



CLIMATE CONTROL: **GENDER AND RACIAL BIAS IN ENGINEERING?**

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EXECUTIVE SUMMARY

“When you walk through the doors of [an oil & gas] corporation, you would think you had taken a step back ... into the 1950s. When we wring our hands and ask why more women do not study STEM in schools, perhaps we should also look at how women are treated in the workplace after we get those STEM credentials. ... Look for companies with women in the boardroom. ... And hope that there are far fewer men trying to get you in the bedroom. ... Thank you so much for conducting this survey.” (*white woman*)

Over 3,000 respondents completed the Workplace Experiences Survey launched by the Society of Women Engineers and the Center for WorkLife Law at the University of California, Hastings College of the Law. Around one-third (897) of respondents left comments—a strikingly high number. The number and tone of comments show engineers’ intense interest in, and strong reaction to, the topic of implicit bias in engineering. The survey asked respondents whether they had been met with the basic patterns of gender and racial bias that have been documented, over and over again, in social psychology studies.

LARGE GENDER GAPS WERE REPORTED FOR THREE PATTERNS OF BIAS

Prove-It-Again Bias: 61% of women vs. 35%¹ of white men reported that they have to prove themselves repeatedly to get the same levels of respect and recognition as their colleagues.

“Women have to look more professional and demonstrate technical prowess at all times to receive the same respect as a male engineer who is just an average engineer.” (*white woman*)

¹ All comparisons are statistically significant based on two sample t-tests, unless noted otherwise.

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Tightrope Bias: Women engineers reported that a narrower range of behavior was accepted in women than men. Women often walk a tightrope, navigating both pressures to behave in feminine ways and pushback for behavior seen as “too masculine.”

- Women engineers were less likely than white men to say they could behave assertively (51% vs. 67%) or show anger without pushback (49% vs. 59%).
- Women (33%) were more likely than white men (16%) to report pressures to let others take the lead; were more likely to report doing more “office housework,” such as finding a time everyone can meet, taking notes, or planning office parties (55% vs. 26%); and were less likely to report having the same access to desirable assignments (65% vs. 85%).

“I was always told I was too aggressive when my male counterparts were recognized as [being] assertive.” (*white woman*)

“The overall culture still needs to change. ... Just last year they hired a new female and one of the managers was telling me how happy they were about hiring her because she really clean[s] up after the guys and keeps the lab tidy.” (*white woman*)

Maternal Wall Bias: Nearly 80% of men said having children did not change their colleagues’ perceptions of their work commitment or competence; only 55% of women did.

“My colleagues assume I am a slacker because I have children, even when I come in evenings or weekends to make up time that I have to miss due to my children. Also I don’t feel like I can talk about my children without being judged.” (*African-American woman*)

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Three separate regression analyses showed that, after controlling for many other variables, women still reported more Prove-It-Again, Tightrope, and Maternal Wall bias. Evidence for the fourth basic pattern of gender bias, Tug of War, was weaker.

LARGE RACIAL GAPS WERE REPORTED FOR TWO PATTERNS OF BIAS

Prove-It-Again Bias: 68% of engineers of color (men as well as women) reported having to prove themselves repeatedly, as compared to 35% of white men.

“Being from an international background, not white bread American raised, we have to work harder.” (*Latino man*)

Tightrope Bias:

- Engineers of color were less likely than white men to say they could behave assertively (49% vs. 67%) or show anger without receiving pushback (45% vs. 59%).
- Engineers of color were more likely than white men to report pressures to let others take the lead (39% vs. 16%) or do office housework (52% vs. 26%) and were less likely to report having the same access to desirable assignments (55% vs. 85%).

“I feel discriminated not only by my gender but also by my cultural heritage. There are very few opportunities extended to someone like me. I am given the work but not the credit for successful outcome. ... The message I get over and over is that I am capable of getting things done right but I don’t deserve the right to be promoted—even if the additional responsibilities were given to me.” (*Latina woman*)

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Although clearly some Latino engineers reported bias, two separate regression analyses showed that, after controlling for many other variables, Asian- and African-American engineers reported more Prove-It-Again and Tightrope bias than their white counterparts, but the effects for Latinos disappeared.

AGE EFFECT SHOWN FOR ONE PATTERN OF BIAS

Regression analysis showed that, after controlling for many other variables, engineers aged 55-64 reported higher Prove-It-Again bias than engineers below 35 years old.

For virtually every workplace process, either women or engineers of color reported experiencing more bias than their men or white counterparts, and a few effects emerged for age.

The survey also asked whether engineers believed that they were fairly treated at work with respect to hiring, promotions, performance evaluations, access to networking and mentoring, and compensation.

Women respondents were more likely than white men to report:

- As compared to my colleagues, I work more but get paid less (40% vs. 29%).
- I feel I get less honest feedback on my performance than my colleagues (29% vs. 20%).

Women respondents were less likely than white men to report:

- I have had as much access to formal or informal networking opportunities as my colleagues (67% vs. 84%).

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- I have been given the advancement opportunities and promotions I deserve (62% vs. 71%).
- My performance evaluations have been fair (77% vs. 83%).

Regression analysis showed that, after controlling for many other variables, women reported experiencing higher levels of bias in hiring, networking/sponsorship, and promotion than their male counterparts.

Engineers of color were more likely than white men to report:

- As compared to my colleagues, I work more but get paid less (48% vs. 29%).
- I feel I get less honest feedback on my performance than my colleagues (35% vs. 20%).

Engineers of color also were less likely than white men to report:

- I have had as much access to formal or informal networking opportunities as my colleagues (64% vs. 84%).
- I have been given the advancement opportunities and promotions I deserve (53% vs. 71%).
- My performance evaluations have been fair (69% vs. 83%).

Regression analysis showed that, after controlling for many other variables, African-American engineers reported higher levels of bias in networking, promotion, and mentoring/sponsorship than their white counterparts. Asian-American engineers reported more bias in performance evaluations than their white counterparts.

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Survey respondents also reported age bias: After controlling for many other variables, engineers over 45 reported higher levels of bias in performance evaluations and mentoring/sponsorship than their younger counterparts (below 35 years old); engineers over 55 reported higher levels of bias in promotions than below 35 years old. In addition, engineers with between two and 10 years of experience at their current companies reported hiring bias, compared with those with less than two years of experience at their companies, after controlling for many other variables.

Even small amounts of bias in basic business systems can have large effects. One computer-simulation study found that even if bias accounts for as little as 1% of the variance in performance ratings, bias can have large effects in reducing the representation of women over time, especially in high-level positions.²

THE TOPIC OF BIAS IS CONTROVERSIAL IN ENGINEERING

While 16.8% of the comments by male engineers expressed the view that diversity is threatening the quality of the profession and that women now have unfair advantages, or similar sentiments, only 3.6% of male lawyers made these kinds of comments in a similar survey.³

“Merit is vastly more important than gender or race, and efforts to ‘balance’ gender and race diminish the overall quality of an organization by reducing the collective merit of the personnel.” (white male engineer)

² Martell, R. F., Lane, D. M., & Emrich, C. (1996). Male-Female Differences: A computer simulation. *American Psychologist*, 51(2), 157-158.

³ Williams, J. C., & Li, S. Forthcoming. Understanding in-house and law firm lawyers' workplace experiences survey. Center for WorkLife Law, UC Hastings College of the Law.

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"I look around me now, in aerospace, and just discovered ... there are NO OTHER WOMEN ENGINEERS LIKE ME. ... They just don't last. ... They disappear around 5 years and we keep hiring and have high turnover. The younger ones now ... tell me they are going to quit. ... They cry at work. ... They are subjected to sexual peccadillos, they don't get opportunities. ... I hear the SAME things ... that happened to me. I have had tires flattened and slit, been sexually approached in a conference room, it just goes on and on. ... I hope before I die to see SOME improvement. Great survey and really brings it home for me. ... It is a miracle I am still here." (*white woman, engineer for 37 years*)

An extensive research base in social psychology provides objective measures of workplace gender and racial bias. Such studies typically ask subjects to rate identical resumes with a man's or woman's name or with names associated with different racial groups. These studies have documented the same patterns of racial and gender bias over and over again.

The most rigorous study of bias within Science, Technology, Engineering, and Mathematics (STEM) fields, with a double-blind randomized design, asked actual professors in STEM to rate the resumes for a job as a lab manager (Moss-Racusin, Dovidio, Brescoll, Graham, & Handelsman, 2012). The study found that both male and female STEM professors rated male applicants more competent and hireable than their female counterparts and that they offered more money and career mentoring for male applicants. Another study found that both male and female subjects were twice as likely to hire a man as a woman for a job that required math (Reuben, Sapienza, & Zingales, 2014).

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These studies echo findings with respect to race. A famous 2004 study found that resumes of candidates with African-American-sounding names needed eight additional years of experience to get the same number of job callbacks as did white candidates with identical resumes—the higher the quality of the resume, the higher the racial gap (Bertrand & Mullainathan, 2004). Earlier studies found that African-Americans were held to stricter standards of competence than whites (Biernat & Kobrynowicz, 1997) and that the black managers' achievements were less likely to be attributed to skill and more likely to be attributed to outside help (Greenhaus & Parasuraman, 1993).

Another famous study asked subjects to rate resumes of mothers and identical women without children and found that the mothers were 79% less likely to be hired, only half as likely to be promoted, offered an average of \$11,000 less in salary, and held to higher performance and punctuality standards (Correll, Benard, & Paik, 2007). This study measured bias both among college students and actual employers and found even stronger bias among employers than college students.

This study builds on that body of work. While the social psychology studies provide objective measures of bias, most take place in social psychology labs with college students, leaving open the question of whether the bias they document occurs in actual workplaces. This study suggests it does.

A prior study showed that, when the experimental design contained clues that the subject being studied was gender bias in STEM, STEM professors favored hiring women over men (Williams & Ceci, 2015). Most people know what the politically correct answer is when asked to consider a hypothetical situation that concerns hiring women in STEM (Jo, Nelson, & Kiecker, 1997). This study takes a different

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approach. We simply asked engineers what they have personally experienced in their careers and compared the answers of women and engineers of color to white men.

The survey tested for four basic patterns of bias. The first two are patterns of both racial and gender bias; the last two concern gender.

Prove-It-Again. Nearly 40 years of studies have documented that women and people of color often need to be more competent than white men in order to be seen as equally competent (Knobloch-Westerwick, Glynn, & Huge, 2013; Moss-Racusin, Dovidio, Brescoll, Graham, & Handelsman, 2012; Heilman, 2012; Heilman & Chen, 2005; Roth, Purvis, & Bobko, 2012; Biernat, Fuegen & Kobryniewicz, 2010; Bowles & Gelfand, 2010; Fiske, Cuddy, Glick, & Xu, 2002; Bauer & Baltes, 2002; Davison & Burke, 2000; Foschi, 2000; Biernat & Kobryniewicz, 1997; Foschi, 1996; Steele & Aronson, 1995; Heilman, Block, & Martell, 1995; Landau, 1995; Scherer, Owen, & Brodzinski, 1991; Heilman, 1983, 1984; Berger, Fisek, Norman, & Zelditch, 1977).

Tightrope. Over 40 years of studies have documented that a narrower range of behavior often is accepted from women than from men (Haselhuhn & Kray, 2012; Rudman, Moss-Racusin, Phelan, & Nauts, 2012; Bowles, Babcock, & McGinn, 2005; Heilman & Chen, 2005; Brescoll & Uhlmann, 2008; Rudman & Fairchild, 2004; Prentice & Carranza, 2002; Glick & Fiske, 2001; Rudman & Glick, 2001; Heilman, Wallen, Fuchs, & Tamkins, 1995; Heilman & Taylor, 1981). As a result, women often walk a tightrope between being seen as “too masculine,” and thus respected but not liked, or “too feminine,” and thus liked but not respected. Tightrope bias has

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been less studied in the racial than the gender context, but a few studies suggest that a narrower range of behavior is accepted from African-Americans (Livingston & Pearce, 2009) and Asian-Americans (Cuddy, Fiske, & Glick, 2008; Fiske, Xu, Cuddy, & Glick, 1999) than from white men.

Maternal Wall. Over 20 years of studies have documented that motherhood triggers strong negative competence and commitment assumptions (Heilman & Okimoto, 2008; Crosby, Williams, & Biernat, 2004; Correll, Benard, & Paik, 2007; Hebl & King et al., 2007; Cuddy, Fiske, & Glick, 2004; Fuegen, Biernat, Haines, & Deaux, 2004; Halpert, Wilson, & Hickman, 1993). In addition, mothers who are indisputably competent and committed tend to be considered less warm, less likeable, and more interpersonally hostile (Correll & Benard, 2010).

Tug of War. Sometimes gender bias against women fuels conflicts among women. Research also documents “strategic distancing”—women may distance themselves from other women because they sense that being seen as a woman is a disadvantage (Van Laar, Bleeker, Ellemers, & Meijer, 2014; Derks, Van Laar, Ellemers, & de Groot, 2011; Ellemers & Van den Heuvel et al., 2004). Women also may be divided by differing strategies for assimilating into masculine work cultures (Duguid, Lloyd, & Tolbert, 2012; Duguid, 2011; Ely, 1994; Kanter, 1977). In addition, women may be motivated to penalize other women to protect their own self-identities (Parks-Stamm, Heilman, & Hearn, 2012).

While the Workplace Experiences Survey was designed to test for both gender and racial bias, most people assumed that the survey concerned gender bias only. Perhaps for that reason, virtually all the comments concerned gender. That

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is why the quantitative data in this report discuss both race and gender, but the qualitative data (based largely on survey comments) focus almost exclusively on gender.

The survey focused on implicit and subtle bias that, studies show, is still held by egalitarian individuals (Dovidio & Gaertner, 2004). It did not ask about blatant bias, yet some comments indicate that some women engineers still face old-style sexual harassment as well as other forms of blatant bias. One example:

“My previous position entailed doing all of the travel and all of the field survey for a team of 7 equally qualified men, bringing back information for them, and supporting them as they did the design work and stayed home to see their families. This attitude—dump the unwanted jobs and the overtime on the women in the team—was consistent, and I had heard this policy expressed by my male boss to one of my male co-workers when he thought I couldn’t hear him. Basically – ‘It[if] she want[s] a job, she will do it. I’d rather she quit than you quit.’” (*white woman*)

This, of course, is illegal.

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Imagine a brilliant engineer.

What jumps into most people's heads is a man (Glick, 1995). Women and people of color do not seem as good a fit (Fiske & Taylor, 2013; Heilman, 1983, 1984, 2012; Steele & Aronson, 1995), which is why they often need to provide more evidence of competence than men in order to be seen as equally competent. Women and people of color literally have to prove it again and again. Stereotypes of the elderly as warm but less competent can also trigger Prove-It-Again bias (Cuddy, Norton, & Fiske, 2005). It is unclear how stereotypes of the elderly play out in workplaces.

Many studies have shown that both women and people of color often are held to higher standards. Double standards have been documented for decades through blind resume studies and other types of studies that provide an objective measure of their existence (Knobloch-Westerwick, Glynn, & Huge, 2013; Moss-Racusin, Dovidio, Brescoll, Graham, & Handelsman, 2012; Roth, Purvis, & Bobko, 2012; Davison & Burke, 2000; Biernat & Kobryniewicz, 1997; Foschi, 1996, 2000). Studies have shown that women post-docs needed to be twice as productive to receive the same competency rating as men (DesRoches & Zinner et al., 2010) and that a female scientist needed 64 more impact points than an identical male scientist to be seen as equally competent—which translates into three extra papers in *Nature* or *Science* or 20 in less prestigious journals (Wenneras & Wold, 1997).

A second mechanism that fuels Prove-It-Again bias is in-group favoritism: in-groups, but not out-groups, tend to get the benefit of the doubt (Brewer, 1999; Brewer & Gardner, 1996; Hewstone, 1990). The Prove-It-Again phenomenon also reflects stereotype expectancy (Hamilton & Rose, 1980), aka confirmation bias (Mahoney, 1977): we see what we expect to see. Because low-competence

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stereotypes set expectations low, more evidence will be required of out-groups, as compared with in-groups, to persuade observers to change their assumptions of lower competence. This is the first comprehensive survey, to our knowledge, to document what social psychology has observed in labs for decades: that women and people of color experience a double standard in the workplace.

Prove-It-Again bias is triggered not only by gender and race, but also by disability (Ameri, Schur, Adya, Bentley, McKay, & Kruse, 2015) and LGBTQ status (Tilcsik, 2011). “You could substitute physical handicap for female gender, and would get the same responses,” noted a male engineer (race not noted). “As a queer identifying employee I am constantly battling stigmas and bigotry from fellow employees. In many instances homophobia tend[s] to influence how I am treated and seen,” said another male engineer. Both observations are correct. Only 133 respondents self-identified as LGBTQ (4.44% of the sample). The two questions designed to test bias against LGBTQ engineers found that they feel less comfortable speaking about their romantic relationships in the workplace and less comfortable bringing their partners or significant others to workplace events ($p < 0.001$ for both questions). We did not find other effects.

Prove-It-Again bias is triggered any time descriptive stereotypes intimate that a group is less competent at engineering than majority men. Male engineers of color reported Prove-It-Again bias, although of somewhat different contours than that reported by women. Even Asian-American² men reported it, despite the stereotype that “Asians are good at science”: 67% of Asian-American men, but only 40% of white men, reported, “I feel I am held to higher standards than my colleagues.”³

² In this study, we have put Asian-American respondents and foreign-born Asian respondents into the same “Asian-Americans” category. We also combined Latinos and foreign-born Spanish speakers as one group.

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QUANTITATIVE DATA

The women engineers surveyed reported statistically significant effects for virtually every Prove-It-Again question. They were much more likely (62%) than white men (37%) ($p < 0.001$) to agree that “After moving from an engineering role to a project management/business role, people assume I do not have technical skill,” and they agreed with the statement more strongly ($d = 0.505$, $t(1,593) = 6.59$, $p < 0.001$). They were also much more likely (61%) than white men (35%) ($p < 0.001$) to agree that “I have to repeatedly prove myself to get the same level of respect and recognition as my colleagues,” and they agreed with the statement more strongly ($d = 0.508$, $t(2,569) = 8.172$, $p < 0.001$) (see Appendix A, Table 1a and Table 2).

Women reported several other manifestations of descriptive stereotyping. Women (47%) were more likely than white men (32%) to report the “stolen idea” and to agree more strongly ($d = 0.314$, $t(2,561) = 5.036$, $p < 0.001$) that “In meetings, other people get credit for ideas I originally offered.” This occurs due to confirmation bias: people expect the great idea to come from someone from a group stereotyped as more competent, in this case, white men. Woman respondents (72%) were less likely than white men (86%) ($p < 0.001$) to report, and disagreed more strongly ($d = -0.388$, $t(2,566) = -6.214$, $p < 0.001$), that “My suggestions or ideas are respected as much as my colleagues’.” Women were more likely than white men to report (53% vs. 40%, $p < 0.001$), and agreed more strongly, that they were held to higher standards ($d = 0.319$, $t(2,554) = 5.08$, $p < 0.001$). Finally, while only 9% of white men had been mistaken for administrative staff or technicians, 45% of women surveyed reported that experience ($p < 0.001$). Women, much more

² This was one of the few statistically significant differences for male engineers of color; the number of men of color who participated in the survey was small, which may help explain why so few statistically significant effects emerged. See Appendix A, Table 1c.

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strongly than white men, agreed with the statement that they had been mistaken for administrative staff or technicians ($d=0.778$, $t(2,556)=12.471$, $p<0.001$) (see Appendix A, Table 1a and Table 2).

Women engineers of color also reported gender bias—but a somewhat different experience than white women reported. They were much more likely to report the Prove-It-Again effect: 71% of women of color, compared to 59% of white women ($p<0.001$), reported that they had to prove themselves repeatedly and that they were held to higher standards (61% for women of color vs. 51% for white women, $p<0.001$). White women engineers were more likely than women engineers of color to feel that their ideas were respected as much as their colleagues' ideas (73% vs. 66%, $p<0.001$). (Note: This difference was largely driven by the experiences of Asian-American and Latina engineers; the differences between African-American women and white women were not statistically significant (73% vs. 70%). See Appendix A, Table 1b.)

Most findings were in the predicted direction, based on prior research. A counterintuitive finding is that Asian-American women were more likely to report Prove-It-Again bias than white women (70% vs. 59%, $p<0.001$), despite the stereotype that “Asians are good at STEM.”

Engineers of color (including both men and women) also reported Prove-It-Again problems, and the divergence between the workplace experiences of engineers of color as a group and white men was slightly higher than those between white men and women on most questions. Engineers of color (62%) were more likely than white men (37%) ($p<0.001$) to report, and agreed more strongly ($d=0.534$,

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$t(468)=5.7, p<0.001$), that “After moving from an engineering role to a project management/business role, people assume I do not have technical skill.” Engineers of color (68%) were more likely than white men (35%) ($p<0.001$) to report, and agreed more strongly ($d=0.689, t(735)=9.141, p<0.001$), that they had to repeatedly prove themselves. Engineers of color (60%) were more likely than white men (40%) ($p<0.001$) to report, and agreed more strongly ($d=0.515, t(726)=6.793, p<0.001$), that they were held to higher standards than their colleagues. Engineers of color (67%) were less likely than white men (86%) ($p<0.001$) to report, and disagreed more strongly ($d=-0.508, t(733)=-6.732, p<0.001$), that their ideas were respected as much as their colleagues’. They also were much more likely to report, and agreed more strongly ($d=0.931, t(731)=12.335, p<0.001$), that they had been mistaken for administrative staff or technicians: 45% reported this, compared to only 9% of white men ($p<0.001$). Finally, they were more likely than white men to report (46% vs. 32%, $p<0.001$), and agreed more strongly ($d=0.363, t(731)=4.812, p<0.001$), that other people got credit for their ideas (see Appendix A, Table 1a and Table 2).

