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TARGET ARTICLE

Ingroup Experts and Peers as Social Vaccines Who Inoculate the Self-Concept: The Stereotype Inoculation Model

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Individuals' choice to pursue one academic or professional path over another may feel like a free choice but is often constrained by subtle cues in achievement environments that signal who naturally belongs there and who does not. People gravitate toward achievement domains that feel like a comfortable fit because they are in sync with ingroup stereotypes and away from other domains that feel like an uncomfortable fit because they deviate too far from ingroup stereotypes. Even individuals who are high performers may lack confidence in their ability and withdraw from certain achievement domains—performance and self-efficacy do not always go hand in hand. What factors might release these constraints and enhance individuals' freedom to pursue academic and professional paths despite stereotypes to the contrary? The present article addresses this question using a new theoretical lens—the stereotype inoculation model—that reveals how ingroup members (experts and peers in high-achievement settings) function as “social vaccines” who increase social belonging and inoculate fellow group members' self-concept against stereotypes. The model integrates insights from several literatures in social psychology and organizational behavior to articulate predictions accompanied by supporting evidence about when ingroup experts and peers serve as social vaccines and the underlying psychological mechanisms. The article concludes by identifying directions for future research, possible interventions, and policy implications of the model.

Fifty years after the birth of affirmative action and a host of other diversity initiatives in education, business, and government, the numbers of women and racial minorities in high-status, high-achievement positions in professional life remain strikingly low—the higher one goes up the professional ladder in business, law, science, technology, engineering, politics, and so on, the more abysmal the numbers (N. M. Carter & Silva, 2010; Catalyst, 2005; Ceci & Williams, 2010; Cole & Barber, 2003; Johnson, 1996; Morrison & von Glinow, 1990; Swain, 1995). Why the intractable problem? Yes, discrimination and intergroup disparities in resources remain important explanations. But that is not the entire story. Recent popular and scholarly reports suggest another explanation: Oftentimes women and minorities who are talented and well qualified choose *not* to pursue particular high-achievement academic and professional paths and instead choose alternative paths that are more interesting to them (Ferriman, Lubinski, & Benbow, 2009; McArdle, 2008; Pinker,

2008; Rosenbloom, Ash, Dupont, & Coder, 2008). The tacit argument here is that individuals make these choices freely—they pursue or avoid certain academic and professional paths based on their talent and intrinsic motivation, unconstrained by societal forces. But are these choices really free?

In this article I propose that what *feels* like a free choice to pursue one life path or “possible self” over another is often constrained by subtle cues in achievement environments that signal who naturally belongs there and is most likely to succeed and who else is a dubious fit. People tend to gravitate toward achievement domains that feel like a comfortable fit in the sense that they conform to ingroup stereotypes and away from other domains that feel like an uncomfortable fit in that they deviate too far from ingroup stereotypes. The demographic composition of achievement settings is often a critical situational cue that activates these stereotypes—who is visible and who is scarce? It is important to note that individuals may be unaware or

only semiaware that their own interests, self-concept, and academic and professional choices are shaped by stereotypic cues in achievement settings. Yet, notwithstanding the absence of awareness, stereotypes leave an implicit imprint on their self-concept.

What factors might release these constraints and enhance individuals' freedom to pursue academic and professional paths despite stereotypes to the contrary? I address this question using a new theoretical lens—the stereotype inoculation model—that shows how in-group members (experts and peers in high-achievement settings) function as “social vaccines” who inoculate and strengthen fellow group members' self-concept so that they become free to choose less traveled paths.

The Need to Belong and Its Influence on the Self-Concept

People's behavior and choices are driven by the need to belong and be accepted by others within a community of peers, coworkers, fellow coethnics, and so on (Baumeister & Leary, 1995; MacDonald & Leary, 2005). Because the need to belong is particularly strong under adversity or stress (Rofe, 1984; Walton & Cohen, 2007), it is likely to play an important role in the lives of individuals who belong to historically disadvantaged groups and find themselves in adverse situations where their group is numerically scarce and their abilities cast in doubt, such as high-stakes academic or professional environments. The experience of being in such environments, feeling like a token, cut off from insider networks and knowledge, may lead some to doubt their belonging, ability, and commitment to the endeavor, especially when faced with difficulty and alternative choices. This experience has been studied in the context of social identity threat, stereotype threat (for reviews, see Aronson & Steele, 2005; Crocker, Major, & Steele, 1998; Schmader, Johns, & Forbes, 2008; C. M. Steele, Spencer, & Aronson, 2002), and belongingness uncertainty (Walton & Cohen, 2007, 2011). Stereotype threat and social identity threat are known to undermine performance in domains where one's group is negatively stereotyped and one's belonging uncertain; over time, weak performance reduces self-confidence in one's ability (or self-efficacy) and leads individuals to withdraw from the domain. This phenomenon has received a great deal of research attention and is well understood. What is far less understood is that sometimes people lack confidence in their ability and withdraw from achievement domains *even when their performance is as good as their peers*. In other words, performance and self-efficacy don't always go hand in hand. This is the paradox at the heart of this article.

Feeling Like an Imposter: The Divergence Between One's Performance and Self-Concept

As a case in point, the imposter phenomenon, a term coined 30 years ago in a study on high-achieving women, revealed that individuals may privately believe they are faking talent despite their objectively excellent performance (Clance & Imes, 1978; McGregor, Gee, & Posey, 2008). Even when they experience success, individuals who feel like imposters are less likely to make internal attributions to their ability (Topping & Kimmel, 1985) and more likely to make external attributions to luck, effort, or personal charm (Chae, Piedmont, Estadt, & Wicks, 1995; Clance, 1985; Thompson, Davis, & Davidson, 1998). They are likely to be dissatisfied with their performance, be unsure of their ability, be anxious, and have low expectations of repeated future success compared to others who do not feel like imposters (Chrisman et al., 1995; Cozzarelli & Major, 1990; Kumar & Jagacinski, 2006; Thompson et al., 1998). Although alleged impostors expect to perform less well than nonimposters and are more anxious before a performance, their actual performance is no different than that of nonimposters (Cozzarelli & Major, 1990). A similar divergence between self-concept and performance comes from other research that confirms that chronic self-conceptions of low ability can mislead individuals to underestimate their future performance, preventing them from pursuing future opportunities even though their performance is objectively as good as others (Ehrlinger & Dunning, 2003). I propose that imposter feelings are closely related to a sense that one does not belong in a particular high-achievement domain.

