

# Seeing is believing: Exposure to counterstereotypic women leaders and its effect on the malleability of automatic gender stereotyping<sup>☆</sup>

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## Abstract

Two studies tested the conditions under which social environments can undermine automatic gender stereotypic beliefs expressed by women. Study 1, a laboratory experiment, manipulated exposure to biographical information about famous female leaders. Study 2, a year-long field study, took advantage of pre-existing differences in the proportion of women occupying leadership positions (e.g., female professors) in two naturally occurring environments—a women's college and a coeducational college. Together, these studies investigated: (a) whether exposure to women in leadership positions can temporarily undermine women's automatic gender stereotypic beliefs, and (b) whether this effect is mediated by the frequency with which female leaders are encountered. Results revealed first that when women were in social contexts that exposed them to female leaders, they were less likely to express automatic stereotypic beliefs about their ingroup (Studies 1 and 2). Second, Study 2 showed that the long-term effect of social environments (women's college vs. coed college) on automatic gender stereotyping was mediated by the frequency of exposure to women leaders (i.e., female faculty). Third, some academic environments (e.g., classes in male-dominated disciplines like science and math) produced an increase in automatic stereotypic beliefs among students at the coed college but not at the women's college—importantly, this effect was mediated by the sex of the course instructors. Together, these findings underscore the power of local environments in shaping women's nonconscious beliefs about their ingroup.

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## Introduction

"[Attitudes] are often as rigid as habits. . . They are so saving of time and mental effort that they often persist throughout life in a way in which they were fixed in childhood or in youth. An attitude is retained as long as it satisfies the individual, but it is likely to be modified under the provocation of serious affective disorganization. . . When in a crisis old attitudes are found to be worthless they no longer offer effective resistance to the new. Conversion, the shock of grief, economic disaster, and falling in love are typical occasions during which old attitudes are abandoned and new attitudes come into being."

"Attitudes are not merely constant dispositions to repeat precisely the same act in the same way when the same stimulus recurs in an old or new context. They are variable in the behavior they produce, and stable only in their significance. . . In modern psychology it has become difficult to picture an attitude as residing in specified neural grooves, capable of activation only in an invariable way through stimuli that are always the same. It is now recognized that stimuli are never twice the same, and that the neural process is one of dynamic interplay rather than of mechanical rigidity."

The quotes above provide two very different conceptions of the nature of attitude and belief. The first defines them as stable mental representations that develop early and change rarely and the second describes them as malleable and context-dependent. Interestingly, both were written by the same person, Gordon Allport, in his 1935 chapter in *A Handbook of Social Psychology*. Allport was not alone in theorizing that attitudes and beliefs can be both malleable and stable. He and other social scientists of his time attempted to reconcile these two, often opposing,

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theoretical views by making a distinction between “general attitudes” that evoke a generalized response tendency from “specific attitudes” that often take precedence and guide behavior at any given time or situation (Allport, 1935, p. 822; Bogardus, 1931, p. 54; Dewey, 1922, p. 42; Krueger & Reckless, 1931, p. 270). Questions about the stability versus malleability of attitudes and beliefs, evident in the early psychological literature but largely dormant for the next 50 years, have re-emerged in theories and empirical research in recent decades (Smith, 1998; Smith & Zarate, 1992; Wilson, Lindsey, & Schooler, 2000).

Are attitudes and beliefs stable, as suggested by several classic and contemporary theories, or are they considerably more malleable depending on individuals’ state of mind and their social context? In the last two decades numerous studies have demonstrated that self-reported attitudes and beliefs vary considerably as a function of changes in people’s internal states (e.g., thoughts, feelings, and motivations; Chaiken & Yates, 1985; Forgas, 1992; Petty, Schumann, Richman, & Strathman, 1993; Schwarz & Clore, 1983; Wilson & Hodges, 1992) and changes in their social environment (e.g., salience of social norms, who is present in the situation, who is asking the question; Feldman & Lynch, 1988; Gaertner & Dovidio, 1986; Hatchett & Schuman, 1975).

With the recent advent of theories of nonconscious processes, especially as they relate to judgments of historically disadvantaged social groups, similar questions have arisen about the relative malleability of automatic compared to controlled beliefs and attitudes (Banaji & Dasgupta, 1998; Bargh, 1999; Devine, 1989; Greenwald et al., 2002; Wilson et al., 2000). Specifically, if automatic attitudes and beliefs operate without perceivers’ awareness, control, or intention, does it mean that such cognitions are resistant to change in the short term (Bargh, 1999; Devine, 1989; Wilson et al., 2000), or are they more flexible than previously imagined? This question is important for both theoretical and practical purposes. In terms of theory, research addressing this issue has the potential to refine contemporary conceptions of automaticity and contemporary theories of stereotype and prejudice reduction by shedding light on whether and when internal and external cues (motivation, attention, and situational stimuli) can modulate automatic processes. In terms of practical importance, such research has the potential to lead to the development of interventions that may alleviate the subtle but frequent automatic biases in thought and behavior that have been widely documented in social psychology (for reviews see Banaji, 2001; Blair, 2001; Greenwald & Banaji, 1995; Fazio & Towles-Schwen, 1999).

### *The malleability of automatic stereotypes and prejudice*

In the past few years more than 40 studies have accumulated that collectively demonstrate the sensi-

tivity of automatic attitudes and beliefs, even those that typically operate without people’s control, to a wide range of motivational, strategic, and contextual influences (for a review see Blair, 2002). Some of these studies demonstrate that automatic responses are rendered malleable when people are spurred by specific motivations (e.g., Lowery, Hardin, & Sinclair, 2001; Sinclair & Kunda, 1999; Spencer, Fein, Wolfe, Fong, & Dunn, 1998) or when people invest the effort to practice specific strategies to avoid stereotypic or prejudicial responses (e.g., Blair, Ma, & Lenton, 2001; Gollwitzer & Schaal, 1998; Kawakami, Dovidio, Moll, Hermsen, & Russin, 2000). By comparison, other studies demonstrate that automatic beliefs and attitudes can also be modified by changing the social context that people inhabit rather than by directly manipulating their goals, motivation, or effort (e.g., Dasgupta & Greenwald, 2001; Macrae, Bodenhausen, & Milne, 1995; Wittenbrink, Judd, & Park, 2001). As a case in point, Dasgupta and Greenwald (2001) found that when perceivers were incidentally exposed to admired African Americans and disliked European Americans they expressed significantly less automatic race bias than others exposed to non-racial exemplars or to admired White and disliked Black exemplars. Importantly, the reduction in race bias endured for 24 hours beyond the manipulation. Moreover, this strategy was not confined to race but also applied to attitudes toward other groups targeted by prejudice, such as the elderly.

### *Goals of the present research*

Using Dasgupta and Greenwald’s paradigm, we sought to further elaborate the conditions under which exposure to admired and counterstereotypic individuals can reduce automatic biases, and identify the underlying mechanism by which it happens. Specifically, we focused on the following issues. First, because Dasgupta and Greenwald’s (2001) research concentrated only on the flexibility of automatic attitudes (i.e., prejudice), it remained unclear whether their contextual manipulation would produce similar effects on automatic beliefs (i.e., stereotypes) about groups.<sup>1</sup> This issue is important

<sup>1</sup> In this paper we make a distinction between *prejudice* and *stereotypes*, in keeping with other researchers’ work (Ashmore & Del Boca, 1981; Fiske & Pavelchak, 1986; Greenwald & Banaji, 1995; Hamilton & Trolier, 1986). Prejudice, defined as a negative evaluation of a group, is a variant of the broader attitude concept that refers to one’s favorable or unfavorable feelings toward any object (Eagly & Chaiken, 1993; Thurstone, 1931; Zajonc, 1980). A stereotype, defined as a culturally shared association linking most or all members of a group with a particular characteristic, is a variant of the broader belief concept. Whereas a prejudicial attitude implies a negative evaluation toward a target group, a stereotype may involve positive or negative beliefs.

because although attitudes and beliefs about the same target sometimes overlap considerably (e.g., negative attitudes about African Americans are related to negative racial stereotypes), at other times they clearly part company (e.g., attitudes about women are largely positive despite pernicious stereotypes about the social roles deemed “appropriate” for women; Eagly, Makhijani, & Klonsky, 1992; Eagly & Mladinic, 1989; Eagly, Mladinic, & Otto, 1991). Thus, the first goal of the present research was to examine whether exposure to counterstereotypic members of a particular social group—both over the short-term and over a longer period of time—can undermine people’s automatic stereotypic beliefs about that group. Whereas earlier studies concentrated on people’s perceptions of outgroups, in this research we focused specifically on their perceptions of ingroups (i.e., women).

