

Perceptions of Safety and Threat in the Environment: The STEP Scale

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Abstract

The Safety and Threat in Environment Perceptions (STEP) scale assesses perceptions of *environments* as safe (welcoming, inclusive) or threatening (critical, intimidating). We first evaluated the factor structure of the scale and demonstrated its unique predictive validity in classrooms (Studies 1 and 2), gyms (Studies 3 and 4), and the workplace (Study 5). When seeing classrooms with stereotypically masculine (vs. neutral) objects, women perceived less safety, which predicted less engagement, interest, and intentions to recruit others. When seeing an unwelcoming (vs. welcoming) gym, women (vs. men) perceived less safety, which predicted less engagement, interest, and intentions to recruit others, especially when the gym contained masculine (vs. feminine or gender-balanced) social cues. When seeing a boardroom with unwelcoming (vs. no) social cues, both men and women perceived greater threat, which predicted less intentions to recruit others. Together, these findings suggest that the STEP scale is a useful measure for assessing perceived safety and threat in any environment.

Keywords

safety, threat, cues, belonging, motivation

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Cues in the environment signal how safe and welcome individuals will feel in a particular setting. Cues can include objects, people, or a combination of physical and social features that convey who or what is valued in that environment. Cues can be communicated verbally—via dialogue, microaggressions, inclusive interactions, policies—or nonverbally—via the presence or absence of certain objects or ingroup members in an environment. Although previous research has investigated the effects of situational cues on outcomes such as belonging, interest, and motivation (Canning et al., 2022; Chaney et al., 2016; Cheryan et al., 2009; Hall et al., 2018; Master et al., 2016; Murphy et al., 2007; Murphy & Taylor, 2012), few studies have directly measured people's overall, gut-level perceptions of the environment itself—of how safe or threatening the *environment* seems.

Assessing perceptions of safety and threat in the environment is important because people's impressions of an environment may guide their engagement and intentions to approach or avoid a space. To this end, the purpose of the present research was to first develop and validate a new measure of the Safety and Threat in the Environment Perceptions (STEP) scale, which can be used across a variety of settings to assess the extent to which people perceive an environment to be safe or threatening. Conceptually, we define safety as overall perceptions that an environment is welcoming,

supportive, and inclusive, whereas threat reflects perceptions that an environment is critical, judgmental, and intimidating.¹ We then examined the unique predictive validity of the STEP scale in shaping people's intended engagement, interest, and intentions to recruit others to a given environment.

Perceptions of Cues in the Environment

Environments are replete with information ranging from physical cues (e.g., features of a room, such as objects, artifacts, signage conveying values, or policies) to social cues (e.g., presence of other people, verbal and nonverbal cues, beliefs of group members). Regardless of what cues are present, the STEP scale is meant to capture people's overall, gestalt impressions of a space. These perceptions provide a valuable window to understanding how people construe the

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environment and what cues they notice and attend to, which may be amplified based on their pre-existing beliefs, identities, or group memberships.

Social psychologists have typically examined how situational cues of threat among members of marginalized or stigmatized groups heighten concerns about being negatively evaluated based on one's group membership. For example, cues related to one's race or gender may remind individuals of stereotypes associated with their group, leading to stereotype threat (Murphy & Taylor, 2012; Schmader et al., 2015; Spencer et al., 2016; Steele & Aronson, 1995; Walton et al., 2015) or social identity threat in which individuals feel devalued based on their group membership (Purdie-Vaughns et al., 2008; Steele, 1997; Wout et al., 2009). For instance, in Science, Technology, Engineering, and Math (STEM) contexts, women (but not men) may worry about being judged negatively by others due to gender stereotypes about women's inferior quantitative abilities (Schmader et al., 2015; Spencer et al., 2016), being underrepresented in STEM (Dasgupta et al., 2015), or seeing objects stereotypically associated with STEM implying that women do not belong there (Cheryan et al., 2009; Master et al., 2016).

Social cues in the environment can also signal threat or safety. For example, women who watched a video of a math, science, and engineering conference reported decreased belonging and intentions to participate when there was a numerical minority of women relative to men in the video. Men, in contrast, were not affected by this gender cue (Murphy et al., 2007). Cues conveying sexism can also contribute to social identity threat; in one study, the mere suggestion that a male instructor was sexist led women (but not men) to feel less favorable about the instructional experience and to underperform on a logic test (Adams et al., 2006). In other studies, women who interacted with a male engineering student who endorsed sexist attitudes and acted in a domineering way performed worse on an engineering test than those who interacted with nonsexist men (Logel et al., 2009). Even seemingly mundane environments, such as gyms, can contain cues that enhance gender disparities with regard to physical activity (Coen et al., 2018). Together, these and other studies suggest a variety of cues in the environment can shape important outcomes.

Assessing Perceptions of Safety and Threat

Impressions of an environment may influence whether or not people choose to enter a space, similar to processes involved in person perception. For example, people's impressions and expectations of others guide their motivation and behavior to approach another person and interact with them or not. Similarly, people's overall, gut-level perceptions of an environment—based on cues indicating a safe or threatening space—may affect people's behavioral intentions within that environment.

When people perceive a space to be safe, they are likely to be motivated to engage in that space freely without being on

guard or hypervigilant for signs of threat in the environment (Park, Naidu, et al., 2023). This tendency may be especially pronounced for members of underrepresented groups who doubt their inclusion in certain settings based on a history of being socially excluded or discriminated against based on their group membership. Along these lines, students from underrepresented racial-ethnic backgrounds reported greater belonging, university support, and academic engagement when they read about their university creating a building on campus that was intended specifically for students of color versus a general space for all students to use (Kirby et al., 2020).

Although past work has examined perceptions of specific aspects of the environment or responses to the environment, few studies have directly measured people's perceptions of the environment itself. For example, existing measures of school climate assess feeling respected and cared for by teachers, perceived fairness of classroom rules, and the absence of bullying and victimization (Bear et al., 2016). A positive school climate—characterized by high perceived social support, clear and consistent behavioral expectations, and low rates of school violence—is associated with better academic, behavioral, and socioemotional outcomes. Students' perceptions of their school as being fair and caring are also related to higher grades and achievement, lower dropout rates, and fewer behavioral problems (Bear, 2010).

In workplace settings, research on organizational climate has focused on workers' perceptions of how supervisors and authority figures treat their employees (Eisenberger et al., 1986) and how members of work teams interact with one another (Edmonson, 1999). When employees feel their supervisors care about them, they perceive greater organizational support—a belief that the organization values their contributions and is concerned for their personal well-being (Rhoades & Eisenberger, 2002). Perceived organizational support, in turn, predicts greater job satisfaction, performance, commitment to the organization, and less turnover and burnout (Eisenberger et al., 1986; Rhoades & Eisenberger, 2002). Along these lines, psychological safety in organizational settings refers to a sense of mutual respect, openness, and trust whereby members of work teams can freely admit their mistakes and share their ideas and concerns without fear of disapproval or retribution, which relate to greater learning and job performance (Edmonson, 1999; Edmonson & Lei, 2014). In contrast, cues in the workplace conveying low concern and caring—such as when managers display busyness cues that convey time scarcity—employees perceive lower organizational support, which predicts less job engagement, greater burnout, and intentions to leave the organization (Park, Italiano, et al., 2023).