Members of disadvantaged groups who are often solos or tokens in high-achieving contexts may be particularly vulnerable to imposter fears. For example, high-achieving women who are a small numeric minority in their profession are more likely to feel imposter fears than equivalent men (e.g., King & Cooley, 1995; Kumar & Jagacinski, 2006; Legassie, Zibrowski, & Goldszmidt, 2008; but see Fried-Buchalter, 1997; Topping & Kimmel, 1985). Similarly, African American graduate students who are a small numeric minority at predominantly White universities experience imposter fear that is correlated with lower academic self-efficacy (Ewing, Richardson, James-Myers, & Russell, 1996). Likewise, for women in engineering who are in small numbers among male peers, self-worth is closely tied to academic performance, particularly failures—failures decrease their self-esteem sharply, but successes don't increase their self-esteem (Crocker, Karpinski, Quinn, & Chase, 2003). Collectively, these examples suggest that the experience of being a numeric minority in high-stakes achievement environments where stereotypes are in the air may reduce individuals'

self-efficacy or confidence in their own ability, especially in the face of difficulty, even if their actual performance is objectively the same as majority-group members.

Belonging uncertainty and self-doubt are likely to be potent in early stages of academic or professional development when one is a newcomer or when transitioning from one developmental stage to another (e.g., transition to college, to graduate school, or to a new job). Worries about failure and fragile self-efficacy are likely to deplete intrinsic motivation and, over time, make individuals lose interest in an achievement domain and choose a different path. This is a common experience for many disadvantaged social groups. Consider Black and Latino students at predominantly White universities; girls and women in science and engineering; and professional women and ethnic minorities who are on upward career trajectories in business, law, medicine, science, and politics, where their ingroup is scarce. A surprising number of these high-performing individuals may choose to leave their academic or professional trajectory and opt for a different path (Ceci & Williams, 2011; Ceci, Williams, & Barnett, 2009; McArdle, 2008; Pinker, 2008; Rosenbloom et al., 2008). At face value these choices appear free, as if they are driven by naturally changing interests. But data from several sources suggest that they are invisibly shaped by subtle stereotypes that signal who naturally belongs in this environment and is likely to succeed and whose success is in doubt (Cheryan, Plaut, Davies, & Steele, 2009; Logel et al., 2009; Settles, 2004; Spencer, Steele, & Quinn, 1999; Steele, James, & Barnett, 2002; Stout, Dasgupta, Hunsinger, & McManus, 2011; von Hippel, Issa, Ma, & Stokes, 2011; Walton & Cohen, 2007, 2011).

The goal of the stereotype inoculation model is to highlight two factors that ought to increase social belonging and build resilience against stereotypes—exposure to ingroup experts and peers in high-achievement contexts. This model integrates insights from several influential literatures in social psychology and organizational behavior including implicit social cognition, stereotype threat and social identity threat, role modeling, social comparison theory, and solo and token status to articulate the conditions under which exposure to ingroup experts and ingroup peers enhances minority group members' sense of belonging and self-concept in high-stakes, high-achievement contexts. The next section describes the model and its primary predictions. Following sections summarize empirical evidence drawn from various literatures in social psychology and organizational behavior that support the model's predictions including underlying psychological processes driving them.

Stereotype Inoculation Model

Whom people aspire to become is very much influenced by individuals they see in successful roles and professions and the degree to which they relate to those individuals, assuming of course a basic foundation of skills in a given achievement domain (Asgari, Dasgupta, & Gilbert Cote, 2010; Asgari, Dasgupta, & Stout, 2011; Dasgupta & Asgari, 2004; Gibson, 2004; Lockwood & Kunda, 1997, 1999). The stereotype inoculation model makes several broad predictions (see Figure 1 for a visual illustration). First, it proposes that analogous to a vaccine, contact with successful ingroup experts and peers in high-stakes achievement contexts functions as a "social vaccine" that inoculates individuals against self-doubt, especially in early years of academic and professional development and other transitional periods when individuals' self-efficacy is in flux. I predict that such contact will enhance beginners' positive attitudes toward the achievement domain, strengthen their identification with it, enhance self-efficacy, and increase motivation to pursue career goals in the domain.

Second, contact with ingroup experts and peers is predicted to be especially important for individuals whose ingroup is a numeric minority and negatively stereotyped in an achievement domain and less important for others whose ingroup is the majority and expected to succeed by default. For members of a negatively stereotyped group, seeing successful ingroup experts defies the negative stereotype, thereby enhancing their own self-efficacy and motivation to succeed (Blanton, Crocker, & Miller, 2000; Brewer & Weber, 1994).

Third, exposure to ingroup experts will be most beneficial if perceivers feel a subjective sense of connection or identification with them because subjective identification makes the path from one's present self to a future "possible self" seem more attainable given that one can imagine following the trajectory of the ingroup member (see Markus & Kunda, 1986; Markus & Nurius, 1986; Markus & Wurf, 1987).

Fourth, the impact of stereotypes on individuals' self-concept in high-achievement domains is predicted to be subtle and often unconscious. Individuals themselves may be unaware that the experts and peers they encounter had any effect on their personal academic and professional interests and choices. Yet the imprint of others ought to be evident in individuals' *implicit* self-conception—making them gravitate toward achievement domains where ingroup members are visible and away from domains where ingroup members are scarce. Although individuals' implicit self-concept is often sensitive to people in achievement contexts, their explicit self-concept may remain relatively stable in the short term. This prediction is

