Research Article

An Emphasis on Brilliance Fosters Masculinity-Contest Cultures

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Abstract

Women are underrepresented in fields in which success is believed to require brilliance, but the reasons for this pattern are poorly understood. We investigated perceptions of a "masculinity-contest culture," an organizational environment of ruthless competition, as a key mechanism whereby a perceived emphasis on brilliance discourages female participation. Across three preregistered correlational and experimental studies involving adult lay participants online ($N = 870$) and academics from more than 30 disciplines ($N = 1,347$), we found a positive association between the perception that a field or an organization values brilliance and the perception that this field or organization is characterized by a masculinity-contest culture. This association was particularly strong among women. In turn, perceiving a masculinity-contest culture predicted lower interest and sense of belonging as well as stronger impostor feelings. Experimentally reducing the perception of a masculinity-contest culture eliminated gender gaps in interest and belonging in a brilliance-oriented organization, suggesting possible avenues for intervention.

Women are underrepresented in fields in which success is believed to require exceptional intelligence (or "brilliance"), such as philosophy, economics, and mathematics (Leslie et al., 2015; Meyer et al., 2015; Storage et al., 2016). Although this relationship between a field's perceived emphasis on brilliance and women's representation is well documented, the underlying causal mechanisms are less understood. Here, we proposed and tested the hypothesis that an emphasis on brilliance has a negative effect on gender diversity because it fosters a workplace climate in which a masculine-coded, competition-based style of interpersonal interaction is perceived to be dominant. Perceptions of such a "masculinity-contest culture" (MCC; Berdahl et al., 2018) may then lower women's interest and well-being in organizations or fields in which brilliance is strongly emphasized.

MCC refers to organizational environments in which individuals feel the "need to aggressively compete and

dominate other [people]" (Kupers, 2005, p. 713; see also Berdahl et al., 2018). In such contexts, individuals may be encouraged to display stereotypically masculine behaviors and attitudes, such as aggressiveness, independence, ambition, and competitiveness (Prentice & Carranza, 2002; Spence et al., 1979), that may be enacted in routine "mine's bigger than yours" contests (Berdahl et al., 2018). MCCs are experienced negatively by men as well as women (Glick et al., 2018; Reid et al., 2018), but they might be particularly difficult to navigate for women, who are traditionally socialized to be modest about their achievements and to avoid being dominant or competitive (Heatherington et al., 1993; Williams & Tiedens, 2016).

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An emphasis on brilliance may promote elements of an MCC (Berdahl et al., 2018) in a few ways. Because brilliance is associated with men (Bian et al., 2017; Storage et al., 2020), privileging stereotypically masculine traits could favor the proliferation of male-typed behavior as the default (Cheryan et al., 2017; Cheryan & Markus, 2020). Moreover, because brilliance is commonly viewed as a fixed attribute rather than something that can be cultivated (Rattan et al., 2012), an emphasis on brilliance may promote performance goals (Dweck, 2008): Individuals may feel pressured to show off their intellectual talent and demonstrate that their intelligence is superior to that of others. In turn, this felt pressure may incite competition to attain "star status," encourage intellectually oriented dominance behaviors (e.g., harsh criticism, dismissing opposing views), and discourage collaboration. Indeed, past work suggests that organizations in which talent is viewed as fixed tend to be characterized by less collaborative norms and more unethical behavior (Canning et al., 2020).

Thus, MCCs—or the perception of such cultures—may be part of the reason that the belief that brilliance is required for success, a belief that seems unprejudiced on its face, creates gender inequality. This mechanism fills an important gap in the literature: Although women in past studies reported lower interest in brilliance-oriented jobs, as well as a lower sense of belonging (Bian et al., 2018; Deiglmayr et al., 2019) and stronger feelings of being "impostors" (Muradoglu et al., 2021) in such positions, we still know little about the proximal variables underlying these effects: Why is it, exactly, that messages that emphasize brilliance undermine women's interest and well-being? Here, we propose that perceptions of MCCs are a key missing piece of the puzzle.

Across three preregistered studies (and a preregistered pilot study), we tested whether (a) fields or organizations that are perceived to value brilliance are also perceived to have an MCC (Studies 1 and 2) and whether (b) perceiving such a culture is in turn associated with lower interest and well-being (Studies 1–3). Importantly, we also tested whether gender moderates these hypothesized relationships: If the perception of an MCC is part of the mechanism through which brilliance-oriented domains undermine women's participation, as we hypothesized, then one or both of these relationships should be stronger for women than for men. That is, (a) women may be more likely than men to perceive undesirable, masculinity-contest-type behaviors as a result of an emphasis on brilliance, and/or (b) women may be more adversely affected by such perceptions than men.

To test the generalizability of our conclusions, we examined these hypothesized links across a wide range

Statement of Relevance

Psychological scientists have repeatedly documented that women are underrepresented in domains that prize raw intellectual talent ("brilliance"), including many fields in academia (e.g., philosophy, mathematics). However, the reasons for this pattern of underrepresentation have remained unclear. This research identifies a possible reason: An emphasis on brilliance in the workplace gives rise to a "dog eat dog" atmosphere of ruthless competition, which discourages women's participation and undermines their well-being. This work suggests that we can make workplaces more inclusive by promoting a culture of free exchange and openness and avoiding the zero-sum logic of "separating the wheat from the chaff"—the brilliant superstars from the plodding masses.

of academic fields (pilot study and Study 1) as well as in business settings (Studies 2 and 3). Similarly, we sampled both the general population (pilot study and Studies 2 and 3) and academics at various career stages from multiple universities (Study 1). To be able to speak to the causal mechanisms involved, we gathered not just correlational (pilot study and Study 1) but also experimental (Studies 2 and 3) data. Our findings across these studies highlight perceptions of an MCC as a key mechanism by which an emphasis on brilliance undermines women's success in academia and industry.

This investigation was approved by New York University's institutional review board. For all studies, including the pilot study, results were not examined until data collection was complete. Throughout, we report all measures, manipulations, and exclusions. Materials, data, analysis scripts, and copies of the preregistrations for all studies can be found on OSF at https://osf.io/fsven/.

Pilot Study

Method

Participants. A convenience sample of 302 individuals (age: $M = 33.57$ years, $SD = 10.05$; 54.4% female; 72.6% White) was recruited via Amazon's Mechanical Turk (MTurk), an online crowd-sourcing platform (Buhrmester et al., 2011). Although the pilot participants were not in academia, their perceptions of academic fields served as an initial test of our hypotheses. Moreover, laypeople's beliefs on these topics could be consequential because

they may be transmitted to and shape the attitudes of others (e.g., their children; Gunderson et al., 2012; Simpkins, 2015). Additional recruitment details, including how sample size was determined, are reported in the supplemental material available at https://osf.io/fsven/.

Procedures and measures. A detailed description of the procedure and measures used in the pilot study is available in the supplemental material. Each participant answered 10 questions for each of nine randomly assigned fields, including social sciences; humanities; and science, technology, engineering, and mathematics (STEM) disciplines (Leslie et al., 2015; Meyer et al., 2015). Each of 27 fields was rated by approximately 100 participants. Participants rated their perceptions of each field's emphasis on brilliance (two items from Meyer et al., 2015; $r = .66$, $p < .001$) and MCC (six items from Glick et al., 2018; $\alpha = .86$). Two additional items allowed us to test two possible alternative explanations for the hypothesized relationship between a field's perceived emphasis on brilliance and its perceived MCC. In response to the first item, participants indicated how much they believed that each field required systemizing (thinking systematically and abstractly) over empathizing (understanding thoughts and emotions; Baron-Cohen, 2002; Billington et al., 2007). Systemizing is a stereotypically male attribute that has been argued to influence career choices and success (e.g., Baron-Cohen, 2002), so fields that are perceived to emphasize it may also be perceived to display stronger masculinity-contest norms. In response to the second item, participants estimated the percentage of all doctoral degrees in each field that were granted to women in 2018 in the United States. If a participant assumed, say, that there are few women in a field, they may use this as a basis for inferring both a strong emphasis on brilliance (Leslie et al., 2015; Meyer et al., 2015) and a strong MCC (Glick et al., 2018). Thus, adjusting for participants' estimates of the percentage of women with PhDs in a field should account for a potential confound. For a similar reason, we also recorded the actual percentage of women with PhDs in a field from authoritative sources (Association of American Medical Colleges, 2018; National Science Foundation, 2019) and used it as a covariate in our analyses. We observed a positive correlation between estimated and actual percentages of PhDs granted to women ($r = .41$, $p < .001$), suggesting modest levels of accuracy.

Analytic strategy. We analyzed the pilot data both at the field level (aggregating responses across participants) and at the participant level (for details, see the supplemental material at https://osf.io/fsven/).[1] For this pilot study, we report standardized coefficients (βs), which indicate the fraction of a standard deviation by which the dependent variable changes in response to a 1-standard-deviation increase in a continuous predictor or a shift from one category to another in a categorical predictor. Predictors were mean-centered in models that included interaction terms, which facilitates interpretation of the lower order coefficients. We report ω_p^2 as a measure of effect size, calculated either with the *estate esize* command in Stata Version 16 (for linear regressions) or with the *effectsize* package Version 0.3.3 in R (for the mixed-effects models; Ben-Shachar et al., 2020). We chose ω_p^2 over the more common η_p^2 because it is less biased (Albers & Lakens, 2018). We follow Field's (2013) guidelines for interpreting the magnitude of ω_p^2 (very small effect: $\omega_p^2 < .01$; small effect: $.01 \leq \omega_p^2 < .06$; medium effect: $.06 \leq \omega_p^2 < .14$; large effect: $\omega_p^2 \geq .14$). Because ω_p^2 corrects for bias, it can be negative; we report negative ω_p^2 values as .00.

