A Goal Congruity Model of Role Entry, Engagement, and Exit: Understanding Communal Goal Processes in STEM Gender Gaps

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Abstract
The goal congruity perspective provides a theoretical framework to understand how motivational processes influence and are influenced by social roles. In particular, we invoke this framework to understand communal goal processes as proximal motivators of decisions to engage in science, technology, engineering, and mathematics (STEM). STEM fields are not perceived as affording communal opportunities to work with or help others, and understanding these perceived goal affordances can inform knowledge about differences between (a) STEM and other career pathways and (b) women’s and men’s choices. We review the patterning of gender disparities in STEM that leads to a focus on communal goal congruity (Part I), provide evidence for the foundational logic of the perspective (Part II), and explore the implications for research and policy (Part III). Understanding and transmitting the opportunities for communal goal pursuit within STEM can reap widespread benefits for broadening and deepening participation.

Keywords
social roles, goals, motivation, gender, STEM, communion, stereotypes, broadening participation

A key challenge facing the United States is increasing both the quantity and quality of talent in science, technology, engineering, and mathematics (STEM). Because women continue to be underrepresented in STEM, particularly in engineering and computing, attracting women to STEM holds promise. Even very talented individuals are opting out of STEM fields, and a critical question thus is whether STEM careers are perceived as serving those goals that people—and particularly women—seek to fulfill in their careers.

We delineate a goal congruity perspective to understand how individuals select into and out of social roles to meet goals, and we elaborate this model to explore communal goal processes as related to STEM pursuits. Communal goals, in particular, differentiate STEM pathways from other career pathways and differentiate women’s choices from men’s choices. The communal goal congruity perspective posits that an important aspect of STEM decisions is the belief that STEM careers do not fulfill communal, other-oriented goals (Diekman & Steinberg, 2013). When communal goals are aligned with opportunities to fulfill those goals, goal congruity exists; when communal goals are impeded, goal incongruity exists. To the extent that people anticipate and experience STEM fields as fulfilling their valued communal goals, individuals will be more likely to enter and persist in such fields.

A Goal Congruity Framework of Role Entry, Engagement, and Exit
The social role perspective has elaborated the consequences of occupying certain social roles for perceived and actual group differences (Diekman & Eagly, 2008; Eagly & Wood, 2011; Eagly, Wood, & Diekman, 2000). In this extension of the social role framework, we explore how individuals also continually create their environment by entering, engaging in, and exiting specific social roles. This new goal congruity perspective presents a framework to understand how motives influence social role selection, and in turn how these social roles afford or impede the pursuit of goals. We posit that social roles can be viewed as an opportunity structure that individuals navigate as they pursue their valued goals. Social roles reflect the constellation of beliefs, expectations,
opportunities, and resources that are shared by the self and others; important social roles become part of an individual’s identity (e.g., my professional role may be a key part of who I am). Our framework focuses on the entry, engagement, and exit of specific social roles (i.e., roles that apply within a specific context, such as career roles). However, diffuse social roles (i.e., those that apply across contexts, such as gender roles) inform the processes laid out here, as we explain in Part II.

Figure 1 depicts anticipated and experienced goal (in)congruity as individuals enact a sequence of role decisions of anticipating roles, entering roles, and either engaging with or exiting roles. Three major constructs are central: motives (ovals in the top row), beliefs and experiences with goal (in)congruity (rectangles in the middle row), and roles (circles in the bottom row). These constructs interact across time in three phases: anticipated (in)congruity prior to role decisions (lightest shade at left); experienced (in)congruity in a particular role (middle); and psychological and behavioral responses to maintain or seek congruity (darkest shade at right). The temporal dimension of our model can be considered as happening across stages of development (e.g., an adolescent might primarily engage with anticipated incongruity, whereas an emerging adult might anticipate incongruity, experience incongruity, and exit a role).

**Phase 1: Anticipated (In)congruity**

As depicted in the left side of Figure 1, both motivation and role experiences inform how individuals engage the environment to serve their motivations. Motivation can take the shape of psychological needs that are required for positive functioning, or as behavioral motives that serve those needs (Sheldon, 2011). For example, core needs for autonomy can be served by specific behavioral motives to be self-directed; although individuals might vary in the extent to which self-direction is important, the basic need for autonomy tends to be present.

To describe goal content, our model employs the dimensions of *communion* and *agency*, which capture a broad array of human experiences (Bakan, 1966). Throughout perceptions of the self and others, attributes tend to cluster along the lines of *agency*—traits related to promoting the interests of the self—and *communion*—traits related to promoting the interests of others (Abele & Wojciszke, 2007; Fiske, Cuddy, & Glick, 2007; Judd, James-Hawkins, Yzerbyt, & Kashima, 2005). Our framework thus examines social role selection from the standpoint of these two fundamental dimensions: In
conscious and nonconscious selection of social roles, individuals seek to pursue goals related to agency, communion, or both.

The focal point of the current model is the construct of goal affordances—that is, beliefs about whether a particular social role is likely to afford or impede valued goals. For example, a particular occupational role might afford or impede valued goals, and the relevance of affordances will depend on the motives that are salient to the individual and in the context. Individuals can experience a state of “motivational readiness” where their desires align with what is available in the environment (Krulanski, Chernikova, Rozensweig, & Kopetz, 2014). Prior experience in the role can inform beliefs about whether that role will afford goal pursuit opportunities. Although primary, firsthand experience will be powerful, secondary experience is also important, especially because many role entry decisions are by definition made about roles that are wholly or partially new. These secondary experiences can take the form of observational learning (e.g., Bandura, 1986) from individuals in one’s social environment (e.g., seeing one’s family or peers in a role) or in the media (e.g., television or film depictions of the role).

Affordance beliefs are central to the model because they convey expectations about goal congruity (goal fulfillment is supported in the role) and goal incongruity (goal fulfillment is impeded in the role). This anticipated goal (in)congruity is the projection that fuels decisions about selecting into particular roles: Will this role allow the fulfillment of valued goals? These projections may be made more consciously or more nonconsciously. For example, individuals may be aware that particular motives are important, and consciously choose to enter social roles they see as affording those opportunities. On the contrary, individuals may sometimes be less aware of either their motives or affordance beliefs, and instead might gravitate toward certain roles even without elaborated conscious thought (or conscious thought may rationalize decisions made on associative bases; Gawronski & Bodenhausen, 2006; Kitayama & Tompson, 2015).

Phase 2: Experienced Goal (In)congruity

The next phase of the goal congruity model (middle section of Figure 1) focuses on what happens after individuals enter into social roles. In Phase 2, beliefs about anticipated goal (in)congruity show themselves to be more or less accurate with actual experiences of goal (in)congruity. Once an individual enters into a social role, experiences in that role shape affordance beliefs. To use Markus and Kitayama’s (2010) term, the self and the context are mutually constituted: An individual’s affordance beliefs shape entry into social roles, and experiences in social roles shape subsequent affordance beliefs.

Fit with one’s context provides a range of benefits. For example, the role congruity framework (e.g., Diekmann & Eagly, 2008) posits that individuals elicit positivity from others for acting consistently with role requirements. Within the person–organization fit literature, value congruence is a major source of fit (Kristof, 1996; Kristof-Brown, Zimmerman, & Johnson, 2005). Interviewers who perceive applicants as highly value congruent with the organization are more likely to recommend job offers, even controlling for other important factors (Cable & Judge, 1997). In meta-analyses, person–organization fit predicts attitudinal outcomes such as job satisfaction, commitment, and turnover intention (Kristof-Brown et al., 2005; Verquer, Beehr, & Wagner, 2003), as well as behavioral outcomes such as organizational citizenship behaviors, job performance, and turnover (Hoffman & Woehr, 2006; Nye, Su, Rounds, & Drasgow, 2012). In particular, the attraction–selection–attrition hypothesis (B. Schneider, 1987) elaborates how organizations selectively focus on individuals who show value congruence with the broader organization, leading to greater similarity in values over time among those who stay in the organization.

Phase 3: Seeking or Maintaining Congruity—Motivational and Role Responses

After some experience with goal congruity or incongruity, individuals respond to maintain congruity (if it is present) or seek congruity (if it is absent). As depicted in Phase 3 (right side of Figure 1), goal congruity can be sought through changes in motives or through changes in roles. Whether an individual engages motivational responses or role responses depends fundamentally on the potential flexibility of each. If it is possible to downplay the importance of the motive, individuals might disengage from the motive. However, when fundamental motives (e.g., relatedness, autonomy, competence; Deci & Ryan, 2000) are involved, an individual might choose to change the role, because these motives are more difficult to disengage from fully. If it is possible to enact the role differently to fulfill goals, then responding by changing the role responses might be favored. In the case where the motive continues to be important and the role cannot be rearranged to meet those motives, individuals might exit the role and enter a different role. We elaborate these different responses below.

Motivational responses. The effects of goal incongruity experiences on motivational engagement and disengagement depend on the extent of the incongruity experience. For short-term experiences of incongruity, the result is likely to be greater activation of the motive; for longer term experiences of incongruity, the result is likely to be disengagement from the motive (Custers & Aarts, 2007; Sheldon, 2011). In the short term, goal incongruity may heighten goal accessibility as individuals try to meet these goals. A fundamental aspect of motivation is that valued goals will be pursued until fulfilled. Long-standing research, dating back to the Zeigarnik (1927) effect, finds that unmet goals gain in strength and accessibility over time (e.g., Fishbach & Ferguson, 2007; Masicampo & Baumeister, 2011).
However, with repeated experience, goal incongruity may reduce goal accessibility: Sustained experience in a goal-incongruent environment leads people to improve their goal pursuit strategies (in which case the environment becomes goal congruent) or to disengage from goals. In part, this disengagement may occur through nonconscious processes resulting from the particular environments that people occupy. Individuals tend to activate and pursue goals that are associated with the immediate physical context (Aarts & Dijksterhuis, 2003) and social context (Aarts, Gollwitzer, & Hassin, 2004). Even if goals are explicitly endorsed by an individual, they may be automatically inhibited if perceived to conflict with the goals of the environment (e.g., Shah, Friedman, & Kruglanski, 2002). Furthermore, the negative affect resulting from failure to fulfill one’s valued goals may lead to nonconscious disengagement from these goals (Aarts, Custers, & Holland, 2007). In addition, experience with goal failure leads individuals to modify their expectations and behavioral strategies for goal pursuit (Carver & Scheier, 1998). Individuals who successfully disengage from unattainable goals experience greater well-being (Wrosch, Scheier, Miller, Schulz, & Carver, 2003).

If continued experience in a social role suggests that a valued goal will not be met, then the key question is whether to disengage from the goal or to disengage from the role. Goal engagement or disengagement then cycles back to feed into the motives that influence future role selection (as reflected in the top arrow in Figure 1). If goal disengagement is unlikely because the goals are fundamental, then role disengagement is favored as a strategy; if role disengagement is unlikely because role exit or reconstruction is not possible, then goal disengagement is favored as a strategy.

**Role responses.** Role decisions to seek or maintain goal congruity can take a number of forms. Most basic is that individuals can opt either to stay in a social role or to exit a social role: If the role is not perceived as affording valued goals, then individuals might leave the social role for another one that affords the goal (e.g., equifinality; Kruglanski et al., 2002). The literature on exit, voice, loyalty, and neglect in organizations (Rusbult, Farrell, Rogers, & Mainous, 1988; Withey & Cooper, 1989) and in relationships (Rusbult & Martz, 1995) suggests that people exit their roles when satisfaction is low, commitment is low, they do not see possibilities for change, and they have a more attractive alternative role. Individuals are more likely to speak up actively about the role problems (i.e., voice) when satisfaction is low, commitment is high, and they see a possibility for change.

However, exit decisions can be both psychologically and financially costly, and a range of possibilities exist for reconstructing or reconstruing the social role. **Reconstruction** involves behaviorally changing the role: For example, employees might negotiate different working conditions that afford valued goals, or organizations might structure opportunities for employees to do so. **Reconstruction** involves cognitively changing the content of the role: For example, students might mentally connect their activities to their broader goals. In short, individuals who are seeking congruity might try a range of strategies in their efforts to align their social roles with their valued goals, and the social structures they are embedded in might support or restrict these actions. These experiences then in turn cycle back to inform their next role selection decisions (as reflected in the bottom arrow in Figure 1).

As noted earlier, perceived goal affordances may or may not be accurate. Like any stereotype, even a perception that accurately captures a group average may be inaccurate when applied to any particular exemplar (McCauley, Jussim, & Lee, 1995). What is important is that either accurate or inaccurate goal affordances can influence social role selection. For the question of recruitment into social roles, then, the mere existence of a goal affordance belief (and anticipated goal incongruity) can shape approach to or avoidance of the role. For the question of retention into social roles, the accuracy of goal affordance beliefs (and experienced goal incongruity) is important: Individuals who enter into a social role with the expectation that they will fulfill valued goals, but find that they cannot, may select out of that social role and into a different one—one that they think will afford their valued goals.

**Summary**

Although the general principles of goal congruity apply across different goals and social roles, a particular invocation of goal congruity principles warrants attention at the present moment. The challenge of recruiting a broad array of highly qualified individuals into STEM pathways has captured public attention, particularly with regard to increasing the participation of girls and women. We propose that understanding communal goal processes in the context of STEM fields is especially important given robust and consensual beliefs that STEM does not afford communal goals. In Part I, we review the extent and nature of gender disparities in STEM pursuits, comparing these with gender disparities (or lack thereof) in other formerly male-dominated occupational fields. We then briefly review prior explanatory models. In Part II, we review the foundational logic and evidence of the model. Part III then elaborates the implications of this theoretical framework for research and policy, with particular attention to what organizations might do to integrate communal opportunities.