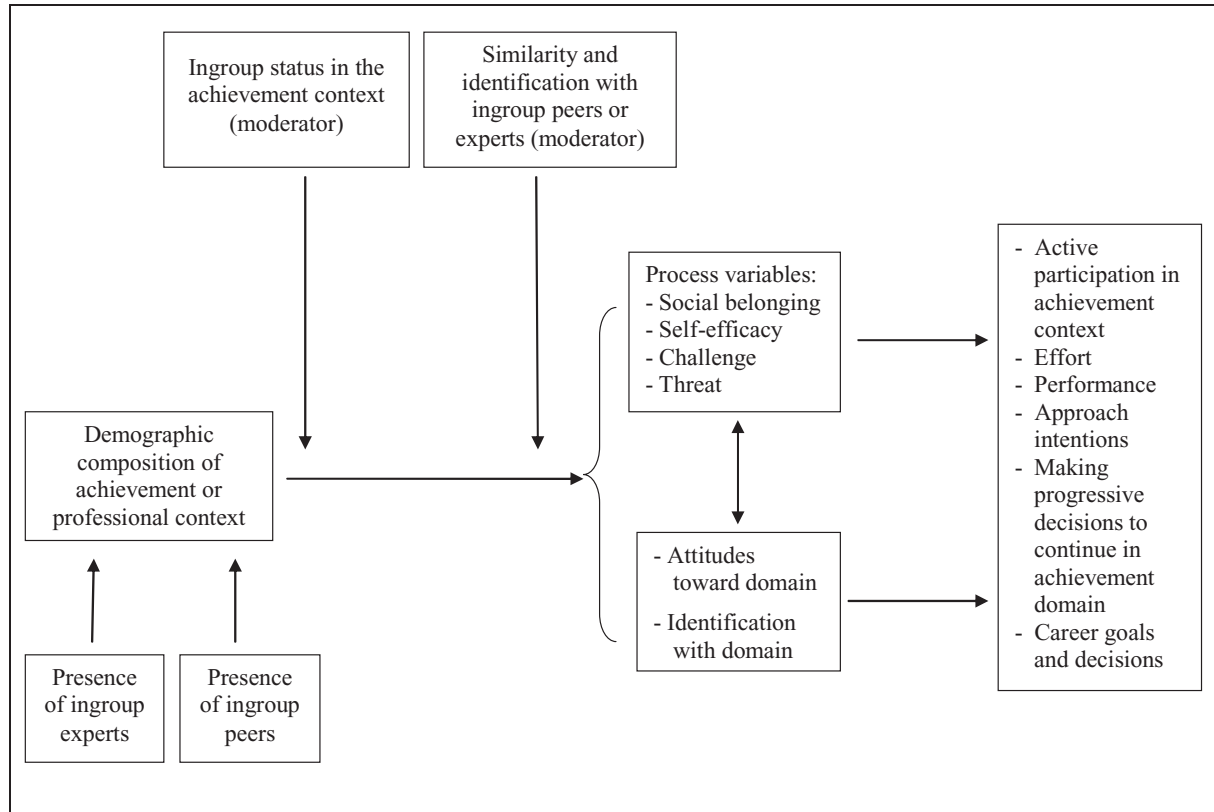


Figure 1. Illustration of the stereotype inoculation model.

informed by theories and research in implicit social cognition, which show that people are sometimes unable or unwilling to explicitly report their attitudes accurately because of incomplete awareness of how social contexts affect personal decisions and/or social desirability concerns (Dasgupta, 2004, 2009; Ferguson & Bargh, 2007; Greenwald & Banaji, 1995; Greenwald et al., 2002; Nisbett & Wilson, 1977; Nosek & Hansen, 2008; Petty, Fazio, & Briñol, 2008; Wilson, Lindsey, & Schooler, 2000). Applied to the stereotype inoculation model, contact with ingroup experts and peers is expected to produce small changes in implicit self-conceptions that, initially, may be too subtle to be consciously noticed or reported (Greenwald & Banaji, 1995; Greenwald et al., 2002). Indeed, classic studies on the self-concept show that individuals spontaneously adjust and calibrate their working self-concept to fit with their social context that are observed when measured indirectly, but not when measured directly, by asking individuals to report their self-beliefs (Markus & Kunda, 1986; Markus & Nurius, 1986). At an implicit level, some self-traits become mentally accessible or valued by individuals more than other traits in particular situations, even though the global content

of their explicit self-concept remain unchanged across situations.

Finally, four interrelated processes are proposed as underlying psychological mechanisms that inoculate the self-concept when individuals encounter ingroup experts and peers in high-achievement, high-stakes environments: a stronger and more stable sense of belonging in the environment, increased self-efficacy, feeling challenged by difficulty, and feeling less threatened. Support for these processes come from several programs of research that are described later (Blanton et al., 2000; Cheryan et al., 2009; Dasgupta, McManus, & Hunsinger, 2011; Davies, Spencer, Quinn, & Gehardstein, 2002; Murphy, Steele, & Gross, 2007; Purdie-Vaughns, Steele, Davies, Dittmann, & Crosby, 2008; Walton & Cohen, 2007, 2011; White, 2002).

Of course the model proposed in this article is not the only path to stereotype inoculation; other solutions have also been proposed. They include (a) emphasizing aspects of one's self-concept unrelated to the threatened social identity (e.g., G. L. Cohen, Garcia, Apfel, & Master, 2006; G. L. Cohen, Garcia, Purdie-Vaughns, Apfel, & Brzustoski, 2009), (b) disidentifying with the threatened identity or some

aspects of it (e.g., Pronin, Steele, & Ross, 2004; Settles, 2004; von Hippel, Walsh, & Zouroudis, 2011), (c) revising one's views of the ingroup (e.g., Derks, Scheepers, Van Laar, & Ellemers, 2011; Derks, Van Laar, & Ellemers, 2007, 2009; Rosenthal & Crisp, 2006; Walton & Cohen, 2011), and (d) revising one's views of ability (e.g., Aronson, Fried, & Good, 2002; Good, Aronson, & Inzlicht, 2003; Kray, Locke, & Haselhuhn, 2010). All of these strategies attempt to change perceivers' *inner appraisals or construals* of the self, the ingroup, or ability domain. The present model is different in three important ways. First, we focus attention on the *situation* and highlight how changing two situational factors can have profound effects on solidifying individuals' feelings of belonging and legitimacy in academic or professional worlds, which affect their attitudes and identification with these domains and motivation to persist when the going gets tough. Second, by highlighting the benefit of ingroup experts and peers in academic and professional settings, the stereotype inoculation model has clear implications for public policies that promote diversity in organizations: It suggests that the recruitment and retention of underrepresented groups who are newcomers at entry level is closely dependent on the visibility of ingroup experts in higher ranks of the organization as well as the visibility of ingroup peers in one's cohort (for more on policy implications, see the end of this article). The third unique aspect of this model is that it emphasizes how "background" implicit processes guide the imprint of situational cues on individuals' sense of belonging, their self-concept, and decisions in ways that have far-ranging consequences. People don't have to be aware that the presence (or absence) of fellow ingroup members is affecting their own interests, choices, and decisions—and indeed they often aren't. Put differently, even when people are not trained to consciously reappraise an achievement situation or domain, their sense of belonging, self-efficacy, and everything that follows may become resilient implicitly, if the *situation* affords exposure to ingroup peers and experts.