Results

For the field-level data ($N = 27$ fields), a linear regression indicated that a stronger perceived emphasis on brilliance was associated with a stronger perceived MCC (see Fig. 1; $\beta = 0.69$, $SE = 0.14$, 95% confidence interval [CI] = [0.39, 0.99], $p < .001$, $\omega_p^2 = .44$, a large effect). For the participant-level data ($N = 302$), a linear mixed-effects model with crossed random intercepts for participant and field indicated that a stronger perceived emphasis on brilliance was again associated with a stronger perceived MCC ($\beta = 0.25$, $SE = 0.02$, 95% CI = [0.22, 0.29], $p < .001$, $\omega_p^2 = .08$, a medium effect). Participant gender (0 = man, 1 = woman) did not moderate this relationship ($\beta = -0.01$, $SE = 0.03$, 95% CI = [−0.07, 0.05], $p = .73$, $\omega_p^2 = .00$). In addition, the relationship between perceived emphasis on brilliance and perceived MCC remained significant when we included systemizing versus empathizing scores and the estimated percentage of women with PhDs as covariates or, in separate models, the actual percentage of women with PhDs (see Tables S3 and S4 in the supplemental material at https://osf.io/fsven/).[2]

Study 1

The preregistered pilot study found support for the first link in the proposed mechanism in the context of academia with a lay sample. Specifically, we found that perceptions of an academic field's emphasis on brilliance were positively associated with perceptions of an MCC in that field. This relationship was robust beyond the (actual or perceived) representation of women and the perceived importance of systemizing (over empathizing), and it emerged among both women and men. In Study 1, we recruited a large sample of academics from a wide range of fields, which provided a more ecologically valid
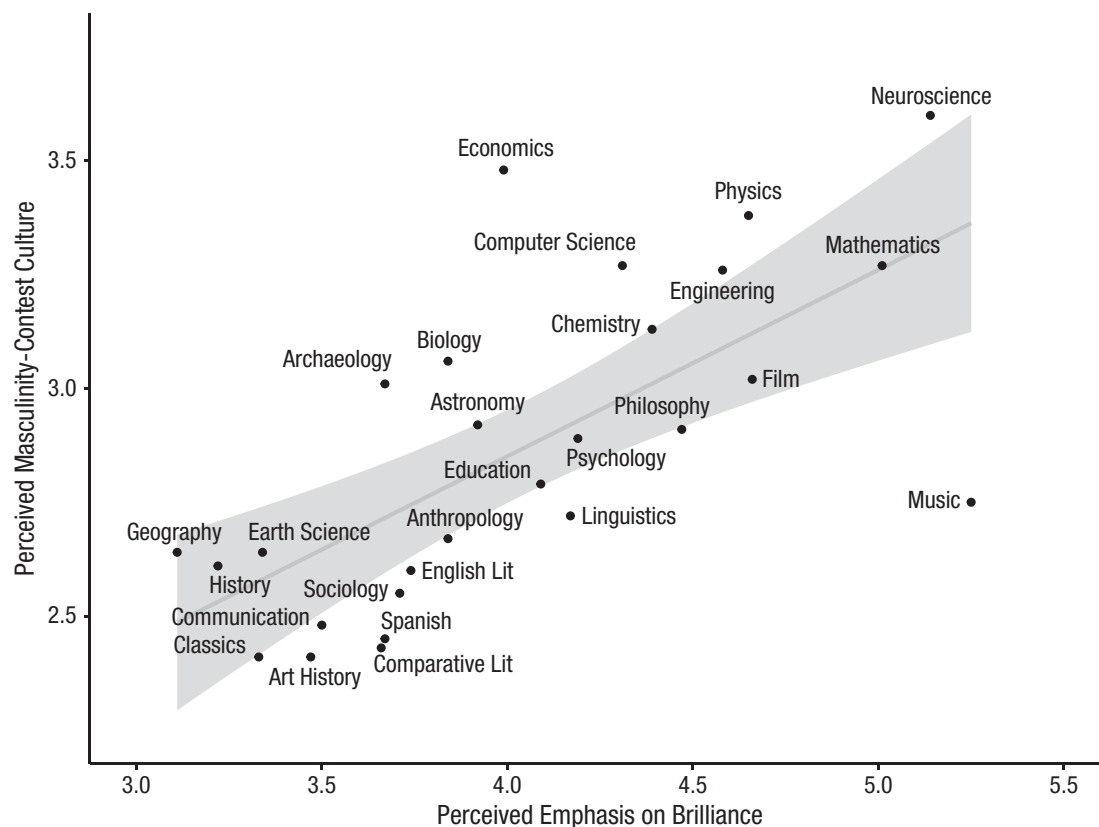
Fig. 1. Relationship between perceived emphasis on brilliance and perceptions of a masculinity-contest culture at the field level in the pilot study. The line indicates the best-fitting regression, and the error band represents ±1 *SE*.

test of the same relationship. This sample also allowed us to investigate the link between academics' perceptions of an MCC in their field and their well-being (the second link in the hypothesized pathway), focusing particularly on belonging and impostor feelings.

Method

Participants. We contacted 43,607 academics using a previously assembled database of email addresses for faculty, postdoctoral fellows, and graduate students from nine public and private research-intensive (i.e., R1) universities across the United States (Muradoglu et al., 2021; for details, see the supplemental material at https://osf.io/fsven/). We decided a priori to include any academic who accepted our invitation to participate and met the preregistered criteria below. We obtained consent from 1,769 (4.06%) academics. Of those who consented, 146 individuals did not complete the study (provided no data). Of participants who completed at least some portion of the study, we excluded those who (a) did not select a field from our predefined set or typed in a field that we could not place in this set ($n = 120$), (b) indicated that they were

staff or an undergraduate student or did not indicate a position ($n = 53$), (c) indicated that some of their answers were jokes or random ($n = 17$), or (d) did not fill out our two key measures, perceived emphasis on brilliance and perceived MCC ($n = 86$). Although we did not preregister this last exclusion criterion, these participants were automatically dropped from analyses involving the two key variables, so we decided to exclude them to maintain a consistent sample size across analyses.

The final sample comprised 1,347 participants (age: $M = 43.90$ years, $SD = 15.66$; 45.5% female; 78.4% White), including graduate students (29.2%), postdoctoral fellows (8.3%), medical residents (0.9%), nontenure-track faculty (25.7%), untenured tenure-track faculty (7.3%), tenured faculty (26.7%), and retired and emeriti faculty (1.9%). There were 30 nonmedical academic disciplines represented (29.3% of participants were in STEM, 35.3% in the social sciences, and 12.3% in the humanities) and 33 medical fields (23.1% of participants). The number of participants per discipline is reported in Table S6 in the supplemental material at https://osf.io/fsven/.

Procedures and measures. Participants selected their academic discipline from a predetermined list and completed four measures, in random order: (a) perceived emphasis on brilliance in their field, (b) perceived MCC in their field, (c) their own impostor feelings, and (d) their own sense of belonging. Items within each measure were presented randomly. Participants were then asked to estimate the percentage of doctoral degrees in their field granted to (a) women and (b) underrepresented minorities, in that order.

Perceived emphasis on brilliance. Participants indicated their agreement with the same two statements as in the pilot study but with reference to their own discipline (Leslie et al., 2015) from 1 (*strongly disagree*) to 7 (*strongly agree*). The two statements were, "Being a top performer in my field requires a special aptitude that just can't be taught," and "If you want to succeed in my field, hard work alone just won't cut it; you need to have an innate gift or talent." Participants rated each statement twice (i.e., four items total): once in regard to their own beliefs about their current field (self-ratings) and once in regard to the perceived beliefs of other academics in that field (other-ratings). Self- and other-items were presented randomly within two separate blocks in randomized order. We first averaged the two self-ratings and the two other-ratings separately; the resulting scores were moderately correlated ($r = .56$, $p < .001$). Similar patterns of results were observed in the models below when the self- and other-ratings were examined separately; thus, we combined the four items into a single measure of perceived emphasis on brilliance ($\alpha = .85$).

Perceived MCC. We used the six statements from the pilot study to assess participants' perceptions that their current discipline is characterized by an MCC (Glick et al., 2018). The items were modified to include the stem, "In my field," and were rated from 1 (*not at all true of field*) to 5 (*entirely true of field*). We included two items each from the "show no weakness" subscale ("Admitting you don't know the answer looks weak"; "Seeking others' advice is seen as weak"); the "put work first" subscale ("Taking days off is frowned upon"; "People with significant demands outside of work don't make it very far"); and the "dog eat dog" subscale ("One person's loss is another person's gain"; "If you don't stand up for yourself people will step on you"). We did not include any items from the "strength and stamina" subscale because beliefs about physical strength and stamina are less relevant in academia. The two items within each subscale were significantly correlated (rs = .46–.55). We averaged the six items together ($\alpha = .81$).

Impostor feelings. Participants reported their impostor feelings in their current field with five items ($\alpha = .93$) from the study by Muradoglu et al. (2021). These items were based on the Clance Impostor Phenomenon Scale (Clance & Imes, 1978; Simon & Choi, 2018) and were rated from 1 (*strongly disagree*) to 7 (*strongly agree*). A sample item is, "Sometimes I'm afraid others will discover how much knowledge or ability I really lack."

Sense of belonging. We measured participants' sense of belonging in their current field with eight items ($\alpha = .91$) adapted from the study by Good et al. (2012), which were rated from 1 (*strongly disagree*) to 7 (*strongly agree*). A sample item is, "I feel accepted by other members in my field."

Alternative explanation: estimated percentage of PhDs granted to women and underrepresented minorities. As in the pilot study, we examined whether the relationship between perceived emphasis on brilliance and perceived MCC might be explained by a third variable: a field's assumed gender balance. We asked participants to estimate the percentage of all doctoral degrees in their current field that were granted to women in 2018 in the United States, from 0 (*0% of PhD degrees to women*) to 100 (*100% of PhD degrees to women*). As in the pilot study, we also examined the actual percentage of women with PhDs as a covariate. Actual and estimated percentages were strongly correlated ($r = .70$, $p < .001$). Finally, we asked participants to estimate the percentage of all doctoral degrees in their current field that were granted to "members of racial/ethnic minority groups traditionally underrepresented in academia (e.g., Black, Latinx, Native American)" in 2018 in the United States, from 0 (*0% of PhD degrees to racial/ethnic minorities*) to 100 (*100% of PhD degrees to racial/ethnic minorities*).

