Identity safety cues in context: Contemporary perspectives on gender, sexuality, and disability disparities

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Abstract

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My collaborators and I expand knowledge on how identity safety cues can counter social identity threats across 10 studies and a theory article (total $N = 4257$). We introduce and test a novel identity safety cue and two novel mechanisms that help explain why some identity safety cues are effective, and we examine key boundary conditions and potential negative consequences of well-intentioned attempts to implement identity safety cues. In Part 1, seven studies demonstrate that feedback receptivity, or people in power's openness to feedback from subordinates, reduces bias concerns about gender, sexual orientation, and disability. These effects occur in part because feedback receptivity increases perceptions of relational leadership. However, when those in power conspicuously ignore feedback given, the beneficial effects of asking for feedback are reversed. In Part 2, three experiments investigate an unintended negative consequence of

providing identity-safe spaces: parents, peers, and hypothetical advisors advise women away from male-dominated opportunities and into more gender-balanced alternatives. This biased pattern of advice is mediated by perceptions that women will belong more in a gender-balanced space. Finally, Part 3 introduces and provides initial empirical support for a novel construct, sense of mattering, that helps identify and measure the extent to which members of marginalized groups feel their contributions at work and school are recognized and valued. Sense of mattering may be a crucial mechanism by which some identity safety cues operate and neglecting it could help reveal why some identity safety cue-based interventions fail. A brief introduction and conclusion place this work in conversation with foundational identity safety cues research to identify key metascience best practices and future directions. Together, this dissertation advances a contemporary understanding of identity safety cues in context.

Acknowledgements

The prototype of a close-to-dissertation student may be of a writer toiling alone, but the process that led to this dissertation was much closer to a team playing together. I couldn't have asked for a better team, and so I'm grateful to have many people to thank for their support.

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Identity safety cues in context: Contemporary perspectives on gender, sexuality, and disability disparities

Members of marginalized groups often must contend with social identity threats, which are broadly defined as an awareness that they may be devalued or perceived negatively because of their social group membership (Steele et al., 2002). Social identity threats have been documented across many different marginalized groups, including women (e.g., Kaiser et al., 2006; Murphy et al., 2007; Schmader et al., 2008; Townsend et al., 2011); LGBTQ+ people (e.g., Alessi et al., 2017; Conley et al., 2003; Fingerhut et al., 2022); and disabled people (e.g., Ball & Traxler, 2023; Dirth & Branscombe, 2018; Silverman & Cohen, 2014). Experiencing social identity threats can result in serious consequences, including deterring members of marginalized groups from entering and remaining in certain fields (Bian, Leslie, Murphy, et al., 2018; Cheryan et al., 2009), and can even harm their health (Fingerhut et al., 2022; Schmader et al., 2008; Townsend et al., 2011). Social identity threats are often sparked by situational cues in the environment that signal that bias is or may be present (e.g., Emerson & Murphy, 2014).

A different type of signal can help alleviate social identity threats: identity safety cues communicate that one's social group membership is valued and respected or that bias is unlikely (Kruk & Matsick, 2021). When applied effectively, identity safety cues can turn off or reduce social identity threats in a given environment (e.g., Davies et al., 2005). Identity safety cues encompass a broad range of signals that one's social identity is valued and respected, including minority representation; diversity philosophies and programming; environmental features that communicate identity-safe norms; and explicitly identity-safe information that neutralizes fears of unfair expectations (see Kruk & Matsick, 2021 for a review and comprehensive taxonomy). Identity safety cues can include everything from increasing the representation of the

marginalized group (Murphy et al., 2007; Purdie-Vaughns et al., 2008) to more subtle, ambient interventions like using non-stereotypic décor (Cheryan et al., 2009, 2011).

In the current work, my collaborators and I seek to advance contemporary research on identity safety cues across three projects. First, we test whether leaders' feedback receptivity is an identity safety cue that reduces marginalized subordinates' concerns about gender, sexuality, and disability bias at school and work (Part 1). Next, we examine a potential negative consequence of one popular identity safety cue: increasing minority representation. We investigate whether the presence of a more gender-balanced alternative to a male-dominated opportunity causes parents, peers, and hypothetical advisors to advise women away from the male-dominated opportunity. This pattern may limit women's access to high-status opportunities within male-dominated fields (Part 2). Finally, we introduce *sense of mattering,* or members of marginalized groups' perceptions that their work contributions are recognized and valued, as a novel mechanism that may help explain why some identity safety cues are so effective and why others may fail in real-world settings (Part 3). Together, this work builds upon past foundational literature to advance our understanding of identity safety cues by improving generalizability; introducing novel cues, mechanisms, and boundary conditions; and employing rigorous contemporary social science methods. Below, I briefly review key opportunities for growth within the literature across these categories to further contextualize the contributions of this dissertation.

Opportunities and Challenges in Identity Safety Cues Research

Despite the wealth of knowledge represented in the literature, there is still considerable room to improve our collective understanding of identity safety cues. I propose that these improvements fall into three categories: attending to generalizability and ecological validity;

building out the theory behind identity safety cues, mechanisms, and moderators; and applying best practices for internal and statistical validity.

Tables 1 and 2 offer a brief assessment of how implementation of best practices across these three categories has progressed over time in identity safety cues research. Articles for Table 1 (2003-2015) were selected based on their inclusion in Kruk and Matsick's (2021) review of identity safety cues. These articles were further selected to include the oldest paper cited by Kruk and Matsick; to include articles spanning the full time range from 2003-2015; and to include articles from each of the four identity safety cue categories identified in their taxonomy (minority representation; diversity philosophies and programming; environmental features; and identity-safe information; Kruk & Matsick, 2021). Because their review and taxonomy represented older articles more heavily and focused only on race and gender, for Table 2 (2016-2024), I included several recent articles not cited in their review that have been instrumental in my own education on identity safety cues (Johnson et al., 2021; Kirby et al., 2024; Moser & Branscombe, 2021). The dimensions for assessment used in the Tables were inspired by the "Table of Limitations" included in articles in the Journal of Personality and Social Psychology (see Part 1) and were customized to reflect the practices I propose are particularly important in this area of research (see below.) Performance on these dimensions did not influence whether an article was selected for inclusion in the Tables.

The Tables reveal a general trend toward better practices over time in identity safety cues research. Articles in Table 1 score between zero and four checkmarks, with an average of 1.67. Table 2 shows noticeable improvement alongside room for further growth: Articles in Table 2 score between four and eight checkmarks, with an average of 5.5. There were also eight

instances of partial credit in Table 2 compared to only one in Table 1. Table 3 offers a view of how the articles contained in this dissertation score on the same dimensions.

Importantly, both the selection and evaluation process of articles in the Tables are somewhat subjective. They should not be considered a comprehensive or conclusive review, but rather a preliminary summary of metascience trends in identity safety research over time from the perspective of the author, and they are intended to spark further reflection and discussion. A more complete review, with preregistered article selection criteria and multiple evaluators achieving inter-rater reliability on article scoring, could be an interesting direction for future research.

Below, I describe the three domains of opportunities for growth in identity safety cues research contained in the Tables in more detail, proposing how future research in this area can ensure maximum impact and confidence in its conclusions.

Generalizability and Ecological Validity

Generalizability and ecological validity is a key area for improvement. Identity safety cues can be tested across multiple identity groups and multiple settings to examine similarities and differences in their functionality. A particularly notable opportunity for growth within the literature is in expanding which identity groups are studied. For example, more work on understudied populations, such as disabled people, nonbinary and transgender people, and people of color, is badly needed.

However, it is not enough to examine one identity group at a time. Past work has taken an initial look at how identity safety cues may operate intersectionally (e.g., Chaney et al., 2016; Moser & Branscombe, 2021), but attending to how other axes of social identity could influence the effect of an identity safety cue is still the exception rather than the norm. One way to

integrate an intersectional perspective is to recruit large samples of diverse participants, enabling researchers to analyze effects with more precision (e.g., do women of different races respond differently to a gender-based identity safety cue?) Another method involves using stimulus sampling (e.g., randomly varying the name and/or image of a character within an experiment) to examine participant perceptions of targets with different identity combinations.

Finally, examining identity safety cues in real-world settings improves ecological validity. Some past work has collected real-world data (e.g., Hall et al., 2018; Muenks et al., 2020; Purdie-Vaughns et al., 2008), and this practice should be retained as a key component of establishing generalizability.

Testing identity safety cues across a range of identity groups and contexts, including examining their intersectional effects and integrating the perspectives of currently understudied groups, will be a strong start to improving the generalizability of identity safety cues research. However, gaps are likely to remain. Constraints on generality should be explicitly acknowledged by specifying and justifying the target population to which results apply (Simons et al., 2017) and identifying areas for future research.

Theoretical Advances: What, Why, and When?

There is also considerable room to grow in our collective knowledge of the theory behind identity safety cues, including testing new cues, better understanding when and why identity safety cues are effective, and revealing potential unintended negative consequences of cue implementation.

While it is common to examine mechanism through statistical mediation analyses, moving beyond the limitations of mediation (e.g., by using experimental design to causally investigate mechanism; Bullock & Green, 2021; Spencer et al., 2005) is still rare. Even within

the mediation approach, a sizable portion of the identity safety cue literature does not rule out alternative explanations or consider multiple potential mediators.

While the current literature establishes the power of identity safety cues to shape equity outcomes, relatively less work has examined the conditions under which such cues may fail, backfire, or incur unintended side effects. Under some conditions, identity safety cues can spark defensive reactions in dominant group members (e.g., organizational multicultural and diversity initiatives; Dover et al., 2016; Plaut et al., 2011). However, other work finds no effect on dominant group members of a range of identity safety cues, including gender-inclusive workplace policies (Chaney & Sanchez, 2018; Hall et al., 2018); the presence of gender and racial diversity (Chaney et al., 2016); and diversity statements (Cunningham & Melton, 2014). Beyond inciting defensive reactions under certain circumstances, some identity safety cues, such as diversity policies, training, and awards, may lead dominant group members to assume the organization is fair and overlook discrimination (Kaiser et al., 2013). Identity safety cues can also have unintended consequences on the behavior of marginalized group members; for instance, the availability of a diversity award can discourage marginalized applicants from applying to more lucrative unrestricted awards (Germano et al., 2021).

Another potential pitfall of identity safety cues is that, when perceived as inauthentic, their effect among marginalized group members can backfire. For example, if organizations advertise gender diversity that is not actually present, it cues social identity threat rather than identity safety and reduces both women's and men's interest in the organization (Kroeper et al., 2022). These investigations of the side effects and boundary conditions of identity safety cues can help guide organizations in establishing identity safety cue interventions that avoid negative

consequences. However, a more robust understanding of the limits and potential unintended consequences of identity safety cues is a crucial next step for the field.

Internal and Statistical Validity

Finally, identity safety cue research should follow the general trend within psychological science toward establishing and promoting best practices to improve internal and statistical validity. For example, the psychometrics of novel or adapted measures should be examined beyond basic reliability (i.e., through factor analysis/SEM.) Researchers can also employ open science principles and enhance replication efforts by making materials, data, and code publicly available; preregistering data collection and analysis plans to reduce researcher degrees of freedom; and attending to statistical power when determining sample sizes.

Internal validity can be further improved by integrating rigorous accuracy-checking systems into the manuscript writing and revision process. For example, researchers can have a collaborator check citation accuracy and can conduct an internal citation audit to reveal and mitigate bias in citing behaviors (Lawson et al., under review). Researchers can also check the accuracy of their statistical analyses by having a second independent analyst reproduce reported results from the raw dataset using a different software package. While these best practices for internal and statistical validity are broadly applicable to social science, they can be applied specifically to identity safety cues research to improve our confidence in results.

Table 1

Selected Identity Safety Cue Articles Assessed on Contemporary Best Practices: 2003-2015

Dimension	McIntyre et al. (2003)	Davies et al. (2005)	Murphy et al. (2007)	Purdie-Vaughns et al. (2008)	Cheryan et al. (2011)	Emerson & Murphy (2015)
Generalizability & Ecological Validity						
Stimulus sampling to examine diverse targets or intersectional generalizability	*NA*	*NA*	✗	✗	N/A	N/A
Effect supported by real-world data	✗	✗	✗	✓	✗	✗
Effect tested in multiple identity groups	✗	✗	✗	✗	✗	✗
Effect tested in multiple contexts/settings	✗	✗	✗	✓	✗	✓
Understudied identity group(s) tested[1]	✗	✗	✗	✗	✗	✗
Intersectionality examined	✗	✗	✗	✗	✗	✗
Constraints on generality (COG) acknowledged	✓	✗	✓	✓	✗	Somewhat
Theoretical Precision						
Potential boundary conditions/situational moderators of effect examined	✓	✓	✗	✓	✗	✓
Mechanism examined beyond mediation (e.g., causal-chain method)	✗	✗	✗	✗	✗	✗
Alternative explanations quantitatively examined	✗	✗	✗	✗	✗	✗
Internal and Statistical Validity						
Psychometrics of novel measures reported beyond reliability (e.g., factor analysis)	*NA*	*NA*	✗	✗	✗	✗
Open Science preregistration (Sample sizes, study designs, measures, hypotheses, and analysis plans)	✗	✗	✗	✗	✗	✗

Sample sizes supported by power analysis (statistical power at least 80%)	✗	✗	✗	✗	✗	✗
Open Science materials, data, & code	✗	✗	✗	✗	✗	✗
Authors report results were verified by an independent analyst	✗	✗	✗	✗	✗	✗
Statement included explaining relevant features of References (Lawson et al., under review)	✗	✗	✗	✗	✗	✗

Note. [1] Race and gender are the most commonly studied groups in identity safety cues research (Kruk & Matsick, 2021). Here I define research on understudied identity groups, in the specific context of identity safety cues work, as research that goes beyond studying women and members of marginalized racial groups (e.g., LGB+ people; transgender and nonbinary people; disabled people). Importantly, people of color are still understudied in social psychology and their experiences should continue to be included in identity safety research.

Table 2

Selected Identity Safety Cue Articles Assessed on Contemporary Best Practices: 2016-2021

Dimension	Chaney et al. (2016)	Hall et al., (2018)	Meunks et al. (2020)	Johnson et al. (2021)	Moser & Branscombe, (2021)	Kirby et al. (2024)
Generalizability & Ecological Validity						
Stimulus sampling to examine diverse targets or intersectional generalizability	*NA*	✗	*NA*	✗	✓	✗
Effect supported by real-world data	✗	✓	✓	✗	✗	✗
Effect tested in multiple identity groups	✓	✗	✓	✓	✗	✗
Effect tested in multiple contexts/settings	✗	✗	Somewhat	✗	✓	✓
Understudied identity group(s) tested[1]	✗	✗	✗	✓	✗	✓
Intersectionality examined	✓	✗	✓	✗	✓	✗
Constraints on generalizability acknowledged	✓	✓	✗	✓	✓	✓
Theoretical Precision						
Potential boundary conditions/situational moderators of effect examined	✗	✗	✗	✓	✓	✓
Mechanism examined beyond mediation (e.g., causal-chain method)	✗	✗	✓	✗	✗	✗
Alternative explanations quantitatively examined	✗	✓	✗	✓	✗	✓
Internal and Statistical Validity						
Psychometrics of novel measures reported beyond reliability (e.g., factor analysis)	✓	✓	✗	✗	✓	✓
Open Science preregistration (Sample sizes, study designs, measures, hypotheses, and analysis plans)	✗	Unclear	✗	2/3 studies	1/3 studies	4/5 studies

Sample sizes supported by power analysis (statistical power at least 80%)	Estimated *N* range given generic power analysis parameters	✗	✗	2/3 studies	2/3 studies	✓
Open Science materials, data, & code	Materials in Supplement; no data/code	✗	✗	✓	✓	✓
Authors report results were verified by an independent analyst	✗	✗	✗	✗	✗	✗
Statement included explaining relevant features of References (Lawson et al., under review)	✗	✗	✗	✗	✗	✗

Note. [1] Race and gender are the most commonly studied groups in identity safety cues research (Kruk & Matsick, 2021). Here I define research on understudied identity groups, in the specific context of identity safety cues work, as research that goes beyond studying women and members of marginalized racial groups (e.g., LGB+ people; transgender and nonbinary people; disabled people). Importantly, people of color are still understudied in social psychology and their experiences should continue to be included in identity safety research.

Current Work

This dissertation contributes to a growing body of work that integrates contemporary best practices to improve our understanding of identity safety cues (see Table 3 for a summary of how the current work performs on the dimensions established above). In Part 1 (Lombard et al., under review), my collaborators and I introduce leaders' feedback receptivity, or openness to feedback from subordinates, as an identity safety cue that reduces marginalized subordinates' bias concerns. We examine feedback receptivity among women, LGB+ people, and disabled people, and across multiple contexts (i.e., research labs, work teams, and classrooms), including a nationwide observational field study on engineering researchers. We introduce a novel mechanism, *relational leadership,* which helps advance our understanding of how power can be used in non-traditional ways to reduce bias concerns. We examine this mechanism across two studies that employ mediation with multiple alternate mediators to ensure that its effects are replicable, and we then employ the causal-chain approach (Spencer et al., 2005) by experimentally manipulating relational leadership in a separate study to move the investigation of mechanism beyond mediation analysis. Finally, we establish an important caveat to the benefits of feedback receptivity: when people in power ask for but conspicuously ignore feedback, marginalized subordinates' bias concerns are higher than if they do not ask.

In Part 2 (Lombard[*], Garr-Schultz[*], & Cheryan, in prep), we continue to attend to how negative consequences can emerge from well-intentioned identity safety cues. While providing opportunities with increased minority representation is generally seen as an identity safety cue that can help reduce gender disparities, we find that the presence of a more gender-balanced alternative to a male-dominated opportunity causes parents, peers, and hypothetical advisors to advise women away from the male-dominated opportunity (e.g., away from Biomechanics and

toward Ecology). This effect may occur because people assume that women will belong more in the gender-balanced alternative than in the original male-dominated opportunity, but these assumptions are based on stereotypes and may be inaccurate for individuals. Furthermore, because male-dominated opportunities often accrue the most power and prestige, this biased pattern of advice may limit women's access to high-status and lucrative opportunities within male-dominated fields. This paper integrates stimulus sampling to attend to intersectionality; tests the observed effect across three different STEM fields, including one (Biology) that is not male-dominated; and quantitatively examines alternate explanations.

Finally, in Paper 3 (Lombard & Cheryan, 2023), we introduce *sense of mattering* as a novel mechanism that may help explain why some identity safety cues are so effective and why others may not be sufficient. We propose that naming and measuring women's perceptions of the extent to which their work contributions are recognized and valued by others is a crucial component of understanding gender equity outcomes. If identity safety cues (e.g., organizational statements valuing diversity) are not accompanied by the tangible recognition and valuing of women's work contributions, they are unlikely to be effective and could even backfire. This work helps enrich our understanding of why and under which circumstances identity safety cues are most likely to work, which could advance the theoretical precision of research on identity safety cues while also guiding the implementation of real-world interventions.

Table 3

Articles Within Dissertation Assessed on Contemporary Best Practices

Dimension	Lombard, Weltzien, & Cheryan, under review. *(Part 1)*	Lombard[1], Garr-Schultz[1], Ziegler, & Cheryan, in prep. *(Part 2)*	Lombard & Cheryan, 2023 *(Part 3)*
Generalizability & Ecological Validity			
Stimulus sampling to examine diverse targets or intersectional generalizability	*NA*	✓	*NA*
Effect supported by real-world data	✓	Pending	✗
Effect tested in multiple identity groups	✓	✗	✗
Effect tested in multiple contexts/settings	✓	✓	Discussed but not tested[2]
Understudied identity group(s) tested[3]	✓	✗	Discussed but not tested
Intersectionality examined	✓	✓	Discussed but not tested
Constraints on generality (COG) acknowledged	✓	✓	✓
Theoretical Precision			
Potential boundary conditions/situational moderators of effect examined	✓	✗	✓
Mechanism examined beyond mediation (e.g., causal-chain method)	✓	✗	*NA*
Alternative explanations quantitatively examined	✓	✓	*NA*
Internal and Statistical Validity			
Psychometrics of novel measures reported beyond reliability (e.g., factor analysis)	✓	*NA*	✓

Open Science preregistration (Sample sizes, study designs, measures, hypotheses, and analysis plans)	✓	✓	✓
Sample sizes supported by power analysis (statistical power at least 80%)	✓	✓	✓
Open Science materials, data, & code	✓	✓	✗ (Available upon request)
Authors report results were verified by an independent analyst	✓	✓	✗
Statement included explaining relevant features of References (Lawson et al., under review)	✓	✓ (Pending)	✗

Note. [1]Indicates equal co-author contributions. [2]Part 3 is primarily a theory paper; data is included for the purposes of showing some preliminary scale development and differentiation from related constructs. All other articles included in Tables 1-3 are empirical. [3]Race and gender are the most commonly studied groups in identity safety cues research (Kruk & Matsick, 2021). Here I define research on understudied identity groups, in the specific context of identity safety cues work, as research that goes beyond studying women and members of marginalized racial groups (e.g., LGB+ people; transgender and nonbinary people; disabled people). Importantly, people of color are still understudied in social psychology and their experiences should continue to be included in identity safety research.

Feedback receptivity from people in power reduces gender, sexual orientation, and disability bias concerns

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Abstract

Seven preregistered studies (total $N = 2443$) demonstrate that feedback receptivity of people in power, or their openness to feedback, reduces bias concerns among members of marginalized groups (meta-analytic $d_z = 0.58$; see Supplement Figure S1). Study 1 finds that the extent to which engineering students and staff perceive their faculty advisors as receptive to feedback predicts women's lower concerns about facing gender bias, and this effect is weaker for men. Studies 2-4 show that reading about a person in power who is high in feedback receptivity (vs. no information about feedback receptivity) reduces women's gender bias concerns in male-dominated environments, LGB+ people's sexual orientation bias concerns at work, and disabled students' ability bias concerns in the classroom. Studies 3-6 find that perceptions of relational leadership, or perceptions that the person in power is caring, trustworthy, and uses power for good, explains why feedback receptivity reduces bias concerns. Study 7 introduces an important caveat: When those in power ask for but then explicitly ignore feedback, bias concerns are higher than when feedback is not solicited. Feedback receptivity may not appear tied to social identity but may be a helpful tool for making academic and professional cultures more equitable.

Keywords: feedback receptivity, bias, identity safety, power, relational leadership

Statement of Limitations

Although feedback receptivity is likely to be broadly beneficial, it may operate differently along axes of identity we did not investigate (e.g., race) and still needs to be investigated with more attention to intersectional identities. Furthermore, we demonstrated feedback receptivity's effects both in a real-world setting and through artificial experimental manipulations, but we did not experimentally test the effects of a feedback receptivity intervention in a field setting. We also do

not know whether feedback receptivity messages produce long-lasting effects, the extent to which such messages may need to be repeated, and whether asking for feedback from subordinates varies in effectiveness and appropriateness across cultures.

Feedback receptivity from people in power reduces gender, sexual orientation, and disability bias concerns

Many teachers, leaders, and other people in power want to foster equitable cultures but are not sure how or where to start. The current work examines whether feedback receptivity from those in power – the act of conveying openness to feedback from subordinates – reduces bias concerns among people who belong to marginalized groups. We examine this phenomenon among women in male-dominated environments (e.g., engineers), LGB+ people, and disabled students[1]. This work provides evidence that feedback receptivity can reduce bias concerns in research labs, classrooms, and work teams across multiple axes of identity and further examines mechanisms and pitfalls of this potential equity strategy.

Feedback Receptivity

Social psychology research on feedback has largely focused on how feedback from those in power influences their subordinates' outcomes. For example, White teachers sometimes withhold critical feedback from Black but not White students, which can deprive Black students of equitable opportunities to improve (Harber, 1998, 2023; see also Crosby & Monin, 2007). Those in power can also influence outcomes through the content of their feedback. Feedback that is agentic (i.e., offering questions and suggestions instead of correction; Mutoni Griffiths et al., 2023), future-focused (i.e., emphasizing what will make someone most effective going forward; Gnepp et al., 2020), and "wise" (i.e., accompanied by affirmations of capability; Cohen et al., 1999; Yeager et al., 2014) typically improves performance compared to feedback that lacks these

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[1] "LGB+" refers to lesbian, gay, bisexual, and other marginalized sexual orientations (e.g., pansexual, queer). We use identity-first language (i.e., "disabled students" rather than "students with disabilities") when referring to members of the disabled community in accordance with the general preferences of disabled activists and community members (Gernsbacher, 2017; Taboas et al., 2023), though we acknowledge and respect community members' individual preferences when it comes to language around disability.

qualities. General positive feedback (i.e., “Good job!”) can also improve performance (Park et al., 2018, 2023), though such feedback can undermine subsequent motivation if interpreted as conveying that the goal is complete or nearly complete (Fishbach et al., 2010; Louro et al., 2007). Wise feedback can be particularly helpful in reducing racial gaps in bias perceptions and task motivation (Cohen et al., 1999; Yeager et al., 2014), and positive feedback can reduce gender gaps in math outcomes (Park et al., 2018). Social psychological findings have established how those in power can influence outcomes based on the type of feedback they provide.

In the current work, we examine what happens when feedback flows in the opposite direction, with those in power signaling that they are open to receiving feedback. Qualitative and correlational research in education and management has found benefits of feedback receptivity for students and employees. For example, interviews with students found that the opportunity to give feedback to teachers increases students’ perceived agency, belonging, motivation, and engagement (Mitra, 2004). Teachers who give mid-course evaluations see improvements in students’ final evaluations of their teaching (McGowan & Osguthorpe, 2011). In business, giving feedback to leaders predicts higher work-group task performance, especially when trust is high (Mackenzie et al., 2011), and predicts positive supervisor-employee relationships (Morrison, 2014). Feedback receptivity may be an effective general strategy for building relationships and improving performance.

Feedback receptivity may act as an identity safety cue (i.e., an indication that one’s identity is valued; Davies et al., 2005) and could therefore be particularly impactful for members of marginalized groups. In education, some have theorized that feedback receptivity might help amplify the voices of those who are often relegated to the margins (Mansfield, 2014; Shields, 2004). We propose that soliciting feedback may be an equity tool that reduces disparities,

extending past work on the protective power of identity safety cues (e.g., Davies et al., 2005; Emerson & Murphy, 2015; Hall et al., 2018). We hypothesize that feedback receptivity may lower members of marginalized groups' concerns about facing bias. While asking for feedback (e.g., "How can we improve the class environment?") appears identity-neutral, it may have powerful benefits for members of marginalized groups.

Bias Concerns

We define bias concerns as worries about being negatively stereotyped, devalued, and discriminated against due to one's social identity (Cheryan et al., 2020). These three components of bias concerns are sometimes studied separately, but they may also operate together at times. These components fit under the umbrella of social identity threats (Steele et al., 2002), though there are other social identity threats that do not constitute bias concerns (e.g., distinctiveness threat, morality threat; Branscombe et al., 1999).

The current work examines the bias concerns of members of three marginalized groups: women, LGB+ people, and disabled people. Marginalization is a multidimensional, dynamic process rooted in power imbalance and stemming from many contextual factors, including underrepresentation, stigma, and discrimination (Causadias & Umaña-Taylor, 2018). Decreasing bias concerns in members of marginalized groups is crucial to establishing more diverse, thriving schools and workplaces.

Not only do women in male-dominated fields (e.g., engineering, computer science, physics) often face negative stereotypes (Bloodhart et al., 2020; Eaton et al., 2020) as well as devaluation and discrimination (Moss-Racusin et al., 2012), they also have concerns about being subjected to these negative experiences (Bian et al., 2018; Cheryan et al., 2009; Pietri et al., 2018; Steele, 1997). These legitimate concerns can hinder women students' recruitment and

entry (Bian et al., 2018; Cheryan et al., 2009), forcing women to ask themselves whether they are willing to endure gender bias at school and work. Gender bias concerns also demand precious attentional resources (Kaiser et al., 2006; Murphy et al., 2007) and invoke physiological stress responses that can harm performance and wellbeing (Schmader et al., 2008; Townsend et al., 2011). Gender bias concerns have crucial implications for women's entry, retention, and success in male-dominated fields.

A smaller selection of work on bias concerns about LGB+ and disabled identity has found similar patterns. Both groups commonly face bias in school and at work (Almeida et al., 2009; Bogart & Dunn, 2019; Sears et al., 2021) and have concerns about potential bias they may face (e.g., Alessi et al., 2017; Ball & Traxler, 2023; Conley et al., 2003; Dirth & Branscombe, 2018; Fingerhut et al., 2022; Silverman & Cohen, 2014). These concerns can manifest as feeling pressure to hide one's identities (Gardner & Prasad, 2022; Lynch & Gussel, 1996; von Schrader et al., 2014), and that pressure inflicts psychological burdens (Barreto et al., 2006; Pachankis, 2007; Quinn & Earnshaw, 2011). Concerns about facing ability-related bias from teachers may have a particularly negative impact because these concerns may reduce disabled students' likelihood of requesting accommodations – adjustments made to academic policies or environments to ensure students with disabilities have equal access – from their teachers (Mamboleo et al., 2020). Because the disability resources system relies on individual students advocating for their needs, reluctance to request accommodations can harm students' academic outcomes (Dong & Lucas, 2016; W. H. Kim & Lee, 2016). LGB+ and disabled people face bias concerns, and these concerns can impede their success.

