextually sensitive than such models would suggest (Bodenhausen, Schwartz, Bless, & Wanke, 1995; Coats & Smith, 1999; Haslam, Turner, Oakes, McGarty, & Hayes, 1992; Smith & Zárate, 1990). For example, Haslam et al. (1992) demonstrated that Australians' stereotypes of Americans depended on the presence of other target groups, and Coats and Smith (1999) showed that exposure to different group exemplars (e.g., Kelly Bundy vs. Madonna) influenced participants' trait descriptions of gender subtypes (e.g., promiscuous women). Because that research used only explicit measures of stereotypes, the possibility remained that traditional stereotype models would be upheld by implicit measures, which have been proposed as truer indicators of the underlying representation (Fazio et al., 1995). If implicit measures are also shown to be sensitive to contextual variation and temporary states, the limitations of traditional models become more pronounced.

Connectionist models, in contrast, can easily accommodate the moderation of implicit stereotypes by conceptualizing representations as "states" rather than "things" (Smith, 1998). From this perspective, a stereotype is a pattern of activation in a network that satisfies parallel constraints imposed by connection weights (representing long-term learning) and current inputs (representing the immediate situation). The large amount of consistent evidence for implicit stereotypes suggests that they have a well-learned, stable core. Nonetheless, connectionist models predict some degree of variation due to differences in current inputs, including characteristics of the target and the perceiver's internal state. Because these effects are believed to occur at the activation stage of information processing, they ought to be observed with implicit measures of stereotypes.

Of additional importance to our argument is the existence of counterstereotypes. In traditional stereotype models, only the most typical or strongest group associations are considered. For example, one's stereotype of women may include information about typical personality traits (e.g., warm, passive, dependent), physical characteristics (e.g., long hair, small stature), and occupations (e.g., nurse, librarian, secretary). Although there is little argument that such stereotypic attributes may constitute the core of the stereotype (see above), there are reasons to believe that the representation may also contain information about counterstereotypes. For example, a number of studies have shown that people possess relatively well-developed subtypes that are inconsistent with the group stereotype, such as the professional or athletic woman (Coats & Smith, 1999; Deaux, Winton, Crowley, & Lewis, 1985; R. J. Green & Ashmore, 1998; see also Brewer, Dull, & Lui, 1981; Devine & Baker, 1991). In addition, most of us can easily generate CS exemplars of the category, such as Diane Sawyer, Hillary Rodham Clinton, Mia Hamm, and Marion Jones.

These counterstereotypes, by definition, are not highly accessible, and they are unlikely to be implicitly activated and influence judgment and behavior in the same way that stereotypic associations have been shown to do. Nonetheless, certain conditions may increase the accessibility and influence of counterstereotypes. As one example, Bodenhausen et al. (1995) showed that participants who had been exposed to successful African Americans were later more likely to agree that discrimination is still a problem in contemporary society for African Americans as a group. The present research investigates mental imagery as a means of making counterstereotypes of women more accessible and thereby moderating implicit gender stereotypes.

Overview of the Present Research

Five experiments were conducted to examine the moderating influence of mental imagery on implicit gender stereotypes. The first three experiments measured implicit stereotypes with a procedure recently introduced by Greenwald and his colleagues, the Implicit Association Test (IAT; Greenwald, McGhee, & Schwartz, 1998; Rudman, Greenwald, & McGhee, 2001). We used the IAT in these initial experiments for two reasons. First, the measure is known for producing very consistent and compelling evidence for implicit associations (Greenwald et al., 1998). Second, the IAT has received widespread media attention, with many reports empha-

sizing the uncontrollable nature of implicit stereotypes and prejudice. Thus, it is important to determine whether such a powerful and seemingly uncontrollable effect can be moderated by an explicit process such as mental imagery. Because it is also important to demonstrate that mental imagery has a general effect on implicit stereotypes, the primary purpose of Experiments 4 and 5 was to examine the influence of CS mental imagery on two new measures of implicit stereotypes, one based on signal detection theory and the other based on the well-established false memory effect.

In all of the experiments, implicit stereotypes are operationalized as the difference between stereotypic and CS responses, regardless of whether the outcome is the response time (RT), the sensitivity of signal detection, or the rate of false alarms (FA). The central prediction, then, is that CS mental imagery will result in a weaker implicit stereotype as compared with control conditions.

Although implicit stereotypes and prejudice are typically examined through such comparative indexes (e.g., Banaji & Hardin, 1996; Blair & Banaji, 1996; Dovidio, Evans, & Tyler, 1986; Fazio et al., 1995; Gaertner & McLaughlin, 1983; Greenwald et al., 1998; Kawakami, Dion, & Dovidio, 1998; Perdue & Gurtman, 1990), one may wonder whether CS mental imagery ought to differentially influence responses to counterstereotypes rather than to stereotypes because such imagery is hypothesized to increase the accessibility of CS associations. Although that prediction is reasonable, there is at least one good reason to anticipate a more complicated outcome. Specifically, stereotypes and counterstereotypes are often bipolar opposites, and as such they are unlikely to be represented independently. Indeed, emerging evidence suggests that increasing the accessibility of one implies a decrease in the other as a result of cognitive consistency and efficiency pressures (Bodenhausen & Macrae, 1998; Dijksterhuis & van Knippenberg, 1996; Greenwald et al., in press). For example, Dijksterhuis and van Knippenberg (1996) demonstrated that increasing the accessibility of stereotypic information resulted in a concomitant inhibition of CS information, whereas neutral or stereotype-irrelevant information was unaffected. Thus, a reduction in implicit stereotypes may be observed in the increased accessibility of CS associations, the decreased accessibility (inhibition) of stereotypic associations, or both.

Experiment 1

Method

Participants

Undergraduate students (N = 42; 17 men and 25 women) at the University of Colorado at Boulder participated in partial fulfillment of a course requirement or for monetary compensation.

Materials

IAT. The IAT requires participants to categorize a series of words into four categories. An implicit stereotype is revealed if they are faster to complete the categorizations when the categories are positioned in a stereotype-consistent versus stereotype-inconsistent manner (see Greenwald et al., 1998; Rudman et al., 2001). In the present experiment, the stereotype-consistent arrangement required the participants to group female and weak items together, and male and strong items together; the stereotype-inconsistent arrangement required them to group female and strong items together, and male and weak items together. The test was administered on Macintosh computers.

Following several blocks of practice trials to familiarize them with the procedure, the participants completed two blocks of combined categorization trials. During those trials, the target words appeared in a box in the center of the screen, and the relevant category labels appeared to the left and right of the box. The participants made their category judgments by pressing either the *left* or *right* button on a button box designed to capture millisecond RT. If a target was incorrectly categorized, a tone sounded and the correct categorization was required before the next trial began. Trials were separated by a 250 ms intertrial interval (ITI).