Regression analysis showed that, after controlling for many other variables, women, African-American, and Asian-American engineers still reported more Prove-It-Again bias than their male or white counterparts (see Appendix D, Table A).

Finally, we found one effect for age. The regression analysis found that, after controlling for many other variables, engineers aged 55-64 reported higher levels of Prove-It-Again bias than engineers below 35—an effect that, interestingly, disappeared for engineers 65 and older (see Appendix D, Table A).

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QUALITATIVE DATA

Many comments documented Prove-It-Again problems: please see appendix F for a demographic breakdown of comments by gender and race.

Sometimes such comments are written off as the complaints of low performers or of women who just hate engineering. Not so. Even women who expressed enthusiasm for their overall experience in engineering agreed that women have to provide more evidence of competence than men, proving themselves over and over again.

"I still have to prove myself more, but over and over I continue to receive high performance reviews." (*white woman*)

"I have learned that I never have the benefit of the doubt ... and must make for myself opportunities which are given to others. I would not trade working as an engineer for anything, and am incredibly motivated to continue in the hopes that things are easier for the women following after me." (*Latina woman*)

Some women found that once they had proven themselves, their expertise was accepted.

"But I do think that once I've proven myself, my male colleagues respect me and the work I do." (*white woman*)

"As an engineering manager, when people meet me for the first time, there is often a clear initial indication that they question my experience (I don't look my age) and how 'technically knowledgeable' I am. I merely focus on getting down to business, focusing on technical issues. ... I can chart the shift—the more we get into business and technical issues, the more quickly age and perceived gender bias melt away." (*white woman*)

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Lack of fit: Women are hired only to fill the diversity quota

One way Prove-It-Again bias shows up is when women in engineering are assumed to be unqualified, hired only to meet a “diversity quota.” Note the assumption of incompetence:

“I frequently hear concern from established colleagues that recently hired women or minorities [are] only filling the ‘diversity slot’ and do not have technical or business skills.” (*white woman*)

“Very positive, welcoming experience in workforce. However, [I] do have to work harder to prove that [I] did not get hired/promoted to satisfy diversity criteria.” (*white woman*)

“With the new push to [get women into] higher grade engineering jobs, I see more pushback from men assuming that the women getting promoted are LESS qualified than their male counterparts.” (*white woman*)

Note how measures to improve diversity are further fueling stereotypes that women engineers are unqualified, which women then have to work harder to overcome. The solution is not to eliminate diversity efforts but to eliminate the Prove-It-Again bias that makes them necessary.

Lack of fit: Disrespect

Disrespect is another expression of the assumption that women are not a good fit for engineering.

“Women are seldom respected. Opinions or suggestions [are] rarely implemented and have many times been mocked during meetings.” (*Asian woman*)

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"The last five years have been as difficult as the very first five in relation to getting respect from co-workers or managers. However, when they need a real assessment of a situation or a good solution to a problem they come to me. Once they get their answer they go back to their disrespectful ways." (*Latina woman*)

"I also have to deal with co-workers who will not address me directly or reply to my emails, and instead direct all of their responses to my manager, who is a man but not an engineer." (*white woman*)

Lack of fit: Women are held to higher standards

Many comments reflected the view that women are held to higher standards, a phenomenon documented in objective measures over and over again (Biernat, Fuegen, & Kobrynowicz, 2010; Bauer & Baltes, 2002; Biernat & Kobrynowicz, 1997; Foschi, 1996; Landau, 1995; Scherer, Owen, & Brodzinski, 1991). Some noted they had to prove themselves before they got the same respect that men automatically receive.

"I have to prove myself to student[s] and colleagues before I can get the respect that a male will get by default." (*white woman*)

"Once I prove my expertise and sound judgment, I am generally treated the same as a male colleague. But I have to prove it first. None of them do." (*white woman*)

Others felt they had to prove themselves constantly.

"Women have to look more professional and demonstrate technical prowess at all times to receive the same respect as a male engineer who is just an average engineer." (*white woman*)

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Still others reported that being held to higher standards is linked with colleagues' perceptions that women are not a good fit for engineering.

"My colleagues range from the males who don't think women should be engineers to those that think women should perform at a higher standard." (*white woman*)

One woman reported that some of her male colleagues were shocked at the disrespect other male colleagues showed her.

"[M]any assume I have no technical skills even when operating in an engineering role until repeatedly proven otherwise. ... Male colleagues are shocked when I am not treated the same way as they are. ... Many don't believe what is said to me, but some others are fairly appalled. Either way, poor behavior is more common in smaller groups or one-on-one interactions than in large team meetings." (*white woman*)

The only comment linking Prove-It-Again bias to race was from a Latina female engineer, who said that she felt discriminated against "not only by my gender but also by my cultural heritage." She continued:

"The message I get over and over is that I am capable of getting things done right but I don't deserve the right to be promoted—even if the additional responsibilities were given to me." (*Latina woman*)

In-group favoritism: Men, but not women, get the benefit of the doubt

Several women noted in-group favoritism: that men, but not women, engineers are given the benefit of the doubt and that men prefer to champion other men (Brewer, 1996). This has both gender and racial effects. For example, one African-American male engineer stated, "I think that being a minority within our company

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also defines the role that people within the majority place you in. ... People gravitate towards cultures that are comparable to their own." This quote aptly articulates the psychology of in-group favoritism. One result is that in-groups, but not out-groups, get the benefit of the doubt.

"I am held to the 'standard' and male staff is not tested if they meet the standard; male staff are given the 'benefit of a doubt' they meet the qualifications and the women are measured on the objective credentials." (*Latina woman*)

"I do not get the benefit of the doubt as my male colleagues do. I often have to list my credentials when meeting new colleagues or upper management." (*Asian-American woman*)

"Men are right, [and] women need to justify and continually argue their point/position/recommendation. ... This is the root issue I see in the workplace for women." (*white woman*)

Another effect of in-group favoritism is that men tend to be judged on their potential and women on their performance. "It's frustrating that men get promoted on their potential. Women have to have the experience already," said a white woman. A third effect is that women may feel "out of the loop" to such an extent that it affects their ability to do their jobs, particularly if women are not included in the informal networks that pass along important, job-relevant information.

"There is a feeling of isolation; feeling that I don't get all the information about things I am responsible for, that I'm not included in group activities, that I have to work harder for the respect of those around me that, to me, feels is more freely given to my male counterparts." (*white woman*)

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"The isolation is profound. If you like being a loner, this career will work for you! There are bright spots (a few individuals who will step away from the pack and befriend you) but dang, they are few and far between."

(white woman)

"I still feel like the odd one out—even though I'm the person in the room with the most power (in the context of a class with students, grades, etc.). It's funny how the feeling of imposter syndrome and isolation doesn't easily go away in such a male-dominated field." *(African-American woman)*

In-group favoritism: Women (and some men) get left out of the boys' club

Almost 40 comments received from the survey mentioned a "boys' club" atmosphere.

"In my industry (oil and gas) the 'good ol' boys' club' still exists. Even after 33 years, I am not, nor will I ever be, a member. There was a point in my career (mid-career, maybe 5 or so years ago) when that was very hard to accept. As I get older, I accept it more and more." *(white woman)*

"Aerospace manufacturing is still the 'good ol' boys' network." *(white woman)*

"Sometimes it is still the 'old boys' club,' here in a large corporation full of old white men at the top, but the demographics are slowly changing." *(white woman)*

Some comments noted that the boys' club meant they have to work harder to be taken seriously.

"Boys' club is still strong, still have to work harder, but perseverance does pay and understanding your value." *(Latina woman)*

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"I find I am always trying to fight with the good old boys' club to try and fit in or be taken serious[ly]." (*Latina woman*)

A few women said that the boys' club only really began to affect their ability to function when they got promoted (which may highlight why more women do not get promoted).

"Once I arrived at the VP engineering level, the pressure to conform to the 'boys' club' became more severe. It was not a positive experience."
(*white woman*)

Others felt that the boys' club affected promotions and pay.

"There still is a good old boys' club where I work. I notice the men often are favored with promotions. Men will have conversations about specific topics which [are] not appropriate for me to comment [on]. ... I know in some cases I work twice as hard and receive the same pay." (*white woman*)

"As all p[roject] m[anagers]s and higher[-ups] in my company are males, the males tend to talk about 'male' things together and therefore the males get more opportunities as they arise." (*Latina woman*)

Sometimes the boys' club made it difficult for women to do their jobs.

"'A man's gotta golf,' quote from my manager after gathering the male engineers from my meeting so they could tee off at 2:00 pm." (*white female*)

"After working in my field for over 30 years, I get constantly trumped by a fellow highly technical male (not an engineer, but in a tech role). He is an outdoor enthusiast (hunter and fisherman) and has instant [rapport] with the guys I work with, even though I bend over backwards, working hard, and spend a lot of time trying to cultivate a trusting working relationship.

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All he has to do is start a hunting story and they flock to him. He has all the answers and is the guy they call first." (*white woman*)

Occasionally, the boys' club was associated with sexual harassment ...

"I was completely unprepared for being an outsider. The 'good ol' boys' club' would not let me in no matter what I did. They were jerks, all the time, and made me feel unsafe at work. It was the most bizarre experience. I would not wish that on anyone. I was a mining engineer at a coal mine." (*white woman*)

... or with less acute forms of disrespect.

"It is disappointing how large progressive companies still have the good old boys' networks and silently expect women to not be in leadership roles. And if men treat women disrespectfully, they don't even get a slap on the hand." (*white woman*)

One male engineer highlighted that a boys' club atmosphere can disadvantage men as well as women if men do not fit in with the particular form of masculinity favored.

"Having gone from journeyman carpenter to civil structural engineer to project manager in my 40-year career, I'm now in the position that the younger, more aggressive individuals do not value my experience. Plus due to my religious affiliation [and no] interest in sports I'm very much left out of the good old boys' network (drinks and golf games)." (*white man*)

A workplace that enshrines one particular flavor of masculinity not only will prove uncomfortable to most women; many men will not fit in comfortably and do their best work.

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Lack of fit: Successes discounted; mistakes remembered

Stereotypes drive the inferences we draw from ambiguous information (Dunning & Sherman, 1997). One result is that, in predominantly men domains, women's mistakes will tend to be noticed more and remembered longer (Bowles & Gelfand, 2010; Bauer & Baltes, 2002; Fyock & Stangor, 1994; Rothbart, Evans, & Fulero, 1979). While their successes often are attributed to luck, men's are attributed to skill (Kulich, Trojanowski, Ryan, Alexander Haslam, & Renneboog, 2011; Garcia-Retamero & López-Zafra, 2006; Fiske, 1998; Swim & Sanna, 1996; Igbaria & Baroudi, 1995; Greenhaus & Parasuraman, 1993; Taylor, Fiske, Etcoff, & Ruderman, 1978; Deaux & Emswiller, 1974). Here is "he's skilled; she's lucky":

"[W]hen I have finished a project quickly the assumption has been that the project must have been easy rather than that perhaps I had done something very clever." (*white woman*)

Some women noted that their mistakes were costlier than men's.

"I feel a lot of pressure to try hard and succeed. I feel like if I don't, it will fall into the stereotype of 'women.' I also feel like my peers are less likely to move on if I ever make a mistake than if a male co-worker makes the same mistake, which increases the pressure to be perfect." (*Latina woman*)

"I have to work hard, harder than the men to get credit but that is something I was aware of when I entered engineering. I do think that ANY mistakes I make are ALWAYS remembered." (*white woman*)

Others reported that their work was hyperscrutinized.

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"[My] work is more highly scrubbed and buddy checked." (*white woman*)

"I also have been trusted less and had more visible oversight of my work than a less technically skilled male colleague of similar age in the same role." (*white woman*)

As noted above, about two-thirds (62%) of women engineers, but only one-third (37%) of white men, reported that when they assumed project management or business roles, they faced assumptions that they lacked technical skills. This also happens to men, but the survey showed it is a more common experience for women. This pattern even extended, for some, to situations where women had assumed leadership roles.

"I am always seeking opportunities to use my technical skills despite my management position, mostly for my own satisfaction but also so others don't forget I have them." (*white woman*)

Lack of fit: Colleagues surprised at women's competence

Sometimes women recall compliments on their intelligence or rewards for their performance—but recall other people seeming surprised.

"Somehow the expectations that my colleagues have about my intelligence are much lower. ... I even get complimented on it, as if it's a strange case or an exception, WHICH I AM NOT. There's somehow the social perception that women are just not as smart." (*Latina woman*)

"My male colleagues have been surprised that I know how to use hand tools and am willing to get greasy on the job." (*white woman*)

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"I feel that I had supervisors who were looking out for me; making sure I got the opportunities I deserved. I was able to move up quickly in the workplace and was respected (even if some were initially surprised at my technical and managerial role, they were accepting of it)." (*white woman*)

One woman had learned how to use this disbelief to her advantage.

"Some of the older generation male staff (particularly in operations related roles) may initially assume a female engineer has little technical capabilities but this can be used to your advantage as you astound them with your technical expertise and gain their respect." (*African-American woman*)

One comment reflected the assumption that women were suited for operational but not manufacturing roles.

"As a manufacturing engineer, I am the first female in my department. People assume that I work on operational excellence because that has been a female role in the past. ... I feel like I have to prove that I belong in my position over and over." (*white female*)

Lack of fit: Women's expertise is ignored or discounted

Many commented that they were talked over or otherwise had their expertise discounted. Many studies show that, in mixed-sex groups, women are more likely to be interrupted than men and that men are more likely to be influential (Smith-Lovin & Brody, 1989; Mulac, Wiemann, Widenmann, & Gibson, 1988; Pugh & Wahrman, 1983; West & Zimmerman, 1983; Lockneed, 1985; Wagner, Ford, & Ford, 1986; Zimmerman & West, 1975). Ignoring an engineer's advice can jeopardize the quality of the team's work product. One experiment showed that when a man was the expert, this raised his status in the group; when a woman was the expert, this

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lowered her status in the group. Not surprisingly, teams that ignored their women experts performed worse than did teams who paid attention to their experts (Thomas-Hunt & Phillips, 2004).

Many, many comments recounted being ignored or talked over.

"When I meet with engineers from other companies, I often find I'm talked over and treated as not technically capable—that is, until I show myself to have better ideas than the men in the room." (*white engineer with gender identified as "other ... though almost everyone at my work speaks of me as a woman"*)

"Sexism still runs rampant. Continuously having to prove myself, being ignored, etc., listening to my male counterpart over me ... all examples." (*woman, race unknown*)

"I feel like my voice isn't heard as much as I would like in meetings." (*Asian-American woman*)

"Constantly talked over at meetings by male colleagues." (*Asian-American woman*)

"I have frequently had male co-workers in my age bracket that try to minimize me in front of staff meetings, act like I don't have technical skills or knowledge, or simply not respond to what I am saying in meetings. I am often effectively ignored." (*white woman*)

"I feel that whenever I speak up in meetings or technical settings that (for most men) it goes through one ear and out the other because they don't have the same level of respect for me as they do for the older white males in the room." (*Latina woman*)

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"The skill set I bring to the table as a woman engineer is often undervalued." (*Latina woman*)

"When presenting with an older, male colleague, it is very common for the audience to assume that I do not know as much, divert their attention from me as I speak, ask my colleague more questions and eventually it turns into a conversation between my colleague and the audience without any input from me. This happens even when I am just as knowledgeable or more so. ... They are also surprised at how knowledgeable I am when I am given a chance to speak and explain something." (*Asian-American woman*)

This can continue even after women reach leadership roles.

"Even in a leadership role, my male colleagues will still ignore my knowledge or guidance on a routine basis, preferring to seek guidance from other male colleagues." (*Latina woman*)

Lack of fit: "Not technical enough" or not engineers

"[At my Fortune 500 company] the female talent has held book discussions...and during our meetings roughly 30% of E & T female staff regularly attend. It is a standing joke that we are all told we are 'not technical enough' and as a team we brainstorm ideas to combat this negative stereotype." (*white woman*)

Many comments reported that women are assumed not to be engineers.

"I wish I knew how I could stop wearing my resume on my shirt when working with others that do not know me." (*Latina woman*)

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"I've also been in the situation where I have to list my degrees as credentials for being an engineer (and a dual degree at that) when co-workers have stated, 'Oh, you're not an engineer.'" (*white woman*)

"Likely the most frustrating thing is people not recognizing me as an engineer because I am female." (*white woman*)

One engineer felt that this pattern of bias increased as she got more senior.

"As I have moved up the ladder, I have noticed more overt sexism impacting my work. I am now a project manager and a professional engineer, but people regularly tell me that they want to talk to the 'real engineer' and are very surprised to find out that I **am** a 'real' engineer because they were expecting a man." (*white woman*)

Women often were mistaken for administrative staff or other more traditionally feminine roles—even when their title was clear. The single largest difference between men and women, both in terms of frequency and in terms of strength of agreement, was on the question "I have been mistaken for administrative or custodial staff." Only 9% of white men, but 45% of women ($p < 0.001$), reported this experience, with the strongest levels of agreement among women for any question in the survey. As in a prior study of women STEM professors, which found that even women in lab coats were mistaken for janitors (Williams, Phillips, & Hall, 2015), one woman had been mistaken for administrative staff or a technician even when her job title in her email signature line said "Engineer." The Workplace Experiences Survey also found this:

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"As a young ... [African-American] engineer in an older, white, male-dominated industry ... the female co-workers of mine are administrative assistants or technicians, and I'm ALWAYS mistaken to be one, even when my job title on our company's intranet and email signature says "Engineer." It's extremely frustrating." (*African-American woman*)

Lack of fit: Stolen idea

As noted above, 47% of women but only 32% ($p < 0.001$) of white men reported that others got credit for an idea they originally offered. One comment elaborated:

"Some of these questions really struck home, such as being in a meeting and proposing a solution that is ignored, but 5 minutes [later, it is] raised by a colleague and applauded. It's difficult (but not impossible) to defend the fact that you proposed the solution first in an environment like that without appearing juvenile." (*white woman*)

Note how difficult it is for a woman to call out the "stolen idea" without creating political problems for herself.

Another woman described a situation in which she had offered up an idea, only to have it ignored. Then a new hire joined the team: "Basically, he brought up the same idea." The idea had been ignored when she brought it up, but when her white male colleague brought it up, "My manager decided it was a good idea." (*African-American woman*). The manager and male colleague were flown from country to country to develop the idea, she commented, "while I sat in the cube back in [the city]."

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Link between Prove-It-again bias and long hours

The need to Prove-It-Again and prepare oneself for hyperscrutiny can lead women engineers, and engineers of color, to work longer hours than their colleagues.

“My awareness/sensitivity to the potential impacts of unconscious biases on my career trajectory have actually inspired me to work even harder on my technical skills to ‘outdo’ my male colleagues.” (Asian-American woman)

A few women tied their long work hours explicitly to gender bias.

“I don’t know if it’s because I am a young female engineer but I am consistently having to correct people that I am not a secretary or a procurement agent (buyer). I also feel like I have to prove myself and my technical skills more. I am young and don’t have a family so I can do this now. I work long hours and on the weekends to exceed the expectations they have set for me. When I tell male colleagues who hired in at the same time they laugh and can’t figure out why I do that.” (*white woman*)

Of course, this is often coded as evidence that women are not a good fit for engineering because they leave after they have children—when in fact they are leaving because they no longer can work longer hours than men to prove it again and again.

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CONCLUSION

The women engineers surveyed reported statistically significant differences from white men for virtually every Prove-It-Again question. Women reported that they had to prove themselves repeatedly, that their suggestions were not as respected as their colleagues', that people questioned their technical skills, that others got credit for ideas they originally offered, and that they were mistaken for administrative staff and technicians—all at higher levels than white men.

Engineers of color reported similar experiences, with the divergence between their experiences and that of white men even greater than the divergence between white men and women. Engineers of color reported that they had to prove themselves repeatedly, that they were held to higher standards, that their ideas were not respected as much as their colleagues', that other people got credit for their ideas, and that they were mistaken for administrative staff and technicians.

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"I have found that the range of acceptable behavior for me as a woman in a male-dominated field is much narrower than for my male peers. I must be very limited in how I show stress, anger, and disappointment, as it is easy to be labeled the 'emotional' woman." (*white woman*)

Prescriptive bias stems from beliefs about how people should behave. Studies since the late 1990s have documented that women are expected to be "communal"—helpful, interpersonally sensitive, modest, and nice—good team players. Men are expected to be "agentic"—direct, assertive, competitive, and ambitious—leaders (Heilman, 2012, 2001; Fiske, Cuddy, Glick, & Xu, 2002; Prentice & Carranza, 2002; Burgess & Borgida, 1999; Eagly & Johnson, 1990; Rudman & Glick, 1999, 2001). The leadership literature documents that leadership tends to be associated with men rather than women (Koenig, Eagly, Mitchell, & Ristikari, 2011; Morgan & Gilrane et al., 2011; Hoyt, 2010; Kellerman & Rhode, 2007; Eagly & Karau, 2002; Eagly, Makhijani, & Klonsky, 1992).

Traditionally, workplaces are designed around masculine prescriptions, so women have to behave in masculine ways in order to be seen as competent—yet women are expected to be feminine (Rudman & Glick, 1999, 2001; Glick, Wilk, & Perreault, 1995). That is why women professionals often find themselves walking a tightrope. If their behavior is seen as too masculine, they risk being respected but not liked. If their behavior is seen as too feminine, they risk being liked but not respected (Heilman & Okimoto, 2007; Rudman & Phelan, 2008; Cuddy, Fiske, & Glick, 2008; Fiske, Cuddy, & Glick, 2007; Glick & Fiske, 2001; Rudman & Glick, 1999, 2001; Fiske, Xu, Cuddy, & Glick, 1999; Heilman, 1995, 2001; Haddock & Zanna, 1994; Fiske 1991; Porter & Geis, 1981). This is often called the likability/competence trade-off.