Feedback receptivity may have a stronger impact on the bias concerns of marginalized group members than dominant group members. Dominant group members generally do not need

to be as vigilant to cues in the environment that may signal bias. While dominant group members may experience bias in some situations, these situations are more likely to be isolated occurrences rather than a common part of everyday life. As a result, dominant group members likely experience less of the habitual vigilance to bias seen in members of marginalized groups (Kaiser et al., 2006), and by extension, may be less responsive to identity safety cues such as feedback receptivity.

Relational Leadership as a Mechanism

Feedback receptivity may reduce bias concerns by increasing perceptions of relational leadership. We define relational leadership as including three characteristics of the person in power: (1) that they care about their subordinates, including warmth and connection (adapted from Diekman et al., 2011; Fiske et al., 2002; Triandis & Gelfand, 1998); (2) that they are trustworthy (Terwel et al., 2010; Willis & Todorov, 2006); and (3) that they want to use their power for good (Moon et al., 2021). These three components may be closely related and perceived as operating together (see Study 5). Asking for feedback may communicate that the person in power wants to use subordinates' perspectives to improve their experiences. Perceptions of greater relational leadership could help to explain how feedback receptivity may reduce bias concerns.

The concept of relational leadership can be contrasted with traditional understandings of power in the psychological literature. Power has often been conceptualized as a corrupting influence that increases the stereotyping and devaluing of lower-status others (Fiske, 1993; Kipnis et al., 1976). Power can decrease willingness to help others (Lammers et al., 2012; Righetti et al., 2015; van Kleef et al., 2008), empathic accuracy, and perspective taking (Galinsky

et al., 2006) and can increase feelings of social distance (Lammers et al., 2012; Magee & Smith, 2013). Power often harms people's ability to be attuned to others.

However, power can also be a force for relational good at times. Power increases other-oriented communication when combined with perspective-taking (Galinsky et al., 2014). Individuals primed with power are more likely to act with generosity if given the option to help others (i.e., contributing to a common resource) versus take from others (i.e., depleting a common resource; Galinsky et al., 2003). Those primed with power behave in a more socially responsible manner when they have other-oriented (i.e., communal) relationship styles (e.g., responding to the needs of others) than when they have transactional relationship styles (i.e., exchange; Chen et al., 2001). When those in power take others' perspectives and priorities into account, power can be used for the good of others.

Supportive relational behaviors of those in power may produce better outcomes for subordinates, especially for those with marginalized identities. Students who perceive faculty to be supportive benefit from greater productivity (Lunsford, 2012; Tenenbaum et al., 2001), self-efficacy (Curtin et al., 2016), and belonging (Clark et al., 2016; Freeman et al., 2007). Teachers and leaders who display relational leadership may also be perceived as allies in resisting oppressive power structures. For example, those who are motivated to obtain power to help others are often perceived as more egalitarian (House & Howell, 1992). When people perceive those in power as relational, it may help improve their outcomes and mitigate disparities.

Alternative Mechanisms

Factors outside of relational leadership may alternatively explain feedback receptivity's capacity to reduce bias concerns. Feedback receptivity may increase perceptions of procedural justice, or fairness in the processes by which decisions are made (Blader & Tyler, 2003). Fairer

teams may subsequently be perceived as less likely to be biased. Feedback receptivity could also increase members of marginalized groups' sense of belonging, which is an important factor in determining their outcomes (Walton & Cohen, 2007). Leaders high in feedback receptivity may also be perceived as lower in certain stereotypically masculine traits (e.g., dominance, egotism; Diekman & Eagly, 2000; Fast et al., 2014; Gerdes et al., 2018) and higher in certain stereotypically feminine traits (e.g., humility, being other-oriented; Zhou & Chen, 2022). Perceiving someone in power as less masculine could subsequently reduce gender and sexual orientation bias concerns because masculinity is associated with preference for traditional gender norms (Glick et al., 2015). Finally, perhaps feedback receptivity operates by reducing the perceived power difference between people in power and their subordinates. Encouraging students to give feedback on their educational experiences is often framed in terms of "redistributing power" between students and teachers by giving students more say in what happens in the classroom (e.g., Cook-Sather, 2006). If feedback receptivity does serve as a signal that power is being redistributed, perceptions of reduced power difference between the person in power and the subordinate could reduce bias concerns for members of marginalized groups. We include measures of each of these constructs to examine whether they better explain the effect of feedback receptivity on women's gender bias concerns than perceptions of relational leadership.

Response to Feedback from People in Power

How those in power respond to the feedback they receive may play an important role in determining outcomes. If people in power conspicuously ignore feedback, it may neutralize or even reverse the positive effects of feedback receptivity. Perceived hypocrisy of those in power – such as when leaders promote organizational values but fail to exemplify them – predicts employees' disenchantment (Cha & Edmondson, 2006) and intentions to leave (Greenbaum et

al., 2015). In a longitudinal experiment, when leaders shared feedback they had received, subordinates' psychological safety improved over time, but there were no durable effects when leaders sought but did not share feedback (Coutifaris & Grant, 2021). Follow-up interviews suggested that leaders' initial request for feedback was received positively but that their defensiveness and inaction over time countered the initial benefits (Coutifaris & Grant, 2021). Leaders who are perceived as ignoring feedback may be penalized.

Overview

Seven studies examine how feedback receptivity may be a tool for equity that reduces members of marginalized groups' bias concerns in academic and work environments. First, using a large sample from six U.S. universities, we investigate whether engineering researchers' perceptions of their faculty advisors' feedback receptivity predict lower gender bias concerns for women more than for men (Study 1). Next, we test whether feedback receptivity experimentally reduces bias concerns for women versus men in male-dominated fields, LGB+ versus straight employees, and disabled students (Studies 2-4). We then examine a potential mechanism, testing whether feedback receptivity's reduction of bias concerns is mediated by perceptions of relational leadership, and investigate several potential alternative mediators (Studies 3-5). Using the causal-chain approach (Spencer et al., 2005), we also investigate whether relational leadership experimentally reduces bias concerns (Study 6). Finally, we test a potentially important moderator: Signaling feedback receptivity may backfire if those in power conspicuously ignore the feedback they receive (Study 7). Feedback receptivity may be a powerful tool for making academic and professional cultures more equitable.

Transparency and Openness (All Studies)

We report all data exclusions, manipulations, and measures in each study. All studies' sample sizes, designs, hypotheses, and analyses were preregistered. Preregistrations, including power analyses for all studies targeting at least 90-95% power for primary tests, and all data, analysis code, and study materials are linked within each study. Data were analyzed using R and SPSS, and all results reported in the manuscript were independently verified by a second analyst.

Study 1: Feedback Receptivity and Gender Bias Concerns in Engineering Labs

Study 1 employs a large, cross-sectional sample of engineering researchers at six top engineering universities in the U.S. to examine how feedback receptivity operates in real-world environments in which women are marginalized. We hypothesize that the extent to which women engineering researchers perceive their faculty advisors to value their feedback will predict lower gender bias concerns. We further predict that this relationship will be weaker or absent for men. This study's preregistration, materials, data, and analysis code are available here: https://osf.io/xh5je/?view_only=8288991b44c647a19e43002456bbada1.

Methods

Participants

In line with our preregistration, we recruited members of engineering labs at six universities nationwide that were randomly selected from a U.S. News Top 20 Best Engineering Schools list (U.S. News, 2023). At each of these universities, all postgraduate members (i.e., graduate students, research staff, and postdocs) of mixed-gender labs whose faculty advisor had an appointment in the school of engineering and who had publicly available email addresses were invited to participate. Recruiting emails were sent to 6092 researchers from 730 labs. Nine hundred and fifty-five participants filled out our questionnaire, which met our preregistered target minimum recruitment goal of 950 participants before exclusions. In line with our

preregistration, 17 participants who did not identify as women or men[2], six participants who did not report their gender, four undergraduates, and three faculty were excluded from analyses. Our final sample size was 925 participants from 455 labs (63.2% men, 36.8% women; 99.6% cisgender, 0.4% preferred another term or unsure; 44.2% Asian/Asian American, 43.5% White, 8.0% Latinx/Hispanic/Latin American, 6.1% Middle Eastern/Middle Eastern American, 3.1% Black/African American, 0.9% another racial/ethnic group, 0.5% declined to answer, 0.2% Native American/American Indian/Alaskan Native, and 5.9% of the sample selected multiple racial/ethnic categories[3]). Positions in their labs were graduate students (81.9%), postdocs (12.0%), lab staff members (4.8%), and another position not listed (1.3%). The mean age was 27.97 years ($SD = 5.37$).

Procedure

Participants completed an online questionnaire in which they were asked to reflect on the principal investigator (PI) of their research lab. First, they responded to four questions assessing how much giving feedback about the lab is valued by the PI; how much the PI wants to improve the lab based on student feedback; how much they feel they can give the PI feedback if they want to; and how much the PI is open to feedback, on a scale ranging from 1 (*Not at all*) to 7 (*Very much*). We computed an overall average score of perceived faculty advisor feedback receptivity across the four items ($\alpha = .92$).

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[2] While we focus on women and men as a starting point for investigating how feedback receptivity may mitigate gender inequity, gender is not binary and is a fluid, socially constructed identity (e.g., Hyde et al., 2019). Inclusive leadership strategies should account for the diverse experiences of nonbinary individuals and should seek to increase their representation.

[3] We presented all race/ethnicity categories in a “select all” format. In all studies, we report the percentages of participants who selected each category, and we also report the percentage of the sample who selected more than one category. Because participants could select more than one category, percentages do not sum to 100%.

Next, to measure gender bias concerns, participants indicated to what extent they had concerns about negative gender stereotypes (Cohen & Garcia, 2005; Marx et al., 2005; 4 items), anticipated gender discrimination (Cheryan et al., 2020; 2 items), and anticipated gender devaluation (Cheryan et al., 2020; 2 items; phrased as gender valuation and recoded) in their lab, on a scale ranging from 1 (*Not at all*) to 7 (*Very much*). The items from these three scales were averaged together into a measure of gender bias concerns (α = .90)[4]. The questionnaire concluded with demographic questions.

Results

In a multilevel linear model, we entered perceived faculty advisor feedback receptivity, gender (dummy-coded as 0 for men and 1 for women), and the interaction between feedback receptivity and gender as predictors with gender bias concerns as a dependent variable. Lab was entered as a random nesting factor, and continuous predictors were grand-mean centered. This model is described below:

Level 1: Students

$$y_{ij} = \beta_{0j} + \beta_{1j}FR + \beta_{2j}Gender + \beta_{3j}(Gender * FR) + e_{ij}$$

Level 2: Labs

$$\beta_{0j} = \gamma_{00} + u_{0j}$$
$$\beta_{1j} = \gamma_{10}$$
$$\beta_{2j} = \gamma_{20}$$
$$\beta_{3j} = \gamma_{30}$$

Women's average gender bias concerns was 2.08 (*SD* = 1.29) while men had average gender bias concerns of 1.44 (*SD* = 0.65). See Supplement Table S2 for grand means and standard deviations of key measures across all studies. Holding all other predictors equal, being a woman (vs. a man)

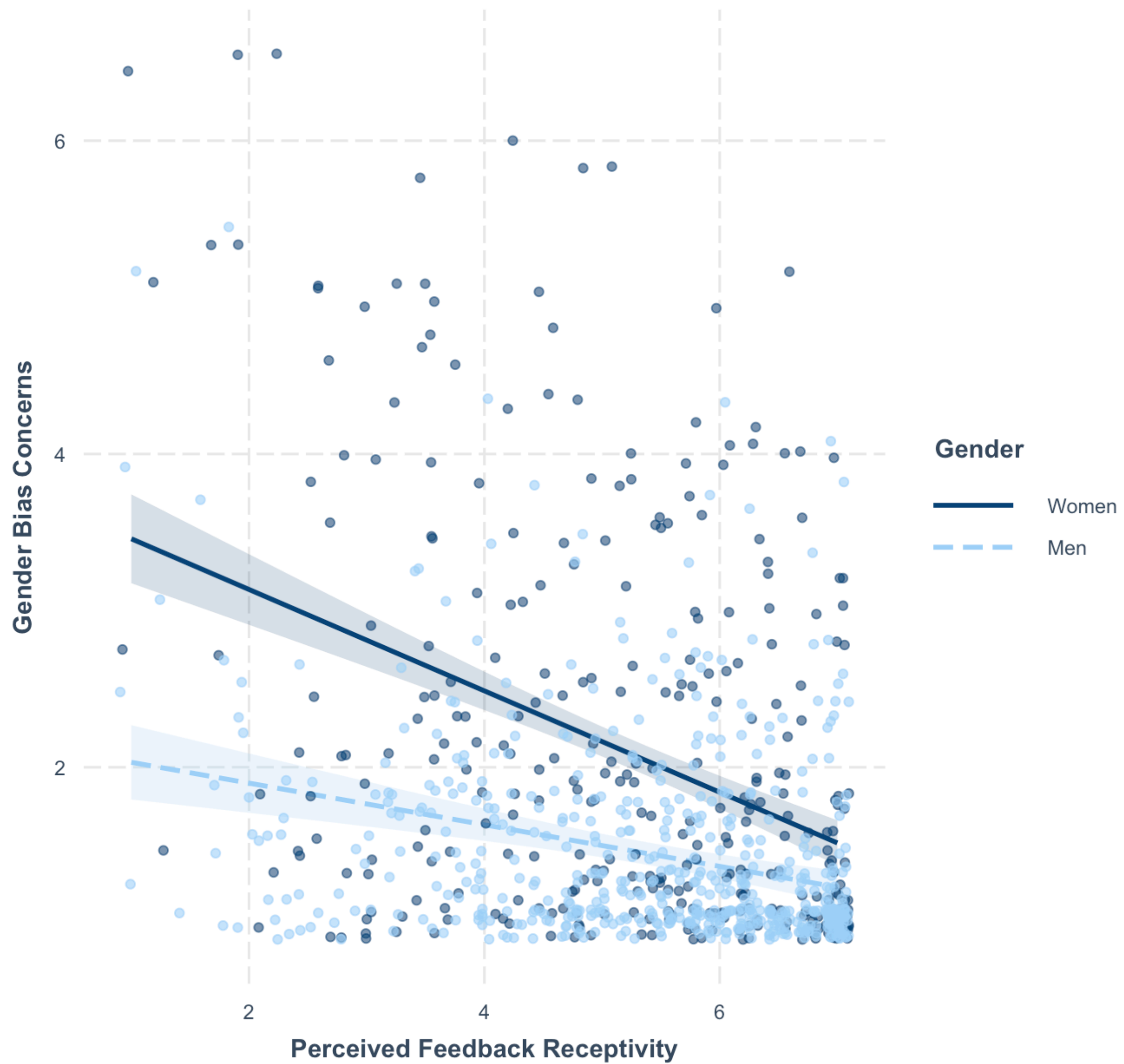
[4] See Supplement Table S1 for main effects and interactions of key analyses broken down by subscale for all relevant studies. 36/37 tests by subscale of the effects of feedback receptivity or the interaction between feedback receptivity and identity on bias concerns produced significant results, and 1/37 produced a marginal (*p* = .059) result.

was associated with a 0.60 (*SE* = 0.06) point increase in gender bias concerns, *t*(917.25) = 9.92, *p* < .001, 95% *CI* [0.48, 0.72]. Additionally, holding all other predictors equal, higher perceived feedback receptivity predicted lower gender bias concerns, *b* = -0.14, *SE* = 0.03, *t*(908.25) = -5.33, *p* < .001, 95% *CI* [-0.19, -0.09]. As predicted in our preregistration, there was a significant interaction between perceived feedback receptivity and participant gender, *b* = -0.19, *SE* = 0.04, *t*(917.73) = -4.52, *p* < .001, 95% *CI* [-0.27, -0.11][5] such that the relationship between perceived feedback receptivity and lower gender bias concerns was stronger for women, *b* = -0.32, *SE* = 0.03, *t*(907.70) = -10.06, *p* < .001, 95% *CI* [-0.39, -0.26], than men, *b* = -0.14, *SE* = 0.03, *t*(908.25) = -5.33, *p* < .001, 95% *CI* [-0.19, -0.09] (see Figure 1).

[5] Because our measure of gender bias concerns was not normally distributed, we also ran our core model through random effects block bootstrapping with 5000 resamples and obtained a main effect of gender [0.50, 0.70], feedback receptivity [-0.18, -0.09], and the interaction effect [-0.25, -0.12]. These results suggest that effects hold with an analytic method that does not rely on a normally distributed outcome variable.

Figure 1

Perceived Faculty Advisor Feedback Receptivity Predicts Lower Gender Bias Concerns for Women versus Men (Study 1)



Next, in line with our preregistration, we ran a robustness check in which we added fixed effects of university to the above model. There was no evidence of variability among the

universities in the effect of feedback receptivity on gender bias concerns. The main effect of gender, $b = 0.61$, $SE = 0.06$, $t(910.91) = 10.05$, $p < .001$, 95% CI [0.49, 0.73], the main effect of feedback receptivity, $b = -0.14$, $SE = 0.03$, $t(903.75) = -5.36$, $p < .001$, 95% CI [-0.19, -0.09], and the interaction between feedback receptivity and gender, $b = -0.18$, $SE = 0.04$, $t(910.39) = -4.44$, $p < .001$, 95% CI [-0.26, -0.10], all remained significant.

We then ran a preregistered set of four exploratory models, including: (1) faculty advisor gender and estimated percentage of women in the lab as predictors; (2) effect of participant gender on perceived feedback receptivity; (3) an intercept-only (or "empty") model examining feedback receptivity at the lab level; and (4) a random effect of slopes of feedback receptivity.

First, we examined whether the observed effect would persist when including faculty advisor gender (dummy-coded as 0 for men and 1 for women) and estimated percentage of women in the lab (dummy-coded categories, using the category with the smallest percentage of women as the reference group) as predictors. This model allows us to identify whether women's representation in engineering labs, either overall or in leadership, moderates feedback receptivity's effect in predicting lower gender bias concerns. In this new model, main effects of gender, $b = 0.71$, $SE = 0.06$, $t(888.92) = 11.39$, $p < .001$, 95% CI [0.59, 0.83], and feedback receptivity, $b = -0.13$, $SE = 0.03$, $t(894.73) = -4.99$, $p < .001$, 95% CI [-0.18, -0.08], remained significant. The interaction between feedback receptivity and gender on gender bias concerns also remained significant, $b = -0.18$, $SE = 0.04$, $t(902.82) = -4.37$, $p < .001$, 95% CI [-0.26, -0.10], demonstrating that feedback receptivity reduced women's more than men's gender bias concerns in our sample even when accounting for faculty advisor gender and estimated percentage of women in the lab. A model which treats our categorical measure of estimated percentage of women in the lab as a continuous predictor produces similar results.

Next, we investigated whether women and men had different perceptions of their faculty advisors' feedback receptivity. A model examining the effect of participant gender on feedback receptivity with lab as a random nesting factor revealed no significant difference between genders in perceptions of feedback receptivity, though there was a trend such that women tended to perceive their faculty advisors as marginally lower in feedback receptivity than did men, b = -0.19, SE = 0.10, t(896.58) = -1.95, p = .052, 95% CI [-0.37, 0.001].

We then used an "empty" (intercept-only) model with perceived feedback receptivity as the outcome variable to evaluate the intraclass correlations (ICCs), which indicate what fraction of variation in perceived feedback receptivity lies between labs. This model yielded an ICC of .246, suggesting that a substantial portion of the variation in perceived feedback receptivity (24.6%) is explained by differences between labs.

Our results so far have assumed a constant effect of gender and feedback receptivity and their interaction in predicting gender bias concerns, but we also wanted to examine whether our findings persist when accounting for lab-level variation in feedback receptivity. To probe this possibility, we ran a model including a random effect of slopes of feedback receptivity to allow the effect of feedback receptivity to vary across labs, but the model failed to converge.

Finally, we ran a series of non-preregistered models to explore whether other aspects of social identity might affect how gender and feedback receptivity predict gender bias concerns. First, we included dummy-coded participant race categories for every category with $n > 30$ (White, Asian/Asian American, Latinx/Hispanic/Latin American, Middle Eastern/Middle Eastern American, and Multiracial with White as the reference group; participants who identified with multiple races were categorized as Multiracial and not included in other categories in this analysis). The interaction between feedback receptivity and gender remained significant when

we included these race categories as fixed effects, b = -0.18, SE = 0.04, t(876.81) = -4.16, p < .001, 95% CI [-0.26, -0.09]. Next, we examined participants' primary sexual orientation identifiers. We collapsed "bisexual," "pansexual," "queer," and the write-in response "bicurious" into one category of non-monosexual queer identity group (n = 80), "gay" and "lesbian" into one monosexual queer identity group (n = 38) and treated the straight/heterosexual category as the reference group (n = 753). All other categories were n < 30 and not included. With these sexual orientation categories included as fixed effects, we found again that the interaction of gender and feedback receptivity on gender bias concerns remained significant, b = -0.15, SE = 0.04, t(861.29) = -3.69, p < .001, 95% CI [-0.24, -0.07]. Models that tested race (collapsed into participants of color vs. White participants) and sexual orientation (collapsed into LGBQ+ vs. straight) and included their interaction with gender and perceived feedback receptivity and the three-way interaction found no significant interaction between race or sexual orientation and any predictors on gender bias concerns. The interactions between gender and feedback receptivity on gender bias concerns remained significant in both models.

Discussion

The more women engineers perceived their faculty advisors to value their feedback, the less they worried about facing gender bias in their labs. This relationship was weaker for men. Feedback receptivity predicted reduced gender bias concerns for women regardless of whether their faculty advisor was a woman or a man and regardless of the estimated percentage of women in the lab. Accounting for participant race and sexual orientation did not appear to attenuate the interaction effect. Notably, we found real-world variability in how much PIs are perceived to be open to feedback. This variability lays the foundation for subsequent experimental work in which we experimentally manipulate feedback receptivity.

Although these data suggest a robust relationship between feedback receptivity and gender bias concerns, this study was correlational, and other factors may play a role in explaining the observed effects. For example, faculty advisors that are high in feedback receptivity may also have other characteristics that reduce women's gender bias concerns (e.g., treat people more fairly). Next, we turn to experiments to isolate the effect of feedback receptivity on bias concerns.

Study 2: Feedback Receptivity and Gender Bias Concerns

In Study 2, we examine whether feedback receptivity causally reduces women's gender bias concerns. We further examine the effect of feedback receptivity in a new setting: hypothetical work teams. This study's preregistration, materials, data, and analysis code are available here: https://osf.io/uvhtk/?view_only=20d6c653fc0f4898b63bf9729859c5a0.

Method

Participants

In line with our preregistration, we recruited 300 participants from Prolific. Three hundred and one participants filled out the questionnaire. Three participants who did not identify as women or men and one participant who did not specify their gender were excluded from analyses. Our final sample size was 297 (50.2% men, 49.8% women; 98.0% cisgender, 2.0% transgender; 70.0% White, 13.8% Asian/Asian American, 10.8% Black/African American, 9.1% Latinx/Hispanic/Latin American, 1.0% Native American/American Indian/Alaskan Native, 1.0% Middle Eastern/Middle Eastern American, 0.7% another race not listed, 0.3% preferred not to disclose, with 6.7% of these participants identifying with multiple race/ethnicity categories). The mean age was 32.19 years (SD = 10.65). This met our preregistered target sample size of at least 280 participants.

Procedure

Participants completed an online questionnaire in which they were asked to imagine a hypothetical work team that was in their professional field. The team were described as 80% men and led by a man to ensure that effects were not driven by assumptions about different gender compositions across the two teams. Participants answered multiple choice questions about the gender proportion and leader gender and could only proceed in the questionnaire once they had answered these questions correctly.

Participants were then shown one of two descriptions of the team. In the feedback receptivity condition, participants were told that “there are many opportunities for employees to give feedback on any issues in the work environment. The supervisor tells employees that feedback on the environment is valued. When people share their feedback, the team makes plans for how to improve the team culture. Then they follow through in making changes.” In the no feedback information condition, participants were told that “there are many opportunities for employees to work. The supervisor tells employees that work is valued. When people work, the team makes plans for how to do the work. Then they follow through in completing work.” After reading the description, participants responded to the same scale of gender bias concerns as Study 1 (feedback receptivity $\alpha = .95$, no feedback information $\alpha = .95$). Participants then read about and filled out the gender bias concerns about the other team. The order in which the teams were presented (and the order in which participants evaluated each team for all dependent measures) was counterbalanced.

We included a multiple-choice attention check question at the end of each condition to assess whether participants remembered which team they were evaluating. Ninety-six percent of participants answered the no feedback information team check correctly, and 95% of participants

answered the feedback receptivity team check correctly. Removing participants who failed either attention check generated similar results. The questionnaire concluded with demographic questions.

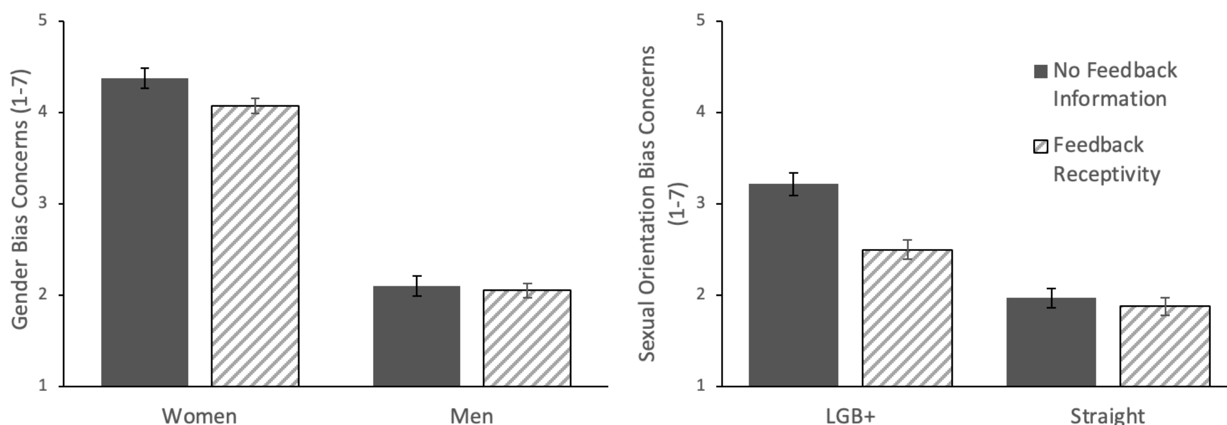
Results

A 2 (gender; between) × 2 (condition; within) ANOVA on gender bias concerns revealed a main effect of gender, $F(1, 295) = 284.38$, $p < .001$, $\eta_p^2 = .49$, a main effect of condition, $F(1, 295) = 14.62$, $p < .001$, $\eta_p^2 = .05$, and the predicted interaction, $F(1, 295) = 8.31$, $p = .004$, $\eta_p^2 = .03$ (see Figure 2). Simple effects tests further examined the effect of condition within women and within men with a Bonferroni-corrected alpha level (unadjusted *p*-values compared to $\alpha = .05/2 = .025$). As predicted, women's gender bias concerns were reduced in the feedback receptivity condition ($M = 4.07$, $SD = 1.33$) compared to the no feedback information condition ($M = 4.37$, $SD = 1.33$), $F(1, 295) = 22.40$, $p < .001$, $d_z = 0.32$, $d_{av} = 0.23$. There was no difference in men's gender bias concerns between the feedback receptivity condition ($M = 2.05$, $SD = 0.97$) and the no feedback information condition ($M = 2.10$, $SD = 0.96$), $F(1, 295) = 0.44$, $p = .51$, $d_z = 0.07$, $d_{av} = 0.04$.

An exploratory analysis on order the team was presented revealed order × condition, $F(1, 293) = 8.34$, $p = .004$, $\eta_p^2 = .03$, and gender × order × condition, $F(1, 293) = 5.46$, $p = .02$, $\eta_p^2 = .02$, interactions on gender bias concerns such that the effect of feedback receptivity was greater when the no feedback information condition was presented first.

Figure 2

Effect of Feedback Receptivity on Bias Concerns (Studies 2 and 3)



Note. Error bars indicate standard errors.

Discussion

Reading about a male-dominated work team led by a man who values employee feedback and where feedback leads to changes reduced women's gender bias concerns compared to reading a description containing no information about feedback receptivity. There was no such difference for men. Feedback receptivity may be a leadership tool that can be used to decrease gender bias concerns for women in male-dominated workplaces.

Study 3: Feedback Receptivity and Sexual Orientation Bias Concerns

In Study 3, we examine whether feedback receptivity reduces bias concerns in another group that is broadly marginalized in the workplace: lesbian, gay, and bisexual people and people with other non-straight sexual orientations (LGB+). This study's preregistration, materials, data, and analysis code are available here: https://osf.io/sytg9/?view_only=bd3e3911f2f346e7af3896aea98da888.

Method

Participants

In line with our preregistration, we requested 220 participants from Prolific, and 219 participated. Eight participants who identified as both straight and LGB+ and two participants

who declined to disclose their sexual orientation were excluded from analyses. Our final sample size was 209 (50.2% straight, 49.8% LGB+; 91.9% cisgender, 6.7% transgender, 1.4% preferred another term/unsure; 58.9% women, 34.9% men, 7.2% nonbinary, 1.9% genderqueer, 0.5% agender, 0.5% bigender, 0.5% demigirl, 0.5% two spirit; 80.9% White, 11.5% Black/African American, 6.7% Latinx/Hispanic/Latin American, 4.8% Asian/Asian American, 1.4% another race not listed, 1.0% Native American/American Indian/Alaskan Native, 0.5% Native Hawaiian/Pacific Islander, with 6.7% identifying with multiple race/ethnicity categories). The mean age was 36.44 years (*SD* = 12.53). This met our preregistered target sample size of at least 208 participants.