Empirical Support for the Stereotype Inoculation Model

Research on Role Models

Seeing same-sex experts benefit women in science, technology, engineering, and math. We sought to test the stereotype inoculation model in the case of female students in science, technology, engineering, and mathematics (STEM; Stout et al., 2011), who are immersed in academic and professional environments where women are a small numeric minority among male peers and where stereotypes abound ques-

tioning their ability and likelihood of success (National Council for Research on Women, 2001; National Science Foundation, 2000, 2009). We investigated three broad issues: (a) whether contact with female (rather than male) scientists, mathematicians, and engineers could inoculate young women against these stereotypes and enhance their attitudes toward STEM, identification with it, self-efficacy, and interest in pursuing STEM careers; (b) whether these benefits emerge more reliably in women's implicit rather than explicit self-conceptions; and (c) the conditions under which these role modeling effects are most powerful. Using both longitudinal studies in naturalistic settings and cross-sectional lab experiments, we found that short-term media exposure and long-term personal contact with female (rather than male) mathematicians and engineers improved women's attitudes toward STEM, increased the importance of STEM to their self-concept, and enhanced their self-efficacy and career aspirations in STEM.

Echoing the theme that performance and self-concept do not always go hand in hand, women's academic performance in STEM was significantly better than that of their male peers *regardless* of the gender of STEM experts they encountered. Yet their attitudes, identification, and self-efficacy in math and engineering fluctuated substantially as a function of expert gender: Seeing female (compared to male) engineers and mathematicians improved their attitudes, identification, self-efficacy, and career interest in STEM.

The benefit of same-sex experts on the self-concept emerged most clearly in women's *implicit* rather than *explicit* self-conceptions, consistent with earlier self-concept research (Markus & Kunda, 1986; Markus & Nurius, 1986; Markus & Wurf, 1987). Specifically, contact with female rather than male scientists and engineers increased women's *implicit* preference for STEM and increased their *implicit* identification with STEM. However, their *explicit* attitudes and identification with STEM remained unaffected regardless of whom they had contact with.

Seeing female experts was most beneficial when students personally identified with them, which is consistent with past research showing that successful individuals are viewed as inspirational role models only when perceivers construe their success as self-relevant and believe that similar success is attainable for oneself (e.g., Lockwood & Kunda, 1997, 1999). Moreover, although seeing a few female scientists and engineers was not sufficient to change women's global stereotypes associating STEM with maleness, it did prevent women from applying those stereotypes to themselves and preserved their own career aspirations in STEM.

Finally, whereas women benefited greatly from contact with same-sex scientists and engineers, men's responses did not change. This is consistent with the idea

that because men constitute the overwhelming majority in STEM and are expected to be competent in these fields, the presence of additional same-sex experts does not matter to men's self-concept. In contrast, because women are relatively scarce in STEM and are negatively stereotyped in the domain, seeing even a few female experts is beneficial for women.

Similarity matters: Other evidence from role model research. Converging support for the stereotype inoculation model comes from other role model research showing that successful individuals are more likely to become personal role models if perceivers share similarities with them, personally identify with them, and see their success as attainable for the self (Asgari et al., 2010; Asgari et al., 2011; Aspinwall, 1997; Blanton, 2001; Davies, Spencer, & Steele, 2005; Haines & Kray, 2005; Hoyt & Blascovich, 2007; Lockwood, 2006; Lockwood & Kunda, 1997, 1999; Lockwood, Jordan, & Kunda, 2002; Marx & Roman, 2002; McIntyre, Paulson, & Lord, 2003; Seta, 1982; Wood, 1989). The dimension of similarity may be manifold—common academic or professional interests, similar life history, shared group membership, similar goal orientations, to name a few.

For example, in a series of studies we found that young women's implicit beliefs about their own leadership ability benefited greatly if they encountered successful professional women who were framed as similar to the self in terms of their gender, personality traits, or collegiate background (Asgari et al., 2011). However, when the same successful women were framed as unique or very different from participants, they did not improve participants' implicit self-beliefs, and in fact it sometimes backfired—deflating participants' implicit self-beliefs about leadership (see also Parks-Stamm, Heilman, & Hearn, 2008; Rudman & Phelan, 2010). This is probably because successful ingroup members who are very different from the self increase feelings of threat (Mendes, Blascovich, Major, & Seery, 2001) by making one's own leadership potential seem even more implausible. The take-home message is that successful ingroup members inspire one's self-concept *only if similarity between them and the self is salient*.

Similarity between the self and other encourages individuals to feel a personal connection with successful others, to identify with them, and perceive their success as attainable. Consistent with this idea, in a longitudinal study we found that if young women entering college had frequent and high-quality contact with successful female professors, this experience enhanced their subjective identification with these professors, and over time increased students' implicit beliefs about their own leadership ability and motivated them to reach for more ambitious career goals (Asgari et al., 2010). Both quality *and* quantity of contact with

successful ingroup members jointly enhanced young women's implicit leadership self-concept and career goals.

Even though personal contact and mentoring relationships are powerful ways to find role models (e.g., Asgari et al., 2010; Dasgupta & Asgari, 2004, Study 2; Settles, Cortina, Stewart, & Malley, 2007), ingroup members may become role models even without personal contact (e.g., Dasgupta & Asgari, 2004, Study 1; Lockwood et al., 2002; Lockwood & Kunda, 1997, 1999; von Hippel, Issa, et al., 2011). Role models may be successful individuals whom one knows about from afar via media exposure; they may be individuals with whom one has had brief contact or long sustained relationships. Research has documented the benefit of both direct contact and mediated exposure to role models—overall, the data suggest that individuals can be inspired by successful others, which benefits their self-concept whether or not they have had personal contact with them (for a partial review, see Gibson, 2004).

Role models are particularly important to minority group members in high achievement domains.

The stereotype inoculation model predicts that seeing ingroup role models in achievement contexts is more important for minority group members who are aware of negative stereotypes of their group than majority group members who don't have to worry about such stereotypes (also see Ensher & Murphy, 1997; Ragins & Cotton, 1991). This prediction is supported by our research presented earlier showing that personal contact with same-sex engineers and mathematicians benefits female students' self-concept, efficacy, and career aspirations more than male students' (Stout et al., 2011).