Demographic information and debriefing. At the end of the study, participants indicated their current position (e.g., graduate student) and provided basic demographic information (e.g., gender, race). Finally, participants were asked to type any thoughts they had about the study (open ended) and to indicate whether any of their answers were random or meant as jokes (yes/no).

Results

The analytic strategy was the same as for the pilot study. Means, standard deviations, and bivariate correlations between all study variables are reported in Table S7 in the supplemental material at https://osf.io/fsven/. We report standardized coefficients for regression and mediation models.

Link between perceived emphasis on brilliance and perceived MCC. First, we conducted a linear mixed-effects model in which we regressed perceived MCC on perceived emphasis on brilliance. The model included a
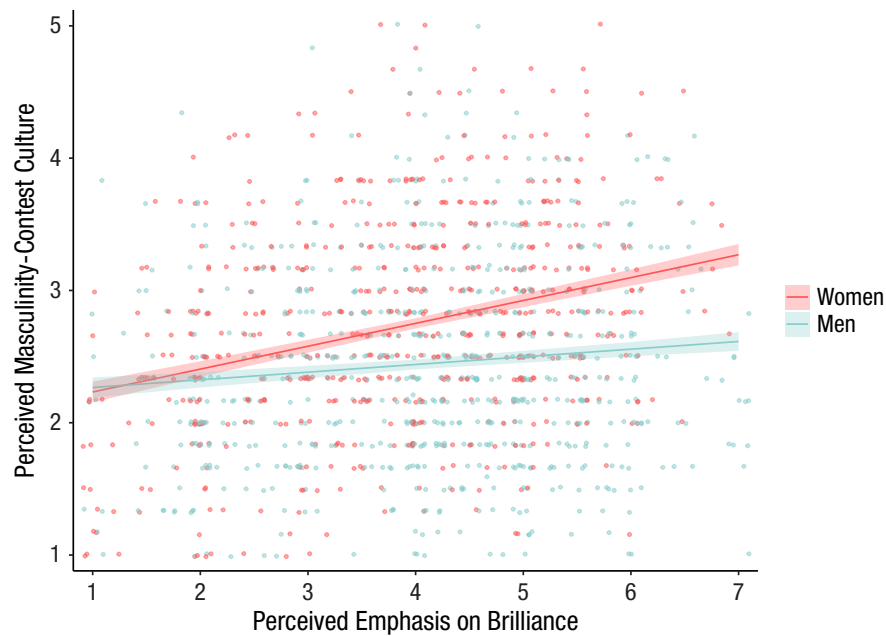
Fig. 2. Relationship between perceived emphasis on brilliance and perceived masculinity-contest culture among academics in Study 1, separately for each participant gender. The lines indicate the best-fitting regressions, and the error bands represent ±1 *SE*.

random intercept for field to account for the nesting of participants in fields. Perceived emphasis on brilliance was positively associated with perceived MCC (β = 0.17, *SE* = 0.03, 95% CI = [0.12, 0.23], *p* < .001, ω_p^2 = .03, a small effect). Next, we added participant gender to the mixed-effects model to test for moderation by this variable. Female academics were overall more likely to perceive an MCC than male academics were (β = 0.39, *SE* = 0.05, 95% CI = [0.29, 0.50], *p* < .001, ω_p^2 = .04). Critically, as seen in Figure 2, the model also revealed a significant two-way interaction between perceived emphasis on brilliance and participant gender (β = 0.19, *SE* = 0.05, 95% CI = [0.09, 0.30], *p* < .001, ω_p^2 = .01): The association between perceived emphasis on brilliance and perceived MCC was significantly stronger among female academics (β = 0.29, *SE* = 0.04, 95% CI = [0.22, 0.37], *p* < .001, ω_p^2 = .08, a medium effect) than among male academics (β = 0.10, *SE* = 0.04, 95% CI = [0.03, 0.17], *p* = .006, ω_p^2 = .01, a small effect). These results did not change appreciably when we adjusted for participants' estimates of the percentage of PhDs granted to women and underrepresented minorities or the actual percentages of women with PhDs in a discipline (see Table S8 in the supplemental material at https://osf.io/fsven/).

Perceived MCC as a mediator between perceived emphasis on brilliance and well-being. We hypothesized that (a) perceiving a stronger emphasis on brilliance in one's field would be associated with stronger

perceptions of an MCC and that (b) in turn, the latter perceptions would predict lower well-being. In addition, we hypothesized that one or both of these relationships would be stronger for women than for men. In the context of a mediation model, this set of hypotheses led to the prediction of stronger indirect effects (via perceived MCC) for women than for men.

Consistent with this prediction, a moderated mediation analysis using the PROCESS module for SPSS (Hayes, 2015; Model 8; see Fig. 3) revealed that participant gender significantly moderated the indirect effect of a field's perceived emphasis on brilliance (*X*) through its perceived MCC (*M*) on both impostor feelings (*Y*; index of moderated mediation: 0.06, *SE* = 0.02, 95% CI = [0.03, 0.10]) and sense of belonging (*Y*; index of moderated mediation: −0.11, *SE* = 0.03, 95% CI = [−0.17, −0.05]). (The use of Model 8 was a deviation from our preregistered analytic plans, as detailed in the supplemental material at https://osf.io/fsven/, including Table S13.) The indirect effects of a field's perceived emphasis on brilliance were significantly stronger for women (impostor feelings—*ab* = 0.09, *SE* = 0.01, 95% CI = [0.07, 0.13]; belonging—*ab* = −0.16, *SE* = 0.02, 95% CI = [−0.21, −0.12]) compared with men (impostor feelings—*ab* = 0.03, *SE* = 0.01, 95% CI = [0.01, 0.05]; belonging—*ab* = −0.05, *SE* = 0.02, 95% CI = [−0.09, −0.02]). Note, however, that participant gender did not moderate the relationship between perceived MCC and the two outcomes (i.e., the *b* paths; impostor feelings: β = −0.07, *SE* = 0.05,

a

b
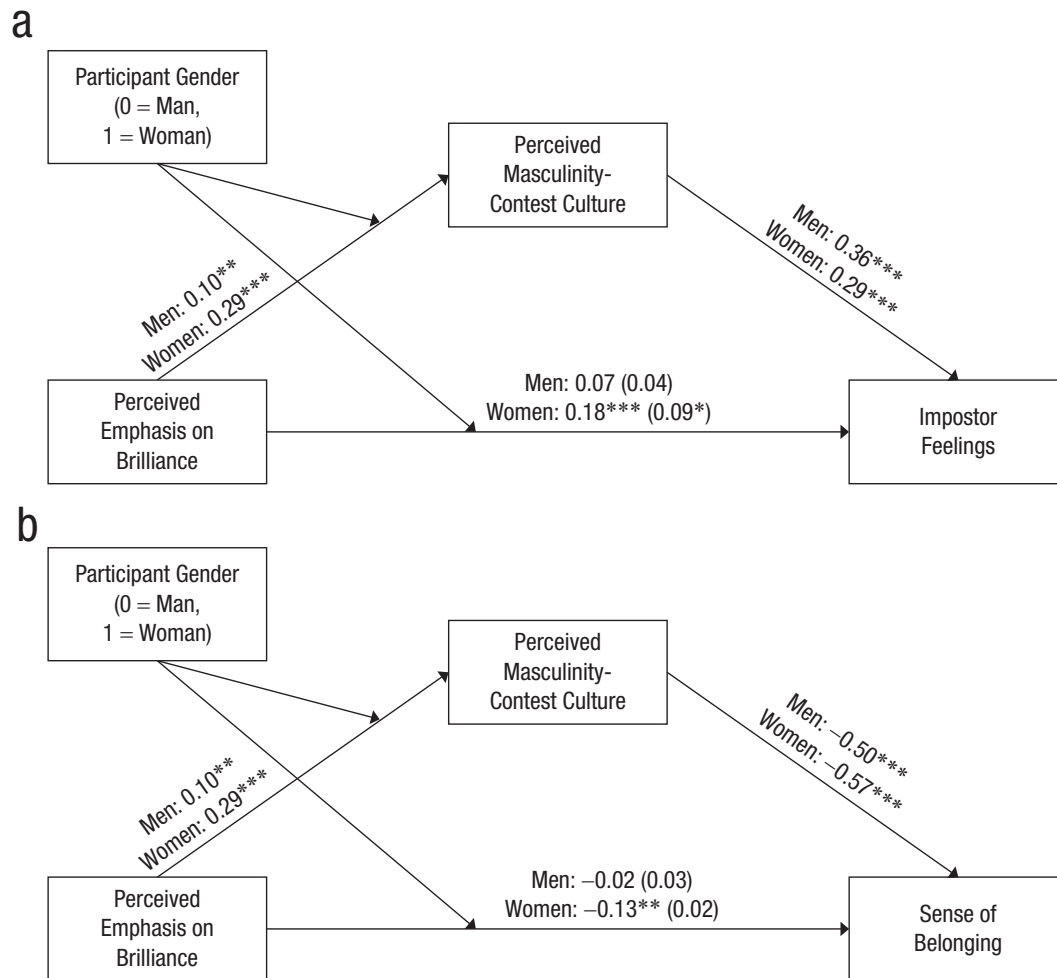
Fig. 3. Effects of perceived emphasis on brilliance through perception of a masculinity-contest culture on (a) impostor feelings and (b) sense of belonging in Study 1, as moderated by participant gender. Standardized coefficients are reported. On the path from the independent to the dependent variable, values outside parentheses show the total effect, and values inside parentheses show the direct effect after controlling for the mediator and moderators. All path coefficients were calculated using linear mixed-effects models in Stata Version 16, whereas the indirect effects and indices of moderated mediation were calculated via simple regressions using the PROCESS module for SPSS. Asterisks indicate significant paths (*p < .05, **p < .01, ***p <.001).