Second, we propose that the influence of counterstereotypic situational cues on the malleability of automatic stereotyping may not be a categorical effect but rather a continuous one. In other words, the more frequently counterstereotypic exemplars occur in the social environment the greater may be the decrement in automatic stereotyping. Indeed, theories of construct accessibility and category representation propose the more frequently a construct or exemplar is activated, the more accessible it becomes and the more likely it is to influence subsequent judgments (Higgins & King, 1981; Nosofsky, 1988; Smith & DeCoster, 1998; Smith & Zarate, 1992; Srull & Wyer, 1980). Applying these theories to automatic beliefs about social groups, our second goal was to test whether the frequency of exposure to counterstereotypic individuals mediates the magnitude of automatic stereotype reduction.

Third, studies on the influence of admired exemplars on implicit social cognition have focused almost exclusively on laboratory tests of conditions that promote the malleability of automatic beliefs and attitudes (for an exception see Rudman, Ashmore, & Gary, 2001, who examined the influence of a particular college course on automatic racial attitudes). In the spirit of “full-cycle research” (Cialdini, 1980),<sup>2</sup> the third goal of the present research was to test the external validity of the predicted findings by examining whether exposure to counterstereotypic ingroup members in a naturally occurring social environment also affects people’s automatic beliefs about their in-

group. A prominent example of an environment that actively promotes counterstereotypic gender roles is a women’s college. Indeed, women’s colleges are based on the premise that given the pervasiveness of gender stereotypes in individual cognition and in social institutions, a radically different environment is needed—where women (atypically) occupy the majority of leadership roles—to ensure women’s development in non-traditional professions (Eccles, 1994; Eccles & Jacobs, 1986; Riordan, 1994; Solnick, 1995; Tidball, 1980, 1985; Tidball & Kistiakowsky, 1976). This idea fits well with Eagly’s social role theory that argues gender stereotypes are learned and maintained by people’s observations of the unequal distribution of women and men in various social roles (Eagly & Steffen, 1984), and that these beliefs change when people notice that women occupy more counterstereotypic roles (Diekmann & Eagly, 2000).

Tidball, Smith, Tidball, and Wolf-Wendel (1999) and Eccles (1994; Eccles & Jacobs, 1986) have shown a strong link between the frequency of counterstereotypic female role models on campus (e.g., faculty, administrators, and peers) and the cultivation of students’ commitment to counterstereotypic professions at women’s colleges. In 1993, 45.5% of the mathematics and science faculty at women’s colleges were female compared to 11.4% at coeducational colleges and 4.6% at technical institutes (Sebrechts, 1993). Using matched samples or after controlling for potential confounding variables (e.g., social class, SAT scores, and geographical region), studies have found that: (a) compared to female students at coeducational colleges, students at women’s colleges are more likely to change majors from female-dominated disciplines to neutral or male-dominated disciplines (Solnick, 1995); (b) women’s college graduates are more likely to attain high-end professional positions and incomes 3–10 years after graduation (Riordan, 1990, 1994); and (c) women’s college graduates are more likely to choose professions in which women are underrepresented such as medicine (Tidball, 1985), and other sciences (Tidball & Kistiakowsky, 1976) compared to female graduates of coeducational institutions. Although some studies reveal no differences between graduates of the two types of colleges (Giele, 1987; Stoecker & Pascarella, 1991), the number and variety of studies showing group differences lend credence to the hypothesis that greater exposure to counterstereotypic women at women’s colleges compared to equivalent coeducational colleges is likely to affect female students’ beliefs about gender. Thus, the third goal of the present research was to conduct a longitudinal study investigating whether female students’ automatic and controlled beliefs about their ingroup are influenced by the frequency with which they meet counterstereotypic female role

<sup>2</sup> Cialdini’s “full-cycle” model of research urges psychologists to use naturally occurring instances of social phenomena both at the beginning of a research program to generate ideas and at the end to test the validity of laboratory findings in the field.

models in their first year at a women's college versus a comparable coeducational college.<sup>3</sup>

### *Overview of the studies*

In summary, two studies were designed to extend previous theory and research by assessing whether exposure to famous women in counterstereotypic leadership positions can undermine women's automatic stereotypes about their ingroup. Study 1, conducted in the laboratory, investigated whether reading biographies of famous women who are scientists, judges, business leaders, etc. can temporarily undermine the automatic activation of the stereotype that women are better suited for supportive roles than leadership roles. Moreover, we explored participants' reactions to the female leaders, particularly their level of identification with them and the degree to which they thought the leaders' success could be attained by other ingroup members including themselves. Finally, we measured the effect of women leaders on participants' explicit beliefs about gender.

Exposure to female leaders, which was experimentally manipulated in Study 1, was replaced in Study 2 by two naturally occurring environments—a women's college and a coeducational college—that differ significantly in the proportion of women who occupy counterstereotypic leadership positions as faculty, college president, deans, etc. Our first goal in Study 2 was to determine whether the primary prediction tested in the laboratory would generalize to a field setting. The second goal was to identify specific features of the environment that may be responsible for these belief changes. We predicted that the effect of the campus environment on changes in automatic gender stereotyping ought to be mediated by the frequency of encounters with women in leadership roles (especially women faculty). Finally, we measured the effect of the college environment on participants' explicit beliefs about gender.

<sup>3</sup> A final (exploratory) goal was to assess whether the predicted effect on automatic ingroup stereotypes would extend to perceivers' automatic self-conceptions. This exploratory goal was based on evidence showing that people's self-conceptions are sometimes sensitive to particular social environments (Cantor & Kihlstrom, 1986; DeSteno & Salovey, 1997; Markus & Kunda, 1986; Markus & Nurius, 1986; Markus & Wurf, 1987; McGuire & McGuire, 1988; Rhodewalt, 1986; Schlenker, 1985). However, other research suggests that certain attributes that are chronically accessible and important to the self do not respond to temporary changes in social contexts (Markus & Wurf, 1987). In the present research we explored whether exposure to counterstereotypic women leaders would have an impact on participants' automatic self-conceptions—results showed that although this effect was in the predicted direction, it was not statistically significant. Given the exploratory nature of this goal and the null finding, these data and measures are not discussed further in this paper.

## **Study 1**

During the experimental session participants completed two ostensibly unrelated studies. Under the guise of the "first study," they were either exposed to pictures and biographical descriptions of famous women in leadership roles or to pictures and descriptions of flowers. Those who saw women leaders also completed a questionnaire assessing the degree to which they identified with those leaders and the degree to which they perceived the individuals' success as attainable for themselves and for other women. Participants in the control condition answered questions about the flowers they had seen. All participants then completed a "second study" that assessed their automatic and self-reported beliefs about women.