Converging evidence from social comparison research finds that minority group members tend to view themselves more positively after seeing a successful ingroup member than majority group members who see a similar ingroup member (Brewer & Weber, 1994). For example, Black students show enhanced self-efficacy and performance after hearing about a high performing ingroup member in a stereotyped domain and show deflated self-efficacy and performance after hearing about a low performing ingroup member (Blanton et al., 2000). Moreover, encountering a high-performing ingroup member enhances Black more than White students' self-efficacy. Similarly, encountering a high-performing ingroup member enhances women's self-concept more than men's (Lockwood, 2006; see also Marx & Roman, 2002). In the business world, seeing role models who are entrepreneurs strengthens female business students' self-efficacy more than male students' self-efficacy; moreover, increased self-efficacy has a stronger effect on women's intentions to pursue entrepreneurial careers compared to men's intentions (BarNir, Watson, & Hutchins, 2011). The

importance of role models to disadvantaged individuals makes sense if we consider that stereotype threat activates a collective mindset (thinking “we”) rather than an individual mindset (thinking “me”; see Brewer & Gardner, 1996). Encountering successful ingroup members when one is in a collective mindset ought to highlight the *similarity* between self and other, thereby inspiring oneself.

Typically, when one thinks of role models who inspire the self, individuals who come to mind are advanced in their intellectual and professional development. Another category of individuals who play a critical role in self-concept development are one’s peers in academic and professional environments. Peers have a powerful socializing effect, especially in early stages of development (D. B. Carter, 1987; Eaton, Mitchell, & Jolley, 1991; Kessels, 2005). I now turn to the role of peers in the stereotype inoculation model.

Ingroup Peers Matter

Research on Solos and Tokens

When individuals find themselves to be the only member of a social group (a solo) or one of a few in an environment comprising peers who belong to a different group (a token), it typically reduces their sense of belonging, self-efficacy, performance, and work satisfaction. Token status is defined as achievement-oriented situations in which an individual’s social group represents 15% or less of the total group (Kanter, 1977). Early work found that female tokens in business settings felt overly visible, boxed into a gender stereotype, socially isolated, and more pressurized to perform than in other business settings where women represented one third or more of the group (Kanter, 1977). Similar negative effects have been observed for African American employees working in businesses where they are the only person of their race (Sackett, DuBois, & Noe, 1991). Field studies in law schools (Spangler, Gordon, & Pipkin, 1978) and the military (Biernat, Crandall, Young, Kobryniewicz, & Halpin, 1998) confirm the negative effect of being a token (15%) and the benefit of increasing the minority group to at least “critical mass” (33%).

The negative effect of being a solo or token is particularly potent for people who belong to historically disadvantaged groups (e.g., women and ethnic minorities) compared to advantaged groups (e.g., White men) and in achievement domains in which the token’s group is negatively stereotyped rather than non-stereotyped (L. L. Cohen & Swim, 1995; Heikes, 1991; Inzlicht & Ben-Zeev, 2000, 2003; Sackett et al., 1991; Sekaquaptewa & Thompson, 2002, 2003; Yoder & Sinnett, 1985). Solos who are racial minorities and women feel that others see them as representatives of their so-

cial group (Pollak & Niemann, 1998; Sekaquaptewa & Thompson, 2002, 2003; Sekaquaptewa, Waldman, & Thompson, 2007). Solo or token status depletes individuals’ confidence in their expected performance and reduces their interest in the activity (Stangor, Carr, & Kiang, 1998; Sekaquaptewa & Thompson, 2002). It can disrupt learning and memory (Lord & Saenz, 1985) and undermine objective performance (Inzlicht & Ben-Zeev, 2000, 2003; Sekaquaptewa & Thompson, 2002, 2003). For example, African American students taking an oral exam perform significantly worse when they are the only Black person among White peers (i.e., a solo) versus when they are in a group of all Black peers (Sekaquaptewa & Thompson, 2002). Similarly, women taking a math exam perform significantly worse when they are the only woman among men (i.e., a solo) versus when they are in a group of all women (Inzlicht & Ben-Zeev, 2000, 2003; Sekaquaptewa & Thompson, 2002, 2003). In professional life, solo or token status makes individuals feel isolated and less satisfied with the work environment (Kanter, 1977; Niemann & Dovidio, 1998; Settles, 2004; von Hippel, Walsh, et al., 2011; Yoder & Aniakudo, 1997) and motivated to change group composition or leave the group (L. L. Cohen & Swim, 1995; Crocker & McGraw, 1984; von Hippel, Walsh, et al., 2011). Applying these findings to the stereotype inoculation model, it is clear that the scarcity of ingroup peers in achievement contexts undermines individuals’ feelings of belonging and self-efficacy, which in turn weaken their performance, domain identification, and career aspirations in domains where their ingroup is negatively stereotyped.

Research on Peers in Learning Groups, Dyads, and Peer Tutors

When and how do ingroup peers inoculate disadvantaged individuals against stereotypes? And what group composition of ingroup peers is most beneficial? To test this component of the stereotype inoculation model we conducted a study with women in engineering to investigate if women feel more efficacious in peer environments that have gender parity or a female majority rather than a female minority (Dasgupta et al., 2011). We systematically varied the gender composition of women in four-person engineering teams such that they were 25%, 50%, or 75% of team members and examined how it affected their appraisals of threat and challenge, actual participation in the team, and their career aspirations after team-work. Results revealed that women engineering students flourished most in teams with mostly female peers (female majority teams) compared to the other two teams. They felt most challenged and least threatened in female majority teams than the other two teams. They were also most likely to participate in the group problem-solving task in female majority teams than the other two teams. Women who

demonstrated more knowledge of engineering during team-work expressed more interested in pursuing engineering careers after the team task if they had worked in female majority and female parity teams but not if they had worked in female minority teams, suggesting that interaction with same-sex peers plays a key role in converting domain knowledge and ability into future career aspirations. Somewhat surprisingly, in our data, groups with gender parity were less beneficial than groups with female majorities. It may be the case that being around a majority of ingroup peers has a special benefit for *beginners* (like our participants), whose sense of belonging and self-efficacy in the field is relatively fragile because of the confluence of being in an early stage of skill development, in an environment where one's ingroup is virtually invisible and where negative stereotypes are salient.