Although past research examined perceptions of climate within schools and organizations, these studies measured people's *responses* to cues within the environment—with constructs such as belonging, trust, commitment, interest, and performance—as a proxy or indicator of threat. In

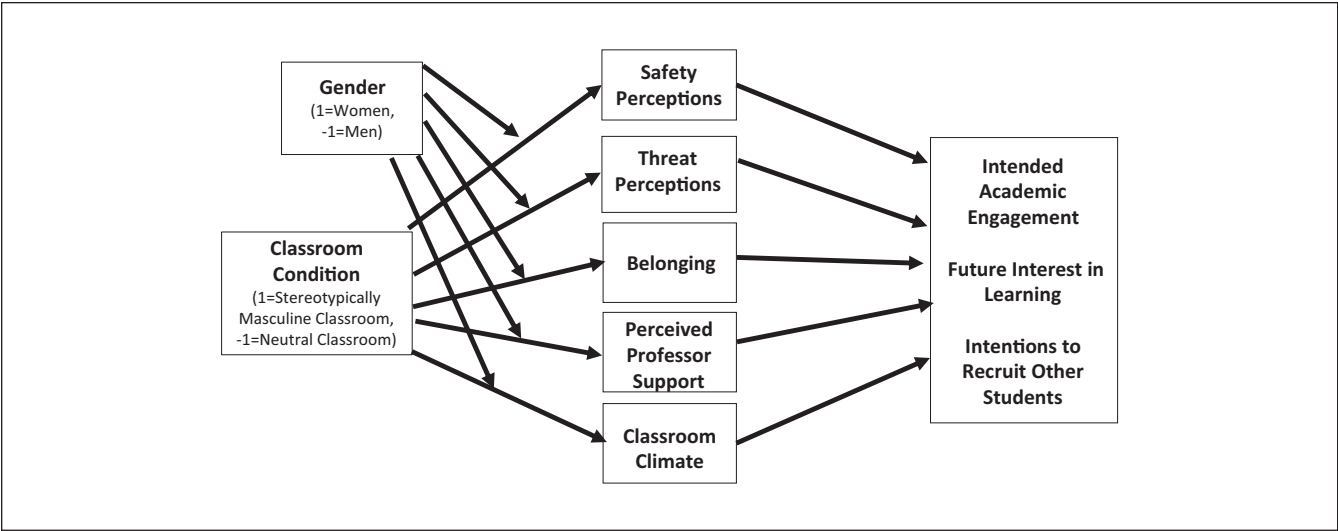


Figure 1. Proposed moderated mediation model predicting dependent measures (Studies 1 and 2).

contrast, the present research goes beyond past findings to assess people’s overall, gut-level impressions of the *environment itself* in terms of safety and threat.

Overview of Current Research

The aims of the present research were to (a) develop and validate a new scale assessing perceptions of safety and threat in the environment and (b) examine how these overall, gut-level impressions shape people’s motivation, interest, and behavioral intentions in that space. If an environment is perceived to be low in safety and/or high in threat, we expected people to be less likely to want to engage in that environment or to encourage others to join in that space.

Moreover, we expected perceptions of safety and/or threat to be amplified for individuals based on their pre-existing expectations and motivations to detect threat (Park, Naidu, et al., 2023). For example, women—who are likely to doubt their abilities and belonging in historically male-dominated settings, such as STEM contexts (Cheryan et al., 2009; Murphy et al., 2007) and gyms (Coen et al., 2018; Craig & Liberti, 2007)—may be more attuned to notice cues in these environments that foreshadow how they might be treated in that space. Thus, women, in particular, may perceive certain environments to be less safe and/or more threatening than other spaces, affecting their intended engagement and interest in that space.

Study 1 developed the STEP scale and examined its unique predictive validity in an academic context. Study 2 sought to confirm the factor structure of the STEP scale and replicate the findings in a separate sample. Study 3 extended the findings of the previous studies in a different context (i.e., a gym) while Study 4 introduced social cues into this space. Finally, Study 5 added social cues to heighten perceptions of threat in a corporate workplace environment.

Study 1

The purpose of Study 1 was to develop the STEP scale and examine its unique predictive validity. Examining women in STEM contexts as a case example, we hypothesized that women who saw an environment with stereotypically masculine STEM cues (vs. neutral cues) would perceive the space as less safe and/or more threatening and in turn, report less intended engagement, interest in learning, and intentions to recruit others into that space. Furthermore, if people’s overall impressions of the *environment* as assessed by the STEP scale have unique predictive validity, these findings should emerge even after controlling for related constructs, such as belonging, perceived support from others in that space, and existing measures of classroom climate. Figure 1 shows the moderated mediation model tested in Studies 1 and 2.

Methods

Participants and Procedure

Participants ($N = 143$) were students from the Introductory Psychology Participant Pool at a large university in the USA who completed the “Study of Environmental Perceptions” for course credit (see Table 1 for demographics). A sensitivity analysis showed that our analyzed sample size provided adequate power ($>.80$) to detect a Gender $\times$ Condition interaction of $f = .14$.

Participants were informed that researchers were interested in studying students’ thoughts and feelings about different classes they could take in college. They were told they would first see a picture of a classroom that might be used to teach a future computer science course. In the *stereotypically masculine classroom* condition, they saw a photo of a classroom containing stereotypical items related to computer science, such as Star Trek memorabilia,

Table 1. Participant Demographics Across Studies.

	Gender	Age	Ethnicity
Study 1, $N = 413$ (online)	41.9% men, 56.7% women, 1.2% non-binary, 0.2% not reported	$M_{age} = 19.07$, $SD = 2.59$	52.3% White; 29.8% Asian/Asian American; 8.0% Black; 4.8% Hispanic/Latinx; 2.7% multi-racial; 2.4% other or unspecified
Study 2, $N = 373$ (online)	59.5% men, 39.9% women, 0.5% non-binary	$M_{age} = 19.30$ $SD = 1.57$	52.3% White; 29.2% Asian/Asian American; 8.6% Black; 5.4% Hispanic/Latinx; 0.5% Native Hawaiian or Pacific Islander; 1.9% multi-racial; 2.1% unspecified
Study 3, $N = 411$ (in-person and online)	49.9% men, 48.7% women, 1.5% non-binary	$M_{age} = 19.19$, $SD = 2.28$	53.0% White; 24.8% Asian/Asian American; 9.2% Black; 6.8% Hispanic/Latinx; 0.7% American Indian or Native American; 2.7% multi-racial; 2.7% other or unspecified
Study 4, $N = 708$ (in-person and online)	46.5% men, 53.5% women	$M_{age} = 19.05$, $SD = 1.79$	46.0% White; 28.1% Asian/Asian American; 11.5% Black; 6.8% Hispanic/Latinx; 0.1% Native Hawaiian or Pacific Islander; 0.1% American Indian or Native American; 5.2% multi-racial; 2.1% other
Study 5, $N = 635$ (online)	29.4% men, 70.6% women	$M_{age} = 51.15$, $SD = 20.22$	83.4% White; 5.6% Asian/Asian American; 4.0% Black; 1.6% Hispanic/Latinx; 0.2% other or unspecified

Notes. Because our focus was on women's and men's responses in the current studies, participants who identified as non-binary (e.g., $n = 5$ in Study 4; $n = 15$ in Study 5) or did not report their gender (e.g., $n = 2$ in Study 4; $n = 4$ in Study 5) were dropped from analyses.