Procedure

The procedure and dependent measures were identical to Study 2 except for the following modifications. First, both teams were described as led by a straight man, and participants were told that they did not know anyone who openly identifies as LGB+ on these teams. Second, to produce an even more tightly controlled manipulation, both teams were described as identical in terms of type of work, salary, and hours worked. Third, the "many opportunities to work" language in the no feedback information condition was shifted to "many opportunities to be involved in different projects" to soften any potential negative implications that this team required more work. Fourth, we replaced the word "gender" with "sexual orientation" when measuring bias concerns (feedback receptivity $\alpha = .92$; no feedback information $\alpha = .94$). Fifth, participants saw both teams side-by-side (left-to-right order counterbalanced) before responding to questions about each team. (See Supplement Table S3 for a summary of counterbalancing procedures and order effects, as well as Supplement Table S4 for exploratory between-subjects analyses, for all experiments.) There were no main effects of order or interactions of order with

sexual orientation and condition on bias concerns, *F*s < 2.51, *p*s > .11, η^2_ps < .01. Sixth, because we conducted this study after Study 5, we included measures and preregistered analyses to explore mediators and found that, consistent with Studies 4 and 5, relational leadership mediated the effect of feedback receptivity on bias concerns and was the strongest mediator; see Supplement Figure S2 and Table S7 for details.

We included a multiple-choice attention check question at the end of each condition to assess whether participants remembered which team they were evaluating. Ninety-seven percent of participants answered the no feedback information team check correctly, and 97% of participants answered the feedback receptivity team check correctly. Removing participants who failed or skipped either attention check generated similar results. The questionnaire concluded with demographic questions.

Results

A 2 (sexual orientation; between) × 2 (condition; within) ANOVA on sexual orientation bias concerns revealed a main effect of sexual orientation, $F(1, 207) = 48.33$, $p < .001$, $\eta_p^2 = .19$, a main effect of condition, $F(1, 207) = 30.70$, $p < .001$, $\eta_p^2 = .13$, and the predicted interaction, $F(1, 207) = 19.09$, $p < .001$, $\eta_p^2 = 0.08$ (see Figure 2). Simple effects tests further examined the effect of condition within LGB+ participants and within straight participants with a Bonferroni-corrected alpha level (unadjusted *p*-values compared to $\alpha = .05/2 = .025$). As predicted, LGB+ participants' sexual orientation bias concerns were reduced in the feedback receptivity condition ($M = 2.50$, $SD = 1.05$) compared to the no feedback information condition ($M = 3.22$, $SD = 1.28$), $F(1, 207) = 48.87$, $p < .001$, $d_z = 0.57$, $d_{av} = 0.61$. There was no significant difference in straight participants' sexual orientation bias concerns between the feedback receptivity condition ($M =$

1.88, SD = 0.98) and the no feedback information condition (M = 1.97, SD = 1.09), $F(1, 207)$ = 0.69, p = .407, d_z = 0.11, d_{av} = 0.08.

Discussion

Reading about a leader who valued receiving feedback reduced LGB+ but not straight participants' sexual orientation bias concerns compared to receiving no information about the leader's feedback receptivity. This study demonstrates that the benefits of feedback receptivity extend to LGB+ people in majority-straight environments and may be a tool that those in power can use to reduce sexual orientation bias concerns.

Study 4: Feedback Receptivity and Disability Bias Concerns

Next, we return to the academic context and investigate whether instructors signaling feedback receptivity in the classroom can benefit disabled students. We only include disabled students in this study and examine their bias concerns and willingness to advocate for accommodations. This study's preregistration, materials, data, and analysis code are available here: https://osf.io/crb6k/?view_only=62380ff3eb0948c39aa280ca211f2dea.

Method

Participants

As preregistered, we recruited students who identify as disabled through community recruitment methods (e.g., posting flyers, partnering with the disability resources office and student disability activism groups) and by utilizing the psychology participant pool, and we stopped posting recruitment materials when 100 students had responded. One hundred and four participants filled out the questionnaire[6]. One participant did not identify as a student and one participant indicated they had taken the same questionnaire before; these participants were

[6]We inadvertently left the survey open after the intended close date, resulting in 3 additional responses. We report the results from the full dataset here, but if we exclude those 3 participants, results are similar.

excluded from analyses in line with our preregistered inclusion requirements. Five participants did not identify as disabled and were also excluded. Twelve participants selected “It depends/Other” when asked whether they identified as disabled. Examining the write-in explanations of these participants, we included them in data analyses, as all descriptions fell under the umbrella of disability. Removing participants who selected “It depends/Other” produced similar results.

Our final sample size was 97 (61.9% women, 22.7% men, 16.5% nonbinary, 6.2% genderqueer, 1.0% identified as “unlabeled”; 83.5% cisgender, 13.4% transgender, 3.1% preferred another term or were unsure; 72.2% White, 34.0% Asian/Asian American, 12.4% Latinx/Hispanic/Latin American, 4.1% Black/African American, 3.1% Native American/American Indian/Alaskan Native, 3.1% Middle Eastern/Middle Eastern American, 1.0% Native Hawaiian/Pacific Islander, with 23.7% identifying with multiple races/ethnicities), which met our preregistered minimum sample size of 64.

Participants described their disabilities in an open-response format, and responses were subsequently grouped into categories. The five most common categories of self-described disability were ADHD (35.1%), unspecified mental disability or neurodivergence (24.7%), anxiety disorders (21.6%), autism (16.5%), and depression (12.4%). Over one-third (38.1%) of participants identified with more than one disability. The majority of participants (70.1%) reported disabilities that fell within the mental/psychological domain, and 32.0% of participants reported physical disabilities, with 14.4% reporting both. For all other self-described disability categories and percentages, see Supplement Table S9. The mean age was 20.94 years (*SD* = 6.86).

Procedure

Participants read descriptions of two classes (presented side-by-side; left-to-right order counterbalanced). Both classes were described as identical in terms of academic subject, course material and difficulty, and amount of work. The instructor of each course was described as an able-bodied, neurotypical man. The feedback receptivity condition description read, “In this course, there are many opportunities for students to give feedback on any issues in the classroom environment. The instructor communicates to students that feedback on the course is valued. The instructor makes plans for how to improve the course. Then he follows through in making changes.” The no feedback information condition description read, “In this class, there are many opportunities for students to be involved in different assignments. The instructor communicates to students that work is valued. The instructor makes plans for how to grade student work. Then he follows through in completing grading.” (Note that we replaced “they follow through,” used in the previous studies, with “he follows through” to disambiguate who is following through on feedback given).

The bias concerns scale was modified to measure ability bias concerns by using the language “your disability” (feedback receptivity $\alpha = .87$, no feedback information $\alpha = .90$). Participants also responded to a single-item question assessing how likely they would be to talk to the instructor about any accommodations they may need, measured on a scale from 1 *(Not at all)* to 7 *(Very much)*. Because we conducted this study after Study 5, we included measures and preregistered hypotheses for mediation. We found, consistent with Studies 3 and 5 and our preregistered prediction, that relational leadership mediated the effect of feedback receptivity on bias concerns; see Supplement Figure S3 for details.

Finally, we included a multiple-choice attention check question at the end of each condition to assess whether participants remembered which course they were evaluating. Ninety-

nine percent of participants answered the feedback receptivity condition check correctly, and 97% answered the no feedback information condition check correctly. Removing participants who failed either manipulation check generated similar results. The questionnaire concluded with demographic questions.

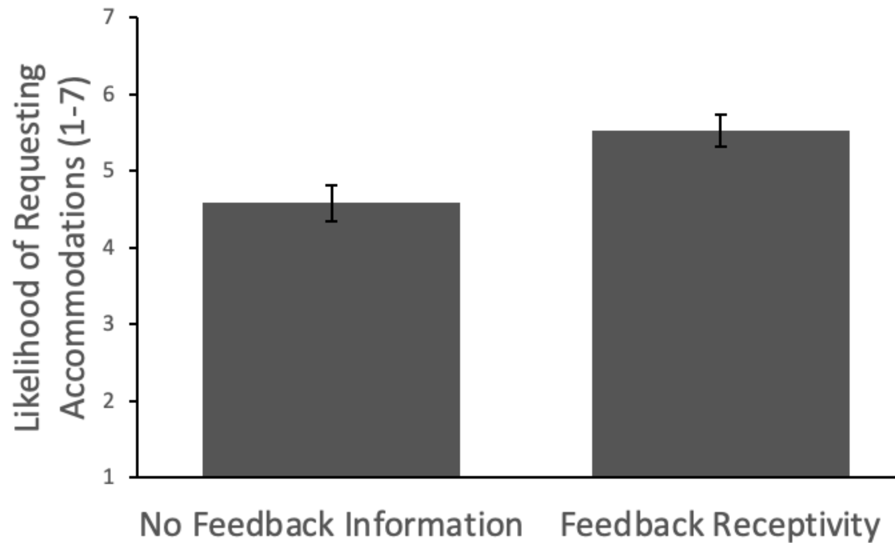
Results

In line with our preregistered predictions, a dependent samples *t*-test revealed that reading about the instructor who valued feedback reduced disabled students' ability bias concerns ($M = 3.00$, $SD = 1.13$) compared to reading about the instructor who did not explicitly mention feedback receptivity ($M = 4.03$, $SD = 1.31$), $t(96) = 7.14$, $p < .001$, $d_z = 0.72$, $d_{av} = 0.85$. Furthermore, participants reported that they would be more likely to talk to the instructor who values feedback ($M = 5.52$, $SD = 1.77$) than the instructor who values work ($M = 4.58$, $SD = 1.96$) about accommodations they may need, $t(96) = -4.54$, $p < .001$, $d_z = .46$, $d_{av} = 0.50$ (See Figure 3).

There was no main effect of order on disability bias concerns, $F(1, 95) = 1.23$, $p = .270$, $\eta_p^2 = .01$, but there was an order × condition interaction, $F(1, 95) = 8.16$, $p = .005$, $\eta_p^2 = .08$, such that the effect of feedback receptivity in reducing disability bias concerns was greater when the feedback receptivity (vs. no feedback information) condition was presented first. However, feedback receptivity significantly reduced disability bias concerns regardless of the order in which conditions were presented (see Supplement Table S4 for details).

Figure 3

Effect of Feedback Receptivity on Likelihood of Requesting Accommodation (Study 4)



Discussion

Feedback receptivity from a professor benefits disabled students in the classroom, reducing their bias concerns and increasing their willingness to ask for accommodations compared to receiving no information about feedback receptivity. Asking for the accommodations they are legally entitled to is crucial for disabled students to have fair access to educational opportunities (W. H. Kim & Lee, 2016; Mamboleo et al., 2020). Signaling feedback receptivity is one way that instructors could reach out proactively to their students, reversing the standard dynamic in which the burden falls on disabled students to initiate communication around accommodations.

Study 5: Mediators of the Effect of Feedback Receptivity on Bias Concerns

Study 5 examines potential mediators of feedback receptivity's effect in reducing bias concerns for women in male-dominated environments. We also remove a potential alternate explanation for effects – evidence of follow-through on feedback given – to examine whether the mere signal of feedback receptivity confers initial benefits on bias concerns.

This was the first study we conducted with relational leadership, sense of belonging, perceptions of the leader's masculinity, and perceived power difference between self and leader as mediators, and we preregistered that perceived power difference would mediate the effect of feedback receptivity on gender bias concerns. However, we instead found that relational leadership was the strongest mediator (see below). We replicated this finding in Study 3 with the same set of mediators, and in Study 4 we preregistered and found that relational leadership significantly mediates the effect (see Supplement Figure S3). This study's preregistration, materials, data, and analysis code are available here: https://osf.io/3ke9n/?view_only=576162008d1f4b64b6d6f9921bcee1ef.

Method

Participants

Per our preregistration, we requested 450 participants from Prolific, and 448 participants participated. Three participants identified as neither men nor women and were excluded from analyses. Our final sample size was 445 (50.3% women, 49.7% men; 99.3% cisgender, 0.7% transgender; 73.3% White, 11.2% Black/African American, 11.0% Asian/Asian American, 9.2% Latinx/Hispanic/Latin American, 1.1% Native American/American Indian/Alaskan Native, 0.4% Middle Eastern, 0.7% another race not listed, 0.2% Native Hawaiian/Pacific Islander, 0.2% prefer not to say, with 7.2% identifying with multiple race/ethnicity categories). The mean age was 39.21 years (SD = 14.13). This met our preregistered target sample size of at least 412 participants.

Procedure

Study 5 used the same team descriptions as Studies 3 and 4 except for one alteration. In previous studies, descriptions included both a signal of feedback receptivity (e.g., "there are

many opportunities … to give feedback”) and evidence of follow-through (e.g., “then they follow through on making changes”). To test whether feedback receptivity confers benefits even before people in power respond, we removed information about follow-through from the previous description. The new descriptions read, “In this team, there are many opportunities for employees to give feedback on any issues in the work environment. The supervisor communicates to employees that feedback on the environment is valued” (feedback receptivity condition) and “In this team, there are many opportunities for employees to be involved in different projects. The supervisor communicates to employees that work is valued” (no feedback information condition).

Participants next responded to measures of gender bias concerns (see below). To explore potential mediators of the effect of feedback receptivity on gender bias concerns, we also assessed perceived relational leadership, procedural justice, sense of belonging, leader masculinity, and power difference between self and leader for each team (see below for specific measures and Table 1 for correlations). The questionnaire concluded with demographic questions. The left-to-right order in which the teams were presented (and the order in which participants evaluated each team for all of the dependent measures) was counterbalanced. There were no main effects or interactions of order with gender and condition on gender bias concerns, Fs < 3.30, ps > .07, η^2_ps < .007 (but see Supplement Table S3).

Dependent Measures

Attention Check. We included a multiple-choice attention check question at the end of each condition to assess whether participants remembered which team they were evaluating. Ninety-five percent of participants answered the no feedback information team check correctly,

and 98% answered the feedback receptivity team check correctly. Removing participants who failed either attention check generated similar results.

Gender Bias Concerns. We measured gender bias concerns by averaging the same eight items used in Study 2. The scale had high reliability (feedback receptivity α = .94, no feedback information α = .95), and examining a scree plot revealed that a one-factor solution best fit the data.

Relational Leadership[7]. We measured perceived relational leadership with ten items that assessed perceptions that the leader would be warm toward them, connect with and care about them, and care about their wellbeing (four items; see Diekman et al., 2011; Fiske et al., 2002; Triandis & Gelfand, 1998); that the leader is trustworthy (two items; see Terwel et al., 2010; Willis & Todorov, 2006); and that the leader wants to use their power for good (four items; adapted from Moon et al., 2021). We computed an overall average score across the ten items (feedback receptivity α = .95, no feedback information α = .95).

Procedural Justice. Five items were averaged to measure how much participants perceived the team would have procedural justice (see Blader & Tyler, 2003 for previous reliability and validity of scale). Participants rated how often decisions would be made in fair ways, how fair decisions and processes would be, the overall fairness with which issues and decisions would be handled, the general sense among employees that things are handled in fair ways, and how much of an effort would be made to be fair to employees when decisions were

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[7] Our preregistration specified that we would include these scales separately in a multiple mediation. However, trust in leader, perceptions of leader's desire to use power for good, and perceptions of leader's relationality were highly correlated and formed a single construct in factor analyses in the three studies that used these measures (see Supplement Table S10). As a result, we report the results of that combined construct. Each of the three components also separately mediated effects of feedback receptivity on bias concerns in the three studies (see Supplement Table S11, S12, and S13). Averaging across the three components (rather than 10 individual items) produces similar mediation results.

made (1 = *not at all* to 7 = *very much*; feedback receptivity α = .97, no feedback information α = .97). Because correlations between procedural justice and relational leadership were high (see Table 1 for Study 5 and Supplement Table S5 for Study 3), we conducted an exploratory factor analysis with principal axis factoring and promax rotation for the items in all our potential mediators on a combined dataset (Study 5 and Study 3, both of which measured all potential mediators) to better understand which constructs are distinct (see Supplement Table S6). The relational leadership items emerged as distinct from the procedural justice items, with no cross-loading between components, and this model better fit the data than one in which procedural justice and relational leadership were collapsed into one component. However, if we combine them into one scale, mediation results are similar to what we report below.

Sense of Belonging. We measured how much participants felt they would belong on the team by averaging four items (see Cheryan et al., 2009 for previous reliability and validity of scale). Participants rated how similar they would be to others, how much they would belong, how well they would fit with the general environment, and how well they would fit in with the people on the team (1 = *not at all* to 7 = *very much*; feedback receptivity α = .95, no feedback information α = .96).

Leader's Masculinity. Perceived masculinity of the team leader was assessed with a single item: "How masculine would this supervisor be?".

Power Difference. We measured perceived power difference between the leader and participant by averaging four items (adapted from Dunbar et al., 2008; Felmlee, 1994). Participants indicated how power would be distributed (1 = *this supervisor and I would have equal power*, 7 = *this supervisor would have much more power than me*); how they would influence each other's behavior (1 = *this supervisor and I would equally influence each other*, 7

= *this supervisor would influence me much more*); how control over how things are done would be distributed (1 = *this supervisor and I would have equal control*; 7 = *this supervisor would have much more control than me*); and who would get their way (1 = *this supervisor and I would get our way equally often;* 7 = *this supervisor would get his way much more often than I would*). Reliability was high for both conditions (feedback receptivity α = .92, no feedback information α = .91).

Results

A 2 (gender; between) × 2 (condition; within) ANOVA on gender bias concerns revealed a main effect of gender, $F(1, 443) = 248.96$, $p < .001$, $\eta^2_p = .36$, a main effect of condition, $F(1, 443) = 14.09$, $p < .001$, $\eta^2_p = .03$, and the predicted interaction, $F(1, 443) = 16.94$, $p < .001$, $\eta^2_p = .04$. Simple effects tests further examined the effect of condition within women and within men with a Bonferroni-corrected alpha level (unadjusted *p*-values compared to α = .05/2 = .025). As predicted, women's gender bias concerns were reduced in the feedback receptivity condition ($M = 3.52$, $SD = 1.31$) compared to the no feedback information condition ($M = 3.98$, $SD = 1.39$), $F(1, 443) = 31.17$, $p < .001$, $d_z = 0.31$, $d_{av} = 0.35$. There was no difference in men's gender bias concerns between the feedback receptivity condition ($M = 2.17$, $SD = 1.13$) and the no feedback information condition ($M = 2.15$, $SD = 1.07$), $F(1, 443) = 0.07$, $p = .799$, $d_z = 0.02$, $d_{av} = 0.02$. The mere signal of a person in power's intention to value feedback can produce positive effects even before they build a reputation for responding to feedback well.

A within-subjects mediation analysis with bootstrapping using the Mediation and Moderation for Repeated Measures macro developed by Montoya (2019) was used to investigate whether greater perceptions of relational leadership mediate the relationship between feedback receptivity and lower gender bias concerns and whether this mediation is significantly moderated

on the *b* path by gender such that the mediation is stronger for women than for men (model 16). Results are similar for a model in which both the *a* path and *b* path are allowed to vary by gender (see Supplement Figure S4). We report component paths of the indirect effect per recommendations by Yzerbyt et al., (2018).

Participants perceived relational leadership more in the feedback receptivity condition than the no feedback information condition, $b = 0.75$, $SE = .06$, $t(444) = 11.71$, $p < .001$, 95% CI [0.62, 0.87], and greater perceptions of relational leadership were subsequently related to lower gender bias concerns for women, $b = -0.74$, $SE = .04$, $t(441) = -17.11$, $p < .001$, 95% CI [-0.82, -0.65], and men, $b = -0.21$, $SE = .05$, $t(441) = -4.15$, $p < .001$, 95% CI [-0.31, -0.11]. Examining the conditional indirect effect for each gender with 10,000 bootstrap samples revealed that perceptions of relational leadership mediated the relationship between feedback receptivity and gender bias concerns, and the indirect effect was greater for women, $b = -0.55$, bootstrap $SE = .06$, 95% bootstrap CI [-0.68, -0.43] than for men, $b = -0.16$, bootstrap $SE = .04$, 95% bootstrap CI [-0.24, -0.08], index of moderated mediation = -0.39, bootstrap $SE = .06$, 95% bootstrap CI [-0.52, -0.27]. Approximately 40% of the variance in gender bias concerns was accounted for by the model ($R^2 = .403$).

Table 1

Correlations Between Dependent Measures (Study 5)

Variable	1	2	3	4	5	6
1. Relational leadership		-.33**	.83**	.62**	.06	-.51**
2. Power difference	-.34**		-.29**	-.29**	.22**	.30**
3. Procedural justice	.79**	-.33**		.64**	.04	-.54**

4. Sense of belonging	.69**	-.34**	.70**		.06	-.59**
5. Leader’s masculinity	-.02	.27**	-.11*	-.10*		.11*
6. Bias concerns	-.43**	.25**	-.52**	-.61**	.08	

Note. Correlations for the feedback receptivity condition are reported above the diagonal, while correlations for the no feedback information condition are reported below the diagonal.
** denotes significance at the .001 level; * denotes significance at the .05 level.

Finally, we examined alternative mediators. As preregistered, we included each alternative mediator in separate within-subjects moderated mediation analyses to determine which mediators should be included in our multiple mediation analysis; all mediators met our preregistered requirements (see Supplement Table S7) and were included in a multiple mediation model on women. The indirect effect of perceived relational leadership was the strongest predictor in this model, b = -.37, bootstrap SE = .09, 95% percentile bootstrap CI [-0.56, -0.21]. No other mediators were significant (see Supplement Table S8 for detailed results). Approximately 57% of the variance in women’s gender bias concerns was accounted for by the model (R^2 = .57).

Discussion

Women had lower gender bias concerns after reading about a leader who valued feedback than after reading about a leader who did not explicitly signal feedback receptivity, while there was no significant difference in men’s gender bias concerns across conditions. This effect was mediated by perceptions of relational leadership such that reading about the feedback receptive leader increased both women’s and men’s perceptions of the leader’s relational leadership, and those perceptions of relational leadership subsequently predicted lower gender bias concerns for

women more than for men. Perceptions of relational leadership remained the strongest mediator of the effect for women when considered alongside procedural justice, sense of belonging, and the leader's perceived masculinity. These results suggest that relational leadership may help explain why feedback receptivity reduces gender bias concerns.

Study 6: Experimentally Manipulating Relational Leadership

In Study 6, we employ the causal-chain approach to mediation (Bullock & Green, 2021; Spencer et al., 2005) to examine whether relational leadership reduces women's gender bias concerns. To isolate the effect of relational leadership, no information on feedback receptivity is provided in either condition. This study's preregistration, materials, data, and analysis code are available here: https://osf.io/t35ak/?view_only=46618b3eedba4e998a5bbae73d4effd3.

Method

Participants

In line with our preregistration, we requested 250 participants from Prolific, and 251 participants responded. Two participants who identified as both women and men and one who identified as neither were excluded from analyses in line with our preregistered inclusion requirements. Our final sample size was 248 (49.2% women, 50.8% men; 98.8% cisgender, 1.2% transgender; 76.6% White, 10.1% Asian/Asian American, 9.7% Black/African American, 8.5% Latinx/Hispanic/Latin American, 2.8% Native American/American Indian/Alaskan Native, 0.8% declined to disclose, and 0.4% another race not listed, with 8.1% identifying with multiple race/ethnicity categories). The mean age was 38.55 years (SD = 12.68). This met our preregistered target sample size of at least 238 participants.

Procedure

The introduction to the task was similar to previous studies (i.e., two hypothetical 80% men, man-led work teams identical in work tasks, hours, and salary). Participants were then told that both teams' supervisors had recently undergone a mandatory Leadership and Team Culture evaluation in which team members answered questions about what it is like to work for their supervisor. Participants were told that both supervisors were rated as equally fair and productive and were shown the percentages (side-by-side; left-to-right order counterbalanced) of each team that had agreed with the following three statements: "My supervisor uses his power to help others", "My supervisor cares deeply about employees", and "I have a great deal of trust in my supervisor." In one team, 81%, 82%, and 78% of team members agreed with these statements (high relational leadership condition). In the other team, 40%, 44%, and 33% of team members agreed with these statements (low relational leadership condition).

Gender bias concerns were measured by averaging the same eight items used in the previous studies. The scale had high reliability (low-rated $\alpha = .94$, high-rated $\alpha = .94$). The left-to-right order in which the teams were presented (and the order in which participants evaluated each team for all of the dependent measures) was counterbalanced. There was a main effect of order, $F(1, 244) = 14.55$, $p < .001$, $\eta^2_P = .06$, such that when averaging across gender and condition, those who first answered questions about the high relational leadership leader (vs. low relational leadership leader) had higher gender bias concerns. This main effect of order did not emerge in other studies. There were no significant interactions involving order on gender bias concerns, Fs < 3.61, ps > .059, η^2_Ps < .015.

We also included a multiple-choice attention check question at the end of each condition to assess whether participants remembered which team they were evaluating. Ninety-eight percent of participants answered the highly-rated leader check correctly, and 96% answered the

low-rated leader check correctly. Removing participants who failed either manipulation check generated similar results. The questionnaire concluded with demographic questions.

Results

A 2 (gender; between) × 2 (condition; within) ANOVA on gender bias concerns revealed a main effect of gender, $F(1, 246) = 118.49$, $p < .001$, $\eta^2_p = 0.33$, a main effect of condition, $F(1, 246) = 391.19$, $p < .001$, $\eta^2_p = 0.61$, and the predicted interaction, $F(1, 246) = 19.85$, $p < .001$, $\eta^2_p = 0.07$.

Simple effects tests further examined effects of condition within women and within men with a Bonferroni-corrected alpha level (unadjusted *p*-values compared to $\alpha = .05/2 = .025$). As predicted, women's gender bias concerns were reduced when the leader was high in relational leadership ($M = 2.80$, $SD = 1.26$) compared to when the leader was low in relational leadership ($M = 5.08$, $SD = 1.25$), $F(1, 246) = 288.98$, $p < .001$, $d_z = 1.38$, $d_{av} = 1.82$. Men's gender bias concerns were also lower when the leader was high in relational leadership ($M = 1.91$, $SD = 0.85$) than when the leader was low in relational leadership ($M = 3.35$, $SD = 1.39$), $F(1, 246) = 119.32$, $p < .001$, $d_z = 1.11$, $d_{av} = 1.25$.

Discussion

Women's, and to a lesser extent men's, gender bias concerns were reduced when reading about a leader high in relational leadership compared to one low in relational leadership. These results suggest that relational leadership is not only associated with but can *cause* lower bias concerns, providing additional evidence in support of our theoretical model. Relational leadership is broadly beneficial (i.e., affects both women and men), but it appears especially important for women in this male-dominated experimental setting. An additional preregistered study manipulating only the "uses power to help others" component of relational leadership

produced similar results; see Supplemental Study in Supplement for details. Relational leadership may explain why feedback receptivity reduces women's gender bias concerns.

Study 7: Response to Feedback

Finally, Study 7 examines a potential important caveat to our findings thus far. Ignoring feedback may counteract the salubrious effects of signaling feedback receptivity. Soliciting feedback but not acting on it could produce worse outcomes than making no initial feedback request, especially for members of marginalized groups. Additionally, we manipulate feedback receptivity through a new channel: course evaluations written by peers. This study's preregistration, materials, data, and analysis code are available here: https://osf.io/vabxh/?view_only=7cc18e501cd244d78d66a7f6120f50ee.

Method

Participants

As preregistered, we requested 250 undergraduate student participants from Prolific, and 256 participated. One participant did not consent, three participants did not identify as men or women, and four participants did not indicate their gender and were excluded. Twenty-five participants were not in their first through fourth year of undergraduate study and were excluded; results are similar if these participants are retained. Our final sample size was 222 (50.0% women, 50.0% men; 96.8% cisgender, 2.3% transgender, 0.9% preferred another term/unsure; 64.9% White, 16.2% Asian/Asian American, 15.8% Black/African American, 10.4% Latinx/Hispanic/Latin American, 2.3% Middle Eastern/Middle Eastern American, 0.9% Native American/American Indian/Alaskan Native, 0.5% Native Hawaiian/Pacific Islander, with 10.4% identifying with multiple race/ethnicity categories). The mean age was 24.8 years (SD = 6.13). This met our preregistered target sample size of at least 182 participants.

Procedure

Participants responded to questions about three different hypothetical Introduction to Computer Science courses. As a baseline control condition, participants first read and responded to a course in which the instructor was a man. No student evaluation was provided in this baseline control condition. Next, participants read about two other courses in counterbalanced order (one after the other; not side-by-side) in which the instructors were also men and anonymous student evaluations were provided. In the response condition, the student evaluation read, "The instructor sent us a feedback form in the middle of the term and asked us for suggestions to improve the course. After we took the survey, he made several changes to the course. It was clear he really listened to us." In the ignore condition, the student evaluation read, "The instructor sent us a feedback form in the middle of the term and asked us for suggestions to improve the course. After we took the survey, he didn't make any changes to the course. It was clear he really didn't listen to us."

