In January 2005, the then president of Harvard University, Lawrence Summers, suggested that the underrepresentation of women in science and engineering might be due, at least in part, to inherent sex differences in cognitive abilities central to math and science. Dr. Summers’s comments were viewed by many to reflect deep-seated stereotypes about men’s and women’s natural abilities. There has been much debate over different theories that might account for women’s underinvolvement in math- and science-related careers (e.g., Bandura, Barbaranelli, Caprara, & Pastorelli, 2001; Benbow & Stanley, 1980). The focus of this chapter is not to directly consider the evidence to support or refute these stereotypic beliefs, but to consider instead the social psychological effect of the mere suggestion that there are underlying sex differences in ability. In other words, we address how cultural stereotypes help to diminish women’s interest and performance in domains that have been traditionally dominated by men.

The belief that mathematics is a masculine domain dates back to Pythagoras, who in the 5th century BC founded a society in which abstract...
thought and matters of the mind were seen as inherently male. Femaleness, in contrast, was associated with bodily matters and mundane aspects of earthly existence (Wertheim, 1995). Although we no longer live in a world in which women are deliberately or explicitly barred from pursuing careers related to math and science, math is still viewed as a domain better suited to men (Meece, Parsons, Kaczala, Golf, & Futterman, 1982). This view extends to fields that involve intensive mathematical components including physical science, computer science, and engineering (Nosek, Banaji, & Greenwald, 2002).

Moreover, evidence suggests that gender differences in attitudes and beliefs about various domains appear to develop in early adolescence. For example, girls often have low confidence for success in mathematics (e.g., Eccles, 1987), are more likely to experience math anxiety (Hyde, Fennema, Ryan, Frost, & Hopp, 1990), and are less likely to choose math-related academic programs compared with their male classmates (National Science Foundation, 2007). In one study of equally math-gifted college students, twice the number of men as women chose majors that involved a moderate level of mathematics such as architecture, business, and economics, and men were over four times more likely than women to pursue majors with high math content such as computer science, engineering, and mathematics (LeFevre, Kulak, & Heymans, 1992). At the same time, women receive lower scores on important standardized tests (Hyde et al., 1990), such as the SAT or Graduate Record Examinations (GRE), which constrain opportunities for them to receive advanced placements in math-intensive academic programs. As a result, fewer women complete advanced education in math-related fields, which often involve higher paid prestigious jobs that contribute to the gender gap in wages.

In this chapter, we acknowledge the negative consequences that stereotypes can have on women’s professional aspirations and discuss two ways in which stereotypes affect women’s eventual career decisions. One is a chronic process of socialization through which the accumulation of gender-stereotype knowledge influences women’s interest in and perception of different activities. These pressures can shape at an early age what girls envision themselves doing. Unfortunately, even for those young women who have a supportive system of teachers, parents, and peers and are inclined to pursue male-dominated professions, they are likely to encounter repeated exposure to a second process by which stereotypes can have deleterious consequences on women’s professional aspirations. This second process, known as stereotype threat, refers to the uncomfortable experience of being in a situation in which one faces possible stereotyped judgment associated with one’s social group (Spencer, Steele, & Quinn, 1999). As we discuss, the desire to avoid anxiety and lower performance created in such situations can also lead many women to choose careers that do not involve the added burden of having to disprove a cultural stereotype.

With this framework in mind, we begin by reviewing the sociocultural literature on how women engage in different domains during their childhood
Female, in the socialization and exposure to stereotypic information. Following this review, we address how cultural stereotypes affect the performance and motivations of women after they enter into masculine fields. Finally, we address what can be done to help women overcome the negative effects of gender stereotypes. Overall, this chapter aims to convey the idea that long-term forces from the sociocultural context interact with situational factors to affect women's academic performance and career paths. Our hope is that this review will provide inspiration for educators and policymakers to reduce the gender divide in career choice by addressing the pernicious effects of gender stereotypes.

STEREOTYPES SHAPE DOMAIN INVOLVEMENT FROM EARLY CHILDHOOD

From an early age, children are bombarded with implicit and explicit messages about what behaviors and activities are considered appropriate for their gender. Any toy store contains clear cues that advertise which toys are appropriate for boys and which are appropriate for girls. This gender division in the toy store not only reflects patterns of different styles of play but also forms a basis for communicating to children who they can become as adults. A quite telling example can be found in a television commercial for a line of Barbie products featuring a jingle that proclaims, “Be who you want to be!” while images on the screen portray the famed doll as an entertainer, a fashion model, a ballerina, and a food server. The message here is not even subtle: You can be anything you want, but it would be best for it to fit into stereotyped prescriptions. Targeting a slightly older generation of young adults and adolescents, the clothing company Abercrombie and Fitch introduced a women’s T-shirt that read “Who needs brains when you have these?” The T-shirt was pulled from stores in November 2005, but again the implication was clear that intelligence might not be a woman’s most notable endowment.

Cultural evidence of the existence of gender stereotypes in contemporary American society is easy to come by, and the earlier examples make it clear that these beliefs and biases are actively marketed to children and adolescents. In light of this exposure, it would not be surprising to learn that boys and girls begin forming different beliefs about their competencies at an early age—beliefs that shape their choices and behaviors regarding different careers. In fact, we might consider two ways in which these stereotypes might shape self-perceptions. One is through socialization processes whereby adults and peers directly or indirectly communicate expectations of what an individual can do, and the other is through exposure to information that shapes at an implicit level a person’s very concept of self, gender, and domains of competence.