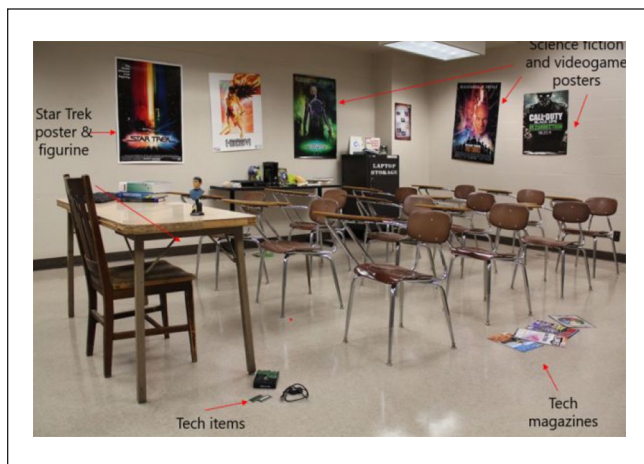


Figure 2. Stereotypically masculine classroom environment (Studies 1 and 2).

Source. Photo from Master et al. (2016).

science fiction posters, and technology/electronic items (Figure 2; Cheryan et al., 2009; Master et al., 2016). In the *neutral classroom* condition, participants saw a classroom with neutral items, such as nature posters, wall art, plants, and water bottles (Figure 3). Both rooms contained a table and chair at the front of the room, desks, a side table, and a storage unit).²

No manipulations other than the ones reported here were used. All data, scripts, and study materials—including additional items not directly relevant to the present research—are available in the Open Science Framework. No analyses were conducted until data collection for each study was completed, no participants were excluded from data analyses unless noted, and the studies were not pre-registered.

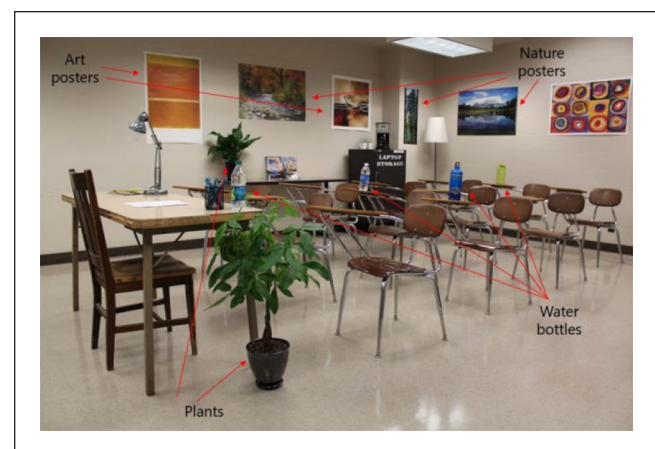


Figure 3. Neutral classroom environment (Studies 1 and 2).
Source. Photo from Master et al. (2016).

Mediator Measures

Perceptions of Safety and Threat in the Environment. While viewing one of the two classroom photos, participants responded to the prompt: “My gut feeling about this classroom environment is that it is. . .” followed by a list of 35 items developed by the authors that were intended to convey safety (e.g., welcoming, inclusive, encouraging) and threat (e.g., critical, intimidating, judgmental) on a scale from 1 = *not at all* to 5 = *very*. Items were generated from brainstorming sessions among the research team discussing words that best conveyed a sense of safety versus threat—psychologically speaking—across various environments. Factor analyses of the items are reported in the results section.³

Belonging. Participants reported their anticipated belonging by responding to items based on existing measures of this

construct (Cheryan et al., 2009; Good et al., 2012; Kirby et al., 2020). Sample items were: “How much would you. . .” “Feel like you belong in this environment?” and “Feel valued in this environment?” from 1 = *not at all* to 7 = *very much* (16 items, $\alpha = .88$).

Perceived Professor Support. Participants reported their perceptions of support from the professor by responding to the prompt: “In this environment. . .” “How much would you feel like the professor cares about their students?” and “How much do you think the professor would provide you with support you might need?” from 1 = *not at all* to 7 = *very much* (adapted from Kirby et al., 2020; 3 items, $\alpha = .95$).

Classroom Climate. Participants completed items from the Delaware School Climate Scale (Bear et al., 2016) which measures school climate in terms of relationships with teachers and classmates, clarity of expectations, fairness of rules, and school safety. Sample items were: “In this environment. . .” “Students treat each other with respect”; “Rules in this class are made clear to students” from 1 = *strongly disagree* to 7 = *strongly agree* (9 items, $\alpha = .87$).

Dependent Measures

Intended Academic Engagement. While viewing one of the photos, participants reported their anticipated engagement in the environment (adapted from Kirby et al., 2020; Townsend et al., 2019). Sample items were: “How involved would you be in this class?” and “How much would you actively participate in this class?” from 1 = *not at all/strongly disagree* to 7 = *very/strongly agree* (9 items, $\alpha = .92$).

Future Interest in Learning. Participants responded to the items: “What is the likelihood that you would take another class in this environment?” and “How interested would you be in learning in this environment in the future?” from 1 = *not at all* to 7 = *very* (adapted from Cheryan et al., 2009; 2 items, $r(411) = .73, p < .001$).

Intentions to Recruit Other Students. Participants reported their intentions to recruit others to take a course in the classroom they saw from 1 = *not at all likely* to 7 = *very likely*. Sample items were: “In this environment. . .” “How likely would you be to talk to other students about taking this class?” and “How likely would you be to encourage prospective students to take this class?” (3 items, $\alpha = .41$).

Results

Exploratory Factor Analysis

To examine the factor structure of the STEP scale, we first conducted an exploratory factor analysis (EFA) in Mplus 8.7 (Muthén & Muthén, 2017) using mean and variance-adjusted

weighted least squares estimators (WLSMV) due to the categorical nature of the items (1–5 response scale) and oblique geomin rotation. Parallel analysis was derived from a separate analysis treating the indicators as continuous, as parallel analysis is not available with categorical indicators, which suggested that up to two factors should be extracted. Consistent with this, a one-factor model was a poor fit to the data and a three-factor model showed clear evidence of over-extraction (i.e., all loadings on the third factor were $< .45$ and none were primary loadings).

We examined model fit using the following criteria: Comparative Fit Index (CFI) should be .90 to .95 for good fit and above .95 for excellent fit (Hu & Bentler, 1999), the Root Mean Square Error of Approximation (RMSEA) should be at or below .06 (Hu & Bentler, 1999), and the Standardized Root Mean Square Residual (SRMR) should be at or below .08 (Browne & Cudeck, 1992). Based on these guidelines, the two-factor model showed good fit to the data: $\chi^2(526) = 1717.15, p < .001$, CFI = .950, RMSEA = .074, SRMR = .051. Standardized factor loadings are shown in Table 2.

The first factor (primary loadings = items 1–16, 34, 35; 18 items, $\alpha = .95$) are interpreted as *perceptions of safety*, whereas the second factor (primary loadings = items 17–21, 23–24, 26–33; 15 items, $\alpha = .92$) are interpreted as *perceptions of threat*. The remaining two items (item 22: Competitive; item 25: Depressing) either had strong cross-loadings ($> .30$) and/or weak primary loadings ($< .45$), so these items were removed from the STEP scale in subsequent testing. The two factors were moderately to strongly negatively correlated ($r = -.54, p < .001$).

In addition, EFAs were run in separate groups for each condition, yielding largely similar conclusions to those of the full sample regarding the optimal number of factors to extract, patterns of loadings, and interpretation of factors. Having established the factor structure of the scale, we examined zero-order correlations among these factors and other measures (Table 3).

ANOVA Analyses

Next, we ran a series of ANOVAs examining main effects of environment (coded as 1 = stereotypically masculine classroom, -1 = neutral classroom), participant gender⁴ (coded as 1 = women, -1 = men), and their interaction in predicting perceived safety, threat, and the dependent variables. Results are shown in Table 4 and Figures 4 and 5. Women (but not men) perceived less safety, greater threat, and reported less intended academic engagement and interest in learning in the stereotypically masculine (vs. neutral) classroom. Although both women and men reported less intentions to recruit others when they saw the stereotypically masculine (vs. neutral) classroom environment, women perceived less safety and reported less intended engagement and interest in learning when they saw the stereotypically masculine classroom than men who saw this environment.

