Mapping social exclusion in STEM to men's implicit bias and women's career costs

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Why are women socially excluded in fields dominated by men? Beyond the barriers associated with any minority group's mere numerical underrepresentation, we theorized that gender stereotypes exacerbate the social exclusion of women in science, technology, engineering, and math (STEM) workplaces, with career consequences. Although widely discussed, clear evidence of these relationships remains elusive. In a sample of 1,247 STEM professionals who work in teams, we tested preregistered hypotheses that acts of gendered social exclusion are systematically associated with both men's gender stereotypes (Part 1) and negative workplace outcomes for women (Part 2). Combining social network metrics of inclusion and reaction time measures of implicit stereotypes (the tendency to "think STEM, think men"), this study provides unique empirical evidence of the chilly climate women often report experiencing in STEM. Men with stronger implicit gender stereotypes had fewer social ties to female teammates. In turn, women (but not men) with fewer incoming cross-gender social ties reported worse career fit and engagement. Moderated mediation revealed that for women (but not men), cross-gender social exclusion was linked to more negative workplace outcomes via lower social fit. Effects of social exclusion were distinct from respect. We discuss the possible benefits of fostering positive cross-gender social relationships to promote women's professional success in STEM.

social networks | implicit bias | gender | STEM | stereotyping

Women continue making inroads into fields traditionally dominated by men, such as those in science, technology, engineering, and math (STEM), but often report a "chilly" climate once there. According to women, men often gatekeep social activities and avoid seeking friendships with women (1–4). Likewise, men report selectively socializing in cliques of mostly men (5–7). This paper investigates how women's social inclusion in workplaces dominated by men is linked both to men's gender stereotypes and women's workplace outcomes. Does women's social exclusion arise merely from generic preferences to affiliate with similar others, or is it symptomatic of women's devaluation in STEM? Integrating network metrics with implicit measures of gender stereotypes, we examined this question among 1,247 STEM professionals. Our findings provide empirical evidence of how cross-gender social exclusion contributes to the chilly climate experienced by many women in STEM.

Women's Social Exclusion: Linked to Men's Implicit Gender Stereotypes

Even in the absence of gender stereotyping, women's felt exclusion could simply reflect homophily, a pervasive preference for affiliating with similar others (8). Although homophily affords men and women comparable numbers of social connections when gender representation is balanced, when women are underrepresented, homophily leaves women less connected. For example, given a ratio of r men to women and equivalent preferences for gender homophily, the average woman would experience r^2 more instances of cross-gender social exclusion than the average man (9), yielding fewer social connections.

Distinct from homophily, women's social exclusion in STEM could also arise from implicit gender stereotyping, an automatic tendency to view men as prototypical STEM workers (10) and implicitly associate the concepts of science or engineering more with men than with women (11–13). Such stereotypes might lead men (and potentially women) to undervalue and thus avoid making social connections with colleagues who are women (relative to those who are men). For example, in workplaces dominated by men, employees tend to preferentially seek ties with men (6) and distance themselves from women, who are seen as having less social capital (14, 15). However, research has not directly linked these patterns of exclusion to implicit gender stereotypes. We hypothesized that men with stronger implicit STEM = male associations would have fewer ties with women. Although this linkage could indicate that gender stereotyping contributes to men's social exclusion of women, as we theorized, we also explored two alternative accounts: that women socially avoid more biased men or that gendered status differences structurally constrain men's ability to socialize with women. Finally, we distinguished between socializing with teammates vs. respecting teammates' contributions. Although socializing may be a better signal of whom men see as truly belonging in the workplace (16), a lack of respect can be a salient concern for women and other marginalized groups (17, 18).

Women's Workplace Outcomes: Linked to Being Socially Excluded by Men

If gender stereotyping plays a role in men's social exclusion of women, experiencing exclusion might also be linked to women's workplace outcomes. In general, being included in social networks is often associated with stronger career trajectories (19, 20), performance (21), and promotion rates (6, 22), plus informal social relationships foster a sense of shared identity (16), provide access to information (23, 24) or activities (25), and afford socioemotional

Significance

Despite widespread initiatives to promote gender diversity and inclusion in science, technology, engineering, and math, subtle barriers to women's success remain. We present evidence that men with stronger implicit stereotypes report socially including fewer women in the workplace. For women, the lack of social connections from men is linked to a lower sense of social fit and less workplace engagement. We discuss implications for how fostering positive cross-gender social relationships might benefit women and other marginalized groups in the workplace.