EFFECTS OF GENDER STEREOTYPES ON CAREER CHOICE
Socialization Discourages Women From Pursuing Male-Dominated Careers

Perhaps the most well-known model of gender socialization processes is Eccles's expectancy-value model (Eccles, 1987). This model proposes that children's expectations for doing well in a particular domain and the value they place on that domain predict their choices to pursue activities in that arena. Past research has shown that both aspects of the model, expectancy and value, play critical roles in what activities children choose to pursue. For example, many studies have shown that gender socialization leads girls to devalue mathematical and scientific fields more than it does boys (e.g., Crombie et al., 2005; Jacobs & Eccles, 1992; Meece, Wigfield, & Eccles, 1990). In a similar way, research has found that girls develop relatively low expectations for their own success in math in early elementary school and these beliefs reliably affect girls' subsequent math performance (e.g., Eccles, Wigfield, Harold, & Blumenfeld, 1993).

Eccles and others (Eccles et al., 1989; Meece et al., 1982) have posited that children's attitudes and beliefs about their competency toward a domain are shaped by parents and teachers. A substantial body of literature supports this assertion (e.g., Bandura, Barbaranelli, Caprara, & Pastorelli, 1996; Frome & Eccles, 1998). For example, during grade school and middle school, parents and teachers underestimate girls' math performance even in the absence of any actual gender difference in math grades; at the same time, they tend to make more favorable ratings of boys (Frome & Eccles, 1998; Jacobs & Eccles, 1992). It is not surprising that adults' beliefs are internalized by girls over time and can undermine their beliefs about their own abilities and their actual achievement (Jacobs & Eccles, 1992). In fact, these beliefs from significant others might have an even stronger effect on girls than would their actual grades in math and science classes (Frome & Eccles, 1998). As such, the perception that one's parents, teachers, or peers endorse gender stereotypes may bias girls' views about which areas they should invest their efforts in, which in turn influences their eventual career choices.

More recent evidence reveals that others' expectations can also influence self-evaluation on a moment-by-moment basis. Among other things, perceptions of how others see one's self can affect the way one sees one's self. For example, when individuals are subtly primed with negative evaluations (e.g., a frowning face), they rate themselves more negatively (e.g., Baldwin, Carrell, & Lopez, 1990). More specific to the topic of gender, women view themselves more stereotypically when they are primed with significant others who they think view them in a stereotypical way (Sinclair & Lun, 2006; see also chap. 5, this volume). This finding suggests that if women believe that important others in math-related domains (e.g., math teachers or mentors) perceive them in a stereotypical manner, these presumed expectations may
then predict the likelihood that women will make more negative assessments of their own math ability. Thus, even when girls are not directly confronting negative expectations from parents and teachers, their internalized beliefs of what these important others think of them can also undermine the self-perceptions of their ability. This process suggests that the effects of social stereotypes in shaping career choice are not realized just in social contexts but are also part of women’s concepts of themselves and their gender—an issue we next consider in more detail.

Unequal Distributions of Women in Certain Careers
Shape Patterns of Implicit Association

Because girls may internalize stereotypic beliefs through gender socialization, part of the solution to facilitate women’s involvement in male-dominant careers is to educate parents and teachers to communicate more positive expectations about girls’ abilities to achieve success in domains that are traditionally masculine. But even if the parents and teachers with whom a child interacts reject prevailing gender stereotypes, children are still exposed to gendered conceptions of different occupations through broader cultural associations and mere observations of who is likely to be employed in what kinds of professions. There is reason to believe that this exposure is sufficient to shape attitudes and beliefs about one’s abilities.

For example, Eagly’s social role theory (Eagly & Steffen, 1984) suggests that stereotypes about women’s and men’s different competencies are the result of the mere fact that men and women are distributed unevenly in different social roles. Thus, children learn what occupations are supposedly suited to their nature through casual observation of the gender distributions in different jobs. Such exposure can lead to the formation of an implicit association between the domain and a given gender group. For example, both men and women generally hold an implicit association between their concept of “math” and their concept of “male” (Nosek et al., 2002). These implicit associations are not lost on children and can shape conceptions of what women can and cannot do. In a study by Hyde (1984), third and fifth graders heard a description of a novel occupation as a wudgemaker that used gendered (he or she) or neutral pronouns (they or he or she) to describe what a wudgemaker does. In their later responses, children assumed that a woman would be good as a wudgemaker only when neutral or female pronouns were used. They assumed a woman would not do well as a wudgemaker, however, when a male pronoun was used. However, the same manipulation had no effect on presumptions of men’s abilities.

Furthermore, the cognitive associations that women have between math and male might also shape self-conceptions through subtle pressures to maintain cognitive consistency. Nosek et al. (2002) found that to the degree that women hold both a strong implicit masculine association with math and a strong
implicit association between self and female, they exhibit a weaker cognitive link between their concepts of self and math. This pattern was seen even for those women who were in math-intensive majors. In other words, at a very cognitive level, a woman’s sense of what it means to be female interferes with her personal association to a masculine domain. This finding might help to explain the basic process by which socialization efforts that increase the salience of young girls’ gender identity can diminish their aspirations in a masculine domain (e.g., Abrams, Thomas, & Hogg, 1990). It also sheds light on why women who pursue math-related studies might feel the need to reject characteristics that they see as highly feminine (Pronin, Steele, & Ross, 2004).