Table 2. Exploratory Factor Analysis of STEP Scale Items (Study 1).

Item	Factor 1, safety perceptions	Factor 2, threat perceptions
1. Supportive	.82* (.02)	.01 (.03)
2. Welcoming	.84* (.02)	-.08* (.03)
3. Inclusive	.73* (.03)	-.03 (.04)
4. Emotionally safe	.75* (.03)	-.09* (.04)
5. Friendly	.82* (.03)	-.11* (.04)
6. Warm	.81* (.03)	-.05 (.04)
7. Pleasant	.84* (.02)	-.09 (.04)
8. Encouraging	.91* (.02)	.07 (.04)
9. Accepting	.76* (.03)	-.09* (.04)
10. Open-minded	.72* (.03)	-.10* (.04)
11. Caring	.87* (.02)	.01 (.03)
12. Comfortable	.72* (.03)	-.16* (.04)
13. Cheerful	.87* (.02)	.02 (.04)
14. Inspiring	.89* (.03)	.15* (.05)
15. Nurturing	.71* (.04)	.13* (.05)
16. Physically safe	.49* (.04)	.00 (.05)
34. Bright	.63* (.04)	.13* (.05)
35. Open	.51* (.05)	.00 (.05)
17. Emotionally harmful	-.18* (.06)	.67* (.04)
18. Draining	-.20* (.05)	.51* (.04)
19. Dismissive	-.19* (.06)	.63* (.04)
20. Demanding	.13* (.05)	.80* (.04)
21. Chilly	.01 (.06)	.46* (.05)
23. Judgmental	.01 (.01)	.87* (.02)
24. Critical	.09 (.04)	.85* (.03)
26. Alienating	-.11* (.05)	.67* (.04)
27. Tense	-.15* (.04)	.72* (.03)
28. Threatening	-.08 (.05)	.73* (.04)
29. Intimidating	-.07 (.05)	.73* (.04)
30. Isolating	-.13* (.06)	.48* (.05)
31. Combative	.05 (.06)	.71* (.04)
32. Condescending	-.07 (.06)	.67* (.04)
33. Dangerous	-.12 (.06)	.59* (.05)
22. Competitive	.36* (.05)	.81* (.04)
25. Depressing	-.42* (.05)	.48* (.04)

Notes. Standardized factor loadings are shown with standard errors in parentheses. Loadings $\geq .45$ with cross-loadings $< .30$ are depicted in bold. Results of a principal axis factor analysis with oblimin rotation on the STEP scale and belonging items revealed that the items loaded onto separate factors. Thus, safety is empirically distinguishable from belonging. * $p < .05$.

Moderated Mediation

Finally, we conducted moderated mediation analyses using Hayes' (2022) PROCESS macro version 4.2 (Model 8). We used 5,000 resamples for 95% bootstrapped percentile confidence intervals to test the indirect effects of classroom condition on the outcome variables through each mediator in parallel (Figure 1). Estimation of indirect effects in a parallel multiple mediator model allows for a simultaneous test of each mediator while controlling for all other mediators in the model. Table 5 reports the results of these analyses.

Intended Academic Engagement. The index of moderated mediation was significant only for perceived safety and belonging.

Future Interest in Learning. The index of moderated mediation was significant only for perceived safety and belonging.

Intentions to Recruit Other Students. The index of moderated mediation was significant only for belonging.

Discussion

Study 1 showed the STEP scale consists of two factors—perceived safety and threat. Using these factors as subscales, when women saw a classroom with stereotypically masculine (vs. neutral) objects, they perceived less safety, which was related to less intended academic engagement and interest in learning in that environment. Women who saw the stereotypically masculine (vs. neutral) classroom also felt less belonging, which was related to less interest in learning and intentions to recruit others to that space. For men, perceived safety and belonging did not differ across classroom conditions in predicting engagement, interest, or intentions to recruit others. Notably, women's decreased perceptions of safety, rather than increased perceptions of threat, contributed to lower intended engagement and interest in learning in the stereotypically masculine classroom. Thus, while safety and threat are inversely related, they reflect distinct psychological experiences captured by the STEP scale.

In sum, Study 1 found that for women, even brief exposure to an image of a STEM classroom showing stereotypically masculine (vs. neutral) physical cues led to decreased perceptions of safety as assessed by the STEP scale, which reduced women's intentions and interest in engaging in that space. Importantly, these findings emerged even after accounting for sense of belonging, perceived professor support, and classroom climate. To test the replicability of the findings, confirm the factor structure of the STEP scale, and examine its convergent and discriminant validity, we conducted Study 2 with a new sample of participants.

Study 2

Participants and Procedure

Participants ($N = 373$) were students from the Introductory Psychology Participant Pool at a large university in the USA who completed the "Study of Environmental Perceptions" in exchange for course credit (see Table 1 for demographics; Table 3 for correlations). A sensitivity analysis indicated that our analyzed sample size provided adequate power ($> .80$) to detect a Gender $\times$ Condition interaction of $f = .15$.

As in Study 1, participants were informed they would see a picture of a classroom that could be used for a future computer science course and were randomly assigned to view a photo of a stereotypically masculine or neutral classroom. They then completed the same measures as before assessing the mediators of perceived safety (18 items, $\alpha = .96$), threat (15 items, $\alpha = .92$),

Table 3. Zero-Order Correlations Among Variables (Studies 1 and 2).

Variable	1.	2.	3.	4.	5.	6.	7.	8.	9.
1. Gender	—	-.06	-.04	-.03	.01	-.01	-.02	-.08	.09
2. Safety	-.06	—	-.57***	.70***	.67***	.64***	.66***	.68***	.44***
3. Threat	-.07	-.56***	—	-.58***	-.41***	-.45***	-.44***	-.48***	-.39***
4. Belonging	-.14**	.75***	-.65***	—	.58***	.56***	.65***	.66***	.61***
5. Perceived professor support	-.03	.63***	-.50***	.68***	—	.77***	.69***	.62***	.44***
6. Classroom climate	-.05	.62***	-.56***	.73***	.78***	—	.71***	.61***	.36***
7. Intended academic engagement	-.05	.57***	-.48***	.70***	.68***	.73***	—	.76***	.51***
8. Future interest in learning	-.07	.68***	-.48***	.76***	.61***	.58***	.67***	—	.53***
9. Intentions to recruit other students	.00	.62***	-.47***	.72***	.63***	.60***	.66***	.73***	—

Notes. Gender was coded as 1 = women, -1 = men. Non-binary participants were coded as missing. Correlations in the upper diagonal region show values from Study 1; correlations in the lower diagonal region show values from Study 2.

** $p < .01$. *** $p < .001$.

Table 4. Results of ANOVAs, Descriptive Statistics, and Pairwise Comparisons (Study 1).