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benefits (26). For members of devalued groups, however, signals of inclusion can be especially impactful. In fields dominated by men, men often serve as the primary arbiters of identity-based information in STEM (27). Thus, women's social ties with men can be salient signals of social fit, the perception of being truly accepted in that setting (28), with stronger effects for women's (vs. men's) workplace outcomes (17). Based on past theory and research, we hypothesized that experiencing cross-gender social inclusion (for women, being included by men) would uniquely relate to women's (more than to men's) sense of social fit and workplace engagement. Because social fit is a critical component of feeling authentic (28) and flourishing at work, we further hypothesized that it would mediate the relationship between women's reports of social inclusion by male teammates and workplace outcomes. Again, we tested whether effects for socializing were distinct from respect (16).

The Present Study

To test the above preregistered hypotheses (https://osf.io/q9gsj), we surveyed 1,247 full-time STEM professionals (385 women and 862 men) from nine organizations. This survey measured participants' social networks, workplace outcomes, and implicit associations (see *Materials and Methods* and *SI Appendix* for details). To index social network structure, each participant listed up to five teammates, then indicated who (including themselves) sought out each person for informal socializing (e.g., chatting during breaks; the parallel respect measure asked "Who respects whom as highly competent?"). Using established metrics (29, 30), we computed each team's cross-gender social integration or density (ties observed between men and women; $n = 854$). We extended standard ego network degree methods (31, 32) to calculate four metrics of participants' observed ties to vs. from same- and cross-gender teammates, to compute same- and cross-gender outdegree and indegree, respectively. Every network metric was computed based on possible ties (if zero, the metric is undefined). Workplace outcomes (values of $n = 1{,}185$ to 1,246) comprised self-reports of work engagement, efficacy, social fit, social identity threat, and workplace support. Finally, 1,051 participants completed a gender–STEM brief implicit association test (BIAT) (33), comparing reaction times to stereotype-congruent (STEM and men) and stereotype-incongruent (STEM and women) trials.

Results

Network data were collected anonymously, precluding linked analyses within teams. Thus, we report analyses of network structure separately for participants' social connections to teammates in Part 1 (focusing on linking men's implicit associations to whom they seek out as social contacts) and ties received from teammates in Part 2 (focusing on how being sought out for social interaction relates to women's outcomes). Analyses use ordinary least squares (OLS) regression (general linear models via SPSS Statistics 26) with mean-centered continuous predictors because no primary measures significantly clustered within the nine organizations (intraclass correlation coefficients < 0.10 and values of $P > 0.05$)*. Men (Part 1) or women (Part 2) were dummy-coded to be the reference group as the preregistered focal gender (exploratory tests of gender moderation used effects coding). Degrees of freedom vary based on completion of study components and team gender composition. Main results focus on connecting metrics of cross-gender socializing to men's implicit stereotypes (Part 1) and women's workplace outcomes (Part 2). Fewer effects emerged for respect (*SI Appendix*), perhaps due to higher rates (and lower variance) of reported respect ties, relative to social ties (*SI Appendix*, Table S2).

*See *SI Appendix*, Table S10, for robustness checks using multilevel models, which replicate our general linear models.

In Part 1, we summarize evidence that men with stronger STEM = male implicit stereotypes report socially including fewer female teammates, whereas women's implicit stereotypes are decoupled from their reported social behaviors. Part 2 analyses point to potential costs: cross-gender social exclusion is linked with more negative workplace outcomes (i.e., engagement, efficacy, threat, and perceived support) for women (more than for men), mediated by lower social fit.

Part 1: Men's Implicit Gender Stereotypes and Cross-Gender Social Ties. As in prior research (12), participants more rapidly associated STEM constructs (science and engineering) with male than female names, with mean D scores (0.20, SD = 0.39) significantly above zero [$t(1{,}050) = 16.74$, $P < 0.001$, Cohen's $d = 0.52$]. Both men and women showed this implicit STEM = male association (*SI Appendix*, Table S2) (values of $P < 0.001$), yet men's associations were stronger [$t(1{,}049) = 4.54$, $P < 0.001$, $d = 0.30$].