In addition to the pressures to maintain cognitive consistency that might force women to choose between associating their self with either their gender or a masculine domain, other motivational processes help to explain why the implicit associations between a given gender and a given domain might be resistant to change. Namely, motivational pressures to justify existing systems of social hierarchy help to ensure that individuals, even women, endorse these gender stereotypes as a means of maintaining the status quo (Jost & Kay, 2005). For example, Schmader, Johns, and Barquissau (2004) found that women who endorse the legitimacy of status differences between men and women were also more likely to endorse gender stereotypes about women’s math abilities. This stereotype endorsement in turn predicted more negative self-perceptions of math competence and less interest in continuing their education in math-related fields. Other research has shown that women who endorse gender stereotypes are more likely to compare their math performance only with that of other women, because men are less likely to be seen as appropriate sources of comparison (Blanton, Christie, & Dye, 2002). The possible consequence of this selective comparison is that gender disparities that are inherent in society might more readily go unnoticed and therefore uncorrected.

The research discussed thus far illustrates that in addition to gender biases that are communicated from close others, the mere distribution of men and women into certain social roles also helps to create and maintain a perception that certain occupations are better suited for men rather than women. On the positive side, such research suggests that simply seeing certain careers as something that women can do could play an important role in shaping children’s beliefs about the suitability of those careers for themselves. In fact, research has confirmed that exposure to successful female scientists can change the implicit associations that women have between women and science (Dasgupta & Asgari, 2004). Fortunately, as social roles become less differentiated by gender, the stereotypic beliefs about men’s and women’s abilities may also diminish (Diekman & Eagly, 2000).

In the preceding section, we considered the ways in which the existence of gender stereotypes can influence girls’ initial interest in pursuing math- and science-related activities. For those women who successfully run the gauntlet
of cultural associations of math with maleness and negative expectancies that might be communicated from close others, unfortunately such stereotypes will throw another obstacle in their path: stereotype threat. In the next section we discuss the ways in which stereotype threat can have a subtle but negative effect on women's experience in male-dominated domains.

**STEREOTYPE THREAT AND WOMEN'S PERFORMANCE IN MALE-DOMINATED FIELDS**

For women in male-dominated domains, their performance and career decisions are inevitably affected by their knowledge of gender stereotypes. In addition to being stereotyped by teachers and supervisors, many women also suffer from a concern that they and their gender group will be viewed in stereotypic ways. Even for women who do not believe that gender stereotypes are true, the simple awareness that they might be judged in terms of negative stereotypes can elicit a disruptive mental state that can degrade their performance in stereotype-relevant domains. This predicament, termed stereotype threat (C. M. Steele & Aronson, 1995), creates a situational pressure that not only impairs performance but can directly affect the career aspirations of women. In this section, we review the evidence that stereotype threat can affect women's performance in male-dominated domains (particularly those that involve math) and discuss some situational factors and individual differences that can exacerbate or buffer the threat (see also chap. 5, this volume). We then consider how stereotype threat shapes women's motivation and career choices in the long run.

**Stereotype Threat Impairs Women's Performance in Male-Dominated Domains**

Research has clearly demonstrated that stereotype threat can affect women's performance on male-dominated tasks. Most of this research has examined the role of stereotype threat in creating a gender gap in performance on standardized math tests. For example, in a series of studies, Spencer et al. (1999) found that women's performance on a math test could be influenced by how the task is described. When it was described as showing gender differences in the past (thus making gender stereotypes relevant), women underperformed relative to their male counterparts; however, their performance was equivalent to men's when the test was described to them as being gender fair. Thus women's math performance varied dramatically depending on the testing situation, a finding that calls into question the assumption that gender differences in test performance necessarily indicate gender differences in math ability. This basic finding has now been replicated in dozens of experiments and has been shown for individuals targeted by other negative stereotypes.
based on race, ethnicity, and socioeconomic status (see C. M. Steele, Spencer, & Aronson, 2002, for a review).

Research suggests that the deleterious consequences of stereotype threat are actualized through a complex interplay of physiological, emotional, and cognitive processes (see Schmader, Johns, & Forbes, 2008, for a review). These include activation of negative stereotypes (C. M. Steele & Aronson, 1995), the elicitation of diffuse physiological arousal (Blascovich, Spencer, Quinn, & Steele, 2001), and an increased tendency to monitor situations for threat-related cues (Kaiser, Vick, & Major, 2006). Assuming that the activation of negative stereotypes promotes a tendency to interpret any number of ambiguous cues as a sign of failure, this biased interpretation can lead to an increase of negative thoughts and feelings (Cadinu, Maass, Rosabianca, & Kiesner, 2005; Keller & Dauenheimer, 2003) followed by active attempts to manage one's impression and suppress feelings of anxiety (Inzlicht, Aronson, Good, & McKay, 2006; Johns, Inzlicht, & Schmader, 2008).

These ongoing processes are resource-demanding in that they require a certain amount of focused attention and controlled processing. This demand creates few problems when tasks are sufficiently easy and well below one's maximum threshold. In fact, women reminded of gender stereotypes outperform men on easy math problems (O'Brien & Crandall, 2003). However, the added burden of stereotype threat reduces one's ability to perform well at tasks requiring active manipulation of complex information, particularly those that require high amounts of working memory capacity, that is, the ability to hold multiple pieces of information in one's short-term memory while tending to different tasks (Schmader & Johns, 2003). Such cognitive impairments mediate the effect of stereotype threat on women's performance on a GRE math test (Schmader & Johns, 2003).