We hypothesized that participants who had seen pictures and biographies of famous women leaders would express less automatic gender stereotypes than those who had seen control stimuli. Moreover, we predicted that participants who perceived the exemplars' success as attainable for most other women including themselves would express weaker automatic gender stereotypes (cf. Bodenhausen, Schwarz, Bless, & Waelenke, 1995; Hantzi, 1995; Hewstone, Hasebrauck, Wirth, & Waelenke, 2000; Wilder, Simon, & Faith, 1996). Finally, we expected that exposure to famous women leaders would not have a significant impact on participants' self-reported beliefs about gender for two reasons. First, because communal attributes typically associated with women (e.g., nurturance and supportiveness) are very positive in valence, sometimes more so than agentic attributes typically associated with men (e.g., ambition and assertiveness), women are likely to be motivated to affirm their beliefs about the ingroup's communal qualities (cf. Eagly & Mladinic, 1989; Lips, 2000). In other words, they may consciously use positive gender stereotypic traits to describe their ingroup. Second, in the case of self-reports, participants have the time and mental resources to discount famous leaders as belonging to a nonrepresentative subtype prior to reporting their beliefs (Allport, 1954; Martin, 1986; Weber & Crocker, 1983; for a review see Richards & Hewstone, 2001). As such, subtyping may prevent stereotype moderation at an explicit level. However, participants who view the famous leaders' successes as attainable for most other women including themselves may be less likely to subtype and more likely to show decreased gender stereotyping even at an explicit level.

### *Method*

#### *Participants*

A community sample of 72 women from New York City participated in this study in exchange for \$10. Participants' age ranged from 17 to 62 (median

age = 26). Thirty-four participants were Caucasian, 12 were Black, 8 were Asian, 6 were Hispanic, 6 were multiracial, 1 was Native American, 1 was Gypsy, and 4 did not specify their race.

### Materials

*Selection of exemplars.* Pictures of 16 famous women in leadership positions were culled from the Internet. These were women who held various counterstereotypic and high profile leadership positions in science, business, law, politics, etc. (e.g., Meg Whitman, CEO of e-Bay, an Internet auction company; Ruth Bader Ginsburg, US Supreme Court Justice). We created paragraph-long descriptions of each individual's accomplishments using published biographies and online resources. Pictures of 16 flowers were collected for the control condition and paragraph-long descriptions were constructed about the origin and use of these flowers. All pictures were converted into gray scale format and a standardized size of  $104 \times 202$  pixels. See Appendix A for all exemplars.

*Automatic beliefs about women relative to men.* All participants completed an Implicit Association Test (IAT; Greenwald, McGhee, & Schwartz, 1998) to assess the extent to which they automatically associated women with leadership qualities relative to supportive qualities (abbreviated as the gender-IAT). The development of this gender-IAT was informed by social role theory (Eagly, 1987) and its contemporary cousin, the role congruity theory (Eagly & Karau, 2002) which argue that people hold strong culturally shared beliefs and expectations about what women and men are actually like (descriptive gender norms) as well as what women and men ought to be like (injunctive gender norms). A key proposition of social role theory is that the majority of gender role beliefs pertain to communal and agentic attributes (Eagly, 1987; also see Bakan, 1966; Broverman, Vogel, Broverman, Clarkson, & Rosenkrantz, 1972). Communal characteristics, ascribed more strongly to women, primarily refer to concern for others' welfare and include attributes such as affection, kindness, interpersonal sensitivity, nurturance, and supportiveness. In contrast, agentic characteristics, ascribed more strongly to men, primarily describe a self-assured and confident personal style and include attributes such as ambition, independence, dominance, self-confidence, and the aspiration to lead rather than follow. In the present research we measured a subset of agentic and communal characteristics that people attribute to men and women. In terms of agentic characteristics we focused on the aspiration to lead and qualities typically associated with leadership roles; in terms of communal characteristics, we focused on the desire to help and support and qualities typically associated with supportive roles.

In the IAT, the stimuli consisted of female and male first names (e.g., Emily and Josh) and words typically

used to describe leaders and supporters (e.g., assertive and sympathetic). See Appendix B for all IAT stimuli. The IAT measures the strength with which an attitude object (e.g., women) is associated with particular types of attributes (e.g., leadership or supportive qualities) using participants' response latency as a measure of belief strength. When highly associated targets and attributes share the same response key, participants tend to classify them quickly and easily whereas when weakly associated targets and attributes share the same response key, participants tend to classify them more slowly and with greater difficulty. Given that women are typically perceived to be better suited for supportive roles than leadership roles especially in high status professions, we predicted that participants would respond faster when women's names and supportive attributes shared the same key while men's names and leadership attributes shared the other key (abbreviated as women + supporter and men + leader, respectively). By contrast, we expected substantially slower performance for opposite combinations of stimuli (women + leader and men + supporter). Automatic gender stereotyping (abbreviated as the IAT effect) was measured as the difference in mean response latencies for the women + leader/men + supporter block compared to the women + supporter/men + leader block. Each of the two critical blocks was composed of 50 trials. The order in which these two blocks were administered was counterbalanced between-subjects.

*Self-reported beliefs about women.* Self-reported beliefs about women were measured by presenting participants with the leader and supporter traits used in the IAT and asking them to rate the extent to which these traits describe women in general. All ratings were done on 7-point scales anchored by 1 ("Does not describe women at all") to 7 ("Describes women very well").

*Demographic measure.* A brief questionnaire was used to document participants' fluency in English, age, nationality or citizenship, race/ethnicity, comfort with computers, and vision.

### Procedure

People came to participate in what they thought were two unrelated studies. The "first study" was introduced as a study on people's general knowledge and memory. Participants either saw pictures and descriptions of famous women leaders or flowers. After reading about the exemplars in the first block of trials, a second block was administered in which participants saw the pictures again, twice each, with an abbreviated correct and incorrect description of each individual (or flower) placed side by side below each picture. Their task was to identify the correct description by pressing one of two response keys. Incorrect identifications were followed by error feedback (i.e., the word "error"). The side on which the correct descriptions appeared was varied

across trials. This memory test was administered to ensure that participants had paid attention to the biographical information as well as to strengthen the “general knowledge” cover story.

After viewing all of the exemplars, participants in the experimental group were asked to rate: (a) how successful and admirable these women were as a group (two items used as a manipulation check), (b) the number of women with whom they identified, (c) the extent of their identification, (d) the extent to which they thought most other women could attain comparable success, and (e) the extent to which they imagined attaining comparable success in their own professional futures (see Appendix C for all items). Participants in the control group were asked to indicate the flowers they liked most and why.

Participants were then told that the “first study” was complete and that they were ready to begin the “second study” on hand-eye coordination. At this time we administered an IAT measuring participants’ automatic beliefs about women and a paper-and-pencil questionnaire assessing their explicit beliefs about women. Participants were then debriefed and paid.

## Results

### Manipulation check

The manipulation check revealed that participants assigned to the counterstereotypic exemplar condition viewed the women leaders as very successful and admirable ( $M = 10.34$  on an 11-point scale,  $SD = 1.45$ ).

### Automatic beliefs about women relative to men

The two data collection blocks of the gender-IAT were retained and practice blocks were discarded. Additionally, the first two trials from each data collection block were deleted because response latencies were typically longer. To correct for anticipatory responses and momentary inattention, latencies less than 300 ms and greater than 3000 ms were recoded as 300 and 3000 ms, respectively. These latencies were then log transformed to normalize the distribution (see Dasgupta, McGhee, Greenwald, & Banaji, 2000; and Greenwald et al., 1998, for similar procedures).