Next, we tested the hypothesis that men with stronger implicit STEM = male stereotypes would have fewer positive social ties to female teammates (lower cross-gender social outdegree). To distinguish social inclusion from generic positivity toward teammates, analyses focused on social ties, covarying for respect ties. As preregistered, men with more stereotypic associations socially included fewer female teammates (cross-gender social outdegree) [$t(694) = 2.30$, $P = 0.022$, $d = 0.17$] (Fig. 1), but their social connections to male teammates (same-gender outdegree) were not associated with implicit stereotypes [$t(906) = 1.20$, $P = 0.230$, $d = 0.08$]. In contrast, women's stereotypic associations were not systematically related to their social inclusion of men (cross-gender social outdegree) [$t(694) = 0.08$, $P = 0.933$, $d = 0.01$] or other women (same-gender social outdegree) [$t(906) = 0.98$, $P = 0.328$, $d = 0.06$]. Although descriptively stronger (and significant) for men, the link between implicit stereotypes and cross-gender social ties did not differ reliably by gender [$t(694) = 1.43$, $P = 0.152$].

As a robustness check of these findings' specificity by gender and tie type, a mixed factorial general linear model tested effects of participant gender and implicit stereotyping (continuous BIAT score) on tie type (social vs. respect cross-gender outdegree, as a within-participant outcome; *SI Appendix*, Table S4). Follow-up regressions probed each tie type separately, with the focal gender as the reference group. Men's implicit stereotypes were significantly more linked to their social (vs. respect) ties to female teammates (a two-way interaction, $P = 0.006$): men holding stronger (vs. weaker) stereotypic implicit associations tended to socially include marginally fewer female teammates ($P = 0.060$, $d = 0.14$) but reported comparable respect for their competence ($P = 0.194$, $d = 0.10$). Indeed, a three-way interaction ($P = 0.033$) indicated a different pattern for women, for whom the two-way interaction ($P = 0.650$) and simple effects of implicit stereotypes on social ($P = 0.803$, $d = 0.02$) and respect ($P = 0.264$, $d = 0.08$) cross-gender ties were all nonsignificant.

Importantly, the focal effect involving men's exclusion of women was not moderated by status (general or relative to teammates; *SI Appendix*, Table S8). That these effects hold across the status continuum suggests that the observed patterns do not simply arise from men being in disproportionately higher-status positions that limit their ability to socialize with women in their network. Alternately, the link between men's BIAT scores and social ties with women could reflect women's strategic avoidance of men with stronger implicit stereotypes. However, men's implicit stereotypes were not significantly related to their reports that women avoid them socially (cross-gender social indegree; covarying for cross-gender respect indegree) ($P = 0.104$, $d = 0.12$), in contrast to the above effect ($P = 0.022$, $d = 0.17$) for men's avoidance of women (cross-gender outdegree). Conclusions from this analysis are somewhat tempered by evidence that individuals from majority (vs. marginalized) groups tend to pay less attention to others (34) and are somewhat less accurate when reporting social network ties