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The Tightrope consists of two sets of pressures that are analytically distinct: pressure to behave in feminine ways and backlash when women behave in masculine ways. The end result is that a broader range of behavior often is accepted from men than from women. A man who “doesn’t suffer fools lightly” knows his stuff; a woman who does the same thing is a b*tch.

Pressure to behave in feminine ways, to be helpful rather than ambitious, nice rather than direct, can leave women in dead-end roles (Williams & Dempsey, 2014; Allen, 2006; Heilman & Chen, 2005; Kanter, 1977). The backlash against women who behave in masculine ways, combined with a workplace that rewards those behaviors, can create much trickier office politics for women than for men. Thus, behaviors that are seen as admirably assertive in a man may be seen as inappropriately abrasive or aggressive in a woman (Cuddy, Fiske, & Glick, 2008; Fiske, Cuddy, & Glick, 2007; Glick & Fiske, 2001; Rudman & Glick, 1999, 2001). Men tend to interrupt to show they are competitive and ambitious—men to be reckoned with—whereas a woman who interrupts may be seen as rude or a prima donna because she is violating expectations that she should be modest and nice (Ridgeway & Smith-Lovin, 1999; Smith-Lovin & Brody, 1989; Mulac, Wiemann, Widenmann, & Gibson, 1988; Wagner, Ford, & Ford, 1986; Lockneed, 1985; Pugh & Wahrman, 1983; Zimmerman & West, 1975). Several studies show that expressing anger tends to increase the perceived status of a man but decrease that of a woman (Judge, Livingston, & Hurst, 2012; Brescoll & Uhlmann, 2008; Brescoll & Uhlmann, 2005; Rudman & Fairchild, 2004). Self-promotion, too, may be accepted in men but seen as inappropriate in women (Phelan, Moss-Racusin, & Rudman, 2008; Rudman, 1998; Rudman & Glick, 1999, 2001; Heatherington et al., 1993; Daubman, Heatherington, & Ahn, 1992; Gould & Slone, 1982).

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Many studies have documented that the qualities associated with leadership are those associated with men and masculinity (Rhode, forthcoming; Koenig, Eagly, Mitchell, & Ristikari, 2011; Morgan & Gilrane et al., 2011; Hoyt, 2010; Kellerman & Rhode, 2007; Eagly & Karau, 2002). Women may display those qualities at their peril—although, of course, if they do not, then they are not leadership material. One study showed that women who were seen as effective managers were also seen as bitter and selfish because they did not conform to prescriptive stereotypes of feminine niceness (Heilman & Chen, 2005).

Existing studies on prescriptive bias focus almost exclusively on gender. Two studies focus on African-Americans: one of African-American men (Livingston & Pearce, 2009) and one of African-American women (Rosette & Livingston, 2012). In addition, the leadership literature shows the Asian-American stereotype that Asians are good at technical tasks but lack leadership ability (Sy & Shore et al., 2010; Cuddy, Fiske, & Glick, 2008; Fiske, Xu, Cuddy, & Glick, 1999). The Society of Women Engineers' survey also explored whether people of color report experiences similar to those reported by women. The survey found that they did, although the configuration of what is seen as appropriate behavior is somewhat different, as described below.

QUANTITATIVE DATA

The biggest differential in the percentages of men and women reporting whether they encountered the Tightrope pattern of bias concerned access to high-quality assignments. Because women are expected to be helpful and not ambitious, they report large loads of “office housework,” and less access than men to career-

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enhancing assignments—the “glamour work.” “You can’t advance or get a raise if the managers don’t give you projects to prove yourself on,” noted one white woman.

The “office housework” consists of several different types of tasks. The first is literal housework, such as planning parties or cleaning up the cups after a meeting. The second is administrative work, such as taking notes. The third is emotion work, such as the expectation that the woman on the team should be the peacemaker if there are conflicts. This was tested through the following question: “As compared with my colleagues in a comparable role with comparable seniority and experience, I more often do the office housework—finding a time everyone can meet, taking notes at a meeting, planning office parties.” Women were far more likely than white men to agree, and agreed more strongly ($d=0.532$, $t(2,554)=8.544$, $P<0.001$): 55% of women agreed, as compared to 26% of white men ($p<0.001$) (see Appendix A, Table 3a and Table 4).

Women (65%) were less likely than men (85%) ($p<0.001$) to report, and disagreed more strongly ($d=-0.359$, $t(2,558)=-5.782$, $p<0.001$), that they had the same access to desirable assignments as their colleagues. Women (50%) were less likely than white men (61%) ($p<0.001$) to report, and disagreed more strongly ($d=-0.254$, $t(2,536)=-4.086$, $p<0.001$), that they were more likely than colleagues in comparable roles with comparable seniority and experience to be assigned to high-profile tasks or work teams (see Appendix A, Table 3a and Table 4).

Women also reported pressures to behave in feminine ways and let others take the lead. They were much more likely than white men (45% vs. 16%, $p<0.001$) to report, and to agree more strongly ($d=0.583$, $t(2,546)=9.344$, $p<0.001$), that “I

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am interrupted at meetings more than my colleagues.” Women were also more likely than white men (33% vs. 16%, $p < 0.001$) to report, and agreed more strongly ($d = 0.406$, $t(2,566) = 6.56$, $p < 0.001$), that they felt pressured to let others take the lead (see Appendix A, Table 3a and Table 4).

Women reported backlash for masculine behaviors. About half of women compared to about two-thirds of white men reported they seldom received pushback when they behaved assertively (51% vs. 67%, $p < 0.001$); women also disagreed more strongly with the statement “I seldom receive pushback when I behave assertively” ($d = -0.352$, $t(2,557) = -5.605$, $p < 0.001$). Women were less likely than white men (49% vs. 59%, $p < 0.001$) to report, and agreed more strongly ($d = -0.181$, $t(2,566) = -2.898$, $p < 0.01$), with the statement “I feel free to express anger at work when it’s justified” (see Appendix A, Table 3a and Table 4).

Women and white men did not report statistically significant differences on three Tightrope questions. The first question concerned self-promotion: about the same percentage of white men (62%) and women (64%) engineers agreed that “Being vocal about my work and accomplishments is rewarded.” Evidently, self-promotion works equally well for men and women engineers, contradicting the findings of lab studies by Laurie Rudman and her colleagues (Rudman, 1998; Rudman & Glick, 1999, 2001).

A second finding also does not fully support prior studies. Although leadership tends to be associated more with men than women, the difference between white men (85%) and women (81%) was not statistically significant on the question “People at work see me as a leader”—though women more strongly disagreed with that statement than white men did ($d = -0.108$, $t(,) = -1.735$, $p = .08$). Nor was

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there a statistically significant difference between women (50%) and white men (48%) on the question “I am expected to be a ‘worker bee,’ which means I should work hard, avoid confrontation, and not complain.” These findings contrast with the large differential (>15 percentage points) between men and women on the question “I feel pressure to let others take the lead” (discussed above), with stronger agreement with that sentiment among women than white men ($d=0.406$, $t(2,566)=6.56$, $p<0.001$).⁵ Perhaps the way to make sense of these findings is that women engineers feel pressured not to take the lead but do so anyway (see Appendix A, Table 3a and Table 4).

Women engineers of color were more likely than white women to report prescriptive bias. Compared with white women engineers, women engineers of color were less likely to report having the same access to desirable assignments as their colleagues (68% vs. 53%, $p<0.001$). Women engineers of color were more likely than white women to report they were expected to be “worker bees” (59% vs. 48%, $p<0.001$). Women engineers of color were more likely than white women to report they felt pressure to let others take the lead (31% vs. 40%, $p<0.001$), less likely to report they felt free to express anger at work (44% vs. 51%, $p<0.01$), and less likely to report they were assigned to high-profile tasks or work teams (47% vs. 51% $p<0.05$). Asian-American women were less likely than white women to report they were seen as leaders (72% vs. 82%, $p<0.001$) and were more likely to report they felt pressure to let others take the lead (43% vs. 31%, $p<0.001$). Latina women reported similar pressure to let others take the lead, compared to a much lower proportion of white women (42% vs. 31%, $p<0.01$) (see Appendix A, Table 3b). The

⁵ See the Data and Methods section for definitions of large, medium, and small differences on percentage agreement.

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differentials between women engineers of color and white women engineers on Tightrope questions not mentioned above were not statistically significant (see Appendix A, Table 3b).

Despite the lack of attention to race in studies of prescriptive bias, the survey found significant effects by race. The largest divergence concerned access to glamour work. Engineers of color were much less likely than white men (55% vs. 85%, $p < 0.001$) to feel, and disagreed more strongly ($d = -0.591$, $t(734) = -7.849$, $p < 0.001$), that they got equal access to desirable assignments. Engineers of color were also much more likely than white men (45% vs. 16%, $p < 0.001$) to report, and agreed more strongly ($d = 0.621$, $t(734) = 8.229$, $p < 0.001$) that they were interrupted at meetings more than colleagues. Engineers of color were also much more likely than white men (52% vs. 26%, $p < 0.001$) to report, and agreed more strongly ($d = 0.482$, $t(732) = 6.39$, $p < 0.001$), that they were more likely to be assigned with office housework.

Tightrope effects also emerged by race. Engineers of color were more likely than white men to report (39% vs. 16%, $p < 0.001$), and agreed more strongly ($d = 0.584$, $t(733) = 7.74$, $p < .00$), that they felt pressure to let others take the lead. Engineers of color were less likely than white men (49% vs. 67%, $p < 0.001$) to report, and disagreed more strongly ($d = -0.381$, $t(727) = -5.028$, $p < 0.001$), that they seldom received pushback when they behaved assertively. Engineers of color were less likely than white men (47% vs. 61%, $p < 0.001$) to report, and disagreed more strongly ($d = -0.346$, $t(729) = -4.579$, $p < 0.001$), that they were assigned to high-profile tasks or work teams. Engineers of color were less likely than white men (45% vs.

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59%, $p < 0.001$) to report, and disagreed more strongly ($d = -0.299$, $t(731) = -3.959$, $p < 0.001$), that they felt free to express anger at work when it's justified. Engineers of color also were more likely than white men (58% vs. 48%, $p < 0.001$) to report, and agreed more strongly ($d = 0.274$, $t(733) = 3.636$, $p < 0.001$), that they were expected to be “worker bees.” Engineers of color disagreed more strongly than white men that people at work saw them as leaders ($d = -0.167$, $t(733) = -2.215$, $p < 0.05$) (see Appendix A, Table 3a and Table 4). We found no racial differences with respect to self-promotion.

Among Asian-American engineers, both men and women were less likely than their white counterparts (76% vs. 85%) to report that they were seen as leaders, although the difference is statistically significant only between Asian-American women and white women (72% vs. 82%, $p < 0.001$). Very few (only 12) Asian-American men filled out the survey, which may explain why the difference between Asian-American men and white men is not statistically significant. No statistically significant difference was reported between white women and Latina or African-American women in response to the question of whether people saw them as leaders.

Regression analysis showed that, after controlling for many other variables, women, African-American, and Asian-American engineers still reported more Tightrope bias than their male or white counterparts (see Appendix D, Table A). The effects for Latino engineers disappeared, perhaps because 20% of the Latino respondents self-identified as both white and Latino.

TIGHTROPE BIAS

QUALITATIVE DATA

Many women left comments (123) about the Tightrope bias: please see appendix F for a demographic breakdown of comments by gender and race.

Backlash for behaving in masculine ways

Almost 30 respondents provided comments about their experiences with backlash. Some women described the feeling of walking a tightrope between being seen as too masculine or too feminine.

"[I]t is exhausting to have to constantly fight gender roles and play the balancing act of being assertive but not bitchy, helpful but not a doormat. It is exhausting on the good days, soul-crushing on the bad days."
(white woman)

"I have often been caught in the difficult situation of managing other people's unconscious bias towards me ... being pushed to be more assertive, take on more responsibilities, and more leadership roles, but then criticized for doing so." *(white woman)*

"Some people require me to champion myself aggressively while others hold it against me even though I always champion the team effort and goals as opposed to individual successes." *(white woman)*

Many others described backlash for assertive behavior.

"Bullying male behavior is rewarded. Females expressing strong views in equally bold manner are told [they are] being 'difficult.'" *(white woman)*

"I am considered to be aggressive because I am assertive. People say that they fear me, yet men who are more assertive than me get respect."
(white woman)

TIGHTROPE BIAS

"....I have heard that I am considered argumentative or aggressive, even though I don't do anything different than my male counterparts." (*Latina women*)

Tightrope bias can increase as women become more senior and behave more like leaders—and so less modest, self-effacing, and nice.

"When my male counterparts in the same capacity provide direction to their teams, they're hailed as a leader. When I do the exact same thing with my team, I'm accused by some of being on the warpath. Or on my period." (*white women*)

"Overall, I am treated fairly with my colleagues, though 'bossy' is definitely used more than 'boss.'" (*white women*)

"I've risen to the ranks of senior management and only now, for the first time in my nearly 30-year career, am I beginning to experience overt sexism in job opportunities. ... The (unofficial) feedback from my last multi-day job interview: I didn't smile enough." (*white women*)

"Assertiveness and plain-speaking are threatening to male managers and I have been told that I have been overlooked or rejected for leadership positions because I intimidate the other managers I would be working with. I am being rejected for the very qualities they are looking for in male managers." (*white women*)

TIGHTROPE BIAS

A trans-woman found the difference between how she used to be treated as a man, and how she was now treated as a woman, eye-opening:

“Moving from being seen as a male engineer to a female engineer has been rather eye-opening. Even though everyone in my department of about 100 has been great about my transition, I feel like I get talked over, and have to be more polite in meetings than previously. I also feel like I need to ‘seed’ my ideas, and let others take them, rather than just saying them.” (*white trans-woman*)

Notice how conversational norms that mandate that women be communal and modest rather than direct and assertive put pressures on women that lead others to get credit for their ideas.

Another woman noted that the rules seemed to be different for her than for the men around her with respect to interrupting.

“I am not shy about speaking up and like my male colleagues, will jump in, interrupt, to clarify or weigh in on a topic. However, I have male peers and staff that have complained about my interrupting or ‘cutting them off’ from speaking. In one instance [I] had a peer who would actively belittle me in front of other peers and our boss when he perceived me as interrupting; yet anyone who watches how males interact knows that they constantly interrupt....” (*white woman*)

Another woman encountered backlash from some managers but not others.

“I also have been scolded in the past for being ‘aggressive’ when behaving assertively in a similar manner to my male colleagues (to be fair that was one prior manager, while 2 other managers have praised my assertive attitude as it gets work done).” (*white woman*)

TIGHTROPE BIAS

Confirming a prior study, which found that Latina women were particularly likely to report pushback for being assertive in the form of accusations they are “too emotional,” driven by the stereotype of the “hot-blooded Latin” (Williams, Phillips, & Hall, 2012), one woman said:

“I raised my voice during a meeting and I was reprimanded for getting emotional. But two male leaders ... get into a yelling match in the same meeting and it’s no big deal.” (*Latina woman*)

Who does the office housework? Who gets the glamour work?

The largest number of comments concerned pressures to do the office housework. Of the many women who detailed these pressures, the most dramatic was:

“Just last year they hired a new female and one of the managers was telling me how happy they were about hiring her because she really clean[s] up after the guys and keeps the lab tidy.” (*white woman*)

Other women reported being expected to do party planning, get lunch, or even sew(!):

“The stupid little sexism things: asking me to sew something when I’m the only woman in a leadership team; asking why my office isn’t decorated for the holidays ‘like the front office girls’....” (*Latina woman*)

“...I have always had good relationships and been treated fairly by my supervisors. Still there are little gender-based issues ... like moving to a new company as a project manager and having everyone assume I have no technical skills, being the default ‘party planner/lunch getter’ in an office full of men....” (*white woman*)

TIGHTROPE BIAS

Requests that women do office housework can undercut their professional credibility:

"I was specifically asked to get coffee in the middle of my presentation during one event." (*Latina woman*)

Other women reported being expected to fill out paperwork or otherwise do administrative work.

"I overheard a senior male colleague explain to the project manager that he should send the paperwork to me. He stated, 'I don't do paperwork.'" (*white woman*)

"I am the 'secretary' of all my other co-workers and must know where they are or can leave paperwork with me for them. I'm the only woman in my section, and until there is a 'critical mass' of women in my workplace, I think ignorance and pressures will not go away." (*white woman*)

"I have to do odd jobs like filing and paperwork for senior colleagues." (*African-American woman*)

"Our office doesn't have any administrative staff. My supervisors always task me to mail reports and make mailing labels, etc...." (*African-American woman*)

Some report that women were channeled into office housework, while male colleagues were channeled into career-enhancing work.

"Now I've met an intelligent engineer who's new to a team similar to mine (she has 2 degrees). She is being treated similarly [to how I was treated earlier in my career] (making labels, alphabetizing files). ... I noticed the teammates my age that have been ... given meaningful work right away now. Always a sore spot for me." (*white woman*)

TIGHTROPE BIAS

"As I have taken on more project management roles, I have been referred to (more than once) as a 'glorified secretary' or 'party planner.' My management seems to think that I should be content to 'hide out' in my current position because it is 'safe,' even though it is not challenging technically." (*white woman*)

Another dynamic involving housework vs. glamour work occurs when women are relegated to back-office roles while men take center stage.

"I had my white male counterpart engineers who were being given the opportunity to present papers [at a conference]. My boss wanted me to write those papers for them, but didn't want me to go to the conference to present." (*African-American woman*)

Another woman noted the "unconscious and well-meaning channeling" of women engineers away from R&D, which remains "an intensely male domain," into technical writing or HR.

"I know that I don't feel like I fit in this old boys' club type of environment [in] R&D. ... One of the things I have noticed is that this relegation, I'll say, of women in engineering, not only to very feminine gender domains like HR, but also even to project management and business or technical writing ... I mean the glamour work in engineering is doing the design work and the R&D work. Not surprisingly, that remains an intensely male domain...." (*white woman*)

The stereotypes that men are technical and women have people skills can cut against women engineers.

TIGHTROPE BIAS

"In the space industry, women tend to be assigned roles that require less engineering skills and more interpersonal skills...." (*white woman*)

Women were willing to do the "junk" work; what they objected to was doing more than their fair share and their lack of access to high-quality work.

"I have not been given projects that will allow me to be promoted, as the interesting assignments tend to go to the men [who are more junior than me.] ... [The] assignments I have gotten are less challenging and at times are more cleanup and secretarial like. I am fine with doing my part of the 'junk' work but would like to see that work evenly distributed...."

(*white woman*)

Pressures to fulfill traditionally feminine roles

Many comments (25) discussed workplace pressures to behave in feminine ways. Some women engineers commented that they felt pressured to fill traditionally feminine roles, such as the office mother, the dutiful daughter, or the peacekeeper. A few examples:

"I was stuck in the daughter mode epically." (*African-American woman*)

"I think the biggest issues that I encounter is the age differences, and my being looked at as a younger daughter situation, more than a coworker."
(*white woman*)

"As part of the leadership team ... I was expected to be the peacekeeper and get everyone to work together. Even though we were all supposedly 'equal,' if the team could not come to a conclusion and finish the project it was considered a failure on my part to reach consensus." (*white woman*)

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An engineering professor found that she had to spend a lot more time establishing a personal connection with students than her male colleagues. Research has found that women professors are at greater risk of being seen as mean—and a powerful antidote is being seen as caring (Baker & Copp, 1997):

“[As] an African-American female engineering professor at a research-intensive institution ... I've taken the initiative to learn all of my students' names, greet them personally when they come in, call on them by name ... to establish a more personal connection. ... I know I am taking a way different approach to teaching than my White male counterparts. ... I feel like I can't afford not to [put in a lot more time and effort].” (African-American woman)

CONCLUSION

Tightrope bias makes workplace politics much trickier for women than for men. Women may be asked time and time again to do low-value work or administrative tasks. They report less access to desirable assignments and high-value tasks and teams. Women may be interrupted more in meetings, which of course makes it difficult to take the floor to state your ideas.

Women may sense that they are expected to let others take the lead or to go into less-valued roles (e.g., technical writing rather than R&D)—it may literally be riskier for women than men to insist on the kind of work that is most highly valued in engineering. Women who insist, or are assertive about other issues, may encounter pushback. Showing anger may also be riskier. In a profession like engineering that prides itself on the direct and unvarnished communication of technical findings, women may find that an assertive style works for men but not for women.

TIGHTROPE BIAS

Although virtually all of the studies on prescriptive bias concern gender, the Workplace Experiences Survey found that engineers of color also reported prescriptive bias based on race—a striking finding. Engineers of color, as compared with white men, reported less access to desirable assignments and high-profile tasks and teams, being interrupted at meetings more, doing more office housework, being pressured to let others take the lead, and less ability to express anger.

Tightrope bias can have profound effects. One study of performance evaluations in the technology sector found criticism of women's personalities pervasive: of those who received negative comments, only 2.4% of men but 75.5% of women were faulted for being difficult or otherwise failing to conform to prescriptive stereotypes of women as modest, self-effacing, and nice. Women (88%) were also much more likely than men (59%) to receive negative comments on their evaluations (Snyder, 2014).

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One influential study found that no bias exists against women in STEM—the disparity between men and women reflects only women’s choices surrounding motherhood (Williams & Ceci, 2012). But lab studies have found that mothers’ workplace experiences are not just about choice; many document that even mothers who do not behave any differently than women without children often encounter strong workplace gender bias.