Several other studies have also found that girls and women benefit from learning science and math in environments with female peers, although the evidence is mixed as to whether groups with gender parity or female majority work best (Harskamp, Ding, & Suhre, 2008; Robinson, Schofield, & Steer-Wentzell, 2005; Springer, Stanne, & Donovan, 1999; Webb, 1984). For example, when it comes to study partners in science, girls perform better if they work with female partners than male partners, whereas boys' performance does not vary by their partner's gender (Harskamp et al., 2008; also see Ding & Harskamp, 2006). Similarly, girls show more academic gains in mathematics after working with female compared to male peer tutors (for a review, see Robinson et al., 2005). Finally, girls' and women's attitudes toward math become substantially more positive after working in same-sex peer groups rather than mixed-sex peers groups (Springer et al., 1999).

Research Comparing Single-Sex and Coeducational Institutions

If contact with ingroup peers in high-achievement environments enhances individuals' self-efficacy, persistence, and career aspirations in domains where their ingroup is negative stereotyped, this benefit should be evident for women in single-sex learning environments around science and math achievement. Do women fare better in science and math if they are in learning environments with female peers only? Several studies comparing women's colleges to coeducational colleges suggest students at women's colleges are (a) more likely to major in science, math, and engineering (Sebrechts, 1993; Sharpe & Fuller, 1995; Solnick, 1995), (b) more likely to choose scientific and medical careers (Tidball, 1985; Tidball & Kistiakowsky, 1976), (c) more likely to report academic self-efficacy (Kim, 2002; Kim & Alvarez, 1995; National Survey of Student Engagement, 2003; Smith, 1990; Smith, Wolf,

& Morrison, 1995), (d) more likely to collaborate intellectually with classmates in and out of class (Kinzie, Thomas, & Palmer, 2007), and (e) more likely to implicitly believe that women are well suited for professional leadership roles (Dasgupta & Asgari, 2004) compared to female students at coeducational colleges. Because students self-select into particular types of colleges and of course random assignment into single-sex versus coed colleges is not possible, these studies try to rule out alternative explanations by using matched colleges that have similar student demographics, similar college resources, geographical locations, and so on, and by statistically controlling potential confounding variables (e.g., students' SAT scores, grade point average, race, social class, etc.).

A similar study comparing graduates of single-sex versus coeducational high schools during transition to college found that graduates of all-girls high schools reported more academic self-efficacy, higher math and computer ability, more interest in contributing to science, and more interest in majoring in engineering than female graduates of coed high schools (Sax, 2009; also see Lee & Bryk, 1986). Although a few studies have reported no institutional differences (Giele, 1987; Mael, 1998; Stoecker & Pascarella, 1991), the number and variety of studies finding differences between single-sex versus coed colleges and schools provide some support for the stereotype inoculation model that ingroup peers in stereotypic achievement domains enhance disadvantaged individuals' motivation and interest.

Research on Ingroup Friends

A central concern in adolescence and young adulthood is the need for peer acceptance (Eaton et al., 1991). Young people often experience a tension between affiliation goals and academic goals in the sense that they worry that being academically successful means losing popularity with their peers if academic success is stigmatized as nerdy or geeky in their environment (Arroyo & Zigler, 1995; Cousins, 1999; Farrell, 1994; Ford, 1992; Gross, 1989; Tyson, Darity, & Castellino, 2005). Young people often self-segregate along social identity lines; within identity groups, peers frequently reward group conforming behaviors and punish nonconforming behavior (Carter, 1987). Given this, not surprisingly, adolescents believe their popularity among peers depends on their achievement in stereotype-consistent domains (Kessels, 2005). Given the importance of peer approval, it is likely that individuals' academic interests will be heavily influenced by the interests of their friends. Several studies support this idea.

Using nationally representative samples, two studies compared girls' interest and self-efficacy in science and math with the interests of their female friends versus male friends in middle and high school (Crosnoe,

Riegle-Crumb, Field, Frank, & Muller, 2008; Riegle-Crumb, Farkas, & Muller, 2006). The authors examined the correlation between students' decisions to take advanced math and physics classes in high school and classes taken by their friends the previous year. They found that high school girls' decisions to take advanced courses in math and physics were significantly predicted by how well their *female* friends performed in the same disciplines the previous year but *not* predicted by how well their male friends performed in the same disciplines the previous year (Riegle-Crumb et al., 2006). For girls with mostly female friends, the correlation between same-sex friends' performance in math and science in one year and their own decision to take advanced courses in the same fields the subsequent year was even stronger than other girls who had few female friends (see also Crosnoe et al., 2008). The same correlation did not emerge for boys' academic decisions.

Other studies reveal that for racial and ethnic minority students, having same-race friends in high-achievement settings enhances academic success, self-efficacy, and a sense of belonging (Fletcher & Tienda, 2009; Harper, 2006; also see Oyserman, Bybee, & Terry, 2003). High-achieving Black male students at predominantly White universities consistently identified same-race friends and acquaintances as a major reason for their collegiate success (Harper, 2006). These same-race friendships were typically formed early in college through campus organizations and activities (see also Walton & Cohen, 2007; for evidence about the importance of friends in general in high achievement contexts). Converging evidence from a large longitudinal study found that students who enter college with more of their high school classmates perform better in college and are more likely to persist than others who enter college with fewer of their high school classmates (Fletcher & Tienda, 2009). Racial minority students benefit more strongly from having a big cohort of same-race high school classmates at college entry compared to White students. Together, these studies suggest that contact with ingroup peers in high-achievement settings enhances individuals' social belonging and self-efficacy without sacrificing their racial or gender identity.

Psychological Mechanisms That Drive the Impact of Ingroup Peers and Experts on the Self-Concept

Four interrelated processes are predicted to drive stereotype inoculation of the self-concept when people encounter ingroup experts and peers: enhanced sense of belonging, self-efficacy, increased challenge, and reduced threat. Several programs of research provide converging evidence for these processes.

Sense of Belonging

Individuals who are members of negatively stereotyped groups often use contextual cues to gauge their group's belonging in stereotypic contexts. For example, the presence of masculine cues in STEM environments (e.g., scarcity of women, science fiction paraphernalia, etc.) reduces women's sense of belonging in these environments and, in turn, decreases their interest in participating in STEM events (Cheryan, Meltzoff, & Kim, 2011; Cheryan et al., 2009; Davies et al., 2002; Murphy et al., 2007; Pronin, Steele, & Ross, 2004; Steele et al., 2002). Replacing masculine cues with gender-neutral ones (i.e., increasing the number of women, replacing masculine cues with educational paraphernalia, art posters, etc.) increases women's belonging and interest in participating in academic and professional events in STEM (e.g., Cheryan et al., 2011; Murphy et al., 2007).