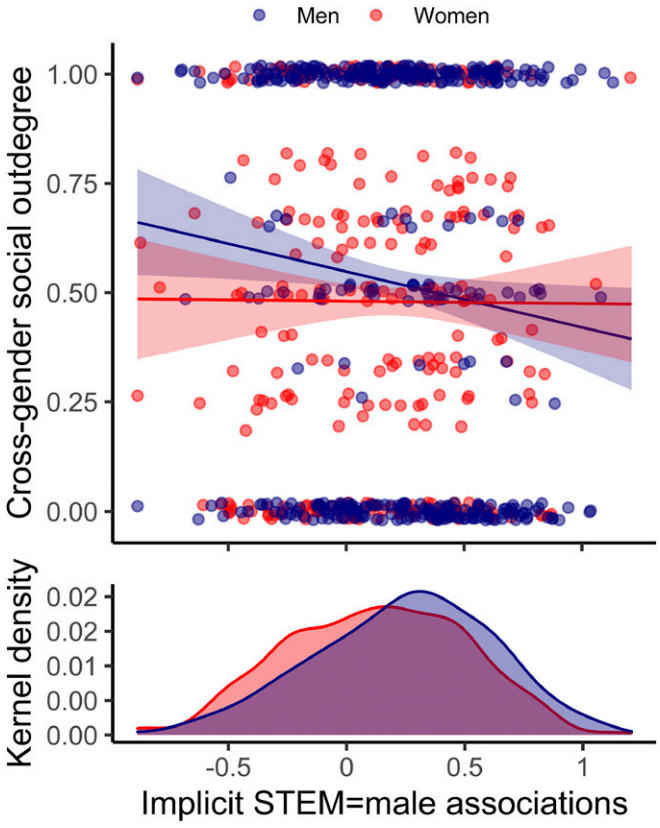

Fig. 1. Linkage between implicit gender stereotypes and outgoing cross-gender social ties (outdegree; *Top*). Bright red denotes participants who are women, and dark blue denotes participants who are men. Scatter points represent raw data, jittered to avoid overplotting, with lines of best fit generated using the corresponding respect-based covariate from the full model. A kernel density plot displays the distribution of implicit STEM = male associations by participant gender (*Bottom*). Implicit associations have been winsorized to ±3 SDs from the mean.

received from others (35), although overall, individual reports on the presence (vs. absence) of specific ties still tend to be highly congruent (36).

Part 2: Cross-Gender Social Ties and Women's Workplace Outcomes. Turning to how network structures relate to women's outcomes, we tested whether women in these same organizations who report more cross-gender social exclusion—at either the team or individual level—have more adverse outcomes, as mediated by (lower) workplace social fit. More fully, we examined the gender composition of teams (*SI Appendix*, Table S5), as well as two partially overlapping indicators of network structure: team- and individual-level cross-gender social ties (differentiating correlates of chilly teams from women's relationships with individual male teammates). Basic models test for unadjusted effects, and full models control for same-gender ties to disambiguate gender-based dynamics from overall team structure (for parallel respect models, see *SI Appendix*, Table S11). Consistent with Part 1 and the preregistered mediation model, Part 2 focuses on incoming social ties, but the reported results hold when controlling for cross-gender respect ties (*SI Appendix*, Table S6).

We tested links between team- and individual-level social integration and five preregistered workplace outcomes (for means and correlations by gender, see *SI Appendix*, Tables S2 and S3). Men on average reported higher social fit and self-efficacy, lower social identity threat, and descriptively (yet nonsignificantly) higher workplace engagement and workplace support than did women.

Team-Level Gender Integration. In support of our preregistered hypotheses, women reported more engagement, support, and social fit and less identity threat when working in more gender-integrated teams (i.e., higher cross-gender density) (values of $P < 0.012$, values of $d \geq 0.18$); no effect emerged for self-efficacy ($P = 0.111$, $d = 0.11$) (see *SI Appendix*, Table S5, for same-gender density covariation). Exploratory tests of gender moderation revealed team gender integration was linked to workplace engagement significantly more strongly for women than men, $P = 0.024$ (two-way interaction). Yet for the other four outcomes, team gender integration was linked to comparable benefits for women and men (values of $P > 0.071$). Overall, women reported higher cross-gender density than did men ($P = 0.043$, $d = 0.14$) (no gender difference in gender integration was predicted), but when gender integration was low, women felt especially disengaged from their work.

Individual-Level Social Inclusion. At the individual level, women reported less social inclusion by their male teammates than did men by their female teammates ($P = 0.043$, $d = 0.14$), consistent with our prediction of lower centrality for women than men. (Moreover, this level of inclusion was lower than men reported from male teammates, $P = 0.001$; *SI Appendix*, Table S2.) As predicted, social ties from male teammates (lower cross-gender indegree) consistently correlated with worse workplace outcomes for women (Table 1). Women who received fewer social ties from male teammates felt lower workplace engagement, less workplace support, lower social fit, and higher social identity threat (all values of $P \leq 0.001$, values of $d > 0.23$) and lower self-efficacy ($P = 0.003$, $d = 0.21$). Notably, workplace outcomes tracked cross-gender social exclusion more strongly among women than men for all outcomes (values of $P < 0.024$), except self-efficacy ($P = 0.060$) (Table 1).