Because entry into many male-dominated fields requires successful performance on these types of cognitively challenging standardized tests, the effect of stereotype threat on women's test scores undoubtedly contributes to the perception that women are less qualified to compete in these disciplines. Thus, women's underperformance on important standardized tests can place them at a disadvantage in their pursuit of advanced education and high-paying occupations typically done by men. A lower test score can also influence women's own beliefs that they have the ability to succeed in a given domain, a pattern that could lead many well-qualified women to self-select out of male-dominated fields. In addition, the challenge of having to engage in the kind of complex manipulation of information required for test performance while also evaluating and managing the impression of one's self in the context is likely to be ego-depleting (Inzlicht, McKay, & Aronson, 2006), adding to the sense that performance in stereotype-relevant domains is fatiguing and aversive.

Another interesting aspect of the stereotype threat phenomenon is that the very women who are most motivated to excel in male-dominated fields
appear to be most at risk for experiencing a threat that their performance could confirm a negative stereotype about their group (C. M. Steele et al., 2002). In other words, stereotype threat is most likely to affect those women who have invested their self-concept in doing well in a male-dominated domain. Women who are highly math-identified face a potentially vicious cycle; the added pressure caused by their motivation to succeed could aggravate the distracting thought processes that interfere with their performance. Their test scores might end up on the surface, seeming to confirm the very stereotype they were trying so hard to refute. Although these processes have been examined most clearly in math-related domains, these same processes could affect women in any discipline (e.g., computer science; Smith, Sansone, & White, 2007), dimension (e.g., negotiation; Kray, Thompson, & Galinsky, 2001), or role (e.g., a leadership position; Davies, Spencer, & Steele, 2005) in which gender stereotypes exist. Furthermore, many situational cues can trigger these stereotype threat processes, increasing the likelihood that women who pursue male-dominated careers will encounter stereotype threat. We next review some of these environmental triggers.

Situations That Trigger Stereotype Threat

The situational nature of stereotype threat implies that some contexts will be more likely than others to trigger the cascade of arousal and negative thoughts that limit attentional resources and lead to women's impaired performance on complex cognitive tasks. Although early research on women's experience of stereotype threat showed performance decrements resulting from very explicit reminders of gender differences in ability, more recent research has revealed that these same effects can be cue by more subtle features of a context. Any aspect of the situation that brings to mind gender-stereotypic assumptions about women's ability, highlights male dominance on the task or domain, or reminds women of their gender might be enough to create stereotype threat. Because understanding these triggers can help in identifying solutions, we next review each cue in more detail.

Cues to Assessing Inherent Ability

Particularly when people first enter a discipline, they frequently encounter situations in which they might feel that their natural talent for that field is being assessed. Entrance exams are the most straightforward examples of these kinds of assessments, but comments made in class, meetings with professors, or even casual shop-talk with new colleagues can all be framed as evaluative encounters. Even just knowing that one is performing a task meant to be a diagnostic measure of ability can raise evaluative concerns and cue the experience of stereotype threat (C. M. Steele & Aronson, 1995).
being told that a task is math related is often enough to automatically activate deeply rooted stereotypes about the domain and induce a concern that one's performance might validate those stereotypes (Smith & White, 2002).

In addition to merely activating stereotypes, situations designed to diagnose abilities are also likely to prime in individuals an entity orientation toward skills in that domain. According to Dweck's work on lay theories of intelligence, entity theorists, in contrast to incremental theorists, tend to view ability as an unchangeable internal characteristic as opposed to something that can be increased through effort or experience (e.g., Dweck, Chiu, & Hong, 1995). An entity orientation tends to focus individuals more on the goal of demonstrating performance (and more specifically, avoiding any displays of failure), as opposed to achieving mastery of the material. If stereotype threat impairs performance in part by changing one's orientation toward performance, then situations that specifically cue the idea that one lacks inherent abilities are likely to be the most threatening to members of stigmatized groups. In support of this idea, Brown and Josephs (1999) demonstrated that gender differences on a math test were found only when the test was described as diagnostic of weak math abilities, as opposed to a test that would identify strengths.

The shift to an entity orientation under stereotype threat is also indicated by research suggesting that a standard stereotype threat prime impairs performance to the same degree as does learning about biological underpinnings of math performance. In this study, women underperformed men on a math test after reading about scientific evidence that gender differences in math performance are due to inherent ability, that is, biological factors such as genes (Dar-Nimrod & Heine, 2006). Women who read research suggesting that gender differences were the result of environmental factors such as socialization did not show lower math performance compared with men. To the degree that biological explanations imply a fixed ability as opposed to a malleable skill, this research provides some evidence that this shift to an entity orientation might underlie stereotype threat effects on performance. This finding suggests that women would face more of a challenge in male-dominated disciplines that emphasize a certain level of inherent ability as a necessary factor for success. Repeated exposure to situations of stereotype threat that cue women to see math ability as a fixed trait might increase their frustration with relatively minor setbacks and lead them to frame those setbacks as evidence that they do not belong in that domain.

Cues That Make Gender Salient

In addition to situations that cue a focus on inherent ability, stereotype threat can be elicited by exposure to explicit and implicit cues in one's environment that simply make gender salient. For example, when college students watch commercials that portray women in a stereotypically feminine way,
women show lower performance on a subsequent math test compared with their male peers and with women who watch neutral commercials (Davies, Spencer, Quinn, & Gerhardtstein, 2002). In addition, merely observing another woman perform poorly at math is enough to create a collective threat to one's sense of self (Cohen & Garcia, 2005). Aside from these relatively overt environmental cues, simply having females answer questions related to gender issues (Shih, Pittinsky, & Ambady, 1999) or color a picture of a girl (Ambady, Shih, Kim, & Pittinsky, 2001) has been found to engender stereotype threat and negatively affect women's and girls' attitudes and performance in math-related tasks. Even placing a cartoon depicting women being inferior in math in the periphery of an experimental setting might constrain women's attention to their gender identities and make them apprehensive about being the target of negative stereotypes (Oswald & Harvey, 2000).