In the first block of 40 test trials, the four categories were positioned in a stereotype-inconsistent manner (female and strong; male and weak). In the second combined categorization block, the male and female categories switched positions, so that the categories were positioned in a stereotype-consistent manner (male and strong; female and weak). To minimize the influence of the switch, we gave the participants 20 trials to practice categorizing the male and female names in the new category positions before they completed the stereotype-consistent trials. In addition, each block of test trials was preceded by 20 practice trials with the combined categories.

We chose 20 forenames to represent the categories of male and female (e.g., "David" and "Diane"). And on the basis of materials developed by Rudman et al. (2001), the categories of strong and weak were represented by 20 words that denote either strength or weakness (e.g., "durable" and "delicate"). These terms were selected to be similar in evaluative tone (positive) to ensure that stereotypes and evaluation were not confounded (see Appendix A for a complete list of the test stimuli). In each test block, all words were presented once, with the order of presentation randomized for each participant. The participants' responses and associated RTs were recorded for each trial. An implicit gender stereotype was operationalized as faster RT for correct categorizations on the stereotype-consistent trials than the stereotype-inconsistent trials.

Mental imagery instructions. The participants were randomly assigned to one of two mental imagery conditions. Those in the CS condition were asked to take a few minutes to imagine what a strong woman is like, why she is considered strong, what she is capable of doing, and what kinds of hobbies and activities she enjoys. In contrast, the participants in the neutral imagery condition were asked to take a few minutes to imagine what a vacation in the Caribbean would be like, how the place would look, what people would do there, and what would make it a true vacation. After creating their mental image, the participants were asked to describe it in a short paragraph.

Procedure

The participants began by completing a practice IAT to familiarize them with the procedure and stimuli. They then completed their randomly assigned mental imagery task, which took approximately 5 min. Finally, the participants were asked to complete the IAT a second time while keeping their mental image in mind.

Results

Before turning to the IAT data, a qualitative analysis of the participants' mental imagery is informative in regard to several important issues. First, none of the participants appeared to have any trouble in producing their assigned mental image. This point is particularly important with respect to the CS mental imagery, as it suggests that people can easily access CS representations. Second, the mental imagery produced by the participants in the CS condition was quite variable. Some participants described a strong businesswoman who is in charge of other people. Other partici-

pants focused on a strong woman who is an athlete or "warrior." And some participants combined these images into a "superwoman" who is able to balance her athletic activities, family, career, and friends. A few participants even focused on a very traditional female image, but they emphasized the strength that is needed to fulfill that role (see Appendix B for mental imagery samples).

Because of computer errors, the RT data from 3 participants were not saved (2 in the neutral condition and 1 in the CS condition). For the remaining 39 participants, all trials with incorrect categorizations were eliminated (6.5%) as were trials on which the RT was higher than 3 standard deviations from the participant's own mean RT (2.3%). The data were then log-transformed before the statistical analysis was conducted to better approximate a normal distribution (see Fazio, 1990; Ratcliff, 1993).

Of primary interest was the effect of the CS mental imagery on the participants' implicit gender stereotype. We hypothesized that participants in the CS condition would produce a weaker implicit stereotype than those in the neutral condition, as revealed by the difference in the RTs on the stereotype-consistent versus stereotype-inconsistent blocks of trials. To test that prediction, a 2 (mental imagery: CS vs. neutral) × 2 (IAT block: stereotype-consistent vs. stereotype-inconsistent) mixed-model analysis of variance (ANOVA) was conducted, with the first factor varying between subjects and the second factor varying within subjects.[1] This analysis revealed the predicted two-way interaction, $F(1, 37) = 8.12$, $p < .01$, $PRE = .18$.[2] As shown in Table 1, the participants who imagined a CS strong woman produced a significantly lower level of the implicit stereotype than the participants who imagined a neutral event ($M = 24$ ms vs. 95 ms, respectively). Moreover, the implicit stereotype was significantly greater than 0 in the neutral condition, $t(18) = 5.42$, $p < .001$, $PRE = .62$, but not in the CS condition, $t(19) = 1.56$, *ns*, $PRE = .11$. The strength of the implicit stereotype produced in the neutral condition highlights the potential power of implicit stereotypes in their default state. Nonetheless, imagining a CS exemplar reduced the implicit stereotype by more than half, providing the first demonstration that mental imagery can have a powerful effect on implicit processes.

Simple effects analyses showed that the CS condition produced significantly faster responses than the neutral condition on the stereotype-inconsistent trials, $F(1, 37) = 4.28$, $p < .05$, $PRE = .10$, whereas the two conditions did not differ on the stereotype-consistent trials, $F(1, 37) = 0.12$, *ns*, $PRE = .003$. Thus the effect of the CS mental imagery was most clearly expressed through an increase in the speed with which the participants were able to make CS categorizations. This result supports the proposal that CS mental imagery increases the accessibility of CS associations.

Table 1
Mean Response Time (in Milliseconds) in Experiment 1 by Implicit Association Test Block and Mental Imagery Condition

Mental imagery	Inconsistent block	Consistent block	Implicit stereotype (reaction time difference)
Neutral	740_a	645_a	95_a*
Counterstereotype	657_b	633_a	24_b

Note. Within a column, means with different subscripts differ significantly at $p < .05$.
* Significantly greater than 0 at $p < .05$.

Experiment 2

The goal of Experiment 2 was to provide a replication of the moderating effect of CS mental imagery and eliminate several competing explanations for the effect. In Experiment 1, the CS and neutral imagery conditions were similar in task requirements. However, the two conditions were not equally relevant for the categorization task, with imagery of a strong woman of greater relevance for gender and strength categorizations than imagery of a Caribbean vacation. Because an irrelevant task can increase cognitive load (Gilbert & Hixon, 1991), it is possible that the neutral mental imagery actually increased the implicit stereotype from baseline levels and thus exaggerated the difference between the two mental imagery conditions. To establish that the neutral mental imagery was indeed neutral with respect to the implicit stereotype, we included a no-imagery condition in Experiment 2. We predicted that the implicit stereotype produced with the CS mental imagery would be smaller in magnitude than the implicit stereotype produced with either neutral or no mental imagery, whereas the latter two conditions would not differ significantly from one another. A second comparison condition was also deemed necessary to distinguish effects due to content versus relevance of the mental imagery. Stereotypic and CS mental imagery are equally relevant for the task, but they differ significantly in their implications for the implicit stereotype. We predicted that the implicit stereotype produced with CS mental imagery would be smaller in magnitude than the implicit stereotype produced with stereotypic mental imagery.

Method

Participants

Undergraduate students ($N = 163$; 53 men and 110 women) at the University of Colorado at Boulder participated in this study for experimental credit in partial fulfillment of a course requirement.

Materials and Procedure

The materials and procedures were the same as those used in Experiment 1, with the following changes.

The order of the two experimental blocks in the IAT was counterbalanced across participants, such that half of the participants in each mental imagery condition completed the stereotype-inconsistent block before the stereotype-consistent block, and the other participants completed the blocks in the reverse order.