Extending these basic analyses, our full model then covaried for same-gender inclusion, followed by robustness checks to ensure results were not confounded with general popularity (reflected in same-gender social indegree or cross-gender respect indegree), inclusion of others (e.g., cross-gender social outdegree), or demographics (e.g., age). In the full model covarying for same-gender social indegree (including all who listed male and female teammates; Fig. 2), women who experienced more social exclusion by male teammates continued to report more negative outcomes: worse fit, engagement, support, and identity threat (all values of $P < 0.001$, values of $d \geq 0.24$), plus marginally lower self-efficacy ($P = 0.075$, $d = 0.13$). For men, in contrast, inclusion by female teammates (cross-gender indegree) was linked to only workplace support ($P = 0.019$, $d = 0.17$, all other values of $P > 0.133$, values of $d < 0.01$). (For overall correlates of same-gender inclusion, see *SI Appendix*, Table S3.) Across all network-based and demographic covariates, the link between men's social ties toward women and all workplace outcomes (except self-efficacy) remained significant, typically moderated by gender (*SI Appendix*, Tables S6 and S7). As in Part 1, participants' general or relative status did not moderate reported effects (*SI Appendix*, Table S9).

Social Fit Mediates Link from Social Inclusion to Workplace Outcomes. Because women's individual-level cross-gender inclusion was tied to positive workplace outcomes, we tested social fit as the preregistered mediator of these relationships. To test the specific effect of cross-gender social inclusion (indegree), we covaried for same-gender indegree. (For all outcomes, the hypothesized indirect path was significantly stronger for women than men without this covariate.) Using the PROCESS macro within SPSS 26 (37) with 5,000 bootstrapped samples, we tested the indirect effect of cross-gender social inclusion via social fit on each other workplace outcome, focusing on effects for women (as preregistered) and allowing participant gender to moderate the *a* and *b* paths. As previously shown, social exclusion by male teammates was more negatively linked to women's social fit than social exclusion by female teammates was to men's social fit. In turn, higher social fit

Table 1. Incoming cross-gender social ties and workplace outcomes

Model	Maximum *n*	Work engagement	Social identity threat	Self-efficacy	Social fit	Work support
Basic model						
Participant gender	844	−0.02	0.63***	−0.04	−0.01	−0.03
C-G indegree	844	0.53***	−0.35**	0.22**	0.56***	0.64***
C-G indegree × gender	***844***	***0.29****	***−0.26****	***0.14***†	***0.33*****	***0.28*****
C-G indegree for women	**360**	**0.81*****	**−0.61****	**0.35****	**0.89*****	**0.92*****
C-G indegree for men	484	0.24*	−0.09	0.08	0.24*	0.36***
Full model						
Participant gender	762	−0.04	0.60***	−0.04	0.02	−0.04
S-G indegree	762	0.16	−0.07	0.19*	0.41***	0.26*
C-G indegree	762	0.49***	−0.37**	0.12	0.44***	0.58***
C-G indegree × gender	***762***	***0.31****	***−0.31****	***0.12***	***0.36*****	***0.32*****
C-G indegree for women	**278**	**0.80*****	**−0.68*****	**0.24**†**	**0.81*****	**0.90*****
C-G indegree for men	484	0.18	−0.07	0.00	0.08	0.26*

Unstandardized estimates from regressing each outcome on cross-gender social ties received from teammates (C-G indegree), participant gender, and their interaction. Indentation indicates follow-up simple effects tests, boldface indicates preregistered predictions for women, and italicization indicates exploratory tests of moderation. The full model covaries for same-gender ties (S-G indegree). Sample and cell sizes vary across models because some women had no same-gender teammates. Work, workplace. $^{\dagger}P < 0.10$. $^{*}P < 0.05$. $^{**}P < 0.01$. $^{***}P < 0.001$.

was linked to greater engagement, support, and self-efficacy for women and men alike (values of $P < 0.001$, values of $d \geq 0.78$) (without moderation by gender, values of $P > 0.40$) and to lower social identity threat ($P < 0.001$), especially for women; this path was over twice as large for women as men [$t(725) = 3.62$, $P < 0.001$, $d = 0.60$]. All indirect effects from cross-gender social inclusion to each outcome were significant via social fit for women but not men (Table 2), with significant indices of moderated mediation by gender (all 95% CIs excluded 0).