**Part I: Considering Gender Disparities in STEM From a Communal Goal Perspective**

The accumulating evidence in explaining women’s lack of representation in STEM has moved from an initial phase focused on ability to a second phase focused on motivation. We present a theoretical framework in which we integrate...
sociostructural elements and motivation to understand why women in particular are less likely to engage in STEM pursuits.

What Is the Problem?

Patterns of representation. The underrepresentation of women in STEM is acute within the United States. Although women hold nearly half (48%) of all jobs in the U.S. economy, they hold under a quarter (24%) of STEM jobs (Beede et al., 2011). In the United States, STEM occupations are particularly projected to grow over the next decade, relative to other occupations, but STEM degrees granted have declined relative to other degrees (U.S. Congress Joint Economic Committee, 2012). Women’s underrepresentation in STEM is particularly puzzling when considered alongside the fact that women are nearing equal representation in degrees earned in other challenging, male-dominated fields, such as medicine (49%) or law (46%; T. D. Snyder & Dillow, 2011). Since the 1970s, women have remained highly represented in occupations characterized more by engaging with people than with things, even as women have entered into high-status occupations, such as physician or lawyer (Lippa, Preston, & Penner, 2014). Female college students have strongly increased their interest in medicine and law (Astin et al., 2002); Indeed, the occupations of lawyer and physician were considered non-traditional for women in the 1980s but are not any longer (U.S. Department of Labor, 2006). In contrast, even talented women continue to opt out of many STEM fields, particularly computer science and engineering (American Association of University Women [AAUW], 2015). The key question is not simply why women are not choosing STEM fields but also what careers women are choosing instead (e.g., Jacobs, Davis-Kean, Bleeker, Eccles, & Malanchuk, 2005).

Considerable variability in gender representation exists within the domain of STEM as well (see Cheryan, Ziegler, Montoya, & Jiang, in press, for a review). Women and men within STEM tend to earn different types of degrees: Among male STEM degree holders, 48% hold engineering degrees and 31% physical and life sciences degrees; among female STEM degree holders, 18% hold engineering degrees and 57% physical and life sciences degrees (Beede et al., 2011). Within the science and engineering workforce, women are most prevalent in social science (53%) and biological and medical sciences (51%), and less prevalent in engineering (13%) or computer/mathematical sciences (26%; National Science Board, 2012). Female STEM degree holders tend to work in non-STEM occupations more than their male counterparts do. Of the 2.5 million female STEM degree holders, only 26% held a job in a STEM occupation, compared with 14% in education and 19% in health care. In contrast, of the 6.7 million male STEM degree holders, 40% held a STEM occupation, with 6% in education and 10% in health care (Beede et al., 2011). Women in STEM may thus be drawn to professions that use science and technology to directly benefit others. Women are well represented in biology and chemistry (50% and 59% of bachelor’s degrees, respectively; National Science Board, 2012), and these degrees can lead to careers in medicine and pharmacy (e.g., women are 48% of medical school graduates; Jolliff, Leadley, Coakley, & Sloane, 2012; women are 54% of pharmacists; U.S. Department of Labor, 2013). The disproportionate representation of female STEM workers in education and health care aligns with the communal goal perspective that careers that more directly afford opportunities to help others are more attractive to women.

Even after earning a STEM degree, women more than men select out of applying for research-intensive academic positions: Across six scientific disciplines, the proportion of female degree holders was larger than the proportion of female applicants for research-intensive tenure-track positions (National Research Council, 2010). However, although men are more likely to be hired into faculty positions, women who are hired tend to be retained at similar rates to men, except in mathematics (as shown in an analysis of approximately 3,000 faculty from 14 universities; Kaminski & Geisler, 2012). The general pattern of similarity in retaining female and male faculty led Kaminski and Geisler to conclude that “if women are hired, they will likely persist and that recruitment is a more pressing issue than retention in achieving gender parity” (p. 866). Within academic science, the key place to increase the representation of women appears to be at recruitment, rather than at retention.

Furthermore, women who persist in academic STEM careers enact these roles differently with regard to leadership and entrepreneurship. According to one study (Niemeier & González, 2004), women chaired departments in only 2.7% of engineering departments, 5.9% of math or physical science departments, and 12.7% of life science departments. In contrast, women chaired in 23.4% of business departments and 31.5% of humanities departments. Even when accounting for cross-discipline discrepancies in the number of senior women faculty eligible to stand for chair, women were underrepresented as chairs of STEM departments. Furthermore, even though women and men earn advanced degrees at similar rates in the life sciences, women engage in fewer commercial practices related to science such as patenting (Ding, Murray, & Stuart, 2006) or disclosure of inventions (Thursby & Thursby, 2005), even though these analyses found the scientific work of men and women to be of similar quality. At a time when need for innovation is high, the loss of female innovators’ potential is of critical importance. Understanding the reasons why women—even those retained in STEM—do not engage with leadership or entrepreneurship to the same extent as men is thus critical for fostering economic and scientific growth and for individual professional development.

Consequences of women’s underrepresentation. These patterns of different participation of women than men in STEM fields
have several consequences. First, society incurs economic and scientific losses because of the failure to recruit and engage fully the most qualified pool of potential STEM practitioners. The shortage of STEM workers in the United States has gained national political and public attention (e.g., U.S. Congress Joint Economic Committee, 2012). Lower numbers of women in STEM result in a narrower range of inquiry and progress in those fields; fields that have experienced increases in diversity also witness an increase in the range of topics pursued (e.g., greater representation of women in legislative bodies leads to more policy advocacy for topics such as education or health care; Swers, 2001, 2002, 2013).

A second consequence of women’s underrepresentation in STEM is the loss to women as a group because women are not accessing these highly valued occupations. Greater entry of women into STEM pathways could be a meaningful inroad to gender equality in occupations generally, because STEM occupations tend to be well paid and relatively protected from unemployment (U.S. Congress Joint Economic Committee, 2012). For example, economic analyses show that convergence in men’s and women’s college major choices in the 1980s led to reductions in the wage gap (Eide, 1994). As noted in economic analyses (Beede et al., 2011), women in STEM earn about 33% more than women in other occupations. Increasing the proportion of women in STEM occupations can thus narrow the gender wage gap (14% in STEM occupations, compared with 21% in non-STEM occupations). In particular, college-educated women earn a higher wage premium in STEM occupations than do college-educated men (20% wage premium for women vs. 11% for men).

A third outcome is that the lack of women in STEM fields can carry forward in constraining opportunities for future generations. The underrepresentation of women in fields such as computer science and engineering can self-perpetuate if few women enter because there are few women in these fields. Low numerical representation of women in STEM fields can create environments that cue social identity threat for women (Murphy, Steele, & Gross, 2007). For example, greater proportions of female faculty in economics departments were shown to foster greater numbers of female economics students (Hale & Regev, 2014). Women in STEM can attract future generations of girls and women to STEM, because the presence of similar models fosters entry into and persistence in careers (e.g., Riegle-Crumb & Moore, 2014; Stout, Dasgupta, Hunsinger, & McManus, 2011; Young, Rudman, Buettner, & McLean, 2013). More generally, broadening the pool of STEM talent would help address the shortage of qualified STEM educators (U.S. Congress Joint Economic Committee, 2012). In this way, more students may be introduced to and excited about STEM topics.

**Applying the Communal Goal Congruity Perspective to Understand Gender Gaps in STEM**

The goal congruity perspective examines how beliefs about how communal goals are afforded or impeded by STEM roles particularly influence STEM career decisions. In Figure 2, we specify the goal congruity model with attention to communal goals in particular. Analysis of students’ reasons for leaving STEM suggests that the mismatch between valued communal goals and perceived or actual opportunities in STEM leads to diverting from the STEM pathway. Considering communal goals—including altruistic purpose or collaborative practices of STEM—might help resolve the perennial problem of students’ “lack of interest” in STEM courses. According to Seymour and Hewitt’s (2000) in-depth study, lack of interest in the subject was the most frequently cited reason for leaving STEM majors (43% of those switching); a critical point, however, is that lack of interest was also cited as a concern by many who persisted in STEM (36% of those staying). Students’ comments detail lack of application and lack of contact with other people as contributing to lack of interest: “I wanted to stick to numbers, but deal with people as well. So I thought that accounting would be the best area for me” (female former engineering major, p. 195); a woman who switched out of math said, “I wanted to open my eyes to a more people-oriented way to use math” (p. 196).

A noteworthy feature of the communal goal congruity perspective is that the framework highlights an underlying psychological orientation that is shared by both women and men—that is, because a communal orientation reflects basic needs for relatedness or altruistic purpose, beliefs about communal goal pursuits are important in some way to everyone (see Figure 2). This importance is reflected in high endorsements of these goals: For example, in our primary data, mean communal goal endorsement is typically at or above 5.0 on a scale with 1 indicating not at all important and 7 indicating very important. As elaborated by Sheldon (2011), psychological needs can manifest in different behavioral motives. Psychological needs represent drives present in human societies across time and culture, and these needs might take different forms depending on time, culture, or individual or group factors. Thus, although humans generally evince needs to connect to others (Baumeister & Leary, 1995) or to serve or help others (Schwartz, 1992), the tendency to endorse communal goals differs by gender, with women more likely than men to endorse communal goals (see Figure 2). For example, gender differences in goal endorsement emerge more extensively for communal goals than agentic goals: Averaged across two studies, women more than men endorsed communal goals, \( d = -.52 \), whereas a smaller difference occurred for the agentic dimension, where men more than women endorsed agentic goals, \( d = .22 \) (Diekman, Clark, Johnston, Brown, & Steinberg, 2011). Thus, communal goals are meaningful to people generally, and to women especially. Because women tend to endorse communal goals more highly than men, women in particular may turn away from STEM and toward other fields.

Initial evidence documenting the importance of communal goal congruity processes in STEM pursuits examined the goals, goal endorsement beliefs, and career interests of large
samples of undergraduate students, drawn from a wide range of majors. As shown in Figure 3, goal affordance beliefs reflect that STEM careers are thought to impede communal goals to work with or help others. Particularly interesting is that STEM fields are rated as significantly less likely to afford communal goals than other formerly male-dominated but non-STEM fields—precisely those fields that have seen larger influxes of women (e.g., law, medicine; Diekman, Brown, Johnston, & Clark, 2010; Diekman et al., 2011, Experiment 1b).

Finally, as shown in Figure 4, given the robust stereotypes that STEM fields inhibit communal goals, endorsing communal goals is negatively associated with interest in STEM (Diekman et al., 2010). In contrast, communal goal endorsement is not associated with interest in male-stereotypic but non-STEM careers (e.g., law, medicine), and communal goal endorsement is positively associated with interest in female-dominated careers (e.g., nursing). Moreover, the negative relationship between communal goals and STEM interest holds even when controlling for other robust predictors, such as self-efficacy and experience in math and science. Knowing about a person’s communal goal orientation thus provides new and unique information about his or her inclination toward a STEM career. Finally, communal goal endorsement underlies gender differences in STEM interest; in short, women tend to endorse communal goals more than do men, and this gender difference in communal goal endorsement predicts gender-differentiated STEM interest. This converging evidence thus suggests that communal goal processes provide useful and unique prediction of STEM-related attitudes.
careers. (d) college science (all levels, except for elementary school math (d = −.01) and (d) courses (2014) found a similarly slight female advantage for math assignments based on 369 samples (Voey & Voey, 2014). Similarly, a meta-analysis of gender differences in teacher-

advantage (Lindberg, Hyde, Petersen, & Linn, 2010). In math performance to be (d) students tested between 1990 and 2007, estimated the effect size (d = .15). The small female advantage in grades is apparent at all levels, except for elementary school math (d = −.01) and college science (d = .01; data not available for graduate-level science). Although Hedges and Nowell (1995) found boys to be especially overrepresented among the most talented students, recent analyses find nearly equal variability in male versus female math performance scores (variance ratio = 1.08; Lindberg et al., 2010). This convergence of the previous gender gap in mathematics performance emerges even on complex mathematical problems (Hyde, Lindberg, Linn, Ellis, & Williams, 2008) and among the most talented students (Hyde et al., 2008; Hyde & Mertz, 2009). Data collected from 1990 to 2009 show a fair amount of gender similarity in advanced mathematics and science courses in high school (National Science Board, 2012). High school girls and boys take advanced mathematics courses at generally equivalent rates (e.g., 73.5% for boys and 77.7% of girls for Algebra II; 29.4% of boys and 30.3% of girls for trigonometry and statistics/probability). Furthermore, high school girls are more likely than high school boys to take advanced classes in biology (49.9% of girls and 39.4% of boys) and chemistry (72.4% of girls and 66.7% of boys), and nearly as likely as boys to take advanced classes in physics (41.5% of boys and 35.9% of girls) or engineering (5.6% of boys and 1.1% girls). Boys and girls thus appear to be performing at generally similar levels of ability in mathematics and science.

Ability-focused explanations also fail to explain why women would enter some math-intensive fields but not others. For example, women earn a substantial proportion of higher degrees in mathematics: In 2008-2009, 43.26% of bachelor’s degrees in mathematics and statistics were awarded to women, as well as 41.20% of master’s degrees and 31.01% of doctoral degrees (Snyder & Dillow, 2011; Table 323). These numbers are certainly well beyond what might be expected if women were deficient in higher mathematical ability. Moreover, analyses of nationally representative samples, in three cohorts ranging from 1982 through 2004, found that gender differences in high school achievement did not account for the gender differences in declaring a college major in physical sciences or engineering (Riegle-Crumb, King, Grodsky, & Muller, 2012), even across multiple aspects of high school achievement (i.e., grade-point average [GPA] or standardized tests) and when examining either the gender differences in average achievement or gender differences at the upper levels of the distribution. Overall, the patterns of convergence over time, along with girls’ excellent performance in mathematics courses, have led various reviewers to conclude that men and women show similar aptitude for mathematics (Halpern et al., 2007; Spelke, 2005).