Two additional mental imagery conditions were included in this experiment. The participants in the stereotype condition were asked to take a few minutes to imagine a "weak woman," defined as a person who is "somewhat fragile and might be described in poetry as a 'delicate flower.'" The

[1] All of the analyses in these experiments were also conducted with participant gender as a factor, which did not qualify any of the mental imagery effects, except as noted.

[2] *PRE* is the proportional reduction in error that is obtained by adding this parameter to the statistical model (see Judd & McClelland, 1989). It therefore reflects the size of the effect.

participants in the no-imagery condition were asked to play with a simple water game for 5 min between the practice and target IAT measures.

The full experimental design was a 4 (mental imagery condition: stereotypic vs. CS vs. gender-neutral vs. no-imagery) × 2 (IAT block: stereotype-consistent vs. stereotype-inconsistent) × 2 (IAT block order: consistent first vs. inconsistent first) factorial, with mental imagery condition and block order varied between subjects and IAT block varied within subjects.

Results

Analyses of the RT data were based on 158 participants. The data from 2 participants were not saved by the computer, and the data from 3 participants were eliminated as outliers because their responses were so discrepant from the others in their condition that they would have unduly biased the analyses. Specifically, 1 participant each in the no-imagery, neutral mental imagery, and stereotype mental imagery conditions had an IAT effect that was more than 3 standard deviations from the mean for that condition. For the remaining participants, all error trials were eliminated (6.5%), as were trials on which the RT was higher than 3 standard deviations from each participant's mean RT (2.2%). The data were then log-transformed before the statistical analyses were conducted.

To test the effect of the mental imagery on participants' implicit gender stereotypes, we conducted a 4 (mental imagery: stereotypic vs. CS vs. neutral vs. no-imagery) × 2 (IAT block: stereotype-consistent vs. stereotype-inconsistent) mixed-model ANOVA.[3] This analysis revealed the predicted two-way interaction between mental imagery condition and IAT block, indicating that the magnitude of the implicit stereotype varied across the mental imagery conditions, $F(3, 154) = 4.94$, $p < .01$, $PRE = .09$.

The first hypothesis was that the implicit stereotype would be smaller in the CS condition than in either the neutral or no-imagery conditions. As shown in the far right column of Table 2, this hypothesis was upheld in tests comparing the CS condition with the neutral and no-imagery conditions, $F(1, 154) = 5.09$, $p < .05$, $PRE = .03$, and $F(1, 154) = 9.96$, $p < .01$, $PRE = .06$, respectively. Furthermore, the implicit stereotypes produced in the neutral and the no-imagery conditions were not significantly different from one another, $F(1, 154) = 0.79$, $PRE = .005$.

The second hypothesis focused on the issue of mental imagery content versus relevance. It was predicted that the CS mental imagery would produce a smaller implicit stereotype than the stereotypic mental imagery, even though both were equally relevant for the IAT. Support for this hypothesis can again be seen in the far right column of Table 2, $F(1, 154) = 12.0$, $p < .001$, $PRE = .07$. Of some interest was the finding that the stereotypic mental imagery did not significantly enhance the implicit stereotype, as compared with either the neutral or the no-imagery conditions, $F(1, 154) = 1.14$, *ns*, $PRE = .008$, and $F(1, 154) = 0.06$, *ns*, $PRE = .00$, respectively. Finally, although the CS mental imagery significantly reduced the implicit stereotype, the mean stereotype was significantly greater than 0 in all of the conditions, all ts > 3.0, dfs = 40, 37, 37, and 40, $PRE = .64, .68, .64$, and $.21$, for the stereotype, no-imagery, neutral, and CS conditions, respectively.

Table 2
Mean Response Time (in Milliseconds) in Experiment 2 by Implicit Association Test Block and Mental Imagery Condition

Mental imagery	Inconsistent block	Consistent block	Implicit stereotype (reaction time difference)
Stereotype	735_a	622_a	113_a*
None	733_a	625_a	108_a*
Neutral	723_a	631_a	92_a*
Counterstereotype	674_b	627_a	47_b*

Note. Within a column, means with different subscripts differ significantly at $p < .05$.
* Significantly greater than 0 at $p < .05$.

Separate analyses of responses on the stereotype-inconsistent and stereotype-consistent IAT blocks, shown in Table 2, showed that the CS condition produced significantly faster responses on the stereotype-inconsistent trials, as compared with the other three conditions (M = 674 ms vs. 730 ms), $F(1, 150) = 5.16$, $p < .025$, $PRE = .03$. In contrast, responses on the stereotype-consistent block of trials did not differ significantly across the mental imagery conditions. As in Experiment 1, these results suggest that the primary effect of the CS mental imagery was to facilitate CS responses.

Experiment 3

Although the results of Experiment 2 provided even stronger support for the moderating influence of CS mental imagery, the finding that the stereotypic mental imagery did not produce a significant increase in the implicit stereotype over control levels was somewhat surprising. Imagining a stereotypic woman ought to increase the accessibility of stereotypic associations, just as imagining a CS woman is expected to increase the accessibility of CS associations. We believed that the null result we obtained was probably due to the fact that the mental imagery generated in the stereotype condition did not match the implicit stereotype being measured. Specifically, the majority of the participants generated mental images of insecure and dependent women, with several noting that this type of woman allowed people to take advantage of her (see Appendix B for samples). Such images were very different from the type of (positive) weakness tested by the IAT (e.g., "delicate," "fine," and "dainty"). To investigate this possibility, we conducted a partial replication of Experiment 2 by instructing participants in a new stereotype condition to focus on a more positive image, which would better match the positive stereotypic associations tested in these experiments.

Method

Participants

Students (N = 57; 17 men and 40 women) at the University of Colorado at Boulder participated in this study for experimental credit in partial fulfillment of a course requirement.

[3] Initial analyses showed that block order did not qualify any of the reported effects in Experiments 2, 3, and 4. Consequently, this factor was dropped from the analyses.

Materials and Procedure

The materials and procedure were the same as those used in Experiment 2, with the exception that the participants in the stereotype condition were instructed to focus on an image of very "feminine women, such as storybook princesses or Victorian women." These new instructions evoked relatively positive images of a weak woman, whose attributes were well matched to the stereotype being measured (see mental imagery samples in Appendix B).

The experimental design was a 2 (mental imagery condition: stereotypic vs. gender-neutral control) × 2 (IAT block: stereotype-consistent vs. stereotype-inconsistent) × 2 (IAT block order: consistent first vs. inconsistent first) factorial, with mental imagery condition and IAT block order varied between subjects and IAT block varied within subjects.

Results

The data from 1 participant were eliminated because the IAT effect was more than 3 standard deviations from the other participants in that condition. For the remaining 56 participants, all error trials were eliminated (4.6%), as were trials on which the RT was higher than three standard deviations from each participant's mean RT (1.9%). The data were then log-transformed before the statistical analyses were conducted.