Discussion

Women in STEM fields dominated by men often report facing a chilly climate. We present evidence that informal workplace friendships provide key insights to gendered career inequities that go beyond what might be expected from mere homophily (an affinity to connect with similar others). Men with stronger "think STEM, think men" implicit stereotypes report socializing with fewer female teammates (regardless of respect), and women who have fewer social ties from men report experiencing

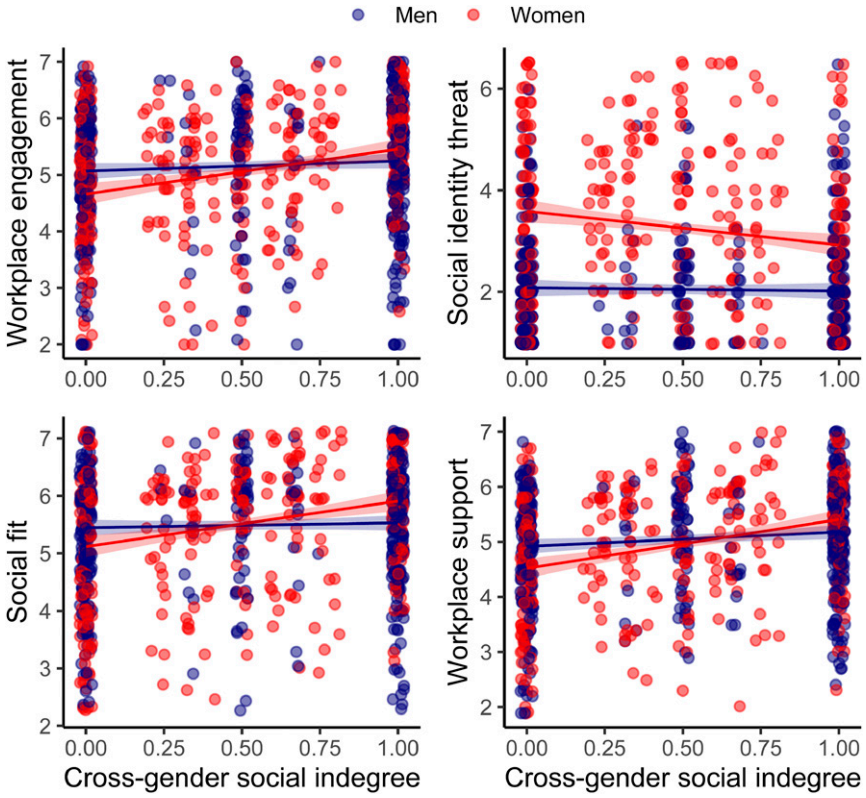

Fig. 2. Incoming cross-gender social ties (indegree) and workplace outcomes: workplace engagement, social identity threat, workplace support, and social fit (clockwise from *Upper Left*). Bright red denotes participants who are women, and dark blue denotes participants who are men. Scatter points represent raw data, jittered to avoid overplotting, with lines of best fit generated using the corresponding same-gender covariate from the full model. Workplace outcomes were winsorized to ±3 SDs from the mean.

Table 2. Social fit as a mediator between incoming cross-gender social ties and workplace outcomes

Outcome by gender	C-G indegree to social fit *a* path*, *B* (*P*)	Social fit to outcomes *b* path*, *B* (*P*)	C-G indegree to outcomes *c′* (direct) path† *B* (*P*)	C-G indegree to outcomes *ab* (indirect) path‡ *B* [95% CI]
Women				
Workplace engagement	**0.82** (<0.001)	**0.45** (<0.001)	**0.23** (0.014)	**0.37** [0.19, 0.57]
Social identity threat	**0.85** (<0.001)	**−0.50** (<0.001)	−0.11 (0.360)	**−0.42** [−0.65, −0.23]
Efficacy at work	**0.82** (<0.001)	**0.32** (<0.001)	−0.02 (0.820)	**0.26** [0.13, 0.41]
Workplace support	**0.89** (<0.001)	**0.37** (<0.001)	**0.32** (<0.001)	**0.33** [0.18, 0.51]
Men				
Workplace engagement	0.08 (0.510)	**0.39** (<0.001)	**0.23** (0.014)	0.03 [−0.05, 0.11]
Social identity threat	0.10 (0.385)	**−0.19** (<0.001)	−0.11 (0.360)	−0.02 [−0.07, 0.02]
Efficacy at work	0.08 (0.510)	**0.28** (<0.001)	−0.02 (0.820)	0.02 [−0.04, 0.08]
Workplace support	0.11 (0.360)	**0.37** (<0.001)	**0.32** (<0.001)	0.04 [−0.04, 0.12]

Estimates from mediational models for each outcome, using cross-gender social ties received from teammates (C-G indegree) as the predictor and social fit as the mediator, with participant gender as a moderator and same-gender social ties from teammates (S-G indegree) as a covariate. Boldface indicates paths significant at $P < 0.05$.