Unfortunately, the simple fact that masculine domains are by definition composed mainly of men means that it is unlikely for women in these fields to be unaware of their minority status resulting from their gender. Research has clearly shown that when women represent the numeric minority in a situation, they perform more poorly than do those working in an all-women or sex-balanced group (Inzlicht & Ben-Zeev, 2000). This is partly because being outnumbered likely increases awareness of one's social identity (Abrams et al., 1990) and activates the relevant gender stereotypes. However, because an imbalanced gender composition of the classroom or the workplace can also reinforce stereotypic notions of what women can do (Eagly & Steffen, 1984), the underrepresentation of women in a domain can also validate the stereotype. Findings such as these argue for the importance of having a critical mass of women in male-dominated settings to help diffuse these effects (see also chap. 3, this volume).

In summary, even when women are strongly motivated to achieve success in male-dominated fields, and even when men in those professions have good intentions about facilitating women's advancement, situational cues that trigger stereotype threat can still create the appearance of a gender difference in ability. However, research also suggests that certain factors could make some women less susceptible to this threat. In the next section, we review some of the individual differences that could safeguard them from experiencing stereotype threat.

Individual Difference Factors That Moderate Stereotype Threat Effects

Although stereotype threat is defined as a situational pressure that can happen to any individual targeted by negative stereotypes, not all stigmatized individuals are equally debilitated by this psychological predicament. One obvious factor that moderates the experience of threat is stigma consciousness (Pinel, 1999)—the degree to which a person is chronically conscious of the possibility
that she will be judged stereotypically by others. Individuals who rate low on this dimension are thought to be less vigilant in situations in which subtle threat-eliciting contextual cues are present and are less likely to perceive themselves as targets of discrimination. Consistent with this analysis, research has shown that women low in stigma consciousness are less likely to underperform on a math test under situations of stereotype threat (Brown & Pinel, 2003) presumably because these women do not anticipate being perceived stereotypically.

Whereas stigma consciousness might moderate stereotype threat effects by influencing the degree to which women worry about being stereotyped by others, women's own beliefs about the validity of gender stereotypes influence the degree to which they worry about confirming the stereotype for themselves (Shapiro & Neuberg, 2007). For example, although stereotype threat theory contends that one does not need to endorse the stereotype to experience its detrimental effects on performance, research does suggest that some women are buffered from threat effects on math performance by completely rejecting the idea that men are inherently better than women at math (Schmader et al., 2004). Because high stigma consciousness and stereotype endorsement are two variables that are likely to make gender stereotypes more chronically accessible, either of these factors might increase women's risk of stereotype threat by lowering the threshold for experiencing threat in ambiguous situations.

In addition, because stereotype threat stems from the fear that one's own actions could confirm a broader stereotype about one's group, any individual difference factor that raises the personal stake in defeating the stereotype could accentuate the experience of stereotype threat. This conjecture implies that threat would be greater for those women who are personally invested in succeeding in the domain and in maintaining a positive image of their gender group. For those who do not define themselves in terms of their gender, the cultural stereotypes about women should pose less of a threat to the self. Indeed, research has shown that these women do not show performance deficits when told that their score on a math test would be used to evaluate the abilities of women in general (Schmader, 2002). This result does not imply, however, that women must disavow their gender identity to succeed in a masculine domain. It is clear from other research that group identification confers psychological benefits (Schmitt, Branscombe, Kobrynowicz, & Owen, 2002), and women might be buffered from the negative experience of stereotype threat in contexts that highlight their gender's positive status on other dimensions (Derks, van Laar, & Ellemers, 2006). Thus, the important point might be to develop a more diffuse concept of the self that acknowledges the strengths of one's gender identity but that also recognizes gender as being but one aspect of self-definition. Research suggests that this multifaceted concept of the self can also serve as a buffer against stereotype threat. For instance, women who were able to list more identities for themselves were less likely to underperform on a math test than were those who could not (Gresky, Ten Eyck, Lord, & McIntyre, 2005).
Just as women are buffered from stereotype threat by investing less of their self-definition in their gender identity, they might also be buffered by investing less of their self-definition in the math domain. As mentioned previously, general research on stereotype threat suggests that the debilitating effects of threat cues on performance are largest among those who are most identified with the domain (Aronson, Lustina, & Good, 1999). The ironic nature of this finding is that those gifted female students who enter male-dominated domains despite social and stereotypic pressures to the contrary are mostly likely to be harmed by the negative stereotypes. Although some degree of domain identification is essential for motivation in the face of obstacles, we might wonder whether there is a way to retain a sense of value for the domain without necessarily defining one's self on the basis of one's performance in that domain. Evidence suggests that this indeed may be possible. For example, Nussbaum and Steele (2007) found that African American students who temporarily detached their sense of self-worth from the stigmatized domain persisted longer on a supposed diagnostic intelligence test compared with those taking a nondiagnostic task and did so while maintaining overall domain identification levels. Disengaging the self-concept from math performance might be similarly beneficial for women performing in male-dominated domains.

In fact, individual difference variables we have discussed thus far suggest that the women who are less likely to experience stereotype threat are those who do not frame a given performance situation as a self-defining moment. In support of this assessment, several general personality characteristics have been identified to moderate stereotype threat effects by leading women to appraise their performance in less self-oriented ways. For example, women with a high dispositional sense of humor were found to experience less performance impairment on math tests under conditions of stereotype threat, perhaps because they take the situation less seriously (Ford, Ferguson, & Brooks, 2004). More relevant is work examining stereotype threat among individuals with an external locus of control, who do not hold themselves responsible for their task performance but tend to make external attributions for their performance. In light of this tendency to discount their outcomes, it should come as little surprise that individuals with an external locus of control show weaker performance deficits in a situation of stereotype threat compared with those with internal locus-of-control beliefs (Cadinu, Maas, Lombardo, & Frigerio, 2006; see also chap. 5, this volume).