95% CI = [−0.17, 0.03], p = .170, ω_p^2 = .001; sense of belonging: β = −0.07, SE = 0.04, 95% CI = [−0.16, 0.01], p = .102, ω_p^2 = .001). These results did not change appreciably when we adjusted for the estimated percentage of women and underrepresented minorities with PhDs or for the actual percentages of PhDs granted to women (see Tables S9 and S10 in the supplemental material at https://osf.io/fsven/).

Ancillary analysis: low self-confidence as alternative explanation? Finally, we investigated the possibility that the negative relationship between perceived MCC and sense of belonging is explained by an internalized lack of confidence, particularly among female academics. We used impostor feelings as a proxy for low confidence

(e.g., Muradoglu et al., 2021) and examined whether the relationship between perceived MCC and sense of belonging emerged above and beyond any variance explained by impostor feelings. The results, reported in full in the supplemental material (see Table S11 at https://osf.io/fsven/), suggested that the relationship between perceived MCC and sense of belonging emerges independently of the variance explained by impostor feelings, among both female and male academics.

Discussion

Academics who thought that their field valued brilliance also perceived their work environments to be characterized by an MCC. This relationship was stronger among

female academics than male academics, unlike in the pilot study with laypeople, where we found no moderation by gender: Perhaps more first-hand exposure to academia (Study 1) prompts women's and men's responses to diverge. For example, women may be more sensitive than men to the effects that an emphasis on brilliance (a stereotypically masculine trait) has on other academics' behaviors because these behaviors often place women at a disadvantage (Cheryan & Markus, 2020). The results of Study 1 also revealed, as hypothesized, that the indirect effects of a field's perceived emphasis on brilliance on academics' well-being via their perception of an MCC were stronger for female than male academics. We tested these relationships experimentally in Studies 2 and 3.

Study 2

In Study 2, we experimentally tested the first link in the proposed causal mechanism—namely, that a work environment that emphasizes brilliance licenses perceptions of an MCC more than an environment that does not emphasize brilliance. We also measured participants' interest in working in this environment and their anticipated well-being, which afforded a (nonexperimental) test of the second link—namely, that perceptions of an MCC are associated with lower interest and well-being. As before, we expected one or both of these links to be moderated by gender, resulting in stronger indirect effects of the manipulation for women than men.

Method

Participants. An a priori power analysis (G*Power Version 3.1; Faul et al., 2009) for a regression model with up to four predictors indicated that a sample size of 273 participants would be required to detect a small to medium effect size ($f^2 = .029$), assuming power of .80 and an α of .05. This effect size was the average reported by Bian et al. (2018). We increased the target sample size by 15% to account for exclusions and recruited a convenience sample of 316 individuals via MTurk (Buhrmester et al., 2011). The study was available to workers in the United States with prior approval rates of 95% or higher, and participants received $0.55 for their time. Following our preregistered criteria, we excluded 24 participants who (a) indicated that some of their answers were jokes or random, (b) provided nonsense responses in an open-ended question described in the procedure, or (c) had duplicate Internet protocol (IP) addresses (final $N = 292$; age: $M = 34.25$ years, $SD = 11.04$; 55.3% female; 69.9% White).

Procedures and measures. In this study, we extended our investigation from academia to nonacademic professional opportunities, where an emphasis on brilliance

has similarly been found to discourage women's participation (Bian et al., 2018). We employed an experimental manipulation adapted from the work by Bian et al. (2018) to convey a focus on brilliance. Participants read information ostensibly from a company's website advertising new openings to join the company's workforce, which included a description of the types of attributes the company values in its employees (for the full script, see at https://osf.io/fsven/). Half of the participants were randomly assigned to a brilliance condition in which the company advertisement emphasized candidates' exceptional intellectual ability (e.g., "a high IQ," "superior reasoning skills," "natural intelligence"). The other half of participants were assigned to a control condition in which the advertisement emphasized candidates' skills without reference to brilliance (e.g., "broad range of skills"; "comfortable with a modern, dynamic workplace"; "positive thinking and productivity"). Bian et al.'s results suggested that women's and men's attitudes toward the company described in the control condition were similar (i.e., this condition was gender neutral).

After the manipulation, participants completed four measures in random order: (a) perceptions of an MCC (Glick et al., 2018), (b) interest in working in the company, (c) anticipated impostor feelings (Clance & Imes, 1978), and (d) anticipated sense of belonging (Good et al., 2012). Item order was random within measures, and a manipulation check followed.

Perceived MCC. We assessed participants' perceptions that the company was characterized by an MCC with the six statements from Study 1, adapted to the hypothetical scenario (i.e., "In this company…"). Statements were rated from 1 (*not at all true*) to 5 (*entirely true*). The two items within each of the three subscales were significantly correlated ($rs = .50$–$.58$). As before, we averaged all items to compute an MCC score ($\alpha = .88$).

Interest in the company. Participants answered three questions ($\alpha = .95$) borrowed from the study by Bian et al. (2018) to gauge their interest in the company (e.g., "Assuming you were looking for a job, how likely would you be to apply for a position at this particular company?"). Statements were rated from 1 (*not at all interested*) to 9 (*extremely interested*).

Anticipated impostor feelings. To measure participants' anticipated impostor feelings if they were to work at the company, we used the five items ($\alpha = .94$) from Study 1 (Clance & Imes, 1978; Simon & Choi, 2018), adapted to the hypothetical scenario (e.g., "If I worked at this company, I would be afraid that people in the company may find out that I'm not as capable as they think I am"). Items were rated from 1 (*strongly disagree*) to 7 (*strongly agree*).
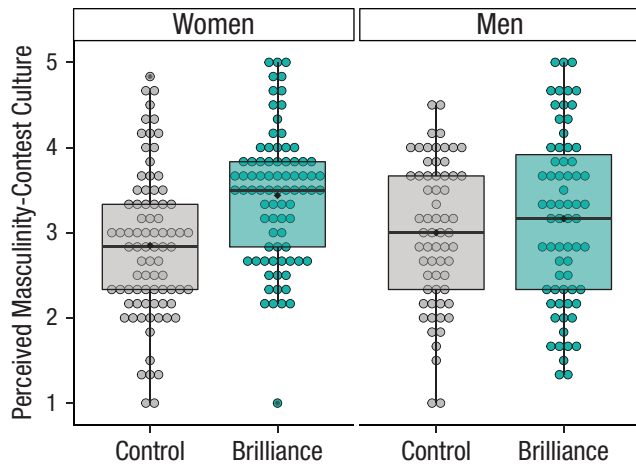
Fig. 4. Perception of masculinity-contest cultures as a function of condition, separately for each participant gender in Study 2. Each dot represents an individual participant's response. Within each box plot, the solid line in the middle represents the median, and the diamond represents the mean. The bottom and top edges of the box indicate the 25th and 75th percentiles, respectively, and whiskers extend 1.5 times the interquartile range.

Anticipated sense of belonging. We measured participants' anticipated sense of belonging if they were to work at the company using the eight items ($\alpha = .92$) from Study 1 (Good et al., 2012), adapted to the hypothetical scenario, as in the study by Bian et al. (2018; e.g., "I would feel valued by other company employees"). Items were rated from 1 (*strongly disagree*) to 7 (*strongly agree*).

Alternative explanation: estimated percentage of female employees. Following a similar procedure as in the pilot study and Study 1, we investigated whether the effects of the brilliance manipulations boiled down to an effect on participants' inferences about the company's gender composition, which by itself could influence women's and men's interest and sense of well-being (e.g., Heilman, 1979). We might expect, for example, that women would be more interested and anticipate higher well-being in contexts with a higher percentage of women through basic homophily effects (Holman & Morandin, 2019; McPherson et al., 2001). To measure this potential confound, we asked participants to estimate the percentage of all employees at the company who were women from 0 to 100.

Manipulation check. Participants indicated their agreement with a single item: "The company emphasizes employees' natural intelligence and inherent aptitude," rated from 1 (*strongly disagree*) to 5 (*strongly agree*).

Demographic information and debriefing. The study ended by asking participants to type any thoughts they had about the study (open ended), provide demographic information (e.g., gender, race), and indicate whether any of their answers were random or jokes (yes/no).

Results

Means, standard deviations, and bivariate correlations between all study variables are reported in Table S14 in the supplemental material at https://osf.io/fsven/. We report unstandardized coefficients for regression and mediation models.

Manipulation check. As intended, participants in the brilliance condition were significantly more likely to agree that the company emphasized employees' natural intelligence and inherent aptitude ($M = 4.16$, $SD = 0.96$), compared with participants in the control condition ($M = 3.76$, $SD = 0.93$), $F(1, 287) = 12.79$, $p < .001$, $\omega_p^2 = .04$. There was no significant main effect of participant gender, $F(1, 287) = 0.02$, $p = .894$, $\omega_p^2 = .00$, and no significant Condition × Participant Gender two-way interaction, $F(1, 287) = 0.02$, $p = .882$, $\omega_p^2 = .00$.

Link between emphasis on brilliance and perceptions of an MCC. We regressed the perception of an MCC on experimental condition (control = 0, brilliance = 1), participant gender (man = 0, woman = 1), and their interaction. As expected, the perception of an MCC was significantly stronger in the brilliance condition ($M = 3.31$, $SD = 0.89$) compared with the control condition ($M = 2.91$, $SD = 0.86$; $b = 0.37$, $SE = 0.10$, 95% CI = [0.17, 0.58], $p < .001$, $\omega_p^2 = .04$, a small to medium effect). There was no main effect of gender ($b = 0.06$, $SE = 0.10$, 95% CI = [−0.14, 0.27], $p = .53$, $\omega_p^2 = .00$), but the Condition × Participant Gender two-way interaction was significant ($b = 0.42$, $SE = 0.21$, 95% CI = [0.17, 0.83], $p = .041$, $\omega_p^2 = .01$; see Fig. 4). The effect of condition on perception of masculinity-contest norms was not significant for male participants ($b = 0.16$, $SE = 0.15$, 95% CI = [−0.14, 0.47], $p = .29$, $\omega_p^2 = .00$) but was significant for female participants ($b = 0.59$, $SE = 0.14$, 95% CI = [0.32, 0.86], $p < .001$, $\omega_p^2 = .11$, a medium effect). These results did not change appreciably when we adjusted for the estimated percentage of female employees in the company (see Table S15 in the supplemental material at https://osf.io/fsven/).