A 2 (mental imagery: stereotypic vs. neutral) × 2 (IAT block: stereotype-consistent vs. stereotype-inconsistent) mixed-model ANOVA revealed the predicted two-way interaction, $F(1, 54) = 6.75$, $p < .025$, $PRE = .11$ (see footnote 3). With mental imagery that more closely matched the stereotype being measured, the participants in the stereotype condition produced an implicit stereotype that was significantly greater in magnitude than the participants in the neutral condition ($M = 68$ ms vs. 146 ms, respectively; see Table 3). The implicit stereotype produced in both conditions was significantly greater than 0, $t(27) = 4.16$, $p < .001$, $PRE = .39$, and $t(27) = 7.24$, $p < .0001$, $PRE = .66$, for the neutral and stereotype conditions, respectively.[4] Simple effects analyses showed that the stereotypic mental imagery significantly slowed responses on the stereotype-inconsistent trials but had little influence on responses on the stereotype-consistent trials, compared with the neutral mental imagery, $F(1, 54) = 8.41$, $p < .01$, $PRE = .13$, and $F(1, 54) = 1.93$, *ns*, $PRE = .03$, respectively.

Discussion of Experiments 1, 2, and 3

These first three experiments provide compelling evidence for the moderating effect of mental imagery on implicit stereotypes as revealed by the IAT. Imagining a CS woman significantly decreased the implicit stereotype (Experiments 1 and 2), and imagining a stereotypic woman significantly increased it, as long as the imagery matched the specific stereotype being measured (Experiment 3). Of some interest was the finding that the mental imagery primarily influenced stereotype-inconsistent (CS) responses in all three experiments: The CS mental imagery facilitated those responses, whereas the stereotypic mental imagery impeded them. Because mental imagery was expected to increase the accessibility of the imagined event and facilitate associated responses, the facilitatory effect of the CS mental imagery appears to support the proposed mechanism. The inhibitory effect of the stereotypic mental imagery, however, argues against the sufficiency of a simple accessibility mechanism.

One resolution can be provided by considering the complex and interrelated nature of stereotype representations. As discussed earlier, the relationship between stereotypic and CS associations may be reciprocal, such that increasing the accessibility of stereotypic associations results in the inhibition of CS associations (Dijksterhuis & van Knippenberg, 1996). Thus, it is not unreasonable that the stereotypic mental imagery had an inhibitory effect on CS responses in the present experiment. Nonetheless, one may still wonder why the effects of both CS and stereotypic mental imagery were observed on the CS but not the stereotypic trials. On the basis of the available evidence, we can only speculate that the specific effect of the mental imagery may be task dependent. Recent research has begun to examine the mechanisms underlying the IAT, with the general conclusion that response competition is central to its operation (Brendl, Markman, & Messner, 2001; De Houwer, in press). However, additional research is needed to determine exactly how manipulations of strategy and context alter that process.

Experiment 4

With three demonstrations of the moderating effect of mental imagery on implicit stereotypes, the primary goal of the next two experiments was to test the generality of the effect with additional measures of implicit stereotypes. The new measures were chosen with two criteria in mind. First, we were interested in measures that would allow us to examine the stereotype more specifically. Although the IAT has many benefits, one of its drawbacks is that the effect it produces is always a contrast between two categories, in our case male and female. As a consequence, we could not identify whether the mental imagery specifically moderated the female stereotype. The second priority was to select measures of implicit stereotypes that could demonstrate the moderating effect of mental imagery on responses other than RT. Of particular interest were responses that could be shown to be independent of

Table 3
Mean Response Time (in Milliseconds) in Experiment 3 by Implicit Association Test Block and Mental Imagery Condition

Mental imagery	Inconsistent block	Consistent block	Implicit stereotype (reaction time difference)
Neutral	684_a	616_a	68_a*
Stereotype	794_b	648_a	146_b*

Note. Within a column, means with different subscripts differ significantly at $p < .05$.
* Significantly greater than 0 at $p < .05$.

[4] Because the size of the effect in the stereotype condition does not appear to be much larger than that in the neutral condition of Experiment 2 ($PRE = .66$ vs. .64, respectively), readers may wonder whether the stereotypic imagery really increased the implicit stereotype in the present experiment. Although statistical comparisons across experiments must be interpreted with caution, a test of the difference between the stereotype condition of the present experiment and the neutral condition of Experiment 2 showed that the stereotype condition produced an implicit stereotype that was significantly larger than that produced in the neutral condition of Experiment 2 ($M = 146$ ms vs. 92 ms, respectively), $F(1, 64) = 4.67$, $p < .05$, $PRE = .07$.

shifts in participants' response criterion. A recent account of the IAT has raised the possibility that such shifts (e.g., intentionally slower responses on the inconsistent trials) may play a role in creating IAT effects (Brendl et al., 2001). Using measures that are independent of such shifts would eliminate that particular explanation of our effects. Thus, the measures chosen for Experiments 4 and 5 allowed us to (a) focus on moderation of the female stereotype specifically and (b) investigate the influence of mental imagery on sensitivity in signal detection and false recognition.

A secondary goal of Experiment 4 was to compare CS mental imagery of a strong woman with two new conditions. First, a strong man mental imagery condition was added to eliminate the possibility that the influence of the CS mental imagery was due simply to priming the trait *strong*. If that was the case, then thinking about a strong man ought to produce the same result. If instead the effect of the strong woman mental imagery was due to its counterstereotypicality per se, then the strong man mental imagery—which is stereotypic—ought not produce the same effect. Second, a stereotype suppression condition was added. By asking some participants to suppress their stereotype, we could assess whether such a strategy is equally effective in moderating implicit stereotypes.

Method

Participants

Students (N = 145; 46 men and 99 women) at the University of Colorado at Boulder participated in partial fulfillment of a course requirement.

Materials

Implicit stereotype measure. A measure recently developed by Nosek and Banaji (in press) was chosen for this experiment. This measure, called the Go/No-go Association Task (GNAT), was developed specifically to examine the associations people have with a single category. The GNAT reveals implicit associations by using signal detection analyses (D. M. Green & Swets, 1966) to determine people's ability to detect specific target stimuli (signal) from other distracter stimuli (noise) under severe cognitive constraints. Although the GNAT was developed to examine implicit evaluation, we adapted it to examine an implicit stereotype of women. Thus in the present experiment, an implicit stereotype is revealed if the participants are more accurate ("sensitive") in detecting stimuli that are stereotypically associated (female–weak) as compared with stimuli that are counterstereotypically associated (female–strong).

Computer instructions informed the participants that they would be tested on their ability to detect certain categories of words at high speeds. On each block of trials, they were given two target categories of words to detect from among distracters. In one block, the target categories were female names and weak words (stereotype consistent); in the other block, the target categories were female names and strong words (stereotype inconsistent). The order of the two blocks was counterbalanced across the participants, and they were given practice trials before each block to become familiar with the target categories.