Study variable	Safety		Threat		Intended academic engagement		Future interest in learning		Intentions to recruit other students	
Gender	$F(1, 403) = 2.92$, $p = .088$, $\eta_p^2 = .01$		$F(1, 403) = .40$, $p = .528$, $\eta_p^2 = .00$		$F(1, 403) = .56$, $p = .455$, $\eta_p^2 = .00$		$F(1, 403) = 3.36$, $p = .067$, $\eta_p^2 = .01$		$F(1, 403) = 2.27$, $p = .133$, $\eta_p^2 = .01$	
Classroom condition	$F(1, 403) = 28.17$, $p < .001$, $\eta_p^2 = .07$		$F(1, 403) = 1.89$, $p = .170$, $\eta_p^2 = .01$		$F(1, 403) = 20.87$, $p < .001$, $\eta_p^2 = .05$		$F(1, 403) = 8.27$, $p = .004$, $\eta_p^2 = .02$		$F(1, 403) = 28.58$, $p < .001$, $\eta_p^2 = .07$	
Gender $\times$ Classroom Condition	$F(1, 403) = 9.28$, $p = .002$, $\eta_p^2 = .02$		$F(1, 403) = 4.13$, $p = .043$, $\eta_p^2 = .01$		$F(1, 403) = 4.56$, $p = .033$, $\eta_p^2 = .01$		$F(1, 403) = 3.81$, $p = .052$, $\eta_p^2 = .01$		$F(1, 403) = 3.00$, $p = .084$, $\eta_p^2 = .01$	
Means (SDs)										
Gender	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men
Classroom										
Masculine	2.29 (.90)	2.71 (.81)	2.48 (.89)	2.36 (.82)	4.07 (1.55)	4.48 (1.39)	3.04 (1.79)	3.76 (1.79)	3.80 (.90)	3.83 (1.01)
Neutral	3.03 (.95)	2.91 (.79)	2.19 (.87)	2.42 (.89)	5.01 (1.35)	4.82 (1.24)	3.95 (2.05)	3.93 (1.83)	4.60 (1.28)	4.24 (1.26)
Pairwise comparisons	Safety		Threat		Intended academic engagement		Future interest in learning		Intentions to recruit other students	
	Women versus men		Women versus men		Women versus men		Women versus men		Women versus men	
Masculine	[-.66, -.18], $p < .001$		[-.12, .36], $p = .319$		[-.79, -.02], $p = .041$		[-1.24, -.19], $p = .007$		[-.34, .29], $p = .872$	
Neutral	[-.13, .37], $p = .348$		[-.48, .01], $p = .062$		[-.20, .59], $p = .331$		[-.51, .55], $p = .934$		[.05, .69], $p = .023$	
Women	Masculine versus neutral		Masculine versus neutral		Masculine versus neutral		Masculine versus neutral		Masculine versus neutral	
	[-.96, -.51], $p < .001$		[.07, .52], $p = .009$		[-1.30, -.58], $p < .001$		[-1.40, -.43], $p < .001$		[-1.09, -.51], $p < .001$	
Men	[-.46, .06], $p = .137$		[-.32, .20], $p = .665$		[-.76, .08], $p = .109$		[-.74, .39], $p = .543$		[-.75, -.07], $p = .018$	

Notes. Bolded values are significant. Intentions to recruit = recruit other students to take a course in the classroom. For pairwise comparisons, 95% confidence intervals for mean differences appear in [brackets] next to p -values.

belonging (16 items, $\alpha = .94$), perceived professor support (3 items, $\alpha = .95$), and classroom climate (9 items, $\alpha = .93$). They also completed the same dependent measures as in Study 1 assessing intended academic engagement (9 items, $\alpha = .93$), future interest in learning (2 items, $r(370) = .81$, $p < .001$), intentions to recruit others (3 items, $\alpha = .71$), and demographics.

To establish discriminant validity, participants completed measures of trait self-esteem (1 item: “I have high self-esteem” from 1 = *not very true of me* to 7 = *very true of me*; Robins et al., 2001); Big 5 personality traits assessing extraversion (e.g., “I see myself as extraverted, enthusiastic”; 2 items, $r = .56$, $p < .001$), agreeableness (e.g., “I see myself as sympathetic, warm”; 2 items, $r = .56$, $p < .001$), conscientiousness (e.g., “I see myself as dependable, self-disciplined”; 2 items, $r = .42$, $p < .001$), openness (e.g., “I see myself as open to new experiences, complex”; 2 items, $r = .20$, $p < .001$), and emotional stability (e.g., “I see myself as anxious, easily upset”; reversed; 2 items, $r = .39$, $p < .001$) from 1 = *strongly disagree* to 7 = *strongly agree* (10 items, Gosling et al., 2003); and evaluative concerns (e.g., “In this environment. . .” “I would feel like an ‘impostor’”; “I would feel like people might find out that I am not as capable as they think I am”; Muenks et al., 2020) from 1 = *not at all* to 7 = *very much*.

Convergent and Discriminant Validity

Tables 3 and 6 report zero-order correlations among the study variables. Showing convergent validity, perceived

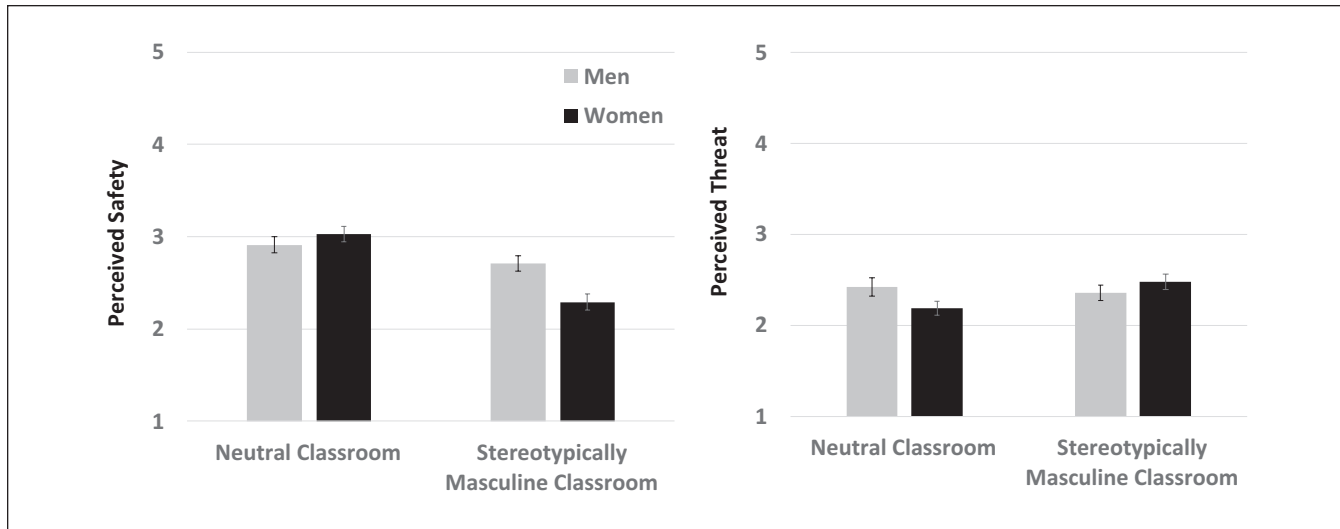


Figure 4. Study I results for perceptions of safety and threat by classroom condition and participant gender. Error bars reflect the standard error around the mean of each condition.