Perceptions of an MCC as a mediator between emphasis on brilliance and downstream outcomes. We expected to find stronger indirect relationships for female than for male participants between experimental condition (*X*) and the three downstream outcomes

Table 1. Results of Regression Models Predicting Downstream Outcomes (Interest in Company, Anticipated Impostor Feelings, and Anticipated Sense of Belonging) as a Function of Participant Gender and Experimental Condition in Study 2

Dependent variable and predictor	b	SE	p	ω_p^2
Interest in company				
Participant gender[a]	−0.42 [−0.91, 0.07]	0.25	.097	.01
Experimental condition[b]	−1.03 [−1.52, −0.54]	0.25	< .001	.05
Participant Gender × Experimental Condition	−1.13 [−2.12, −0.15]	0.50	.024	.01
Anticipated impostor feelings				
Participant gender[a]	0.14 [−0.22, 0.50]	0.18	.443	.00
Experimental condition[b]	0.61 [0.24, 0.97]	0.18	.001	.03
Participant Gender × Experimental Condition	0.85 [0.12, 1.58]	0.37	.022	.01
Anticipated sense of belonging				
Participant gender[a]	−0.08 [−0.33, 0.18]	0.13	.548	.00
Experimental condition[b]	−0.59 [−0.85, −0.34]	0.13	< .001	.06
Participant Gender × Experimental Condition	−0.44 [−0.95, 0.07]	0.26	.089	.01

Note: Predictors were mean-centered to facilitate interpretation of the coefficients. The coefficients of participant gender and experimental condition in this table can be interpreted as one would interpret the main effects in an analysis-of-variance table. These results did not change appreciably when we adjusted for the estimated percentage of female employees in the company (see Table S15 in the supplemental material at https://osf.io/fsven/). Values in brackets are 95% confidence intervals.
[a]Participant gender was coded 0 for man and 1 for woman. [b]Experimental condition was coded 0 for control and 1 for brilliance.

(Y; interest in joining the company, anticipated impostor feelings, and anticipated sense of belonging) via perceptions of an MCC (M). We again used PROCESS Model 8, which was a deviation from our preregistered analytic plans, as detailed in the supplemental material at https://osf.io/fsven/, including Table S20. Indeed, participant gender significantly moderated the indirect effects for all three downstream outcomes (see Fig. 5 and Tables 1 and 2)—interest in the company: index of moderated mediation: −0.44, SE = 0.22, 95% CI = [−0.89, −0.01]; anticipated impostor feelings: index of moderated mediation: 0.39, SE = 0.19, 95% CI = [0.02, 0.77]; and anticipated sense of belonging: index of moderated mediation: −0.23, SE = 0.12, 95% CI = [−0.47, −0.004]. Specifically, these indirect relationships were significant for female participants (interest—ab = −0.61, SE = 0.15, 95% CI = [−0.93, −0.33]; impostor feelings—ab = 0.54, SE = 0.13, 95% CI = [0.29, 0.81]; and sense of belonging—ab = −0.32, SE = 0.08, 95% CI = [−0.50, −0.17]). However, for male participants, none of the three indirect pathways were significant (interest—ab = −0.17, SE = 0.17, 95% CI = [−0.53, 0.16]; impostor feelings—ab = 0.15, SE = 0.15, 95% CI = [−0.13, 0.45]; and sense of belonging—ab = −0.09, SE = 0.09, 95% CI = [−0.28, 0.08]). These differences were largely due to the a paths (see Fig. 4); the b paths (from perceptions of an MCC to outcomes) were not significantly different for women and men (see Table 2).

None of these results changed appreciably when we adjusted for the estimated percentage of female employees in the company (see Tables S15–S17 in the supplemental material at https://osf.io/fsven/). Additionally, as in Study 1, the relationships between perceived MCC and interest and anticipated sense of belonging remained significant when we adjusted for impostor feelings (see Table S18 in the supplemental material at https://osf.io/fsven/).

Discussion

When a company emphasized brilliance, participants expected it to have a stronger MCC. This causal link emerged only among women, which is consistent with the findings of Study 1, where the correlation between perceptions of a field's brilliance orientation and its expected masculinity-contest norms was stronger for female than for male academics. Also consistent with Study 1, results of Study 2 showed that stronger perceptions of an MCC were associated with more negative outcomes for both women and men.

Finally, the brilliance-emphasis manipulation had an indirect effect—via perceptions of an MCC—on interest and well-being only for women. This finding provides support for the proposal that the perception of an MCC functions as a mechanism by which an emphasis on brilliance discourages women's participation.
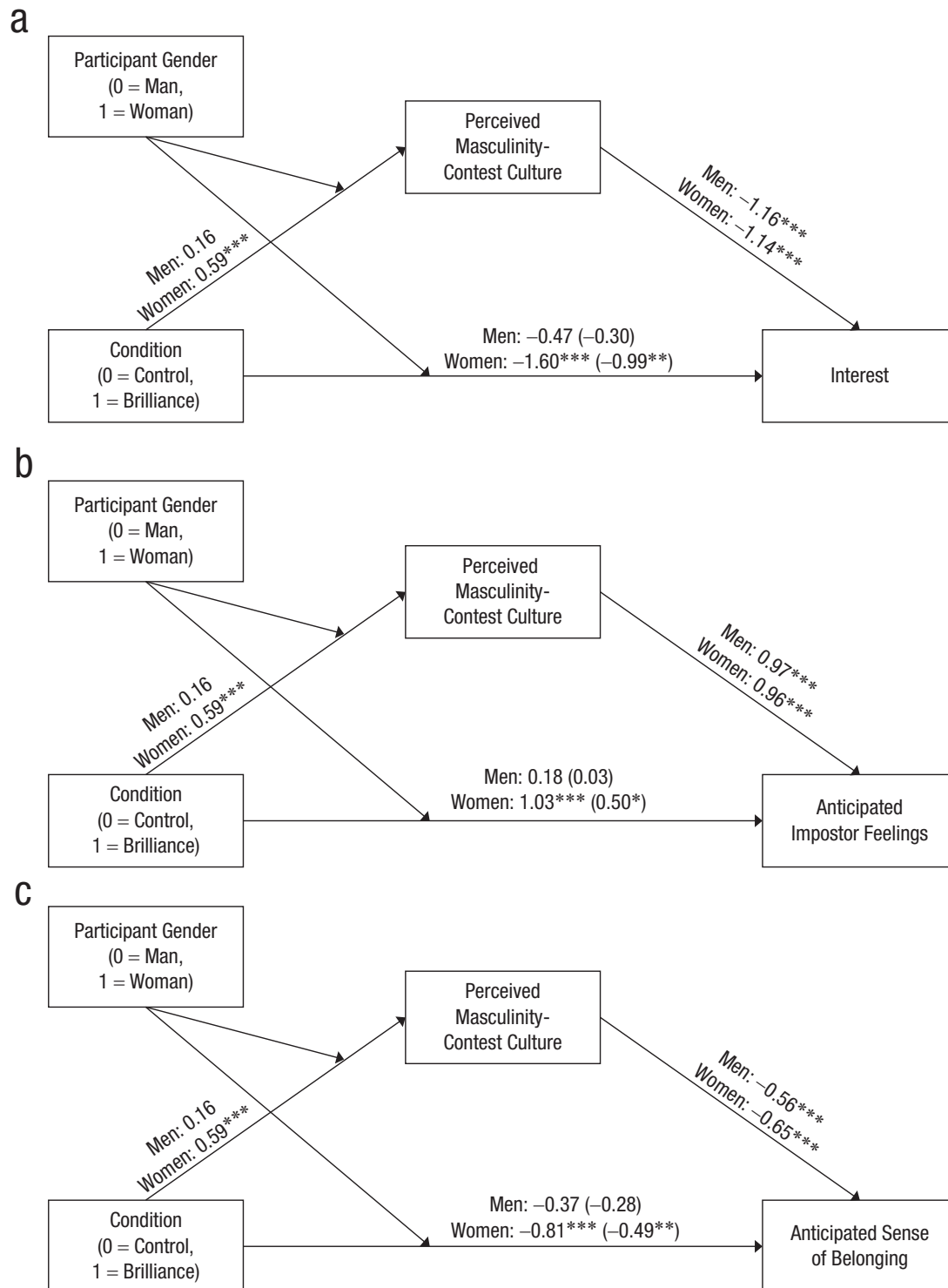
Fig. 5. Effects of experimental condition through perception of a masculinity contest culture on (a) interest, (b) anticipated impostor feelings, and (c) anticipated sense of belonging in Study 2, as moderated by participant gender. Unstandardized coefficients are reported. On the path from the independent to the dependent variable, values outside parentheses show the total effect, and values inside parentheses show the direct effect after controlling for the mediator and moderators. All path coefficients were calculated via simple regression models in Stata Version 16, whereas the indirect effects and indices of moderated mediation were calculated using the PROCESS module for SPSS. Asterisks indicate significant paths (*$p < .05$, **$p < .01$, ***$p < .001$).

Table 2. Results of Regression Models Predicting Downstream Outcomes (Interest in Company, Anticipated Impostor Feelings, and Anticipated Sense of Belonging) as a Function of Participant Gender and Masculinity-Contest Culture (MCC) Ratings in Study 2

Dependent variable and predictor	b	SE	p	ω_p^2
Interest in company				
Participant gender[a]	−0.33 [−0.78, 0.12]	0.23	.151	.003
MCC	−1.15 [−1.40, −0.90]	0.13	< .001	.22
Participant Gender × MCC	0.03 [−0.47, 0.53]	0.25	.915	.00
Anticipated impostor feelings				
Participant gender[a]	0.07 [−0.24, 0.39]	0.16	.642	.00
MCC	0.96 [0.79, 1.14]	0.09	< .001	.29
Participant Gender × MCC	−0.01 [−0.36, 0.34]	0.18	.948	.00
Anticipated sense of belonging				
Participant gender[a]	−0.03 [−0.26, 0.20]	0.12	.785	.00
MCC	−0.60 [−0.73, −0.47]	0.06	< .001	.22
Participant Gender × MCC	−0.09 [−0.35, 0.17]	0.13	.500	.00

Note: Predictors were mean-centered to facilitate interpretation of the coefficients. The coefficients of participant gender and MCC in this table can be interpreted as one would interpret the main effects in an analysis-of-variance table. These results did not change appreciably when we adjusted for the estimated percentage of female employees in the company (see Table S16 in the supplemental material at https://osf.io/fsven/). Values in brackets are 95% confidence intervals.
[a]Participant gender was coded 0 for man and 1 for woman.