Immediately after reading about each course, participants reported gender bias concerns about that course using the same eight questions as the previous studies (control $\alpha = .93$; response $\alpha = .91$; ignore $\alpha = .95$). As a manipulation check, participants responded to a scale of perceived feedback receptivity from Study 1 (control $\alpha = .91$; response $\alpha = .93$; ignore $\alpha = .88$). There were no main or interaction effects of order, Fs < 2.03, ps > .16, η^2_ps < .009.

Results

Participants perceived the instructor in the response condition to be more receptive to feedback ($M = 6.25$, $SD = 0.96$) than the baseline control ($M = 4.43$, $SD = 1.30$), $t(221) = 18.69$, $p < .001$, $d_z = 1.25$, $d_{av} = 1.59$, indicating that the course evaluation excerpt successfully manipulated perceived feedback receptivity. Additionally, participants perceived the instructor in

the ignore condition (M = 1.99, SD = 1.21) to be less receptive to feedback than the baseline control, $t(221) = -22.86$, $p < .001$, $d_z = 1.53$, $d_{av} = 1.95$.

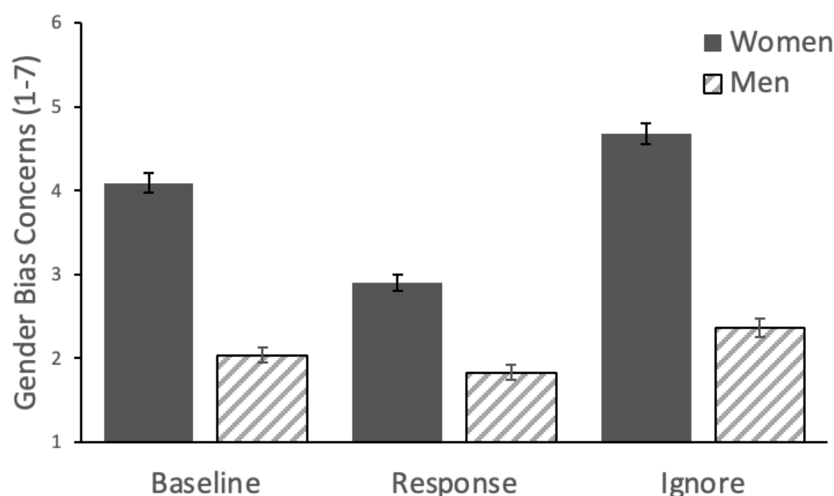
Our preregistered 2 (gender; between) × 3 (condition; within) mixed-model ANOVA on gender bias concerns revealed a main effect of condition, $F(1.83, 402.85) = 159.53, p < .001, \eta^2_p = 0.42$, a main effect of gender, $F(1, 220) = 196.80, p < .001, \eta^2_p = 0.47$, and the predicted condition by gender interaction, $F(1.83, 402.85) = 49.80, p < .001, \eta^2_p = 0.18$ (see Figure 4). Note that Mauchly's test indicated that the assumption of sphericity was violated, $\chi^2(2) = 21.19, p < .001$, so degrees of freedom were corrected with the Greenhouse-Geisser estimate of sphericity ($\varepsilon = .92$).

We ran planned simple contrasts to identify differences between conditions within each gender, comparing p-values to a Bonferroni-adjusted alpha level of .05/6 = .008 to control familywise error rate. Consistent with previous studies, women reported significantly lower levels of gender bias concerns when reading about an instructor who responded to feedback (M = 2.90, SD = 1.08) than the baseline control with no feedback information (M = 4.09, SD = 1.30), $F(1, 220) = 188.89, p < .001, d_z = 1.03, d_{av} = 1.00$. Additionally, women's gender bias concerns were lower when reading about an instructor who responded to feedback than one who ignored feedback (M = 4.68, SD = 1.28), $F(1, 220) = 284.08, p < .001, d_z = 1.29, d_{av} = 1.51$, and were even higher than the baseline control when they read about the instructor who ignored feedback, $F(1, 220) = 49.48, p < .001, d_z = 0.56, d_{av} = 0.46$. Replicating the previous studies, there was no significant difference in men's gender bias concerns after reading about the instructor who responded to feedback (M = 1.83, SD = 0.94) and the baseline control instructor (M = 2.04, SD = 0.91), $F(1, 220) = 5.95, p = .015, d_z = 0.37, d_{av} = 0.23$. However, adding the ignore condition produced a new pattern: Men had lower gender bias concerns after reading about the

instructor who responded to feedback than one who ignored feedback (*M* = 2.37, *SD* = 1.12), $F(1, 220) = 26.27, p < .001, d_z = 0.71, d_{av} = 0.52$, and higher gender bias concerns when the instructor ignored feedback than the baseline control, $F(1, 220) = 15.46, p < .001, d_z = 0.50, d_{av} = 0.32$.

Figure 4

Effect of Response to Feedback on Gender Bias Concerns (Study 7)



Discussion

Signaling feedback receptivity can backfire when instructors ask for feedback but conspicuously ignore it. Women students had higher gender bias concerns when a professor asked for but then ignored feedback than when they did not ask or when they asked and followed through. Men students also had the highest gender bias concerns when a professor asked for but ignored feedback, but this effect was less extreme than for women. While asking for feedback generally has favorable effects, when it is not paired with appropriate follow-through, it can be

worse than not asking in the first place. Those in power who want to use feedback receptivity as a tool to reduce bias concerns should be careful not to give the impression of ignoring feedback.

General Discussion

Feedback receptivity from those in power helps reduce bias concerns for those with marginalized identities. These effects emerged across seven preregistered studies, three marginalized populations (women in male-dominated environments, LGB+ people, and disabled students), three settings (classrooms, engineering labs, and work teams), and three methods of signaling feedback receptivity (naturalistic in engineering labs, expressing that one values feedback, and student testimonials in course evaluations). Effects were absent or lesser for members of dominant groups. Feedback receptivity is a powerful tool that reduces bias concerns for women, LGB+ people, and disabled people.

Feedback receptivity reduced bias concerns by increasing perceptions of relational leadership. Perceptions of relational leadership explained the relationship between feedback receptivity and bias concerns for women in male-dominated fields, LGB+ people, and disabled students. Perceptions of relational leadership remained a significant mediator even when accounting for alternative mediators (e.g., sense of belonging, procedural justice). Manipulating the mediator had causal effects on bias concerns. Relational leadership synthesizes existing psychological work on relationship quality with work on power and helps explain why feedback receptivity reduces bias concerns.

Importantly, when leaders asked for but then conspicuously ignored feedback, bias concerns were higher than when they did not ask. This finding establishes a boundary condition for the benefits of feedback receptivity that may help to explain why real-world attempts to ask

for feedback are not always effective. When paired with appropriate follow-through, asking for feedback is a potentially flexible and powerful leadership strategy for improving equity.

Theoretical Contributions

Our findings provide several key contributions to work in social psychology. First, our work extends the literature on feedback in social psychology (e.g., wise feedback; Cohen et al., 1999) by demonstrating that the ways people in power solicit, not just give, feedback can influence equity outcomes.

Second, these findings advance our understanding of bias concerns in workplace and educational environments, extending past work on stereotype threat and the protective power of identity safety cues (e.g., Davies et al., 2005; Emerson & Murphy, 2015; Hall et al., 2018). Thus far, work on how those in power can increase identity safety in subordinates has focused on ideas such as mindsets of intelligence (Canning et al., 2019, 2022; Muenks et al., 2020), identity-paired role models (e.g., Pietri et al., 2019; Stout et al., 2011), and improving physical spaces (e.g., Cheryan et al., 2009; Master et al., 2016). Feedback receptivity moves beyond the foundations of identity safety theory to establish another kind of identity safety cue from leaders.

Furthermore, past work on identity safety cues has often used cues that explicitly reference identity, such as gender-inclusive policies (Hall et al., 2018), reporting one's gender pronouns (Johnson et al., 2021), and explicit statements valuing marginalized groups (Maimon et al., 2023; Moser & Branscombe, 2021; Purdie-Vaughns et al., 2008). Our findings contribute to a growing body of work on identity safety cues that are identity-neutral on the surface but help close equity gaps, such as mentoring programs (Dobbin & Kalev, 2018), treating others as respected work partners (Muragishi et al., 2023), and supportive work/life organizational policies (Kalev & Dobbin, 2022).

Third, we join a growing body of research investigating how, contrary to traditional understandings that power makes people less attuned to others' needs (e.g., van Kleef et al., 2008), power can at times be leveraged for the good of others (Chen et al., 2001; Galinsky et al., 2014; Moon et al., 2021). We introduce relational leadership as a construct that demonstrates how power can produce prosocial outcomes. How power was used, rather than the extent to which a power difference was perceived, emerged as the key mediator of positive outcomes in our studies. Power can be a force for good when leaders are committed to building strong relationships.

Fourth, being heard in organizational settings is often linked to procedural justice (Blader & Tyler, 2003; Lind et al., 1990), but we introduce relational leadership as a novel mechanism that moves beyond perceptions of fairness to examine how perceptions of care, trustworthiness, and the use of power for good are shaped by feedback receptivity and, in turn, shape bias concerns. Furthermore, relational leadership combines multiple closely related constructs, suggesting that factors that have been seen as distinct (e.g., warmth, trust) may operate similarly in some contexts.

Fifth, we examine the role of response to feedback in shaping outcomes. We disaggregate the feedback receptivity cue into two parts— signal and follow-through— and find that the mere signal of feedback receptivity is enough to confer initial benefits even before evidence of follow-through is present. However, under certain circumstances (i.e., conspicuously ignoring feedback given), giving the cue of feedback receptivity can backfire. Much of the existing literature has positioned feedback receptivity as predominantly promoting positive outcomes (e.g., Cook-Sather, 2006; Fast et al., 2014; Mansfield, 2014; Morrison, 2014), but our work introduces a nuanced understanding of how feedback receptivity can produce both positive and negative

outcomes depending on follow-through. These findings extend prior work on how some identity safety and diversity cues can result in harm (Georgeac & Rattan, 2023; Germano et al., 2021; Kroeper et al., 2022) especially when leaders are perceived as hypocritical (Greenbaum et al., 2015).

Finally, this work examines the experiences of populations that are typically understudied (e.g., disabled students, LGB+ employees) in psychological research on diversity and especially on identity safety cues (Kruk & Matsick, 2021). Including understudied groups is crucial to building a more complete understanding of how identity safety cues function across contexts, expanding generalizability, and avoiding causing unintentional harm to vulnerable populations.

Implications for Culture Change

Our findings establish that feedback receptivity reduces bias concerns. Centering subordinates' feedback may help those in power enact transformative, context-appropriate culture change that could contribute to more equitable environments. Feedback receptivity interventions give subordinates a role in equity reform and can help identify the most urgent areas to address. Listening to feedback could also help those in power tailor equity interventions to their particular context (e.g., Yeager & Walton, 2011). In addition, because the simple act of asking for feedback does not explicitly reference identity, it may be particularly helpful for reducing bias concerns while eliciting less resistance from dominant-group members than targeted diversity efforts. Feedback receptivity does not appear to harm dominant group members; across all studies, feedback receptivity did not increase dominant group members' bias concerns. Finally, even if members of marginalized groups are not equally represented in a field or in positions of leadership, people in power who are motivated to create inclusive cultures can begin to reduce bias concerns by signaling that they are open to feedback. This is particularly

important because it prioritizes not simply getting more marginalized students and workers “into the door” or “through the pipeline” but also creating positive cultures where they can thrive with less fear of bias. Feedback receptivity can be a useful and practical strategy for fostering more welcoming cultures.

How should feedback receptivity be implemented in educational institutions and workplaces? One strength of feedback receptivity is that it can be integrated at multiple levels of culture and signaled through multiple methods. Feedback receptivity could be communicated through person-to-person interactions (e.g., an instructor expressing that they value feedback), artifacts (e.g., syllabi), and behaviors (e.g., evidence of change in response to feedback). Institutional policies could encourage feedback receptivity by establishing formal feedback mechanisms (e.g., surveys) and methods for following up on feedback. By integrating feedback receptivity across organizations, those in power could maximize its reach and impact.

Strengths and Limitations

The present work has several strengths (see Table 2). We investigate feedback receptivity both in a large-scale field study and experimentally. We replicate the observed phenomenon in multiple contexts (e.g., labs, classrooms, work teams), among three different marginalized populations, and across multiple domains of feedback requests (i.e., soliciting feedback “on the team culture”; “on the work/classroom environment”; “about the lab/group”; and “suggestions to improve the course”). We also investigate mechanism through both mediation analyses and controlled experimental manipulations. Finally, we examine the separate effects of signaling openness to and responding to feedback, and we identify a boundary condition on the effectiveness of signaling feedback receptivity (i.e., conspicuously ignoring feedback given).

Feedback receptivity may operate differently along axes of identity we did not investigate (e.g., race) and still needs to be investigated with more attention to intersectional identities. Furthermore, we demonstrated feedback receptivity's effects both in a real-world setting and through artificial experimental manipulations, but we did not experimentally test the effects of a feedback receptivity intervention in a field setting. We also do not know whether feedback receptivity messages produce long-lasting effects, the extent to which such messages may need to be repeated, and whether soliciting feedback from subordinates varies in effectiveness and appropriateness across cultures. Finally, we do not know whether feedback receptivity reduces disparities in other outcomes, such as retention, wellbeing, and performance.

Table 2

Assessment of Limitations

Dimension	Assessment
Internal Validity	
Is the phenomenon examined with experimental methods?	Yes (Studies 2-7)
Were manipulations validated (e.g., with manipulation checks or pretest data)?	Yes (All studies)
Were alternative explanations ruled out?	Yes (Studies 1, 3, and 5 included measures for alternative explanations)
Were potentially confounding variables addressed?	Yes (Studies 2-7 used tightly controlled experiments)
Are boundary conditions examined?	Yes (Study 7)
Is there consistency in moderators? (i.e., where the effect is *not* observed?)	Yes (Across all studies that tested whether identity moderated the effect, dominant group members showed absent or lesser effects.)

Is the phenomenon's mechanism examined, including addressing the limitations of mediation analyses?	Yes (Mediation in Studies 3, 4, and 5; experiment manipulating proposed mechanism in Study 6 to address limitations of mediation and establish causal pathway)
Statistical Validity	
Were sample sizes, study designs and measures, hypotheses, and data analysis plans preregistered?	Yes (All studies)
Was the statistical power at least 80%?	Yes (All studies)
Were the reliability and validity of all dependent measures established (here or elsewhere)?	Yes (In all studies, dependent measures were either adapted from existing valid scales or had validity explored with factor analysis. Reliability is reported for all scales.)
Is multicollinearity among predictors/mediators addressed?	Yes (Discussed in all studies featuring correlated predictors)
Were the distributional properties of variables examined (e.g., for normality assumptions?)	Yes (All studies)
Generalizability & Ecological Validity	
Were different experimental methods used?	Yes
Were methods artificial/hypothetical?	No (Study 1) Yes (Studies 2-7)
Was the phenomenon assessed in a field setting?	Yes (Study 1)
Are the results generalizable to different identity groups?	Yes (3 identity groups: Gender, sexual orientation, disability)
Are the results generalizable across different contexts/settings?	Yes (3 contexts: Labs, classrooms, work teams)
Are the results generalizable across different cultures/countries?	Unsure (Not tested)
Are the results generalizable across different time/historic periods?	Unsure (Not tested)
Is the phenomenon examined in terms of intersectional identity?	Yes (S1 examined intersections between gender, race, and sexual orientation in predicting gender bias concerns.)

	However, we measured bias concerns in reference to one identity at a time.
What are the main limitations in generalizability?	Limitations on generalizability based on the current data include potential effects of time (i.e., longitudinal), age, and culture. Additionally, we do not know whether feedback receptivity reduces disparities in other outcomes, such as retention, wellbeing, and performance.

Future Directions

Future work could explore who is encouraged to give feedback and whose voices are heard. Some methods of soliciting feedback may risk unintentionally reinforcing existing inequities by centering the perspectives of the subordinates with the most power and privilege. For instance, asking a class to share public verbal feedback could favor those with the most confidence speaking up (e.g., H. S. Kim, 2002). Members of marginalized groups may face additional barriers to providing feedback; giving those in power critical feedback may be particularly challenging due to valid fears of silencing and retaliation. Once feedback is solicited, those seeking to foster equitable cultures should ensure that all subordinates have a fair opportunity to share their feedback and be heard. Our work suggests that asking for feedback is a promising first step, but creating an environment in which members of marginalized groups feel comfortable giving feedback about sensitive topics is likely to require building trust over time.

Examining how feedback receptivity operates when the people in power are members of marginalized groups is another important future direction. For example, feedback receptivity could be weaponized against teachers and other leaders with marginalized identities (see Kreitzer & Sweet-Cushman, 2022 for a review of evidence on bias in student evaluations of teaching). Future research could also investigate how feedback receptivity operates when the person in

power and subordinate are members of different marginalized groups (e.g., LGB+ employees' perceptions of a straight woman leader).

The content of feedback given is another interesting area of study. Some requests for feedback could operate differently than others. For instance, perhaps a leader who solicits feedback about a work product may be less effective at reducing subordinates' bias concerns than one who solicits feedback about the group's environment.

Future work could also examine what leaders do after feedback is received. Some leaders may have the impulse to reject useful feedback: Research could examine how to reduce defensiveness in leaders and help them successfully implement change. Conversely, not all feedback is helpful or actionable, and sometimes problems require solutions that are different from those that subordinates suggest. Research should investigate whether leaders can offset the potential backlash of choosing not to act on feedback by explaining the reasoning behind their decisions. Future work could explore how those in power can navigate the process of responding to feedback in a way that facilitates a more equitable culture.

Relational leadership also sparks a series of future research questions. Research could examine other interventions to increase perceptions of relational leadership; could investigate why relational leadership reduces bias concerns and whether it affects other relevant outcomes (e.g., interest, performance); and could disentangle perceptions of relational leadership from broader liking or positive feelings toward the person in power. Future work could also examine relational leadership in naturalistic contexts to better understand how perceptions of relational leadership emerge and shape real-world outcomes.

Could traditionally dominant groups ever benefit as much from feedback receptivity as traditionally marginalized groups? We hypothesize that there may be times when members of

dominant groups experience similar or more benefit from feedback receptivity. First, dominant group members may experience reduction in bias concerns in situations in which they feel marginalized. For example, among men who work on a majority-women work team, potential cues of bias may be more salient. As a result, they may show a reduction in bias concerns in response to feedback receptivity like the effect we observed in women. Furthermore, bias concerns are not the only relevant outcome of feedback receptivity. Dominant group members may still prefer leaders high in feedback receptivity and could experience other benefits (e.g., performance, recruitment, perceived authenticity of leader). Future work could examine when feedback receptivity and relational leadership narrow disparities between marginalized and dominant group members and when they may be broadly beneficial across groups.

Conclusion

The relatively simple, actionable leadership strategy of requesting feedback reduces bias concerns for women in male-dominated workplaces, LGB+ workers, and disabled students. This effect is mediated by increased perceptions of relational leadership, suggesting that members of marginalized groups perceive people in power who value feedback as more attuned to others in their leadership decisions and subsequently less likely to foster a biased environment. However, when those in power conspicuously ignore feedback after requesting it, bias concerns spike higher than if there is no initial feedback request. Taken together, these results demonstrate that positive outcomes for marginalized group members are shaped by whether those in power are willing to receive, not just give, feedback.

Citation Diversity Statement

Research has found that scholars from marginalized groups tend to be under-cited compared to their non-marginalized peers (e.g., Borsuk et al., 2009; King et al., 2017). To measure progress toward our goal of a References section that reflects the diversity of scholars studying the topics examined in this article, we conducted a citation audit using a procedure created by Azpeitia et al. (2022); results are available from the first author. We also examined the journals that appeared most frequently in our References, as these frequencies may relate to citation diversity due to biases in publishing. We cited 67 different journals. The journal we cited most was the Journal of Personality and Social Psychology (21 cited articles), followed by Personality & Social Psychology Bulletin (8 cited articles.) We are committed to supporting more equitable and cumulative citing behaviors in psychology, including working to diversify the author identities and journal outlets represented in our References.

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Part 2: Women are Directed Away from Male-Dominated Opportunities When Gender-Balanced Alternatives are Present

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Abstract

Three preregistered studies (total $N = 1540$) reveal that women are directed away from male-dominated educational opportunities when more gender-balanced alternatives are present. Study 1 demonstrates that people advise women in computer science away from a male-dominated course when a more gender-balanced course is available, but not when the second course alternative is also male-dominated. Study 2 finds the same pattern in parents' advice on which engineering courses their daughters, but not sons, should take. Study 3 finds this pattern again in undergraduates' recommendations for which biology course a woman peer should take. The tendency to direct women peers away from the male-dominated biology course is mediated by students anticipating that their peers will feel a lower sense of belonging and lower interest in a male-dominated opportunity when the alternative is gender-balanced than when it is also male-dominated. This effect persists when controlling for perceptions of class difficulty and student success. The availability of gender-balanced alternatives may at times inadvertently reinforce existing gender disparities.

Statement of Relevance

Many organizations and educational institutions have introduced options intended to appeal to women with the goal of diversifying traditionally male-dominated fields. However, there may be inadvertent negative consequences to this strategy. We demonstrate across three experiments that hypothetical academic advisors, parents, and students are more likely to direct women away from male-dominated opportunities when more gender-balanced alternatives are present than when these gender-balanced alternatives are not present. This biased pattern of advice disadvantages women by reinforcing gender disparities, thereby making it harder for women to access high-status and lucrative opportunities. We suggest that the solution to this pattern of sustained inequity lies not in eliminating gender-balanced alternatives. Instead, efforts should focus on ensuring unbiased advising and making cultures in male-dominated spaces more inclusive.

Women are Directed Away from Male-Dominated Opportunities When Gender-Balanced Alternatives are Present

Many educational institutions and organizations are attempting to increase the representation of women in male-dominated fields. One strategy that has been effective in drawing more girls and women into a field is adding an alternative within or adjacent to the larger field that might appeal to a broader population. For example, the College Board added AP Computer Science Principles, which focuses on “the broader aspects of computing,” as a second option to its original, more technical offering of AP Computer Science A(College Board, 2020). Northwestern University added a BA pathway to their traditional BS option for students interested in computer science (Northwestern McCormick School of Engineering and Applied Science, 2024), Stanford University added a concentration in Symbolic Systems that combines computer science with other disciplines like philosophy and psychology (Stanford School of Humanities & Sciences, n.d.), and Berkeley added The Beauty and Joy of Computing, a computer science curriculum that endeavors to attract “all kids, not just the ones who fit the nerd stereotype” (Garcia & Harvey, 2024). These opportunities appear to be largely successful in terms of increasing diversity. For example, female students are more highly represented within the new AP programs than in the traditional pathways (College Board, 2020).

In the current work, we examine whether one inadvertent negative consequence of diversifying a field via adding a potentially more appealing alternative for women is that women are directed away from male-dominated opportunities when these more gender-balanced alternatives are present compared to when they are absent. This tendency to direct women away from male-dominated opportunities could contribute to limiting women’s opportunities for success because more gender-balanced alternatives are often less prestigious and lucrative than

traditional male-dominated opportunities (Laberge et al., 2022). Directing women away from male-dominated opportunities could widen gender disparities in higher-status subfields.

Changing Options Shapes Choices

How choices are framed can powerfully influence people's decisions (Savani & Rattan, 2012; Stephens & Levine, 2011; Tversky & Simonson, 1993). The number (e.g., Iyengar & Lepper, 2000), order (Evans et al., 2021; Li & Epley, 2009), temporal presentation (i.e., sequential v. simultaneous; Basu & Savani, 2019), grouping of option attributes (Martin & Norton, 2009), unavailable or less desirable "decoy" alternatives (Di Crosta et al., 2023; Kaptein et al., 2016; Karmarkar, 2017), and options recommended by default (Desiraju & Dietvorst, 2023; Jachimowicz et al., 2019) can shape the choices people make. In the realm of academic choices, women and students of color's decision to apply for a general academic award (i.e., an award open to everyone) decreases when they are also given the option of applying to an award for people with their identity (Germano et al., 2021). Decisions are impacted by the available alternatives.

In the current work, we shift away from investigating people's own choices and examine how the availability of different options influences academic advice. More specifically, we examine how the presence of an alternative academic choice that is gender-balanced instead of male-dominated influences the extent to which people direct women away from the original male-dominated opportunity.

Biased Patterns of Advice

Past work on educational and career disparities has largely examined how people make their own choices about majors and careers (e.g., Dasgupta & Stout, 2014; Siy et al., 2023). However, others' guidance can provide powerful influence. Sources of social support – such as

academic advisors (e.g., Canaan & Mouganie, 2023; Sutton & Sankar, 2011), parents (e.g., Kerin et al., 1975; Sha et al., 2016), and peers (e.g., Kazi & Akhlaq, 2017; Koech et al., 2016) – can direct students into or away from certain opportunities (e.g., careers, majors, courses, extracurriculars). Understanding the motivation underlying academic and career choices requires examining not only people's own perceptions and interests, but how those around them advise them toward some opportunities while blocking others.

Unfortunately, advisors, parents, and peers often display biases that can affect students. Parents and teachers hold lower expectations for the math ability of girls versus boys, and these expectations can affect students' math attitudes and performance (Beilock et al., 2010; see also Gunderson et al., 2011; Riegle-Crumb & Humphries, 2012; Robinson-Cimpian et al., 2014). Teachers' and school officials' racial biases can also affect students' outcomes (e.g., Jacoby-Senghor et al., 2016; Jarvis & Okonofua, 2020; Yeager et al., 2014). By college, advice from peers influences students' career choices (Koech et al., 2016), and women considering majoring in computer science are deterred by their perceptions of peers' negative judgments (Cheryan et al., 2020). Gendered patterns of influence from advisors, parents, and peers can direct women students away from male-dominated opportunities.

Why People May Direct Women Away from Male-Dominated Opportunities

People may discourage women from pursuing male-dominated opportunities because they anticipate that women will have a lower sense of belonging in them. A significant body of research has investigated the factors that preclude women's sense of belonging in a setting. For instance, women and girls report a lower sense of belonging in fields with a higher proportion of men (Master et al., 2021; Murphy et al., 2007) and in computer science classrooms and companies that display stereotypically masculine objects (e.g., Star Trek posters; Cheryan et al.,

2009; Master et al., 2016). Women report a lower sense of belonging in majority-men and stereotypically masculine environments.

Sense of belonging predicts women's subsequent choices. Women students are more likely to apply for a scholarship specifically for women over a general unrestricted scholarship, and this tendency is mediated by their greater sense of belonging with the women's scholarship (Germano et al., 2021). A lower sense of belonging is a strong predictor of decreased interest and anticipated success in a field, even when controlling for other factors known to deter women such as stereotype threat and lower anticipated success (Cheryan et al., 2009; Good et al., 2012; Walton & Cohen, 2007). Feeling a lower sense of belonging predicts women's lower interest and intentions to pursue academic courses and fields.

However, much less work has examined others' perceptions of belonging and the influence of those perceptions. People have stereotypes about how much others belong to a certain group (e.g., Cheryan & Monin, 2005; Ho et al., 2011), and these perceptions can be the basis of exclusion (Verkuyten, 2007; Zou & Cheryan, 2022). Advisors, parents, and peers may also make assumptions about how much belonging girls and women will feel in different situations. These assumptions about someone else's sense of belonging may then guide recommendations. When a gender-balanced alternative is present, people may believe that the women they are advising will feel a lower sense of belonging in a male-dominated opportunity. This assumed lower sense of belonging may constrain women's access to opportunities.

There may be alternative explanations for why people discourage women away from male-dominated opportunities when gender-balanced alternatives are present. People may stereotype women as having lower interest in the male-dominated opportunity (Master et al., 2021) in the presence of a gender-balanced alternative. People may believe that women will be

less successful or have a more difficult time in the male-dominated opportunity when they also see a gender-balanced alternative, perhaps because they stereotype these alternatives as requiring less brilliance or stereotype women as having less ability (Bian, Leslie, Murphy, et al., 2018; Moss-Racusin et al., 2012). People may also be trying to protect women from the discrimination they could face when choosing male-dominated opportunities (Brooks et al., 2014; Moss-Racusin et al., 2012). The current studies examine these alternative explanations.

The Costs of Directing Women Away from Male-Dominated Opportunities

Reinforcing existing disparities by directing women into opportunities where they are already well-represented could have negative consequences for women. Because occupations with fewer women are generally more highly valued and associated with higher pay (Levanon et al., 2009), directing women away from male-dominated opportunities has negative consequences for the status and income of their future careers. Women who major in less (vs. more) male-dominated fields have worse labor market outcomes (Roksa, 2005; Thomas & Zhang, 2005; Xu, 2012). Even within similar job types (e.g., computer science faculty), individuals employed in more gender-balanced subfields are less likely to be employed at highly prestigious institutions (Laberge et al., 2022). Directing women away from male-dominated opportunities shapes their future outcomes.

Current Work

Across three preregistered studies, we test whether women are directed away from male-dominated opportunities when more gender-balanced alternatives are present. Study 1 examines whether people advise women against taking a male-dominated Programming Languages course when a gender-balanced Human Computer Interaction alternative is available compared to when the alternative is a male-dominated Networks course. Study 2 examines whether parents advise

their daughters, but not their sons, against taking a male-dominated Mechanical Engineering course when a gender-balanced Environmental Engineering course is available compared to when the alternative is a male-dominated Electrical Engineering course. Study 3 investigates whether undergraduates advise a woman peer away from a male-dominated Biomechanics course when a more gender-balanced Ecology course is available compared to when the alternative is a male-dominated Biophysics course. Study 3 also examined whether perceptions that women would belong less in the male-dominated course and other potential explanations mediate this effect.