We conducted an Exemplar type (women leaders vs. flowers)  $\times$  IAT block (women + supporter vs. women + leader) Analysis of Variance (ANOVA). The ANOVA revealed a significant 2-way interaction between Exemplar type and IAT block ( $F(1, 70) = 5.54$ ,  $p = .02$ ); all other effects were non-significant ( $F < 1$ ). Follow-up  $t$  tests were conducted to examine the interaction effect. Results showed that participants who had previously seen famous female leaders were significantly faster at associating women with leadership attributes (Mean RT = 772 ms) compared to those who had previously seen control exemplars (Mean RT = 860 ms;  $t(70) = 2.04$ ,  $p = .045$ ). The speed with which partici-

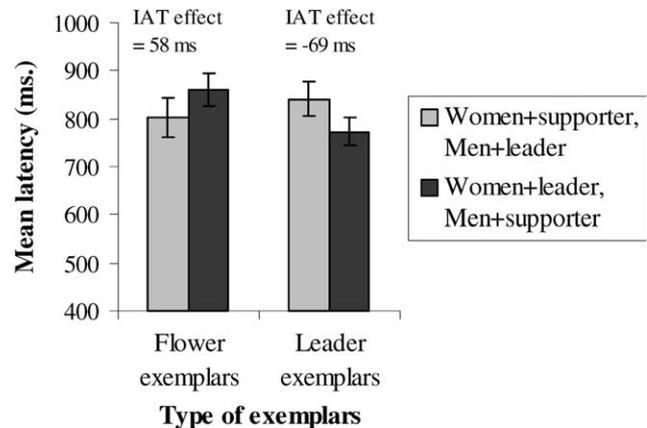


Fig. 1. The influence of famous women leaders on automatic beliefs about gender.

pants associated women with supportive attributes did not differ significantly across exemplar conditions (Mean RTs = 841 and 802 ms in the experimental and control conditions, respectively;  $t(70) < 1$ ; see Fig. 1).<sup>4</sup>

Further  $t$  tests examining participants’ responses within each of the two exemplar conditions revealed that those who had seen famous women leaders were significantly faster at associating women with leadership attributes than supportive attributes during the IAT ( $t(40) = -1.99$ ,  $p = .05$ ; IAT effect =  $-69$  ms;  $d_{\text{IAT}}$  effect =  $-.30$ ), whereas those who had seen control exemplars were relatively faster at associating women with supportive attributes than leadership attributes, although this effect was not statistically significant ( $t(30) = 1.39$ ,  $p = .17$ ; IAT effect =  $58$  ms.;  $d_{\text{IAT}}$  effect =  $.25$ ).

### Identification, attainability and their relation to automatic beliefs about women

We conducted a series of correlations to examine whether participants’ automatic beliefs about women as measured by the gender-IAT were correlated with their perception that the female leaders’ success could be attained by other women and the self, as well as their degree of identification with one or more women leaders. This analysis was conducted using participants in the experimental condition only. Results showed that the more people believed that the famous leaders’ success could be attained by most other women, the less automatic gender stereotypes they expressed ( $r = -.47$ ,  $p = .003$ ). Similarly, the more they believed that they could attain comparable success in their own lives the less automatic gender stereotypes they expressed ( $r = -.44$ ,  $p = .006$ ). However, participants’ identification with female leaders and the number of such leaders

<sup>4</sup> To make it easier to interpret the figures, we used raw response latencies as the dependent variable in all graphs. However, the actual analyses were conducted using log transformations of these response latencies.

they endorsed were not related to their automatic beliefs about women ( $r = -.14$ ,  $p = .39$ , and  $r = -.12$ ,  $p = .48$ , respectively).

#### *Self-reported beliefs about women*

Recall that participants had self-reported the extent to which they thought women possessed various leadership and supportive traits. Ratings for the six leadership traits were averaged together into one index ( $\alpha = .90$ ) and ratings for the six supportive items were averaged together into another index ( $\alpha = .95$ ). A difference score was then created (supportive ratings minus leadership ratings) to capture the extent to which participants endorsed the stereotypic belief that women possessed more supportive qualities than leadership qualities ( $M_{\text{diff}} = .67$ ,  $d_{\text{diff}} = .65$ ,  $M_{\text{supporter}} = 5.66$ ,  $M_{\text{leader}} = 4.99$ ). A  $t$  test comparing this mean difference score to zero confirmed that participants' explicit beliefs about women were significantly stereotypic ( $t(68) = 5.08$ ,  $p < .0004$ ). A follow-up  $t$  test was conducted to examine whether participants' explicit beliefs were influenced by exposure to famous female leaders. As expected, results revealed no effect of leader exposure on explicit beliefs ( $t(68) = 1.11$ ,  $p = .27$ ).

#### *Identification, attainability, and their relation to self-reported beliefs about women*

A series of correlations were conducted to examine whether participants' explicit beliefs about women were correlated with their perceptions of attainability and identification with the famous women leaders. To make the explicit belief measure analogous to the IAT measure, difference scores were used for these correlations (explicit ratings of women's supportive minus leadership qualities). Results showed that participants' explicit beliefs about women were not associated with the degree to which they thought the famous leaders' success could be attained by other women or themselves ( $r = -.12$ ,  $p = .50$ ;  $r = .02$ ,  $p = .89$ , respectively). Similarly, their explicit beliefs about women were not correlated with their level of identification with female leaders or the number of such leaders they endorsed ( $r = .13$ ,  $p = .43$ , and  $r = -.15$ ,  $p = .36$ , respectively).

#### *Correlations between automatic and self-reported beliefs*

We found nonsignificant correlations between participants' automatic and self-reported beliefs about women's supportive and leadership attributes ( $r$ s ranged between  $-.04$  and  $.06$ ,  $p$ s  $> .50$ ). These low correlations are consistent with other reports in the stereotyping literature (Banaji & Hardin, 1996; Rudman & Glick, 2001; Rudman & Kilianski, 2000). Participants' self-reports were correlated, such that those who thought that women possessed leadership traits also thought that they possessed supportive traits ( $r = .43$ ,  $p = .0002$ ).

#### *Discussion*

Study 1 provides support for our hypothesis that seeing women in high profile and counterstereotypic leadership positions as judges, business leaders, scientists, politicians, and so on, has a robust effect on women's nonconscious beliefs about their ingroup. We found that people who were exposed to pictures and biographies of famous women leaders were more likely to automatically associate women with leadership qualities than those who were exposed to control exemplars. Moreover, exposure to women leaders did not simply activate less stereotypic beliefs but rather activated more counterstereotypic beliefs.

This study extends Dasgupta and Greenwald's (2001) findings in several ways. First, these data show that exposure to admired members of disadvantaged groups not only affects people's automatic attitudes (prejudice) but also affects their automatic beliefs (stereotypes) about social groups. Second, by illustrating that increased exposure to admired individuals benefits people's beliefs about their ingroup, these data suggest that even when participants belong to a stereotyped target group, the counterstereotypic accomplishments of fellow ingroup members are not necessarily chronically accessible in their mind. Situations that familiarize them with ingroup members who have succeeded in atypical leadership domains can have a strong impact on their automatic beliefs.

Third, these data provide correlational evidence suggesting how counterstereotypic leaders might influence automatic gender-related beliefs. Specifically, we found that the more participants believed that other women including themselves could become as successful as the famous leaders the less likely they were to express automatic gender stereotypes. Given that this finding is correlational we cannot, of course, be sure whether perceiving the famous leaders' success as attainable produced a decrease in gender stereotyping or whether pre-existing counterstereotypic beliefs about women produced perceptions of attainability. However, it should be noted that the present correlation between the belief that female leaders' success can be achieved by most other women and decreased gender stereotyping is conceptually consistent with other experimental research on stereotype change documenting that when counterstereotypic individuals are presented as representative members of a particular group they are capable of changing perceivers' stereotypes about that group (Bodenhausen et al., 1995; Hantzi, 1995; Hewstone et al., 2000; Wilder et al., 1996). Despite the conceptual similarity between the present correlation and past research on stereotype change, clearly a direct test is needed to assess the causal link between perceived attainability and automatic stereotyping by manipulating whether or not counterstereotypic female leaders'

successes are portrayed as attainable and by examining whether such a manipulation produces a reduction in automatic gender stereotyping.

Finally, the present study did not find group differences in women's explicit beliefs about gender after exposure to female leaders compared to control stimuli. In fact, across both conditions women consistently reported the belief that their ingroup possessed more supportive qualities than leadership qualities. Moreover, individual differences in explicit beliefs were not correlated with participants' level of identification with women leaders or their perception that the leaders' success was attainable. A comparison between this finding and the earlier correlations for automatic beliefs suggest that the perceived fate of the self and other ingroup members may be more tightly linked to women's nonconscious beliefs about gender than to their consciously held beliefs. However, we offer this interpretation cautiously given that the non-significant correlations between explicit beliefs and attainability may be due to insufficient statistical power.