Explanations for the Lack of Women in STEM

The question of why women are underrepresented in STEM, particularly in some fields and at the highest levels, has been the focus of a wide range of research studies. We review evidence for explanations related to both competence (i.e., Do women and girls have the ability to achieve in STEM, and are they ascribed this ability by others?) and motivation (i.e., Do women and girls want to achieve in STEM?).

“Can they?” Explanations related to actual ability. Much previous research about gender-differentiated STEM pursuits has focused on ability—that is, do girls and women have the same mathematical and scientific talents as boys and men? The documentation of gender differences in underlying cognitive abilities is challenging, and differences vary in nuanced ways across methods, samples, ages, or culture (D. I. Miller & Halpern, 2014). We limit our review here to meta-analytic evidence, which provides effect size estimates across multiple studies.

Meta-analytic evidence, based on over 1 million U.S. students tested between 1990 and 2007, estimated the effect size in math performance to be $d = .05$, indicating a slight female advantage (Lindberg, Hyde, Petersen, & Linn, 2010). Similarly, a meta-analysis of gender differences in teacher-assigned school grades based on 369 samples (Voyer & Voyer, 2014) found a similarly slight female advantage for math courses ($d = .07$) and a female advantage for science courses ($d = .15$). The small female advantage in grades is apparent at all levels, except for elementary school math ($d = −.01$) and college science ($d = .01$; data not available for graduate-level

Figure 4. Effects of communal goal endorsement on interest in careers.
Note. STEM = science, technology, engineering, and mathematics.

“Do they want to?” Motivational explanations. Given the accumulating evidence that girls and women show similar aptitude for mathematics and science as do boys and men, it is time for a critical shift in the focus of explanatory theory: Rather than asking whether women and girls can perform in STEM fields, we need to ask whether girls and women want to perform in STEM fields—and if not, why not? Despite
gender similarities in mathematics performance, gender differences in mathematics attitudes and affect persist, with boys expressing more positivity toward mathematics (Else-Quest, Hyde, & Linn, 2010; Hyde, Fennema, Ryan, Frost, & Hopp, 1990). Ceci, Williams, and Barnett (2009) conclude their comprehensive review by positing gender differences in interests and lifestyle preferences as promising explanations for the gender gap in STEM pursuits. Understanding such gender differences in motivation, even in the context of gender similarities in mathematical and scientific aptitude and performance, is precisely the focus of the communal goal congruity perspective.

Moreover, the time is ripe to consider explanations that focus on ability or perceived ability along with motivational explanations because these beliefs and motives are inextricably linked. The breadth of abilities among girls and women contributes to their STEM decisions (Valla & Ceci, 2014). Young women are more likely to score highly on both the quantitative and the verbal sections of the SAT than are young men, and individuals with this profile are less likely to select into math-intensive fields (Wang, Eccles, & Kenny, 2013). Women’s decisions to enter into non-STEM educational pathways reflect that they have more choice, rather than less ability. We consider two clusters of explanations—gender differences in encountered stereotyping and prejudice, and gender differences in self-efficacy and identification—before elaborating the case for examining communal goal processes.

Women divert from STEM pathways because of gender stereotypes and prejudice. The evidence for continued gender stereotypes related to STEM is abundant. For example, stereotypes that pair men with math have been demonstrated at implicit levels; individuals may be unaware that they hold these associations, or that these associations can influence their behavior (Nosek, Banaji, & Greenwald, 2002). Implicit stereotypes that pair boys with math have been shown in children as young as 7 years old (Cvencek, Meltzoff, & Greenwald, 2011; Cvencek, Meltzoff, & Kapur, 2014). Moreover, both male and female science faculty have shown gender bias in preferring male over female applicants for a lab manager position, even when qualifications were matched experimentally (Moss-Racusin, Dovidio, Brescoll, Graham, & Handelsman, 2012; but see Williams & Ceci, 2015, for evidence of reverse preference by faculty among highly qualified applicants for a hypothetical faculty position). Scientific abstracts that were ostensibly authored by a male versus female scientist were rated as higher in quality (Knobloch-Westerwick, Glynn, & Huge, 2013). Implicit stereotypes pairing men with math/science predicted how much individuals in an “employer” role overestimated men’s performance on a math task and underestimated women’s performance (Reuben, Sapienza, & Zingales, 2014). For all of these reasons, beliefs about ability might shape motivational differences to enter into and persist in STEM fields, even given increasing female achievements in mathematics and science.

Particularly important is that girls’ and women’s intrinsic motivation may be undermined by widespread gender stereotypes about math and science. For example, stereotypic beliefs can function as self-fulfilling prophecies (Geis, 1993), leading girls to gain less exposure to math and science. Although the gender gap in formal math exposure (e.g., number of courses) has narrowed (Hyde et al., 1990), boys tend to receive greater exposure to math and science through informal means, such as hobbies, games, and sports. Differential exposure to video games, for example, has been tied to gender differences in spatial cognition, which can be reduced with specific training (Terlecki & Newcombe, 2005). Differential exposure to technical material can facilitate greater interest in technical skills among boys than girls, thus leading to boys’ advantage on measures of technical aptitude; exposure can drive interest and knowledge gain within a specific domain, given gender similarities in general mental ability (Schmidt, 2011). Moreover, cultural stereotypes are reproduced, sometimes without awareness or knowledge, by parents and teachers. An observational study of boys’ and girls’ interactions with science exhibits at a children’s museum found that even though boys and girls approached the exhibit at equal rates and asked equal numbers of questions, parents spent more time explaining scientific principles to boys than to girls (Crowley, Callanan, Tenenbaum, & Allen, 2001). Despite the growing evidence about similarity in mathematical and scientific abilities of boys and girls, strong gender stereotypes still influence socializers’ attitudes and behaviors. Differences in exposure and encouragement can foster the continuing gender differences that are observed in attitudes and interest in mathematics and science, even as achievement and course performance move toward gender similarity.

Women divert from STEM pathways because of lower self-efficacy or identification. Given robust cultural stereotypes that pair men with math, women and girls may perceive themselves as less skilled in math and science than do men and boys. One’s perceived self-efficacy in a given academic domain clearly predicts positivity toward the academic domain and persistence in the domain and related career fields (Bussey & Bandura, 1999; Eccles, 1994; Lent, Brown, & Hackett, 1994). Expectancies about success are related to self-evaluations of skill: For example, Beyer (1990) found that women held lower expectancies than men of their performance on male-stereotypic tasks (i.e., politics and sports-related tasks), which were in turn related to their self-evaluations of their performance. In contrast, men did not hold lower expectancies than women of their performance on female-stereotypic tasks (i.e., fashion and celebrities). In a task where candidates projected their own performance on simple math tasks (where men and women perform similarly), men were more likely to overestimate and women were more likely to underestimate their performance (Reuben et al., 2014). Beliefs that a field requires “genius”—innate talent rather than hard work—are more
prevalent in male-dominated fields, such as physics (Leslie, Cimpian, Meyer, & Freeland, 2015), and dampen women’s motivations to pursue such fields (Smith, Lewis, Hawthorne, & Hodges, 2013). Women’s career choices are thus in part driven by their self-assessments of being lower in math ability than men (Correll, 2001, 2004). Indeed, because individuals gauge their talents in part by comparing across performance in different dimensions (Möller & Marsh, 2013), excellent performance in one domain (e.g., verbal) might diminish the impact of very good performance in another domain (e.g., math).

In addition, even individuals who view themselves as capable in math and science may not identify with math and science. The threat of confirming cultural stereotypes about women’s incompetence at math has far-reaching negative consequences, including the sense that one’s social identity is devalued in a particular field (Steele, Spencer, & Aronson, 2002). Stereotype threat—the fear of confirming negative cultural stereotypes about one’s group—has been shown to decrease working memory (Beilock, Rydell, & McConnell, 2007), learning (Rydell, Shiffrin, Boucher, Loo, & Rydell, 2010), motivation (Davies, Spencer, Quinn, & Gerhardtstein, 2002; Davies, Spencer, & Steele, 2005), and interest in careers or tasks (Davies et al., 2002). These social identity threats lead to STEM domain disidentification through changes in achievement orientation, reduced sense of belonging, and reduced intrinsic motivation. Women with stronger implicit stereotypic associations between science and men identify less with science and hold less positive attitudes toward science, whether measured implicitly or explicitly (Young et al., 2013). Women who highly identify with their gender and who implicitly associate men with math are less likely to associate math with the self, even when they have selected into math-intensive majors (Nosek et al., 2002). Moreover, high gender identification paired with high implicit stereotyping predicted weaker performance on a mathematics final exam, as well as less intent to pursue a math-related career (Kiefer & Sekaquaptewa, 2007). Overall, continued encounters with beliefs that women are less talented or committed to STEM can create conditions under which even highly qualified women might be motivated to pursue other career paths.

Summary

Although gender stereotypes pairing men and boys with science/math have continuing legacies for the motivation of women to pursue careers in STEM, women have overcome similar obstacles in other fields. Other fields that have achieved gender equality, such as law and medicine, were extremely male dominated in the 1970s, and thus were subject to similar barriers of women entering as outsiders. Thus, although explanations based on stereotypic identification or violation provide an important source of women’s opting out of STEM, they are not sufficient to explain why women’s rate of increase in STEM fields is slower than in other fields where these barriers have also been present.

The explanations reviewed thus far for why women would choose non-STEM fields focus on the ways in which women or girls are not perceived as having the qualities to succeed in STEM roles. We shift the focus now to whether STEM roles are perceived as having the qualities to attract women and girls. The communal goal congruity perspective thus joins other research that emphasizes the role of motivation in understanding STEM pursuits (e.g., Ceci et al., 2009), and the consideration of social role processes can provide a framework to understand how broad cultural expectations (i.e., gender roles) produce internalized motivational states (i.e., communal goals), which then influence attitudes and behaviors relevant to STEM pursuits.

PART II: The Communal Goal Congruity Perspective of STEM Entry, Engagement, and Exit

The goal congruity perspective examines the gender gap in STEM decisions from a new angle: Rather than focusing on how to align women and girls more closely with men and boys by increasing self-efficacy or experience in math and science, this research focuses on what many women and girls—and communally oriented individuals generally—seek in careers.

Phase 1: Anticipated Incongruity of Communal Goals and STEM Roles

Communal motivation. Communal, other-oriented goals tend to be important to people. These goals are part of a broad cluster of prosocial attributes (e.g., morality) that can facilitate smooth social functioning (Diekman & Clark, 2015). The fulfillment of communal goals such as helping others and being with others can serve important needs, such as belonging (Baumeister & Leary, 1995; Fiske, 2004), relatedness (Deci & Ryan, 2000), or affiliation (Hill, 1987). Communal attributes lead to positive consequences for the self and others. One example is that individuals who value communion reported more frequently receiving and providing social support, and their endorsement of communal goals was related to positive outcomes, such as feeling more peaceful, prosocial, engaged, empathetic, cooperative, and connected to others (Crocker & Canivezzo, 2008). Moreover, volunteering appears to buffer the link between stress and mortality (Poulin, Brown, Dillard, & Smith, 2013), as well as stress and psychological distress (Poulin, 2014). Communal opportunities offer particular benefits within occupational roles: Collaboration with colleagues predicts scientific productivity (Landry, Traore, & Godin, 1996; Lee & Bozeman, 2005), and workers whose jobs allow them closer contact with the beneficiaries of their help report greater motivation.
and exhibit greater persistence (Grant, 2007; Grant et al., 2007). Thus, fulfilling communal goals benefits the community, specific others, and the self.

Consistent with the centrality of communion to social life, both communal traits and behavior are evaluated extremely positive (Abele, Uchronsfolk, Suitner, & Wojciszke, 2008; Eagly & Mladinic, 1989; Rudman & Goodwin, 2004), and social norms include expectations that individuals will enact communal traits such as being friendly, polite, and helpful (e.g., Schwartz, 1977). For example, a child’s communal tendencies as rated by peers and teachers (e.g., “This child is helpful to peers.” “This child is kind to peers.”) positively predict subsequent social acceptance, even when controlling for aggressive tendencies (Crick, 1997). The tendency to consider the needs of others, balanced against the needs of the self, has been shown to be advantageous in career performance across a wide range of occupations and contexts (Grant, 2013). Communal information receives priority in information processing: Individuals recognize communal words faster than agentic words, and are more likely to spontaneously mention communal than agentic information when describing other people (Abele & Bruckmüller, 2011).

Although many predictions of the goal congruity model hold for communal goals generally, greater precision can be obtained through specifying the type of communal goal that is important to a particular person or in a particular situation. Communal goals can involve helping others—that is, providing emotional or material support—or by working with others—that is, acting in concert with others, either physically or psychologically (Diekman & Steinberg, 2013). In addition, collaboration and altruism may involve connecting with distal others, such as society or a broader community, or proximal others, such as a mentor or lab mates. Given that the initial step must be to begin investigating communal goals in the context of STEM at all, we focus on the broader umbrella construct of communal goals and affordances here, and return to the question of particular communal opportunities in discussing research directions in Part III.