All studies were approved for human subjects research and met all relevant ethical guidelines. Data were analyzed using SPSS or R. All studies' designs, analyses, and hypotheses were preregistered and are publicly available (https://osf.io/d8a9f/?view_only=d41847c8c48440ebbe4306d400ca3b38).

Study 1: People Advise Women Against Male-Dominated Computer Science Courses

We first investigate whether people direct women away from a male-dominated computer science course when a more gender-balanced course alternative is present. We further explore whether effects hold for women across different racial/ethnic groups.

Method

Participants

In line with our preregistration and based on a power analysis, we requested 350 participants residing in the U.S. from Prolific, and 351 responded to the survey. One participant did not consent, and one other response had a duplicate Prolific ID to a prior participant and was excluded. Our final sample size was 349 (56.2% women, 40.4% men, 2.9% nonbinary, 1.1% agender, 0.6% genderqueer, 0.3% other; 96.0% cisgender, 3.7% transgender, 0.3% preferred

another term or were unsure; 77.9% White, 9.7% Asian/Asian American, 9.5% Latinx/Hispanic/Latin American, 8.9% Black/African American, 2.0% Native American/American Indian/Alaskan Native, 0.9% Another racial/ethnic group; 0.6% Middle Eastern, 0.3% Native Hawaiian/Pacific Islander[8,9]). Participants ranged in age from 18 to 79, with a mean age of 34.95 years (SD = 12.79).

Procedure

Participants completed an online questionnaire in which they were asked to imagine that they were an academic advisor at a university. Participants viewed a description of a woman freshman who had taken an introductory computer science course the previous term and was trying to decide which computer science course to take next. The woman was described using a first and last name, and her GPA (i.e., 2.9) was listed. Participants were randomly assigned to see one of 12 first/last name combinations representing 4 racial/ethnic groups (Black American, Asian American, Latina American, White American; names from Pope et al., 2023).

Participants were then shown two potential courses: a first focal course option and an alternative course. All participants read about a male-dominated Programming Languages course as the first course option (focal course; see Table 1 for all course descriptions). Next, participants were randomly assigned to read about a second male-dominated computer science course, Networks, or a gender-balanced computer science course, Human-Computer Interaction, as the

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[8] In all studies, participants were free to select more than one gender and racial/ethnic category, so percentages may not sum to 100%.

[9] To examine for effects of participant gender, we conducted exploratory 2 (course condition) x 2 (participant gender) ANOVAs on likelihood of recommending the first class in Studies 1 and 3. In Study 1, there was no significant main effect of participant gender, $F(1, 333) = 1.76$, $p = .186$, and no significant interaction of participant gender with course condition, $F(1, 333) = 2.01$, $p = .157$. In Study 3, there was a significant main effect of gender such that women were more likely than men to recommend the first course, $F(1, 449) = 7.05$, $p = .01$, but there was no significant interaction of gender with course condition, $F(1, 449) = .24$, $p = .62$.

alternative course (see Table 2 for procedures for all studies). Participants completed the measures listed below, and the survey concluded with demographic questions.

Table 1

Descriptions of Courses for All Studies

	Condition		
Study and Field	Male-Dominated Focal Course	Gender-Balanced Alternative	Male-Dominated Alternative
Study 1: Computer Science	A programming language is used by computer programs to direct computer software. Each computer language has its own syntax and structure and is typically designed for one or more particular algorithms that collectively form a computer program. In programming languages, students can gain experience in type theory, automated theorem proving, language semantics and implementation, and program analysis and optimization.	Human computer interaction is the study of the interaction between people and technology. In human computer interaction, students learn how to design, implement and evaluate ways for people to interact with computing technology. Topics include ways in which people's needs and abilities should influence interface design, how to render and visualize information, and how to use novel devices and modalities to improve interactions.	Networks provide the means for communicating between computers. Networking research includes a broad range of topics that include mobile systems, wireless protocols, ad-hoc networks, Quality of Service management, multimedia networking, peer-to-peer networking, routing, network simulations, active queue management, and sensor networks. In networks, students can gain experience focusing on both the low-level aspects of networking as well as higher-level concerns like security and cryptography.
Study 2: Engineering	Mechanical engineers research, design, develop, build, and test mechanical and thermal sensors and devices, including tools, engines, and machines. In mechanical engineering, students learn to use mechanical and thermal devices to solve problems, design mechanical and	Environmental engineers use principles of engineering, soil science, biology, and chemistry to develop solutions to environmental problems. In environmental engineering, students learn to prepare and review environmental reports, design projects, analyze scientific data, and evaluate environmental improvement	Electrical engineers design, develop, test, and supervise the manufacturing of electrical equipment. In electrical engineering, students learn about the manufacturing of electrical equipment such as electric motors, radar, and navigation systems. Topics include integrated circuits, robotics, power

	thermal devices, develop and test prototypes, analyze test results, and fix faulty devices. Topics include thermodynamics, heat transfer, fluid mechanics, machine design, and system mechanics.	programs. Topics include recycling, waste disposal, public health, and water and air pollution control, climate change, and environmental sustainability.	systems, communication systems, and computers.
Study 3: Biology	Biomechanics students study the mechanical laws relating to the movement or structure of living organisms. In biomechanics courses, students learn about the interplay between mechanics and biological systems. Topics include health, function and disease in living systems, and the use of biomechanics principles to improve the design of medical devices, robotics, and athletic equipment.	Ecology students study the origins, maintenance, or conservation of biological diversity. In ecology courses, students learn about species interactions in biological communities and relationships of communities to environment. Topics include material cycles, biotic diversity, behavioral ecology, the structure of ecological communities, and anthropogenic impacts on ecological communities.	Biophysics students study biological systems and processes using physics-based methods. In biophysics courses, students learn about the ways in which the principles and methods of physics can shed light on complex biological processes. Topics include biological numeracy and estimation, principles of gene regulation, cellular processes, and evolutionary dynamics.

Table 2

Summary of Procedures for All Studies

Variable	Study 1	Study 2	Study 3
Participant scenario	Hypothetical academic advisors choose a computer science course for a woman student.	Parents choose an engineering course for their daughter/son.	Undergraduates choose a biology course for their woman friend.
Focal course (seen by **all participants**)	Programming Languages (15% women)	Mechanical Engineering (18% women)	Biomechanics (38% women)
Male-dominated alternative (Condition 1)	Networks (16% women)	Electrical Engineering (17% women)	Biophysics (30% women)
Gender-balanced alternative (Condition 2)	Human-Computer Interaction (43% women)	Environmental Engineering (43% women)	Ecology (60% women)

Measures

Course Choice. Participants were asked which of the two courses they recommended for the woman student (forced-choice).

Likelihood of Recommending Programming Languages (focal course). Participants responded to a continuous measure of recommendation consisting of two items: "How likely would you be to recommend that this student take a programming language course?" and "How much do you think this student's next course should be programming languages?" Both items were measured on a scale of 1 to 7. This scale had high reliability, $r_s = .76$.

Attention Check. We included a multiple-choice question to assess whether participants remembered the student's gender. Almost all (93%) of participants remembered the student's gender correctly. Excluding participants who did not correctly remember the student's gender generates similar results.

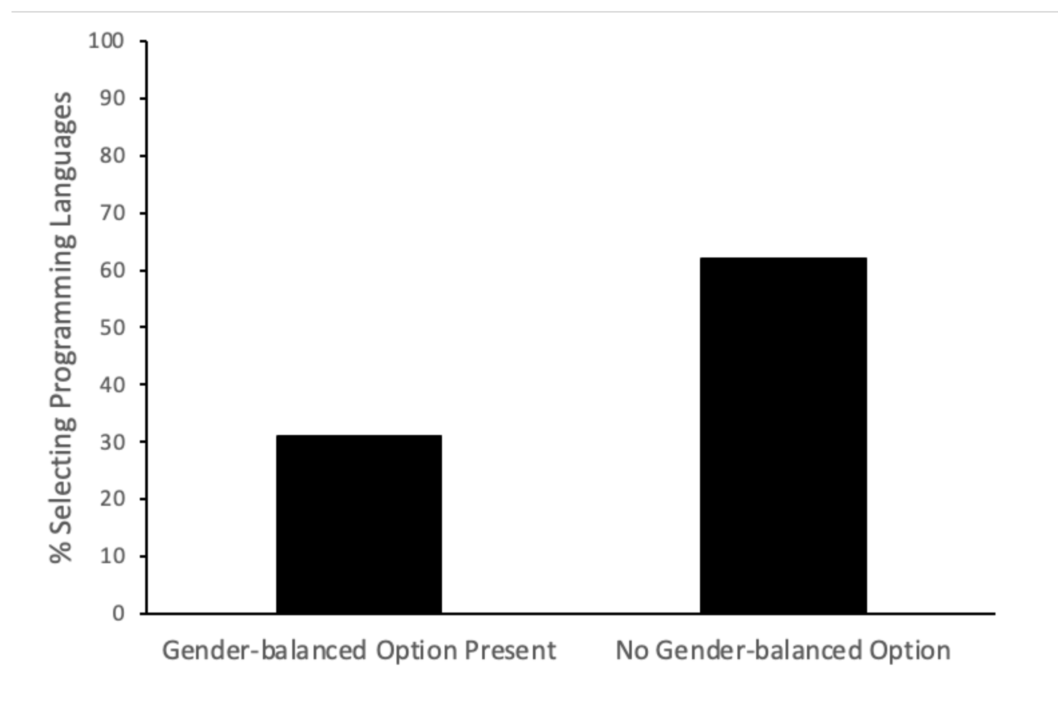
Results

Choice and Recommendation

As predicted, significantly fewer participants selected Programming Languages (focal course) as the next course when the gender-balanced Human Computer Interaction course was the alternative (31%) than when the male-dominated Networks course was the alternative (62%), χ^2 (1, N = 349) = 33.02, $p < .001$ (see Figure 2).

Figure 2

Percent Recommending Programming Languages Depending on Alternative Course Option



As predicted, people were less likely to recommend Programming Languages (focal course) when the gender-balanced Human Computer Interaction course was the alternative (M = 4.31, SD = 1.35) than when the male-dominated Networks course was the alternative (M = 4.75, SD = 1.34), $t(346.93) = -3.13$, $p = .002$, $d = 0.33$.

Race/Ethnicity Effects

We next examined whether the race of the student moderated results. In a preregistered 2 (second course: Human Computer Interaction vs. Networks) × 4 (racial group of student name: Asian American, Black American, Latinx American, or White American) ANOVA on likelihood of recommending Programming Languages (focal course), we found no main effect or interaction with racial/ethnic group, $F(3, 341)$'s < .60, ps > .62, suggesting that effects of more gender-balanced alternatives may hold across students of different racial/ethnic groups.

Stimulus Effects

We followed recommendations from Judd et al (2012) to test for name stimulus effects by using a linear mixed-effects model. We entered which course they saw second (HCI = -1/2, Networks = 1/2) as a fixed effect and stimulus as a random effect. The overall effect of course remained significant across the 12 names that were used, $F(1, 347) = 9.78$, $p = .002$.

Discussion

Participants were less likely to recommend that a woman student take a male-dominated Programming Languages course (focal course) when a gender-balanced Human Computer Interaction course was available than when the alternative was not gender-balanced. Course recommendations did not appear to be influenced by the race of the student.

Study 2: Parents Advise Their Daughters, But Not Sons, Away from Male-Dominated Engineering Courses

Study 2 examines whether parents are less likely to recommend a male-dominated engineering course for their daughters versus for their sons when a gender-balanced course alternative is present. Whereas the previous study asked about hypothetical women, this study asks parents about their actual children.

Method

Participants

Participants were recruited via the Prolific online research platform. We requested 710 participants, and 726 individuals responded to the online survey. After applying the preregistered exclusion criteria, five participants who did not respond to at least one survey item were eliminated, leaving responses from 721 U.S.-based adults (50.1% women, 49.7% men, 0.6% nonbinary; 99.0% cisgender, 0.1% transgender, 0.1% prefer another term or unsure, and 0.7%

did not respond). In order to be eligible to complete the study, participants had to have at least one child. Participants ranged in age from 24 to 83, with an average of 46.58 years (*SD* = 12.10). In terms of racial/ethnic identification, 81.1% identified as White, 7.8% identified as Latino/a/ Hispanic/ Latin American, 7.4% of participants identified as Black/ African American, 5.8% identified as Asian/ Asian American, 1.8% identified as Native American/ American Indian/ Alaskan Native, 0.7% identified as Native Hawaiian/ Pacific Islander, 0.6% of participants identified with another racial/ethnic group from those listed, 0.1% identified as Middle Eastern/ Middle Eastern American. Household incomes ranged from less than $10,000 to over $200,000 per year with an average of between $50,000 and $75,000 per year.

Parents were randomly assigned to report on either their oldest (*N* = 360) or youngest (*N* = 361) child. The children that parents reported on were 47.6% girls or women, 51.3% boys or men, 1% nonbinary, and .1% identify with another term or option not listed. While we do not have an adequate sample size to examine recommendations in nonbinary or other gender expansive subgroups in the current study, this should be investigated in future work. In terms of race, 81.3% of the children were White, 9.4% were Black/ African American, 9.3% were Latino/a/ Hispanic/ Latin American, 7.8% were Asian/ Asian American, 1.7% were Native American/ American Indian/ Alaskan Native, 1.0% were another racial/ethnic group from those listed, 0.8% were Native Hawaiian/ Pacific Islander, and 0.3% identified as Middle Eastern/ Middle Eastern American.

Procedure

Participants were asked to imagine that their child was a freshman in college. Participants imagined that their child had taken an introductory engineering course last term and enjoyed it, and was seeking advice about which engineering course to take next. Participants were then

provided with information about two potential courses. All participants saw a description of a male-dominated Mechanical Engineering course (focal course) as the first course option. Participants were then randomly assigned to view a second male-dominated engineering course, Electrical Engineering, or a gender balanced engineering course, Environmental Engineering, as the alternative (see Table 1). After viewing information about two courses, participants indicated which class they would recommend their child take next. Finally, participants responded to demographic questions.

Measures

Next Course. Participants responded to the question “Which class would you advise [child] to take?” by selecting one of the two courses for which they read descriptions.

Likelihood of Recommending Mechanical Engineering (focal course). Participants responded to the prompts “How likely would you be to recommend that [child] take a mechanical engineering course?” and “How much do you think [child’s] next course should be mechanical engineering?” on a scale from 1 to 7. These two items were highly related (r_s =.84) and a combined average was used for analyses.

Results

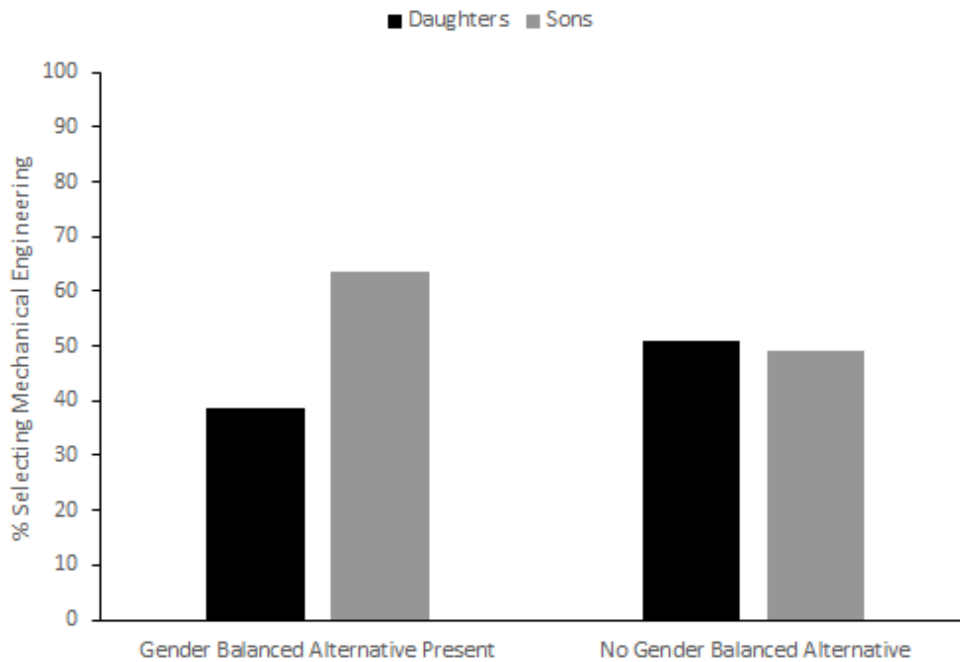
First, we conducted a logistic regression analysis examining how many participants selected Mechanical Engineering (focal course) as the next course their child should take based on the condition to which they were assigned (gender balanced course alternative present (1) vs absent (0)), the gender of their child for whom they were choosing a course (son (1) vs daughter (0)), and the interaction between the two. Results revealed a significant effect of condition, B = .63, SE = .21, $Wald$ = 8.57, p = .003, $Exp(B)$ = 1.87, 95% CI = [1.23, 2.85], no significant effect of whether parents were making a recommendation for their son versus daughter, B = .08, SE =

.21, *Wald* = .14, p = .71, *Exp(B)* = 1.08, 95% *CI* = [.71, 1.64], and a significant interaction between the two, B = -1.13, *SE* = .31, *Wald* = 13.56, $p < .001$, *Exp(B)* = .32, 95% *CI* = [.18, .59]. For sons, the presence of a gender-balanced alternative increases the odds of participants selecting Mechanical Engineering by 87%. For daughters, the presence of a gender-balanced alternative decreases the odds of participants selecting Mechanical Engineering by 40%.

We also conducted chi-squared analyses, as preregistered, to examine which course parents recommended for sons and daughters when the course alternative was male-dominated and when the course alternative was gender-balanced (see Figure 2). When participants were presented with the male-dominated alternative (Electrical Engineering), there was no significant difference in the proportion of parents who recommended mechanical engineering as the next course for daughters (50.9%) versus sons (48.9%), χ^2 (1, N = 355) = 0.14, p =.71. In contrast, when parents were presented with a more gender balanced alternative (Environmental Engineering), they were significantly less likely to choose mechanical engineering as the next course for daughters (38.5%) compared to sons (64.2%), χ^2 (1, N = 350) = 23.13, $p < .001$. There was no effect of child age, such that participants did not make significantly different recommendations based on whether they were imagining their oldest versus youngest child, χ^2 (1, N = 718) = 2.01, p = .16.

Figure 2

Percent of Parents Selecting Mechanical Engineering Depends on Alternative Course Option



Next, a 2 (child gender: daughters vs. sons) x 2 (second course option: Environmental Engineering vs. Electrical Engineering) ANOVA on likelihood of recommending Mechanical Engineering (focal course) revealed a main effect of child gender, $F(1, 700) = 15.92$, $p < .001$, $\eta_p^2 = .02$, no significant main effect of course alternative condition, $F(1, 700) = .59$, $p = .44$, $\eta_p^2 =.001$, and the predicted significant interaction between child gender and second course option, $F(1, 700) = 6.08$, $p =.01$, $\eta_p^2 = .01$. Child age (youngest vs. oldest) did not significantly predict parent likelihood of recommending Mechanical Engineering (focal course), nor did it interact with child gender or condition to significantly influence outcomes (all ps > .30).

Bonferroni-corrected follow-up simple effect tests to our original 2 (child gender: daughters vs. sons) x 2 (second course option: Environmental Engineering vs. Electrical Engineering) ANOVA indicated that parents did not significantly differ in their likelihood of

recommending Mechanical Engineering (focal course) for daughters (M = 4.70, SD = 1.43) and sons (M = 4.87, SD = 1.31) when they were choosing between two male-dominated courses, $F(1, 704) = 1.26$, $p = .26$, partial $\eta^2 = .002$, but were significantly less likely to recommend Mechanical Engineering for a daughter (M = 4.36, SD = 1.54) than a son (M = 5.05, SD = 1.43) when a gender-balanced alternative was available, $F(1, 704) = 20.75$, $p < .001$, partial $\eta^2 = .03$.

Discussion

Parents were less likely to recommend that their daughters, compared to sons, take a male-dominated Mechanical Engineering class when a gender-balanced alternative (Environmental Engineering) was also available. When a gender-balanced alternative was not present, parents were equally likely to recommend Mechanical Engineering to their daughters and sons. Daughters, but not sons, are more likely to be advised away from traditional male-dominated courses when a gender-balanced alternative is available.

Study 3: Peers Advise Women Away from Male-Dominated Biology Courses

Study 3 examines whether undergraduates direct a woman peer away from taking a male-dominated Biomechanics course to a greater extent when the alternative is a more gender-balanced Ecology course compared to a similarly male-dominated Biophysics course. Biology is female-dominated at the undergraduate level (Cheryan et al., 2017), providing an opportunity to examine whether the effect occurs even within fields that are not male-dominated overall. Study 3 also tests perceptions of the student's belonging, success, interest, and expectations of discrimination and difficulty as potential mediators of this effect.

Method

Participants

Undergraduates were run online through the psychology participant pool (*N* = 324), in lab through the psychology participant pool (*N* = 120), or by handing out questionnaires in public spaces on campus (*N* = 29). In line with the preregistered exclusion criteria, three participants who did not respond to at least one item were eliminated, leaving 470 participants (61.9% women, 34.9% men, 2.1% nonbinary, 0.6% genderqueer, 0.4% unreported gender, and 0.2% another unlisted gender). Approximately half (56.4%) identified as Asian/Asian American, 39.4% identified as White, 7.0% identified as Latino/a/Hispanic/Latin American, 3.2% identified as Black/African American, 2.6% identified as Middle Eastern/Middle Eastern American, 1.1% identified as Native Hawaiian/Pacific Islander, 1.1% identified as Native American/American Indian/Alaskan Native, 0.6% did not report race/ethnicity, 0.2% identified as Biracial, and 0.2% identified as Indian. Participants ranged in age from 18 to 46, with an average of 19.41 (*SD* = 2.29) years.

Procedure

Participants imagined that they were helping their friend decide which one of two courses to take using the same procedures as Study 1 with the following exceptions. First, the courses were in biology and consisted of the male-dominated Biomechanics as the focal course (described as 69% men, 31% women), the male-dominated alternative Biophysics (described as X), and the more gender-balanced Ecology (described as Y; see Table 1). Second, participants were asked to answer additional questions on the mediators (see below). Participants completed the measures listed below, on scales from 1 *(Not at all)* to 7 *(Very much)* unless otherwise noted, and the survey concluded with demographic questions.

Measures

Next Course. Participants were asked which of the two courses (Biophysics or Ecology) they recommended for the woman student (forced choice).

Likelihood of Recommending Biomechanics (focal course). Recommendation for the Biomechanics was measured using a combined average of the same two items as the previous study (r_s =.60).

Perceived Belonging in Biomechanics (focal course). Four items were combined to measure how much the friend was perceived to belong in Biomechanics: “How isolated would your friend be in a biomechanics course?”, “How much does your friend belong in a biomechanics course?”, “How much would your friend fit in with the students in a biomechanics course?”, and “How much would your friend fit into the environment of a biomechanics course?” (α = .68).

Perceived Interest in Biomechanics (focal course). Three items were combined to assess how interested the friend was in Biomechanics: “How much do you think your friend wants to take a biomechanics course?”, “How much do you think your friend would enjoy taking a biomechanics course?”, and “How interested do you think your friend would be in a biomechanics course?” (α =.88).

Perceived Discrimination in Biomechanics (focal course). Four items were combined to assess the amount of discrimination the friend would face in Biomechanics: “How much do you think students in a biomechanics course would negatively stereotype your friend based on her gender?”, “How much would people of your friend's gender be respected by others in a biomechanics course?”, “How concerned would you be that people of your friend's gender would not be valued in a biomechanics course?”, and “How likely would your friend be to encounter discrimination in a biomechanics course?” (α =.86).

Perceived Success in Biomechanics (focal course). Two items were combined to measure the friend's perceived success in biomechanics: "How successful would your friend be in a biomechanics course?" and "How good do you think your friend would be at biomechanics?" (r_s =.80).

Perceived Difficulty of Biomechanics (focal course). Two items measured perceived difficulty of the Biomechanics course: "How difficult do you think a course in biomechanics would be for your friend?" and "How difficult do you think an introductory course in biomechanics is?" Because the two items were not highly correlated (r_s =.43), we use the first question, but using the second question generates similar results.

Manipulation Check. A multiple-choice question for each course assessed whether participants remembered the gender representation. Almost all (95.5% for Biomechanics, 97.5% for Biophysics, 98.3% for Ecology) of participants answered correctly. Excluding participants who did not pass the manipulation check generates similar results.

Attention Check. We included a multiple-choice question to assess whether participants remembered the student's gender. Due to a programming error, the first 12 participants run in lab and 70 participants run online did not receive this question. Of the 388 who received this question, almost all (94.1%) of participants remembered the student's gender correctly. Excluding participants who incorrectly remembered student gender generates similar results.

Results

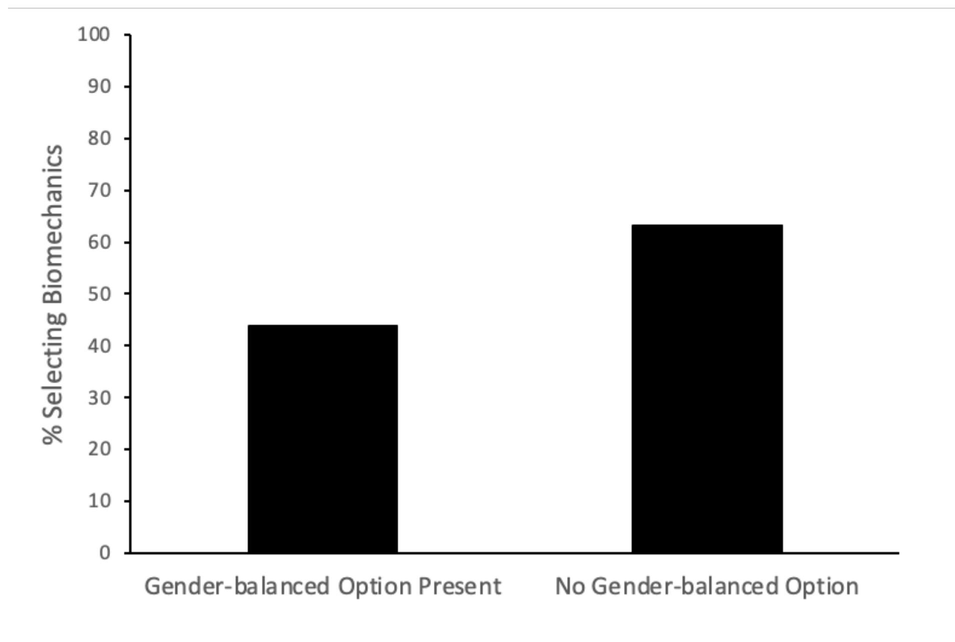
Choice and Recommendation of Biomechanics

Consistent with our preregistered hypothesis, a chi-square test of independence revealed that participants were less likely to choose Biomechanics as the next course for their friend when the second course was Ecology (course with a greater proportion of women) than when it was

Biophysics (course with a lower proportion of women), X^2 (1, $N = 467$) = 17.69, $p < .001$. When Ecology was the alternative, only 43.7% of participants recommended Biomechanics, compared to 63.1% when Biophysics was the alternative (see Figure 4).

Figure 4

Undergraduates' Likelihood of Recommending Biomechanics as a Next Course for their Friend



Also consistent with our preregistered hypothesis, participants were less likely to recommend Biomechanics (continuous choice) when the gender-balanced course (Ecology) was the alternative ($M = 4.29$, $SD = 1.15$) than when the male-dominated course (Biophysics) was the alternative ($M = 4.62$, $SD = .90$), $t(438.11) = -3.45$, $p < .001$, $d = 0.32$.

Turning to the mediators, participants were less likely to believe their friend belonged in Biomechanics (focal course) when the course alternative was Ecology ($M = 4.22$, $SD = 0.89$) compared to Biophysics ($M = 4.52$, $SD = 0.82$), $t(465) = 3.85$, $p < .001$, $d = 0.35$. Participants were also less likely to believe the friend was interested in Biomechanics when the course

alternative was Ecology (M = 4.52, SD = 1.13) compared to Biophysics (M = 4.95, SD = 0.89), t(436.60) = 4.58, p < .001, d = 0.42. Perceptions of belonging and interest in Biomechanics were correlated at r(450) = 0.58, p < .001. There were no significant differences in participants' ratings of how much discrimination they would encounter in Biomechanics (Ecology: M = 3.88, SD = 1.30; Biophysics: M = 3.70, SD = 1.29), t(464) = 1.53, p < .001, d = 0.14, how successful their friend would be in Biomechanics (Ecology: M = 4.51, SD = 1.21; Biophysics: M = 4.62, SD = 1.01), t(447.68) = 1.07, p = .286, d = 0.10, or how difficult Biomechanics would be (Ecology: M = 4.87, SD = 1.01; Biophysics: M = 4.90, SD = .95), t(464) = .23, p = .816, d = 0.03.