## Study 2

Thus far, our investigation of the impact of counterstereotypic individuals on women's automatic beliefs has been confined to the laboratory where variables can be manipulated and controlled with ease. Despite the many advantages of laboratory research, we believe it is also important to investigate this phenomenon in a naturally occurring setting in order to test whether encountering counterstereotypic female leaders in everyday life affects women's automatic beliefs about gender. Thus, the primary goal of Study 2 was to compare women's automatic beliefs across two field settings that vary substantially in the frequency of female leaders—a women's college and a coeducational college. To the extent that women's colleges have more women in counterstereotypic leadership positions (as tenured faculty, science and math faculty, college presidents, and deans) than equivalent coeducational colleges, such campuses present a unique natural environment in which to study how women's beliefs about gender may be affected. To that end, we tracked one group of female students who had chosen to attend a women's college and another group who had chosen to attend a comparable coeducational college. To rule out the possibility that group differences, if obtained, are due to self-selection and pre-existing differences among participants, we included a within-subjects factor to assess each participant's beliefs at two time periods—during their first couple of months in college (first-year) and again during their sophomore year. We predicted that when they entered college in their first year, women at both institutions would express similar automatic stereotypes

about gender; however, by virtue of inhabiting different social environments, their beliefs would diverge a year later, such that in their sophomore year women at the single-sex college would express substantially less automatic gender stereotypes than their peers at the coeducational college.

Second, we also attempted to identify specific features of the college environment that might influence changes in automatic gender stereotypic beliefs such as: (a) the number of female faculty participants interacted with, (b) their role models on campus, (c) the types of courses they took, (d) the amount of support they received from faculty and staff, (e) the extent to which they thought college was preparing them for future leadership roles, and (f) their extracurricular activities. We predicted that changes in automatic gender stereotyping across time ought to be mediated by the frequency with which participants were exposed to counterstereotypic women (e.g., female professors).

Third, if exposure to female course instructors plays an important role in changing automatic gender stereotypes, this variable should be particularly likely to affect the beliefs of single-sex versus coed college students enrolled in a large number of courses in male-dominated disciplines such as science, mathematics, etc., because such courses are more likely to be taught by male professors at coed colleges, but equally likely to be taught by professors of both sexes at women's colleges (Sebrechts, 1993; Tidball et al., 1999). In other words, a heavy course load in math and science may serve to strengthen gender stereotypes in female students at the coed college but not at the women's college. More importantly, the interaction effect of college type  $\times$  course type on automatic gender stereotypes is likely to be mediated by the sex of the course instructors.

Finally, we measured women's explicit beliefs about gender across time. We did not have a strong prediction about whether or not explicit beliefs would change across the first year in college. On the one hand, one might argue that a year ought to be sufficient time for conscious belief change to occur. On the other hand, given that communal traits are often perceived to be more positive than agentic traits (cf. Eagly & Karau, 2002; Lips, 2000), participants may be motivated to maintain their current beliefs by claiming more communal traits for their ingroup. Conscious belief change may require more than simple exposure to counterstereotypes; it may require changing the subjective value attached to these trait dimensions.

## Method

### Participants

Eighty-two female students were recruited from two liberal arts colleges located in the same town in the east coast of the United States. One was a women's college

( $n = 41$ ) and the other was a coeducational college ( $n = 41$ ). Both colleges attracted students from similar demographic and high school backgrounds. Of the 82 students who were initially recruited, 52 participants (63%) remained in the study one year later ( $n = 25$  from the women's college,  $n = 27$  from the coeducational college). Of the participants who were lost to attrition, the majority could not be reached because their address had changed and three were known to have transferred to other colleges (1 from the coeducational college, 2 from the women's college).<sup>5</sup> Participants were paid \$7–10 for each experimental session.

### Materials

*Automatic beliefs about women relative to men.* All participants completed a gender-IAT; this was identical to the IAT used in Study 1.

*Self-reported beliefs about women.* Self-reported beliefs about women were measured with the same questionnaire used in Study 1.

*Campus experience questionnaire.* In order to assess the frequency with which participants were exposed to counterstereotypic women leaders and other types of counterstereotypic experiences on campus, we asked them a number of questions about their courses and extra-curricular activities in college. Specifically, participants were asked to list all their current courses, together with a brief description of the main topic of each course, the instructors' names, and their sex. This information was used to determine: (1) the percentage of participants' course instructors who were women; (2) the percentage of courses they were taking in which male students typically outnumber female students (e.g., math, science, business, economics, etc.); and (3) the percentage of courses with gender-related content (e.g., women's history, psychology of gender). (4) Participants also rated how supportive and available faculty and staff were and how close they felt to these individuals using 11-point scales ranging from "not at all" (1) to "very" (11). Then they listed the names of faculty or staff members who they viewed as their personal role models. This information was used to determine participants' (5) total number of role models on campus, and (6) female role models on campus. (7) Participants then indicated on an 11-point scale the extent to which they believed their college was preparing them for future leadership roles in life. (8) Finally, they listed all extracurricular activities, workshops, talks, and programs they had attended that were related to gender issues.

*Demographic measure.* The demographic measure described in Study 1 was used here as well.

### Procedure

Students were recruited from first-year classes and orientation programs at both colleges in the fall semester. They were told that the study was on people's attitudes and beliefs. During the experimental session they completed the gender-IAT, followed by the explicit belief questionnaire, the campus experience questionnaire, and finally the demographic measure. All participants agreed to return for Session 2 the following year. They provided the experimenter with their contact information, were paid, and excused with thanks.

Early in the following fall semester, we contacted participants again and reminded them about the study they had participated in the previous year and invited them to return for the second session. During this session, participants completed all the same measures again with one exception. For the campus experience questionnaire, they were asked to list all their courses for the current semester (i.e., first semester of their sophomore year) as well as for the previous semester (i.e., second semester of their first-year). Then they were fully debriefed, paid, and thanked for their time.

*Design.* The overall design of this study was a Type of college (single-sex vs. coeducational)  $\times$  Year in College (first year vs. sophomore year)  $\times$  IAT block (women + leader vs. women + supporter) mixed factorial. The first factor was varied between-subjects whereas the remaining were varied within-subjects. In addition, we counterbalanced the order of IAT blocks (women + leader first vs. women + supporter first).

### Results and discussion

#### *Automatic beliefs about women relative to men*

The IAT data were prepared, trimmed, and log transformed using the procedure described in Study 1. Gender-IAT scores were calculated by subtracting participants' mean reaction time (RT) for the women + supporter/men + leader block from the mean RT for the women + leader/men + supporter block. Thus, larger IAT scores indicate more stereotypic beliefs and negative IAT scores indicate more counterstereotypic beliefs. In order to examine whether the type of college attended influenced participants' automatic beliefs about women, we conducted a Type of college  $\times$  Year in college ANCOVA using participants' gender-IAT scores as the dependent variable. Participants' age and citizenship were used as covariates in this analysis because the demographic data showed that although participants at both colleges were of the same median age (18 years old), there was greater variability in age at the women's college (age range = 16–26) than the coeducational college (age range = 17–21). Moreover, although the majority of participants at both institutions were American citizens, the women's college sample included some international students whereas the coeducational college did not include any. In order to

<sup>5</sup> The students who remained in the study were no different from the ones who dropped out in terms of their automatic beliefs about gender ( $F_s = ns$ ). Moreover, college affiliation did not interact significantly with the attrition variable ( $F < 1$ ).