During the trials, the target category labels appeared at the top of the computer screen (e.g., FEMALE — WEAK) and a series of words appeared, one at a time, in the middle of the screen. The participants were instructed to press the spacebar whenever a target word appeared (go response) and to refrain from making a response whenever a distracter word appeared (no-go response). Moreover, they had to make their decision (go vs. no-go) before the stimulus left the screen. This response window was only 600 ms, and the words were separated by only a 400 ms ITI to eliminate thoughtful decisions (Nosek & Banaji, in press). If the participant made an incorrect response (i.e., a slow response to a target or a response to a distracter word), a large red X appeared for 200 ms of the ITI. If the participant made a correct response or refrained from making an incorrect response within the response window, nothing happened and the next stimulus appeared after the 400 ms ITI. With a word appearing every second and the demand that the participant read the word and make the appropriate decision in less than 600 ms, this task was very difficult. In fact, many participants reported that they felt very frustrated by their apparent lack of control and inability to make thoughtful decisions.

Each of the two test blocks contained 60 trials, composed of 15 female names, 15 male names, 15 weak words, and 15 strong words, with each item appearing once in each block. Ten of the stimuli in each category were the same as those that had appeared in the IAT in the prior three experiments, with additional words generated to provide the higher number of stimuli needed for the GNAT (see Appendix A).

Correct responses that were within the response window were coded as hits and incorrect responses within the response window were coded as FAs. The RTs in this task were irrelevant due to the constraints imposed by the response window (see Draine & Greenwald, 1998). Instead, the number of hits and FAs were used to calculate d', a measure of each participant's sensitivity to the target stimuli (see D. M. Green & Swets, 1966). In the present research, we were interested in participants' sensitivity when the target stimuli were stereotype consistent versus stereotype inconsistent. We expected that the targets would be easier to detect (i.e., a larger d') when they were stereotype consistent than stereotype inconsistent. In addition to assessing a very different type of response from the IAT, the d' measure is also notable because it is independent of criterion shifts (D. M. Green & Swets, 1966). Thus the GNAT provides a method of examining implicit stereotypes that cannot be interpreted in terms of such shifts.

Mental imagery and suppression instructions. The instructions for the strong woman (CS) mental imagery were the same as in the prior experiments, and the instructions for the strong man mental imagery took those instructions and simply replaced all references to "woman" with "man." The participants in the neutral mental imagery condition were asked to form a mental image of the "typical house." They were told to try and "see" the shape of the house, the location of the doors and windows, and to take note of any special features, such as a porch. Finally, the participants in the stereotype suppression condition were told that the word detection task is a measure of gender stereotypes and that they should try to suppress such stereotypes and avoid making associations between females and weakness.

Procedure

As in the prior experiments, the participants first completed a practice GNAT to get used to the procedure. They were then given one of the mental imagery instructions or the stereotype suppression instruction, followed by a second GNAT. The experimental design was a 4 (task condition: suppression vs. strong male mental imagery vs. strong female mental imagery vs. neutral mental imagery) × 2 (GNAT block: stereotype-consistent vs. stereotype-inconsistent) × 2 (GNAT block order: consistent first vs. inconsistent first) factorial, with task condition and GNAT block order varied between subjects and GNAT block varied within subjects.

Results

Before the statistical analyses were conducted, we examined the data for outliers. Some of the participants (n = 10; 5 in the house condition, 3 in the strong man condition, and 2 in the suppress condition) had results that were very discrepant from the other participants in their condition. Most of these outliers were produced by participants who had generated a large negative d' score on one of the blocks. A negative score indicates that the partici-

pants were making more responses within the response window to the distracter items than to the target items and thus were not following instructions (see Nosek & Banaji, in press). Indeed 6 of the participants generated a nearly perfect score in the opposite direction to what they should have been doing ($d' = -3.67$).

For the remaining 135 participants, we conducted a 4 (task condition: suppression vs. neutral mental imagery vs. strong man mental imagery vs. strong woman mental imagery) × 2 (GNAT block: stereotype-consistent vs. stereotype-inconsistent) mixed-model ANOVA (see footnote 3). A main effect for GNAT block provided one of the first demonstrations of implicit stereotypes with this powerful technique. Across conditions, the participants had significantly greater sensitivity in detecting stereotypically than counterstereotypically associated words ($M = 2.40$ vs. 1.25), $F(1, 131) = 422.43$, $p < .0001$, $PRE = .76$. Contrary to expectation, the two-way interaction was not significant, $F(3, 131) = 0.19$, $PRE = .01$. Instead, the analysis including participant gender revealed a significant three-way interaction between participant gender, task condition, and GNAT block, $F(3, 127) = 2.85$, $p < .05$, $PRE = .06$. To understand this interaction, we examined the data separately for the male and female participants. For the male participants, the strong woman mental imagery had no effect on their implicit stereotypes, as compared with the other task conditions, $F(1, 39) = 1.39$, *ns*, $PRE = .03$. Indeed, none of the task conditions were significantly different from one another. Instead, the implicit stereotype was very strong across all of the conditions: mean d' in the consistent block = 2.38, mean d' in the inconsistent block = 1.12, mean implicit stereotype = 1.26, $PRE = .77$.

The female participants, in contrast, produced the expected pattern of results. As shown in the far right column of Table 4, the strong woman mental imagery resulted in a significantly weaker implicit stereotype compared with the other three task conditions, $F(1, 88) = 5.95$, $p < .025$, $PRE = .06$. Imagining a strong woman resulted in a weaker implicit stereotype compared with (a) neutral mental imagery, $F(1, 88) = 4.75$, $p < .05$, $PRE = .05$; (b) a suppression strategy, $F(1, 88) = 2.99$, $p < .09$, $PRE = .03$; and (c) strong man mental imagery, $F(1, 88) = 4.20$, $p < .04$, $PRE = .04$. In contrast, the latter three conditions did not differ significantly from one another. Thus, neither the suppression strategy nor the strong man mental imagery moderated the implicit stereotype compared with the neutral condition (both Fs < 0.5). Although the CS mental imagery substantially reduced the implicit stereotype, it was significantly greater than 0 in all of the conditions, $PRE = .78$, .89, .85, and .55, for the neutral, suppression, strong man, and strong woman conditions, respectively, all ts > 5.0, dfs = 19, 24, 23, and 22, respectively, ps < .0001.

Separate analyses of the female participants' responses on the stereotype-consistent and stereotype-inconsistent blocks showed that the effect of the CS mental imagery produced some change in each block, but neither was significant (see Table 4). The CS mental imagery slightly reduced sensitivity in the stereotype-consistent block compared with the other conditions ($M = 2.23$ vs. 2.45), $F(1, 88) = 1.98$, *ns*, $PRE = .02$; and it slightly increased sensitivity in the stereotype-inconsistent block compared with the other conditions ($M = 1.40$ vs. 1.27), $F(1, 88) = 0.65$, *ns*, $PRE = .007$. One of the problems in doing between-subjects comparisons within a single block is that there is no control for general individual differences in performance, which may obscure small effects when they are not controlled. To control for that variance, we reran each within-block analysis controlling for the participants' performance on the same block of trials in the practice GNAT that they had completed before the mental imagery manipulation. These analyses showed that the difference between the CS condition and the other conditions was marginally significant for the stereotype-consistent block, $F(1, 87) = 3.57$, $p = .06$, $PRE = .04$, but it continued to be nonsignificant for the stereotype-inconsistent block, $F(1, 87) = 0.77$, *ns*, $PRE = .009$. These results stand in contrast to Experiments 1 and 2 by showing that the primary effect of the CS mental imagery in this experiment was on stereotypic instead of CS responses.