We conducted an exploratory simple mediation analysis using 10,000 bootstrapped resamples to test whether lower perceived belonging in Biomechanics mediated the lower likelihood of recommending Biomechanics when Ecology was the course alternative compared to Biophysics[10]. Perceived belonging was a significant mediator, indirect effect = -0.15, 95% bootstrap SE = 0.04, 95% bootstrap CI = [-.23, -.07]. The relationship between alternative course and likelihood of recommending Biomechanics was attenuated when controlling for perceived sense of belonging, direct effect = -0.18, SE = 0.09, t(464) = -1.99, p = .047. The model accounted for 18.6% of the variance in recommending Biomechanics.

[10] We preregistered within-subjects mediation models where we compare recommendations for Biomechanics versus Ecology (dropping participants in the Biophysics condition). Lower perceived belonging in Biomechanics versus Ecology was a significant mediator: a path: b = -0.68, SE = 0.13, t(229) = -5.30, p < .001; b path: b = -1.18, SE = 0.07, t(229) = -16.10, p < .001; c' path: b = 0.41, SE = 0.16, t(227) = 2.65, p = .01; indirect effect = -1.10, 95% bootstrap SE = .13, 95% bootstrap CI = [-1.36, -.84]. This model accounted for 30.6% of the variance in recommending Biomechanics. In the multiple mediation, perceived interest, indirect effect = -0.30, bootstrap SE = .06, 95% bootstrap CI [-.43, -0.18], success, indirect effect = -0.28, bootstrap SE = .08, 95% bootstrap CI [-0.44, -0.12], and discrimination, indirect effect = -0.22, bootstrap SE = .11, 95% bootstrap CI [-0.43, -0.01], were significant mediators but perceived belonging, indirect effect = -0.22, bootstrap SE = .14, 95% bootstrap CI [-0.49, 0.05], and difficulty, indirect effect = -0.01, bootstrap SE = .07, 95% bootstrap CI [-0.15, 0.13], were not. This model accounted for 57.2% of the variance in recommending Biomechanics. Comparing the male-dominated and gender-balanced options may have different (and more) explanations than comparing when the male-dominated option is paired with either gender-balanced versus male-dominated alternatives.

Next, we conducted an exploratory multiple mediation analysis to examine whether perceived belonging remained a significant mediator upon controlling for perceived interest, anticipated discrimination, anticipated success, and perceived difficulty (see Table 2 for correlations and Fig. 5). Perceived belonging remained a significant mediator, indirect effect = -0.05, bootstrap *SE* = .03, 95% bootstrap *CI* [-0.10, -0.01]. Perceived interest also significantly mediated the effect of course alternative on recommending Biomechanics, indirect effect = -0.14, bootstrap *SE* = .04, 95% bootstrap *CI* [-0.22, -0.08]. Anticipated discrimination, *b* = .0002, bootstrap *SE* = .01, 95% bootstrap *CI* [-0.02, 0.02], anticipated success, *b* = -0.02, bootstrap *SE* = .02, 95% bootstrap *CI* [-0.07, 0.02], and perceived difficulty, *b* = -.001, bootstrap *SE* = .01, 95% bootstrap *CI* [-0.01, 0.01] were not significant mediators. The relationship between course alternative and likelihood of recommending Biomechanics was attenuated when controlling for all the mediators, direct effect = -0.10, SE = 0.08, $t(460) = -1.25$, $p = .21$, and the model accounted for 32.9% of the variance in recommending Biomechanics.

Table 2

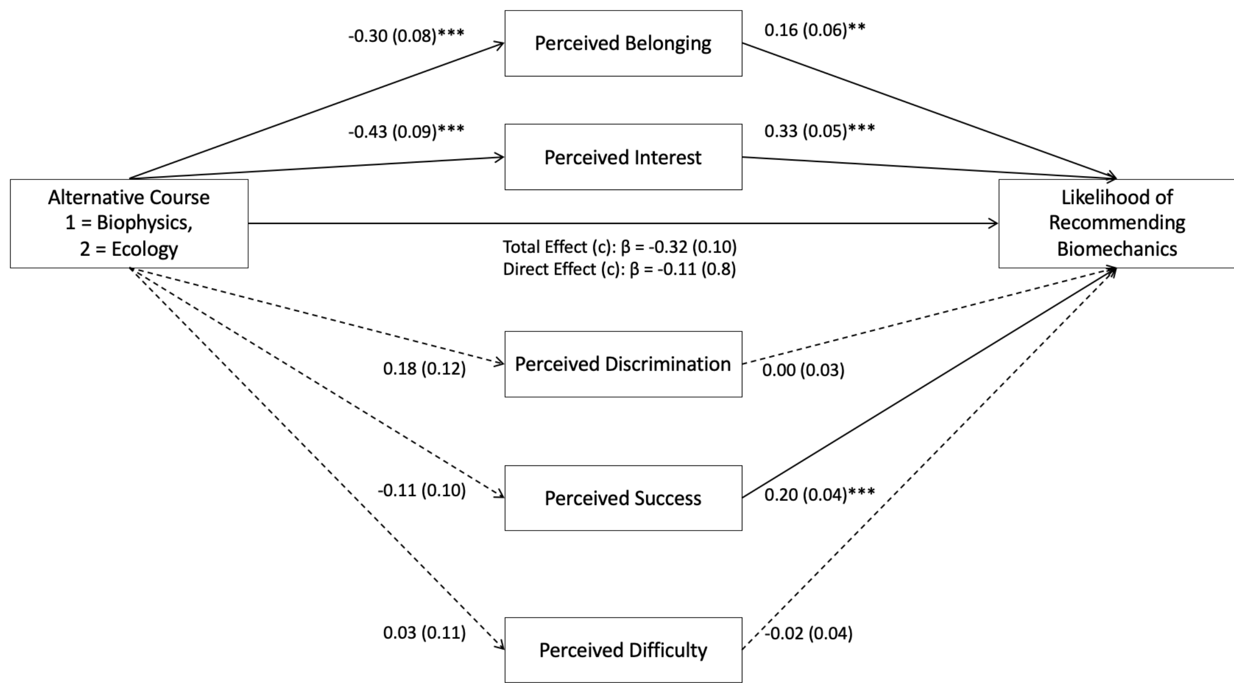
Correlations between Potential Mediators in the Biomechanics Condition

Variable	1	2	3	4
1. Belonging				
2. Interest	.57***			
3. Discrimination	-.33***	-.06		
4. Success	.41***	.46***	.07	
5. Difficulty	-.09	-.02	-.01	-.30***

Note. * $p < .05$; ** $p < .01$; *** $p < .001$.

Figure 5

Perceived Belonging and Interest as Mediators of the Relationship between Alternative Course Option and Likelihood of Recommending Biomechanics as a Next Course



Race/Ethnicity Effects

A 2 (second course: Biophysics vs. Ecology) × 4 (racial group of student name: Asian American, Black American, Latinx American, or White American) ANOVA on likelihood of recommending Biomechanics, we found no main effect or interaction with racial/ethnic group, $F(3, 460)$'s < .73, ps > .53, suggesting that effects of more gender-balanced alternatives may hold across students of different racial/ethnic groups.

Stimulus Effects

Consistent with Study 1, we entered which course they saw second (Ecology = -1/2, Biophysics = 1/2) as a fixed effect and stimulus as a random effect in a linear mixed-effects model. The overall effect of course remained significant across the 12 names that were used, $F(1, 466) = 11.93$, $p < .001$.

Discussion

College undergraduates were more likely to direct a woman friend away from a male-dominated biology course when they had a gender-balanced alternative compared to when they had a male-dominated alternative. Undergraduates perceived that their friend would have a lower sense of belonging and lower interest in Biomechanics when the alternative was gender balanced compared to when it was also male-dominated, and these perceptions subsequently predicted their lower likelihood of recommending the Biomechanics course. These two mediators remained even upon controlling for other possible explanations, including perceptions of discrimination, success, and difficulty of the course.

General Discussion

The availability of more gender-balanced opportunities within a male-dominated field can help reduce gender disparities in the field as a whole. However, these gender-balanced alternatives may have unintended consequences. Three preregistered studies revealed that when a more gender-balanced alternative was present (versus absent), people were more likely to direct women away from the original male-dominated opportunity. This pattern of guidance held true across fields that are currently male-dominated (i.e., computer science and engineering) and also female-dominated (i.e., biology) at the undergraduate level (National Center for Education Statistics, 2022). Hypothetical advisors, parents, and student peers all showed this pattern of

shifting recommendations for the male-dominated opportunity. The availability of more gender-balanced alternatives may potentially limit women's access to high-status and lucrative careers.

Perceptions of women's belonging may help explain this biased pattern of advice. People expected that women would feel like they belong less in the male-dominated opportunity when presented with a more gender-balanced alternative, and thus were more likely to advise women away from a male-dominated course when a gender-balanced course was available than when it was not. However, these assumptions may not be based on reliable evidence or factually accurate.

Perceived interest was also a significant mediator and may play a role in explaining why women are directed away from male-dominated opportunities when gender-balanced alternatives are present. People have stereotypes that girls are less interested than boys in computer science and engineering, and these stereotypes contribute to gender disparities (Master et al., 2021). Our results reveal that stereotypes about girls' lower interest in male-dominated opportunities are magnified when these opportunities are presented alongside more gender-balanced opportunities. This assumption that women are less interested in these male-dominated opportunities drives them to discourage women's participation in them.

Theoretical Contributions

This work makes several important theoretical contributions. First, we merge research on option sets with work on gender disparities to reveal that educational recommendations are influenced by the available alternatives. These recommendations of a particular class, along with perceptions about women's sense of belonging and interest in it, were significantly influenced by the presence or absence of a completely separate and distinct class.

Second, we introduce and establish perceptions of belonging as a potentially new construct with consequences for gender equity. People make assumptions about girls' and women's abilities and interests in male-dominated fields (e.g., Bian, Leslie, & Cimpian, 2018; Master et al., 2021). This work shows that people also appear to have stereotypes about how much women will feel that they belong in male-dominated environments. This perception about others' belonging predicted how much people recommended that women pursue a male-dominated opportunity. In addition to perceptions of belonging, we also uncover perceptions of interest as a second belief that may powerfully shape people's advice to women.

Third, this paper illuminates how advice from important others can reinforce gender disparities. Most of the work on bias and diversity in educational contexts has examined people's own attitudes and perceptions about a context (Dasgupta et al., 2015; Muragishi et al., 2023). Here we shift the lens of explanation for gender disparities in STEM away from students' own interests and perceptions to the recommendations and perceptions of others.

Finally, we test our effects across multiple contexts. For example, we show these effects in male-dominated STEM fields (e.g., computer science and engineering) and in a STEM field that is now granting a majority of degrees to women (e.g., biology; National Center for Education Statistics, 2024). We also establish that these biased patterns of guidance extend to students across multiple racial/ethnic groups. We further test our theoretical model across multiple actors—including advisors, parents, and peers.

Practical Implications

These findings have implications for gender disparities in classrooms and workplaces. If students followed the recommendations given by their parents in Study 2, when a gender-balanced environmental engineering course is not present as an alternative, the Mechanical

Engineering course would end up with roughly equivalent representation of women and men students (50.9% girls or women, 49.2% boys or men). However, when environmental engineering is present as an alternative, the same course would remain male-dominated (38.5% girls or women, 63.7% boys or men). Including a gender-balanced alternative may create a self-perpetuating cycle such that gender inequality in traditionally male-dominated opportunities is reinforced and sustained over time.

We propose four primary recommendations to mitigate the tendency for gender-balanced alternatives to reinforce gender disparities. First, those giving advice should ensure that they consider a range of factors beyond student demographics before guiding students away from or into certain opportunities. Advisors, parents, and peers should avoid assuming that they know where an individual woman will feel the greatest sense of belonging or interest without obtaining more information. Second, efforts should be made to improve the culture of male-dominated opportunities so that those who guide women can recommend options without risking them feeling a low sense of belonging once there. Third, fields should work to adjust the way that opportunities are valued: If opportunities, prestige, and pay were not lesser in more gender-balanced fields (Laberge et al., 2022), the negative consequences of women being directed into gender-balanced alternatives could be minimized. Finally, requiring all students to take a series of high-quality courses covering different subdomains could level the playing field (Cheryan et al., 2017), reducing the gender biases that appear when course choices are unconstrained.

Assumptions About Women's Belonging and Interest

One question might be whether people are accurate in estimating that women will feel a lower sense of belonging and lower interest in a male-dominated opportunity when a gender-balanced alternative is present. Although such perceptions may be rooted in some truth on

average about women's attitudes toward male-dominated fields (e.g., Cheryan et al., 2017), applying them broadly to all women, especially by third parties that may not be able to make predictions about what is best for a particular woman's future, is not only prone to error but is a form of discrimination.

Future Research

Future research could build on our current findings in multiple ways. Researchers could examine the extent to which students follow the advice they are given. Future work could also investigate whether people alter their advice to students with other marginalized social identities (e.g., based on race, social class) based on the alternatives present. For example, NIH launched a new funding program in 2023 called Research With Activities Related to Diversity (ReWARD) to fund "scientists who significantly contribute to diversity, equity, inclusion, and accessibility" (Boone et al., 2023). The presence of such programs may cause scientists of color to be advised by program officers and colleagues to apply through these funding mechanisms over others. Finally, future work could build on the idea of third-person belonging and interest judgments and further study how people's perceptions of others' belonging and interest may influence their behaviors and judgments.

Conclusion

While introducing alternatives that may attract more women can improve representation of women in male-dominated fields as a whole, these practices may have unintentional consequences for women's representation within those fields. Advisors, including parents and peers, may direct women away from male-dominated opportunities when these options are present, perhaps to protect women from feeling a lower sense of belonging. The strategy of introducing new alternatives that appeal to women may inadvertently reinforce gender disparities

within fields and should be approached with care to ensure that it does not exclude women from prestigious and lucrative opportunities.

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Part 3: Does my work matter? Reduced sense of mattering as a source of gender disparities

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Abstract

Women may experience lower rates of entry and success into certain academic and professional spaces because of their observations that their work contributions are less valued than men's. We introduce *sense of mattering* as a mechanism that may help explain women's underrepresentation in male-dominated fields and leadership roles, distinguish it from related constructs, and advance a theoretical framework for how sense of mattering may shape gender disparities. Women's professional contributions are often undervalued, and women perceive and anticipate this unfair disadvantage, which may in turn limit their success, retention, and representation in stereotypically masculine spaces and roles. Attending to sense of mattering has the potential to improve upon past attempts to reduce gender disparities by emphasizing the importance of increasing the extent to which women's contributions are recognized and valued.

Keywords: mattering, bias, gender, social identity threat, belonging, STEM, stereotypes

Does My Work Matter? Reduced Sense of Mattering as a Source of Gender Disparities

I spent probably the first five to six years of my career trying to prove that I could be a contributing member, and that I was a valuable member of the team.

- Michelle Harris (Qtd. in Thomas et al., 2018, p. 6, on being a Black woman in computer science)

My friends coined a word: hepeated. For when a woman suggests an idea and it's ignored, but then a guy says the same thing and everyone loves it.

– *Dr. Nicole Gugliucci (Physics professor, 2017, Viral tweet)*

Whether they are being interrupted and talked over in meetings, not credited for their ideas, or not looked to as valuable team members, women face myriad cues that their work contributions are not valued equally to men's. Past work has examined many factors that contribute to producing and reinforcing gender disparities at work and school, including overt and covert gender bias; masculine environments; women's lower sense of belonging and lower self-efficacy; and lack of early experience with the subject matter (Cheryan et al., 2017; Dasgupta & Stout, 2014; Moss-Racusin et al., 2012). However, women may also pick up on situational cues that their work itself will be undervalued—that their contributions will not be highly regarded and recognized. We name, define, and provide evidence for a construct that may help explain why certain spaces remain gender-imbalanced: disparities in *sense of mattering,* or the extent to which one perceives that one's contributions and work are valued and recognized by others.

Gender disparities are important to examine because they are prevalent in society. Computer science and engineering are a particularly stark example because women's

representation has remained largely constant (e.g., around 20% of computer science and engineering degrees) for the past two decades despite numerous efforts to increase it (National Academies of Sciences, Engineering, and Medicine, 2020; National Science Foundation, 2021). But gender bias is not solely a problem of majority-men fields: while women were awarded 64% of bachelor's degrees in agricultural and biological sciences in 2020 (National Center for Science and Engineering Statistics (NCSES), 2023), they are still underestimated by their male peers in undergraduate biology classrooms (Grunspan et al., 2016) and face high rates of gender bias and sexual harassment from classmates and instructors (Leaper & Starr, 2019). Furthermore, even in fields that are gender-balanced overall, women are consistently underrepresented at leadership and management levels (Haveman & Beresford, 2012). Similar dynamics are also likely at play beyond traditional professional and academic environments. For instance, women athletes are far less recognized for their accomplishments than men (Daniels, 2009; Eastman & Billings, 2000) and face staggering gender disparities in pay and playing conditions (Perras, 2019; Zerunyan, 2017). Gender disparities are prevalent in a wide variety of social contexts.

In this article, we review relevant evidence and establish sense of mattering as a novel construct that could reshape approaches to addressing gender disparities. First, we theoretically distinguish sense of mattering from related constructs and provide initial empirical support for sense of mattering. Next, we discuss evidence that women's contributions are systematically undervalued and overlooked, particularly in majority-men contexts (Bloodhart et al., 2020; Grover et al., 2017; Heilman & Haynes, 2005); that this disadvantage has professional consequences (Lincoln et al., 2012; Roth et al., 2012; Sarsons et al., 2021); and that it can be communicated by situational cues, even those in which gender bias is subtle and not immediately evident (Cortina, 2008; Joshi et al., 2020; Karpowitz & Mendelberg, 2014; Kolev et al., 2019).

These cues may signal to women that their work matters less than men's. We then discuss how attending to sense of mattering promotes a focus on changing environments to better value women's contributions. This focus may in turn benefit work on other sources of gender disparities. Finally, we propose avenues for future research and opportunities for real-world intervention.

Distinguishing Sense of Mattering from Related Constructs

We first describe why sense of mattering may be distinct from other related constructs such as sense of belonging, purpose in life, quest for significance, distinctive treatment, psychological standing, and agentic goals. We then turn to summarizing some initial data assessing the sense of mattering construct and its relation to other commonly-studied related constructs.

Sense of Belonging

Sense of belonging involves a feeling of fit in an environment (Cohen & Garcia, 2008) and positive social attachment to others (Baumeister & Leary, 1995; Walton & Cohen, 2007). Women's lower sense of belonging in spaces in which they are underrepresented is crucial to understanding current gender disparities (e.g., Cheryan et al., 2009; Good et al., 2012; Smith et al., 2013). Belonging uncertainty can undermine the motivation and achievement of marginalized groups (Walton & Cohen, 2007).

However, feeling a sense of belonging in a group or broader environment may be distinct from feeling that one's contributions are recognized and valued[11]. For example, imagine a player on a sports team who is well-liked and fits in with her teammates but rarely gets playing time or

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[11] Sense of belonging is sometimes conflated with aspects of sense of mattering in measurement, particularly in longer scales that include other constructs such as perceptions of bias, trust in instructors, and feeling valued and appreciated (e.g., Good et al., 2012; Moudgalya et al., 2021).

recognition for her athletic skills (high belonging, low mattering). Conversely, a student who takes on most of the responsibility for a group project may be highly valued for boosting the group's grade but could still feel that they don't fit in well with others in the group (low belonging, high mattering).

Some initial work suggests that belonging and mattering may be different constructs. In one paper on sense of belonging in math, some sense of mattering measures were included (e.g., "valued," "respected") and were found to be distinct from and only moderately correlated with a sense of social connection and fit (Good et al., 2012). We argue that sense of mattering and belonging should be assessed separately; receiving recognition as a worthy contributor may be an important motive that is separate from fitting in or perceiving interpersonal bonds (see "Initial Empirical Support for Sense of Mattering" below for initial data distinguishing sense of mattering from sense of belonging).

Interpersonal and Existential Mattering

Feeling that one matters interpersonally and existentially is desirable and important (Gossett et al., 1996; Heintzelman & King, 2014; Marshall, 2001; Raque-Bogdan et al., 2011; Rayle, 2005; Rayle & Chung, 2007; Taylor & Turner, 2001). Interpersonal mattering has been studied as perceiving that others are interested in us, rely on us, or consider us important or significant to them on a personal level (Elliott et al., 2004; Gossett et al., 1996; Marshall, 2001; Raque-Bogdan et al., 2011; Schieman & Taylor, 2001). Existential mattering, or feeling that one's life matters more broadly, has been explored in work on meaning in life and is defined as perceiving that one's actions make a difference in the world and that one's existence has significance, importance, and value (Costin & Vignoles, 2020; George & Park, 2017).

However, sense of mattering in professional and academic contexts is different from interpersonal and existential mattering. Someone could feel that others depend on them and are interested in them as people (interpersonal mattering; Rosenberg & McCullough, 1981), or that their presence in the world is important and valuable in a broad sense (existential mattering; Costin & Vignoles, 2020; George & Park, 2017), while not feeling that others at work value or recognize their contributions. The drive to be recognized and valued for one's work may be an understudied form of mattering that is distinct from motivations to be socially significant to others or to serve a broader existential purpose.

Other Related Constructs

Other constructs we propose are related to but distinct from sense of mattering include psychological standing, agentic goals, distinctive treatment, and intragroup standing. Psychological standing, one's subjective feeling of entitlement to speak up on a social or political topic, is focused on willingness to communicate one's own opinions rather than perceptions of how one is viewed by others (Effron & Miller, 2012). Agentic goals, such as the desire for power and status, are also distinct from sense of mattering. A high sense of mattering does not necessarily mean one has a high degree of power (i.e., control over resources and outcomes related to the work; Anderson & Berdahl, 2002; Fast et al., 2012). Rather, high sense of mattering occurs when one perceives that one's contributions are fairly valued and recognized, regardless of who wields power over final decision-making. Distinctive treatment, in which others seek one out for help or expertise (e.g., "look to you for guidance;" Begeny et al., 2021), may help boost sense of mattering but is likely not necessary to feel that one matters, because professional contributions are not limited to providing assistance to others or being considered an expert. Similarly, intragroup standing, which consists of self-perceptions of one's status within a

group, overlaps with sense of mattering in that it can include the sense that one's opinions and ideas are valued, but is distinct in that it largely focuses on being regarded as a leader (e.g., "seen as a role model for others in the organization;" Begeny et al., 2021). Sense of mattering may be a unique construct that influences people's participation, experiences, and success.

Initial Empirical Support for Sense of Mattering

We conducted a preregistered study (https://osf.io/sz4qn/?view_only=97a66633ba1745918afd9269022210a3) to assess whether sense of mattering may be distinct from related constructs. Undergraduate students (121 women, 120 men) responded to items assessing anticipated sense of mattering in computer science (4 items, e.g., "How much would you feel that your contributions would be recognized by others?"; $\alpha = .94$); interest in computer science (e.g., "How likely are you to take computer science classes in the future?"; $\alpha = .94$; Cheryan, Meltzoff, et al., 2011); anticipated sense of belonging (e.g., "How much do you think you would belong in the field of computer science?"; $\alpha = .95$; Cheryan et al., 2009); anticipated success (e.g., "How successful do you think you would be/are at computer science?"; $\alpha = .92$; Cheryan, Siy, et al., 2011; Correll, 2001); and stereotype threat concerns (e.g., "How anxious would you be about confirming a negative stereotype about your gender in computer science?"; $\alpha = .94$; Cohen & Garcia, 2008; Marx et al., 2005). All items were measured on a scale from 1 *(Not at all)* to 7 *(Very much)*.

As predicted, sense of mattering in computer science among undergraduates was related but not identical to anticipated sense of belonging, $r(240) = .54$; anticipated success, $r(240) = .43$; and stereotype threat concerns, $r(240) = -.21$. We conducted a factor analysis (not preregistered) to further investigate whether these constructs are distinct. Examining a scree plot, eigenvalues, parallel analysis, and optimal coordinates all suggested a 3-factor solution for the

data. A factor analysis with principal axis factoring and promax rotation showed that the items loaded onto three values that cumulatively explained 73% of the variance. The four sense of mattering items all loaded onto one factor. Interest, belonging, and anticipated performance loaded onto another factor, while stereotype threat concerns comprised the final factor. All loadings of items to their respective factors was high (above .6) and there was no cross-loading above .2. These results provide initial evidence that sense of mattering is distinct from related constructs.

Women's Contributions are Undervalued

Women's work is often valued less by others compared to men's. This undervaluing can take three distinct but related forms: actual work contributions being valued less coming from women than men; assumptions that women's contributions will be less valuable than men's; and lack of recognition or credit for women's contributions. All three forms of undervaluing may harm women's sense of mattering.

There are many examples of women's actual work contributions being undervalued. Women undergraduates who are randomly assigned to lead majority-men groups in math tasks are perceived as less competent by group members than when they are assigned to lead all-women groups, even when the women leaders are experienced and knowledgeable in math (Grover et al., 2017). Additionally, voicing ideas in a majority-men team setting does not predict status and leadership emergence for women, though it does for men (McClean et al., 2018). The same work product is rated less favorably when it is said to have been completed by a woman than a man (Davison & Burke, 2000).

Women also face assumptions that their contributions will not be as valuable as men's. These assumptions are evident in cultural stereotypes that associate brilliance with men and not

women (Bian et al., 2018). Qualitative research with Black women engineers and computer scientists has also repeatedly revealed that Black women are excluded socially from study groups and team projects due to assumptions that they are less capable (Charleston et al., 2014). Even after demonstrating competency, Black women report that others continue to hold low expectations for their contributions (Thomas et al., 2018). Women are often assumed to contribute less competence and expertise than they actually do in majority-men group settings.

Women's contributions can also face a lack of recognition or credit. In group work on a task involving leadership and decisiveness, observers fail to recognize women's contributions relative to men's unless given specific information about the different roles each contributor had to fill in order to complete the task (Heilman & Haynes, 2005). Similarly, when undergraduates in science courses identify which classmates they study with, seek help from, find knowledgeable, and perceive to be best in the class, both women and men nominate their women peers at proportions lower than the actual success rates of women, suggesting that they under-recognize the contributions of women and over-recognize the contributions of men (Bloodhart et al., 2020). Social network analysis reveals that men over-nominate their male peers as knowledgeable in biology classes relative to actual performance, leading to a persistent gender gap in nominations (Grunspan et al., 2016). In economics, women are penalized in tenure decisions for coauthoring papers with men: while an additional coauthored paper with at least one woman predicts a slight increase in the probability of receiving tenure, an additional paper coauthored with a man has no effect in predicting tenure prospects, likely because women are under-credited for their authoring contributions relative to men (Sarsons et al., 2021). Not being recognized for one's contributions may be an especially prominent problem for Black women: Black women's contributions in group discussions are least likely to be correctly attributed to

them compared to White women and Black men (Sesko & Biernat, 2010). Women are consistently ascribed less credit for their work contributions than they deserve.

Undervaluing and failing to recognize women's contributions has consequences for their access to professional opportunities, from scholarly awards (Lincoln et al., 2012) and funding allocation (Brooks et al., 2014) to promotion potential ratings (Roth et al., 2012) and hiring (Moss-Racusin et al., 2012). It also may hinder their entry into certain fields; for example, students' perceptions of recognition from others strongly predicted their identification with math even when controlling for self-evaluations of competence (Cribbs et al., 2015). When women's contributions matter less than men's, it therefore broadly contributes to gender gaps in representation, leadership positions, and career achievements.

Situational Cues Contribute to Women's Lower Sense of Mattering

Multiple situational cues can communicate lower sense of mattering to women. Overt gender bias, such as men expressing negative stereotypes about women's abilities, is one clear example (Logel et al., 2009; Spencer et al., 1999). However, subtler cues can also communicate that women's contributions do not matter as much as men's do. For example, selective incivility occurs when certain individuals (e.g., women) are treated with chronic, low-level disrespect and rudeness, which can perpetuate gender disparities (Cortina, 2008). Being interrupted and talked over may also reinforce women's lower sense of mattering. Women face intrusive interruption at disproportionate rates (Blair-Loy et al., 2017; Hancock & Rubin, 2014; Jacobi & Schweers, 2017; Karpowitz & Mendelberg, 2014). Some cues are especially prevalent in certain spaces. For instance, economics (Casselman, 2021) and philosophy (Haslanger, 2008; Moulton, 1983, p. 153) are examples of majority-men fields that are known for cultures of incivility in their

academic spaces and discourse. Cultures of incivility may harm women's sense of mattering and subsequently their representation in certain majority-men fields.

Women are often exposed to situational cues, including those listed above, that communicate lower sense of mattering. Importantly, women often perceive these cues even before they enter majority-men fields (e.g., Bian et al., 2018; Cheryan et al., 2009). Low sense of mattering might therefore harm women's entry and participation before they have the chance to make meaningful contributions.

Additionally, even environments where women and men are not treated any differently could unintentionally communicate a lower sense of mattering to women if they have cultures that privilege masculinity. To extend the interruption example from above, even if men and women are interrupted at the same rates, high-interrupt professional cultures may hinder women's success more broadly because most women are socialized to refrain from intrusively interrupting others (Berdahl et al., 2018; Cheryan & Markus, 2020; Karpowitz & Mendelberg, 2014). Valuing abstract or broad speech is another subtle example of how gendered features of the professional space can communicate a lower sense of mattering. Men tend to speak more abstractly, while women are more likely to use concrete speech (Joshi et al., 2020). While broad speech does not predict performance, it can still be rewarded in grant proposals, which may contribute to gender gaps in scientific funding (Kolev et al., 2019). Even when environments do not explicitly privilege men over women, they may foster masculine cultures in which women are more likely than men to suffer a low sense of mattering.