The most famous study, already mentioned, found that mothers were dramatically less likely to be hired and promoted, offered sharply lower salaries, and held to higher performance and punctuality standards than identical women without children: the only difference was that one resume listed membership in the PTA (Correll, Benard, & Paik, 2007). Many other studies have documented the negative competence and commitment assumptions triggered by pregnancy and motherhood (Heilman & Okimoto, 2008; Crosby, Williams, & Biernat, 2004; Hebl, 2007; Cuddy, Fiske, & Glick, 2004; Fuegen, Biernat, Haines, & Deaux, 2004; Halpert, Wilson, & Hickman, 1993). In addition, mothers who remain indisputably competent and committed may be seen as bad mothers and, so, bad people. One study found that such mothers tended to be considered less warm, less likable, and more interpersonally hostile (Correll & Benard, 2010).

Another aspect of Maternal Wall bias is the “flexibility stigma.” For women, taking family leave or requesting a reduced schedule can trigger Maternal Wall bias (Crosby, Williams, & Biernat, 2004; Epstein, 1983; Stone & Hernandez, 2013.) For men, doing the same thing may lead to career detriments because it signals that men are not living up to the idealized male breadwinner role (Rudman &

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Mescher, 2013; Vandello, Hettinger, Bosson, & Siddiqi, 2013). One study found career detriments for men who disclosed that they had caregiving responsibilities (Berdahl & Moon, 2013).

QUANTITATIVE DATA

The Maternal Wall

The Workplace Experiences Survey found that mothers were much more likely than white men with children to report bias triggered by parenthood: 55% of women engineers with children vs. 78% of white male engineers with children reported that having children did not change their colleagues' perceptions of their work commitment or competence ($p < 0.001$). Women also felt more strongly than white men that having children changed how their colleagues perceived them ($d = -0.591$, $t(950) = -6.138$, $p < 0.001$) (see Appendix A, Table 5a and Table 6).

No statistically significant differences emerged on this Maternal Wall bias question among mothers from different racial/ethnic groups (see Appendix A, Table 5b).

Engineers of color (both men and women) were less likely than white men (57% vs. 78%, $p < 0.001$) to report, and disagreed more strongly ($d = -0.508$, $t(305) = -4.37$, $p < 0.001$), that having children did not change their colleagues' perceptions of their work commitment (see Appendix A, Table 5a and Table 6). In addition, Asian-American male engineers were more likely than their white counterparts to agree that having children had not changed colleagues' perceptions of their work commitment or competence (13% vs. 3%, $p < 0.01$)).

Pressures to work more—or fewer—hours

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We found racial but no gender differences on questions relating to pressures to work more or fewer hours after engineers had children. Engineers of color were more likely than white men to report, and agreed more strongly ($d=0.337$, $t(270)=2.752$, $p<0.001$), that they felt pressure to work fewer hours after they had children (11% vs. 3%, $p<0.001$). Also, engineers of color were less likely than white men to report (90% vs. 99%, $p<0.001$), and disagreed more strongly ($d=-0.338$, $t(305)=-2.93$, $p<0.01$), that they received pressure to work more hours (see Appendix A, Table 5a and Table 6).

White women received a lot fewer suggestions than women engineers of color saying that they should work fewer hours after having children (3% vs. 11%, $p<0.001$)—and more suggestions that they should work longer hours after having children (98% vs. 91%, $p<0.001$) (see Appendix A, Table 5b).

The flexibility stigma

The survey's findings confirmed that both men and women believed the flexibility stigma affected them at work but that women were less likely than white men to report, and disagreed more strongly ($d=-0.268$, $t(2,563)=-4.29$, $p<0.001$), that “Asking for family leave or flexible work arrangements would not hurt my career”—only half of women agreed, as compared to nearly two-thirds of white men ($p<0.001$). Women engineers and white men reported at similar rates (41% vs. 37%, the difference is not statistically significant) that they felt pressured to work long hours to show commitment, but women engineers more strongly agreed with the statement than white men ($d=0.139$, $t(2,567)=2.24$, $p<0.05$) (see Appendix A, Table 5a and Table 6).

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There are two statistically significant racial differences on the flexibility stigma among women. African-American women engineers were more likely than white women engineers (61% vs. 51%, $p < 0.01$) to report that taking leave or adopting a flex schedule would not hurt their careers (see Appendix A, Table 5b). Latina engineers were more likely than white women to report that they felt pressured to work long hours to show commitment (50% vs. 41%, $p < 0.01$) (see Appendix A, Table 5a and Table 5b).

Engineers of color disagreed more strongly than white men that asking for family leave or flexible work arrangements would not hurt their careers ($d = -0.267$, $t(733) = -3.553$, $p < 0.001$). Engineers of color agreed more strongly than white men that they felt pressured to work long hours to show commitment ($d = 0.201$, $t(733) = 2.669$, $p < 0.01$). The percentage agreement differences between engineers of color and white men were not statistically significant for both flexibility stigma questions (see Appendix A, Table 6).

Regression analysis showed that, after controlling for many other variables, women engineers reported more Maternal Wall bias than male engineers (see Appendix D, Table A).

QUALITATIVE DATA

Many comments documented issues related to leave and parenting issues: please see appendix F for a demographic breakdown of comments by gender and race.

Many comments (45) reflected the Maternal Wall bias. Some women reported having encountered no gender bias until they hit the maternal wall.

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"I didn't even think about any of these issues until I had my first child and returned to work. Prior to that I was treated fairly and could compete with every male colleague." (*white woman*)

For others, things went well until the birth of their second child:

"Engineering was great up until my 2nd child." (*Latina woman*)

Or their third:

"[M]any men ... exhibit behaviors that suggest that they have an unconscious bias towards me, and ... [presume] that a female engineer with [three] ... children doesn't take her career seriously." (*Asian-American woman*)

Many lost out on work opportunities after having children, even if their behavior remained unchanged.

"When I was pregnant, my boss really didn't know how to handle planning for my absence. He took a team leader role away from me when I was about 20 weeks pregnant 'just in case' I had to be out before my due date. He didn't give it back until I complained that it was only being taken away because of my pregnancy." (*white woman*)

"After returning to work after maternity leave 5 years ago, I felt very 'mommy-tracked': assigned to low-profile work, less interesting projects, and little customer interaction. This is part of why I left the company." (*white woman*)

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This last engineer left to work for a new company. Another, an Asian-American engineer, took a different tack. After she had children, she continued to work full time and overtime but “my project assignments weren’t nearly as interesting, challenging or fulfilling—and a lot of the work became repetitive and unmotivating. I also felt I was less likely to get staffing to help me with my work,” so she began to fall behind her male colleagues with equivalent experience. This ended when she “confronted” her superiors on this topic, which was “not easy” but effective. “I am confident that if I had never brought this up, I would continue to be doing less interesting projects, and I would continue to be doing all my projects by myself, with no staff to assist on the more menial tasks.”

Others reported well-documented patterns of stereotyping:

“Several years ago two male co-workers were discussing what type of employee they would prefer to hire in the department. They said that they would never want to hire a woman, because women take more time off to take care of their children.” (*white woman*)

“After having children ... the principals in my office ... automatically assumed that my career wasn’t as important (relative to my male counterparts, with or without children).” (*Asian-American woman*)

Other engineers stressed that they continued to work hard after they had children, but that fact did not overcome the stereotype that mothers are uncommitted.

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"Since becoming pregnant, many of my male colleagues have spread rumors that I'm lazy and shouldn't be moved to other projects because mothers tend to be less effective at their jobs. I was working from the hospital while I was in labor and soon following my son's arrival, and I was actually at work for a huge program review (in which I was presenting most of the engineering information) 5 days after giving birth [worked part time only until he was 6 weeks old and have worked full time since]. ... Yet the rumors remain." (*white woman*)

"My colleagues assume I am a slacker because I have children, even when I come in evenings or weekends to make up time that I have to miss due to my children." (*African-American woman*)

"[H]aving kids made it seem to others that I am not as dedicated to my career as they are, but I am and always was." (*white woman*)

Some women reported they worked harder after each child to disprove the assumptions motherhood had triggered.

"After each child, this continued. I've had to work harder and longer, even with my increased responsibilities at home, to prove I am just as good of an engineer." (*white woman*)

"My awareness/sensitivity to the potential impacts of unconscious biases [triggered by motherhood] ... have actually inspired me to work even harder on my technical skills to 'outdo' my male colleagues." (*Asian-American woman*)

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Other engineers reported comments that reflect prescriptive bias—messages that good mothers should not work hard.

“I’ve received countless negative comments about my travel and work hours. ‘Who watches your child when you’re gone?’ and ‘I could never leave my child alone that much’ are common comments.” (*white woman*)

“There was an older male senior engineer who told me he thought I shouldn’t be promoted to senior engineer manager (a position to which I had applied) because my child was young and I wouldn’t see him. ... When I told the local managers several months later, they were horrified. I got the senior manager role but they took away much of the responsibility.” (*white woman*)

“Men make comments about how if [I] were really trying to be a good mom, instead of pretending to be one [by pumping], I’d just stay home like [their wives], as nature intended.” (*white woman*)

All these comments reflect hostile prescriptive bias (Burgess & Borgida, 1999), which sends the message that a good mother should be home with her children. The following comment reflects benevolent prescriptive bias, which conveys the same assumptions but in a benevolent rather than a disapproving tone (Williams & Bornstein, 2006):

“This new manager told me directly that I would not ‘want’ a promotion because it requires more responsibility, and I am a mom so I wouldn’t want to travel.” (*white woman*)

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Women are so aware of Maternal Wall bias that they may attempt to hide their plans in order to avoid it.

"I hid my engagement in 2013 from my employer out of fear my projects would be cut back. I was promoted to lead engineer during this time (a year after being 'promised' the promotion) and when my manager found out I was engaged, he said, 'Oh, crap.' I addressed the situation dead on, asking him what his fears were. He told me I was going to go all 'crazy' with wedding planning. ... And I'd have babies, and my work would suffer. ... [W]hen people found out [my fiancé] was engaged, they gave him higher-profile projects and raises." (*white woman*)

The flexibility stigma for mothers

The largest number of comments (78) concerned the flexibility stigma. Most (70) discussed its impact on women.

"We have great workplace flexibility programs on paper, but there can be an unwritten stigma associated with using them." (*white woman*)

"Gender bias is still out there. Forget about trying to start a family. Workplaces aren't as flexible with hours, time, scheduling as we were led to believe." (*white woman*)

"My employer allowed me to work part time when my oldest child became ill frequently and without explanation. However, once he was old enough to go to school, they demanded I work full time again. I also suffered much ridicule from my co-workers for being the first person to be allotted that schedule. Many people tried to discredit me in my job because they were jealous of this situation, even though I was also paid in proportion to the amount I was working. ... I would have otherwise been content to work my part-time schedule but the judgment made it very difficult." (*white woman*)

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The last quote was from a woman who noted that her husband, also an engineer, took off significant time with their ill child “but never suffered the same type of judgment and ridicule.” She “tried to leave on good terms” in order not to burn her bridges, but her supervisor refused to give her a letter of recommendation after “seven years ... of glowing recommendations.” He was angry with her for leaving—an illustration of the costs to companies of the flexibility stigma. So is the following, which illustrates how telecommuting can enhance productivity:

“With the technology options we have available today, I would appreciate more support in allowing us to work remotely. I still feel this is ‘frowned upon,’ but I get a lot more work done when I work from home away from distractions.” (*white woman*)

Several women stressed how reducing their hours led to dead-end assignments

“While my last boss was awesome, fully supportive of me within company politics as well as demands of my personal life (I worked part time ~32 hours/week), I was frequently assigned tasks below my ability level.” (*white woman*)

“My company has been supportive of my working ... 32 [hours] per week—due to health reasons and wanting family flexibility. But it has definitely ‘mommy tracked’ my career.” (*white woman*)

The flexibility stigma affects even mothers who apparently have never requested workplace flexibility. Said an African-American woman engineer:

“The biggest obstacle is the negative perception of needing a flexible work schedule as a single mother.”

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Other comments reflect subtler versions of the flexibility stigma:

"I have been permitted to work 32 hours/week, which helps me succeed as an engineer and mother immensely. Unfortunately, I do feel like I should not highlight this to other colleagues that I do this as it is considered a special and rare schedule. Part-time schedules are not largely supported across the company." (*white woman*)

Studies show that offering part-time schedules on a secretive, one-off basis, tends to lead women to be stigmatized (Perlow & Kelly, 2014).

Others noted that going part time had caused them to lose valuable benefits. One company chose to pay the fine imposed by the Affordable Care Act rather than give health benefits to a part-time engineer.

"My request [for part time] was approved, but with NO benefits aside from some earned vacation weeks, not even a little \$300/year wellness benefit or any health care, even though it's now federal law for 30+ hr/week employees. My company is paying the fine! ... That's one reason I quit engineering. I was sick of the old school mentality and thinking that seem to dominate the field." (*white woman*)

Most people would assume that the above engineer quit for family reasons, but in fact, she states that she felt driven out by old-fashioned attitudes about work and family life.

Some women expressed disbelief that despite years of dedication to their companies, things went south quickly after they had children.

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"I spent 15+ years putting in unbelievable hours, pushing myself to near burn-out for this company prior to having a baby. And now it's disappointing [the reaction to my 35 hours/week schedule]. ... They don't come right out and say there's a problem, but the 'vibe' is there and lately I've been worried about how secure my position is." (*white woman*)

The flexibility stigma for fathers

One-third of white men disagreed that a flexibility stigma exists at all, while three respondents discussed the flexibility stigma for fathers. Studies show that men as well as women can be disadvantaged by taking parental leave (Vandello, Hettinger, Bosson, & Siddiqi, 2013), as illustrated by this comment:

"I took parental leave while my child was an infant, and I felt that the organization failed to work with me to develop a good transition plan so that I would have projects to work on when I returned to work full time."
(*white man*)

"The biggest gender-related issue I have encountered has been the effect of part-time status of colleagues with child-care responsibilities. At our firm this describes about 10% of staff, the majority women, but also including some men. Limited hours affect working relationships and ability of these staff to take on responsibility for projects and corporate management. Some largely overcome this limitation by extreme dedication and organization. All tend to rebound when they rejoin staff full time."
(*white man*)

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"My husband (also an engineer in a similar field) is getting to the point that he has significantly more leave accrued than I do but he's under more pressure to perform and continue moving up whereas I am not. So when the kids need a parent during normal work time the options are for me to take leave without pay or him to take leave but end up working anyways. It's a big stress for us." (*white woman*)

Stigma feeds attrition

A number of women left their companies as a direct result of the flexibility stigma.

"When my children were young ... I did experience my supervisor 'offering' me a flexible schedule, telecommuting, part-time [status] in order to 'spend more time with my family.' I accepted it, which led to miniscule assignments that were not challenging and isolated me from the rest of the team. This eventually led to my leaving that company." (*white woman*)

"I felt very 'mommy tracked,' assigned to low-profile work, less-interesting projects and little customer interaction. This is part of why I left that company 2 years ago and found a role with a new company that's been much more flexible and respectful of my role as mother and engineer."

"The biggest issue is not being offered substantial program opportunities when you work less than full time with no overtime ... no work on good programs, no opportunity for advancement or leadership roles, no raises. But it is not based on work output, which is frustrating." (*white woman*)

The last engineer quoted left engineering for five years but then returned. Other engineers had to threaten to leave in order to gain part-time schedules.

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“When I told my company of my plans to leave [in favor of a company with less challenging work, but flexible hours] they became more willing [and] ... offered me a flexible schedule. I still put in as many hours as my peers and meet my deadlines, but it might not be in the typical 8-5 time frame as everyone else.” *(white woman)*

On the other hand, non-stigmatized flexible work arrangements help companies retain engineers. Some women said their reduced schedules were the only reason they stayed at their companies. An example:

“The reduced schedule may be part of why I’m delayed in career rewards like promotions, but it’s the primary reason I have not left my toxic work environment.” *(white woman)*

Many women had good experiences

While many comments reflected the Maternal Wall bias and the stigmatization of flexible schedules, a smaller number discussed positive experiences with workplace flexibility. These comments make it clear that workplace flexibility is not impossible in engineering and that many company supervisors are getting it right.

Many engineers reported that their workplaces were very supportive of their part-time schedules. As one white woman engineer stated, “My bosses have been surprisingly supportive.” Her current boss let her change her work schedule so she could drop off her children at school. “He knows what it’s like to be a single parent” and was also encouraging her to take a professional certification exam. “I feel like my team at work wants the best for me,” she concluded. “I like working here.”

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Many other comments reported very positive experiences.

“My job has been very support[ive] and I have seen some of my greatest advances since having children.” (*white woman*)

“I’m still working part time after 14 years. I have been given many opportunities despite my part-time schedule.” (*white woman*)

“I have been working in a job share⁶ role for 7 years and it has been an amazing experience for myself and beneficial to my company.” (*white woman*)

“I went part time almost 5 years ago and have been promoted 3 times since then.” (*white woman*)

Are engineers without children left holding the bag?

When flexible work arrangements and parenthood are not managed well, employees without children are sometimes left to pick up work that their colleagues with children are unable to do. Roughly 20% of survey respondents agreed that “I have to spend more time working to compensate for the schedules of my colleagues who have children,” with little variation between women, people of color, and white men. Nine comments discussed situations in which people without children were treated as if they had “no life” and were automatically available to pick the hours others could not work. Understandably, this often leads to resentment.

Sometimes women without children reported assumptions that they will not mind the extra work because they “have no life.” About 21% of male and 20% of female

⁶ A job share is when two people share one full-time job, working together as a team to cover all the responsibilities of one full-time employee.

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engineer respondents agreed with this statement, with no statistically significant differences by gender or race (see Appendix A, Table 5). The problem arises when there is a lack of reciprocity.

"I have been required by my managers to pick up extra work for other employees (both men and women but mostly women) who had family issues. ... [T]his means I had to work extra hours. It is disappointing that none of these employees have ever personally thanked me or offered to help me with any of my projects. Sometimes I dread working with people with families. It is important to take care of your family; however, they never reciprocate...." (*white woman*)

A woman who is head of her company's engineering division reported that she was expected to pick up the slack for others with family obligations.

"Socially, these other engineers take time off for family time and I did not have children (placed my career first) so I end up covering longer work hours/workload because they have family stuff going on." (*white woman*)

"Also, since I am a married female without children, I sometimes feel like I am a target for the others to dump evening or late afternoon activities on my workload due to their home-life situation." (*African-American woman*)

Men also reported this phenomenon.

"As an engineer without children, I end up picking up the slack for all the engineers (both male and female) in my office who have to leave early/ arrive late/work from home in order to take care of their children. It's easy to be resentful about this when others don't work as hard but get the same pay." (*white man*)

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This resentment stems from poor management of work-life issues. The solution is to go back and redefine the ideal worker as someone who also has a life outside of work. This will not only make life easier for women, but also for men. It will also make it easier to retain women—and millennial men, who are more likely than older men to say that work-life balance is important to them (Harrington, Deusen, Fraone, & Eddy, 2015).

A workplace perfectly designed for the workforce of 1940

Many engineers commented that engineering is caught in a time warp.

“[Aerospace] is extremely male dominated, and basically stuck back in the 1940s, inflexible with schedules, etc. Most of the men have either stay-at-home wives, or wives who work part time or have extended families who help care for their children. There is no hope anytime soon in this industry for part-time work (during child-bearing ages) while maintaining a career path and security within the company. Part-timers will always be the first to be let go in this ‘boom or bust.’” (*white woman*)

In the 1940s, the ideal worker was seen as someone who started to work in early adulthood and continued, full time and full force, for 40 years without a break. Many commented that this ideal remained unchanged. Survey responses showed that 41% of women and 36% of white men agreed with the statement that “I feel pressured to work long hours to show my commitment, even when the workload does not really justify the overtime.” Women engineers more strongly agreed with this statement than white male engineers ($d=0.139$, $t(2,567)=2.24$, $p<.05$), but the percentage agreement differential was not statistically significant. The survey responses showed similar findings on racial differences. Engineers of color

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agreed more strongly with this statement than white men ($d=.0201$, $t(733)=2.669$, $p<.01$), but the percentage agreement differential was not statistically significant. Women engineers of color did not differ much from their white counterparts on this question. Women engineers of color as one group did not show statistically significant differences from white women, but Latina women were considerably more likely than white women to report pressure to work long hours even when the work didn't justify it (50% vs. 41%, $p<0.01$) (see Appendix A, Table 5a and Table 6).

Many other comments agreed that the ideal worker remains defined by old-fashioned norms that formed in the days of an all-men engineering workforce:

"Most of my male peers have wives that manage their child care duties or housework." (*white woman*)

"The senior management of the engineering firm I worked for (for almost 10 years) do/did not participate in the daily management of their households or the daily business of raising their kids; many of them chose to work extremely long hours, weekends, and even through family vacations. All of them were men." (*white woman*)

"You have to spend time proving to the 'back in my day' people that you are willing to sacrifice life and limb to stay in that position. ... [At 26,] there is more on your mind than 10 hours at work every day. A woman shouldn't have to choose between being emotionally and personally happy and professionally content." (*African-American woman*)

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For women to conform to the ideal worker norm, they must either have no children or have children once they are well established.

“Women who want to move up the ladder and succeed in this company cannot have children ‘interrupting’ their commitment to work, even if we continue to work the same hours and put in the same effort. For the most part, the most successful women have no children or had children after becoming very successful.” (*white woman*)

One white woman engineer mused:

“I’ve heard from others in other fields that they would not want their daughters to become engineers because of the horrible work-life balance for engineers, which I cannot contradict.” (*white woman*)

If engineering wants to retain women—and millennial men—it needs to match today’s workplace to today’s workforce.

CONCLUSION

Women choose to have children, but they do not choose the workplace bias often triggered by that decision. Maternal Wall bias impedes the careers of many women engineers due to old-fashioned assumptions that the ideal worker is someone always available for work and that mothers do not—or should not—remain committed to their careers. Some companies have established high-quality flexible work that keeps mothers on the career track, but in others, flexible work stigmatizes those who use it, leading to high attrition.