Why not agentic motivation? Agentic and communal motives (Bakan, 1966) can influence role decisions, but the communal dimension particularly deserves attention when explaining the gender gap in STEM pursuits. Gender differences in achievement motivation have narrowed over time, with more recent data tending to show fairly small or nonexistent differences (see Eagly & Diekman, 2003, for a review). Indeed, a recent Pew Report (Patten & Parker, 2012) found that young women especially stated that it was very important to have a high-paying career (66% of women vs. 58% of men aged 18-34). A meta-analysis of job attribute preferences found that the tendency for men more than women to value freedom, leadership, and challenge in their work narrowed from the 1970s through the 1990s (Konrad, Ritchie, Lieb, & Corrigall, 2000). Moreover, attributing women’s lesser participation in STEM to their lack of achievement motivation is an untenable argument when considering women’s increased presence in achievement-oriented careers such as business, law, medicine, or politics.

Financial motivation also fails to adequately explain women’s tendency to opt out of STEM. Although many of the careers with the most growth in women’s representation (e.g., medicine, law, business) are highly remunerative, STEM occupations tend to yield higher earnings than non-STEM occupations. For example, a U.S. Department of Commerce report found that average hourly earnings were 26.7% higher in STEM versus non-STEM occupations among bachelor’s degree holders; 40.0% higher for workers with some college or an associate’s degree; and 59.6% higher for those with a high school diploma or less (Langdon, McKittrick, Khan, & Doms, 2011). Moreover, STEM fields have experienced approximately half of the unemployment rate of other fields (Langdon, 2011), and they are predicted to grow more than other fields (U.S. Congress Joint Economic Committee, 2012). Thus, if motivations for job security and financial remuneration are primary factors in women’s career choices, higher levels of women’s STEM representation would be expected given the clear economic benefits of these jobs.

Gender differences in communal motives. A wide range of evidence finds that women endorse communal goals more than do men. The distinction between needs and behavioral motives (see Figure 2) provides a framework to understand both gender similarity and gender difference. Psychological needs are posited as necessary for the positive functioning of people generally, but needs might be expressed in different motives. For example, both women and men have needs for belonging (Baumeister & Leary, 1995) and relatedness (Deci & Ryan, 2000). However, those needs might be expressed differentially given gender norms, and pursued through different behavioral strategies (see Diekman & Eagly, 2008). Thus, a similar psychological need (belonging, purpose) might be expressed through different behavioral motives (higher or lower communal goal endorsement).

Goals related to communion and agency are pursued by both men and women, and our review of gendered patterns in endorsement of communal goals is thus consistent with other reviews that find that gender differences reflect differences in degree of endorsement (i.e., quantitative differences) rather than in kind of endorsement (i.e., qualitative differences; Carothers & Reis, 2013). Both goal selection and goal pursuit methods align with diffuse gender roles (Diekman & Eagly, 2008). Such role-congruent motivations occur because of rewards and punishments associated with role congruity and incongruity. When individuals violate the expectations associated with their roles, they are more likely to elicit negative reactions from others (e.g., Rudman & Fairchild, 2004; Rudman, Moss-Racusin, Phelan, & Nauts, 2012). Moreover, these role expectations are often internalized, so
that punishments or rewards are self-initiated. For example, individuals for whom traditional gender norms were highly relevant experienced greater positive affect after remembering or experiencing a gender-stereotypic interaction, whether in experimental studies (Wood, Christensen, Hebl, & Rothgerber, 1997) or in naturalistically occurring interactions recorded in daily diaries (Witt & Wood, 2010).

Pohlmann’s (2001) analysis of self-reported goals found that both sexes considered agentic and communal goals important, but the majority of women (60.2%) rated communal goals as more important than agentic goals, whereas a majority of men (61.6%) rated agentic goals as more important. Similarly, Roberts and Robins (2000) found that female college students were more likely than male college students to endorse helping others as a life goal. Empirical examinations of self-reported attributes consistently find that women more than men endorse traits related to communion. For example, a meta-analysis of standardized personality tests (Feingold, 1994) documented greater tender mindedness among women than men ($d = -0.97$). A meta-analysis including adult samples in 25 different cultures (Costa, Terracciano, & McCrae, 2001) showed that women, more than men, reported greater warmth ($d = -23$) and tender mindedness ($d = -28$), and data integrated across 127 samples (Schwartz & Rubel, 2005) showed that women, more than men, endorsed the values of benevolence ($d = -29$) and universalism ($d = -21$). Finally, adult women tend to report greater other interest than do men (Gerbas & Prentice, 2013). All of these different traits share a focus on other people; across a wide variety of empirical demonstrations, women more than men display an orientation to care about others.

Moreover, gender differences in communion have remained relatively stable, even in the face of increasing gender similarity in other domains. Twenge’s (1997) meta-analysis of self-reported personality traits revealed that the gender difference in agentic traits diminished from the 1970s to the 1990s, primarily because of women’s adoption of these traits. In contrast, the gender difference in communal traits across this time period remained stable. In a cross-temporal study of sociopolitical attitudes, Eagly, Diekman, Johannesen-Schmidt, and Koenig (2004) found that women more than men endorsed attitudes reflecting social compassion and traditional morality, both of which were argued to stem from a concern for others’ well-being. The gender difference in these attitudes was stable from the 1970s through the 1990s.

The stability of women’s communion in recent decades aligns with the stability of women’s caregiving roles, as predicted by social role theory (Eagly et al., 2000). For example, in the United States, although women have entered male-typical roles, they have maintained responsibility for female-typical roles (Eagly & Diekman, 2003). Women have retained primary responsibility for caregiving, even as they have entered the paid workforce (Bianchi, Robinson, & Milkie, 2006). Within the paid labor force, women tend to hold communally demanding jobs (Cejka & Eagly, 1999). Another important stabilizing factor is that these communal traits are highly regarded by others. Communal traits elicit extremely positive evaluations (Eagly & Mladinic, 1989), which are shared by both men and women (Rudman & Goodwin, 2004) and are predicted to continue into the future (Diekman & Goodfriend, 2006). Socialization of communal traits begins early in childhood and is incorporated into chronic self-perceptions and motivations. For example, girls more than boys show evidence of a more relationally interdependent self—that is, girls tend to see the self as fundamentally connected to other people (Cross & Madson, 1997), and women tend to meet interdependence needs through close dyadic relationships, whereas men meet interdependence needs through larger collectives (Gabriel & Gardner, 1999; Gardner & Gabriel, 2004). If communion is a central and steady aspect of the female gender role, it is unsurprising that women would seek careers that fulfill communal goals.

In addition to more highly endorsing communal values than men, women might be more able to choose careers on the basis of those values. Although women generally increasingly earn equal or greater salaries than their husbands (Raley, Mattingly, & Bianchi, 2006), even higher earning wives tend not to consider themselves providers, and both spouses work to preserve men’s identities as providers (e.g., Tichenor, 2005). Women’s secondary breadwinner status may provide them greater flexibility to choose careers on the basis of personal values rather than on income. In a nationwide sample of college seniors (Higher Education Research Institute, 2010a), women were more likely than men to rate that the “personal expression of values” is very important or essential to their choice of a career path (73.0% of women vs. 64.5% of men). The goals that men more than women report as very important or essential in their career choices reflect men’s social roles as breadwinners: College men value high-income potential more than do women (62.7% of men vs. 55.3% of women), as well as social recognition or status (41.2% of men vs. 33.6% of women). Similarly, college men rated “high pay” as more important than did women ($d = .50$; Morgan, Isaac, & Sansone, 2001), although some recent data among an adult sample suggest that this gap may be closing or reversing (Patten & Parker, 2012). Overall, the constellation of an individual’s social roles (gender roles, career roles, and family roles) combines to influence his or her career choices.

Affordance beliefs: STEM careers are believed not to afford communal goals. The belief that STEM careers impede the pursuit of communal goals means that the gender gap in STEM careers may remain despite the erosion of other barriers, unless communal goal incongruity is addressed. In particular, understanding the sources, mechanisms, and consequences of goal affordance stereotypes can offer a route to increasing participation in STEM. As shown in Figure 3, STEM careers are believed to be less likely to fulfill...
communal goals than female-stereotypic careers or than other male-stereotypic but non-STEM careers. However, individuals who do see the communal opportunities within STEM tend to have more positive attitudes toward and engage more in STEM (Thoman, Brown, Mason, Harmsen, & Smith, 2015; Weisgram & Bigler, 2006). Moreover, individual differences in believing that STEM affords communal goals more strongly predict positivity toward and motivation to pursue STEM than individual differences in endorsing communal goals (Brown, Thoman, Smith, & Dickman, 2015).

The belief that STEM careers impede communal goals appears to be robust and consensual. These beliefs are endorsed by both women and men, and by STEM majors and nonmajors (Diekmann et al., 2011). Likewise, perceptions of the goals afforded by physical/mathematical sciences, compared with education/social services or medicine, did not differ by gender (Morgan et al., 2001). Such beliefs might emerge in childhood, as demonstrated with other career value affordances (Weisgram, Bigler, & Liben, 2010). Moreover, in addition to explicit stereotypes about goal affordances (see Figure 3), implicit measures reflect a dissociation between STEM and communal goals. Using Implicit Association Tests (IATs; Greenwald, McGhee, & Schwartz, 1998), we found that participants less easily associated science (vs. medicine) with communal constructs such as warmth (vs. power) and together (vs. alone; Diekmann et al., 2011, Experiment 1c). These implicit associations can exert influence beyond the awareness or control of individuals; for example, a female engineering major may retain nonconscious beliefs that may associate engineering with individualized work, and these nonconscious associations might direct her tendencies to approach or avoid specific engineering activities.

The dissociation between STEM and communal goals can result from the lack of direct connection between STEM practitioners and the people who benefit from their work. In an unpublished investigation both proximal and distal communal affordances, science and engineering careers were perceived as less likely to fulfill proximal communal goals (such as direct helping) than distal communal goals (such as helping society; Steinberg, 2015). Similarly, a qualitative study by the National Academy of Engineering (Committee on the Public Understanding of Engineering Messages, 2008) found that K-12 students had trouble connecting engineers with those who help. As one teenager noted, engineers are “behind the scenes helping people” (p. 59), unlike doctors who visibly influence their beneficiaries. Cunningham, Lachapelle, and Lindgren-Streicher (2005) found that among elementary school students, the majority thought that engineers repair cars, install wiring, and drive machines, whereas a minority of students reported that engineers designed things and worked as a team. Even adults may not be aware of the range of functions that engineers perform. The report from the Committee on the Public Understanding of Engineering Messages (2008) found that whereas the majority of respondents agreed that engineers create economic growth (69%) and preserve national security (59%), fewer agreed that engineers save lives (14%) or are sensitive to societal concerns (28%). In another study (Klotz et al., 2014), both engineering and nonengineering students were fairly unlikely to see engineering as related to disease, food availability, or water supply, even though these are key issues that engineers could contribute to in terms of sustainability. To the extent that students believed that engineering improved quality of life or saved lives, they were more likely to pursue engineering.

Another reflection of the noncommunal content of stereotypes about STEM comes from the finding that drawings of scientists tend to show them alone: Indeed, one study of teachers found that scientists were drawn as solitary, whereas social scientists were drawn with other people (MacDuffie, 2001). Moreover, even those in STEM majors see their fields as less connected to personal values than do students entering other fields. In a survey of college seniors (Higher Education Research Institute, 2010b), those pursuing careers in engineering were unlikely (14%) to report that it was “essential” for their career to reflect their personal values, compared with students pursuing careers in teaching (28%), law (27%), or medicine (24%).

Role-relevant experience. Like other stereotypes, beliefs about the goals afforded by careers emerge from multiple sources, including personal experience, observations of others, and media representations; these previous role-relevant experiences form the basis of affordance expectations (see Figure 2). Personal experience includes an individual’s own direct experience and history with STEM in both formal and informal settings. Unpublished data from our laboratory suggest that these communal experiences are important. Individuals who report greater experience of communal activities in their science and mathematics education (e.g., mentoring, being mentored, working in groups) are more likely to believe that STEM affords communal goals, and in turn express greater interest in pursuing a STEM career, even controlling for quantity of experience in mathematics and science (Steinberg & Diekmann, 2016). These communally oriented science and math educational experiences are more frequently reported in China than in the United States and help explain cultural differences in communal goal affordance beliefs and STEM interest (Brown, Steinberg, Lu, & Diekmann, 2016). Especially important is that the extent of communal experience in science and mathematics predicts beliefs about communal goal affordances, above and beyond mere quantity of experience (Brown et al., in preparation; Steinberg & Diekmann, 2016). Thus, it may not be simply quantity of experience that shapes STEM interest but the particular communal quality of those experiences.

When individuals lack direct personal experience with STEM fields, observational learning becomes even more
important. Through observing others’ experiences, including the consequences of their decisions, people gain important information without having to experience the same events directly (e.g., Bussey & Bandura, 1999). Drawing from the stereotype formation literature, one prediction is that at low levels of experience, stereotypic information about groups will be highly influenced by particular group exemplars; as experience increases, an abstract stereotype will form (Sherman, 1996). Thus, even brief exposure to actual STEM practitioners can change beliefs about what their careers involve. For example, Fermlab (2010) documented pictures of scientists drawn by seventh graders before and after they spent the day visiting scientists in their labs. Afterward, the pictures reflected images that scientists were more approachable, friendly, and less “geeky.” Therefore, exposure to information emphasizing the communal nature of STEM careers may be especially effective in changing STEM attitudes among those with limited experience. For example, an intervention with middle school girls (Weisgram & Bigler, 2006) asked female scientists to incorporate information about how they helped others in their careers, and girls who internalized this altruistic message increased their interest in science. Furthermore, exposure to STEM practitioners who integrate communal goals in STEM can help foster these beliefs among students. For instance, the extent to which presenters at a 1-day intervention focused on communal aspects of their scientific work predicted students’ communal affordances, their sense of fit in science and math careers, and their science career interest (Belanger, Diekman, & Weisgram, 2016).