Parallel findings emerge for racial and ethnic minorities in elite academic and professional environments where their ingroup is scarce (Purdie-Vaughns et al., 2008; Walton & Cohen, 2007, 2011). Threats to social belonging hinder racial minority students' motivation more so than their White counterparts at elite predominantly White institutions (Walton & Cohen, 2007, 2011). Interventions that affirm minority students' feelings of belonging by reminding them of their close friends at college or by framing social adversity as a common transient experience for all students in college enhances their self-efficacy, achievement-related motivation and action, grades, and health (Walton & Cohen, 2007, 2011). Along the same lines, for African American professionals, minority representation in the workplace and the organization's diversity philosophy determines their sense of belonging, comfort, and trust (Purdie-Vaughns et al., 2008). Organizations that affirm diversity either by having a racially diverse workforce or by promoting a diversity-oriented company philosophy increase Black professionals' feelings of belonging, comfort, and trust in the workplace.

Collectively, these findings show that increasing the visibility of ingroup members in high achievement academic and professional environments enhances disadvantaged individuals' sense of belonging and in turn inoculates their self-concept and motivation to remain engaged in the domain. These findings are consistent with the stereotype inoculation model. Our model goes further by proposing that diversity cues in the environment may involve successful ingroup experts who are advanced in their career or one's peers in an achievement context. Moreover, stereotype inoculation may occur by virtue of personal contact with these individuals or mediated exposure from afar. As long as perceivers *identify with* ingroup peers and experts and view them as *similar to the self*, their presence is likely to enhance social belonging, domain identification, self-efficacy, and career aspirations.

Self-Efficacy

Increased exposure to ingroup peers and experts is also likely to increase resilience by boosting self-efficacy in an achievement domain. Evidence supporting this prediction comes from studies showing that individuals are strongly influenced by social comparisons with ingroup members, especially in domains where the ingroup is negatively stereotyped. When an ingroup member performs very well in a stereotyped domain, it enhances perceivers' self-efficacy and performance, whereas when she or he performs very poorly in a stereotyped domain, it deflates perceivers' self-efficacy and performance (Blanton et al., 2000; see also Brewer & Weber, 1994; Marx & Roman, 2002). Successful social comparison targets who are outgroup members don't produce self-enhancement and may even produce self-deflation (Blanton et al., 2000).

The scarcity of ingroup peers and experts reduces individuals' self-efficacy in stereotyped domains. For example, women feel less efficacious in group tasks where they are solos or tokens in mostly-male groups versus all-female groups (Sekaquaptewa & Thompson, 2003; Stangor et al., 1998). Reduced self-efficacy, in turn, partially mediates and predicts lower performance among solos (Sekaquaptewa & Thompson, 2003). Similarly, masculine cues in computer science classrooms decrease women's self-efficacy in computer science and reduce their intention to take computer science classes (Cheryan et al., 2011)

Taken together, these data fit with the prediction in the stereotype inoculation model that people are more likely to view ingroup (than outgroup) members' success as reflecting their own future potential because they identify with the former. Subjective identification leading to self-efficacy is more likely for numeric minorities who are negatively stereotyped in a particular domain and less likely for positively stereotyped majorities.

Appraisals of Challenge and Threat

Contact with ingroup experts and peers has the potential to change one's view of adversity into opportunity; the same situation that was previously a threat now becomes a challenge. This prediction draws on theories of stress appraisal, which argue that when people face a difficult task or situation they evaluate its importance to the self and their ability to handle it successfully (Lazarus & Folkman, 1984). If they think they have the mental resources to handle it they feel challenged, but if they think their inner resources are overwhelmed by task demands they feel threatened (Drach-Zahavy & Erez, 2002). Challenge appraisals promote better performance on difficult tasks than threat appraisals (Jamieson, Mendes, Blackstock, & Schmader, 2010; Schmader et al., 2008; Tomaka & Blascovich, 1994;

White, 2002). For example, Tomaka and Blascovich (1994) found that students who appraised an upcoming mental math task as challenging performed better than others who appraised it as threatening. In the context of solo status and gender, White (2002) found among women who were solos in majority male groups, those who found the group task threatening performed worse than others who found it challenging. However, among women who were in majority female groups, perceiving the task as threatening did not harm performance as much. In other words, feeling threatened had more of a harmful effect when women were solos in mostly male groups than when they were in all-female groups.

Consistent with the aforementioned findings, the proposed model predicts that contact with a critical mass of ingroup peers, especially high-performing peers, will enhance challenge appraisals and reduce threat when individuals encounter difficulty in high-achievement domains. In support of this prediction, we recently found that women in engineering felt most challenged and least threatened when they anticipated working in engineering teams where women were in the majority rather than teams with gender parity or teams where women were in the minority (Dasgupta et al., 2011). Feeling challenged translated into more active participation and problem-solving behavior among women in female-majority teams than in female-minority teams or gender parity teams.

Future Directions and Policy Implications

Below are some future directions for research suggested by the stereotype inoculation model that need closer empirical investigation and promise to be generative, both theoretically and practically. I also elaborate on some policy implications of the model.

Timing Is Everything

Increasing contact with ingroup peers and experts is particularly important in early years of training and other periods where individuals transition from one developmental stage to another. Students beginning a new chapter of their academic life are more likely to be vulnerable to self-doubt (especially if they are a small numeric minority) than advanced peers who have weathered the early years and figured out their place in the world. A similar argument holds for young professionals entering the workforce or at the threshold of a new career stage where one's social belonging is uncertain and self-efficacy fragile. Our research provides suggestive evidence that younger students are particularly sensitive to interventions that inoculate their self-concept (Asgari et al., 2010; Asgari et al., 2011; Dasgupta et al., 2011; Stout et al., 2011); however, we have not compared beginners versus advanced students to

rigorously test any group difference. I believe a lot can be learned from examining the effectiveness of stereotype inoculation at different developmental stages of academic or professional life.