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“Women do not always support other women as many would expect them to.” (*white woman*)

A prior survey of woman STEM professors found that 75.5% reported that women in their environment supported each other (Williams, Phillips, & Hall, 2014). An engineer who responded to the Workplace Experiences Survey agreed: “I do believe that women from a generation ahead of me did not have the same ease of experience that I am having, and so I am grateful that they blazed the trail.” (*white woman*)

Sometimes, however, gender bias against women fuels conflict among women. If women perceive that there is just one, or a few, women’s slots for prized positions, then naturally they end up competing for that position. Some survey comments suggested this pattern: “[T]he male engineers see me as competition. ... And the women don’t really understand how to support each other due to the competition for being the token [female] engineer.” (*white woman*)

Research documents that women who have experienced discrimination in heavily male environments early in their careers often distance themselves from other women (Derks, Van Laar, Ellemers, & de Groot, 2011). Women do this not because they are “queen bees” with a personality problem, but because they are ambitious women operating in an environment where associating with women may be a liability. “I am not a girl at Google; I am a geek at Google,” said Marissa Mayer, later CEO of Yahoo, while she was still at Google (Rosin, 2012). Note how adeptly she aligns herself with the in-group—men—and distances herself with the out-group—women. This strategic distancing often creates situations where women want nothing to do with women’s networks or events or, in extreme cases, with other women in any context.

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Women also may find themselves divided against each other by their different strategies with respect to assimilating into the male-dominated environment. Some women respond by assimilating as much as possible into the boys’ club (Duguid, 2011; Duguid, Loyd, & Tolbert, 2012). Tugs of War result when women fault each other for assimilating too much or too little. “A lot of times I find myself becoming a chameleon to ‘fit in’ with the guys” (white woman). This can lead to a low sense of belonging and intent to leave one’s workplace. “I have taken up fantasy football in the past. I am currently considering learning how to golf since I know a lot of networking happens on the golf course...” (*white woman*)

The other three forms of gender bias sometimes are passed through from woman to woman. Women might hold other women to higher standards “because that’s what it takes to succeed here as a woman” (Prove-It-Again pass-through). Women may criticize each other for handling motherhood wrong—for taking too much time off for children or not enough. Conflicts sometimes arise between mothers and women without children if the latter feel they have to work longer to make up for the time mothers take off for family matters (Maternal Wall pass-through). Finally, women may criticize each other for navigating the Tightrope wrong—for being too masculine or too feminine (Tightrope pass-through).

The Tug of War can operate by race as well as gender when workplace politics make it strategically desirable for people of color to distance themselves from members of their own group or to use double standards when judging other members of their group. People of color may also fault each other for assimilating with the majority too little or too much (Carbado & Gulati, 2013).

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QUANTITATIVE DATA

Only a few questions tested for Tug of War patterns. Of the women sampled, 21% agreed that “I am regularly competing with my female colleagues for the women’s slot” (a question not asked of men). Yet the mean Likert scale score of women on this statement, which measures the extent to which women agreed, was only 2.52 (between disagree and somewhat disagree), which means that, on average, women disagreed with the statement. An example:

“I frequently hear concern from established colleagues that recently hired women or minorities are only filling the ‘diversity slot’ and do not have technical or business skills. I do not feel the competition is between women in these cases, but there is a strong perception. ... Similarly, many assume I have no technical skills even when operating in an engineering role until repeatedly proved otherwise. This is not coming from other women.” (*white woman*)

Many, many more comments said that the real problem was the “boys’ club” (discussed below).

Another common expression of the Tug of War is when women opine that other women do not understand what it takes to succeed in the profession (implicit: I do). Women engineers were more likely than white men (24% vs. 11%, $p < 0.001$) to report, and more strongly agreed ($d = 0.358$, $t(2535) = 5.699$, $p < 0.001$), that “Some women engineers just do not understand the level of commitment it takes to be a successful engineer.” It is unclear if this is great news—male engineers are less biased—or whether it simply means that male engineers were politically savvy enough to understand that it would sound sexist if they agreed with this statement

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(the social desirability effect) (Jo, Nelson, & Kiecker, 1997). Yet the fact that one-quarter of the women felt free to judge other women in this way suggests conflicts among women based on women’s different strategies for assimilating into the “boys’ club.”

Women engineers of color reported more Tug of War bias than white women engineers on all four Tug of War questions. Women of color were more likely than white women to report that they were regularly competing with female colleagues for the woman’s slot (27% vs. 20%, $p<0.001$), that it was difficult to get administrative support (24% vs. 18%, $p<0.001$), and that some women engineers just did not understand the level of commitment it took to be a successful engineer (28% vs. 22%, $p<0.01$). Women engineers of color were less likely than their white counterparts to report that they felt they had a lot in common with engineers of their own gender (75% vs. 81%, $p<0.001$).

The Workplace Experiences Survey also found that women engineers were more likely than white men to feel they did not get sufficient support from administrative staff: 19% of women engineers vs. 13% of white male engineers reported they found it difficult to get administrative personnel to do “the kinds of support work for me that they do for other engineers” ($p<0.01$); women also more strongly agreed with this statement ($d=.268$, $t(732)=3.546$, $p<0.001$).

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QUALITATIVE DATA

Only 51 respondents reported Tug of War problems: please see appendix F for a demographic breakdown of comments by gender and race. Far more comments were from women who said there was no Tug of War because they were solos or close to it or that the real problem related to the challenges of being in this position and/or of fitting in with the “boys’ club.”

“I have always been the only female engineer in my department so some of the questions about relating to other women do not apply.” (*Asian-American woman*)

“I work at a company that is spread out over a large number of small offices. As a result, I am the only female engineer in my office, and I barely know the other female engineers in the company. I feel as though there is no one I can talk to, to discuss the challenges women engineers at our company face.” (*woman, race unknown*)

“I have not had many women co-workers, period, let alone those with whom I could compete or form social bonds.” (*white woman*)

One woman said she was one out of 200 engineers; another that she was 1 out of 100; 1 out of 60; 1 out of 30.

“I am the only female engineer in my office.” (*white woman*)

“I don’t have any female colleagues at work, which I find somewhat strange.” (*white woman*)

“I just wish we had more female engineers.” (*white woman*)

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“Some of these questions are difficult to respond to. ... I have no women colleagues so it is difficult to make a comparison to other women.”
(white woman)

One of the reasons women face such challenges in meetings is because they are the only women engineers.

“I’m used to being the only woman in meetings and on teams.” *(white woman)*

“I do many times find myself the only woman in the meeting.” *(white woman)*

Women were divided on whether, if there were more women, they thought the Tug of War would arise.

“I don’t compete with my female colleagues for the ‘woman’s slot’ because I don’t have any women colleagues. I don’t think it would be any different if I did, though. I’ve been surprised at how accepted I am as a young woman engineer.” *(white woman)*

“I am the only woman engineer in my immediate work group. ... But I know I will be competing for the ‘woman’s slot’ should there ever be another woman on my team.” *(white woman)*

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“My biggest challenge is fitting in”

Some women felt that fitting in was not a problem, even when they were the only woman engineer.

“In meetings I rarely notice I am the only female in the room because I am treated as an equal. ... [A]n environment of mostly male co-workers does not affect me and it shouldn’t make a difference to anyone as long as you do your job well.” (*white woman*)

Far more comments reflected that fitting in was a big challenge.

“My biggest challenge is fitting in with the guys. ... [As one of two women in a department of about 20 people,] I often feel left out as they resort to complaining about their wives/home life, or talk solely about sports & cars....” (*white woman*)

Some women felt their social isolation at work corroded their quality of life.

“It can be very uncomfortable being the only or one of the very few females in a large group of males.” (*white woman*)

“It’s very socially isolating being the only female engineer or manager in a company. I feel like I don’t have any friends at work.” (*white woman*)

One woman reflected that she contributed to her own social isolation due to her reluctance to socialize with other women engineers. Whether that reluctance reflected social distancing or an introverted personality is unclear.

“I feel socially isolated. ... Often the other female engineers (if there are any...) are either clique-ish or have been so used to being socially isolated ... they do not want to socialize. I’m guilty of that myself.” (*white woman*)

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Tug of War: conflicts over assimilation to the boys’ club

Some women deal with solo status by assimilating into male norms.

“[H]ave some fun with the guys sometimes. The best way to succeed is to be seen as ‘one of the guys.’ Don’t be offended easily or you will be avoided.” (*white woman*)

“I have acted like ‘one of the guys’ to fit in with the rest of the group. This has seemed to help my career.” (*white woman*)

“There were times when men said inappropriate things to me at work. But rather than make a big deal out of it, I found it much easier to sweep it under the rug. It makes it seem like nothing affects you and you are ‘one of the guys.’” (*white woman*)

“I feel I have been both lucky and that it is largely due to my own attitude ... where I feel just as much or more respected ... even though I am a mother of three and one of only a few women in a technical capacity. ... I don’t usually feel left out in any way. I will on occasion be singled out, only as people are addressing the group as ‘guys’ and realizing I’m the only woman. ... I just prefer they stick with ‘guys.’ ... [They] feel more awkward than me, I think. ... [T]here is one VP who often uses sexist (and all other kinds of strange) idioms, such as ‘blow your skirt up’ but he doesn’t realize they are sexist and I know that he respects me as a person...” (*white woman*)

The speaker clearly feels comfortable assimilating into the “boys’ club” because she was treated with respect and had recently been awarded “very rare and secret stock options as a token of the value my company places in me.”

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One woman noted that women used to distance themselves much more openly from other women, but that it is not politically savvy anymore. “I think right now you would want to show support, but maybe not be a leader of the cause. Ten years ago, [you would] just pretend it’s not there.” Yet others appeared to align with men against other women. One endorsed the view that no bias exists against women in engineering and that anyone who thinks it exists is a complainer or ill-informed.

“...I wasn’t at work for 9 months during a 5-year period. I was not penalized for having kids. I just wasn’t there. This was a personal choice I took. I would rather have kids than make more money a year or 2 earlier. Unequal pay is a myth today in the US.” (*white woman*)

Note that this engineer felt that pay was completely fair at her company and that she herself had been held back only to the extent that she was absent for child-rearing reasons. This is a very different situation than situations where bias artificially and permanently penalizes mothers merely because they are mothers. Yet she generalizes her positive experience into a global negative judgment of other women whose experiences may differ from hers.

Another woman felt that any problems faced by women engineers are due to their failures to behave in a professional manner.

“I have always been treated as one of the guys by my peers, which has been perfectly fine for me. If you behave professionally, you are treated professionally.” (*white woman, 35 years in engineering*)

Another felt that women should just “suck it up” and not complain that they had to prove themselves more than men.

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“Women do seem to need to prove themselves more, but don’t make excuses and you will be respected.” (*white woman*)

Women whose strategy is to assimilate seamlessly typically seek to deflect attention away from the fact that they are women because of their strategic calculations (conscious or not) that making their female identity salient will work against them. One woman eloquently articulated her assumption that being seen “as a woman” precluded being seen as “equal.”

“There are different types of female engineers, those who want to be seen as women and those who want to be seen as equal.” (*white woman*)

Perhaps the harshest judgment was presented as a critique of younger women, expressing particular disapproval with the way they handled sexual harassment.

“Respect in engineering is earned, not just given. Too many younger women are under the impression that they should be highly respected just because they showed up to the office. Younger women have a distorted sense of what gender harassment is and often do not handle themselves appropriately in challenging situations. ... The nonstop whining and groundless harassment complaints from younger women in my field are making it much harder for other young women to get hired and much harder for old ladies like me to get jobs. Employers are tending to paint us all with the same brush.” (*African-American woman, in engineering for 30 years*)

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Tug of War: tokenism, leading to competition

As noted, 21% of woman respondents reported that they felt there was just one woman’s slot. Many comments also reflected this view.

“I 100% believe there is a ‘woman’s spot’ and have had very senior people in my organization confirm that they also believe that exists.” (*white woman*)

“The boys’ network is definitely alive and well at the company I work with. There are women in senior positions to function as ‘tokens’ but when you go into middle management there are none.” (*Asian-American woman*)

“I also feel like I will never be promoted because then they will lose their ‘minority hire’ and have to go find another girl.” (*white woman*)

“I would love to see more female superiors support less experienced female engineers in the workplace. Oftentimes, this interaction can be very competitive.” (*white woman*)

“I have been the only female in Tech Services out of 100 or more for the past 8 years at my company, replacing the one before me after she replaced the one before her.” (*white woman*)

Tug of War: strategic distancing

A few comments reflected strategic distancing.

“Sometimes it is still the ‘old boys’ club.”... We have a very strong Women’s Network available to us, but I am surprised at how many women do not take advantage of the opportunities to network and support each other.” (*white woman*)

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More subtle is strategic distancing that faults other women for poor performance.

“More than half the women engineers that I have worked with leave a bad name for themselves simply based on their own performance (not because they are female). They have been slow, unmotivated, poor work ethic and just basically a disappointment when it comes to work.” (*white woman*)

The commenter continues to say that she has had a great experience because she is a “good employee” and has “put herself out there.”

Tug of War: pass-through of other patterns of bias

Much less common—rare, in fact—were comments that evidence a pass-through of the other three patterns of gender bias. The following comment illustrates this, in which a woman appears to judge other women for navigating the Tightrope wrong and attributes her success to her greater adeptness.

“I feel like I frequently have an advantage over my other female colleagues because I am well-spoken and not easily intimidated (though I am also not often harsh or aggressive).” (*white woman*)

A few comments reflected common stereotypes about women: that they are not good leaders ...

“Being managed by a woman is a nightmare. ... Being managed by men (who are decent managers in general) is much better. Women tend to perceive other women as a threat to their success, even when your career paths don’t overlap.” (*white woman*)

... or are gossip and drama queens ...

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“Working with other females is more difficult than working with just males. If you don’t participate in drama and gossip, you are respected and your ideas and input are valued.” (*white woman*)

... or are “catty” ...

“I actually find it easier to work on a team that is predominantly males vs. a team with more women. I have been in a male culture so long I fit in there and not so much with other women who can often be very ‘catty.’” (*white woman*)

... or are better suited to traditionally feminine roles.

“There is bias even among women that women engineers are better suited to more clerical tasks and support roles.” (*white woman*)

Note, however, that these comments were very rare.

Tug of War: conflict between female professionals and administrative staff

Another common Tug of War pattern is between female professionals and administrative staff: 19% of women, but only 13% of white men, reported that they found it “difficult to get administrative personnel to do the kinds of support work for me that they do for other engineers.” The percentage of engineers of color who reported this was even higher (24%). Said one, “I hate it when a secretary/admin staff female makes my work life harder! As if it’s not hard enough.” (*white woman*)

TUG OF WAR BIAS AND THE “BOYS’ CLUB”

Tug of War: Mommy wars

Motherhood, too, can divide women if they end up judging each other for doing motherhood wrong. Only a few comments reflected this dynamic.

“‘Woman engineer with small children’ is a lonely world. There are not many like me and not many who understand. Older women with older children seem to have forgotten how it was.” (*white woman*)

“My core engineering group (mostly male, age 35+) has been the MOST supportive of my career and having children. My biggest hurdle has been other women, and mostly HR related.” (*white woman*)

“For the past 34 years, sadly, I experienced more difficulty [with women than with men]. ... very competitive environment, with behaviors like talking behind your back ... Only in the past few years have I been meeting and working with women in my age range (who are now successful and, I believe, comfortable enough to work cooperatively)” (*white woman*)

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CONCLUSION

In contrast with the other three forms of bias, which emerged strongly both from quantitative and qualitative data, evidence of Tug of War bias is weaker. We did find that about a quarter of the women engineers agreed that “Some women engineers just do not understand the level of commitment it takes to be a successful engineer”—and that women were significantly more likely than white men to make such judgments about other women. Yet women engineers more often reported that they face a “boys’ club” atmosphere that makes it difficult to fit in. The Tug of War may arise in environments where women feel like they are competing for the one “woman’s slot” or where women feel they face a loyalty test in which the politically astute approach is to align with the “boy’s club” against other women.

WORKPLACE PROCESSES

The survey also asked whether engineers believed that they were fairly treated at work with respect to hiring, promotions, performance evaluations, access to networking and mentoring, and compensation. Both women and people of color reported feeling disadvantaged by each of these workplace processes. No statistically significant differences emerged between men and women, or between engineers of color and white men, on the questions about sponsors or mentoring.

QUANTITATIVE DATA

Women respondents were more likely than white men to report less access to hiring, equal pay, fair and honest performance evaluations, informal and formal networking opportunities, and advancement opportunities. Women engineers were more likely than white men to report (24% vs. 12%, $p < 0.001$), and agreed more strongly ($d = 0.442$, $t(2,551) = 7.004$, $p < 0.001$), that it was harder to get hired as a woman. They were more likely than white men to report (40% vs. 29%, $p < 0.001$), and agreed more strongly, that they work more but get paid less ($d = 0.269$, $t(2,552) = 4.293$, $p < 0.001$). They also were more likely than white men to report (29% vs. 20%, $p < 0.001$), and agreed more strongly ($d = 0.191$, $t(2,538) = 3.069$, $p < 0.01$), that they get less honest feedback on their performance. Women engineers, on the other hand, were less likely than white men to report (67% vs. 84%, $p < 0.001$), and disagreed more strongly ($d = -0.292$, $t(2,557) = -4.696$, $p < 0.001$), that they had the same access to informal or formal networking opportunities; were less likely than white men to report (62% vs. 72%, $p < 0.001$), and disagreed more strongly ($d = -0.283$, $t(2,500) = -4.503$, $p < 0.001$), that their pay was comparable to their colleagues with similar qualifications and experience; were less likely than white men to report (62% vs. 71%, $p < 0.001$), and disagreed more strongly ($d = -0.24$, $t(2,553) = -3.861$,

WORKPLACE PROCESSES

$p < 0.001$), that they had been given the advancement opportunities they deserved; and were less likely than white men to report (77% vs. 83%, $p < 0.01$), and disagreed more strongly ($d = -0.145$, $t(2,557) = -2.33$, $p < 0.05$), that their performance evaluations had been fair. (See Appendix A, Table 7a and Table 8).

Women engineers, however, reported similarly as white male engineers on two questions: “I have had good mentors at my workplace,” and “I have a sponsor who is willing to use their influence and power to help advance my career.”

Engineers of color also were much more likely than white men to report less access to equal pay, fair and honest performance evaluations, informal and formal networking opportunities, and advancement opportunities. Engineers of color were more likely than white men to report (48% vs. 29%, $p < 0.001$), and agreed more strongly ($d = 0.413$, $t(722) = 5.438$, $p < 0.001$), that they work more but get paid less; and were more likely than white men to report (35% vs. 20%, $p < 0.001$), and agreed more strongly ($d = 0.33$, $t(731) = 4.378$, $p < 0.001$), that they get less honest feedback on their performance. Engineers of color were less likely than white men to report (64% vs. 84%, $p < 0.001$), and disagreed more strongly ($d = -0.381$, $t(734) = -5.055$, $p < 0.001$), that they felt that they had the same access to informal or formal networking opportunities as their colleagues; were less likely than white men to report (57% vs. 72%, $p < 0.001$), and disagreed more strongly ($d = -0.401$, $t(720) = -5.264$, $p < 0.001$), that their pay was comparable to their colleagues with similar qualifications and experience; were less likely than white men to report (53% vs. 71%, $p < 0.001$), and disagreed more strongly ($d = -0.442$, $t(731) = -5.849$, $p < 0.001$), that they had been given the advancement opportunities they deserved; were less likely

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than white men to report (69% vs. 83%, $p < 0.01$), and disagreed more strongly, that their performance evaluations had been fair ($d = -0.345$, $t(733) = -4.581$, $p < 0.001$) (see Appendix A, Table 7a and Table 8).

Engineers of color and white men did not differ on whether they felt they had good mentors or whether they had a sponsor who was willing to use their influence on their behalf.

Comparing the three groups (women engineers, engineers of color, and white male engineers), the bias gaps between engineers of color and white men are greater than those between women and white men: engineers of color report bias in workplace systems at higher rates than women do. Both groups of comparisons show the largest gap in access to informal and formal networking opportunities. Pay and advancement opportunities come next.

Women engineers of color reported more biases than white women engineers on most of the workplace processes questions. Women engineers of color, compared with white women, were more likely to report that they work more but get paid less (49% vs. 37%, $p < 0.001$) and that they get less honest feedback on their performance (34% vs. 28%, $p < 0.001$). Women engineers of color, compared with white women, were less likely to report that they got the advancement opportunities and promotions they deserved (51% vs. 65%, $p < 0.001$), that their performance evaluations had been fair (69% vs. 79%, $p < 0.001$), that they had sponsors who were willing to use their influence and power to help advance their careers (42% vs. 51%, $p < 0.001$), and that they had as much access to informal or formal networking opportunities as their colleagues (63% vs. 69%, $p < 0.01$). Women engineers of color and white women reported similarly on bias in hiring and mentorship (see Appendix A, Table 7b).

WORKPLACE PROCESSES

As we looked closer at the subgroups of women engineers of color, we found that differentials on the questions concerning pay, getting less honest feedback, and lack of informal/formal networking opportunities were mostly driven by the differences between African-American women and white women. African-American and Latina women were most likely to report not receiving advancement opportunities. Asian-American women were the only group to report that they did not have sponsors who were willing to use their influence and power to help advance their careers. All three minority groups (African-American, Latina, and Asian-American women) reported more bias on performance evaluations than white women.

Regression analysis showed that, after controlling for many other variables, women still reported experiencing higher levels of bias in hiring, networking, and promotion than their male counterparts. Regression analysis also showed that, after controlling for additional variables, African-American engineers still reported experiencing higher levels of bias in networking, promotion, and mentoring/sponsorship but not in performance evaluations. Asian-American engineers reported experiencing higher levels of bias in performance evaluations than their white counterparts but not in networking, promotion, or mentoring/sponsorship. Neither group reported bias in hiring or compensation while controlling for other variables (see Appendix D, Table B).