The STEM-related experiences of close others, such as parents or peers, can inform beliefs about STEM, and thus help dispel inaccurate stereotypes. Parents can also communicate the utility of the STEM fields to their children. When an intervention increased mothers’ perceptions of the usefulness of science and math, their children also perceived science and math as more useful and took a greater number of advanced math courses than other students (Harackiewicz, Rozek, Hulleman, & Hyde, 2012). Even brief experience with computer science majors who conform to or break the mold of the “geeky” computer science major can influence interest in computer science up to 2 weeks later (Cheryan, Drury, & Vichayapai, 2013; Cheryan, Sty, Vichayapai, Drury, & Kim, 2011). In part, these patterns occur because the experiences of close others can disambiguate what is involved in the field. For example, Harackiewicz and colleagues’ (2012) intervention described many ways in which STEM is used in daily life and careers, including socializing with friends and when helping people in a range of professions.

Another important cue that might be signaled by STEM practitioners is the extent to which a communal orientation is accepted and beneficial in the field. Following from this principle, the goal congruity model offers a distinctive reason for why role models might be particularly important in recruiting women to STEM fields. In addition to providing an example of success, work/family balance, and overcoming prejudice, female STEM role models might communicate that their field allows the fulfillment of communal goals (see Diekman, Weisgram, & Belanger, 2015, for a review). In unpublished data from our laboratory (Clark, Fuesting, & Diekman, 2016), fictional male and female scientists were equally likely to cue that science affords communal goals, and communally oriented individuals especially inferred that science affords communal goals when they learn about a female scientist who is prototypic of her gender.

Finally, beliefs about the goals integral to STEM are transmitted throughout society through media representation. Social learning occurs through observation of one’s direct environment, as well as through the symbolic environment of the mass media (Bandura, 2001). In a study of middle school–aged children taking the Draw a Scientist Test, commonly cited sources of drawings were TV/films (37%), their own imagination (10%), and someone they knew (8%; Steinke et al., 2007). In general, STEM is portrayed as incompatible with communal goals. For example, a content analysis of the portrayal of scientist characters in children’s television shows (Long et al., 2010) found that scientists were portrayed as caring in a slim minority of scenes (M = 2.0% of scenes for male scientists and M = 3.9% for female scientists). In contrast, scientists were portrayed as intelligent in most scenes (M = 58.0% of scenes for male scientists; M = 64.8% of scenes for female scientists). Other research shows that these portrayals can have an impact. An illustrative example is that experimentally manipulating the representation of computer scientists as stereotypic or counterstereotypic influenced readers’ subsequent interest in computer science (Cheryan, Plaut, Handron, & Hudson, 2013). Repeated exposure to counterstereotypic role models through media might disrupt stereotypes that deter women from STEM.

**Anticipated (in)congruity.** A critical question, given the strong stereotypes that STEM careers impede communal goals, is whether these stereotypic beliefs might be leveraged to increase interest—that is, if the communal opportunities within STEM are emphasized, will communally-oriented people show greater positivity to these careers? Even the mere expectation that goals will be fulfilled can influence persistence: For example, new volunteers’ expectations about the emotional consequences of their volunteering activities predicted their persistence in the volunteer role over time (Barraza, 2011). The expectations about what STEM roles will offer are thus extremely important.

Existing research suggests that communal factors influence women’s career choices broadly. Meta-analytic data show that women, more than men, tend to prefer jobs that allow them to help others (d = −.35), make friends (d = −.22), and work with people (d = −.36), whereas men, more than women, prefer jobs that afford solitude (d = .26; Konrad et al., 2000). Women and more feminine individuals show a
preference to work with people rather than things, and this preference predicts vocational interests (Lippa, 1998). College women, relative to their male counterparts, reported that helping others is an important work value; for both men and women, involvement with others predicted interest across a range of careers (Morgan et al., 2001). Especially interesting is Eccles’s (2007) review of evidence that women were more interested in health-related careers because women accorded greater value to people- or society-oriented occupations than did men, even when these women predicted success for themselves in science. The critical variable thus is not simply whether an individual thinks she has the ability but also whether she thinks this path will fulfill her valued goals.

Goal affordance beliefs should function like other stereotypes in the extent to which they can be changed, and in the features that make them more or less likely to be changed. Like other robust stereotypes (e.g., gender, race), it is difficult to change associations that are based on repeated experience; nonetheless, there should be some flexibility in when these stereotypes are applied, both by individuals and to particular fields or local contexts (e.g., Blair, 2002). Research with novel occupations has shown that affordance beliefs can be flexible: For example, Weisgram et al. (2010) found that novel occupations portrayed as affording altruism elicited greater interest among girls than among boys (d = −.40 for children; d = −.40 for adolescents; d = −.19 for college students).

Both collaborative and altruistic opportunities influence beliefs and attitudes about STEM careers. For instance, we (Diekman et al., 2011, Experiment 3) experimentally manipulated the opportunities for collaborative communal goals within a description of a scientist’s daily tasks. Participants were randomly assigned to read about the typical day of an entry-level scientist whose daily activities were framed to be either collaborative or independent. The essential tasks were held constant across conditions but varied in the degree to which they involved communal activities. For example, the collaborative condition included, “I usually have to communicate closely with the Operations Group (they run the high-throughput screens) to check on the status of ongoing experiments so I can go from primary to secondary characterizations,” whereas the independent condition included the task, “I usually have to check a database maintained by the Operations Group (they run the high-throughput screens) to learn the status of ongoing experiments so I can go from primary to secondary characterizations.” As predicted, the collaborative framing particularly benefited women: Women reported more positive attitudes toward the science career when it was framed to be collaborative than independent, whereas men did not. In these data, emphasizing communal activities in science attracted women without dissuading men. It is also noteworthy that the same patterns held when communal goal orientation, rather than gender, predicted science positivity.

Further work has conceptually replicated the finding that elevating communal goal affordances fosters positivity toward STEM. For instance, when biomedical research was described as helping others, as compared with a control condition, participants expressed more positivity toward biomedical research and more motivation to pursue biomedical research in the future (Brown, Smith, Thoman, Allen, & Muragishi, 2015). Moreover, women who perceived STEM courses as affording communal goals were more likely to take STEM courses in college (Stout, Grunberg, & Ito, 2016). Increasing the congruity between women’s communal goals and the perceived opportunities to fulfill those goals can thus provide a new opportunity to increase interest in STEM careers and engagement in STEM-related activities.

Projected belongingness. Perhaps one of the most important outcomes of feeling that one’s goals are valued in a work role is a sense of belongingness or fit in the field. Belonging is a key predictor of persistence in STEM fields (Cheryan, Plaut, Davies, & Steele, 2009; Good, Rattan, & Dweck, 2012; Stout et al., 2011). Women’s sense of belonging in STEM can be reduced by various factors, including men’s greater numerical representation in particular settings (e.g., Murphy et al., 2007), masculinity of the physical environment (Cheryan et al., 2009), and the absence of role models (Cheryan, Drury, & Vichayapai, 2013; Cheryan et al., 2011; Stout et al., 2011). Consistent with a communal goal perspective, increasing communal goal affordances can foster elevated projections of belongingness. In one experimental example, participants read about a service-learning engineering course that included a community service project or a traditional engineering course that included a conventional course project (Belanger, Diekman, & Steinberg, 2016). Both conditions emphasized the same engineering skills. Participants believed that the service-learning course would afford more communal goals than the traditional course. The more that they thought the engineering course would fulfill communal goals, the more they felt like they would belong in the course. This sense of belonging in the course subsequently fostered positivity toward taking the course. The belief that communal opportunities will be available within a STEM context can thus set in motion a cascade of positive psychological consequences.

Projected ability and performance. One route to greater persistence and performance is through greater self-efficacy in the domain; individuals who feel that their communal goals and skills are integral to the role might also feel more equipped to succeed in the role. To continue the example above, individuals reading about an engineering course that incorporated communal opportunity also projected greater self-efficacy in engineering (Belanger, Diekman, & Weisgram, 2016). In turn, projected self-efficacy predicted projected likelihood of taking the course. Students who read
about a service-learning course in engineering tend to think that they will perform better in the course, even though they anticipate the service-learning course will be more difficult and time-consuming (Belanger, Diekman, & Steinberg, 2016). Communal opportunities in STEM do not appear to “dumb down” these fields but instead offer individuals greater motivation to engage in their challenges.

**Phase 2: Experienced (In)congruity**

Once individuals have entered a role and engage in goal pursuit, they experience goal progress or goal failure to varying degrees. For example, students in their first college-level engineering course make friends (or not), work on group projects (or not), and perform well on examinations (or not). In this section, we consider the implications of fulfilling or failing to fulfill communal goals for psychological responses. Although emotional and volitional responses are highly integrated within educational decisions (e.g., Op’t Eynde & Turner, 2006), affective cues are the primary signal to approach or avoid an environment or a task. We thus focus first on affective processes, and second on volitional processes.

An obvious but important point is that experienced congruity or incongruity can only occur if previous beliefs (i.e., anticipation) are positive enough to allow the individual to engage in the role or activity. As Fazio and colleagues note, avoidance behavior precludes any opportunity to learn whether one’s attitudinal expectancies should be disconfirmed (Fazio, Pietri, Rocklage, & Shook, 2015). Individuals who possess strong beliefs that STEM will not afford their valued goals select out of the STEM pathway, and in so doing lose any opportunity to understand how these communal goals might be integrated into STEM practice. Our theoretical model, then, underscores the importance of enhancing the likelihood of approach behavior, so that individuals can make decisions about their roles based on their own experiences, rather than solely on presumptions about what the experience will be like.

**Affective processes.** Affective processes are closely intertwined with motivational frameworks; generally speaking, motivational drive states that are unmet lead to negative affect, and motivational drive states that are met lead to positive affect (e.g., Carver & Scheier, 1998). Thus, situations that facilitate goal incongruity are generally expected to foster negative affect, particularly anxiety, whereas situations that facilitate goal congruity are generally expected to foster positive affect. Highly communal individuals who recall being in an environment with low communal opportunities (compared with high communal opportunities) are more likely to report negative affect and less likely to report positive affect (McCarty, Monteith, & Kaiser, 2014). Furthermore, negative affect may lead individuals to nonconsciously disengage from goals (Aarts et al., 2007).

Furthermore, the biosocial model of affective decision making (Kitayama & Tompson, 2015) suggests that when behavioral conflicts exist (e.g., I am not enjoying this class that I need for my major), individuals search for positive incentives to direct behavior. Applied to the communal goal congruity model of STEM decisions, the prediction would be that when individuals experience conflicting affect within a particular role, the presence of communal goal pursuit opportunities will be particularly impactful. When the positive incentive of communal opportunity is present, individuals will seek those opportunities and produce cognitive narratives that support these behavioral tendencies.

**Anxiety.** Goal incongruity either within or across roles can foster anxiety. Indeed, Gray and McNaughton (2003) argued that the base cause of anxiety is conflict among goals. Goal conflict can lead to behavioral inhibition system emotions of anxiety, uncertainty, and frustration. For example, Nash, McGregor, and Prentice (2011) experimentally manipulated goal conflict by randomly assigning participants to an achievement or relationship priming condition, followed by random assignment to an achievement or relationship threat condition. For those participants who had goals activated and then threatened, anxiety-related emotions were elevated.

The consequences of elevated anxiety among women in STEM are important; not only are negative effects likely for those particular women, but this anxiety can also perpetuate the pattern of fewer women within STEM. Numerous demonstrations within the stereotype threat literature show that heightened anxiety contributes to women’s lesser performance in mathematics tasks, in part through decrements in working memory (Schmader & Johns, 2003; Schmader, Johns, & Forbes, 2008). Moreover, stereotype threat can inhibit the very ability to learn new skills (Rydell et al., 2010) and heighten attention to negative feedback (Forbes & Leitner, 2014). Finally, social identity threat can set into motion a negative cycle: Feelings of stereotype threat among female science students predicted decreased beliefs that science afforded communal goals, and, in turn, decreased identification as scientists (Smith, Brown, Thoman, & Deemer, 2015). Although anxiety as a result of social identity threat may differ from anxiety as a result of goal incongruity, both sources of anxiety suggest that the individual does not belong in STEM, and the psychological processes of anxiety are likely to be similar. Such anxiety may be particularly detrimental because the anxiety of women in STEM can be transmitted to others and perpetuate gender stereotypes about reduced math ability among girls and women. For example, female teachers’ math anxiety predicts students’ endorsement of gender stereotypes about math, which in turn predicts girls’ lower end-of-year performance in mathematics (Beilock, Gunderson, Ramirez, & Levine, 2010).

**Positive affect and well-being.** Just as goal incongruity can produce negative affective states, goal congruity can
produce positive affective states. These positive affective states can in turn contribute to success in various roles (Boehm & Lyubomirsky, 2008; Lyubomirsky, King, & Diener, 2005). According to Fredrickson’s (2001) broaden and build perspective, positive emotions foster actions and cognitions that lead to further positive emotions, thus resulting in an upward spiral. For example, initial positive affect facilitates broader coping styles, which can be advantageous in meeting adversity and in turn predict further positive affect (Fredrickson & Joiner, 2002).

Within academic contexts, positive emotions have received relatively little research attention compared with anxiety (Pekrun, Goetz, Titz, & Perry, 2002), even though positive emotions, such as hope or enthusiasm, are essential in opting into pathways and in sustaining persistence throughout challenges. Snyder (C. R. Snyder, 2002) elaborates on the construct of hope, which is conceptualized as including both the sense that one can meet one’s goals (i.e., agentic thinking) and the generation of different ways to meet those goals (i.e., pathways). Individuals with high trait levels of hope in their first year of college earned higher GPAs at the end of the second semester, even controlling for ACT scores, and high-hope students were more likely to graduate (C. R. Snyder et al., 2002). In addition, prosocial actions at work can lead to affective benefits. For example, using a daily diary methodology, Sonnentag and Grant (2012) found that firefighters and rescue workers who perceived their actions at work had greater prosocial impact reported greater positive affect at bedtime.