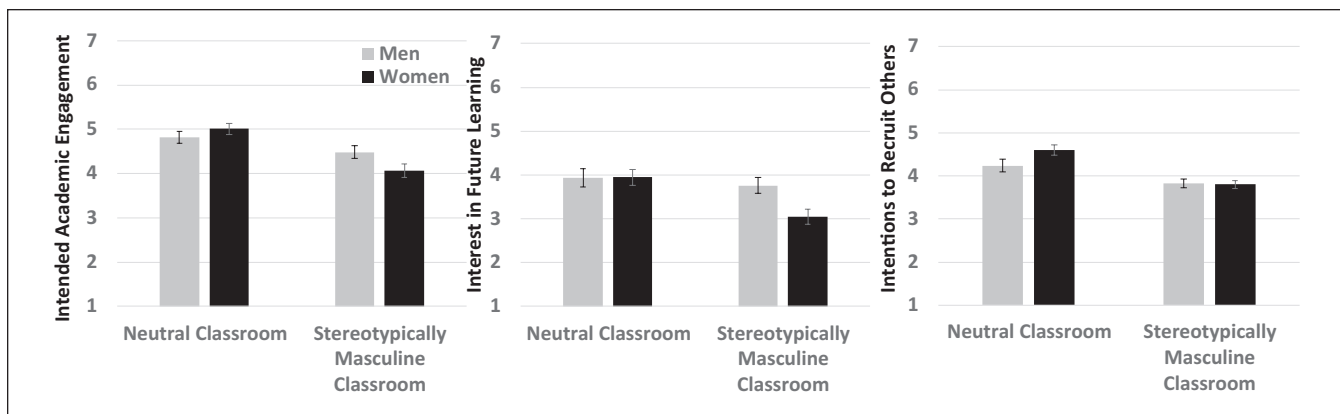


Figure 5. Study I results for intended academic engagement, future interest in learning, and intentions to recruit other students by classroom condition and participant gender. Error bars reflect the standard error around the mean of each condition.

safety was related to greater belonging, perceived professor support, and classroom climate, while perceived threat was related to less belonging, perceived professor support, and worse classroom climate (Table 3). Showing discriminant validity, safety, and threat were unrelated to self-esteem, and safety was unrelated to the Big 5 personality traits. Threat was related to less agreeableness, conscientiousness, emotional stability, and to having more evaluative concerns, whereas safety was related to having less evaluative concerns (see Table 6).

Confirmatory Factor Analysis

A confirmatory factor analysis was tested on the validation sample, specifying the two-factor model found in exploratory analyses (omitting the two poor indicators; see Study 1). WLSMV estimators were again used given the categorical item response scale. This two-factor model was a good fit to the data: $\chi^2(494)$

$= 1476.22, p < .001$, CFI = .960, RMSEA = .073, SRMR = .057. Standardized loadings ranged from .45 to .93 (see Table 7) and the two factors were strongly correlated ($r = -.63, p < .001$). In contrast, a one-factor model fit the data poorly: $\chi^2(495) = 3865.35, p < .001$, CFI = .861, RMSEA = .135, SRMR = .113. Constraining the model to one factor resulted in a significant decrement in model fit relative to the two-factor model: $\chi^2_{diff}(1) = 193.51, p < .001$ (computed using DIFFTEST in Mplus). In addition, fit for the two-factor model was good when examining each condition separately (Condition 1: $\chi^2[494] = 1032.59, p < .001$, CFI = .947, RMSEA = .076, SRMR = .071; Condition 0: $\chi^2[494] = 929.17, p < .001$, CFI = .970, RMSEA = .069, SRMR = .061).

ANOVA Analyses

Next, we ran ANOVAs to test for main effects of classroom condition, participant gender, and their interaction in predicting

Table 5. Results of Moderated Mediation Analyses Predicting Dependent Variables (Studies 1 and 2).

	Study 1			Study 2		
	Effect	p-Value	95% CI	Effect	p-Value	95% CI
<i>X → M path</i>						
Condition → safety	-.23	<.001	[-.32, -.15]	-.16	<.001	[-.26, -.07]
Condition → threat	.06	.170	[-.03, .15]	.14	.002	[.05, .23]
Condition → belonging	-.25	<.001	[-.36, -.15]	-.21	.001	[-.33, -.09]
Condition → perceived professor support	-.25	.003	[-.41, -.09]	-.16	.053	[-.32, .00]
Condition → classroom climate	-.09	.140	[-.21, .03]	-.22	<.001	[-.33, -.11]
<i>Moderating effect of W on X → M path</i>						
Gender × condition → safety	-.13	.003	[-.22, -.05]	-.12	.012	[-.22, -.03]
Gender × condition → threat	.09	.043	[.00, .17]	.03	.511	[-.06, .11]
Gender × condition → belonging	-.14	.011	[-.25, -.03]	-.13	.035	[-.26, -.01]
Gender × condition → perceived professor support	-.13	.103	[-.30, .03]	-.20	.015	[-.36, -.04]
Gender × condition → classroom climate	-.10	.094	[-.23, .02]	-.06	.303	[-.17, .05]
<i>M → Y path (with all variables in the model)</i>						
Safety → intended academic engagement	.22	.006	[.06, .38]	.00	.973	[-.13, .14]
Threat → intended academic engagement	.04	.853	[-.09, .17]	.05	.480	[-.08, .18]
Belonging → intended academic engagement	.31	<.001	[.20, .43]	.31	<.001	[.19, .44]
Perceived professor support → intended academic engagement	.16	<.001	[.07, .25]	.14	.002	[.05, .22]
Classroom climate → intended academic engagement	.39	<.001	[.27, .51]	.40	<.001	[.27, .53]
Safety → future interest in learning	.59	<.001	[.36, .82]	.46	<.001	[.26, .66]
Threat → future interest in learning	-.08	.424	[-.26, .11]	.15	.122	[-.04, .34]
Belonging → future interest in learning	.47	<.001	[.31, .64]	.87	<.001	[.69, 1.05]
Perceived professor support → future interest in learning	.17	.009	[.04, .30]	.20	.002	[.07, .33]
Classroom climate → future interest in learning	.23	.008	[.06, .39]	-.14	.141	[-.33, .05]
Safety → intentions to recruit other students	-.11	.205	[-.27, .06]	.18	.014	[.04, .33]
Threat → intentions to recruit other students	-.11	.101	[-.24, .02]	.08	.233	[-.05, .22]
Belonging → intentions to recruit other students	.53	<.001	[.41, .65]	.51	<.001	[.38, .65]
Perceived professor support → intentions to recruit other students	.15	.001	[.06, .24]	.19	<.001	[.09, .28]
Classroom climate → intentions to recruit other students	-.08	.177	[-.20, .04]	-.00	.969	[-.14, .14]
	Safety	Threat	Belonging	Perceived Professor Support	Classroom Climate	
<i>Index of moderated mediation</i>						
DV: Intended academic engagement						
Study 1 condition	-.06 [-.12, -.01]	.01 [-.02, .04]	-.09 [-.17, -.02]	-.04 [-.11, .01]	-.08 [-.19, .01]	
Study 2 condition	-.00 [-.04, .04]	.00 [-.01, .02]	-.08 [-.18, -.00]	-.06 [-.13, .01]	-.05 [-.16, .04]	
DV: Future interest in learning						
Study 1 condition	-.16 [-.30, -.05]	-.01 [-.06, .02]	-.13 [-.26, -.03]	-.05 [-.12, .01]	-.05 [-.13, .01]	
Study 2 condition	-.11 [-.23, -.02]	.01 [-.02, .05]	-.23 [-.48, -.01]	-.08 [-.19, .01]	.02 [-.02, .08]	
DV: Intentions to recruit other students						
Study 1 condition	.03 [-.02, .08]	-.02 [-.06, .01]	-.15 [-.28, -.04]	-.04 [-.11, .01]	.02 [-.01, .06]	
Study 2 condition	-.04 [-.11, -.00]	.00 [-.01, .03]	-.14 [-.28, -.00]	-.08 [-.16, .01]	.00 [-.03, .03]	
<i>Conditional indirect effects of condition on dependent variables</i>						
<i>DV: Intended academic engagement</i>						
<i>Study 1</i>						
Women	-.08 [-.15, -.02]	.00 [-.01, .03]	-.06 [-.11, -.02]	-.06 [-.12, -.02]	-.08 [-.15, -.01]	
Men	-.02 [-.06, .00]	-.00 [-.01, .01]	.03 [-.03, .09]	-.02 [-.06, .02]	.00 [-.06, .08]	
<i>Study 2</i>						
Women	-.00 [-.04, .04]	.01 [-.01, .03]	-.11 [-.20, -.04]	-.05 [-.11, -.01]	-.11 [-.21, -.04]	
Men	-.00 [-.01, .01]	.01 [-.01, .02]	-.02 [-.08, .02]	.01 [-.02, .04]	-.06 [-.13, -.01]	
<i>DV: Future interest in learning</i>						
<i>Study 1</i>						
Women	-.22 [-.34, -.12]	-.01 [-.05, .02]	-.19 [-.30, -.09]	-.07 [-.13, -.01]	-.04 [-.11, -.00]	
Men	-.06 [-.14, .01]	.00 [-.02, .02]	-.05 [-.15, .02]	-.02 [-.07, .02]	.00 [-.04, .05]	
<i>Study 2</i>						
Women	-.13 [-.25, -.05]	.03 [-.01, .08]	-.30 [-.52, -.11]	-.07 [-.16, -.01]	.04 [-.01, .12]	
Men	-.02 [-.08, .03]	.02 [-.01, .05]	-.07 [-.19, .05]	.01 [-.04, .05]	.02 [-.01, .08]	
<i>DV: Intentions to recruit other students</i>						
<i>Study 1</i>						
Women	.04 [-.02, .08]	-.02 [-.05, .01]	-.21 [-.32, -.13]	-.06 [-.11, -.02]	.02 [-.01, .05]	
Men	.01 [-.01, .04]	.00 [-.01, .02]	-.06 [-.16, .02]	-.02 [-.06, .02]	-.00 [-.02, .02]	
<i>Study 2</i>						
Women	-.05 [-.11, -.01]	.01 [-.01, .05]	-.18 [-.31, -.06]	-.07 [-.14, -.01]	.00 [-.04, .05]	
Men	-.01 [-.03, .01]	.01 [-.01, .03]	-.04 [-.11, .03]	.01 [-.03, .05]	.00 [-.03, .03]	