Age also mattered: after controlling for many other variables, regression analysis showed that engineers aged 45 and up reported higher levels of bias in performance evaluations and mentoring/sponsorship than their younger counterparts (engineers below 35); engineers aged 54 and up reported higher

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levels of bias in promotions than engineers below 35. In addition, after controlling for many other variables, regression analysis showed that engineers with between two and 10 years of experience in their current company reported more hiring bias compared to those with less than two years of experience in their company. (see Appendix D, Table B).

QUALITATIVE DATA

A very large number of comments (335) concerned workplace systems. This section provides some representative examples.

Hiring

"My assessment when I applied for a role that I was definitely qualified for, was that I needed more experience. However, prior people (white males) were hired with less experience." (*African-American woman*)

"[A]s you move up the chain of command, companies often say they have a hard time finding qualified women engineers. This is ridiculous to hear, because obviously there are qualified women out there, but they probably haven't been in the familiar 'old boys' club' network pool that companies look to for applicants." (*white woman*)

Performance evaluations

"I was even told that I need to do more than my male counterparts to be rated the same (for the same job) for performance evaluation!" (*Asian-American woman*)

WORKPLACE PROCESSES

"When women get assertive they face a backlash by receiving sub-par performance reviews. It's the only way supervisors and peers (especially if male) can get back at assertive women." (*white woman*)

"[My male colleagues] got promotions and higher salary raises than me even though I had a better performance review at the end of the year." (*white woman*)

"One colleague repeatedly tells women that 'women are not cut out for engineering.' He also attacks all women during performance reviews with a much higher intensity than men." (*white woman*)

"Sometimes it is still the 'old boys' club. ... One of the biggest challenges I see is the employee evaluation system, which is based on the rules decided decades ago by how men worked...." (*white woman, noting the flexibility stigma*)

Equal pay

Women also felt they were underpaid compared with white men, including some who knew they were because their husbands worked for the same company.

"I've had several women I have mentored where their job—we go by salary grade—is similar to a man, but they're at a lower grade." (*white woman*)

"My husband works for the same company in a different engineering group but has already received a promotion and our salary adjustments this year show he is making \$7K more than me [although I started to work in engineering 7 months before him.] I'm proud of him and believe he deserves his ranking and salary but it's hard to not wonder if part of my experience is due to discrimination." (*white woman*)

"I work for a Fortune 500 company that prides itself hugely on its Diversity and Inclusion. I just had the experience of managing a male engineer and watching him be paid more than me and get a bigger raise. Then, when I objected, my company said I was on par with my peer group and compared me to engineers with HALF of my experience. ... Seeking other opportunities!" (*white woman*)

"I didn't realize until I moved up to [management] how much I was underpaid until I was able to see the entire team's pay. I also realized the trend was not just with me but the other females on the team." (*white woman*)

"When I started, I found out I was paid over 5K less than a male colleague hired in on the same day." (*white woman*)

Promotions

"I am starting to get frustrated as I see my male peer[s] get promoted ahead of me despite repeated performance reviews in the upper echelon of workers and being selected for a private program to receive restricted stock." (*white woman*)

"I initiated and chased a request for promotion, and finally got it ~1 year later than a male colleague with the same level of experience and lower level of performance (as described by other co-workers)." (*white woman*)

"I was the only female [type of engineer] (2 female engineers total) at my company and the first female they hired so I was their guinea pig. It got to a point where I was at the company for 5 years and had to leave because there were no advancement opportunities and I still had to prove myself over and over." (*white woman*)

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Networking

"I miss out on informal social networking opportunities when my colleagues go hunting/fishing/to lunch or happy hour and don't invite me. I see how critical that interaction is to promotion within the company. I am considering leaving the field altogether after 13 years as I don't see a way for me to advance my career and am frequently lonely at work." (*white woman*)

"[F]rom a socializing with co-workers viewpoint it's challenging to talk sports & hunting when you really are not interested in their topics yet you want to have a professional/team connection." (*white woman*)

Other women emphasized the influence of the boys' club or male social bonding.

"I have had a much harder time building a network at my company, which is very 'old boys' club' in how people are informally mentored and develop key sponsors to help promote their careers." (*white woman*)

"The results of this engineering demographic are that many early career male engineers merely have to sneeze to find a mentor." (*white woman*)

Some women noted how important women's groups and organizations are in providing opportunities for women excluded from the boys' club.

"I have not had easy access to informal or formal networking, but I have worked to make my own network. Through the use of professional societies (SWE and other specific technical fields) I have built a strong legal network." (*white woman*)

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"We have a group called the Drilling Women's Engineering Network which helps greatly with sponsorship, networking, and mentoring. While I have benefitted greatly from this group, it's mostly by plugging women in with other women. This is of limited help as the top managers in my organization are male." *(white woman, nine years as an engineer)*

CONCLUSION

As compared with white men, women engineers feel they are less fairly treated in hiring, performance evaluations, networking, mentoring/sponsorship, promotion, and pay. As compared with majority men, engineers of color report bias in performance evaluations, networking, mentoring/sponsorship, promotion, and pay.

DISCUSSING GENDER BIAS IS CONTROVERSIAL IN ENGINEERING

WorkLife Law administered a similar survey to lawyers at about the same time as the Workplace Experiences Survey was administered to engineers. While the survey found substantial levels of bias reported by both groups, some striking differences emerged. Most striking was that male engineers were much less willing than male lawyers to take the survey. Despite very substantial efforts to recruit male engineers (not matched by similar efforts to recruit male lawyers), only 15% of respondents to the SWE survey were male, as compared with 37% of respondents to the lawyer survey. To try to increase the sample of men, we purchased a mailing list of 5,000 male engineers. Only 1% of those on the mailing list completed the survey.

Survey comments also highlight that discussing diversity is more controversial in engineering than in law. Among those who left comments, 16.8% (15/89) of male engineers, but only 3.6% (4/85) of male lawyers, felt that diversity is threatening the quality or otherwise hurting their profession, felt that women have unfair advantages, and/or attacked the survey. Prior research suggests that men in STEM are more reluctant than women, and more reluctant than men in other fields, to accept evidence of gender bias (Handley, Brown, Moss-Racusin, & Smith, 2015). As discussed below, far more men expressed support for greater diversity than expressed skepticism; nonetheless, a strong current of opposition exists in engineering that does not exist, or is not nearly as strong, in other professions.

Many of the negative comments by male engineers reflect the belief that engineering is highly meritocratic and that a focus on gender and racial bias will contaminate the purity of “engineering work [which] can and should be disconnected from ‘social’ and ‘political’ concerns because such considerations

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may bias otherwise 'pure' engineering practice," to quote one study documenting this belief system (Cech, 2013; Cech, 2014, p. 48). Prior studies have found that organizations and individuals that see themselves as highly meritocratic are actually more likely to exhibit gender and racial bias (Castilla & Benard, 2015; Uhlmann & Cohen, 2007; Monin & Miller, 2001). Illustrative comments, all from white men:

"Merit is vastly more important than gender or race, and efforts to 'balance' gender and race diminish the overall quality of an organization by reducing the collective merit of the personnel."

"This survey is a great example of why women engineers are having issues in the workplace. As an engineer, I don't care who I work with (male, female, ethnicity, etc.) all I expect is someone to work to the best of their abilities. ... The 'poor me' attitude (as shown throughout this survey) will not help gain respect in this field, engineers by nature are results oriented."

"The worldview in these questions is out of date, and somewhat paranoid. Women at [my company] are well respected and given more opportunities than the average male engineer. ... Technical competence is everything."

Occasionally, opposition to diversity was linked directly to stereotypes of women.

"Diversity is overly emphasized relative to technical issues governed by physical laws. ... Woman managers are much more difficult to work for and with. ... It's like hitting a moving target, and an approach of 'I'll know it when I see it... and that's not it.' They also tend to enlarge solvable problems into intractable issues."

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Other comments signaled a political dimension to opposition to diversity efforts.

"My daughter is working on her engineering degree and she is very disappointed that she is looked at as a 'female' engineer. The SWE does not make her workplace any better, she finds that people think she was only hired to meet their 'female' engineering quota. ... She has attended a couple of SWE events and was thoroughly disgusted with leftist ideas of this organization." (*white man*)

Another theme was that women now get preferential treatment.

"There is tremendous pressure to hire women engineers at nearly any price or cost."

"As an older white male, I have faced significant reverse discrimination and find it very ironic that I am told that I have some inherent advantage because of who I am. It's nonsense and the exact opposite of what I have been confronted with."

"As regards gender bias, my workplace offers women more incentives and monetary support than it does to males."

"In my organization, I feel that women have a distinct advantage over me as a man when it comes to raises, promotions, and other incentive programs."

"[Women] will always be safe from a RIF. As well as certain companies guaranteeing female engineers higher raises...."

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"Focusing on gender, and only gender, I have seen some great engineers promoted and given great opportunities based on merit. I have also seen some really poor engineers promoted and given great opportunities ... oddly enough all female. I've worked in groups where the worst engineer in [the] group was a female and given the most accolades...."

One woman recounted hearing male colleagues on a business trip:

"They were talking about how all the Board positions go to women, and you're only going to get a Board position if you're a woman or minority. They just went on and on and on. I was thinking, 'Are you guys just dumb that you're having this conversation in front of me?'... This whole question came up about the pay gap, and the women, and my theory about women ... [doing the same job as men often getting] a lower salary grade. ... They both said, 'The men are just ruthless at asking for promotions and salary increases.' ... I was floored."⁷ (*white woman*)

Note that her male colleagues acknowledged, and justified, the practice of paying women less. A few men attacked the survey itself.

"[T]his survey is biased, aimed at eliciting responses that will 'prove' that women are not treated as fairly as men." (*white man*)

"Poorly developed questions and survey. Looks like trying to get to a prescribed answer." (*man, race not identified*)

⁷ Some research (Mohr, 2014), although its validity has been questioned (Rice, 2014), finds that women don't ask for a promotion until they have 100% of the requirements, whereas men will put themselves up for promotion with only 60%. To test for this, the Workplace Experiences Survey asked, "I would ask for promotion only if I believe that I have already met all the stated qualifications for that role." We found no statistically significant difference between men and women, although we did find a difference between Latinos and white men. (All 15 Latinos vs. 85% of the 290 white men agreed with this statement.)

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"The survey captured the kinds of things I experience very well—overall it is much harder to be taken seriously as an engineer..." (*Latina woman*)

"Taking this survey brings up questions to things that I deal with and suppress. It was upsetting to come to the realization that this happens every day and I continuously suppress it. It makes me [want] to leave the company but then I think it will happen everywhere." (*Latina woman*)

Although a small number of male respondents pushed back against calls for greater diversity in engineering, by no means did all male engineers hold this view. In fact, 49 expressed support for diversity efforts and/or hopes for further improvement.

"I have worked for 36 years and will soon retire. During my career, my workplace has become much more welcoming for woman engineer[s], but there are still some lingering (and mostly subconscious) issues that arise—by both the men and women who work here." (*white man*)

"My employer encourages diversity and I do see ... the workforce becoming more diverse over the last 5 years, though with much further to go in becoming more evenly distributed in reflecting the diversity of the general population." (*white man*)

"I have noticed a direct correlation between [a] higher concentration of women in upper management and the attitude engineers show towards women. Having three women bosses right now I find the differing perspective and style quite refreshing." (*white man*)

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"There are not a lot of women ... [and the] few we have tend to do more technical writing instead of coding or other engineering tasks. I think there are a lot of [inherent biases] that male engineers don't notice. Let's face it, when I was writing this, I couldn't bring myself to write 'men engineers' even though I am perfectly comfortable writing 'women engineers.' 'Men engineers' are just engineers. Under the radar biases." (*white man*)

"My company, and specifically male senior leaders ... whom I know personally, have made serious efforts to get more women into our engineering workforce and to help them move up to the highest levels in technical and management roles. Progress is slow but real. ... Nevertheless, my female colleagues continue to report a sense that their peers take them less seriously because of their gender, and this is consistent with what I observe in my male colleagues." (*male engineer of color* ⁸)

Far more men treated the survey as a straightforward workplace survey and noted age discrimination

While backlash exists in engineering, it is important to keep it in context. Far more men took the survey at face value, as a survey about engineers' workplace experiences. About half of male engineers (52/95) who left comments treated it as a straightforward workplace survey. Of men who treated the survey as a workplace survey, surprisingly few (5) reported very positive experiences:

"Engineering is a great profession for women and men, especially nowadays. I have enjoyed my career as an engineer working on many interesting and challenging problems..." (*white man*)

⁸ In this dataset, 26 individuals self-identified as other minorities. Most of them were Native Americans or American Indians or Alaska Native. Two of them were Native Hawaiian or other Pacific Islander.

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"I am coming to the end of my career (38 years) and still enjoy my profession and am mentoring the staff to help advance their careers. ... Passing this knowledge and experience on is very rewarding." (*Latino man*)

On a more negative note, quite a few comments (37) reflected the belief that age discrimination negatively affects older engineers. Regression analysis showed that engineers aged 55-64 reported more Prove-It-Again bias than engineers under 35 (see Appendix D, Table A). Regression analysis also showed that, after controlling for many other variables, engineers aged 45 and up reported higher levels of bias in performance evaluations and mentoring/sponsorship than their younger counterparts (under 35 years old); engineers aged 55 and up reported higher levels of bias in promotions than engineers under 35 years old. In addition, after controlling for many other variables, regression analysis showed that engineers with between two and 10 years of experience in their current companies reported more hiring bias, compared with those with less than two years of experience in their companies (see Appendix D, Table B).

"I feel like I've been put out to pasture because I'm a long-time employee." (*white man*)

"As I get older (I am 63 years old), I find opportunities for me are less in my engineering career even though I have more than 40 years of professional experience." (*Asian-American man*)

"Continue to see growing lack of respect for experienced engineers from new entry-level and early career engineers." (*white man*)

Some women reported age discrimination in the other direction.

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"I have found more issue with the fact I don't have enough 'gray hair' even though I do have 12 years of experience. I look younger than my age and have had trouble with clients taking me seriously because they think I am too young to know what I'm doing. It's had very little to do with the fact I'm female." (*white woman*)

"Many young women feel that they're being singled out for gender reasons when being asked to do admin stuff (schedule meetings, take minutes, etc.). It's not because you're a woman, it's because you're a rookie." (*white man*)

"I think being a young person (I am currently 25) has been harder than being a woman for now. I am often assumed to be an intern or co-op even with a master's degree and 2 years [of] experience." (*white woman*)

Other comments reflected various sources of dissatisfaction with engineering. Nine people noted cost cutting and/or outsourcing as an issue.

"The work atmosphere has become oppressive as cost reductions rule the day. ... Management continues to sub-optimize engineering tools to save a few bucks ... assuring the discontent of their technical staffs...." (*white man*)

"I am pressured to meet schedule (however unrealistic it may be) over the quality of work put in to meet our customer's quality standards." (*white man*)

Others felt that respect and/or pay has diminished and pressure has doubled.

"Pay has stagnated, pressure has doubled, respect (there is none)." (*white man*)

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"There is definitely pressure to [outsource and] reduce compensation to the engineering staff. ... It generally feels like the level of respect given to engineering staff in the past, is in decline." (white man)

"The culture is too much based on working hard and not working smart. Too many long hours are being spent due to the inability of organizations to plan ahead." (white man)

Other engineers faulted the business practices, including this white male engineer who described managers and executives as "clueless, money hungry nerf-herders":

"My company uses the GE human resources model which basically states that 10% of any given workforce is underperforming. ... This system is extremely degrading and non-motivating." (*white man*)

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"I truly get frustrated when I read all the articles in the magazines and the newspapers about the need for more programs and funds to encourage/ entice girls/women to go into STEM fields. Sure, that would help but what is the point if we still encounter a hostile work environment? More needs to be done to make the technical work environment fair for women so we STAY in the field." (*Asian-American woman*)

While the pipeline plays a role in creating a lack of diversity in engineering, so does climate. When a major STEM organization working with the Center for WorkLife Law used a version of the Workplace Experiences Survey as an internal climate survey, it found statistically significant differences in the levels of bias among different demographic groups—and also that employees' perceptions of bias were significantly correlated with their turnover intentions. Comments in the Workplace Experiences Survey also linked perceptions of bias to intent to leave. Thirty people mentioned that they had left or were planning to leave their companies or the engineering field: 28 of them were women, and 10 of them were people of color.

"My journey as an engineer has been quite a challenge, starting from my undergraduate education and continuing through my professional career. Often times I have felt isolate[d], misunderstood and like an outsider. Over the course of the past five years, I have seriously contemplated leaving the profession." (*African-American woman*)

"It's hard being an engineer and a woman. I've wanted to leave many times, but [I will] back myself into a financial situation if I do stop working. I'm looking at ways to get out and to replace my income with something else." (*Asian-American woman*)

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"[The] construction industry is extremely biased against female engineers so I want to leave quickly." (*Asian-American woman*)

"The job I had before that I was paid less for the same job, not given the opportunities my male colleagues were, and it was an absolutely horrid work environment. When I handed in my resignation, my boss seemed confused, and asked me why I thought all the women were leaving because it wasn't just me resigning. I should have responded 'Because you're a ^*&#^&@* and you encourage that behavior in others.'" (*Asian-American woman*)

Both the quantitative and the qualitative evidence from the survey found that precisely the same kinds of gender and racial bias that have been documented over and over again exist in engineering workplaces. Survey evidence also showed that both women engineers and engineers of color feel they are disadvantaged in pay, promotions, performance evaluations, and mentoring; women also reported that they believe it is harder to get hired as a woman.

An important point for both engineers and companies is that the climate differs dramatically in different companies. Many comments reflected that women who find a hostile climate leave to join organizations that treat women better.

"Many of my responses would change significantly if I was evaluating my current employer ...compared to my previous employer. ... My previous employer did not value me and when I decided to leave, my top priority was finding a culture that would value my strengths and skill sets, where I would feel more confident and more like myself at work. While I am much happier at my new job, I am still the only female engineer in my group of 20+ engineers." (*white woman*)

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"I have worked for several different firms and have had a different experience at each. As a female, I feel the most respected at my current job. I have not felt the same at all of my other jobs. At one job I was treated very differently as a woman, i.e., not given challenging work, talked down to, etc." (*white woman*)

"The company I work for today is much more progressive than those I have worked for in the past. ... While the corporat[e] management still has some sexist throwback, my office does not." (*white woman*)

Is the climate in engineering improving? Overall, 64 women and six men commented that they felt that engineering is moving in the right direction, while 45 women and three men saw no progress. Here are comments from women who saw no progress:

"I would actually not advise young people to go into engineering, especially young women unless they make sure they marry a man in engineering management so he can get her up the ladder. The ROI of studying electrical engineering was extremely low for me." (*white woman, 20+ years at an aerospace company*)

"I have noticed more than once that my manager (male) tends to favor male co-workers within my team who either don't have kids or don't have commitments with kids. If I can go back in time, I probably would have chosen a different profession with more gender diversity." (*Asian-American woman*)

"Sadly, there has been no positive change for women engineers in my workplace over the past five years. I would also note that each time the economy gets tighter, it corresponds to a more hostile workplace for women engineers." (*white woman*)

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"Please help, the gender issues feel overwhelming to me and I constantly consider leaving engineering for another line of work. I feel it is so unfair that I want to quit ALL THE TIME." (*white woman*)

Others celebrated women's progress and their experiences.

"I've had a great experience being an engineer. I've never felt like I was treated differently because I was a woman." (*white woman*)

"My mentors—both male and female—have created a welcoming, mentoring environment that I've been able to learn in." (*white woman*)

"In my company, they are trying to hire more women engineers and promote them faster than before. I have been at my company for 25 years and this was not always the case. I'm glad things are starting to change." (*white woman*)

"I have seen a lot more women become managers in the last few years at my company than I have in the past." (*white woman*)

The bottom line for women and engineers of color is this: There are companies that value diversity in the workplace. If you feel bias in your job, know that there are companies that offer their employees better opportunities. There are also strategies that you can employ to help you navigate bias in the workplace. For example, see Joan Williams' videos recorded for Lean In: <http://leanin.org/education/introduction-to-what-works-for-women-at-work/>.

The bottom line for employers? If your workforce is not diverse, your climate may need attention. An influential study found that the typical one-shot bias training often does little to improve diversity (Kalev, Dobbin, & Kelly, 2006). An open question is whether a new approach may prove more effective. Older,

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sensitivity-type trainings are unlikely to work and may make matters worse. Newer trainings that focus on the cognitive bases of bias, while more scientific, typically do not show how implicit bias plays out in everyday workplace interactions or provide ways managers can interrupt bias. A new approach, “Bias Interrupters for Managers,” does both. When Williams gave this training to campus leaders, department chairs, and administrators at a major STEM university campus in 2016, 71% of participants reported learning two or three strategies for interrupting bias; 26% reported learning four or more.

Bias training may be one component of an effective approach to climate change, but it is certainly not sufficient. If an organization is facing challenges with diversity, it is probably because bias is constantly being transmitted through its basic business systems. One study of performance evaluations in tech provides an example: not only were women (89%) much more likely than men (59%) to get negative comments on their performance evaluations; women were much more likely to get negative comments about their personalities—what the study author called “the abrasiveness trap.” Only 2% of the men, but roughly 75% of the women, received such comments, which reflect Tightrope bias (Snyder, 2014).

If implicit bias is constantly being transmitted through basic business systems, what is needed is to change the business systems, using a model called Metrics-Driven Bias Interrupters:

1) Do an assessment. The Workplace Experiences Survey has been adapted into an internal climate survey. Use it, or use focus groups or another method, to pinpoint whether implicit bias is playing out in your organization—and, if so, where.

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2) Develop an objective metric. If you do find bias playing out, develop an objective metric to measure it.