Self-Concept Change Without Awareness or Semiawareness

I started this article by proposing that life choices that *seem* subjectively free are typically more constrained than we think. Individuals are often unaware of the ways in which their own interests, self-conceptions, and choices are shaped by situational forces in achievement and professional settings leaving an imprint on their implicit self-concept. Data from our lab often reveal that exposure to ingroup experts and peers elicit systematic shifts in people's implicit self-beliefs and ingroup beliefs even though their explicit self-beliefs and ingroup beliefs remain unchanged (Asgari et al., 2010; Asgari et al., 2011; Dasgupta & Asgari, 2004; Dasgupta et al., 2011; Stout et al., 2011). This is reminiscent of a similar point made by Markus and colleagues almost 25 years ago (Markus & Kunda, 1986; Markus & Nurius, 1986). Given the limits of introspection (Nisbett & Wilson, 1977), self-concept research stands to gain a lot from assessing self-beliefs using *both* explicit and implicit measures to shed light on the myriad ways in which situational cues affect minority-group members' self-concept and their varying degrees of awareness of it. To the extent that individuals are aware of situational cues that constrain their achievement interests and decisions, they may be better positioned to seek out ingroup experts, peers, and groups as sources of support. However, if they are unaware of situational constraints and view their academic and professional decisions as solely guided by an intrinsic calling, they are more vulnerable to attrition despite talent.

Ingroup Peers: How Many Is Enough?

Although it is clear that contact with ingroup peers in high-achievement settings protects stereotyped individuals' self-concept, what is not clear is the exact group composition that's *most beneficial*. Some research suggests that disadvantaged individuals show the biggest improvement if they are in "critical mass" (typically one third) in an achievement context (e.g., Biernat et al., 1998; Kanter, 1977; Sackett et al., 1991). Other research suggests that they do best if their ingroup is in the majority in a given context (e.g., Dasgupta et al., 2011). Yet other research shows that they do best in achievement contexts with ingroup members only (e.g., Cohen & Swim, 1995; Inzlicht & Ben-Zeev, 2000; Sekaquaptewa & Thompson, 2002, 2003; Stangor et al., 1998). This unresolved issue needs more research. The answer may depend on whether

stereotyped individuals are in early stages of academic and professional development or later stages. In an early stage, homogeneous peer groups and learning environments may be more beneficial, but in a later stage with increased mastery and self-efficacy, individuals may become resilient to their numeric minority status.

Full-Cycle Research: Back and Forth Between Lab and Field

Some psychological phenomena, particularly in social psychology, benefit greatly from full-cycle research—testing ideas iteratively in the laboratory and field so that knowledge from both sources enriches understanding of the phenomenon of interest (Cialdini, 1980; see also Dasgupta & Hunsinger, 2010). In developing the stereotype inoculation model, I drew widely from laboratory experiments, field studies, case studies, and occasionally popular news reports. Our empirical research testing the model combines controlled lab experiments and messier field studies, cross-sectional research designs, and longitudinal designs in search of converging evidence of stereotype inoculation and the conditions that make it more or less likely (Asgari et al., 2010; Asgari et al., 2011; Dasgupta & Asgari, 2004; Dasgupta et al., 2011; Stout et al., 2011). Full-cycle research allows controlled tests of cause and effect, encourages investigation in theoretically interesting field environments, helps flag disjunctures between lab evidence and field evidence, and increases the chance that researchers will stumble upon new hypotheses related to stigma and stereotype inoculation in naturally unfolding environments. This multifaceted research strategy promises to reveal more, in the future, about the conditions under which individuals can successfully deflect negative stereotypes from impacting their self-concept so that their academic and professional decisions involve real freedom of choice.

Policy Implications

The primary proposal of the stereotype inoculation model—that diversifying the demographics of high-achievement settings increases the recruitment and retention of future generations of students and professionals—is consistent with the broad mission of affirmative action and other equivalent diversity policies. Evidence reported in this article shows that increased diversity benefits newcomers who are women and minorities if they see others like them in upper echelons of their organization (e.g., ingroup members who are professors at academic institutions or managers and partners in their company) and among their peers (e.g., ingroup members in one's entering class of students or cohort of new hires).

Organizational policies that promote interpersonal contact and perhaps also mentoring relationships with

ingroup experts are likely to have the strongest effects on newcomers' sense of belonging, self-efficacy, and engagement in the domain because contact personalizes ingroup experts and makes it easier for beginners to identify with them as similar others and not view them as unattainable superstars (e.g., Asgari et al., 2010; Stout et al., 2011).

Ingroup experts may be rendered visible in other ways, by highlighting their expertise and contribution to the achievement domain even if they are not part of the perceiver's organization. For instance, imagine academic curricula in STEM where the teaching of basic scientific concepts and their applications to technology, engineering, or medicine briefly highlights the work of scientists and innovators who are women or ethnic minorities. Consider other ways in which entry-level students or professionals might encounter the work of ingroup experts via professional conferences, internships, workshops, guest lectures, and so on. These opportunities become possible when organizational policies encourage curriculum development and training development that incorporates the contribution of people in the field who are usually invisible because of their small numbers.

When it comes to ingroup peers, the stereotype inoculation model suggests that organizational policies that promote the hiring or admission of underrepresented individuals in clusters or cohorts is likely to create a community of ingroup peers, enhance feelings of belonging, and in the long-run improve retention. Given research showing the detrimental effects of tokenism and solo status and the positive effects of work teams where disadvantaged individuals are in the majority, organizational policies that create opportunities for individuals to get together with similar others in high-achievement domains where they are usually solos and tokens are likely to foster greater belonging, self-efficacy, and commitment to the performance domain (e.g., some schools encourage all-girls robotics teams, some universities have active local chapters of the Society of Black Engineers). Harkening back to an earlier theme, these opportunities are likely to be critical for beginners and newcomers whose sense of belonging is uncertain and self-efficacy fragile.

A final policy suggestion involves peer-mentoring programs. Peers who are somewhat more advanced can play key roles as "near peer mentors" if organizations create peer-mentoring programs in which relatively advanced peers in academic or professional settings form relationships with younger peers who are just starting out. Peer mentoring provides opportunities for professional and social relationships to develop that foster in newcomers a sense of community in the achievement domain.

Each of these policy suggestions involves increasing the numbers and visibility of individuals who are

usually invisible or creating organizational infrastructure that connects advanced vanguards with the next generation of beginners. Although organizational policymakers have to create these environments explicitly and consciously, the effects of these environments on newcomers' feelings of comfort and belonging, self-confidence, and desire to stay rather than leave may be quite implicit and unconscious.

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