The culmination of the literature thus suggests that making progress toward valued goals will lead to affective benefits, and that these affective boosts in turn might facilitate an upward spiral in terms of goal pursuit. Above and beyond these affective benefits of goal congruity, however, may be particular benefits due to communal goal congruity, because these goals are highly valued and typically involve other people.

Volition and Performance

Increasing perceived communal affordances can also increase persistence and performance in STEM-related tasks. The sense of communal goal congruity within STEM contexts is predicted to lead communally oriented individuals in particular to feel a greater sense of self-efficacy in STEM. Moreover, individuals in a context that promotes goal congruity may self-regulate more effectively in such an environment. In an experiment conducted with high school students (Yeager et al., 2014), for example, students who considered the prosocial benefits of going to school persisted longer at boring math tasks. Another experiment with college students demonstrated that reading about the benefits of math to society led to greater performance in graduate record exam (GRE)-type math problems (Rodriguez, Romero-Canayas, Downey, Mangels, & Higgins, 2013).

A particularly important aspect of motivation in STEM roles is the sense that one belongs. Parallel with the discussion of anticipated belonging earlier, the experience of communal goal incongruity in STEM fields may lead to decreased belonging in several ways. First, the general perception that one’s values are not affirmed by one’s career may lead to a decreased sense of belonging, regardless of the specific content of those values. Additionally, some activities that would fulfill communal goals (e.g., collaboration, mentoring) would provide a direct means of social connection and foster a sense of belonging. Thus, having one’s communal goals go unmet may produce a particular lack of belonging in STEM careers, above and beyond the general consequences of one’s work failing to meet valued goals.

We hypothesize that communal goal incongruity is an important signal to a lack of fit in STEM; individuals who highly value communal goals, but who perceive the field and others around them to prioritize other goals, are likely to feel a lack of belonging and be less likely to persist in the field. Proximal social goals might be especially important during adolescence, when academic decisions can be particularly influenced by peers (e.g., Bouchey & Harter, 2005; Nelson & DeBacker, 2008; Wentzel & Caldwell, 1997). In contrast, communally oriented individuals who feel that the field and others around them prioritize communal goals may feel greater belonging and persist in the field. Data consistent with this prediction come from a naturalistic study of workplace conversations, which showed that female STEM faculty actually reported more disengagement from their jobs the more that they engaged in research conversations with male colleagues (Holleran, Whitehead, Schmader, & Mehl, 2011). Although the specific content of these conversations was not reported, our model would predict that these effects might be attenuated if conversations signaled the value of communal aspects of research. In short, the typical research conversations that STEM faculty engage in may not connect to communal goals, and these conversations may then signal that those who pursue communal goals do not belong in STEM.

Phase 3: Seeking Congruity

After some experience in the role and some experience with goal pursuit, individuals will make adjustments to their motives or to their roles in order to achieve goal congruity. Even individuals in roles that afford communal goals will need to recalibrate at certain points; in a constant feedback loop, people determine whether goals are being met, whether these goals are worth continuing to pursue, and how to structure their roles to afford the pursuit of their valued goals.

Motivational Responses

Unmet goals can increase in their potency over time (Zeigarnik, 1927); the implication for communally oriented
people in STEM fields—if these goals are unmet—is that the desire to pursue these communal goals may increase in intensity over time. Moreover, being in situations that are perceived as incongruous with important goals can facilitate actions directed at pursuit of those goals: Nash et al. (2011) demonstrated that participants with experimentally evoked goal conflict were more likely to show approach motivation—to report intention to pursue their ideals—and to show behavioral manifestation of approach motivation. The implication is that when communal goals are blocked in a particular context, communally oriented people will seek alternative ways of fulfilling these goals (perhaps leading to role exit, as discussed below). Thus, goal-incongruous environments can foster actions aimed at fulfilling goals. With regard to communal goal pursuit in STEM, this greater activation of communal goals in noncommunal environments may lead to an unfortunate cycle, in which communal goals are elevated but continue to be unmet.

Over repeated experience with goal frustration, the goal itself may become less valued. Applying these principles to women in STEM leads to the prediction that female STEM majors will likely adopt (consciously or not) the goals that are valued in their major and disengage from goals that are devalued by their major. For example, an engineering student who initially wants to help other people may over time find this goal less important because it is not reinforced by the people or activities in her day-to-day life. After all, one way to achieve communal goal congruity in fields that are perceived to impede communal goals is to decrease the importance of such goals. Indeed, Cech (2014) captured this process in her discussion of the “culture of disengagement” in engineering, in which engineering students become distanced from issues of societal relevance throughout their undergraduate years.

Role Responses

People who experience goal incongruity and who continue to value communal goals will seek ways to alter their environment for more successful goal pursuit; these individual-level strategies are likely to succeed to the extent that they are supported by the broader environment. At the individual level, these responses can involve reconstruing the role (e.g., using cognitive processes to highlight communal opportunities in the role), reconstructing the role (e.g., engaging in different activities in the role), and—at the most extreme—exiting the role to seek new opportunities elsewhere. The most obvious behavioral strategy to reduce communal goal incongruity—and the one fundamentally motivating this research—is to opt out of STEM fields for fields that are perceived as more communally oriented.

Reconstructing the role. Individuals might achieve goal congruity by reappraising their major or field as affording communal goals. One way in which this might happen is to consider STEM fields from a more abstract perspective. Because STEM fields are seen as beneficial to society but unlikely to involve direct helping, highlighting these distal opportunities for communal goal fulfillment may be one way of increasing the perceived communal impact of STEM. In an experimental demonstration of this phenomenon (Steinberg, 2015), participants who adopted a high-level construal of a STEM career (i.e., focused on the “why” of STEM) rated the career as more likely to fulfill communal goals relative to those who adopted a low-level construal of the career (i.e., focused on the “how” of STEM). Similarly, connecting a task with its abstract communal benefits increased persistence and performance (Rodriguez et al., 2013; Yeager et al., 2014). Therefore, promoting an understanding of STEM careers within the broader societal context may be a way to provide role-relevant experience aligned with abstract communal goals. For example, a scientist might focus on the parts of her job that include contributing to the understanding of societal problems, or an engineering student might focus on the end result of robotics initiatives that will ultimately aid people in disadvantaged communities.

Another strategy that might be useful is to make plans to fulfill communal goals. The effects of such plan making can be achieved before the plans are acted upon, given evidence that making plans to fulfill goals reduces the negative effects of unfulfilled goals. For example, participants who wrote about plans to fulfill goals showed protection of executive function and self-regulatory ability, compared with participants in control conditions (Masicampo & Baumeister, 2011). Thus, the mere act of considering how to meet communal goals may relieve some of the negative effects of goal incongruity.

Reconstructing the role. When individuals in STEM fields find that their work life is not fulfilling communal goals, they may seek out opportunities to fulfill these goals both in and outside of work life. In college settings, students might pursue communal goals in curricular domains (e.g., classes), cocurricular domains (e.g., informal faculty advising), extracurricular domains (e.g., student clubs), and nonacademic domains (e.g., family or friend roles). However, these communal pursuits may take time and effort away from demanding intensive STEM coursework. In addition, cocurricular, extracurricular, or nonacademic pursuits may indicate to others or to the individual that he or she is not interested or does not “have what it takes” to succeed in STEM. Communally oriented behavior in particular may be perceived as irrelevant to or even impeding success in STEM. The ideal situation may be spending time on activities that integrate STEM work with communal goal pursuits, such as mentoring or study groups. Such integration of communal goal pursuits (e.g., spending time with or helping others) with agentic goal pursuits (e.g., achieving success in academics) can occur in different ways. For example, some individuals seek reassurance from friends during periods of academic doubt, others
study with academic role models in order to bring their actual selves in line with their ideal academic selves, and others spend time socializing as mood repair (Cantor, 1994).

Indeed, communal individuals may create environments where they can fulfill communal goals: For instance, in new roommate relationships, communally oriented individuals both provided and received more social support than less communally oriented individuals (Crocker & Canivezzo, 2008). In particular, individuals with higher levels of proactive personality are more likely to shape environments to be consistent with their own values, and in turn, to meet with both subjective and objective success in their work roles (Seibert, Michael, & Kraimer, 1999). However, as we note below, individual ability to effect change is likely to be constrained by organizational norms, and thus individual-level role change will more likely succeed if supported by the broader organizational culture.

**Relationships.** Involving others in STEM pursuits can enhance opportunities for STEM activities to meet communal goals. One way to increase goal congruity in STEM may be to seek out professional relationships with individuals who themselves pursue communal goals. For example, interpersonal support is critical for persistence in STEM, especially among individuals who are highly relational in their self-construal (Cross & Vick, 2001). Cultivating strong mentoring relationships may be particularly effective for the persistence and success of communally oriented people in STEM because these relationships can both fulfill communal goals and provide guidance, resources, and advocacy. Communal-oriented students were more likely to report engaging with mentors in STEM, and communally oriented mentors were preferred by STEM students and employees (Fuesting & Diekman, 2016). In addition, the vast majority of female science majors at elite colleges reported at least one mentor as critical to their decision to pursue science (Downing, Crosby, & Blake-Beard, 2005), and women with female science professor role models in particular showed more implicit identification with science (Young et al., 2016). Peer encouragement is central to interest in science (Stake, 2006; Stake & Nickens, 2005). High school girls were more likely to take advanced mathematics and science coursework if their friendship group expected to earn high grades in science, particularly if those friendship groups were female (Riegle-Crumb, Farkas, & Muller, 2006). These relationships were not observed for boys, and friendship did not predict girls’ likelihood of taking advanced English, which suggests that there is a particular benefit to young women’s pursuit of science and math if they are surrounded by high-performing female peers. In a separate sample, although both boys and girls are more likely to take advanced classes if their friends earned high grades, girls benefited more from high-achieving friends at advanced levels of math and when they were at risk (Crosnoe, Riegle-Crumb, Field, Frank, & Muller, 2008). At the college level, retention in engineering degree programs among relationally interdependent women was especially improved by social support (Cross & Vick, 2001).

When STEM activities are associated with both intellectual pursuits and sustaining relationships, such activities may be increasingly attractive to communally oriented individuals. Indeed, evidence for this idea was provided by an experiment in which participants completed a math-related task either alone or with a confederate (Isaac, Sansone, & Smith, 1999). Regardless of whether the confederate expressed interpersonal goals or not, individuals reported more interest in the task when they completed it with another person. Furthermore, when a math department was framed as a relational context in which collaboration happened regularly instead of a context that focused on building skills, participants felt a greater social connection with math and greater math motivation (Walton, Cohen, Cwir, & Spencer, 2012). This framing effect is consistent with the communal goal congruity prediction that opportunities to meet the goal of relating to others will particularly foster STEM interest.

Individuals might particularly gain from seeking out opportunities to interact with the beneficiaries of their work. Beliefs about whether one’s job will benefit others, along with direct contact with those who benefit, increase both the perception that individuals can benefit others and the importance of benefiting others (Grant, 2007). These beliefs about benefits to others increase job effort, job persistence, and helping behavior. For instance, contact with individuals who benefit from phone bank employees’ work led to increases in employees’ job effort and performance, and laboratory studies show that this effect is mediated by beliefs about impact as well as affective commitment to the beneficiary (Grant et al., 2007). Thus, women’s long-term persistence in STEM might be especially influenced by beliefs that their work helps others and by direct contact with beneficiaries.

**Extra-role goal pursuits.** Individuals might also fulfill communal goals through extra-role activities—that is, through family or community roles outside of STEM. Individuals whose communal goals are not fulfilled by their careers may increasingly devote time to family or community as a way to fulfill those communal goals. This behavioral strategy might be particularly likely for women, both because they endorse communal goals more highly than men and because it is societally accepted for women to prioritize family roles. This route to goal fulfillment may function effectively for some; however, for others, the lack of communal goal fulfillment in work roles might be detrimental to career commitment and persistence—or be perceived as detrimental by others.

Individuals with higher other-oriented empathy and helpfulness are more likely to volunteer (Penner, 2002), and thus community service may be a route to fulfilling communal goals outside of the work role. However, for people generally and women in particular, rates of community involvement have declined over time (e.g., Putnam, 2001). For example,
time use diary data show that married mothers’ time participating in organizations declined from 1.5 hr per week in 1965 and 2.2 hr per week in 1975 to 0.6 hr per week in 2000 (Bianchi et al., 2006). Married fathers’ time declined less rapidly, from 1.1 hr per week in 1965 and 1975 to 0.8 hr per week in 2000. Community participation may thus not be as available or as normative as it once was. Another obstacle is time scarcity: Women, compared with men, report less free time overall (Mattingly & Bianchi, 2003; Mattingly & Sayer, 2006; Sayer, 2005). Thus, women in particular may be unlikely to seek out community service that would offer opportunities to work with or help others.

For both family roles and community roles, there may be clear benefits to fulfilling communal goals, particularly if opportunities for communal goal fulfillment do not exist in the occupational role. However, there are also obstacles to relying solely on extra-role pursuits for communal goal fulfillment. These extra-occupational roles may not be readily available to everyone, and pursuing them may entail costs of time, energy, and commitment to the occupational or educational role. Thus, to the extent that one’s STEM role can incorporate both agentic and communal goal fulfillment, it is likely to be more satisfying to the role occupant.