Another general personality variable that has been studied as a moderator of stereotype threat effects on women's math performance is self-monitoring, the tendency to adjust one's behavior in social contexts to conform to expectations held by others (Inzlicht et al., 2006). In light of our assertion that threat is exacerbated by focusing too much on the self, it seems counterintuitive that women high in self-monitoring are less likely to underperform on a math test when they are the only woman in a room of men (Inzlicht et al., 2006).
However, as Inzlicht et al. (2006) pointed out, these high self-monitors (i.e., those who are more sensitive to situational demands and particularly adept at conveying a desired public appearance to others) are actually buffered from stereotype threat because they are more adept at regulating their behavior to the demands of situations, and thus are less cognitively distracted by a situation that cues that type of vigilance.

Thus far, we have focused on the immediate consequence of experiencing stereotype threat on women’s math-related task performance. We have described the various situational cues that can trigger stereotype threat as well as some of the individual difference variables that could buffer some women from these effects. However, even those women who are less susceptible to experiencing stereotype threat in a given situation could still experience the long-term effects of frequent exposure to the sorts of situational cues that trigger threat-based processes. In the next section, we address how stereotype threat may affect women’s motivations and career decisions.

STEREOTYPE THREAT CAN DIRECTLY AFFECT CAREER CHOICE

Although some women might successfully buffer themselves from the experience of stereotype threat, the accumulated exposure to these pressures—pressures that are not experienced by men in the same domains—can undermine women’s interest in remaining in these disciplines. Indeed, C. M. Steele et al. (2002) argued that many stigmatized individuals psychologically disidentify with stereotyped domains as a means to escape the constant rigors of trying to succeed in an area in which one’s group is expected to fail. For example, one study showed that women majoring in math or science disciplines reported experiencing more stereotype threat and were more likely to contemplate changing their major than were women majoring in social sciences or the humanities (J. Steele, James, & Barnett, 2002).

Unfortunately, the tendency to disidentify from a domain in which one experiences stereotype threat might be preceded by being too personally invested in that domain. Individuals who excel in a domain in which their group is negatively stereotyped are more likely to become self-schematic for that domain (Von Hippel, Hawkins, & Schooler, 2001). This strong attachment of the self to the domain might make these high-performing members of stigmatized groups more finely attuned to interpreting their outcomes in very self-defining ways. For example, Crocker, Karpinski, Quinn, and Chase (2003) found that female engineering students were very reactive to bad grades they received in science courses such that they reported lower levels of self-esteem, affect, and identification with their major compared with male engineering students or female psychology students. Interpreting negative outcomes as threats to one’s self-concept could become fatiguing and aversive and over time drive them away from those fields.
In addition to disidentification from male-dominated domains as a result of stereotype threat, other evidence suggests that even subtle reminders of gender stereotypes can lead women to steer clear of more masculine activities. In a series of experiments, Davies and colleagues showed that simply priming women with feminized examples of women (e.g., by showing them stereotypic television commercials) had a direct and significant effect on their behavioral choices (Davies et al., 2002, 2005). Women in this situation expressed significantly less interest in pursuing academic majors involving high levels of mathematics and, in another set of studies, avoided leadership roles in favor of subordinate roles. These findings suggest that continuous exposure to something as commonplace as stereotypic TV ads can have subtle influences that may ultimately push women to choose careers outside of math and science.

As can be seen, gender stereotypes not only affect how women perform in male-dominated domains but can also affect women's desire to take on roles or continue pursuing careers in which they are likely to face repeated exposure to stereotype threat. In light of the role of this phenomenon in helping to create the underrepresentation of women in these areas, it is critical to consider effective ways to combat the deleterious effects of stereotype threat.

CLOSING THE GAP: SUCCESSFUL STRATEGIES FOR DIFFUSING THE EFFECTS OF STEREOTYPES ON WOMEN'S CAREER CHOICE

As we reviewed in this chapter, stereotypes can influence women's choice of careers through socialization processes as well as the experience of acute stereotype threat. Although the effects of both processes can be quite profound, their focus on environmental forces offers some hope. Socialization cannot happen without appropriate social context, and stereotype threat by nature is a situational pressure. Because contexts can be altered, the negative effects of gender stereotypes can be circumvented by instituting policies and interventions designed to change the social environments to which young girls and women are exposed. Such change can happen through coordinating efforts to increase the representation of women in male-dominated domains, to create threat-free environments, and to educate the public about the role of social context in shaping performance. This last part of the chapter addresses approaches that aim to change the threatening context in hopes of superseding the negative influences of stereotypes on women (see also chaps. 9–12, this volume).

Increasing the Representation of Women in Male-Dominated Careers

In an ideal world, eliminating the negative effects of stereotypes would require a multifaceted effort to change the cultural representations to which people are exposed. However, stereotypes about women's lack of proclivity for certain fields, such as math and science, might be most likely to change when...
we see equal representation of women and men at the highest levels of achievement in male-dominated fields. Recall that just the observation of the unbalanced representation of women and men in a field can shape the views of who belongs in that domain (Eagly & Steffen, 1984). Therefore, direct efforts to change the gender representation in an organization or institution can be one way to avoid this biased sense of belonging. Because women's performance on math tests can be hampered by the simple fact that women are in the minority in that testing context (Inzlicht & Ben Zeev, 2000), changing the gender composition of a context can also help to directly close the performance gap. Meanwhile, when a critical mass of women is present in a masculine domain, women are also exposed to positive female role models who, as is discussed later, can inspire in them a greater sense of confidence and self-efficacy.