3) Implement a Bias Interrupter. A Bias Interrupter is an evidence-based tweak to one of the basic business systems (hiring, assignments, performance evaluations, compensation, etc.) designed to interrupt bias. A full open-source toolkit will soon be available at <http://biasInterrupters.org>.

4) Return to the metric, and ratchet up as needed. Then return to the metric to see whether the Bias Interrupter has been effective. If not, ratchet up to a stronger interrupter. For more detail, see “Hacking Tech’s Diversity Problem” (Williams, 2014).

DATA AND METHODS

Between February and May 2016, Professor Joan Williams at the Center for WorkLife Law (CWLL), UC Hastings College of the Law, conducted the Workplace Experiences Survey on behalf of the Society of Women Engineers (SWE). SWE reached out to its membership and the membership of five other organizations for survey respondents. A total of 3,093 professionals in science, technology, and engineering completed the survey online. Respondents included women and men, aged 18 to 65 and up, with at least two years of experience as an engineer, from multiple sectors (academia, corporate, government, military, and nonprofit). The survey data was weighted to be representative of the gender and race distribution of engineers in the U.S. using the 2015 Current Population Survey⁹ (see Appendix G for details about the weights of the data). The weighted data was used in regression analyses but not bivariate and univariate analyses (see explanation of both terms below). Appendix B lists the demographic distribution of the survey respondents (unweighted data). Please note that in the charts, percentages may not always add up to 100 because of computer rounding or the acceptance of multiple response answers from respondents.

Apart from questions about the respondents' demographic information and their industries and positions, the main part of the Workplace Experiences Survey consists of 39 Likert scale questions asking respondents to choose an answer on a scale from one to six, from strongly disagree to strongly agree,¹⁰ for each of the 38 statements. (One item was excluded from the analysis. See Appendix C for details.) We conducted univariate, bivariate, and multivariate analyses on the survey data.

For the univariate analysis, we dichotomized the Likert scale variables (e.g., combined strongly agree, agree, and somewhat agree into the "agree" category) and calculated the percentage of respondents who agreed with each statement.

⁹ <http://www.bls.gov/cps/cpsaat11.htm>

¹⁰ This is the six-point scale: strongly disagree, disagree, somewhat disagree, somewhat agree, agree, and strongly agree

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For the bivariate analysis, we compared the percentages of respondents who agreed with each statement by gender and race, specifically between women, people of color, and white men. We chose to do the comparisons this way instead of comparing women vs. men and whites vs. people of color because we hoped to single out the “disadvantaged” subgroups in engineering and offer specific recommendations instead of making general observations on gender and race differences. We conducted Chi-square tests and two sample t-tests on the comparisons and considered differences statistically significant when the p values were smaller than .05. Moreover, we labeled statistically significant differences of more than 15 percentage points as “large” differences, 5-15 percentage points as “medium” differences, and less than five percentage points as “small” differences.

We also calculated the mean scores of the responses on the Likert scale questions and compared the means by gender and race (again, between women, people of color, and white men). The higher the mean score, the more strongly a group of respondents agreed with the statement. For instance, women engineers on average scored 3.87 on the question “I have to repeatedly prove myself to get the same level of respect and recognition as my colleagues,” while white male engineers on average scored 3.12 on this question. The differential is .739.

Therefore, we reported that women engineers more strongly agreed with the statement than white male engineers. Women engineers on average were much closer to “somewhat agree” (score is 4 for somewhat agree) on this statement than white male engineers. We ran two sample t-tests to test if the differences of means by two demographic groups (for instance, women vs. white men) were statistically significant. We reported the t-test statistics and p values in the appendix tables and the report.

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We also calculated Cohen's D (d) to measure the effect sizes of the differences on the average Likert scale scores by groups. D was calculated by taking the groups' mean differences and dividing by the average of each group's variance ("pooled variance"). The mean difference was either considered "small" (d = 0.10 – 0.40), "medium/moderate" (d = 0.50 – 0.70), or "large" (d = 0.80 or above). We reported d in the report.

For the multivariate analysis, we conducted regression analyses predicting variations of bias experienced while controlling for gender, race, age, education, workplace seniority, dependent children, and academic status (whether the respondent worked in an academic environment or not). Regression analysis results are presented in Appendix D of the report.

We designed the survey to tease out possible biases that exist in workplaces, based on the vast amount of social science research conducted in the past 30 years. On the basis of previous literature, we classified the survey items into the four major categories (Prove-It-Again, Tightrope, Tug of War, and Maternal Wall). The breadth of the survey instruments made it difficult to create scales for each category, as the items are not heavily overlapped, especially for the Tug of War and Maternal Wall questions.

We conducted both exploratory (using a randomly selected 50% of the sample) and confirmatory (using the other 50% of the sample) factor analysis on all items of the four major categories. We created scales (by averaging the items) for the Prove-It-Again and Tightrope bias. The scales did not include items with eigenvalues less than .5 in the confirmatory factor analysis. If an item had similar eigenvalue (say, around .4) in two factors, we placed the item in the category that fits our literature

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review and classifications. We also calculated Cronbach's alpha for the items used for creating scales and reported them.

The Tug of War and Maternal Wall items did not load well together in the factor analysis. So we chose to use two Tug of War items and run regression models separately on each item. We did the same for the Maternal Wall questions.

For the workplace processes questions, we calculated Cronbach's alpha to decide if we could create scales. There are two questions for each of the following processes: performance evaluations, mentoring/sponsorship, and compensation. We created scales for the latter two processes (alpha bigger than .7 for both processes) and chose to use one question, "My performance evaluations have been fair," for the performance evaluations process.

Appendix D, tables A and B, lists the questions that we used to create scales or that we used as dependent variables in the regression analyses for both the four types of bias and the workplace processes.

The percentage and average score comparisons by different demographic groups are presented in Appendix A, Tables 1 to 8, for different types of bias (Prove-It-Again, Tightrope, Maternal Wall, Tug of War, and workplace processes). The survey data analysis constitutes the quantitative data sections of this report.

Professor Williams conducted 11 interviews of women engineers to understand their workplace experiences. Interviews averaged 60 minutes and were conducted between March 7, 2016, and April 25, 2016. The sampling frame of the interviewees consisted primarily of board members from the Society of Women Engineers. Moreover, nearly one-third of the survey respondents left comments while filling

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out the survey. The demographic distributions of respondents who left comments are very similar to the demographics of those who did not leave comments, which means the comments may well represent views of the whole sample (see Appendix E). Both the interviews and comments collected from the surveys were analyzed and included as the qualitative data sections of this report.

APPENDIX A: COMPARISON TABLES

Table 1a: Percentage agreement with Prove-It-Again questions: comparisons between women engineers, engineers of color, and white male engineers

Question	% Women	% People of Color (POC)	% White Men	Wom-en-White Men Diff	POC-White Men Diff
"I feel I am held to higher standards than my colleagues."	53%	60%	40%	13%***	20.3%***
"My suggestions or ideas are respected as much as my colleagues'."	72%	67%	86%	-13.4%***	-18.4%***
"In meetings, other people get credit for ideas I originally offered."	47%	46%	32%	14.3%***	13.6%***
"After moving from an engineering role to a project management/business role, people assume I do not have technical skills."	62%	62%	37%	24.6%***	24.5%***
"I have to repeatedly prove myself to get the same level of respect and recognition as my colleagues."	61%	68%	35%	25.6%***	32.5%***
"I have been mistaken for administrative or custodial staff."	45%	45%	9%	35.4%***	36.1%***

Chi-square tests and two sample t-tests were conducted for comparison. *p<0.01; **p<0.01; ***p<0.001

APPENDIX A: COMPARISON TABLES

Table 1b: Percentage agreement with Prove-It-Again questions: comparisons between white women, African-American women, Asian-American women, and Latina women engineers

Question	White Women (WW)	Women of Color (WC)	WW-WC Diff	African-American Women (BW)	WW-BW Diff	Asian-American Women (AW)	WW-AW Diff	Latina (L)	WW-L Diff
"I feel I am held to higher standards than my colleagues."	51%	61%	9.6%***	68%	16.4%***	57%	5.90%	59%	7.6%
"My suggestions or ideas are respected as much as my colleagues'."	73%	66%	-7.4%***	70%	-3.1%	65%	-8.2%**	64%	-9.1%**
"In meetings, other people get credit for ideas I originally offered."	47%	47%	-0.60%	57%	9.8%*	41%	-6.1%	45%	-2.5%
"After moving from an engineering role to a project management/ business role, people assume I do not have technical skills."	61%	64%	2.70%	74%	12.6%*	62%	0.4%	59%	-2.3%
"I have to repeatedly prove myself to get the same level of respect and recognition as my colleagues."	59%	71%	12.3%***	78%	18.8%***	70%	10.8%***	68%	8.9%*
"I have been mistaken for administrative or custodial staff."	44%	48%	3.9%	50%	5.8%	41%	-2.9%	55%	10.7%**

Chi-square tests and two sample t-tests were conducted for comparison. *p<0.01; **p<0.01; ***p<0.001

APPENDIX A: COMPARISON TABLES

Table 1c: Percentage agreement with Prove-It-Again questions: comparisons between white men, African-American men, Asian-American men, and Latino male engineers

Question	White Men (WM)	Men of Color (MC)	WW-WC Diff	African-American Men (BM)	WM-BM Diff	Asian-American Men (AW)	WM-AM Diff	Latina (L)	WM-L Diff
"I feel I am held to higher standards than my colleagues."	40%	55%	14.5%*	43%	2.9%	67%	26.7%*	67%	26.7%**
"My suggestions or ideas are respected as much as my colleagues'."	86%	77%	-8.2%	57%	-28.3%**	75%	-10.5%	93%	7.9%
"In meetings, other people get credit for ideas I originally offered."	32%	41%	8.5%	43%	10.4%	42%	9.3%	20%	-12.4%
"After moving from an engineering role to a project management/ business role, people assume I do not have technical skills."	37%	43%	6.2%	67%	29.6%	‡	‡	30%	-7.1%
"I have to repeatedly prove myself to get the same level of respect and recognition as my colleagues."	35%	39%	3.2%	57%	21.7%	50%	14.6%	27%	-8.7%
"I have been mistaken for administrative or custodial staff."	9%	21%	11.1%**	0%	-9%	25%	15.7%*	27%	17.4%**

Two sample t-tests were conducted for comparison. ‡ There are no observations in this cell. *p<0.01; **p<0.01; ***p<0.001

APPENDIX A: COMPARISON TABLES

Table 2: Likert Scale average scores of Prove-It-Again questions: comparisons between women engineers, engineers of color, and white male engineers

Question	Mean Women	Mean People of Color (POC)	Mean White Men	POC-White Men Diff	Women-White Men Diff
"I feel I am held to higher standards than my colleagues."	3.658	3.944	3.218	0.726***	0.440***
"My suggestions or ideas are respected as much as my colleagues'."	4.09	3.953	4.561	-0.608***	-0.471***
"In meetings, other people get credit for ideas I originally offered."	3.374	3.442	2.952	0.491***	0.423***
"After moving from an engineering role to a project management/business role, people assume I do not have technical skills."	3.818	3.848	3.036	0.812***	0.782***
"I have to repeatedly prove myself to get the same level of respect and recognition as my colleagues."	3.866	4.112	3.127	0.985***	0.739***
"I have been mistaken for administrative or custodial staff."	3.165	3.278	1.862	1.416***	1.303***

Two sample t-tests were conducted for comparison. Effect sizes (d) were calculated and presented in the report. *p<0.01; **p<0.01; ***p<0.001

APPENDIX A: COMPARISON TABLES

Table 3a: Percentage agreement with Tightrope questions: comparisons between women engineers, engineers of color, and white male engineers

Question	% Women	% People of Color (POC)	% White Men	Women-White Men Diff	POC-White Men Diff
"Being vocal about my work and accomplishments is rewarded."	62%	63%	64%	-2.2%	-1.0%
"I am expected to be a 'worker bee', which means I should work hard, avoid confrontation, and not complain."	50%	58%	48%	2.5%	9.9%***
"People at work see me as a leader."	81%	80%	85%	-3.5%	-4.5%
"I feel free to express anger at work when it's justified."	49%	45%	59%	-9.3%***	-14.2%***
"As compared to my colleagues in a comparable role with comparable seniority and experience, I am more likely assigned to high-profile tasks or work teams."	50%	47%	61%	-10.9%***	-14.8%***
"I seldom receive pushback when I behave assertively."	51%	49%	67%	-16%***	-17.7%***
"I feel pressure to let others take the lead."	33%	39%	16%	17.1%***	23.8%***
"I have had the same access to desirable assignments as my colleagues."	65%	55%	85%	-19.6%***	-30.4%***
"I am interrupted at meetings more than my colleagues."	45%	45%	16%	29.1%***	28.3%***
"As compared to my colleagues in a comparable role with comparable seniority and experience, I more often do office housework – finding a time everyone can meet, taking notes at a meeting, planning office parties, etc."	55%	52%	26%	29%***	26.1%***

Chi-square tests and two sample t-tests were conducted for comparison. *p<0.01; **p<0.01; ***p<0.001

APPENDIX A: COMPARISON TABLES

Table 3b: Percentage agreement with Tightrope questions: comparisons between white women, African-American women, Asian-American women, and Latina women engineers

Question	White Women (WW)	Women of Color (WC)	WW-WC Diff	African-American Women (BW)	WW-BW Diff	Asian-American Women (AW)	WW-AW Diff	Latina (L)	WW-L Diff
"Being vocal about my work and accomplishments is rewarded."	62%	64%	1.6%	66%	3.7%	68%	6.0%	59%	-3.3%
"I am expected to be a 'worker bee', which means I should work hard, avoid confrontation, and not complain."	48%	59%	11.3%***	65%	16.9%***	56%	8.3%**	59%	10.8%**
"People at work see me as a leader."	82%	79%	-2.8%	83%	1.0%	72%	-9.7%***	85%	2.8%
"I feel free to express anger at work when it's justified."	51%	44%	-7%**	42%	-9.4%*	42%	-9.7%**	49%	-2.2%
"As compared to my colleagues in a comparable role with comparable seniority and experience, I am more likely assigned to high-profile tasks or work teams."	51%	47%	-4.6%*	46%	-4.9%	46%	-4.8%	47%	-4.0%

APPENDIX A: COMPARISON TABLES

"I seldom receive pushback when I behave assertively."	52%	48%	-3.6%	48%	-3.5%	52%	0%	46%	-6%
"I feel pressure to let others take the lead."	31%	40%	9.5% ***	32%	1.0%	43%	12.2%***	42%	11%**
"I have had the same access to desirable assignments as my colleagues."	68%	53%	-15.5%***	43%	-25.3%***	56%	-12.4%***	57%	-11.1%**
"I am interrupted at meetings more than my colleagues."	46%	47%	1.3%	39%	-6.8%	46%	0%	54%	8.1%*
"As compared to my colleagues in a comparable role with comparable seniority and experience, I more often do office housework – finding a time everyone can meet, taking notes at a meeting, planning office parties, etc."	56%	55%	-1.0%	56%	0.9%	51%	-4.3%	57%	1.8%

Chi-square tests and two sample t-tests were conducted for comparison. *p<0.01; **p<0.01; ***p<0.001

APPENDIX A: COMPARISON TABLES

Table 4: Likert scale average scores of Tightrope questions: comparisons between women engineers, engineers of color, and white male engineers

Question	Mean Women	Mean People of Color (POC)	Mean White Men	POC-White Men Diff	Women-White Men Diff
"Being vocal about my work and accomplishments is rewarded."	3.728	3.752	3.749	0.003	-0.021
"I am expected to be a 'worker bee', which means I should work hard, avoid confrontation, and not complain."	3.487	3.727	3.309	0.418***	0.178*
"People at work see me as a leader."	4.345	4.28	4.466	-0.186**	-0.121*
"I feel free to express anger at work when it's justified."	3.326	3.16	3.569	-0.410***	-0.244***
"As compared to my colleagues in a comparable role with comparable seniority and experience, I am more likely assigned to high-profile tasks or work teams."	3.523	3.408	3.836	-0.428***	-0.313***
"I seldom receive pushback when I behave assertively."	3.475	3.456	3.916	-0.460***	-0.441***
"I feel pressure to let others take the lead."	3.001	3.187	2.497	0.690***	0.504***
"I have had the same access to desirable assignments as my colleagues."	3.945	3.653	4.428	-0.775***	-0.483***
"I am interrupted at meetings more than my colleagues."	3.366	3.373	2.552	0.821***	0.815***
"As compared to my colleagues in a comparable role with comparable seniority and experience, I more often do office housework – finding a time everyone can meet, taking notes at a meeting, planning office parties, etc."	3.605	3.512	2.828	0.684***	0.777***

Chi-square tests and two sample t-tests were conducted for comparison. *p<0.01; **p<0.01; ***p<0.001

APPENDIX A: COMPARISON TABLES

Table 5a: Percentage agreement with Maternal Wall questions: comparisons between women engineers, engineers of color, and white male engineers

Question	% Women	% People of Color (POC)	% White Men	Women-White Men Diff	POC-White Men Diff
"I have to spend more time working to compensate for the schedules of my colleagues who have children."	20%	22%	21%	-1.0%	0.5%
"My colleagues have communicated to me that I should work fewer hours because I have children."	5%	11%	3%	2.7%	8.7%***
"My colleagues have communicated to me that I should work more hours because I have children."	96%	90%	99%	-2.8%	-8.1%***
"I feel pressured to work long hours to show my commitment, even when the workload does not really justify the overtime."	41%	43%	37%	4.6%	6%
"Asking for family leave or flexible work arrangements would not hurt my career."	50%	50%	63%	-12.8%***	-13.1%***
"Having children did not change my colleagues' perceptions of my work commitment or competence."	55%	57%	78%	-23.8%***	-20.8%***

Chi-square tests and two sample t-tests were conducted for comparison. *p<0.01; **p<0.01; ***p<0.001

APPENDIX A: COMPARISON TABLES

Table 5b: Percentage agreement with Maternal Wall questions: comparisons between white women, African-American women, Asian-American women, and Latina women engineers

Question	White Men (WM)	Men of Color (MC)	WW-WC Diff	African-American Men (BM)	WM-BM Diff	Asian-American Men (AW)	WM-AW Diff	Latina (L)	WM-L Diff
"I have to spend more time working to compensate for the schedules of my colleagues who have children."	20%	23%	3.1%	21%	1.0%	24%	4.5%	23%	3.8%
"My colleagues have communicated to me that I should work fewer hours because I have children."	3%	11%	7.5%***	7%	3.8%	16%	12.6%***	3%	-0.3%
"My colleagues have communicated to me that I should work more hours because I have children."	98%	91%	-6.5%***	94%	-3.7%	88%	-9.8%***	96%	-2.0%
"I feel pressured to work long hours to show my commitment, even when the workload does not really justify the overtime."	41%	43%	2.0%	45%	3.7%	38%	-3.3%	50%	9.4%**
"Asking for family leave or flexible work arrangements would not hurt my career."	51%	48%	-2.5%	61%	9.9%*	45%	-5.5%	44%	-7.2%
"Having children did not change my colleagues' perceptions of my work commitment or competence."	55%	54%	-0.6%	59%	4.2%	57%	2.2%	49%	-5.6%

Chi-square tests and two sample t-tests were conducted for comparison. *p<0.01; **p<0.01; ***p<0.001

APPENDIX A: COMPARISON TABLES

Table 6: Likert scale average scores of Maternal Wall questions: comparisons between women engineers, engineers of color, and white male engineers

Question	Mean Women	Mean People of Color (POC)	Mean White	POC-White Men Diff	Women-White Men Diff
"I have to spend more time working to compensate for the schedules of my colleagues who have children."	2.454	2.449	2.497	-0.048	-0.043
"My colleagues have communicated to me that I should work fewer hours because I have children."	2.155	2.336	2.075	0.261***	0.08
"My colleagues have communicated to me that I should work more hours because I have children."	4.871	4.712	4.954	-0.242***	-0.083
"I feel pressured to work long hours to show my commitment, even when the workload does not really justify the overtime."	3.198	3.295	2.993	0.302***	0.205**
"Asking for family leave or flexible work arrangements would not hurt my career."	3.471	3.469	3.848	-0.379***	-0.376***
"Having children did not change my colleagues' perceptions of my work commitment or competence."	3.756	3.907	4.653	-0.746***	-0.897***

Two sample t-tests were conducted for comparison. Effect sizes (d) were calculated and presented in the report. *p<0.01; **p<0.01; ***p<0.001

APPENDIX A: COMPARISON TABLES

Table 7a: Percentage agreement with workplace processes questions: comparisons between women engineers, engineers of color, and white male engineers

Bias Type	Question	% Women	% People of Color (POC)	% White Men	Women-White Men Diff	Minority-White Men Diff
Workplace: hiring	"It is harder to get hired at my workplace if you're a woman."	24%	24%	12%	11.6%***	11.8%***
Workplace: performance evaluations	"I feel I get less honest feedback on my performance than my colleagues."	29%	35%	20%	9.3%***	15%***
Workplace: performance evaluations	"My performance evaluations have been fair."	77%	69%	83%	-6.6%**	-14%***
Workplace: mentoring/sponsorship	"I have had good mentors at my workplace."	65%	63%	68%	-3.5%	-5.1%
Workplace: mentoring/sponsorship	"I have a sponsor who is willing to use their influence and power to help advance my career."	49%	41%	45%	4.0%	-3.9%
Workplace: networking	"I have had as much access to informal or formal networking opportunities as my colleagues."	67%	64%	84%	-16.9%***	-20.7%***
Workplace: promotion	"I have been given the advancement opportunities and promotions I deserve."	62%	53%	71%	-9.3%***	-17.7%***
Workplace: compensation	"My pay is comparable to my colleagues' with similar qualifications and experience."	62%	57%	72%	-10.3%***	-15.4%***
Workplace: compensation	"As compared with my colleagues, I work more but get paid less."	40%	48%	29%	11.1%***	18.7%***