Notes. Condition was coded as 1 = stereotypically masculine classroom, -1 = neutral classroom. Gender was coded as 1 = women, -1 = men. DV = dependent variable. Paths reflect unstandardized coefficients with 95% confidence intervals in brackets. Bolded values are significant. X = classroom condition, Y = dependent variable, M = mediator, W = moderator (participant gender).

Table 6. Zero-Order Correlations Among Variables to Establish Discriminant Validity (Study 2).

Variable	1.	2.	3.	4.	5.	6.	7.	8.	9.
1. Safety	—								
2. Threat	-.56***	—							
3. Self-esteem	.02	-.00	—						
4. Extraversion	-.08	.04	.31***	—					
5. Agreeableness	.08	-.18***	.04	.06	—				
6. Conscientiousness	.05	-.16***	.18***	.09	.26***	—			
7. Openness	-.01	-.03	.23***	.29***	.29***	.22***	—		
8. Neuroticism	.05	-.11*	.44***	.12*	.10	.18***	.10	—	
9. Evaluative concerns	-.32***	.41***	-.30***	-.10	-.09	-.18***	-.19***	-.29***	—

* $p < .05$. *** $p < .001$.

Table 7. Confirmatory Factor Analysis (Study 2).

STEP scale item	Factor 1	Factor 2
	Safety	Threat
	Perceptions ($\alpha = .96$)	Perceptions ($\alpha = .92$)
Supportive	.86 (.01)	
Welcoming	.90 (.01)	
Inclusive	.74 (.02)	
Emotionally safe	.82 (.02)	
Friendly	.91 (.01)	
Warm	.91 (.01)	
Pleasant	.93 (.01)	
Encouraging	.82 (.02)	
Accepting	.85 (.02)	
Open-minded	.81 (.02)	
Caring	.87 (.01)	
Comfortable	.81 (.02)	
Cheerful	.82 (.02)	
Inspiring	.79 (.02)	
Nurturing	.75 (.02)	
Physically safe	.45 (.04)	
Bright	.57 (.04)	
Open	.60 (.03)	
Emotionally harmful		.75 (.03)
Draining		.80 (.03)
Dismissing		.67 (.04)
Demanding		.61 (.04)
Chilly		.52 (.04)
Judgmental		.78 (.03)
Critical		.73 (.03)
Alienating		.81 (.02)
Tense		.84 (.02)
Threatening		.86 (.02)
Intimidating		.72 (.03)
Isolating		.69 (.04)
Combative		.54 (.04)
Condescending		.75 (.03)
Dangerous		.73 (.04)

Notes. Standardized factor loadings are shown with standard errors in parentheses. All loadings are significant at $p < .001$.

perceived safety, threat, and the dependent measures. Results are shown in Table 8, and all significant and marginally significant interactions are shown in Figures 6 and 7. As in Study 1, women reported less safety, less intended engagement, interest in learning, and intentions to recruit others to the stereotypically masculine (vs. neutral) classroom environment.

Moderated Mediation

As in Study 1, we next conducted moderated mediation analyses using Hayes' (2022) PROCESS macro version 4.2 (Model 8; see Figure 1). Table 5 reports the results.

Intended Academic Engagement. The index of moderated mediation was significant only for belonging and perceived professor support.

Future Interest in Learning. The index of moderated mediation was significant only for perceived safety, belonging, and professor support.

Intentions to Recruit Other Students. The index of moderated mediation was significant only for perceived safety, belonging, and professor support.

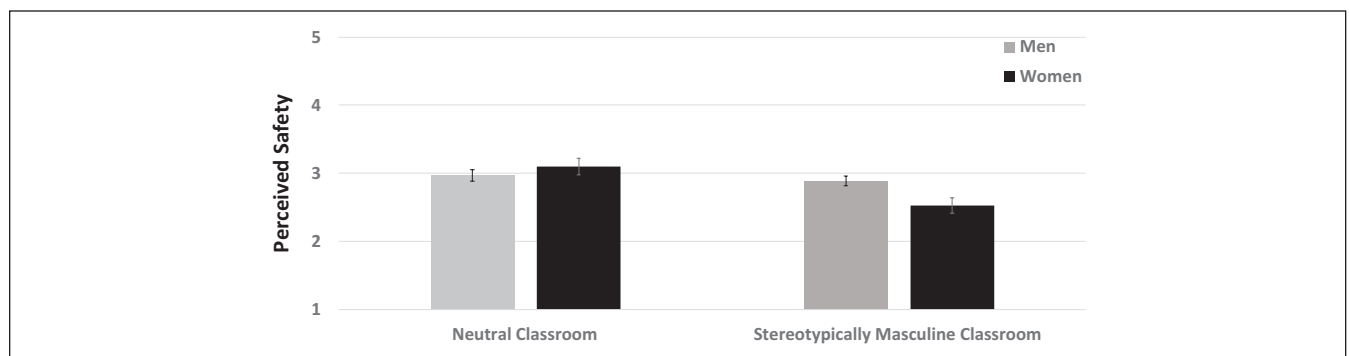
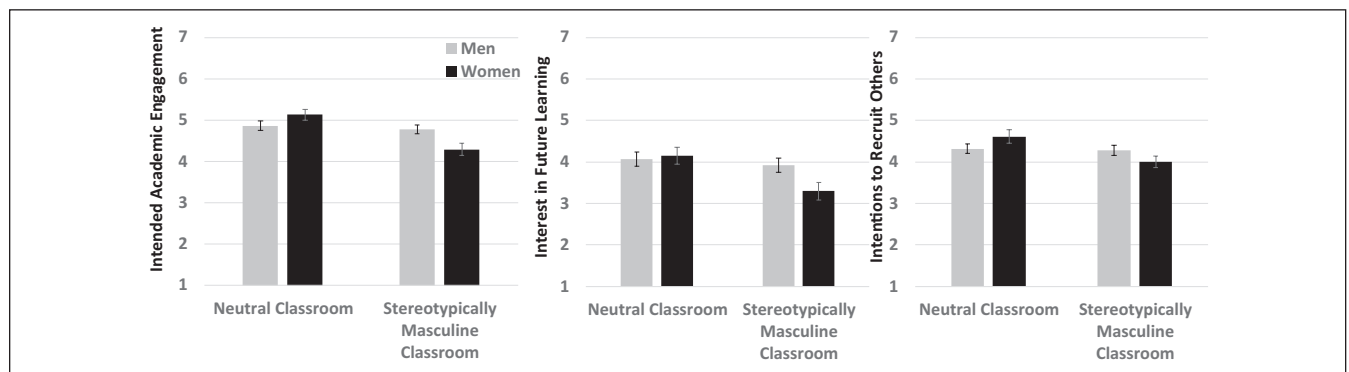
Discussion