Of course, this first suggestion sets up a catch-22. A greater presence of women in masculine domains will no doubt change the socialized notion of what women can and cannot do, and will also alleviate the experience of stereotype threat on women's performance. However, the problem still remains of how to combat the influence of gender stereotypes at present so that more and more women are able to enter and excel in male-dominant arenas. One potential solution is to create what Davies et al. (2005) have called identity safe environments.

Creating an Identity Safe Environment

Earlier in this chapter we discussed how seemingly innocuous contextual cues, such as advertisements, can socialize young girls to shy away from masculine careers and can also elicit stereotype threat (Davies et al., 2005). Thus, combating the effects of gender stereotypes on women's career choices means minimizing these threatening cues. As mentioned earlier, one means of doing this is to provide women with positive female role models who alleviate stereotypic concerns (see also chap. 10, this volume). Because individuals derive a sense of identity from their group memberships, they can experience an increase in self-esteem when their fellow group members succeed. In line with this reasoning, research has demonstrated that women are less likely to underperform on a math test when in the presence of or after learning about a competent female researcher (Marx & Roman, 2002). In addition to alleviating stereotype threat effects on performance, exposure to female leaders can also reduce women's automatic stereotypic beliefs about their gender (Dasgupta & Asgari, 2004). In general, the presence of successful women in masculine domains sends an encouraging message to young people that women are capable of doing well there.

If one key to reducing the effects of stereotypes on women's self-concepts and career pursuits is to instill greater confidence in them about their math abilities, then success might be found with interventions designed to focus
women on positive aspects of their individual character. For example, research has shown that people can maintain a certain level of self-esteem in the face of self-threats by affirming themselves as decent, moral, and competent (e.g., having a sense of humor, being creative, or having social skills; C. M. Steele, Spencer, & Lynch, 1993). Consistent with these findings, when women under stereotype threat affirmed a valued attribute, they performed at levels comparable to that of men (Martens, Johns, Greenberg, & Schimel, 2006). This effect can be achieved through group affirmation as well, such as by telling women before they take a diagnostic math test that they make better participants than do men (McIntrye, Paulson, & Lord, 2003). A more recent study shows how the positive effects of affirmation extend beyond a testing setting to have a reliable effect on academic performance and grades (Cohen, Garcia, & Master, 2006). In this study, European and African American seventh graders wrote briefly about values most important to their self once during the beginning of the fall semester. Results showed across two separate samples that, compared with those who wrote about unimportant values, affirmed African American students demonstrated grades that were more comparable to those of European American students in a targeted course. In fact, interventions such as these might be most important when employed in middle school—a time when many girls begin to decide that they cannot excel in traditionally male classes such as math and science (Eccles et al., 1989).

Such research highlights the benefits of instilling in young girls a sense of confidence but other research suggests that simply focusing on one's self as an individual rather than as a stereotypic representative of one's group could also relieve stereotype threat effects on women's math performance (Ambady, Paik, Steele, Owen-Smith, & Mitchell, 2004). In this study, women who first listed their individual characteristics, even when this list included negative traits, did not show stereotype threat impairment on their math performance. Women were also buffered from stereotype threat effects on performance when prompted to think about characteristics shared between men and women (Rosenthal & Crisp, 2006). In both of these studies, efforts to reduce the degree to which gender stereotypes place women in a distinct and devalued social category were effective at combating stereotype threat. These findings highlight that one core problem with stereotypes is that they are categorical trait ascriptions that confer to an individual a social expectation about what she will be able to do. Thus, by definition, negative gender stereotypes constrain a woman's sense of what choices she has. Efforts to dismantle such categorical thinking can therefore be quite effective at opening up new possibilities.

In sum, an identity safe environment can be created by providing contexts that promote more positive and less stereotypical conceptions of women. For example, ensuring that campus math departments promote the appearance of successful female math figures (e.g., bringing female mathematicians in for colloquiums, hiring more female faculty, hiring female math tutors) and
reducing the number of threatening subtle cues in the environment (e.g., having equal numbers of male and female restrooms, having posters that depict equal numbers of male and female students experiencing success) can all be means of engendering an identity safe environment. These strategies are likely to be effective across a variety of domains. But as reviewed earlier, much of the research on stereotype threat pertains to test performance. Because tests are so often interpreted, by both students and evaluators, as windows into one's ability, test scores are likely to play a unique role in women's choices to pursue certain careers. As such, we might consider remedies that specifically address the role that stereotypes play during a testing situation.

Reduce the Focus on Testing

Because of the debilitating effects that stereotype threat has on women's performance on standardized math tests, one must be cautious in assuming that test scores denote ability. However, universities and scholarship committees rely on the test scores of students to make decisions, and these decisions can have a profound influence on the career choices that are available to women. Although it might be impossible to do away with testing altogether, it would be helpful to be more mindful of how such assessments are framed and how much weight a student's math test scores are given in academic decisions.

One aspect of this increased mindfulness is to emphasize skill over ability by teaching students that learning is an incremental process, and that tests can be used to measure a step in the process toward mastery. In fact, the Educational Testing Service made a move in this direction when it changed the denotation of the A in SAT from aptitude to assessment. Research suggests that efforts to change people's lay theories about not just tests but intelligence itself can be effective. For example, Good, Aronson, and Inzlicht (2003) showed that when seventh-grade students were mentored by college students to think about intelligence as a malleable quality that increases with hard work, girls showed an increase in math performance by the end of the school year and the gender gap in test performance was eliminated.