The one anomalous finding in the present experiment was the null result for the male participants. Because there were no gender differences in any of the other experiments, and the sample of males in the present experiment was very small, we hesitate to overinterpret this gender difference. We did, however, examine the mental imagery of the men and women in the strong woman condition to determine whether the men had produced less CS mental imagery. Specifically, two independent raters coded all of the strong-woman descriptions for CS content ($\alpha = .87$). This analysis showed that if anything, the men had produced mental imagery that was slightly higher than the women in CS content, although the difference was nonsignificant ($M = 1.23$ vs. 0.43), $t(34) = 1.15$. Thus the null result for the male participants cannot be attributed to a failure in their completion of the mental imagery task.

Table 4
Mean Sensitivity (d') in Experiment 4 by Go/No-Go Association Task Block and Mental Imagery Condition for the Female Participants

Mental imagery	Inconsistent block	Consistent block	Implicit stereotype (d' difference)
House	1.12_a	2.35_a	1.24_a*
Suppress	1.42_a	2.56_a	1.14_a*
Strong man	1.26_a	2.45_a	1.19_a*
Strong woman	1.40_a	2.23_a	0.83_b*

Note. Within a column, means with different subscripts differ significantly at $p < .05$. In the third and fourth columns, the suppress and strong woman conditions differ at $p < .09$.
* Significantly greater than 0 at $p < .05$.

Experiment 5

The main goal of Experiment 5 was to examine the moderating influence of CS mental imagery on a third measure of implicit stereotypes. The measure chosen for this experiment is based on the well-established Deese–Roediger–McDermott (DRM) false memory paradigm (Deese, 1959; Roediger & McDermott, 1995). The DRM paradigm is characterized, most generally, by presenting participants with a list of words that are all associated with a particular concept (e.g., "apple," "orange," and "kiwi") and later asking them to complete a surprise memory test. The basic finding is that participants have a higher rate of false recognition for words that are associated with the concept (e.g., "fruit") as compared with words that are unassociated with the concept (e.g., "sleep"; for a review, see Roediger, McDermott, & Robinson, 1998). Research-

ers recently extended the false memory effect to stereotypes, by showing that exposure to a list of words describing feminine or masculine roles (e.g., "secretary, nurse"; "detective, mechanic") resulted in an increase in the false recognition of stereotypically consistent roles and traits (Lenton, Blair, & Hastie, 2001). Moreover, the participants reported being unaware that gender stereotypes had influenced their recognition judgments. One of the attractions of the DRM paradigm is that it can be used to study specific concept or category associations (e.g., stereotypes of women). In addition, any effect of the mental imagery can be shown to be independent of overall shifts in response criterion if the imagery moderates the target (stereotypic or CS) FA rates but has no effect on other FA rates or on the hit rate.

Method

Participants

Students (N = 129; 36 men and 93 women) at the University of Colorado at Boulder participated in the study in partial fulfillment of a course requirement.

False Memory Measure of Implicit Stereotypes

The false memory measure was administered on Macintosh computers. The participants were presented with a series of 90 words, shown one at a time in a fixed order. Each word appeared for 1.5 s, followed by a 500 ms blank interval. Embedded among the words were 15 terms for female (e.g., "woman," "lady"), 15 gender-neutral roles (e.g., "author," "realtor"), and 15 gender-neutral traits (e.g., "funny," "honest"). The female terms were included to prime the concept *female*, and the gender-neutral roles and traits were included so the participants would know that there had been some in the list. Prior research has shown that participants will not make FAs when they are certain a specific type of word did not appear on the word list (see Lenton et al., 2001). The remaining words were included to disguise the purpose of the task.

After all the words were presented, the participants worked for 4 min on simple math problems, and then they were given a surprise recognition test. This test included 12 words from the studied list (potential hits) and 34 words that had not appeared on the list (potential FAs). The new words included 10 stereotypically feminine roles and traits ("nurse," "hairdresser," "librarian," "receptionist," "secretary," "nice," "warm," "caring," "soft," and "sensitive") and 10 CS (masculine) roles and traits ("executive," "athlete," "lawyer," "judge," "doctor," "assertive," "active," "smart," "confident," and "independent"). The participants were asked to judge whether each word was one that had appeared in the list of words they had seen before ("old") or one that had not appeared in the list ("new"). The primary dependent variable was the proportion of FAs to feminine versus masculine attributes.

Procedure

The participants first completed the mental imagery task by imagining either a strong woman or a Caribbean vacation (see Experiment 1), and then they completed the IAT measure that was used in Experiments 1, 2, and 3.[5] Following this task, they were asked to bring their mental image to mind and describe it again in a short paragraph, for the ostensible purpose of allowing us to examine whether mental imagery changes over time. The real purpose of this task was to reinforce the mental imagery and give the participants a sense that that part of the experiment was over. In a "new study," the participants were administered the false memory measure as described above. Debriefing showed that none of the participants believed the mental imagery had influenced their performance on the memory test.

Results

An examination of the data showed that 2 participants had responded "old" to all words on the recognition test. Because these participants did not follow instructions, their data were excluded from the analysis. For the remaining participants, hit and FA rates were calculated. As a whole, the participants were generally quite accurate across all types of words, with a mean hit rate of .78. Neither this hit rate nor any of the nontarget FA rates differed significantly between mental imagery conditions, indicating that the CS mental imagery did not cause a shift in the participants' overall response criterion (all Fs < 1.5). Of greater interest, however, were the FA rates to the feminine and masculine attributes.[6] To examine the influence of the mental imagery on those rates, we conducted a 2 (mental imagery: neutral vs. CS) $\times$ 2 (FA type: stereotypic vs. CS) mixed-model ANOVA. This analysis revealed a main effect for FA type, $F(1, 125) = 39.94$, $p < .0001$, $PRE = .23$, and the expected two-way interaction between mental imagery and FA type, $F(1, 125) = 9.32$, $p < .01$, $PRE = .07$.

The means in Table 5 show that the main effect was due to the participants' higher rate of FA to masculine than feminine attributes. Although we expected that priming of the female concept would increase the FA rate to the feminine items, the higher rate for the masculine items makes some sense in light of research that has shown that masculine attributes are often considered to be "normal," whereas feminine attributes are considered more abnormal (Lenton et al., 2001; Zárate & Smith, 1990). As a consequence, the masculine attributes in the present experiment may have seemed more similar to the neutral attributes that had appeared in the memory list, resulting in their overall higher FA rate. Of greater importance, however, was the finding that this main effect was moderated by the mental imagery manipulation. Although both groups produced a higher FA rate to masculine than feminine attributes, this difference was greater in the CS condition, $t(63) = 6.23$, $p < .0001$, $PRE = .38$, than in the neutral condition, $t(62) = 2.46$, $p < .025$, $PRE = .09$. Simple effects analyses showed that the CS mental imagery resulted in a significantly lower FA rate to the feminine attributes, $F(1, 125) = 3.91$, $p = .05$, $PRE = .03$, and a nonsignificantly higher FA rate to the masculine attributes, $F(1, 125) < 1.0$, $PRE = .006$, compared with the neutral mental imagery. Thus, as in Experiment 4, the primary effect of the CS mental imagery was on the stereotypic responses.