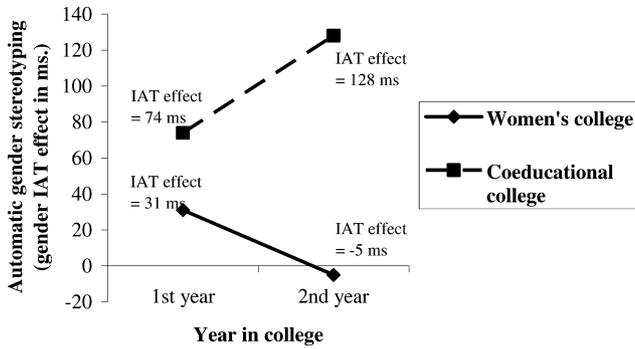


Fig. 2. The influence of college environment and time spent in college on automatic beliefs about gender.

control for these two demographic variables, age and citizenship were used as covariates in all analyses. The ANCOVA revealed a marginally significant interaction between Type of college  $\times$  Year in college ( $F(1, 48) = 3.52, p = .07$ ; see Fig. 2). Further analyses were conducted to locate the source of this interaction effect. Results showed that during their first semester in college, participants at both the women's college and the coeducational college expressed similar automatic beliefs about women (IAT effect<sub>same-sex</sub> = 31 ms,  $d_{IAT\ effect} = .22$ ; IAT effect<sub>coed</sub> = 74 ms,  $d_{IAT\ effect} = .40$ ;  $F < 1$ ). However, one year later, those who were now sophomores at the women's college expressed no gender stereotypes at all whereas those who were sophomores at the coeducational college expressed strong gender stereotypes (IAT effect<sub>same-sex</sub> = -5 ms,  $d_{IAT\ effect} = .02$ ; IAT effect<sub>coed</sub> = 128 ms,  $d_{IAT\ effect} = .77$ ;  $F(1, 48) = 10.87, p = .002$ ). This finding shows that participants' beliefs about gender had been similar when they entered college, but had diverged substantially in different directions one year later, suggesting that the campus environment may have played a significant role in shaping participants' nonconscious beliefs.

Two other ANCOVAs examined changes in participants' automatic beliefs across time for each college separately. Results showed that the change in automatic gender stereotypes across time was not statistically reliable when each college was considered separately (women's college:  $F(1, 24) = 1.29, p = .26$ ; coeducational college:  $F(1, 26) = 1.26, p = .20$ ). Given that these latter two analyses used considerably smaller samples ( $n = 25$  and  $27$ , respectively), it is possible that the main effect of time was constrained by low statistical power.

*The impact of campus atmosphere on automatic beliefs about women*

Next, we conducted a series of linear regressions to identify features of the campus atmosphere that best predicted changes in automatic beliefs about women. First we tested whether the effect of college on automatic beliefs about women was mediated by the frequency with which students were exposed to female faculty (i.e.,

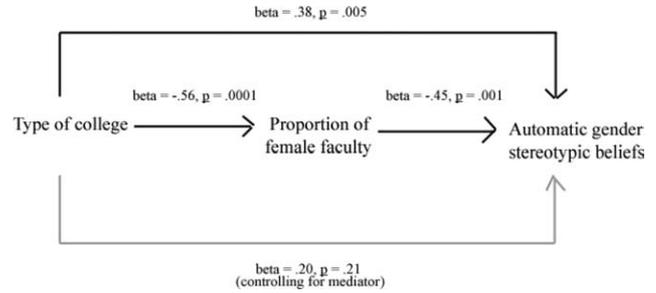


Fig. 3. Frequency of exposure to female faculty mediates the relation between the type of college attended and reduction in automatic gender stereotyping.

women in leadership roles).<sup>6</sup> In order to test for mediation, a series of four hierarchical regressions were conducted (see Fig. 3). In all the regressions that follow, participants' age, citizenship, and their gender-IAT scores in Year 1 were controlled in the first step of the regression equation. In the first regression, we examined the relationship between the type of college attended (predictor variable) and participants' gender-IAT score in Year 2 (outcome variable). As expected, the type of college significantly predicted automatic gender-related beliefs expressed in Year 2 of college ( $F(4, 46) = 3.57, p = .01$ ), such that students at the women's college expressed significantly less automatic gender stereotypes in their sophomore year than their peers at the coeducational college ( $F_{change}(1, 46) = 8.57, p = .005$ ;  $\beta = .38, t = 2.93, p = .005$ ). In the second hierarchical regression we examined the relationship between the percentage of female faculty participants encountered as course instructors (mediator variable) and participants' gender-IAT score in Year 2 (outcome variable). Results showed that exposure to female faculty significantly predicted automatic gender beliefs in Year 2 of college ( $F(4, 46) = 4.38, p = .004$ ), such that the more female professors participants encountered in the classroom the less automatic gender stereotypes they expressed ( $F_{change}(1, 46) = 11.51, p = .001$ ;  $\beta = -.45, t = -3.39, p = .001$ ). In the third regression, we examined the relationship between the type of college attended (predictor variable) and the percentage of female faculty encountered (mediator variable). Not surprisingly, the women's college had significantly more female faculty than the coeducational college ( $F(4, 46) = 7.89, p < .0004$ ;  $F_{change}(1, 46) = 24.08; p = 10^{-4}; \beta = -.56, t = -4.91, p = 10^{-4}$ ). Finally, in the fourth regression, we examined the effect of college (predictor variable) on participants' gender-IAT score in Year 2 (outcome variable) after controlling for exposure to female faculty

<sup>6</sup> The female faculty predictor variable was calculated by taking the total number of female faculty whose courses participants had taken over their three semesters in college and dividing it by the total number of courses taken. Thus, this variable represented the proportion of course instructors participants had who were women.

(mediator). Now, the effect of college on automatic gender-related beliefs was nonsignificant ( $F_{\text{change}}(1, 45) = 1.60, p = .21; \beta = .20, t = 1.26, p = .21$ ). The Sobel test confirmed that frequent exposure to female faculty mediated the relationship between the type of college attended and changes in automatic gender-related beliefs ( $z = 2.79, p = .005$ ).

Besides exposure to female faculty, one other variable—the proportion of science and math courses taken—had a significant effect on participants’ automatic beliefs about women. Specifically, we first examined whether taking math/science courses had a differential impact on female students’ automatic gender stereotypes as a function of the type of college they attended. A regression was conducted to test whether the proportion of such courses, the type of college, and the interaction between science/math courses  $\times$  college (predictor variables) influenced participants’ gender-IAT score measured in Year 2 (outcome variable) after controlling the effect of age, citizenship, and Year 1 gender-IAT score (see Fig. 4). We found a significant effect of the type of college ( $F(5, 46) = 2.77, p = .03$ ), such that participants at the women’s college expressed less gender stereotypic beliefs in their sophomore year than those at the coeducational college ( $\beta = .39, t(51) = 3.01, p = .004$ ). More importantly, there was a significant interaction between

the type of college and the proportion of math and science courses participants had taken ( $F_{\text{change}}(1, 45) = 3.99, p = .05$ ), such that at the coeducational college, the more math/science classes women took, the more automatic gender stereotypes they expressed, whereas at the women’s college, taking math/science classes did not predict changes in women’s automatic beliefs about gender ( $\beta = .81, t = 2.00, p = .05$ ).

Next, we tested whether the significant interaction effect of college type  $\times$  math/science courses on automatic gender-related beliefs was mediated by the sex of the course instructors (see Fig. 5). To that end, we conducted two follow-up regressions to test for mediation. First, we tested whether type of college, math/science courses taken, and college  $\times$  math/science courses (predictor variables) influenced the proportion of female professors participants encountered in the classroom (mediator variable), after controlling for participants’ age, citizenship, and gender-IAT scores from Year 1. We found a significant effect of college type and proportion of math/science courses on the number of female faculty seen ( $F(5, 46) = 9.71, p < .0004; F_{\text{change}}(2, 46) = 18.07, p < .0004$ ), such that students at the coed college encountered fewer female faculty than their peers at the women’s college ( $\beta = -.57, t = -5.44, p < .0004$ ), and students who took a higher proportion of math and science courses encountered fewer female faculty than those who took a lower number of such courses ( $\beta = -.31, t = -2.81, p = .007$ ). But more importantly, we also found a significant interaction between type of college and math/science courses ( $F_{\text{change}}(1, 45) = 6.08, p = .02$ ), which indicated that at the coed college, the more math/science courses women took the fewer female professors they encountered as instructors, whereas at the women’s college, taking more math/science courses did not predict exposure to female professors ( $\beta = -.78, t = -2.47, p = .02$ ). A second regression tested whether type of college, math/science courses, and college  $\times$  math/science courses influenced automatic gender stereotypes in Year 2 (outcome variable) once the proportion of female faculty (mediator) was controlled.