Perceiving negative stereotypes about women's abilities and interests could also cue women to anticipate that their contributions will matter less than men's in certain fields. Concerns about being devalued (e.g., Davies et al., 2005; Murphy et al., 2007; Purdie-Vaughns et

al., 2008) or stereotyped (Davies et al., 2002; Schmader et al., 2008; Shapiro & Neuberg, 2007; Steele et al., 2002) can deter individuals with marginalized identities from pursuing certain fields and can harm their success and wellbeing. Negative stereotypes may cause lower mattering for women because they may anticipate that their contributions will be undervalued and underrecognized in majority-male workplaces.

Finally, being met with sanctions when one attempts to assert professional mattering may act as a situational cue that reinforces women's sense that their contributions are undervalued and overlooked. Gender backlash occurs when women face social and economic sanctions for violating their assigned gender role (Heilman et al., 2004; Rudman & Fairchild, 2004; Williams & Tiedens, 2016). Seeking positions of power, promoting or negotiating for oneself, or demanding to be heard may backfire for women in professional spaces, and those consequences could communicate lower sense of mattering to women if they observe that their attempts to be recognized for their contributions only lead to being even more severely undervalued. Future work could investigate the extent to which backlash operates not only as a penalty, but as a signal that shapes women's sense of mattering.

Theoretical Contributions of Sense of Mattering

We review several examples of areas of research on gender disparities which may benefit from being investigated through the lens of sense of mattering. Specifically, we propose that (1) sense of mattering is an important construct to name, conceptualize, and measure, (2) sense of mattering is a mechanism that could help us understand why certain gender disparities persist; and (2) overlooking sense of mattering, especially in implementing interventions, may at times have unintended consequences.

Naming, Conceptualizing, and Measuring Sense of Mattering

Establishing and measuring sense of mattering is our first theoretical contribution. Many mechanisms for gender disparities have been identified, including low sense of belonging (Cheryan et al., 2009; Dennehy & Dasgupta, 2017), low confidence (Dennehy & Dasgupta, 2017), social identity threat (Hall et al., 2015), and lack of positive interactions with men (Hall et al., 2018). While a significant body of empirical work has identified that women's work contributions are often underrecognized and undervalued, we argue that naming, conceptualizing, and measuring sense of mattering alongside other constructs is crucial to understanding and remedying gender disparities. If researchers, professional organizations, and academic institutions are aware that disparities persist because women receive cues that their work contributions will be undervalued, they could target interventions more effectively (e.g., introducing group practices that explicitly credit each member's contributions to a product).

Proposing Sense of Mattering as a Mechanism

We propose that sense of mattering should be included alongside other variables for a more complete picture of why some interventions are, or are not, effective. Defining and conceptualizing sense of mattering as a potential mechanism for gender disparities in student outcomes helps us to better understand the processes by which gender disparities are produced and maintained and can be remedied. Future work may find that some documented phenomena hypothesized to operate through other mechanisms may additionally or more powerfully be mediated by sense of mattering.

For example, sense of mattering could help explain why growth mindset interventions are effective, especially when they are endorsed at the instructor level. Past work finds that STEM faculty who hold growth mindsets of intelligence have smaller gender achievement gaps in their classes than STEM faculty who hold fixed mindsets of intelligence, and this effect is mediated

by students' lower expectations that they will be stereotyped and their greater sense of belonging (Canning et al., 2022). However, instructor growth mindsets may also influence students' sense of mattering. For example, welcoming clarifying questions rather than acting as though they are slowing down the class (Yeager et al., 2022) communicates a willingness to value all contributions, not only those that are communicated with the most speed and confidence. Valuing questions from students who are less confident is especially important since students who are underrepresented often hesitate to speak up (e.g., women ask fewer questions in academic seminars than men; Carter et al., 2018). Teacher practices that communicate growth mindsets may work in part because they boost sense of mattering, especially in underrepresented students.

Another example of work that may benefit from investigating sense of mattering as a potential mechanism is research on the benefits of same-gender role models. Seeing same-gender role models increases women's self-efficacy, domain identification, and commitment to pursue STEM careers (Stout et al., 2011). This effect appears to be driven by feeling connected with the same-gender role models, which subsequently makes a future career in the field more plausible (Stout et al., 2011). An additional possibility is that seeing same-gender role models receiving recognition and respect for their expertise may also increase women students' sense of mattering (i.e., their sense that this is a field in which women's contributions can be recognized and valued). Role models bolstering sense of mattering could operate alongside or perhaps even more powerfully than feelings of connectedness between the self and expert. Seeing examples of successful women in the field may increase women's confidence that their own ideas, contributions, and work would be recognized rather than dismissed if they pursued a similar career.

When Overlooking Sense of Mattering Might Backfire

Interventions are likely to fail when women receive signals that their work is not equally valued. This could limit the effectiveness of some interventions in real-life applications, even if they perform well in highly controlled laboratory settings. For example, consider the intervention of normalizing high effort expenditure to increase sense of belonging. Being concerned that one must expend more effort than one's peers to succeed predicts lower sense of belonging and motivation in majority-men fields for women but not men (Smith et al., 2013). The authors suggest that the solution is to manipulate women's perceptions of how success is achieved by emphasizing that "everyone has to put forth high effort to succeed" (Smith et al., 2013). But if a student sees her male classmates being recognized for their ideas, highly valued as contributors, and achieving success while she struggles to be heard, valued, and rewarded for her accomplishments, the gender-blind message that everyone has to work hard may be invalidating rather than encouraging. Assuring women that everyone has to expend high effort to succeed could backfire when situational cues indicate to women that not all effort is equally valued. Interventions that are perceived as ignoring existing differences by using language that implies everyone's experiences are similar may be particularly invalidating.

Another example comes from the self-efficacy literature. Some point to women's behavior, such as evaluating their performance less favorably than equally performing men (Exley & Kessler, 2019), as sources of gender disparities. One intervention strategy, therefore, is to encourage women to develop higher self-efficacy and confidence (e.g., Dickerson & Taylor, 2000; Goodwin et al., 2020; Hartman & Barber, 2020). But in some settings, increasing confidence in one's own value could intensify sense of mattering concerns by highlighting the gulf between one's capabilities and the extent to which they are recognized by others.

Failing to account for sense of mattering could help explain why some interventions fail in the real world, even if they effectively target important realities like women's lower belonging or self-efficacy. Interventions are unlikely to succeed if they fail to address underlying cues that communicate that women's contributions are not valued. Interventions that aim to address women's internal perceptions must simultaneously work to change the behaviors of others, policies, and practices to more accurately recognize and value each contributor.

Future Directions

Our empirical results begin to build the foundation for work on sense of mattering. Future work should continue to investigate disparities in sense of mattering and their potential consequences. Other important areas of inquiry include examining potential moderators, engaging with intersecting social identities, extending beyond traditional academic and professional contexts, and applying knowledge about sense of mattering to help close gender gaps.

Measurement

Future work should examine what makes people feel that they matter in professional and academic contexts. Sense of mattering could be measured in terms of either current work environments or potential work environments (e.g., a field one may be interested in entering). Our work used self-report items that targeted others' interest in one's ideas (e.g., "How much would people in this field be generally interested in what you had to say?"); the sense that one would matter or be valued (e.g., "How much would you feel like you mattered to others in this field?"; "How much would you feel valued by others in this field?"); and recognition of contributions (e.g., "How much would you feel that your contributions would be recognized by others?"). Future research could more thoroughly investigate how sense of mattering can be

measured. Future work could also examine whether there are distinctions between perceptions of how others value one's actual contributions; what others assume about one's potential contributions; and the extent to which one is given recognition and credit, all of which could be components of sense of mattering.

Potential Moderators

Future work should also explore potential moderators of the effect of sense of mattering and identify contexts in which gender disparities in sense of mattering may most strongly influence outcomes. For example, professional mattering concerns may emerge most when domain identification is high. Past work has established that stereotype threat's greatest effects occur when people strongly identify with the domain in which they experience the threat (Steele et al., 2002). Similarly, it may be more important for one's contributions to be valued and recognized the more one identifies with one's work.

The developmental trajectory of sense of mattering is another area for future research and is necessary to identifying optimal sites of intervention. For instance, sense of mattering could be particularly important as adolescents seek opportunities to explore, express agency, and be recognized by others (Marshall, 2001; Rayle, 2005). Conversely, perhaps the importance of sense of mattering intensifies as women become meaningful contributors within their field and notice that their work is systematically undervalued. Future research should examine how factors such as age, position in one's career trajectory, and identification with one's work may influence whether and how strongly sense of mattering contributes to gender disparities.

Other Forms of Identity and Intersectionality

We have largely focused on how sense of mattering may help explain gender disparities. However, future research could examine how disparities in sense of mattering could also help

explain the academic and professional experiences of Black, Indigenous, and other people of color. Work on how sense of belonging informs marginalized racial groups' underrepresentation in certain fields (e.g., Walton & Cohen, 2007) could be improved by attending to the role sense of mattering may play in career choice, success, and wellbeing. Black, Latinx, and Indigenous people may be particularly attuned to the importance of having their work contributions valued because they are forced to contend with pervasive stereotypes of unintelligence (Bergsieker et al., 2010).

Such work could also specifically examine the experiences and sense of mattering of Black women. Qualitative research finds that Black women in computer science higher education settings and careers commonly experience social isolation and assumptions of incompetence, a combination that often leads to exclusion from important collaboration opportunities with peers (Charleston et al., 2014; Thomas et al., 2018). Facing climate threats on the basis of both gender and race may compound lower sense of mattering.

Furthermore, future work could investigate how facing invisibility may accentuate the importance of sense of mattering. Indigenous groups are often intentionally omitted from public awareness (Fryberg & Eason, 2017). Black women are often rendered invisible relative to Black men and White women (Purdie-Vaughns & Eibach, 2008; Sesko & Biernat, 2010). Other identity intersections can also lead to invisibility (e.g., older gay men; Carnaghi et al., 2022). People who already lack recognition and representation based on the identities they hold may have particularly low sense of mattering.

Interrogating the role sense of mattering disparities may play in upholding White supremacy would also enable us to examine how White people can perpetuate biases that result in lower sense of mattering for Black, Indigenous, and other people of color. For instance, the

U.S. was and is built on a foundation of stolen labor and profit, most dramatically through the enslavement of Black people, Reconstruction-era backlash aimed at continuing to exploit formerly enslaved people's labor, and the resulting prison-industrial complex that continues to operate in the present day (Browne, 2007), as well as the stealing of land of Indigenous people (Akee, 2021). The U.S.'s legacy of stolen and forced labor is also a legacy of stealing credit and minimizing contributions: White people have consistently claimed the rewards of work done by Black people, Indigenous people, and other people of color. One example is cultural appropriation, in which a dominant culture co-opts and often profits from cultural traditions or features that are negatively stereotyped or stigmatized when practiced by communities of their cultural origin (Mosley & Biernat, 2021; Rogers, 2006). In workplaces and educational institutions across the U.S., enduring patterns of under-recognizing and undervaluing Black, Indigenous, and other people of color's work may function as tools of White supremacy. These patterns may communicate a lower sense of mattering to members of marginalized racial groups in predominantly White spaces. While White women may be victims of lower sense of mattering in majority-men fields, they may simultaneously be complicit in communicating lower sense of mattering to their colleagues of color. Future work should explore how sense of mattering may influence outcomes at the intersection of multiple identities, including race.

The importance of sense of mattering may also be heightened within a society that in many ways defines human worth through contributions to capitalist production (Berne et al., 2018). For many people in the U.S., survival itself is predicated on being able to work and earn enough money for necessities such as food, housing, and healthcare. In contexts like these, threats to sense of mattering may not only be social and professional, but existential. A worker

whose contributions are not adequately recognized or valued may face consequences that could threaten their very survival.

Disability justice activists have argued that capitalist notions of productivity are central to the oppression and dehumanization of disabled people (Berne et al., 2018). Not only might disparities in sense of mattering reinforce White heteropatriarchy, but our societal emphasis on sense of mattering as a crucial measure of one's inherent worth may itself perpetuate ableism and other intersecting systems of oppression. The power that sense of mattering and its level of cultural importance holds in shaping the experiences of disabled people prompts a rich set of questions for further study.

Finally, transgender people and those whose genders fall under the nonbinary umbrella may be met with transphobia and backlash in professional spaces for deviating from their assigned gender roles (Dray et al., 2020). People with marginalized sexual orientations also face negative stereotypes about their competence and experience pressure to conceal their identities in the workplace (Cech & Rothwell, 2018; Cech & Waidzunas, 2011). These biases may limit the extent to which LGBTQ+ people's work contributions are recognized and respected. Future work could examine whether interventions that prioritize increasing sense of mattering through shifts to the culture of the environment could also benefit LGBTQ+ individuals.

Intervening to Close Gender Gaps

Future work should examine strategies for intervening on behaviors and outcomes that suggest to women that they matter less than men. Crucially, these interventions must address not only women's perceptions of mattering, but the actual mattering of their contributions. Interventions might include introducing systems that explicitly credit each group member for their contributions (see Heilman & Haynes, 2005 for evidence supporting this intervention

strategy); valuing specific speech and recognizing women's discursive contributions; reducing incivility and verbal interruptions; and auditing promotion and award systems to detect and alter biases that lead to women's accomplishments being overlooked. Such interventions may have a positive effect on people of all genders but are especially important for women in stereotypically masculine environments and roles, since women's sense of mattering in these contexts is likely to be lower than men's.

It is not sufficient to only shift women's attitudes about how much they matter without also shifting the larger context that communicates women's mattering. Sense of mattering is rooted in observations of how others value or do not value one's professional contributions. Intervening by communicating to women that their contributions are fairly valued when we know this is often not true would be shortsighted and would likely backfire once it is clear that the cues are not aligned with reality. Perceived dishonesty or hypocrisy regarding who and what is valued can cause disenchantment and disengagement (e.g., Cha & Edmondson, 2006; Greenbaum et al., 2015). We argue that women's perceptions are rooted not in a mindset that needs to be shifted through psychological interventions, but in the reality of working in spaces typically built for men. Low perceptions of mattering might have negative consequences, but it is the reality of mattering disparities that needs to be remedied.

Conclusion

Women's contributions are systematically undervalued in academic and professional fields, social contexts, and roles in which they are underrepresented, which may lead to gender disparities in sense of mattering. Lower sense of mattering may subsequently discourage women from pursuing and persisting in majority-men fields. Attending to sense of mattering may enrich and extend work on how factors such as sense of belonging, self-efficacy, growth mindsets, and

stereotypes about the field help explain gender disparities. Furthermore, examining gender disparities through the lens of sense of mattering highlights the importance of moving beyond existing interventions that focus on women's own perceptions of their ability, belonging, and intelligence. Remedying the cues women receive that their contributions at work do not matter as much as men's may be crucial to closing gender gaps and promoting women's wellbeing and success.

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General Discussion

In Part 1, we found that feedback receptivity from people in power reduces gender, sexual orientation, and disability bias concerns in research labs, work teams, and classrooms. This effect is driven by perceptions of relational leadership, and it backfires if leaders ask for but conspicuously ignore feedback. Part 2 examines an inadvertent negative consequence of a common identity safety strategy—increasing numeric representation of marginalized group members. When a gender-balanced alternative to a male-dominated opportunity is present, parents, peers, and hypothetical advisors advise women but not men away from the male-dominated opportunity, a pattern that stands to strengthen gender disparities over time and may be rooted in biased assumptions about where women belong. In Part 3, we introduce a novel mechanism that may help explain why some identity safety cues work in applied settings and others fail. Sense of mattering may be an understudied but important influence on women's outcomes, and interventions that introduce identity safety cues without changing the extent to which women's contributions are valued may backfire.

Together, this work builds upon the literature to introduce new cues, mechanisms, and boundary conditions that help us better understand how, why, and when identity safety cues can improve members of marginalized groups' outcomes. Attending to generalizability and ecological validity, prioritizing theoretical precision, and verifying internal and statistical validity strengthen the current work's conclusions and relevance.

Theoretical and Methodological Contributions

The current work makes key theoretical and methodological contributions in each of the three domains of best practices identified in the Introduction (see Introduction Table 3). In the domain of generalizability and ecological validity, this dissertation uses stimulus sampling to

examine how perceptions of women may differ based on race (Part 2); integrates a large-scale descriptive field study to increase ecological validity (Part 1); tests three different identity groups, including two that are typically understudied in identity safety cues research (Part 1); tests the central effect in at least three different contexts (Parts 1 and 2); and examines intersectionality (Parts 1 and 2).

In the domain of theoretical precision, the current work considers potential boundary conditions and situational moderators of the effect both empirically (Part 1) and in the development of relevant theory (Part 3). The thorough investigation of mechanism is also a key theoretical contribution: both empirical articles examine not only the proposed mechanism, but other potential mediators that could explain the effect (Parts 1 and 2). Part 1 further employs the causal-chain approach (Spencer et al., 2005) to examine the causal effect of the mechanism itself on the dependent variable, an approach that is still uncommon in identity safety cues research (see Tables 1 and 2). Part 3 investigates mechanism from a theory perspective, introducing and operationalizing a new construct that could act as a mechanism that helps explain the positive effects of identity safety cues.

In the domain of internal and statistical validity, the current work follows many now-common best practices (e.g., preregistration; availability of data and code; power analysis used to determine sample sizes) but also makes several more novel contributions, especially in Part 1. For example, Part 1 identifies several clusters of constructs that are closely related and may operate together (i.e., bias concerns; relational leadership) and provides empirical evidence for the validity of combining them for the purposes of the research. Using factor analysis to examine the underlying structure of novel constructs and scales that combine constructs that have previously been studied independently can increase our confidence in the observed results. We

also audit our References to examine potential biases in who is cited most, and Part 1 includes a statement summarizing our process and these results.

More broadly, this work advances the theory of identity safety cues by:

1. Introducing new identity safety cues (e.g., feedback receptivity).
2. Establishing novel mechanisms that could help explain why some identity safety cues work (e.g., relational leadership; sense of mattering)
3. Examining unintended consequences of the implementation of identity safety cues (i.e.., ignoring feedback given; advising women away from male-dominated opportunities; introducing belonging-focused cues without attending to women's sense of mattering)
4. Expanding generalizability by examining intersectionality, groups typically understudied in identity safety cues research, and multiple identity groups.

Implications and Recommendations

Recommendations for Intervention

The current work gives rise to several holistic recommendations for educators and organizations seeking to integrate new identity safety cues into classrooms and workplaces.

1. **Ask for (and don't ignore!) feedback.** Feedback receptivity reduces bias concerns across multiple marginalized populations (Part 1). Leaders could integrate requests for feedback structurally (e.g., through the practice of sending out anonymous surveys) and promote them interpersonally (e.g., through expressing that they value receiving feedback.) Furthermore, asking for feedback may help generate ideas for, and decide how to prioritize, other identity safety cues. It is crucial to respond to feedback given— we found that asking for but then ignoring feedback was worse than not asking.

As one participant wrote, “[a teacher’s] tone and attitudes carry a lot of weight. But words without actions mean nothing. Don’t say anything about wanting to care about my needs if you don’t mean to carry through.”

2. **Evaluate potential pitfalls when introducing identity safety cues.** As noted above, signaling feedback receptivity was effective, but not if the feedback was conspicuously ignored. Similarly, offering opportunities for women in STEM where women are more highly represented may be an identity safety cue, but when outside advisors assume that women belong *only* in these gender-balanced spaces, women may be blocked from important career opportunities. Most identity safety cues are likely to have caveats like these, easy-to-make or even well-intentioned missteps that could reduce the effectiveness of real-world intervention. Steering away from assumptions about what is best for a marginalized group and integrating only identity safety cues that are authentic are good starting points for maximizing the chances of success.

3. **Offer identity safety cues that go beyond belonging.** While it is crucial to foster environments where everyone feels they belong, identity safety cues must also counter biases that undermine the recognition and perceived value of members of marginalized groups’ contributions. Fostering a high sense of mattering by prioritizing identity safety cues that communicate that each contributor’s work will be recognized and valued is likely to be more effective than focusing on belonging alone. In other words, don’t just invite the woman engineer on the team to lunch— make sure her ideas are respected in meetings.

Recommendations and Reflections for Researchers

Like in any initiative to improve the credibility and validity of scientific practices, the practices that already enjoy robust structural support at the field, university, and lab level were the easiest to employ in this research program. For example, Open Science practices are now commonplace and often expected by journals, so a wealth of resources— including online repositories, forms and templates to aid in preregistration, and easy-to-use packages and software for statistical power analysis—have emerged to support their use. In contrast, stimulus sampling to observe participants' perceptions of diverse targets is still relatively rare. Employing this practice in Part 2 required me and my collaborators to learn new ways of using survey programming functionality, weigh different analytic approaches (e.g., hierarchical linear modeling vs. ANOVAs), and use pretested names from previous work in our lab that may not be readily available to the public. Improving researchers' access to resources that would make practices like stimulus sampling easier, as well as normalizing and expecting experimental methods to attend to intersectionality, could help make these practices more popular.

Importantly, this dissertation benefitted from support at the lab level in practices that are not yet sufficiently supported at the field or university level. Standardized procedures and personnel support within our lab for data analytics checking, citation checking, and citation diversity audits made these practices achievable and normalized the effort required to complete them. Researchers can identify practices they want to make standard within their labs and develop workflows over time that integrate and support their use. Trainees' professional development can also involve implementing these practices.

Often, scientific best practices rely on significant labor to which researchers may not have equitable access. Collecting publicly available emails to recruit participants for the field study in Part 1, verifying all analyses with an independent analyst working in a different software

package, and checking the accuracy of each citation were made possible by hundreds of hours of work from lab managers and research assistants. In a smaller lab, at a university without a steady supply of highly engaged undergraduate research assistants, or without support from the grants that funded lab staff positions, the scope and precision of the work might have been limited. Still, many labs may have access to research assistants but still consider tasks like advanced data analysis beyond their abilities. Training and rewarding mentoring and prioritizing involving undergraduate students beyond simple coding tasks and data collection could be another shift at the lab, university, and field level that would make some time-intensive best practices more feasible.

Seeking to establish generalizability across multiple identity groups and contexts was a particularly rewarding component of this research program. For example, when conducting the research described in Part 1, I was motivated to choose disabled students as our third social identity group after conversations with students and collaborators about how disability is frequently omitted in social identity work. Despite having the smallest sample size, the study with disabled students had the largest effect size out of four studies that used a similar experimental design and materials. If we had not decided to test a traditionally understudied group, we may not have discovered that feedback receptivity appears to be an especially powerful identity safety cue for disabled students. Studying these populations can help us identify which identity safety cues may be particularly effective or ineffective for people whose experiences are often omitted from the literature. This valuable information can then be used to ensure that intervention is maximally productive and does not unintentionally harm understudied groups.

Limitations and Future Directions

While the current work contributes to building a more comprehensive understanding of identity safety cues across social groups and contexts, there are still many opportunities for future research to improve upon this work, especially by expanding to whom we can say the conclusions apply. This dissertation has several notable constraints on generality. All research studies were conducted on participants who live in the United States, so we do not know if effects would persist in other cultures. A global perspective in research on identity safety cues is especially important not only because of crucial cross-cultural differences in how the self and social group memberships are conceptualized (e.g., Markus & Kitayama, 2010), but also because it may reveal prerequisites to the successful application of identity safety cues. For example, in some countries, lack of access to safe and affordable education is a fundamental barrier to girls' downstream participation in STEM, so identity safety cues intended to encourage girls to study STEM fields would likely be irrelevant without addressing their lack of access to school (Cheryan et al., under review).

Other areas in which the present work, and identity safety cues research more broadly, could be expanded by future research include investigating the longitudinal impact of identity safety cues and determining how much exposure is necessary for durable benefits; examining the extent to which the importance and impact of identity safety cues generalizes across different time periods or historic events; and exploring the developmental trajectory of how identity safety cues affect children who are members of marginalized groups. The experiences of other understudied groups, such as transgender and nonbinary people, older adults, and marginalized racial groups should also be examined. While the present work attends to intersectionality through linear models (Part 1) and stimulus sampling (Part 2), many studies still focused on the experiences of one marginalized group at a time. Future work should take an intersectional lens

to further explore how identity safety cues could work differently depending on which combination of group memberships a participant holds.

Finally, while the available literature combined with this dissertation offers an initial look at when identity safety cues can inadvertently go wrong, it would be useful to develop a unified taxonomy or theoretical framework that helps explain when and why these negative consequences occur. When are identity safety cues most likely to draw defensive reactions from dominant group members? Under which circumstances are people most likely to conclude that identity safety cue efforts are inauthentic? And when do paternalistic attempts to protect members of marginalized groups (e.g., by relegating them to shared-identity spaces) emerge from identity safety efforts, and how can this be avoided? Better understanding common pitfalls in applied settings, paired with continued efforts to increase generalizability, could contribute to ongoing advancements in our collective understanding of identity safety cues.

Conclusion

The present work provides evidence for feedback receptivity as a powerful identity safety cue, introduces two novel mechanisms by which identity safety cues can function – relational leadership and sense of mattering— and examines an inadvertent negative consequence of establishing gender-balanced spaces within male-dominated fields to increase identity safety. Together, the theory and methods of this research program help advance a contemporary understanding of identity safety cues' effects, mechanisms, and pitfalls. Research on identity safety cues should attend to intersectionality and understudied groups, examine boundary conditions, and employ rigorous social science methods.

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Part 1 Supplementary Materials

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Supplemental Study. Manipulating Perceptions of Using Power for Good

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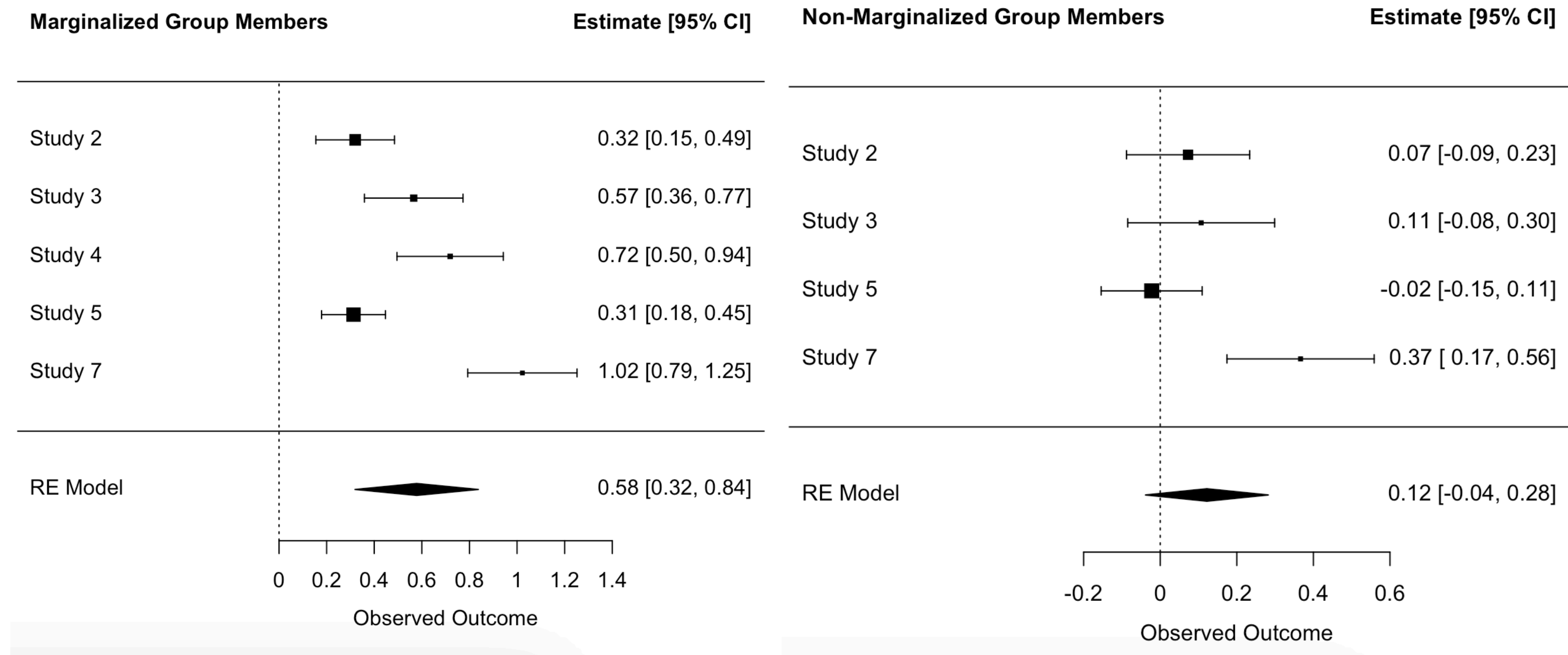
Figure S1

Internal Meta-Analyses of Effect of Feedback Receptivity



Note. Effect sizes reported are the standardized mean change using change score standardization (d_z). We included all preregistered experiments that tested the effect of feedback receptivity (vs. control) on bias concerns. “Marginalized Group Members” refers to women in Studies 2, 5, and 7, LGB+ people in Study 3, and disabled people in Study 4, while “Non-Marginalized Group Members” refers to men in Studies 2, 5, and 7 and straight people in Study 3.