Discussion of Experiments 4 and 5

The results of Experiments 4 and 5 show that CS mental imagery moderates implicit stereotypes, as expressed through signal detection sensitivity and (false) recognition judgments, as well

[5] This measure represents a direct replication of prior experiments, and it will not be discussed further, except to note that the results were replicated: The CS condition produced a significantly weaker implicit stereotype than the neutral condition (M = 73 vs. 111 ms), $F(1, 124) = 4.57$, $p < .05$, $PRE = .03$. Furthermore, the implicit stereotype was significantly greater than 0 in both the CS and neutral conditions, PRE = .43 and .56, respectively, ts$(62) > 6.0$, ps $< .0001$.

[6] Signal detection analyses are not appropriate here because masculine and feminine attributes were not included in the memory list, and thus there are no hits for those categories.

Table 5
Mean False Alarm Rates in Experiment 5 by Lure Type and Mental Imagery Condition

Mental imagery	Masculine lures	Feminine lures	Implicit stereotype (false alarm difference)
Neutral	$.38_a$	$.33_a$	$-.06_a$*
Counterstereotype	$.42_a$	$.26_b$	$-.16_b$*

Note. Within a column, means with different subscripts differ significantly at $p < .05$.
* Significantly greater than 0 at $p < .05$.

as RT. These experiments extend prior research by demonstrating that mental imagery of a strong woman moderates implicit stereotypes of women specifically. In addition, Experiment 5 produced the effect even when the imagery occurred in a separate context and the participants did not believe that it had any relevance for their task. Moreover, the moderation was obtained for a range of stereotypic attributes (e.g., "secretary" and "nice"), most of which were only indirectly associated with the focal trait dimension of strength.

Of great interest was the finding that the CS mental imagery moderated the implicit stereotypes in these experiments primarily through the inhibition (or decrease) in stereotypic responses, with little accompanying change in CS responses. We proposed at the outset that CS mental imagery operates by increasing the accessibility (strength or weight) of CS associations, and that this accessibility may result in a decrease in the accessibility of stereotypic associations. Thus, the moderation of stereotypic responses is not problematic theoretically. What is not clear, however, is why we did not observe a corresponding change in CS responses, and why the results were exactly opposite to what was observed in Experiments 1 and 2, where the CS mental imagery primarily moderated CS and not stereotypic responses.

We believe that an answer to this puzzle will ultimately be found in the measures themselves. Several researchers have begun to question the assumption that all implicit measures reveal the same processes, with calls to analyze their structural properties more thoroughly (Bosson, Swann, & Pennebaker, 2000; Brauer, Wasel, & Niedenthal, 2000; De Houwer, 2000; but see Cunningham, Preacher, & Banaji, 2001). It is premature to draw conclusions at this point in the debate, but it seems only reasonable that various measures may "tap into" different aspects of an implicit process, with some better at revealing inhibitory processes and others better at revealing facilitatory processes. In the present research, the IAT, GNAT, and DRM paradigm differed on a number of dimensions, including response (RT, d', FA), stimuli, and specificity of the stereotype, as well as in procedure. It remains for future research to determine which dimensions are critical and what each type of process may imply about behavior "downstream." Nonetheless, we have shown that the influence of CS mental imagery is not restricted to a single type of response, and that it can both facilitate CS responses and inhibit stereotypic responses.

General Discussion

Five experiments provided compelling evidence for the moderating influence of mental imagery on implicit stereotypes. Participants who imagined a strong (CS) woman produced substantially weaker implicit gender stereotypes than participants who imagined a gender-neutral event. This same reduction was not found when the participants attempted to suppress their stereotypes nor when the mental image was equally relevant for the task but stereotypic in nature (i.e., a weak woman or a strong man). Indeed, when the imagery closely matched the implicit stereotype, it served to significantly increase it (Experiment 3). These results leave little doubt that the CS mental imagery per se was responsible for diminishing implicit stereotypes. The diversity of methods used to measure the stereotypes also suggests that the influence of CS mental imagery is both real and general. These results raise several important issues regarding both stereotyping and the representation of stereotypes.

Theoretical Implications

As noted earlier, current models of stereotyping hold that implicit stereotype activation occurs at the earliest stage of information processing, before explicit processes can have any effect (Bargh, 1999; Bodenhausen & Macrae, 1998; Brewer, 1988; Devine, 1989; Fiske & Neuberg, 1990). By showing that mental imagery—an explicit process—moderates implicit stereotypes, the present research suggests that those models are insufficient. In particular, it appears that implicit and explicit processes may be more interdependent than previously believed. Not only can implicit stereotypes influence explicit judgments and behavior, but explicit thoughts and strategies may also influence implicit stereotypes. Of some interest is the likelihood that this influence may often be unintended. That is, although the CS imagery was itself intentional, the moderation of implicit stereotypes was probably unintentional. Few people are aware of implicit processes, and thus even fewer are concerned about altering them. We suspect that most controlled strategies are directed toward one's explicit judgments and behavior. Notwithstanding that fact, such controlled strategies can feed back into the system and alter implicit stereotypes. Prior research has provided evidence for such feedback in the form of stereotype rebound following attempts to suppress the stereotype (e.g., Macrae, Bodenhausen, Milne, & Jetten, 1994). The present research shows that other strategies, such as CS mental imagery, may result in the reduction of implicit stereotypes.

At perhaps an even deeper level, the present research suggests that stereotypes cannot be assumed to reflect only well-learned associations. Although those associations may constitute the core of the representation, stereotypes are clearly more malleable than prototype and associative network models would suggest (e.g., Bargh, 1999; Devine, 1989; Fazio et al., 1995). Prior research has challenged those ideas, but the present results amplify the challenge by demonstrating stereotype malleability with implicit measures that presumably provide a closer look at the representation. We believe that our results are best understood with connectionist models, in which a representation is viewed as a state that reflects both long-term learning and current inputs. In most of the present experiments, the implicit stereotype was significantly greater than 0 in all conditions, providing evidence for the influence of well-learned stereotypic associations. Nonetheless, its magnitude was substantially diminished by CS mental imagery, providing evidence for the additional influence of current input.