*Gender moderated the *a* path for all four outcomes and the *b* path for only social identity threat.

†PROCESS Model 58 held the direct (*c′*) path constant across men and women.

‡For all outcomes, the index of moderated mediation had a 95% bootstrap CI excluding zero.

more negative workplace outcomes, as mediated by lower social fit.

The first finding extends past research focusing on explicitly negative attitudes toward women (38, 39) or especially positive attitudes about men (40), to provide evidence of the more subtle effects of implicit STEM = male stereotypes for women's inclusion in STEM. In workplaces where women are devalued, connections to female colleagues (vs. male colleagues) are perceived as less valuable (6). Thus, the evidence that men's implicit stereotypes correlate negatively with their social ties to female teammates is consistent with our theorizing that women's exclusion from social networks arises from their devaluation in fields dominated by men. We cannot rule out the possibility that women are more likely to avoid socializing with implicitly biased men, but we note that women often fail to recognize implicit sexism directed at them (41), and here men's reports that women socialize with (vs. avoid) them—though not a perfect proxy for women's social behavior (34, 35)—were uncorrelated with men's own implicit associations. Another interpretation, that men's typically higher-status roles constrain potential social ties with (often lower-status) women, also seems less plausible because our network metrics control for number of women in each team, and participants' status did not moderate key effects (*SI Appendix*, Table S8). Finally, although implicit associations may partially reflect gender ratios experienced in STEM (42), here men's implicit associations were unrelated to the proportion of women among scientists or engineers on their team (*SI Appendix*, Table S3).

Although we could not directly connect men's self-reports of excluding women to women's outcomes, a second set of analyses provides evidence that women may especially benefit from experiencing cross-gender social inclusion. For example, women who feel socially included by male teammates report greater workplace engagement, support, and self-efficacy, as well as lower social identity threat, all of which are mediated by feeling greater social fit. Paralleling evidence that cross-group friendships are particularly beneficial for racial minorities (43), cross-gender social ties were more strongly associated with women's than men's workplace outcomes.

These findings converge with existing organizational research on cross-gender mentoring: in organizations dominated by men, earnings and career progress satisfaction are higher among women with senior mentors who are men (44, 45). Proposed mechanisms align with our hypotheses: Interactions with influential men may be less available to women (vs. men), a gender gap that often widens as careers advance (46). When selecting protégés, men may preferentially mentor other men (47), potentially due to greater perceived rapport (48). Finally, women in particular benefit most when a relationship is initiated by the mentor, not themselves (49), consistent with our finding that receiving social ties from men is linked to women's workplace outcomes, more than when women initiate such ties. Future work is needed to generalize these effects to other environments and marginalized groups, including people who are nonbinary, who may face exclusion from both networks dominated by men and (some) women-focused initiatives in STEM.

This project also distinguishes social and respect ties. Notably, in both sets of analyses, effects regarding social ties emerged independently of men's reported or women's experienced cross-gender respect. Although implicit stereotypes could plausibly correlate with lower respect for women's contributions, and women's experiences of disrespect from male teammates could be particularly linked to their workplace outcomes, supplemental analyses found otherwise. Men's (and women's) implicit stereotypes were unrelated to the respect they reported for female teammates (*SI Appendix*, Table S3), and both men and women reported similar workplace benefits (e.g., engagement and support) associated with respect received from teammates of a different gender (*SI Appendix*, Table S11). For instance, even for self-efficacy, which was more strongly associated with cross-gender respect indegree for women than men, cross-gender respect from teammates appears to function as a "tide that lifts all boats" (linked to benefits among both men and women), whereas cross-gender social inclusion was linked primarily to women's outcomes. Such findings echo other evidence that informal socializing with coworkers is more associated with identity-building than are formal workplace relationships (16).

Limitations. The lack of direct linkages between participants' reports in our social network data precludes testing for potentially misaligned perceptions, for example, if women with stalled professional trajectories overestimate their social exclusion by male teammates. However, linkable network studies report widespread perceptual agreement (50, 51), with greater accuracy among lower-status individuals (35). Thus, a woman's report of a man socially excluding her not only reflects her lived experience but is typically an accurate representation of his reported and actual behavior. Future work could establish stronger causal connections by studying these processes in whole networks over time.