Table S1

Results by Bias Concerns Subscale (All Studies)

Study	Subscale	Identity (i.e., gender, sexuality)	Condition	Condition × identity
1	Negative stereotype concerns	b = 0.95, SE = 0.08, t(917.28) = 12.11, p < .001, 95% CI [0.80, 1.10]	b = -0.08, SE = 0.03, t(908.81) = -2.39, p = .02, 95% CI [-0.15, -0.01]	b = -0.21, SE = 0.05, t(917.76) = -3.89, p < .001, 95% CI [-0.31, -0.10]
	Discrimination	b = 0.42, SE = 0.06, t(912.93) = 7.02, p < .001, 95% CI [0.30, 0.53]	b = -0.10, SE = 0.03, t(898.12) = -4.02, p < .001, 95% CI [-0.15, -0.05]	b = -0.22, SE = 0.04, t(917.40) = -5.36, p < .001, 95% CI [-0.30, -0.14]
	Devaluation	b = 0.07, SE = 0.08, t(912.61) = 0.87, p = .39, 95% CI [-0.09, 0.22][1]	b = -0.29, SE = 0.03, t(899.91) = -8.40, p < .001, 95% CI [-0.35, -0.22]	b = -0.11, SE = 0.05, t(913.88) = -2.03, p = .04, 95% CI [-0.22, -0.004]
2	Negative stereotype concerns	F(1, 295) = 197.78, p < .001, η_p = .40	F(1, 295) = 11.87, p < .001, η_p = .04	F(1, 295) = 3.59, p = .059, η_p = .01[1]
	Discrimination	F(1, 295) = 322.20, p < .001, η_p = .52	F(1, 295) = 5.10, p = .025, η_p = .02	F(1, 295) = 8.06, p = .005, η_p = .03
	Devaluation	F(1, 295) = 172.21, p < .001, η_p = .37	F(1, 295) = 8.52, p = .004, η_p = .03	F(1, 295) = 5.87, p = .016, η_p = .02
3	Negative stereotype concerns	F(1, 207) = 27.98, p < .001, η_p = .12	F(1, 207) = 16.04, p < .001, η_p = .07	F(1, 207) = 9.79, p = .002, η_p = .05
	Discrimination	F(1, 207) = 38.43, p < .001, η_p = .16	F(1, 207) = 26.17, p < .001, η_p = .11	F(1, 207) = 14.57, p < .001, η_p = .07

	Devaluation	$F(1, 207) = 52.76$, $p < .001$, $\eta_p = .20$	$F(1, 207) = 26.86$, $p < .001$, $\eta_p = .12$	$F(1, 207) = 18.48$, $p < .001$, $\eta_p = .08$
4	Negative stereotype concerns	NA	$t(96) = 4.87$, $p < .001$, $d_z = .49$	NA
	Discrimination	NA	$t(96) = 6.13$, $p < .001$, $d_z = .62$	NA
	Devaluation	NA	$t(96) = 7.95$, $p < .001$, $d_z = .81$	NA
5	Negative stereotype concerns	$F(1, 443) = 180.96$, $p < .001$, $\eta_p^2 = .29$	$F(1, 443) = 13.10$, $p < .001$, $\eta_p^2 = .03$	$F(1, 443) = 13.22$, $p < .001$, $\eta_p^2 = .03$
	Discrimination	$F(1, 443) = 226.91$, $p < .001$, $\eta_p^2 = .34$	$F(1, 443) = 7.66$, $p = .006$, $\eta_p^2 = .02$	$F(1, 443) = 15.99$, $p < .001$, $\eta_p^2 = .03$
	Devaluation	$F(1, 443) = 176.78$, $p < .001$, $\eta_p^2 = .29$	$F(1, 443) = 7.74$, $p = .006$, $\eta_p^2 = .02$	$F(1, 443) = 7.74$, $p = .006$, $\eta_p^2 = .02$
6	Negative stereotype concerns	$F(1, 246) = 85.49$, $p < .001$, $\eta_p^2 = .26$	$F(1, 246) = 222.92$, $p < .001$, $\eta_p^2 = .48$	$F(1, 246) = 12.37$, $p < .001$, $\eta_p^2 = .05$
	Discrimination	$F(1, 246) = 117.71$, $p < .001$, $\eta_p^2 = .32$	$F(1, 246) = 326.90$, $p < .001$, $\eta_p^2 = .57$	$F(1, 246) = 23.25$, $p < .001$, $\eta_p^2 = .09$
	Devaluation	$F(1, 246) = 65.74$, $p < .001$, $\eta_p^2 = .21$	$F(1, 246) = 358.88$, $p < .001$, $\eta_p^2 = .59$	$F(1, 246) = 10.72$, $p = .001$, $\eta_p^2 = .04$
7	Negative stereotype concerns	$F(1, 220) = 140.76$, $p < .001$, $\eta_p^2 = .39$	$F(1.90, 416.91) = 81.87$, $p < .001$, $\eta_p^2 = .27$	$F(1.90, 416.91) = 40.32$, $p < .001$, $\eta_p^2 = .16$
	Discrimination	$F(1, 220) = 209.12$, $p < .001$, $\eta_p^2 = .49$	$F(2, 440) = 85.07$, $p < .001$, $\eta_p^2 = .28$	$F(2, 440) = 48.81$, $p < .001$, $\eta_p^2 = .18$

Devaluation	$F(1, 220) = 76.06$, $p < .001$, $\eta_p^2 = .26$	$F(1.78, 392.06) = 149.16$, $p < .001$, $\eta_p^2 = .40$	$F(1.78, 392.06) = 13.41$, $p < .001$, $\eta_p^2 = .06$

Note. [1]indicates that the finding differs in significance level from the full scale results reported in the main text

Table S2

Grand Means and Standard Deviations of Key Measures (All Studies)

Measure	Study 1	Study 2	Study 3	Study 4	Study 5	Study 6	Study 7
	M (SD)						
Feedback Receptivity	5.38 (1.44)						
Bias Concerns	1.68 (0.99)	3.14 (1.58)	2.39 (1.22)	3.52 (1.32)	2.96 (1.48)	3.27 (1.67)	2.99 (1.53)
Relational Leadership			4.87 (1.28)	4.75 (1.36)	4.71 (1.16)		
Power Difference			4.79 (1.41)		4.96 (1.36)		
Sense of Belonging			4.76 (1.47)		4.45 (1.44)		
Masculinity			4.97 (1.20)		5.16 (1.25)		
Procedural Justice			5.16 (1.37)		4.82 (1.27)		

Note. Reported means are across all groups (i.e., conditions and demographic categories).

Table S3

Counterbalancing Procedures and Order Effects (S2-S7)

Study	Significant order effects	How were conditions presented?
2	Order × condition, gender × order × condition: effect driven by control condition being presented first	Two conditions in counterbalanced order with questions after each.
3	None	Side-by-side (left-right order counterbalanced), then questions starting with left condition
4	Order × condition: effect present across orders, but greater when feedback condition was presented first	Side-by-side (left-right order counterbalanced), then questions starting with left condition
5	None (when excluding participants who failed either attention check, there is an order × condition effect)	Side-by-side (left-right order counterbalanced), then questions starting with left condition
6	Main effect of order: across gender and condition, bias concerns were greater when the high (vs. low) relational leadership leader was presented first	Side-by-side (left-right order counterbalanced), then questions starting with left condition
7	None	Baseline control first, then two experimental conditions in counterbalanced order (not side-by-side)

Note. <note about dropping attention check>

Table S4

Between-Subjects Robustness Checks on Bias Concerns (S2, S3, S4, S5, S7)

Study	Comparison	Identity groups	Between-subjects simple effects	
			Marginalized identity group	Non-marginalized identity group
2	Feedback vs. control	Women, men	$t(293) = 1.94$, $p = .054$[1], $d_s = 0.28$	$t(293) = 1.40$, $p = .163$, $d_s = -0.28$
3	Feedback vs. control	LGB+, straight	$t(205) = 2.02$, $p = .044$, $d_s = 0.36$	$t(205) = 1.12$, $p = .265$, $d_s = 0.24$
4	Feedback vs. control	Disability	$t(95) = 3.29$, $p = .001$, $d_s = 0.67$	NA
5	Feedback vs. control	Women, men	$t(441) = 2.42$, $p = .016$, $d_s = 0.29$	$t(441) = 0.86$, $p = .391$, $d_s = 0.13$
7	Response vs. ignore	Women, men	$t(218) = 9.70$, $p < .001$, $d_s = 1.73$	$t(218) = 2.26$, $p = .025$, $d_s = 0.46$

Note. [1] indicates that the finding differs in significance level from the within-subjects results presented in the main text. Studies 3-6 compare the first condition participants responded to questions about. Participants viewed stimuli for both conditions on the same page before answering questions about each (see Table S3).

Table S5

Correlations Between Potential Mediators (Study 3)

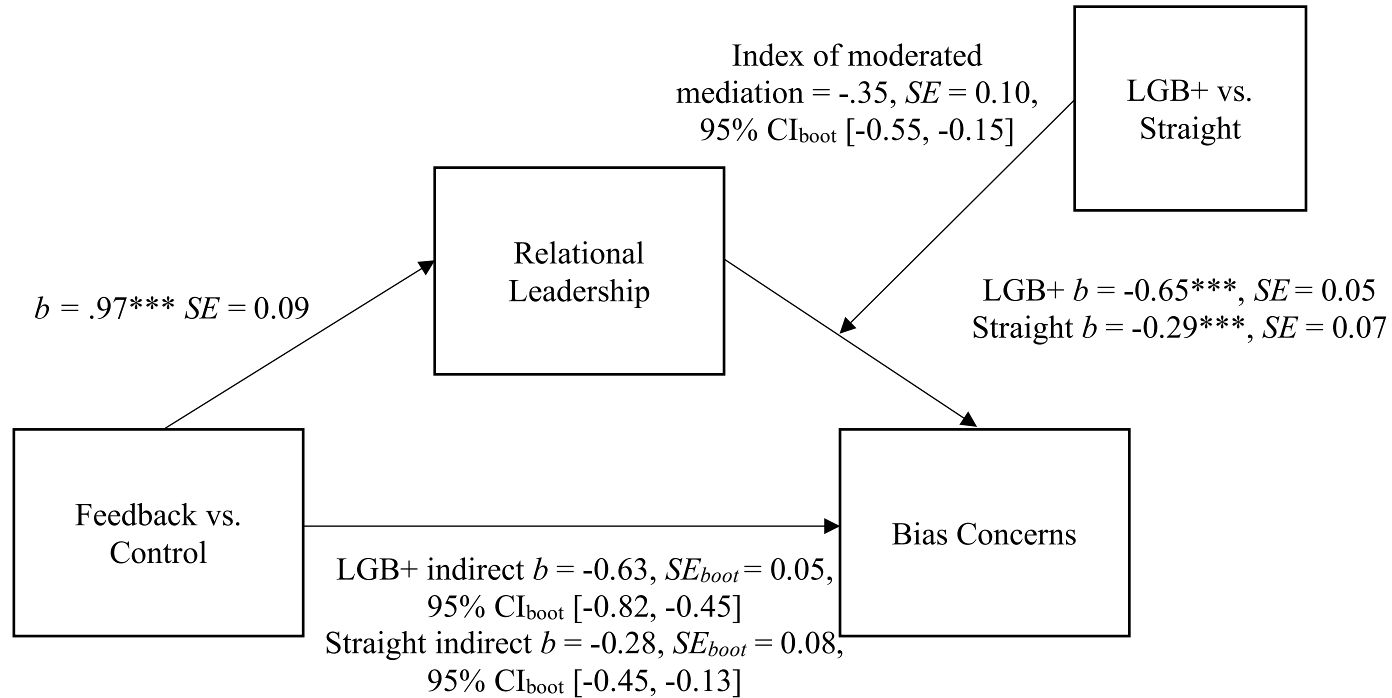
Variable	1	2	3	4	5	6
7. Relational leadership		-.28***	.79***	.71***	.12	-.62***
8. Power difference	-.43***		-.24***	-.19**	.25***	.23**
9. Procedural justice	.86***	-.42***		.66***	.12	-.65***
10. Sense of belonging	.83***	-.40***	.76***		.22**	-.58***
11. Leader's masculinity	-.13	.26***	-.18**	-.15*		-.03
12. Bias concerns	-.60***	.21**	-.63***	-.66***	.15*	

Note. Correlations for the feedback condition are reported above the diagonal, while correlations for the control condition are reported below the diagonal.

*** denotes significance at the .001 level; ** denotes significance at the .01 level; * denotes significance at the .05 level.

Figure S2

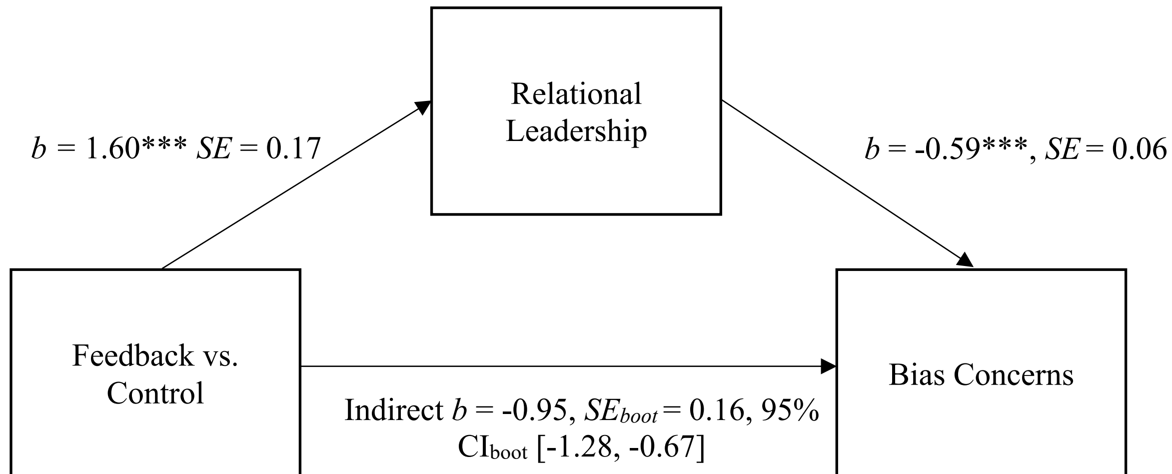
Moderated Mediation Results: Feedback Receptivity (vs. Control) to Bias Concerns Through Relational Leadership (Study 3)



Note. *** Indicates significance at the $p < .001$ level for effects without confidence intervals. $R^2 = 0.44$.

Figure S3

Mediation Results: Feedback Receptivity (vs. Control) to Bias Concerns Through Relational Leadership (Study 4)



Note. *** Indicates significance at the p < .001 level for effects without confidence intervals. R^2 = 0.47. All Study 4 participants were disabled students (no comparison group).

Table S6

Fit Indices for Exploratory Factor Analysis Extracting 3 and 4 Components with All Potential Mediators

Measure	3-factor solution	4-factor solution
Components	Relational leadership + procedural justice; belonging; power difference + masculinity	Relational leadership; Procedural justice; belonging; power difference + masculinity
Cumulative prop. variance explained	.75	.80
TLI (higher = better)	.79	.88
BIC (lower = better)	4565.55	1963.17
RMSR (lower = better)	.04	.03

Note. Analyses were conducted with principal axis factoring and promax rotation on a merged dataset containing all items from all mediators in Studies 3 and 5. The 4-factor solution performs better on all listed fit indices, leading us to retain relational leadership and procedural justice as separate constructs.

Table S7

Separate Within-Subjects Moderated Mediation Analyses to Determine Eligibility for Multiple Mediation (Study 5)

Mediator	Women's indirect effect			Index of moderated mediation		
	b	Bootstrap *SE*	95% bootstrap CI	*b*	Bootstrap *SE*	95% bootstrap CI
Power difference	-0.48	0.07	[-0.63, -0.36]	-0.38	0.08	[-0.55, -0.23
Procedural justice	-0.46	0.07	[-0.59, -0.33]	-0.31	0.07	[-0.45, -0.18]
Sense of belonging	-0.17	0.05	[-0.28, -0.08]	-0.10	0.04	[-0.20, -0.03]
Masculinity	-0.21	0.07	[-0.36, -0.09]	-0.31	0.08	[-0.47, -0.15]

Table S8

Multiple Mediation Results: Comparing Mediator Strength (Studies 3 and 5)

Mediator	LGB+ participants (Study 3)			Women participants (Study 5)		
	Indirect effect	Bootstrap *SE*	95% bootstrap CI	Indirect effect	Bootstrap *SE*	95% bootstrap CI
Relational leadership	-0.60	0.20	[-1.01, -0.22]	-0.37	0.09	[-0.55, -0.21]
Power difference	-0.15	0.15	[-0.47, 0.12]	-0.11	0.06	[-0.23, 0.01]
Procedural justice	-0.10	0.18	[-0.45, 0.27]	-0.12	0.08	[-0.28, 0.03]
Sense of belonging	-0.04	0.11	[-0.25, 0.19]	-0.03	0.04	[-0.12, 0.04]
Masculinity	-0.13	0.09	[-0.30, 0.03]	-0.02	0.04	[-0.09, 0.07]

Note. Overall model R^2 = .54

Table S9

Participants' Self-Described Disabilities (Study 4)

Disability category	Percent of participants[a]
ADHD	35.1%
Unspecified mental disability or neurodivergence	24.7%
Anxiety disorders	21.6%
Autism	16.5%
Depression	12.4%
Chronic pain (including fibromyalgia)	7.2%
Unspecified physical disability or chronic illness	6.2%
Mobility impaired, including temporary	6.2%
Dysgraphia or dyslexia	4.1%
Deaf or hearing impaired	3.1%
Blind or vision impaired	3.1%
Diabetes	3.1%
Chose not to answer	3.1%
OCD	2.1%
PTSD/cPTSD	2.1%
IBD/Chron's disease	2.1%
Chronic fatigue	2.1%
Epilepsy	1.0%
Hypermobility	1.0%
POTS	1.0%
Speech disorders	1.0%
Hypothyroidism	1.0%
Eating disorders	1.0%
Information processing disorders	1.0%
Bipolar disorder	1.0%

Note. Disability categories were generated by grouping participants' open responses to the question, *"How do you describe your disability? Feel free to provide as much or as little specificity as you want."*

[a] Percentages do not add to 100% because 38.1% of participants identified with more than one disability.

Table S10

Factor Analysis for Relational Leadership Scale (Studies 3, 4, and 5)

Study	Eigenvalue of 1-factor solution	Proportion variance explained	Minimum factor loading
3	7.69	.77	.83
4	7.48	.75	.82
5	7.22	.72	.78

Note. All analyses were conducted with principal axis factoring and promax rotation.

Table S11

Moderated Mediation for Each Component of Relational Leadership (Study 3)

	LGB+		Straight		LGB vs. straight		
Component	Indirect effect *(SE)*	95% bootstrap CI	Indirect effect *(SE)*	95% bootstrap CI	Index of moderated mediation *(SE)*	95% bootstrap CI	R^2
Relationality	-0.58 (0.09)	[-0.76, -0.40]	-0.19 (0.07)	[-0.34, -0.06]	-0.39 (0.10)	[-0.58, -0.20]	.36
Trust	-0.45 (0.08)	[-0.61, -0.30]	-0.24 (0.06)	[-0.36, -0.12]	-0.21 (0.08)	[-0.37, -0.07]	.44
Use power for good	-0.52 (0.08)	[-0.69, -0.36]	-0.23 (0.09)	[-0.41, -0.06]	-0.29 (0.10)	[-0.50, -0.09]	.36

Table S12

Simple Mediation for Each Component of Relational Leadership (Study 4)

Component	Indirect effect *b*	Indirect effect bootstrap *SE*	95% bootstrap CI	R^2
Relationality	-0.78	0.14	[-1.09, -0.52]	.42
Trust	-0.60	0.13	[-0.87, -0.37]	.32
Use power for good	-0.87	0.19	[-1.26, -0.52]	.39

Note. All Study 4 participants were disabled students, so there is no comparison group for moderated mediation.

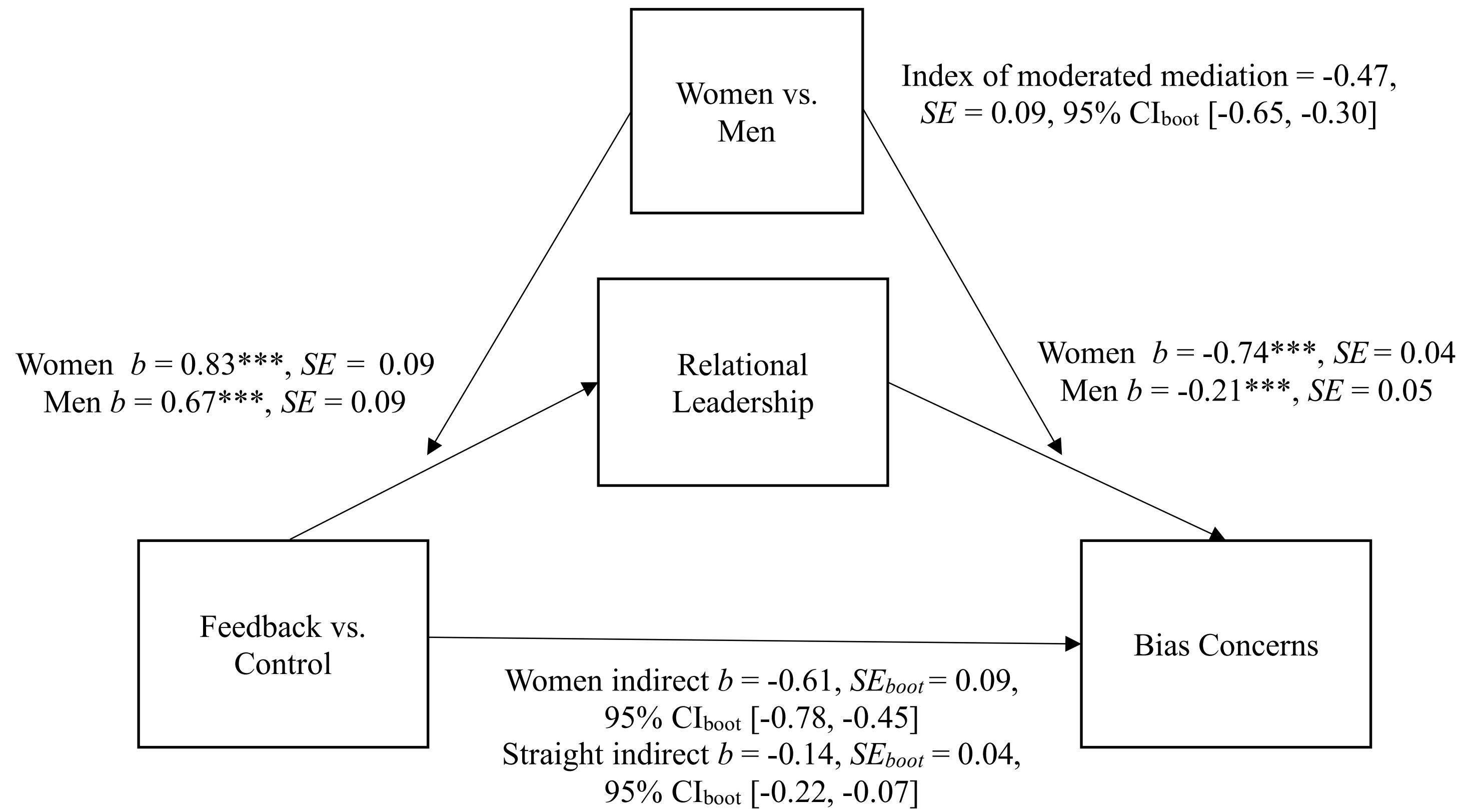
Table S13

Moderated Mediation for Each Component of Relational Leadership (Study 5)

Component	Indirect effect *(SE)*	95% bootstrap CI	Indirect effect *(SE)*	95% bootstrap CI	Index of moderated mediation *(SE)*	95% Bootstrap CI	R^2
	Women		Men		Women v. men		
Relationality	-0.51 *(0.07)*	[-0.65, -0.39]	-0.12 *(0.04)*	[-0.21, -0.04]	-0.39 *(0.07)*	[-0.53, -0.26]	.32
Trust	-0.38 *(0.06)*	[-0.50, -0.27]	-0.09 *(0.03)*	[-0.16, -0.03]	-0.29 *(0.06)*	[-0.41, -0.18]	.36
Use power for good	-0.48 *(0.06)*	[-0.60, -0.36]	-0.13 *(0.04)*	[-0.21, -0.07]	-0.34 *(0.06)*	[-0.47, -0.23]	.36

Figure S4

Mediation with Moderation on Both Paths (MEMORE Model 9; Study 5)



Note. *** denotes $p < .001$. Allowing the *a* path to vary by gender does not result in a model that explains significantly more variance than the model we report in the main text ($R^2 = .40$; see Study 5).

Table S14

Sensitivity Analyses for Key Effects (S2-S7)

Study	Minimum effect size Cohen's *f* (ANOVAs)	Minimum effect size d_z (paired samples *t*-test using *N* of smaller group)
2	0.04	0.23
3	0.09	0.28
4	*NA*	0.29
5	0.06	0.19
6	0.10	0.26
7	0.18	0.27

Note. The table displays the smallest effect size we have .8 power to detect for each key analysis in each study. We used G*Power (Faul et al., 2007) for these analyses.

Supplemental Study: Manipulating Perceptions of Using Power for Good

In this experiment, we experimentally manipulated only the "uses power for good" component of relational leadership to see if it reduces bias concerns. We later combined this component with perceptions of trustworthiness and caring and ran a similar study on the unified construct of relational leadership (See Study 6 in the main manuscript). This study's preregistration, materials, data, and analysis code are available here: https://osf.io/pdbr3/?view_only=ee2d00d0aff04c778c04d85ed867026b.

Participants

In line with our preregistration, we recruited 244 participants from Prolific. All participants identified as either men or women and were included in analyses. Our final sample size was 244 (122 women, 122 men; 240 cisgender, 4 transgender; 173 White, 23 Asian/Asian American, 16 Black/African American, 18 Multiracial, 11 Latinx/Hispanic/Latin American, 2 Native American/American Indian/Alaskan Native, 1 Native Hawaiian/Pacific Islander). The mean age was 40.62 years (SD = 13.49).

Procedure

The introduction to the task was similar to other studies (i.e., two hypothetical 80% men, man-led work teams, identical in work tasks, hours, and salary). Participants were then told that both teams' supervisors had recently undergone a mandatory Leadership and Team Culture evaluation in which team members answered questions about what it is like to work for their supervisor. Participants viewed an infographic with summaries of the evaluation results for both leaders (side-by-side, left-to-right order counterbalanced). Both leaders were rated as having medium-high productivity, medium-high fairness, medium trustworthiness, medium care for employees, and poor team gender balance. The only difference was that 95% of respondents said

that one leader used power to help others (feedback receptivity condition), whereas only 43% of respondents said this of the other leader (control condition).

Dependent Measures

Attention Check. We included a multiple-choice attention check question at the end of each condition to assess whether participants remembered which team they were evaluating. Almost all (99.6%) of participants answered the control team check correctly, and 98.4% of participants answered the feedback receptivity team check correctly.

Manipulation Check. We used the same four items (adapted from Moon et al., 2021) used in Study 2 to measure perceptions that the leader desires to use power for good as a manipulation check to assess whether participants perceived a difference in desire to use power for good between conditions. Reliability was high for both conditions (95% $\alpha = .88$, 43% $\alpha = .92$).

Gender Bias Concerns. We measured gender bias concerns by averaging the same eight items used in the studies in the main manuscript. The scale had high reliability (95% $\alpha = .96$, 43% $\alpha = .96$).

Results

The manipulation was effective in moving perceptions of the leader's desire to use his power for good: A dependent-samples *t*-test revealed that participants in the 95% condition perceived the leader as wanting to use his power for good more than participants in the 43% condition, $t(243) = -27.99$ $p < .001$.

A 2 (gender; between) × 2 (condition; within) ANOVA on gender bias concerns revealed a main effect of gender, $F(1, 242) = 216.09$, $p < .001$, $\eta^2_p = .47$, a main effect of condition, $F(1,$

242) = 111.07, $p < .001$, $\eta^2_p = .31$, and the predicted gender by condition interaction, $F(1, 242) = 7.97$, $p = .005$, $\eta^2_p = .03$

Simple effects tests further examined the effect of condition within women and within men with a Bonferroni-corrected alpha level ($\alpha = .05/2 = .025$). As predicted, women's gender bias concerns were reduced when the leader was highly rated as using power for good ($M = 3.91$, $SD = 1.34$) compared to when the leader was less highly rated ($M = 4.94$, $SD = 1.25$), $p < .001$, $d_z = 0.82$, $d_{av} = 0.80$. Men's gender bias concerns were also lower when the leader was highly rated as using power for good ($M = 1.99$, $SD = 1.15$) than when the leader was less highly rated ($M = 2.59$, $SD = 1.39$), $p < .001$, $d_z = .52$, $d_{av} = 0.47$.

Part 1 Supplementary Materials References

Faul, F., Erdfelder, E., Lang, A.-G., & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods*, *39*(2), 175–191. https://doi.org/10.3758/BF03193146

Moon, B., Lee, N. M.-H., & Bourdage, J. S. (2021). Personalized and socialized need for power: Distinct relations to employee traits and behaviors. *Canadian Journal of Behavioral Science*. https://psycnet.apa.org/doiLanding?doi=10.1037%2Fcbs0000279