Exiting the role. The problem fundamentally motivating this research perspective is why women (more than men) opt out of the STEM pathway at some point, even when they have performed well in science or mathematics courses. When individuals do not see possibilities for fulfilling valued goals within their current role structure, they will modify that role structure. At the most extreme endpoint, this modification can result in leaving the STEM role for another role that is perceived to meet valued goals. As shown in Figure 2, the decision to exit one role leads back to a decision to enter another role. Indeed, career decisions are not made in isolation; individuals who opt out of the STEM pathway are always opting in to a different field, and so the relative benefits of each role need to be considered. Given the average breadth of women’s abilities (e.g., Wang et al., 2013), women in particular may have the option to pursue communal goals through a variety of career roles, and this breadth of choice may undermine commitment to STEM roles if communal goals are thwarted in those roles. Understanding how STEM roles are perceived to, and actually do, fulfill or fail to fulfill communal goals, is key to understanding these decisions in fuller context.

Part III: New Directions for Research and Policy

Research Directions

The goal congruity framework integrates a social structural perspective that attends to the influence and opportunities of social roles along with longstanding research on the intrapersonal processes of intrinsic motivation. This convergence highlights key points of need in research going forward.

Navigating the opportunity structure of social roles. Although individuals pursue goals within many contexts, psychological theory and evidence about the pursuit of multiple goals across multiple roles are underdeveloped. We articulate two principles to form predictions: the primacy principle and the complementarity principle. In the primacy principle, individuals have a particular goal that takes precedence over others, and if this goal is not fulfilled, the individual will continue to seek to modify or substitute the specific social role until it is satisfied. Individuals who are extremely communally oriented, for example, might require communal activities in more than one role to meet their communal needs.

In the complementarity principle, an individual will prefer a new social role within a current decision set if it provides an opportunity to fulfill goals that are currently unfulfilled in the individual’s role system. Individuals will thus seek complementarity, rather than redundancy, in pursuing valued goals across the array of current or prospective roles. This principle leads to the prediction that even communally oriented individuals can meet a motivational threshold at which roles that meet other needs will be preferred. Further, specific types of communal goals can have distinct impact: For college students, highlighting the altruistic aspects of biomedical research fostered motivation to pursue such research, and highlighting the collaborative aspects of biomedical research did not further enhance motivation (Brown, Smith, et al., 2015). In general, the goal congruity framework predicts that individuals will opt for roles that afford opportunities to goal pursuit, particularly if those goals that are not afforded elsewhere.

These two principles offer a framework to understand how different types of communal goals might be important, but the question remains as to when certain goal opportunities will be particularly impactful. Considering the different goals that might be valued and the different roles that might provide goal pursuit opportunities leads us to delineate these five dimensions that will influence the attractiveness of goal pursuit opportunities:

1. Individual differences: People vary in how much they endorse specific aspects of communal goals; an individual might chronically value altruism over social connection, and thus individual differences in endorsement of the subgoals will predict how much particular opportunities influence their STEM attitudes and behaviors. In addition, individual differences in abilities to reconstruct or reconstrue roles will affect the likelihood of these responses. For example, proactive personality types (Seibert et al., 1999) may be more likely to reconstruct their work role to be consistent with their communal values. Individuals who are high in cognitive flexibility or
reappraisal tendencies might be more able to recon-
strue their roles in a way that aligns with their impor-
tant values.
2. **Group and cultural differences:** As we have expli-
cicated particularly around gender, groups may vary both in their endorsement of different aspects of com-
munion, and in the norms surrounding the expression and support for different aspects of communion. In particular, underrepresented minority students and first-generation students may prioritize giving back not just to society in general but to the specific commu-
nities that support them (e.g., Stephens, Fryberg, Markus, Johnson, & Covarrubias, 2012). Moreover, the fact that groups occupy positions with more or less power within a particular context means that some groups will have more latitude to pursue the goals that they especially value.

3. **Developmental differences:** The life stage of individ-
uals may also influence which kinds of communal opportuni-
ties are paramount. In adolescence, connection to others is likely to be important because of con-
cerns about fitting in and forming one’s identity. In adul-
thood, the opportunity to find broader altruistic meaning and to transcend the self may take prece-
dence. In late adulthood, individuals may particularly seek generativity, or to create something larger than the self for future generations, and communal contribu-
tions may be even more important. An additional factor is that mid-career individuals (who are more likely to have financial security) might have more flexibility to shift specific jobs or even careers to pur-
sue valued goals.

4. **Field or organization differences:** The particular con-
text that an individual occupies—whether by field, such as physics versus biology, or by local organization—also will predict what communal opportunities matter most. We propose that individuals will seek out what they value and what is missing in a particular setting. Thus, a “one size fits all” solution will not be suc-
cessful across all STEM fields. For example, collabor-
ate work in project teams is widespread in engineering, so connection to others or altruistic meaning might matter more. Fields or local contexts also differ in their flexibility to include different communal opportunities or not. Finally, organiza-
tions vary in the normativity of communal opportuni-
ties; in some settings, communal opportunities are highly valued, in some they are disregarded, and in some they are devalued.

5. **Temporal differences:** Drawing on Maslow’s (1962) hierarchy of needs, relatedness, or connection to oth-
ers may take priority before higher order goals such as self-transcendence. There may be an immediate benefit of social connection to others, but there may be a long-term benefit if the STEM pursuit allows one to meet goals of transcending the self. Within certain roles, these short-term and long-term benefits might align, whereas in other roles tradeoffs may be more apparent.

**Integration of communal and agentic opportunities.** Both communal and agentic motives are highly valued by individ-
uals (and agentic motives are increasingly endorsed by U.S. women; Eagly & Diekman, 2003). Without agentic motivation to achieve or build competence, individuals are not likely to excel in STEM. Indeed, agentic motivation or agentic affordances predict positive attitudes toward STEM fields, unique from communal motives or communal afford-
dances (Diekman et al., 2010; Yang & Barth, 2015). We particularly encourage research into how agentic and com-
munal orientation integrate to promote success in STEM: Individuals who are highly agentic and highly communal might be most likely to reach levels of excellence in STEM when communal opportunities are available. Moreover, the pursuit of knowledge and competence is necessary to the broad communal impact of STEM (e.g., efficient development of vaccines). Without agentic opportunities to achieve or build competence, individuals cannot persist or prosper in STEM. Without communal opportunities to understand the impact of one’s work for the broader world, individuals may falter when challenges arise. Understanding when particu-
lar goal opportunities are preferred is thus the key question, and working toward the integration of agentic and communal opportunities can maximize long-term persistence in STEM.

**Predicting role disengagement and reengagement.** Integral to the goal congruity perspective is the idea that individuals pursue goals across a network of social roles: If goal pur-
suit is not successful within the STEM domain, for example, individuals will opt out of STEM roles for other occupational roles or seek to meet needs in extra-work roles. The impli-
ca tion is that roles that initially appear irrelevant to career success—for example, community volunteering—can in fact contribute to satisfaction and persistence in occupational roles. To date, little research has examined how an individ-
ual’s multiple roles serve valued goals in combination, and how goal fulfillment in one role can influence engagement in a different role. When communal motives are satisfied in extra-role activities, the extent of communal opportunities at work might simply matter less to that individual. Under-
standing the sociostructural influences on extra-role goal pursuit, however, is critical: If organizational culture does not value or provide flexibility for extra-role activities along-
side one’s work role, individuals will not successfully meet goals through this pathway.

The goal congruity model can provide a clearer conceptual-
ization of loyalty and neglect within the exit/voice/loyalty/ neglect literature (Rusbult et al., 1988; Withey & Cooper, 1989). Loyal individuals do not voice or exit; because they are defined by the behavior of staying, these individuals
might be most likely to react to dissatisfaction by reconstruc-
ting the role to the extent possible. This path would allow
them to reshape the role somewhat without voice but to edge
closer to their goals. Finally, our model offers a psychologi-
cal lens on neglect. Those who are withdrawing from their
roles are likely dissatisfied in some way, and our model
would predict that (a) valued goals are not currently met in
that role, and (b) another role—family, community, leisure—is
likely providing the opportunity to meet those goals. What
manifests as “neglect” or disengagement from a particular
role may mean engagement in a different role; understanding
the push and pull of how specific roles afford key goals is
critical.

Considering both the proximal and distal components of
communal opportunity in STEM (Steinberg, 2015) leads to
the prediction of two routes by which proximal and distal
communal opportunities might foster positivity. First, these
varying types of opportunities might differentially influence
recruitment versus retention: The proximal promise of benefi-
tsing society may help attract women into STEM, but prox-
imal connections such as mentorship and collaboration may
be key for retention. Second, consistent with the comple-
mentarity principle, each type of opportunity might substi-
tute for the deficit of the other. For example, abstract altruistic
meaning can serve as a buffer if concrete connections to oth-
ers are especially lacking, or concrete connections can help
retain people if abstract meaning is lacking (consistent with
the finding that considering the future altruistic benefits of
learning increased motivation but only when the task was
boring; Yeager et al., 2014). Generally speaking, communicat-
ing communal affordances at both proximal and distal
levels can convey how STEM fields offer multiple opportu-
nities for communal goal pursuit.

Generalizing the goal congruity framework to other groups and
roles. The goal congruity framework can inform the under-
standing of entry, engagement, and exit in many other educa-
tional or occupational pathways. Depending on the field,
different goals may be central. For example, understanding
worker shortages in teaching or nursing might benefit from
examining whether these professions are increasingly thought
to impede agentic goals of authority, independence, and status.
Because agentic goals are valued by both men and
women, these perceived agentic affordances might be espe-
cially important over time. Moreover, the basic logic of com-
munal goal congruity—that pathways seen as impeding
communal goals are less desirable, and pathways seen as
facilitating communal goals are more desirable—has been
demonstrated in business (McCarty et al., 2014) and politics
(M. C. Schneider, Holman, Diekman, & McAndrew, 2015).
This framework can also be invoked to explain factors that
inhibit men’s pursuit of some occupations: Men’s lower
endorsement of communal goals has been shown to underlie
their lesser interest in health care and education occupational
roles (Block, 2013). Applying the framework depicted in
Figure 1 to different occupational domains will enable
greater understanding of how goal congruity processes oper-
ate similarly and differently across fields. In the political
realm, women’s communal emphasis can foster avoidance of
conflict; when political roles are framed as serving the com-

munity rather than engaging in conflict, women express
greater interest (M. C. Schneider et al., 2015).

The power of focusing on the psychological mechanism
that underlies the gender gap in STEM pursuit—that is, the
perceived communal opportunities available in a field—is
that this framework can then be applied to other individuals
and groups. It is not simply belonging to a gender group that
influences STEM interest but the psychological tendency
to value communal goals. Interventions that highlight commu-
nal opportunities in STEM can thus attract communally ori-
ented people generally, including members of both
represented and underrepresented groups. In particular, com-
munal goals may be especially highly endorsed by specific
social groups that are currently underrepresented in STEM
e.g., Native Americans, Latinos, first-generation students).
For example, Native American students endorse communal
work goals more highly than individualistic work goals;
moreover, communally oriented Native American students in
STEM fields were especially unlikely to feel a sense of aca-
demic belonging, and in turn less likely to report intrinsic
motivation, intention to persist, or high levels of performance
(Smith, Cech, Metz, Huntoon, & Moyer, 2014). Furthermore,
Native American and Latino undergraduate research assis-
tants who initially believed biomedical research afforded
altruistic goals reported more psychological involvement in
their research 10 to 12 weeks later, and this greater involve-
ment was associated with enhanced interest in pursuing a sci-
cence research career (Thoman et al., 2015). First-generation
students are particularly likely to endorse other-oriented
interdependent values (e.g., “Give back to my community”)—
compared with continuing-generation students (Harackiewicz
et al., 2014), and these values are posited to misalign with the
independent values of elite academic institutions, leading to
lesser belonging among first-generation students (Stephens
et al., 2012). The communal goal congruity model suggests
that communally oriented activities in academic contexts can
help these students to find greater fit within institutions.
For example, when first-generation students believed that work-
ing in science allowed for helping others and giving back to
the community, they expressed more intrinsic science inter-
est (Allen, Muragishi, Smith, Thoman, & Brown, 2015).

A critical question, however, is whether individuals who
are marginalized in STEM have the latitude to engage in
communal pursuits, even if they personally find these pur-

suits valuable. When communal activities are perceived as
irrelevant or even detrimental to STEM, those individuals
who might most benefit from these activities may be least
able to engage in them. For this reason, authority support for
communal opportunities in STEM is particularly critical, as
we detail in Policy Implications.
Given the robust prediction of positivity toward STEM from greater communal affordances, an essential question is where these affordance beliefs come from, and how they might be changed. Further examination of these processes would allow for more effective interventions. For instance, socialization agents (such as textbooks, classroom structure, teachers, and parents) likely reflect stereotypes of STEM as lacking communal opportunities, and greater to exposure to these beliefs among socialization agents will predict stronger stereotypic beliefs held by the student. Furthermore, the representation of communal exemplars within a student’s own social network is likely to influence the development of communal affordance stereotypes. Similar to processes of stereotype malleability (Dasgupta & Asgari, 2004) or stereotype inoculation (Stout et al., 2011), students who are exposed to more communal exemplars in STEM may be less likely to endorse the belief that STEM fields are noncommunal or to connect these beliefs to the self.