Implications. Insofar as men remain the primary arbiters of who belongs in STEM (27), women are disadvantaged by a paucity of

cross-gender social ties. Because social relationships carry identity information, and men's structural advantages afford them more sway over such information in STEM, women socially excluded by men might be particularly disadvantaged in the pursuit of strong identity fit. As such, interventions aimed at fostering inclusion might focus on improving cross-gender social relationships, drawing on contact theory (52). Such efforts must be mindful of a bias–exclusion cycle, whereby the underrepresentation or devaluation of a group reinforces implicit stereotypes that lead to exclusion, perpetuating inequalities. Because implicit stereotypes are resistant to change (53) and advantaged groups are often unaware that subtle exclusion carries important costs (54), interventions can seek to change individuals' awareness, motivation, and situational affordances to foster more inclusive cross-group social connections. Over time, positive contact may erode stereotypic implicit associations (55).

Materials and Methods

Participants and Protocol. Full-time employees in STEM roles at nine (US and Canadian) organizations were emailed an online consent form and invitation to an anonymous survey by an organizational liaison (estimated response rate = 29%). Analyses retained 1,247 full-time STEM professionals (862 men and 385 women; 75% White, 11% East Asian, and 14% other ethnicities; Mdn_{age} = 35 to 39 y; 87% heterosexual). For preregistered exclusions, sector information, gender-based demographic differences (e.g., in status), and analyses covarying for these differences, see *SI Appendix*. Study protocols were approved by research ethics boards at the University of British Columbia and the University of Waterloo. For full materials, see https://osf.io/jb9f7.

Social Network Structure. A social network measure assessed the social and respect-based connections between participants and their five closest teammates: "the 5 coworkers (e.g., supervisors, teammates) you work with most often." Next, two counterbalanced sociomatrix network grid measures adapted from prior work (56–58) recorded connections between each pair of listed individuals on their teams in both directions. For social ties, participants were asked "Who socializes with whom informally? For example, who seeks out whom to chat during breaks, go for coffee/drinks, or connect outside of work?" (e.g., "Does Alice socialize with Bob?" and "Does Bob socialize with Alice?") by selecting −1 (no), 0 (maybe), or +1 (yes) in a matrix of teammates' names (and their own). Respect ties were recorded by asking "Who respects whom as highly competent? For example, who seeks whose input on tough work problems, who picks whom for project teams?" Across both domains, negative (no) ties were rare (13%) and thus combined with maybe (28%) ties as nonties. Ties skipped by participants or lacking teammate gender (12%) were omitted from analysis. For network metric computation, see *SI Appendix*.

Gender–STEM BIAT. Implicit associations between the categories "male" and "female" and STEM were assessed using a gender–STEM BIAT (33). The BIAT (59) is a brief version of the widely used implicit association test (60) that reflects the tendency to automatically associate concepts in one's semantic network (61). This BIAT used either "science" or "engineering" (matched to each participant's self-identified work domain) as the focal category; BIAT type did not moderate any reported relationships. The nonfocal category ("family") was never visible in trials. Aside from adding the science category and shorter practice blocks, this BIAT matched prior research (33). For BIAT stimuli and scoring, see *SI Appendix*.

Workplace Outcomes. Participants rated these workplace outcomes on a scale from 1 (strongly disagree) to 7 (strongly agree): organizational commitment (e.g., "I would be very happy to spend the rest of my career with this organization") (62), meaningful work (e.g., "The vision we collectively work toward inspires me"), workplace efficacy (e.g., "Whatever comes my way in my job, I can usually handle it"), social fit (e.g., "I feel connected to people who work in [my field]"), and perceiving a supportive workplace (e.g., "[Organization name] cares about my general satisfaction at work") adapted from prior research (63). Organizational commitment and meaningful work correlated (r = 0.63) and yielded parallel results, so they were averaged into workplace engagement. Gender-based social identity threat (e.g., "How often do you worry that people at work will judge you because of what they think of your gender?") (64, 65) was rated from 1 (never) to 7 (always). For scale items and reliability (all values of $\alpha \geq 0.80$), see *SI Appendix*, Table S1.

Data Availability. Per the study consent form, our anonymized dataset with key study variables (as well as our syntax file) (66) is available to qualified academic researchers on the Open Science Framework (https://osf.io/fka2j) upon request.

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