Study 3

In Study 3, we experimentally tested the second link in the proposed causal mechanism—namely, that work environments perceived to be characterized by an MCC undermine interest and well-being more than work environments not perceived to be characterized by an MCC. In this study, we kept the emphasis on brilliance constant—and high—across conditions and manipulated only the perceived workplace norms, measuring their effects on participants' interest and anticipated well-being, as well as whether these effects differ for women and men. Although gender did not moderate the negative relationship between perceived MCC and these outcomes in Studies 1 and 2, Study 3 provided the first opportunity to investigate these potential moderation effects experimentally. Notably, this study also speaks to potential interventions: If an emphasis on brilliance is discouraging to women because it licenses the expectation of an MCC, then it is important to know whether countering these expectations makes a brilliance-oriented workplace equally motivating and psychologically safe for women and men.

Method

Participants. As in Study 2, we based our target sample size on effect sizes from the study by Bian et al. (2018) and an a priori power analysis (G*Power Version 3.1;

Faul et al., 2009) for a regression model with up to four predictors. The power analysis indicated that to detect the small to medium effect size (f^2 = .029) found by Bian et al., assuming power of .80 and an α of .05, we would need to recruit 273 participants. We increased the target sample size by 15% to account for exclusions. We recruited a convenience sample of 357 individuals via MTurk (Buhrmester et al., 2011). The study was available to workers in the United States with prior approval rates of 95% or higher, and participants received $0.55 for completing the study. Following our preregistered criteria, we excluded 81 participants who (a) indicated that some of their answers were jokes or random, (b) provided nonsense responses in an open-ended question described in the procedure, or (c) had duplicate IP addresses (final *N* = 276; age: *M* = 33.22 years, *SD* = 11.51; 55.8% female; 65.6% White). Gender information was missing for three participants.

Procedures and measures. As in Study 2, we extended our investigation from academia to nonacademic professional opportunities (Bian et al., 2018). Participants read information ostensibly from a company's website advertising new openings to join the company's workforce. In Study 3, for all participants, the advertisement emphasized employees' exceptional intellectual ability (i.e., identical to the brilliance condition in Study 2). To manipulate perceptions of an MCC at the hypothetical company, we asked participants to imagine that they had an

acquaintance currently employed at the company and that they had sent this person an email asking what it was like to work there. Each participant was randomly assigned to either a high-MCC condition, in which the acquaintance's response suggested that the company was strongly characterized by an MCC (e.g., "There's sometimes a sense here that admitting you don't know the answer or seeking others' advice looks weak"), or a low-MCC condition, in which the acquaintance's response indicated that the company was not characterized by an MCC (e.g., "There's usually a sense here that admitting you don't know the answer or seeking others' advice is okay"). The full manipulation is reported in the supplemental material at https://osf.io/fsven/.

After the manipulation, participants completed the same three measures as in Study 2, in random order: (a) interest in working in the company (α = .93), (b) anticipated impostor feelings (α = .92), and (c) anticipated sense of belonging (α = .90), followed by a question asking participants to estimate the percentage of all employees at the company who were women, as in Study 2. Item order was random within measures, and two manipulation checks followed.

Manipulation checks. To confirm that our manipulation shaped perceptions of an MCC as intended, we asked participants to indicate their agreement with the item, "The company has a work environment of ruthless competition," on a scale from 1 (*strongly disagree*) to 5 (*strongly agree*). In addition, we considered the possibility that the relationship between emphasis on brilliance and the perception of an MCC might be bidirectional. Thus, to investigate whether the low-MCC condition inadvertently lowered the perception of an emphasis on brilliance relative to the high-MCC condition (which would compromise our conclusions), we asked participants to indicate their agreement with a second manipulation-check item, "The company emphasizes employees' natural intelligence and inherent aptitude" (1 = *strongly disagree*, 5 = *strongly agree*).

Demographic information and debriefing. Study 3 ended by asking participants to type any thoughts they had about the study (open ended), provide demographic information (e.g., gender, race), and indicate whether any of their answers were random or jokes (yes/no).

Results

Means, standard deviations, and bivariate correlations between all study variables are reported in Table S21 in the supplemental material at https://osf.io/fsven/. We report unstandardized coefficients for the regression and mediation analyses.

Manipulation checks. As expected, participants in the high-MCC condition were significantly more likely to perceive a work environment of ruthless competition (M = 4.24, SD = 0.88), compared with participants in the low-MCC condition (M = 2.05, SD = 1.07), $F(1, 269)$ = 331.03, $p < .001$, ω_p^2 = .56, a large effect. The effect of participant gender and its interaction with condition were not significant ($ps > .336$).

Contrary to our concerns, results showed that participants rated the company's emphasis on brilliance as being higher in the low-MCC condition (M = 4.38, SD = 0.68) than in the high-MCC condition (M = 4.13, SD = 1.00), $F(1, 269)$ = 5.20, p = .023, ω_p^2 = .01, a small effect. It is possible that this is a positivity spillover effect: If participants perceived the low-MCC company more positively as a result of its weak MCC, they may have also inferred that this company is able to attract the most competent people. Regardless of the reason for this difference, the important point is that it works against our ability to find the predicted effects. The effect of participant gender and its interaction with condition were not significant ($ps > .55$).

Link between perception of an MCC and downstream outcomes. First, we examined whether the MCC manipulation influenced the three downstream outcomes: (a) interest in the company, (b) anticipated impostor feelings, and (c) anticipated sense of belonging. To do this, we regressed each of the three outcome variables on MCC condition (low = 0, high = 1). As expected, participants in the high-MCC condition reported lower interest in employment opportunities at the hypothetical company compared with those in the low-MCC condition (b = −2.67, SE = 0.22, 95% CI = [−3.10, −2.24], $p < .001$, ω_p^2 = .35, a large effect). High-MCC participants also anticipated stronger impostor feelings (b = 1.47, SE = 0.16, 95% CI = [1.15, 1.79], $p < .001$, ω_p^2 = .23, a large effect) and a lower sense of belonging (b = −1.74, SE = 0.13, 95% CI = [−1.99, −1.49], $p < .001$, ω_p^2 = .40, a large effect).

Given the unexpected effect of the MCC manipulation on participants' perceptions of the company's emphasis on brilliance, we also tested whether the effects of MCC condition on interest and well-being emerged above and beyond these perceptions. (This analysis was not preregistered.) Indeed, the effects of MCC condition remained significant for all outcomes (see Table S22 in the supplemental material at https://osf.io/fsven/).

Moderation by gender. Next, we investigated whether the consequences of perceiving an MCC in a brilliance-oriented organization varied on the basis of participant gender. For the purposes of this analysis, we regressed each of the three outcome variables on MCC condition (low = 0, high = 1), participant gender (man = 0, woman = 1), and their interaction. The results of these models,

Table 3. Results of Regression Models Predicting Downstream Outcomes (Interest in Company, Anticipated Impostor Feelings, and Anticipated Sense of Belonging) as a Function of Participant Gender and Masculinity-Contest Culture (MCC) Condition in Study 3

Dependent variable and predictor	b	SE	p	ω_p^2
Interest in company				
Participant gender[a]	−0.26 [−0.69, 0.17]	0.22	.241	.001
MCC condition[b]	−2.70 [−3.13, −2.27]	0.22	< .001	.36
Participant Gender × MCC Condition	−0.95 [−1.82, −0.09]	0.44	.031	.01
Anticipated impostor feelings				
Participant gender[a]	0.39 [0.07, 0.72]	0.16	.018	.02
MCC condition[b]	1.48 [1.15, 1.80]	0.16	< .001	.23
Participant Gender × MCC Condition	−0.03 [−0.68, 0.61]	0.33	.916	.00
Anticipated sense of belonging				
Participant gender[a]	−0.27 [−0.53, −0.02]	0.13	.032	.01
MCC condition[b]	−1.75 [−1.99, −1.50]	0.13	< .001	.41
Participant Gender × MCC Condition	−0.22 [−0.72, 0.28]	0.25	.391	.00

Note: Predictors were mean-centered to facilitate interpretation of the coefficients. The coefficients of participant gender and MCC condition in this table can be interpreted as one would interpret the main effects in an analysis-of-variance table. These results did not change appreciably when we adjusted for the estimated percentage of female employees in the company and participants' perceptions of the company's emphasis on brilliance (see Table S23 in the supplemental material at https://osf.io/fsven/). Values in brackets are 95% confidence intervals.
[a]Participant gender was coded 0 for man and 1 for woman. [b]MCC condition was coded 0 for low and 1 for high.

reported in Table 3, revealed a significant Condition × Gender interaction on interest in the company ($b = -0.95$, $SE = 0.44$, 95% CI = [−1.82, −0.09], $p = .031$, $\omega_p^2 = .01$). For the two other outcomes, this interaction was not significant (impostor feelings: $b = -0.03$, $SE = 0.33$, 95% CI = [−0.68, 0.61], $p = .92$, $\omega_p^2 = .00$; belonging: $b = -0.22$, $SE = 0.26$, 95% CI = [−0.72, 0.28], $p = .39$, $\omega_p^2 = .00$). Nevertheless, given our preregistered analytic strategy, we examined the effect of condition separately for female and male participants for the three outcome variables. The condition differences were statistically significant for all three outcomes among both women and men ($ps < .001$). Numerically, the high- versus low-MCC differences were greater among women than among men for interest (women: $b = -3.12$, $SE = 0.29$, 95% CI = [−3.69, −2.55], $\omega_p^2 = .29$; men: $b = -2.16$, $SE = 0.33$, 95% CI = [−2.82, −1.51], $\omega_p^2 = .13$) and belonging (women: $b = -1.84$, $SE = 0.17$, 95% CI = [−2.17, −1.51], $\omega_p^2 = .30$; men: $b = -1.62$, $SE = 0.19$, 95% CI = [−2.00, −1.24], $\omega_p^2 = .21$) but were virtually identical for impostor feelings (women: $b = 1.46$, $SE = 0.22$, 95% CI = [1.03, 1.89], $\omega_p^2 = .14$; men: $b = 1.50$, $SE = 0.25$, 95% CI = [1.01, 1.98], $\omega_p^2 = .12$). The results reported here did not change appreciably when we adjusted for the estimated percentage of female employees in the company and participants' perceptions of the company's emphasis on brilliance (see Table S23 in the supplemental material at https://osf.io/fsven/).