Although we believe that the influence of CS mental imagery is best understood in terms of alterations in the pattern of activation that constitutes the stereotype, it is useful to consider alternative explanations. For example, one possibility is that the CS mental imagery had its effect by shifting the participants' response criterion. As noted earlier, the RT differences produced with the IAT have been characterized as the result of such shifts, with the criticism that controlled processing would then be implicated (Brendl et al., 2001). By promoting counterstereotypes, the CS mental imagery could have caused the participants to lower their response criterion and thereby make faster responses on the stereotype-inconsistent trials of the IAT. Such an explanation is untenable, however, in Experiments 4 and 5, which provided evidence for moderation with measures that are independent of criterion shifts: d' in Experiment 4 and FA rate in the absence of changes in other response rates in Experiment 5.

Another potential explanation for the present results is stereotype suppression. By instructing the participants to focus on CS images, we may have communicated the importance of avoiding stereotypes and increased their motivation to do so. Although the motivation of the participants to engage in CS mental imagery may be important, we find it highly unlikely that their motivation to avoid stereotypes, in and of itself, can account for the results obtained. First, it is not clear why the motivation to avoid stereotypes would have resulted in faster RT on the stereotype-inconsistent trials instead of slower and more cautious RT on the stereotype-consistent trials of the IAT, which would arguably be the easier method of avoiding stereotypes. In addition, directly instructing participants to avoid stereotypes in Experiment 4 was shown to be ineffective in reducing them from control levels. Finally, implicit stereotypes were moderated by the CS mental imagery in Experiment 5 even though the imagery was separated from the stereotype assessment and the participants did not think it was relevant for the task.

The present results, in combination with prior research, suggest that both implicit and explicit stereotypes are responsive to current inputs, including the perceiver's thoughts and social context. As such, the congruence between the constructs may depend, to some extent, on whether the measures elicit similar thoughts or invoke the same social contexts. If a perceiver imagines a specific CS exemplar while completing an explicit measure, but a nameless abstraction while completing an implicit measure of stereotypes, we would predict less correspondence than if the imagery were the same (cf. Lord & Lepper, 1999; Tourangeau & Rasinski, 1988).

Practical Implications

By focusing on counterstereotypes, we present an alternative to current approaches to reduce stereotyping. People are used to being told that they should "be color-blind" and that they "shouldn't use stereotypes." However, without a great deal of motivation and practice, the obvious strategies of suppression and avoidance are difficult to achieve and, furthermore, can have unintended effects (Macrae et al., 1994; Monteith, Sherman, & Devine, 1998). Instead of trying to reduce or inhibit stereotypic associations, the present research suggests that people may be able to achieve the same goal through the activation and strengthening of CS associations. Although the current data cannot address the long-term consequences of CS mental imagery, it is likely that the effects are cumulative (see Kawakami, Dovidio, Moll, Hermsen, & Russin, 2000). That is, connectionist models have shown that current inputs have incremental effects on the connection weights that determine the long-term form of the representation (see Smith, 1998). A single CS episode would have only a minute effect on those weights, and we would not expect to see long-term changes in the stereotype. But many such episodes ought to effect more stable and long-lasting changes. Thus, a more positive and proactive approach to changing stereotypes would be to encourage people to consider the diversity within social groups and especially the many examples of group members who disconfirm the stereotype. Other research has shown that such an approach can alter judgments of an out-group and its members (Bodenhausen et al., 1995). The present research extends that work by showing that consideration of counterstereotypes may also influence implicit responses. One practical implication of a "focus on counterstereotypes" approach for society is the importance of making CS group members salient (cf. Dasgupta & Greenwald, 2001).

Finally, the present research extends work on mental imagery. Mental imagery has been shown to influence judgment, emotion, and behavior in a variety of domains, ranging from political judgments to athletic and intellectual performance. Our results provide support for the power of mental imagery in yet another domain: the moderation of implicit stereotypes. We believe that mental imagery is a potentially valuable strategy because it is a common and easily implemented process. People use mental imagery to reexamine the past, to make judgments about the present, and to prepare for the future (Kosslyn et al., 1990; Taylor et al., 1998). Our participants had little difficulty engaging in the CS mental imagery, and they appeared to enjoy the experience. Thus, mental imagery is a strategy for moderating implicit stereotypes that has high external validity. In conclusion, the present findings suggest that mental imagery is a promising strategy to counteract the influence of implicit stereotypes on judgment and behavior.

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Appendix A

Stimuli Used to Represent the Four Categories in the Implicit Association Test and Go/No-Go Association Task

Male	Female	Strong	Weak
Aaron	Amy	bold	dainty
Bill	Betsy	durable	delicate
Clarence	Charlene	iron	feather
David	Diane	mighty	fine
George	Gloria	powerful	flower
Jason	Janet	robust	fragile
Kevin	Karen	solid	slight
Matthew	Martha	stamina	small
Richard	Rachel	stout	tender
Tony	Tanya	vigorous	wispy
Andrew*	Angela*	forceful*	fluffy*
Brian*	Brenda*	intense*	gentle*
Gary*	Gina*	potent*	little*
Paul*	Peggy*	steel*	mild*
Scott*	Sarah*	tough*	soft*

* Stimuli used only in the Go/No-Go Association Task, Experiment 4.

Appendix B

Samples of the Participants' Descriptions of Their Mental Imagery

Experiment 1: Strong Woman

I see a woman who is first and foremost physically strong. She is very muscular and fit. She walks and composes herself with confidence. She is very outgoing which makes her a good leader. I can see her as a powerful business woman who is in charge of many others. She is not the type who needs a boyfriend or anyone for that matter to depend on. She is very self reliant.

A strong woman would be very toned and strong. She would most likely be wearing athletic clothes. Her shoulders would be broad and her legs would be explosively strong. She would probably walk more like a man than like a woman. She would have hair like a girl.

A strong woman is someone with many laugh lines on her face. You can see her motivation and passion in her eyes. She's a mother, a wife, and a career-woman. She stands tall and proud. Her confidence shows in her posture. She's bright and witty and has a great sense of humor about her past. She takes advantage of every opportunity and does as much for herself as she does for others. She's practical, but also a dreamer and most of all gives 110% of herself in everything she does.

Experiment 2: Weak Woman

The 'typical' weak woman would be self-conscious, low self-esteem and very unsure of herself. She would keep her posture somewhat aloof and her head hung rather low. She would not regard herself highly and neither would anyone else. She would allow herself to be victimized.

A weak woman is frail and unhealthy in appearance. She is submissive in manner. A weak woman cannot do anything without the approval of others and usually her actions are caused by the need to make others happy with her. . . . She never drives or goes anywhere by herself, she must always have someone beside her. . . .

Experiment 3: Feminine Woman

This woman would have long flowing hair, be dressed beautifully and have pure skin and delicate hands. She would be graceful and kind, tender yet strong. In her free time she enjoys reading, gardening, taking walks and being courted. As I see her now, she is sitting in front of a mirror brushing her long hair and daydreaming.

Her hair is curled perfectly and up in a bun—the only strands out are ones that she wanted. She is dainty, and thin but people listen to her quiet voice. She has wise words to say. She doesn't talk much, but when she does you *want* to listen. Her clothes are always perfect and always clean. As she pours the tea, her hands are tender, fingernails perfect and she doesn't spill a drop.

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