**Varied sources of fit.** The goal congruity model highlights a different way to achieve fit within academic and organizational contexts. Within social psychology, this sense of fit has primarily been investigated through research on social belonging; students benefit when they feel a sense of social connection to others in the academic environment (e.g., Walton & Cohen, 2011). The goal congruity framework highlights that fit can also emerge when an individual feels that his or her occupational role will serve valued goals. Other sources of fit might have to do with cognitive style (e.g., regulatory fit; Higgins, 2006), or generally with whether one’s attributes are congruent with role requirements (e.g., role congruity; Diekman & Eagly, 2008; Eagly & Karau, 2002). These various sources of fit might operate independently or be related: An individual might feel a sense of fit stemming from goal congruity, whether or not he or she feels a sense of social belonging in a particular setting. An additional benefit of considering goal congruity as a cue to fit is that it does not rely on demographic cues—and thus a wide array of role models from different backgrounds could potentially signal belonging to members of underrepresented groups. A broader conceptualization of psychological fit that draws from multiple sources could provide more elaborated understanding of why people choose and persist in their social roles.

The sense of fit due to goal congruity might counteract other belonging threats, such as social exclusion. We predict that a sense of fit from goal congruity would buffer against threats to belonging in STEM and promote recovery following such threats. Conversely, the lack of fit resulting from goal incongruity may contribute the tenuous sense of belonging experienced by women and other underrepresented groups (e.g., Good et al., 2012; Harackiewicz et al., 2014). Thus, increasing opportunities to meet both proximal and distal communal goals may have important implications for the social experience of people in the STEM fields.

**Summary.** The goal congruity perspective provides a generative framework to ask and answer questions about how individuals navigate their role system to meet multiple valued goals. Although this review focused on the impact of communal opportunities within STEM, the broader principles and predictions of the framework provide the chance to understand the role actions of a wide range of individuals and groups.

**Policy Implications**

In this section, we examine the strategies that STEM organizations might implement to reduce communal goal incongruity. A critically important question is whether it is possible or realistic to practice STEM fields in communally oriented manners. Certainly, like any complex and challenging field, STEM fields can be engaged with in relatively agentic ways, relatively communal ways, and a mixture of the two. However, it is clear that individuals and organizations in STEM fields already integrate communal practices. For example, this quote by theoretical physicist Janna Levin (Tippett & Levin, 2008) puts forth a view of mathematics that both embraces communal values of common understanding and consensus, and rejects dominant, self-promoting values:

> I am absolutely struck with the power of mathematics, and that’s why I’m a theoretical physicist. If I want to answer questions, I love that we can all share the mathematical answers. It’s not about me trying to convince you of what I believe or of my perspective or of my, sort of, assumptions. We can all agree that one plus one is two, and we can all make calculations that come out to be the same, whether you’re from India or Pakistan or, you know, Oklahoma . . . we all have that in common.

As noted by Sonnert, Fox, and Adkins (2007), explanations of the representation of women in science and engineering tend to focus on causes within the individual (e.g., goals, beliefs, history) or within institutions or structures (e.g., patterns of interaction, institutional settings). Unlike research that focuses on only one of these important aspects, the goal congruity framework encompasses both levels of analysis: Individual-level responses are important, but so are organizational structures and practices that value and reinforce—or alternatively, inhibit—those responses.

We focus here on institutional-level strategies because individual-level strategies will be limited in their effectiveness if they are not supported by the organizational unit or the broader culture. For example, a lone chemist who views her work as ultimately benefiting cancer patients may not be as effective at sustaining motivation as the chemist who has similar views and is supported in those beliefs by others in her department, or whose activities allow more direct contact with the beneficiaries of her work. Supporting this idea is evidence that engineering students are more likely to perceive
public welfare beliefs (e.g., social consciousness, understanding consequences of technology) as important to the extent that they think their engineering programs emphasize these beliefs (Cech, 2014). Organizational units are also an important locus for change: In the analysis of factors associated with greater representation of women in biology, physical sciences, and engineering over time, Sommert and colleagues (2007) found that departmental factors provided greater prediction than institutional factors. These authors thus recommend focusing on departments or majors as potentially effective points of change in individuals’ decisions, because the immediate culture appears to have a greater impact than does the broader institutional culture. Individuals will be less likely to succeed if they have to “go it alone.” The values identified and communicated by organizational units can bolster the effectiveness of individual-level strategies.

The core strategy for organizations to reduce the potential for communal goal incongruity is to highlight the ways in which their field does serve communal goals. Indeed, student experience (including whether engineering is perceived as helping society and high-quality interactions with peers and the engineering community) is a major predictor of student attrition (Litzler & Young, 2012). For example, schools and universities could highlight the ways that the STEM fields fulfill communal goals by offering service-learning courses in the STEM fields. Service-learning courses include a community service component which is meant to benefit the community as well as the student (Furco, 2001). Research demonstrates that students believe that a service-learning engineering course will afford more communal goals than a traditional engineering course (Belanger, Diekman, & Steinberg, 2016). Furthermore, the perception that the service-learning course will fulfill more communal goals than the traditional course predicts preferences for the service-learning course over the traditional course. These data suggest that practices that highlight the ways in which a field serves communal goals may be a useful strategy to improve communal goal congruity.

A major challenge to highlighting communal opportunities within organizations is the possibility that communal activities are devalued in STEM settings. For example, penalties may occur if communally oriented individuals violate the agentic expectations of a male-dominated work role (e.g., Moss-Racusin, Phelan, & Rudman, 2010; Rudman & Mescher, 2013). Because STEM careers are not typically associated with communion, a communally oriented employee might be perceived as having other female-stereotypic attributes that are not desirable in a STEM career (e.g., lack of competence in mathematics). Indeed, communally oriented men in the workplace who requested family leave were perceived as having more communal traits, fewer agentic traits, and being weaker (Rudman & Mescher, 2013). Thus, individuals in STEM fields might be especially penalized for violating the expectation that STEM careers are not communal: Individuals who pursue communal activities in noncommunal contexts might be perceived by STEM employers as not seriously committed to STEM.

Although stigmatization based on communal attributes is possible, to date, evidence suggests that these negative effects may be somewhat attenuated because of the general positivity attached to communal behaviors. For example, both STEM students and workers prefer a potential mentor who demonstrates communal workplace behaviors, relative to equally successful but less communal behaviors (Fuesting & Diekman, 2016). In addition, women in male-dominated fields may be more likely to be stigmatized for feminine but noncommunal aspects of identity. For example, women’s responses to stereotype threat included distancing from aspects of femininity seen as relevant to the math stereotype (e.g., valuing femininity, being flirtatious) but did not include distancing from aspects seen as less relevant to the math stereotype (e.g., empathy, warmth; Pronin, Steele, & Ross, 2004). Although the positive effects of increased goal congruity through communal activities in STEM might outweigh negative effects, the possibility of negativity toward communally oriented people in STEM deserves awareness, attention, and action.

To the extent that fewer communally oriented people currently occupy STEM roles, organizations might perpetuate that state of affairs. If STEM fields tend to deter communally oriented people, these organizations might attract and retain fewer communally oriented individuals over time, consistent with the attraction–selection–attrition hypothesis (B. Schneider, 1987). Moreover, individuals who already feel vulnerable in STEM (i.e., members of an underrepresented group) may especially avoid communally oriented tasks that are not perceived as central to the STEM role. The unfortunate result is that expectations that STEM fields do not value communal pursuits can thus lead to the self-fulfilling prophecy that STEM practitioners do not attempt to pursue communal goals, at least until a critical mass of communally oriented individuals change expectations.

**Institutional examples.** Some STEM programs have adopted strategies that integrate communal opportunities in STEM. Although these initiatives range in content, strategy, and scope, they provide examples of the benefits of (a) increasing societal relevance of STEM, (b) facilitating collaborative opportunities in STEM, and (c) deemphasizing or disrupting stereotypic expectations about preparation or talent in STEM.

Numerous programs highlight the ways in which STEM fields are relevant to benefiting society. For example, an engineering program for middle school girls focused on hands-on activities along with lessons about the altruistic impact of engineering projects (Colvin, Lyden, & León de la Barra, 2013). Girls reported greater perceptions that engineers fulfilled communal goals, and they increased enrollment in subsequent engineering activities. Farrell (2002)
recounted a strategy of highlighting social relevance of engineering in college-level courses to bring more women into the field. Several schools have changed traditional curricula, so that students have more hands-on or collaborative experience in the first years of college, instead of waiting for higher level courses. One indicator of the appeal of engineering projects that directly help others is that the National Engineering Design Challenge attracted more than 40% female participants when the challenge was to design a device to help people with disabilities.

Institutional support for collaborative communities also reaps benefits. Cuny and Aspray (2001) detailed strategies that a panel of experts in computer science and engineering developed to recruit and retain female graduate students. They emphasize creating a peer community for female students (either at the home institution or across institutions) to provide opportunities for interaction with fellow students. The panel acknowledged that certain stereotypes of computer science and engineering might particularly deter women, including beliefs that working with computers is incompatible with working with people, or that the culture of the field will conflict with personal values. Thus, they recommend ensuring that departmental initiatives such as departmental publications or visiting speakers do not reinforce these ideas. More broadly speaking, STEM educational initiatives that focus on active learning (which often includes participation in class and group work) can reduce gender gaps in STEM achievement (e.g., Haak, HilleRisLambers, Pitre, & Freeman, 2011).

There are also clear examples of success in recruiting and retaining female STEM majors from initiatives that combine multiple strategies. For example, Harvey Mudd College (described in AAUW, 2015) successfully increased their female computer science graduates from 12% of graduates in 2000 to 38% in 2014. Their comprehensive program included various opportunities for students to consider the practical and societal applications of their research, to engage collaboratively in research, to develop relationships with faculty, and to attend conferences focused on women in computing together. The Electronics and Computing Service Scholars program at Miami University strategically integrated communal opportunities: Students are selected on the basis of their service vision, first-year coursework includes service learning, and ample opportunities for social connection and collaboration are available. Even the first year of the program showed gains in gender and ethnic diversity of those who applied and were admitted, relative to local and industry benchmarks (Brinkman & Diekman, 2016).

Yowell and Sullivan (2011) described an implementation of the rebranding effort developed by the National Academy of Engineering to improve the public understanding of engineering. At the University of Colorado—Boulder, recruitment flyers and postcards for engineering events were redesigned to show people interacting with technology rather than technology alone, and to include taglines highlighting the social impact of engineers. In response, they found that attendance at a program to introduce high school girls to engineering quadrupled, and the enrollment of women engineering students, which was previously at a 5-year average of 19%, increased to 24% in the year following the redesign.

Finally, recognition of the ways in which stereotypic expectations might have channeled girls out of STEM pathways early suggests that a route to inclusivity is to de-emphasize past experience and emphasize the potential of all students to learn relevant skills. For example, the initiative that successfully increased female computer science graduates at Harvey Mudd College included introductory courses specifically aimed at incoming students with little prior programming experience (AAUW, 2015). In addition, Cuny and Aspray (2001) suggested broadening admissions criteria to create space for people who have the ability to succeed in computer science and engineering but lack direct experience with these classes. Admission policies that emphasize past experience with computer science and engineering might disproportionately disadvantage women who became interested as a means of addressing societal problems but did not focus on the field from an early age (also see Holloway, Reed, Imbrie, & Reid, 2014).

Despite the goal congruity perspective’s potential to promote fuller understanding of women’s STEM engagement, the possibility exists that the focus on communal affordances in STEM will deflect attention from other key processes, such as prejudice against women in STEM. Much like attributions for responsibility, where explanation may be equated with exoneration (A. G. Miller, 2004), exploring relatively internal factors may be perceived as denying the contributions of relatively external factors. One implication thus may be that focusing on internal factors is seen to do a disservice to working against structural barriers that inhibit gender equality in STEM. We find this conclusion unsatisfying for a number of reasons. First, as is clear from this review, we contend that giving women’s varied motivations a primary place in our theoretical frameworks is itself necessary for progress toward gender equality. Second, truly disentangling what is “internal” and what is “external” is not easily done, given that social psychology has long documented how relatively external beliefs or roles can become internalized. As noted by Williams (1999), women’s occupational decisions include both elements of choice and elements of discrimination: “Choice concerns the everyday process of making decisions within constraints” (p. 37). Third, understanding the roots of a large-scale issue like gender gaps in STEM pursuits requires attention to multiple factors; there is not just one solution to this challenge. The elaboration of motivational processes thus serves as a call for more, rather than less, research on external factors that demotivate underrepresented groups.

**Closing**

The challenge of attracting more women, and people generally, to STEM is one of magnitude and complexity. Certainly,
there are multiple contributing factors and multiple potential solutions; however, considering communal goal processes provides a useful framework to identifying key challenges and promising solutions.

Although the question of whether women possess the ability to pursue careers within the STEM field has been answered with a resounding “yes,” important legacies related to ideas about gender differences in mathematical or scientific ability remain. The mere belief that boys are more interested in science or math can lead to a cascade of events that lead boys and young men to have greater exposure and immersion in science and mathematics. Piquing the interest of girls and young women, and sustaining that interest throughout challenges, is necessary to open the doors of STEM more broadly. This understanding of the proximal motivators of science and mathematics engagement is critically important, particularly given recent advancements in understanding how the breadth of girls’ cognitive abilities predicts their academic pathways (e.g., Valla & Ceci, 2014).

The question of why individuals do or do not persist in STEM pathways is a pressing concern, both for practical reasons and for a greater understanding of the processes by which individuals make important life choices. Our perspective posits that communal goal processes in particular are an essential component in understanding these decisions. Understanding how STEM fields can and do offer opportunities for communal goal pursuit, and transmitting these aspects broadly, can reap widespread benefits. Although one route to goal congruity in STEM fields is by disengaging from communal goals, this outcome will incur costs to individuals, to local organizational units, to STEM disciplines, and ultimately to society. Elaboration of the possibilities for communal goal pursuits in STEM roles can thus provide another pathway to broadening participation at all levels.

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