In a similar vein, Walton and Cohen (2007) taught a sample of 1st-year college students to view the difficulties and challenges that they would face during their college career as a normal part of the learning process. The assumption is that individuals who are performing under a burden of negative stereotypes might be more likely to interpret any sign of difficulty as an indicator that they do not belong in college. Those who do not contend with these stereotypes are less likely to question whether they belong. By reminding students that struggle and self-doubt is a normal part of education and growth, students learned to reappraise their college experience and it showed in their performance. Minority students who received this intervention reported studying more for their classes and showed a significant increase in their grades measured 8 months
later. We argue that these same interpretive processes affect women’s experiences in traditional math domains such as science and math, in which even the former president of Harvard University believes that inherent abilities could be the root cause of women’s low test scores.

Thus far we have described some of the policies and interventions that could help to combat the effects that stereotypes have on the underperformance and underrepresentation of women in male-dominated careers. Perhaps the most important first step to instituting these changes is to get the word out about the ways in which stereotypes affect women’s attitudes, behavior, and performance. In fact, education is probably the approach that can be used most extensively to counteract not only stereotype threat but also negative stereotype influences in general.

**Education**

One notable aspect of the influence that stereotypes have on people is that their effects often go unnoticed or are misattributed. In fact, in much of the research on stereotype threat, manipulations that are shown to have an observable effect on women’s test performance have little to no effect on women’s conscious experience of the situation (e.g., Schmader, 2002). In a similar way, the strong implicit biases that women have between men and science are held even by female math majors who explicitly report strong identification with math (Nosek et al., 2002). Because the effects of stereotypes happen at an implicit level, it is all too easy to attribute group differences in behavior and performance as indicative, not of the stereotype, but of true underlying differences in ability. To counteract this fundamental attribution error, women and men alike need to be educated about the ways in which stereotypes exert their influence.

In fact, one way to alleviate the sting of stereotype threat is to teach women about its effects (Johns, Schmader, & Martens, 2005). At first glance, we might wonder whether publicizing stereotype threat would simply provide women with yet another hurdle that they need to overcome. However, research by Johns et al. (2005) suggests that knowing about stereotype threat provides women with an external explanation for their anxiety during a test, and being able to externalize anxious arousal might free up the cognitive resources needed for the task. Johns et al. (2005) showed that after learning about the deleterious consequences that negative stereotypes could have on their math performance, women performed similarly to men on a subsequent math test, and better than women who did not learn about stereotype threat (but who still took a test under threatening conditions). Furthermore, although both of these groups reported that gender stereotypes might have contributed to their anxiety during the test, only those women educated about stereotype threat performed better on the math test to the degree that they made this external attribution.
Among those women uneducated about stereotype threat, the tendency to focus on the role of gender stereotypes in creating their anxiety predicted lower performance. These results imply that teaching women to acknowledge stereotypes as an external source of anxious arousal during stereotype-relevant tasks might be an important way to deflect the threat that those stereotypes seem to pose to one’s self and group identity.

Other research has shown similar effects based on the explanation that students are given for the gender gap in mathematical test performance (Dar-Nimrod & Heine, 2006). As mentioned previously, compared with men, women in this study underperformed on a math test after reading an essay summarizing evidence that the gender gap arises from genetic factors. However, women who read about the environmental causes of gender differences in math performance performed significantly better than did women given the genetic explanation and equal to men in the same condition. Because these effects of education could last beyond the immediate context, this type of intervention could be a powerful psychological tool to help stigmatized individuals cope with stereotype threat.

In addition to educating women, however, educators, administrators, policymakers, and parents must also be taught to understand the role that stereotypes could play in their own behavior toward young girls and interpretation of children’s performance. To defeat the sort of direct socialization processes described earlier, mentors need to be aware of their own biased expectations as discussed in the beginning of this chapter, and take efforts to avoid them—but this does not mean being overwhelmingly positive. Research suggests that the best way to increase motivation among stigmatized students is through a combination of accurate criticism, emphasizing that standards are set high but also providing assurances that you believe that the student is up to the challenge of good performance (Cohen, Steele, & Ross, 1999). It is under these conditions of “wise mentoring” that students can be most intrinsically motivated to hone their skills and learn from their mistakes. We presume that these same mentoring tactics would be useful for women as well not only in the classroom but also in their career fields later on.

CONCLUSION

We have reviewed in this chapter studies showing the limiting effects that gender stereotypes continue to have for women. From a young age, gender stereotypes in culture socialize girls to shy away from careers in which women are the minority. But even for those women who buck these trends and enter male-dominated disciplines, the frequent exposure to situations of stereotype threat has the potential to turn them away. If the glass ceiling prevents women’s advancement up a hierarchy to leadership positions.
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almost any domain, the effects that stereotypes have on women’s career
choice might be more aptly characterized as a glass door—one that closes off
entry to certain fields. In fact, the emphasis on career choice in our chapter
tle is a bit misleading, given that the research suggests that gender stereotypes
limit the options that women have available to them. However, as
more and more women enter into and are successful in male-dominant
careers, the stereotypes and their detrimental effects will begin to change.
Whereas comments of the sort made by Lawrence Summers could have the
effect of closing the glass door more tightly, we counter that raising aware-
ness of the influence that stereotypes can have might reveal that the door can
be opened.

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