Chi-square tests and two sample t-tests were conducted for comparison. *p<0.01; **p<0.01; ***p<0.001

APPENDIX A: COMPARISON TABLES

Table 7b: Percentage agreement with workplace process questions: comparisons between white women, African-American women, Asian-American women, and Latina women engineers

Bias Type	Question	White Women (WW)	Women of Color (WC)	WW-WC Diff	African-Am Women (BW)	WW-BW Diff	Asian-Am Women (AW)	WW-AW Diff	Latina (L)	WW-L Diff
Workplace: hiring	"It is harder to get hired at my workplace if you're a woman."	23%	25%	2.0%	21%	-1.9%	24%	0.6%	30%	6.7%
Workplace: performance evaluations	"I feel I get less honest feedback on my performance than my colleagues."	79%	69%	-9.8% ***	70%	-8.4% *	68%	-10.4% ***	66%	-12.5% ***
Workplace: performance evaluations	"My performance evaluations have been fair."	28%	34%	6.8% ***	37%	8.9% *	32%	4.7%	34%	6.8%
Workplace: mentoring/ sponsorship	"I have had good mentors at my workplace."	65%	62%	-2.9%	63%	-2.5%	63%	-2.2%	60%	-5.6%
Workplace: mentoring/ sponsorship	"I have a sponsor who is willing to use their influence and power to help advance my career."	51%	42%	-9.3% ***	44%	-7.7%	37%	-14.1% ***	44%	-6.8%

APPENDIX A: COMPARISON TABLES

Bias Type	Question	White Women (WW)	Women of Color (WC)	WW-WC Diff	African-Am Women (BW)	WW-BW Diff	Asian-Am Women (AW)	WW-AW Diff	Latina (L)	WW-L Diff
Workplace: networking	"I have had as much access to informal or formal networking opportunities as my colleagues."	69%	63%	-6% **	56%	-12.6% **	63%	-6.0%	68%	-0.2%
Workplace: promotion	"I have been given the advancement opportunities and promotions I deserve."	65%	51%	-13.5% ***	47%	-17.5% ***	55%	-10% **	49%	-15.6% ***
Workplace: compensation	"My pay is comparable to my colleagues' with similar qualifications and experience."	63%	56%	-7.7% ***	39%	-25% ***	63%	-0.2%	59%	-4.8%
Workplace: compensation	"As compared with my colleagues, I work more but get paid less."	37%	49%	11.7% ***	59%	21.6% ***	44%	6.5% *	48%	10.5% **

Chi-square tests and two sample t-tests were conducted for comparison. *p<0.01; **p<0.01; ***p<0.001

APPENDIX A: COMPARISON TABLES

Table 7b: Percentage agreement with workplace process questions: comparisons between white women, African-American women, Asian-American women, and Latina women engineers

Bias Type	Question	Mean Women	Mean Minority	Mean White Men	Minority-White Men Diff	Women-White Men Diff
Workplace: hiring	"It is harder to get hired at my workplace if you're a woman."	2.651	2.735	2.071	0.664***	0.580***
Workplace: performance evaluations	"I feel I get less honest feedback on my performance than my colleagues."	2.896	3.072	2.663	0.409***	0.233***
Workplace: performance evaluations	"My performance evaluations have been fair."	4.295	4.016	4.485	-0.469***	-0.190**
Workplace: mentoring/ sponsorship	"I have had good mentors at my workplace."	3.924	3.863	3.938	-0.075	-0.014
Workplace: mentoring/ sponsorship	"I have a sponsor who is willing to use their influence and power to help advance my career."	3.323	3.065	3.182	-0.117	0.141
Workplace: networking	"I have had as much access to informal or formal networking opportunities as my colleagues."	4.056	3.955	4.455	-0.501***	-0.399***
Workplace: promotion	"I have been given the advancement opportunities and promotions I deserve."	3.753	3.466	4.093	-0.627***	-0.340***
Workplace: compensation	"My pay is comparable to my colleagues' with similar qualifications and experience."	3.764	3.589	4.143	-0.554***	-0.380***
Workplace: compensation	"As compared with my colleagues, I work more but get paid less."	3.261	3.475	2.892	0.582***	0.369***

Two sample t-tests were conducted for comparison. Effect sizes (d) were calculated and presented in the report. *p<0.01; **p<0.01; ***p<0.001

APPENDIX B: DEMOGRAPHIC DISTRIBUTIONS OF THE SAMPLE

TOTAL RESPONSES = 3,093

Demographic	Observations	Proportion of Responses
Women	2,587	84.93%
Dependent children	1,136	37.36%
White	2,040	81.89%
African-American	102	4.09%
Latino/Latina	140	5.62%
Asian-American	183	7.35%
Other People of Color	26	1.04%
18-25 years old	143	5.60%
26-34 years old	898	35.17%
35-44 years old	590	23.11%
45-54 years old	543	21.27%
55-64 years old	336	13.16%
65 years old and up	43	1.68%
Bachelor's degree or below	1,185	45.91%
Master's or professional degree	1,020	39.52%
Doctorate degree	376	14.57%
2-5 years of workplace seniority†	338	13.23%
6-10 years of workplace seniority†	756	29.59%
11-20 years of workplace seniority†	544	21.29%
21-30 years of workplace seniority†	539	21.10%
31 years and up of workplace seniority†	262	10.25%
Academia	339	13.63%

†The workplace seniority variables were measured by the question "How long have you been at your current employer/the employer you have spent the most time with in the past 5 years?"

APPENDIX C: NUMBER OF SURVEY QUESTIONS FOR EACH TYPE OF BIAS

Type of Likert Scale Questions	# of Likert scale questions
Prove-It-Again	6
Tightrope	10
Tug of War	4
Maternal Wall	6
Workplace process: hiring	1
Workplace process: performance evaluation	2
Workplace process: promotion	1
Workplace process: mentoring/sponsorship	2
Workplace process: networking	1
Workplace process: compensation	2
LGBTQ & respect	3
Total	38

†One Prove-It-Again question did not yield reliable statistics (i.e., the gender and racial differences were not statistically significant on this item, which was not consistent with the hypothesis constructed on the basis of previous research): “I would ask for a promotion only if I believe I have already met all the stated qualifications for that role.” Therefore, only 38 questions were analyzed.

APPENDIX D: REGRESSION TABLES PREDICTING FOUR TYPES OF BIAS AND WORKPLACE PROCESSES BIAS

Table A: Linear regression models predicting four types of bias

	(1) Prove-It-Again	(2) Tightrope	(3) Tug of War I	(4) Tug of War II	(5) M-Wall I	(6) M-Wall II
Women	0.685*** (0.0684)	0.204*** (0.0603)		0.631*** (0.0913)	1.114*** (0.134)	0.492*** (0.114)
With Dep. Child	0.0166 (0.106)	-0.0243 (0.0872)	-0.0189 (0.0800)	0.236 (0.121)		0.0180 (0.174)
African-American	0.779** (0.281)	0.784*** (0.186)	0.350* (0.173)	-0.459 (0.248)	0.115 (0.562)	-0.0504 (0.400)
Latino/Latina	0.204 (0.191)	-0.109 (0.142)	0.118 (0.141)	0.0412 (0.221)	-0.838*** (0.251)	-0.255 (0.273)
Asian-American	0.560** (0.180)	0.440* (0.205)	0.189 (0.129)	-0.162 (0.262)	-0.491 (0.278)	0.294 (0.374)
Other people of color	0.254 (0.312)	0.255 (0.278)	0.0929 (0.307)	-0.332 (0.189)	0.640 (0.706)	0.612 (0.367)
35-44 (age)	-0.0527 (0.166)	0.0975 (0.159)	0.0577 (0.103)	0.361 (0.291)	-0.151 (0.268)	-0.0747 (0.300)
45-54 (age)	0.201 (0.146)	0.0393 (0.134)	-0.00512 (0.119)	0.546** (0.173)	-0.0962 (0.253)	0.247 (0.246)
55-64 (age)	0.447** (0.171)	0.00538 (0.128)	-0.0819 (0.120)	0.956*** (0.193)	-0.122 (0.296)	0.323 (0.210)
65 & up (age)	0.279 (0.273)	0.0762 (0.233)	0.121 (0.405)	0.863** (0.314)		
Master/Professional	-0.0951 (0.0993)	-0.178 (0.0939)	-0.0278 (0.0789)	0.193 (0.156)	-0.279 (0.186)	0.137 (0.182)

APPENDIX D: REGRESSION TABLES PREDICTING FOUR TYPES OF BIAS AND WORKPLACE PROCESSES BIAS

Doctorate degree	-0.170 (0.140)	-0.158 (0.118)	-0.313* (0.148)	-0.305 (0.174)	-0.00529 (0.363)	0.535 (0.324)
2-5 years	0.0357 (0.172)	0.0435 (0.142)	0.0534 (0.124)	-0.234 (0.205)	0.300 (0.314)	0.0617 (0.259)
6-10 years	-0.0583 (0.160)	-0.0730 (0.156)	-0.0617 (0.133)	-0.377 (0.256)	0.283 (0.311)	0.0188 (0.316)
11-20 years	-0.118 (0.173)	-0.210 (0.160)	0.0582 (0.141)	-0.233 (0.290)	0.364 (0.277)	-0.420 (0.291)
21-30 years	-0.388* (0.190)	-0.138 (0.187)	-0.0937 (0.166)	-0.509* (0.239)	-0.103 (0.333)	-0.651* (0.266)
31 years & up	-0.533* (0.208)	-0.426* (0.201)	-0.0957 (0.250)	-0.412 (0.281)	-0.529 (0.369)	-0.351 (0.327)
Academia	0.322* (0.147)	0.108 (0.112)	0.389* (0.165)	0.0635 (0.168)	-0.0262 (0.354)	-0.194 (0.288)
Constant	2.657*** (0.113)	2.991*** (0.131)	2.489*** (0.111)	1.822*** (0.151)	2.333*** (0.311)	3.028*** (0.237)
Observations	2361	2361	1857	2332	909	2350
R-squared	0.161	0.131	0.013	0.152	0.181	0.060

Standard errors in parentheses

*p<0.05; **p<0.01; ***p<0.001

APPENDIX D: REGRESSION TABLES PREDICTING FOUR TYPES OF BIAS AND WORKPLACE PROCESSES BIAS

Prove-It-Again: scale of five items (average, six-point scale) (Cronbach's alpha = 0.80)

- "I have to repeatedly prove myself to get the same level of respect and recognition as my colleagues."
- "I feel I am held to higher standards than my colleagues."
- "My suggestions or ideas are respected as much as my colleagues'." (reverse-coded)
- "In meetings, other people get credit for ideas I originally offered."
- "I have been mistaken for administrative or custodial staff."

Tightrope: scale of five items (average, six-point scale) (Cronbach's alpha = 0.77)

- "I feel pressure to let others take the lead."
- "I am expected to be a 'worker bee', which means I should work hard, avoid confrontation, and not complain."
- "People at work see me as a leader." (reverse-coded)
- "I have had the same access to desirable assignments as my colleagues." (reverse-coded)
- "As compared to my colleagues in a comparable role with comparable seniority and experience, I am more likely assigned to high-profile tasks or work teams." (reverse-coded)

Tug of War I: "I am regularly competing with my female colleagues for the woman's slot." (six-point scale)

Tug of War II: "Some women engineers just do not understand the level of commitment it takes to be a successful engineer." (six-point scale)

Maternal Wall I: "Having children did not change my colleagues' perceptions of my work commitment or competence." (six-point scale) (reverse-coded)

Maternal Wall II: "Asking for family leave or flexible work arrangements would not hurt my career." (six-point scale) (reverse-coded)

APPENDIX D: REGRESSION TABLES PREDICTING FOUR TYPES OF BIAS AND WORKPLACE PROCESSES BIAS

Table B: Linear regression models predicting bias in workplace processes

	(1) Hiring	(2) Performance Evaluation	(3) Networking	(4) Promotion	(5) Mentor/Sponsor	(6) Compensation
Women	0.558*** (0.0977)	0.129 (0.114)	0.259** (0.0994)	0.276* (0.116)	0.0319 (0.102)	0.0728 (0.0475)
With Dep. Children	-0.0635 (0.140)	0.269 (0.158)	-0.226 (0.158)	0.0444 (0.169)	0.0167 (0.148)	-0.0561 (0.0569)
African-American	0.516 (0.309)	0.562 (0.298)	0.774* (0.379)	1.230** (0.381)	0.862* (0.365)	-0.159 (0.0828)
Latino/Latina	0.250 (0.307)	0.432 (0.332)	0.0586 (0.287)	0.164 (0.349)	-0.184 (0.274)	0.0209 (0.106)
Asian-American	0.00252 (0.258)	0.745* (0.366)	0.384 (0.281)	0.476 (0.342)	0.339 (0.256)	-0.195 (0.116)
Other People of Color	-0.397* (0.184)	-0.0923 (0.398)	-0.101 (0.267)	-0.410 (0.256)	0.318 (0.394)	-0.0161 (0.129)
35-44 (age)	-0.337 (0.192)	0.267 (0.292)	0.117 (0.237)	-0.216 (0.222)	0.240 (0.240)	-0.163 (0.0874)
45-54 (age)	-0.246 (0.196)	0.636* (0.286)	0.0346 (0.203)	0.319 (0.274)	0.741** (0.246)	-0.0664 (0.0819)
55-64 (age)	-0.0574 (0.260)	0.935*** (0.245)	0.283 (0.246)	0.665* (0.267)	1.013*** (0.229)	-0.141 (0.105)
65 up (age)	-0.158 (0.318)	1.230*** (0.372)	-0.0253 (0.360)	0.818* (0.413)	1.007** (0.353)	0.0197 (0.147)
Master/Professional	0.0645 (0.138)	-0.0577 (0.178)	-0.102 (0.146)	-0.191 (0.159)	0.130 (0.165)	-0.0691 (0.0705)
Doctorate Degree	0.0931 (0.205)	-0.240 (0.360)	-0.140 (0.184)	0.0954 (0.316)	0.107 (0.271)	-0.0500 (0.0869)
2-5 years	0.622* (0.274)	0.0690 (0.250)	0.0631 (0.272)	0.140 (0.285)	-0.121 (0.268)	-0.166 (0.106)
6-10 years	0.449* (0.212)	0.0255 (0.324)	-0.367 (0.222)	0.183 (0.251)	-0.0684 (0.281)	-0.0804 (0.104)
11-20 years	0.398 (0.239)	-0.103 (0.310)	-0.314 (0.243)	-0.0832 (0.247)	-0.353 (0.281)	0.0684 (0.101)
21-30 years	0.0536 (0.261)	-0.366 (0.307)	-0.163 (0.273)	-0.523 (0.312)	-0.446 (0.287)	-0.0482 (0.128)
31 years & up	0.118 (0.312)	-0.669* (0.336)	-0.412 (0.350)	-0.892* (0.360)	-0.696 (0.367)	-0.0688 (0.125)
Academia	0.109 (0.221)	-0.223 (0.319)	0.0434 (0.184)	-0.340 (0.295)	-0.169 (0.253)	0.0758 (0.0839)
Constant	1.805*** (0.192)	2.153*** (0.221)	2.836*** (0.243)	2.876*** (0.225)	3.086*** (0.242)	3.647*** (0.125)
Observations	2347	2348	2351	2347	2358	2330
R-squared	0.103	0.091	0.071	0.106	0.096	0.048

Standard errors in parentheses

* p<0.05, ** p<0.01, *** p<0.001

APPENDIX D: REGRESSION TABLES PREDICTING FOUR TYPES OF BIAS AND WORKPLACE PROCESSES BIAS

All outcome variables are on the 6-point scale: 1: "strongly disagree" 2: "disagree" 3: "somewhat disagree" 4: "somewhat agree" 5: "agree" 6: "strongly agree".

Hiring: "It is harder to get hired at my workplace if you're a woman." (six-point scale)

Performance Evaluations: "My performance evaluations have been fair." (six-point scale)

Networking: "I have had as much access to informal or formal networking opportunities as my colleagues." (six-point scale)

Promotion: "I have been given the advancement opportunities and promotions I deserve." (six-point scale)

Mentoring/sponsorship (average of two items, six-point scale)

(Cronbach's alpha = 0.71)

- "I have had good mentors at my workplace." (reverse-coded)
- "I have a sponsor who is willing to use their influence and power to help advance my career." (reverse-coded)

Pay (average of two items, six-point scale) (Cronbach's alpha = 0.78)

- "My pay is comparable to my colleagues' with similar qualifications and experience." (reverse-coded)
- "As compared with my colleagues, I work more but get paid less."

APPENDIX E: COMPARISON BETWEEN THE DEMOGRAPHIC DISTRIBUTIONS OF COMMENTING RESPONDENTS

Respondents who left comments were slightly more likely to be women and to be older, with slightly higher levels of education and slightly longer workplace seniority. But overall, the two groups have quite comparable demographics.

Variable	Left comments		Did not leave comments		Sig. Test
	Obs.	Prop.	Obs.	Prop.	
Women	804	90.0%	1,783	82.8%	***
Dependent children	339	38.0%	797	37.1%	
White	697	81.1%	1,343	82.3%	
African-American	36	4.2%	66	4.0%	
Latino/Latina	53	6.2%	87	5.3%	
Asian-American	64	7.5%	119	7.3%	
Other people of color	9	1.0%	17	1.0%	
18-24 (age)	38	4.3%	105	6.3%	**
25-34 (age)	278	31.4%	620	37.2%	***
35-44 (age)	207	23.4%	383	23.0%	
45-54 (age)	206	23.3%	337	20.2%	*
55-64 (age)	142	16.0%	194	11.6%	***
65 & up (age)	15	1.7%	28	1.7%	
Bachelor's degrees or below	400	44.6%	785	46.6%	*
Master's or professional degrees	377	42.1%	643	38.2%	
Doctorate degrees	119	13.3%	257	15.3%	
2-5 years of workplace seniority	112	12.6%	226	13.6%	***
6-10 years of workplace seniority	232	26.0%	524	31.5%	**
11-20 years of workplace seniority	214	24.0%	330	19.8%	
21-30 years of workplace seniority	191	21.4%	348	20.9%	
31 years & up of workplace seniority	107	12.0%	155	9.3%	*
Academia	105	12.2%	234	14.4%	

* p<0.05; ** p<0.01; *** p<0.001

APPENDIX F: DEMOGRAPHIC DISTRIBUTIONS (BY GENDER AND RACE) OF COMMENTS LEFT ON THE FOUR BIAS TYPES

	Woman	Man	Other Gender Type	White	African-American	Latino/Latina	Asian-American	Other People of Color
Prove-It-Again	106	2	2	83	4	11	8	0
Tightrope	123	2	1	91	6	9	14	3
Maternal Wall	123	5	0	107	5	7	4	0
Tug of War	51	0	0	42	2	3	3	0

APPENDIX G: WEIGHTS

According to the 2015 Current Population Survey (<http://www.bls.gov/cps/cpsaat11.htm>), the gender distribution of engineers in the U.S. is 82% men and 18% women. The racial/ethnic distribution of engineers is 67% white, 8% black or African-American, 7% Hispanic or Latino, 16% Asian-American, and 2% other people of color (estimated). We calculated the joint distribution of race and gender in the population and our sample (e.g., % white multiplied by % women is the proportion of white women. Between the two gender and five racial categories, we created 10 joint categories). We used the gender/race joint percentages in the population divided by the gender/race joint percentages in the sample to create a weight variable of 10 different values. Each value corresponds to a joint gender/race category. Underrepresented groups received weights greater than 1. Overrepresented groups in the sample received weights less than 1. The weight was applied in the regression analyses.

Gender	Race	Gender/ race joint percentages (population)	Gender/ race joint percentages (sample)	Weight
Woman	White	0.106	0.701	0.151
Woman	African-American	0.023	0.038	0.611
Woman	Asian-American	0.028	0.050	0.551
Woman	Latino	0.016	0.068	0.238
Woman	Other	0.004	0.006	0.553
Man	White	0.493	0.117	4.202
Man	African-American	0.109	0.003	38.776
Man	Asian-American	0.129	0.006	21.484
Man	Latino	0.076	0.005	14.576

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Erratum

Page 56:

The text should read:

Also, engineers of color were more likely than white men to report (10% vs. 1%, $p < 0.001$), and agreed more strongly ($d = 0.338$, $t(305) = 2.93$, $p < 0.01$), that they received pressure to work more hours (see Appendix A, Table 5a and Table 6).

White women received a lot fewer suggestions than women engineers of color saying that they should work fewer hours after having children (3% vs. 11%, $p < 0.001$)—and fewer suggestions that they should work longer hours after having children (2% vs. 9%, $p < 0.001$) (see Appendix A, Table 5b).

Page 125, Table 5a:

The data should read across the row:

My colleagues have communicated to me that I should work more hours because I have children:
4%, 10%, 1%, 2.8%, 8.1%***

Page 126, Table 5b:

The top table row should read: White Women (WW), Women of Color (WC), WW-WC Diff, African-American Women (BW), WW-BW Diff, Asian-American Women (AW), WW-AW Diff, Latina (L), WW-L Diff

The data should read across the row:

My colleagues have communicated to me that I should work more hours because I have children:
2%, 9%, 6.5%***, 6%, 3.7%, 12%, 9.8%***, 4%, 2.0

Page 129, Table 7b:

The data should read across the rows:

I feel I get less honest feedback on my performance than my colleagues: 28%, 24%, 6.8%***, 37%, 8.9%*, 32%, 4.7%, 34%, 6.8%

My performance evaluations have been fair: 79%, 69%, -9.8%***, 70%, -8.4%*, 68%, -10.4%***, 66%, -12.5%***