From a practical, intervention-focused perspective, we might also ask whether the outcomes for women and men were more similar when the brilliance-oriented company was portrayed as having low levels of an MCC. With respect to interest, female participants reported lower scores than male participants in the high-MCC condition ($b = -0.72$, $SE = 0.31$, 95% CI = [−1.32, −0.12], $p = .020$, $\omega_p^2 = .02$) but not in the low-MCC condition ($b = 0.23$, $SE = 0.32$, 95% CI = [−0.40, 0.86], $p = .46$, $\omega_p^2 = .00$; see Fig. 6a). With respect to anticipated impostor feelings, gender differences were not significant in either condition (high-MCC condition: $b = 0.38$, $SE = 0.23$, 95% CI = [−0.07, 0.83], $p = .10$, $\omega_p^2 = .01$; low-MCC condition: $b = 0.41$, $SE = 0.24$, 95% CI = [−0.05, 0.88], $p = .083$, $\omega_p^2 = .01$; see Fig. 6b). In both cases, women anticipated numerically stronger impostor feelings than men. With respect to anticipated sense of belonging, female participants reported lower scores than male participants in the high-MCC condition ($b = -0.38$, $SE = 0.18$, 95% CI = [−0.73, −0.03], $p = .033$, $\omega_p^2 = .01$) but not in the low-MCC condition ($b = -0.16$, $SE = 0.18$, 95% CI = [−0.52, 0.20], $p = .38$, $\omega_p^2 = .00$; see Fig. 6c). Similar to the results found in Study 2, the effects of MCC condition on interest and sense of belonging remained significant when we adjusted for impostor feelings (see Table S24 in the supplemental material at https://osf.io/fsven/).
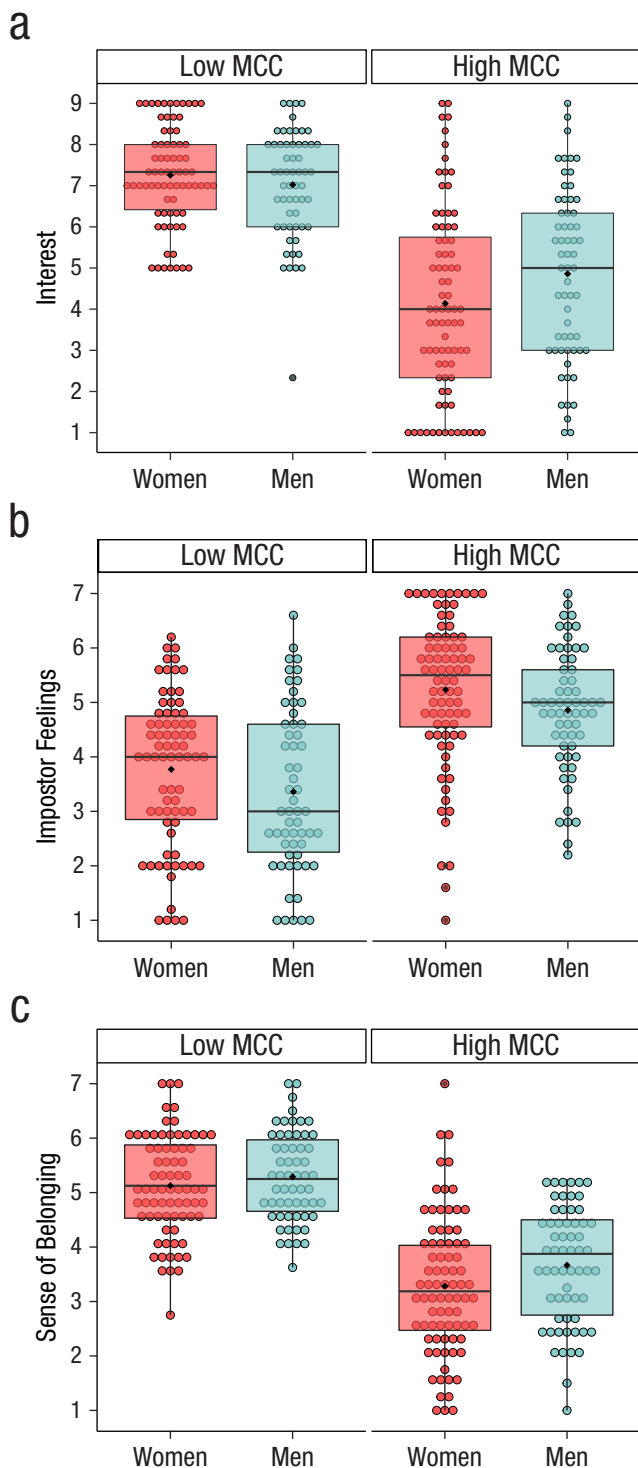
Fig. 6. Effects of a masculinity-contest culture (MCC; high vs. low) and participant gender on (a) interest, (b) anticipated impostor feelings, and (c) anticipated sense of belonging in Study 3. Each dot represents an individual participant's response. Within each box plot, the solid line in the middle represents the median, and the diamond represents the mean. The bottom and top edges of the box indicate the 25th and 75th percentiles, respectively, and whiskers extend 1.5 times the interquartile range.

Discussion

When a brilliance-oriented company was said to display high (vs. low) levels of an MCC, participants showed lower interest in joining the company and were more likely to anticipate feeling like impostors who would not belong. These findings provide evidence for the second link in our hypothesized causal pathway—namely, that MCCs undermine interest and expected well-being. These links were only partially moderated by gender, consistent with what we observed in Studies 1 and 2, where the relationship between perceptions of workplace norms and psychological outcomes was similar in magnitude for women and men. Of relevance to future interventions, results showed that when participants were led to believe that a brilliance-oriented company was not characterized by an MCC, women were just as interested in this company as men were and anticipated similar levels of belonging.

General Discussion

We proposed that contexts in which brilliance is prized can be unwelcoming for women because the emphasis on brilliance—a stereotypically male trait that is viewed as relatively fixed—fosters the perception of an MCC. The results of three preregistered studies (and a preregistered pilot study) provided support for this proposal in the context of academia (pilot study and Study 1) and in a hypothetical industry context (Studies 2 and 3).

These findings contribute to the growing literature on field-specific ability beliefs by identifying a mechanism through which an emphasis on brilliance undermines gender diversity—namely, the perception of a negative work environment. Although the effect sizes in our studies were somewhat variable and may not generalize to academic or professional contexts outside of the United States, the results as a whole indicate that perceptions of an MCC may play a key role in the maintenance of gender disparities in brilliance-focused domains. Indeed, countering the perception of a masculine cultural ethos might be an effective way to increase the participation of women in domains in which brilliance is prized (Study 3).

Our results also suggest that the gender composition of brilliance-focused contexts might not, by itself, be what makes these environments unwelcoming to women. In our studies, beliefs about what is valued in a context were consequential beyond the estimated gender ratios. Thus, it may be possible to foster a more inclusive environment in brilliance-oriented contexts by changing the work culture even if current gender ratios are still imbalanced. Similarly, it does not seem that an internalized lack of self-confidence was driving

the negative effects of brilliance-focused contexts, for either women or men: We found the expected downstream effects on sense of belonging (Studies 1–3) and interest (Studies 2 and 3) through perceptions of an MCC even when we adjusted for participants' impostor feelings, which indicates that perceptions of the culture—rather than low confidence—drove the negative effects of an emphasis on brilliance.

In future investigations, it will be worthwhile to examine objective markers of an MCC (rather than individual perceptions) and to investigate precisely why emphasizing brilliance leads the negative elements of stereotypic masculinity (e.g., dominance, competition) to become the norm. In particular, it would be informative to disentangle the role of stereotypically masculine standards (i.e., the association of brilliance with men; Cheryan & Markus, 2020) from the role of fixed mindsets (i.e., the tendency to view brilliance as innate and unchangeable; Rattan et al., 2012). Future research should also explore why women have a lower threshold for anticipating an undesirable workplace culture from an emphasis on brilliance. Although we found that both men and women perceive MCCs in contexts that emphasize brilliance, women also appeared to be more sensitive to this connection (Study 2). To some extent, this lower threshold seems to be a function of women's prior experiences (e.g., compare nonacademic and academic women's perceptions of academia in the pilot study and Study 1, respectively), but which aspects of experience are relevant remains to be determined.

In summary, an emphasis on brilliance leads individuals to perceive an environment characterized by a competitive struggle for intellectual dominance. Women seem particularly attuned to this link, and because perceiving such an environment is generally demotivating, professions in which brilliance is prized continue to confront gender gaps.

Transparency

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Author Contributions
    A. C. Vial, A. Cimpian, and G. E. Newman developed the research concept. A. C. Vial and A. Cimpian designed the studies. A. C. Vial collected the data for all studies, with the collaboration of M. Muradoglu for Study 2. A. C. Vial and A. Cimpian analyzed the data, and M. Muradoglu created the figures. A. C. Vial drafted the manuscript, and M. Muradoglu, G. E. Newman, and A. Cimpian provided critical revisions. All the authors approved the final manuscript for submission.
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Notes

1. Unless otherwise noted, all analyses were conducted in Stata Version 16 (StataCorp, 2019).
2. In all studies, we also examined the potential moderating roles of participant race and (when relevant) the role of participant exposure to the different academic fields. There were no interactions with these variables, and the relationship between perceived emphasis on brilliance and perceived MCC remained significant in all models (see Tables S5, S12, S19, and S25 in the supplemental material at https://osf.io/fsven/).