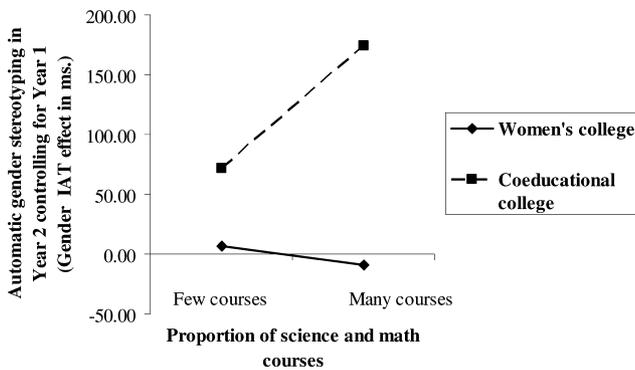


Fig. 4. The influence of science and math-related courses and college environment on automatic beliefs about gender.

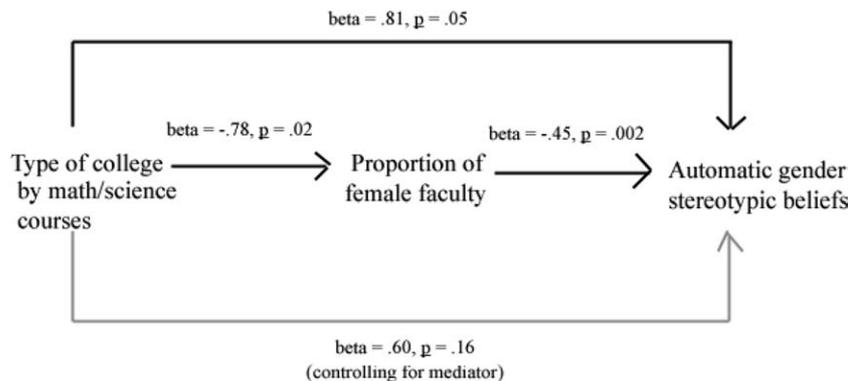


Fig. 5. Frequency of exposure to female faculty mediates the effect of type of college by proportion of math/science courses on automatic gender stereotyping.

We found that after controlling the effect of female faculty, the interaction between type of college  $\times$  math/science courses became non-significant ( $F_{\text{change}}(1, 44) = 2.00, p = .16; \beta = .60, t = 1.42, p = .16$ ). A Sobel test confirmed that the proportion of female faculty participants had seen in the classroom mediated the relation between the interaction variable (college  $\times$  math/science courses) and changes in automatic gender stereotypic beliefs ( $z = 1.99, p = .047$ ).

None of the remaining six campus atmosphere variables had significant effects on participants' automatic beliefs about women (all  $ps > .28$ ).

#### *Self-reported beliefs about women*

Participants' ratings of women were averaged together into one index for the six leadership traits ( $\alpha = .93$ ) and another index for the 6 supportive traits ( $\alpha = .81$ ). A difference score was then created (supportive ratings minus leadership ratings) to capture the extent to which participants endorsed the stereotypic belief that women possessed more supportive qualities than leadership qualities. A Type of college  $\times$  Year in college ANCOVA was conducted using the difference scores as the dependent variable and participants' age and citizenship as covariates, to test whether participants' explicit beliefs about women varied between the two colleges and whether they changed across time. Results revealed no significant main effects or interaction effects (all  $ps > .15$ ). A follow-up  $t$  test compared these mean difference scores to zero (collapsed across college type and year in college). Results confirmed that participants' explicit beliefs about women were significantly stereotypic regardless of the college they attended or their year in college ( $t(49) = 8.06, p < .0004; M_{\text{diff}} = .89, d_{\text{diff}} = 1.29, M_{\text{supporter}} = 6.30, M_{\text{leader}} = 5.41$ ).

#### *Campus atmosphere and its impact on self-reported beliefs about women*

We then conducted a series of linear regressions to explore if any aspect of the campus atmosphere predicted changes in explicit gender-related beliefs from the first-year to the sophomore year. Only faculty and staff support marginally predicted explicit beliefs about women ( $F_{\text{change}}(1, 43) = 3.27, p = .08$ ). Specifically, at the women's college the more support participants received from faculty and staff, the more they reported that women possess leadership qualities; however, at the coeducational college, the more support participants received from faculty and staff, the less they reported that women possess leadership qualities ( $\beta = -1.32, t(49) = -1.81, p = .08$ ). The pattern of data for the coeducational college is unexpected. Perhaps women at the coeducational institution who received support thought that they were being helped disproportionately more than male students and this perception strengthened their stereotype that women were dependent and in

need of help. Alternatively (or additionally), this effect may have been driven by the sex of the support-givers. If female students at the coeducational college were getting help and support from male faculty, they may have interpreted that help as an indication that women needed "extra help" to succeed. By comparison, women at the single-sex college who were surrounded by others of the same sex, may not have interpreted the support as extra help but rather as a legitimate aid to success. However, given that both explanations are post hoc and clearly speculative, we present them cautiously until they are tested directly in the future.

None of the other campus atmosphere variables were significantly related to participants' explicit beliefs about gender (all  $ps > .20$ ).

#### *Correlations between belief measures in year 1 and year 2*

Overall, participants' beliefs about gender during their first year were not significantly correlated with their beliefs in their sophomore year. This was true for both automatic and self-reported beliefs at the women's college ( $r_{\text{year 1-year 2 gender-IAT}} = .32, p = .11; r_{\text{year 1-year 2 gender ratings}} = .32, p = .14$ ) as well as the coeducational college ( $r_{\text{year 1-year 2 gender-IAT}} = .17, p = .40; r_{\text{year 1-year 2 gender ratings}} = .05, p = .80$ ). These data suggest that, at an individual level, women's gender-related beliefs changed substantially over the course of one year in college; this was true for both automatic and self-reported beliefs. However, when gender-related beliefs were collapsed across individual differences so that between-group comparisons could be drawn, only automatic beliefs showed a theoretically predicted divergence between the two colleges across time; self-reports did not.

#### *Correlations between automatic and self-reported beliefs*

We found small and nonsignificant correlations between participants' automatic and self-reported beliefs (average  $r = .15$ ). At both colleges correlations between gender-IAT scores and explicit ratings of women's supportive qualities relative to leadership qualities were nonsignificant or marginal (women's college: Year 1,  $r = .07, p = .74$ ; Year 2,  $r = .22, p = .31$ ; coeducational college: Year 1,  $r = .36, p = .07$ ; Year 2,  $r = -.05, p = .83$ ).

#### *Summary*

Overall, Study 2 showed that women students' automatic beliefs about their ingroup were clearly affected by the atmosphere on campus. Although participants' beliefs were similar when they entered college, they diverged substantially in different directions one year later, suggesting that the campus environment played a significant role in shaping their nonconscious beliefs. Moreover, our data showed that changes in participants' gender-related beliefs were mediated by one particular

feature of the campus environment—the frequency with which they encountered female faculty in the classroom. Finally, participants' self-reported beliefs about gender did not change substantially over the course of the year. We speculate that women may have been motivated to protect their conscious beliefs about their ingroup given that the attributes they applied most strongly to the ingroup (i.e., communal and supportive traits) tend to be viewed very positively; sometimes more positively than agentic attributes.