References

Albers, C., & Lakens, D. (2018). When power analyses based on pilot data are biased: Inaccurate effect size estimators and follow-up bias. *Journal of Experimental Social Psychology*, 74, 187–195. https://doi.org/10.1016/j.jesp.2017.09.004

Association of American Medical Colleges. (2018). *Faculty roster: U.S. medical school faculty.* https://www.aamc.org/data-reports/faculty-institutions/interactive-data/data-reports/faculty-institutions/interactive-data/2018-us-medical-school-faculty

Baron-Cohen, S. (2002). The extreme male brain theory of autism. *Trends in Cognitive Sciences*, 6(6), 248–254. https://doi.org/10.1016/s1364-6613(02)01904-6

Ben-Shachar, M., Lüdecke, D., & Makowski, D. (2020). effectsize: Estimation of effect size indices and standardized parameters. *Journal of Open Source Software*, 5(56), Article 2815. https://doi.org/10.21105/joss.02815

Berdahl, J. L., Cooper, M., Glick, P., Livingston, R. W., & Williams, J. C. (2018). Work as a masculinity contest.

Journal of Social Issues, *74*(3), 422–448. https://doi.org/10.1111/josi.12289

Bian, L., Leslie, S. J., & Cimpian, A. (2017). Gender stereotypes about intellectual ability emerge early and influence children's interests. *Science*, *355*(6323), 389–391. https://doi.org/10.1126/science.aah6524

Bian, L., Leslie, S. J., Murphy, M. C., & Cimpian, A. (2018). Messages about brilliance undermine women's interest in educational and professional opportunities. *Journal of Experimental Social Psychology*, *76*, 404–420. https://doi.org/10.1016/j.jesp.2017.11.006

Billington, J., Baron-Cohen, S., & Wheelwright, S. (2007). Cognitive style predicts entry into physical sciences and humanities: Questionnaire and performance tests of empathy and systemizing. *Learning and Individual Differences*, *17*(3), 260–268. https://doi.org/10.1016/j.lindif.2007.02.004

Buhrmester, M., Kwang, T., & Gosling, S. D. (2011). Amazon's Mechanical Turk: A new source of inexpensive, yet high-quality, data? *Perspectives on Psychological Science*, *6*(1), 3–5. https://doi.org/10.1177/1745691610393980

Canning, E. A., Murphy, M. C., Emerson, K. T. U., Chatman, J. A., Dweck, C. S., & Kray, L. J. (2020). Cultures of genius at work: Organizational mindsets predict cultural norms, trust, and commitment. *Personality and Social Psychology Bulletin*, *46*(4), 626–642. https://doi.org/10.1177/0146167219872473

Cheryan, S., & Markus, H. R. (2020). Masculine defaults: Identifying and mitigating hidden cultural biases. *Psychological Review*, *127*(6), 1022–1052. https://doi.org/10.1037/rev0000209

Cheryan, S., Ziegler, S. A., Montoya, A. K., & Jiang, L. (2017). Why are some STEM fields more gender balanced than others? *Psychological Bulletin*, *143*(1), 1–35. http://doi.org/10.1037/bul0000052

Clance, P. R., & Imes, S. A. (1978). The imposter phenomenon in high achieving women: Dynamics and therapeutic intervention. *Psychotherapy: Theory, Research & Practice*, *15*(3), 241–247. https://doi.org/10.1037/h0086006

Deiglmayr, A., Stern, E., & Schubert, R. (2019). Beliefs in "brilliance" and belonging uncertainty in male and female STEM students. *Frontiers in Psychology*, *10*, Article 1114. https://doi.org/10.3389/fpsyg.2019.01114

Dweck, C. S. (2008). *Mindset: The new psychology of success*. Random House.

Faul, F., Erdfelder, E., Buchner, A., & Lang, A.-G. (2009). Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods*, *41*, 1149–1160. https://doi.org/10.3758/BRM.41.4.1149

Field, A. (2013). *Discovering statistics using IBM SPSS statistics*. SAGE.

Glick, P., Berdahl, J. L., & Alonso, N. M. (2018). Development and validation of the Masculinity Contest Culture scale. *Journal of Social Issues*, *74*(3), 449–476. https://doi.org/10.1111/josi.12280

Good, C., Rattan, A., & Dweck, C. S. (2012). Why do women opt out? Sense of belonging and women's representation in mathematics. *Journal of Personality and Social Psychology*, *102*(4), 700–717. https://doi.org/10.1037/a0026659

Gunderson, E. A., Ramirez, G., Levine, S. C., & Beilock, S. L. (2012). The role of parents and teachers in the development of gender-related math attitudes. *Sex Roles*, *66*(3), 153–166. https://doi.org/10.1007/s11199-011-9996-2

Hayes, A. F. (2015). An index and test of linear moderated mediation. *Multivariate Behavioral Research*, *50*(1), 1–22. https://doi.org/10.1080/00273171.2014.962683

Heatherington, L., Daubman, K. A., Bates, C., Ahn, A., Brown, H., & Preston, C. (1993). Two investigations of "female modesty" in achievement situations. *Sex Roles*, *29*(11), 739–754. https://doi.org/10.1007/BF00289215

Heilman, M. E. (1979). High school students' occupational interest as a function of projected sex ratios in male-dominated occupations. *Journal of Applied Psychology*, *64*(3), 275–279. https://doi.org/10.1037/0021-9010.64.3.275

Holman, L., & Morandin, C. (2019). Researchers collaborate with same-gendered colleagues more often than expected across the life sciences. *PLOS ONE*, *14*(4), Article e0216128. https://doi.org/10.1371/journal.pone.0216128

Kupers, K. A. (2005). Toxic masculinity as a barrier to mental health treatment in prison. *Journal of Clinical Psychology*, *61*(6), 713–724. https://doi.org/10.1002/jclp.20105

Leslie, S. J., Cimpian, A., Meyer, M., & Freeland, E. (2015). Expectations of brilliance underlie gender distributions across academic disciplines. *Science*, *347*(6219), 262–265. https://doi.org/10.1126/science.1261375

McPherson, M., Smith-Lovin, L., & Cook, J. M. (2001). Birds of a feather: Homophily in social networks. *Annual Review of Sociology*, *27*(1), 415–444. https://doi.org/10.1146/annurev.soc.27.1.415

Meyer, M., Cimpian, A., & Leslie, S. J. (2015). Women are underrepresented in fields where success is believed to require brilliance. *Frontiers in Psychology*, *6*, Article 235. https://doi.org/10.3389/fpsyg.2015.00235

Muradoglu, M., Horne, Z., Hammond, M. D., Leslie, S.-J., & Cimpian, A. (2021). Women—particularly underrepresented minority women—and early-career academics feel like impostors in fields that value brilliance. *Journal of Educational Psychology*. Advance online publication. https://doi.org/10.1037/edu0000669

National Science Foundation. (2019). *Doctorate recipients from U.S. universities: 2018* (Special report NSF 20-301). https://ncses.nsf.gov/pubs/nsf20301/

Prentice, D. A., & Carranza, E. (2002). What women and men should be, shouldn't be, are allowed to be, and don't have to be: The contents of prescriptive gender stereotypes. *Psychology of Women Quarterly*, *26*(4), 269–281. https://doi.org/10.1111/1471-6402.t01-1-00066

Rattan, A., Savani, K., Naidu, N. V. R., & Dweck, C. S. (2012). Can everyone become highly intelligent? Cultural differences in and societal consequences of beliefs about the universal potential for intelligence. *Journal of Personality and Social Psychology*, *103*(5), 787–803. https://doi.org/10.1037/a0029263

Reid, E. M., O'Neill, O. A., & Blair-Loy, M. (2018). Masculinity in male-dominated occupations: How teams, time, and tasks shape masculinity contests. *Journal of Social Issues*, *74*(3), 579–606. https://doi.org/10.1111/josi.12285

Simon, M., & Choi, Y. J. (2018). Using factor analysis to validate the Clance Impostor Phenomenon Scale in sample of science, technology, engineering and mathematics doctoral students. *Personality and Individual Differences*, *121*, 173–175. https://doi.org/10.1016/j.paid.2017.09.039

Simpkins, S. D. (2015). The role of parents in the ontogeny of achievement-related motivation and behavioral choices. *Monographs of the Society for Research in Child Development*, *80*(2), 1–151. https://doi.org/10.1111/mono .12156

Spence, J. T., Helmreich, R. L., & Holahan, C. K. (1979). Negative and positive components of psychological masculinity and femininity and their relationships to self-reports of neurotic and acting out behaviors. *Journal of Personality and Social Psychology*, *37*(10), 1673–1682. https://doi.org/10.1037/0022-3514.37.10.1673

StataCorp. (2019). *Stata statistical software* (Version 16) [Computer software]. https://www.stata.com/

Storage, D., Charlesworth, T. E. S., Banaji, M. R., & Cimpian, A. (2020). Adults and children implicitly associate brilliance with men more than women. *Journal of Experimental Social Psychology*, *90*, Article 104020. https://doi.org/ 10.1016/j.jesp.2020.104020

Storage, D., Horne, Z., Cimpian, A., & Leslie, S. J. (2016). The frequency of "brilliant" and "genius" in teaching evaluations predicts the representation of women and African Americans across fields. *PLOS ONE*, *11*(3), Article e0150194. https://doi.org/10.1371/journal.pone.0150194

Williams, M. J., & Tiedens, L. Z. (2016). The subtle suspension of backlash: A meta-analysis of penalties for women's implicit and explicit dominance behavior. *Psychological Bulletin*, *142*(2), 165–197. https://doi.org/10.1037/bul0000039