## General discussion

Both the laboratory study and the field study reported in this paper converge on the same message—women's automatic stereotypic beliefs about their ingroup can be undermined if they inhabit local environments in which women frequently occupy counterstereotypic leadership roles.

### *The effect of local environments on gender stereotyping*

Study 1 showed that when women were placed in an experimental situation where they were exposed to famous women who have made major contributions to science, law, politics, etc., they were more likely to express automatic counterstereotypic beliefs about women compared to others in a control situation. Moreover, seeing female leaders was especially effective when women interpreted the success of the famous individuals as attainable for other women and themselves.

Study 2 replicated and extended the same finding in two ways—first, by comparing participants in two naturalistic environments known to vary in the proportion of women in leadership roles (i.e., a women's college and a coeducational college). After one year in college, students at the women's college showed no automatic gender stereotypic beliefs whereas their peers at the coeducational college showed substantially stronger stereotypic beliefs. Second and importantly, Study 2 identified the mediating mechanism underlying changes in automatic beliefs about gender—namely, how often people were exposed to women in leadership roles (which, in the context of college, mostly comprised exposure to female faculty). Results revealed the more students at both institutions encountered course instructors who were women, the less gender stereotypes they expressed at an automatic level. Female students who encountered mostly male faculty—which was especially likely for math and science classes at the coeducational college—showed a sharp increase in automatic stereotypes about women. This finding is consistent with other research suggesting that the reason why women's colleges are particularly successful at cultivating women's interest in counterstereotypic disciplines and

professions is because of a critical mass of role models in those disciplines in the form of female faculty and other female students (Eccles, 1994; Eccles & Jacobs, 1986; Tidball et al., 1999).

The present studies also provide support for Eagly's social role theory that argues gender stereotypes are learned and maintained by people's observation that women and men occupy different types of social roles in society. That is, the reality that women are disproportionately located in care-taking roles that require communal behavior, and that men are disproportionately located in authoritative roles that require agentic behavior, helps feed gender stereotypes. These stereotypes change when people notice that women and men increasingly occupy atypical roles in society (Diekmann & Eagly, 2000; Eagly & Steffen, 1984). Whereas Diekmann and Eagly's research demonstrated that changes in women and men's occupations in society across several decades predicted stereotype change, our research suggests that equivalent changes within a local environment, over a shorter period of time, can also have a powerful impact on stereotype change.

Our data suggest that, at least initially, these belief changes may emerge more clearly in people's nonconscious beliefs than their conscious beliefs. We speculate that women's conscious beliefs about their ingroup may be slower to change in this particular case because communal attributes such as helpfulness and supportiveness are very positively valenced, more so than agentic attributes such as ambition and assertiveness (Eagly & Karau, 2002; Eagly et al., 1991; Eagly & Mladinic, 1989; Rudman & Glick, 2001). As such, women may be motivated to think of their ingroup as well-liked and nice, although by doing so they underplay leadership qualities that are critical for professional success in counterstereotypic and high status domains.

The divergent findings for automatic versus controlled gender stereotyping beg the question, what might be the consequence of automatic belief change in the absence of self-reported belief change? To attempt to answer this question, we borrow from Eagly and Karau's (2002) role congruity theory that argues gender stereotypes about women's leadership qualities stem from the incongruity between the perceived characteristics of women and the perceived characteristics of good leaders. Specifically, when people (both women and men) envision particular leadership positions or when they evaluate the current occupant of a leadership position, agentic traits and gender stereotypes become mentally accessible, making them perceive women as less suitable for the position than men because of the perceived "lack of fit" or incongruity between the leadership role and women's descriptive and prescriptive gender role (also see Heilman, 1983, 1995). We speculate that perceivers are unlikely to be aware that role incongruity is the reason why a woman seems less suitable

for a leadership position than a man, or the reason why a current leader seems to be more deficient in interpersonal skills if that individual is female rather than male. If perceived role incongruity drives leader evaluations and other related actions at a nonconscious level, then people's automatic beliefs about women's leadership abilities ought to predict their judgments of, and behavior toward, women seeking leadership positions. Support for this speculation comes from Rudman and Glick (2001) who found that automatic gender stereotypical beliefs (but not self-reported beliefs) predicted negative evaluations given to an agentic female job candidate in terms of her interpersonal or social skills. Moreover, such automatic beliefs also predicted positive evaluations given to an agentic male job candidate in terms of his hireability or suitability for a job.

Changes in automatic gender stereotypes of the sort demonstrated in the present studies ought to decrease the incongruity between leadership roles and gender roles thus increasing the accessibility of women when people think of who should occupy leadership positions. Specifically, changes in automatic gender stereotypes may: (a) provide women more access to agentic leadership positions because they are now seen as a "better fit," (b) make perceivers evaluate women who are already in those roles more positively because their leadership attributes are now given more weight, and (c) over time lead to conscious belief change.

In conclusion, the present studies underscore the power of local environments in shaping women's nonconscious beliefs about their ingroup. They show that the more women see counterstereotypic ingroup members in their immediate environment the more it undermines their automatic gender stereotypes even in the absence of specific motivation and effort on their part to change such beliefs. At the same time, the data also suggest that conscious reflection and subjective interpretation of the counterstereotypic individuals' success as attainable for one's ingroup and self may further contribute to nonconscious stereotype change.

#### Appendix A

Famous women in leadership positions (counterstereotypic condition)

Madeline Albright	Former Secretary of State of the United States.
Ruth Bader Ginsberg	US Supreme Court Justice.
Connie Chung	Famous broadcast journalist on national TV
Abby Cohen	Leading financial analyst on Wall Street.

Eileen Collins	First American woman to pilot a spacecraft.
Cynthia Cooper Mia Hamm	Three-time WNBA champion. American soccer athlete of the year and Olympic gold medalist.
Toni Morrison	Writer and recipient of the Nobel Prize for literature in 1993.
Antonia Novello	First woman to become Surgeon General of the United States.
Wilma Rudolph	First American woman to win three Olympic gold medals.
Diane Sawyer	Famous broadcast journalist on national TV
Gloria Steinem	One of the major American feminist leaders of the 20th century.
Meg Whitman	CEO of e-Bay, one of the first successful Internet auction sites.
Oprah Winfrey	Leading talk show host on national TV
Marian Wright Edelman	CEO of the Children's Defense Fund, a political advocacy group.
Chien Shiung Wu	World-renowned physicist

Flower exemplars (control condition)

Rose, carnation, sunflower, iris, daisy, poppy, tulip, lily, orchid, hibiscus, buttercup, geranium, hyacinth, morning glory, dandelion, violet.

#### Appendix B

IAT items	
<i>Leader words</i>	<i>Supporter words</i>
Leader	Supporter
Ambitious	Helpful
Determined	Understanding
Dynamic	Sympathetic
Assertive	Compassionate
<i>Male names</i>	<i>Female names</i>
Josh	Emily
Brandon	Donna
Peter	Debbie
Ian	Katherine
Andrew	Jane

#### Appendix C

*Manipulation checks for Study 1*

People have different definitions of what it means to be successful. Think about the pictures and descriptions

of women you just viewed. In your opinion, how successful do you consider these women as a group? (1 = “not at all successful,” 11 = “very successful”).

In your opinion, how much do you admire these women? (1 = “I don’t admire them at all,” 11 = “I admire them very much”).

#### Identification with the exemplars

Among the women whose pictures and descriptions you just viewed, which one(s) in particular do you identify with most? List all of them here. (If you don’t really identify with any of the women, please say so in the space below).

How much do you identify with the lives and accomplishments of the women you listed in the previous question? (1 = “I don’t identify with them at all,” 11 = “I identify with them very much”).

#### Perceived attainability of the exemplars’ success

Think about the women you personally identify with (i.e., the women you listed above). To what extent do you think that some day in the future, you might reach a similar level of success in your own field? (1 = “not at all likely,” 11 = “very likely”).

Do you think it is possible for most other women to be as successful as these women? (1 = “not at all possible,” 11 = “very possible”).

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