Study 2 provided further evidence for the factor structure of the STEP scale. Consistent with Study 1, perceptions of safety and threat loaded onto two factors with high internal reliability. Also, replicating Study 1, women perceived less safety than men when they saw the stereotypically masculine classroom, which predicted less interest in learning and intentions to recruit others into that setting. Women also perceived less belonging and professor support in the stereotypically masculine classroom, which predicted less intended engagement, interest in learning, and intentions to recruit others. Men did not differ in these outcomes as a function of perceived safety, belonging, or professor support. Importantly, the effects of safety emerged even after controlling for belonging, perceived professor support, and classroom climate. Also, as in Study 1,

Table 8. Results of ANOVAs, Descriptive Statistics, and Pairwise Comparisons (Study 2).

Study variable	Safety		Threat		Intended academic engagement		Future interest in learning		Intentions to recruit other students	
Gender	$F(1, 367) = 1.55$, $p = .214$, $\eta_p^2 = .00$		$F(1, 367) = 1.89$, $p = .171$, $\eta_p^2 = .01$		$F(1, 367) = .79$, $p = .375$, $\eta_p^2 = .00$		$F(1, 366) = 2.02$, $p = .156$, $\eta_p^2 = .01$		$F(1, 367) = .00$, $p = .978$, $\eta_p^2 = .00$	
Classroom condition	$F(1, 367) = 11.63$, $p < .001$, $\eta_p^2 = .03$		$F(1, 367) = 9.98$, $p = .002$, $\eta_p^2 = .03$		$F(1, 367) = 13.17$, $p < .001$, $\eta_p^2 = .04$		$F(1, 366) = 6.72$, $p = .004$, $\eta_p^2 = .02$		$F(1, 367) = 6.33$, $p = .012$, $\eta_p^2 = .02$	
Gender $\times$ Classroom Condition	$F(1, 367) = 6.34$, $p = .012$, $\eta_p^2 = .02$		$F(1, 367) = .49$, $p = .485$, $\eta_p^2 = .00$		$F(1, 367) = 9.08$, $p = .003$, $\eta_p^2 = .02$		$F(1, 367) = 3.38$, $p = .067$, $\eta_p^2 = .01$		$F(1, 367) = 4.84$, $p = .028$, $\eta_p^2 = .01$	
Means (SDs)										
Gender	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men
Classroom										
Masculine	2.53 (.98)	2.89 (.79)	2.38 (.89)	2.44 (.80)	4.29 (1.30)	4.78 (1.11)	3.30 (1.84)	3.92 (1.76)	4.00 (1.22)	4.28 (1.23)
Neutral	3.10 (1.02)	2.97 (.90)	2.05 (.84)	2.23 (.80)	5.13 (1.18)	4.86 (1.20)	4.15 (1.79)	4.07 (1.84)	4.61 (1.39)	4.32 (1.14)
Pairwise comparisons	Safety		Threat		Intended academic engagement		Future interest in learning		Intentions to recruit other students	
	Women versus men		Women versus men		Women versus men		Women versus men		Women versus men	
Masculine	$[-.63, -.10]$, $p = .008$		$[-.30, .18]$, $p = .633$		$[-.84, -.14]$, $p = .006$		$[-1.15, -.09]$, $p = .021$		$[-.65, .08]$, $p = .124$	
Neutral	$[-.15, .39]$, $p = .370$		$[-.43, .06]$, $p = .145$		$[-.08, .62]$, $p = .135$		$[-.46, .62]$, $p = .769$		$[-.07, .66]$, $p = .118$	
Pairwise comparisons	Masculine versus neutral		Masculine versus neutral		Masculine versus neutral		Masculine versus neutral		Masculine versus neutral	
	Women versus men		Women versus men		Women versus men		Women versus men		Women versus men	
Women	$[-.86, -.28]$, $p < .001$		$[.07, .60]$, $p = .013$		$[-1.22, -.45]$, $p < .001$		$[-1.43, -.27]$, $p = .004$		$[-1.02, -.22]$, $p = .002$	
Men	$[-.33, .15]$, $p = .482$		$[-.00, .43]$, $p = .053$		$[-.39, .24]$, $p = .628$		$[-.62, .33]$, $p = .552$		$[-.37, .29]$, $p = .803$	

Notes. Intentions to recruit = recruit other students to take a course in the classroom. For pairwise comparisons, 95% confidence intervals for mean differences appear in [brackets] next to p -values. Bolded values are significant. Degrees of freedom vary because some participants did not complete all the measures.

**Figure 6.** Study 2 results for perceptions of safety by classroom condition and participant gender. Error bars reflect the standard error around the mean of each condition.**Figure 7.** Study 2 results for intended academic engagement, future interest in learning, and intentions to recruit others by classroom condition and participant gender. Error bars reflect the standard error around the mean of each condition.

decreased perceptions of safety, rather than increased perceptions of threat accounted for the findings. Thus, perceptions of safety and threat tap into distinct psychological experiences that are more nuanced than previously conceptualized.

In contrast to Study 1, Study 2 did not show significant effects for intended engagement as a function of perceived safety. Rather, women's perceptions of belonging and professor support predicted engagement. Also, in contrast to Study 1, women who saw the stereotypically masculine classroom viewed it as less safe, which predicted less intentions to recruit others into that environment.

Internal Meta-Analysis

Although Study 2 supported the factor structure of the STEP scale from Study 1, some of the findings did not reach statistical significance across studies. To provide a more precise estimate of the effects, we conducted an internal meta-analysis across the two studies (Goh et al., 2016; see Supplemental Materials for full results).

Results of the meta-analysis showed that compared to the neutral classroom, women perceived the stereotypically masculine classroom to be less safe (weighted $r = -.25$, $z = -7.20$, $p < .001$, 95% CI $[-.32, -.19]$) and more threatening (weighted $r = .13$, $z = 3.61$, $p < .001$, 95% CI $[.06, .20]$); they also felt less belonging, perceived less professor support, and reported worse classroom climate when they saw the stereotypically masculine (vs. neutral) environment.⁵

Women (vs. men) also viewed the stereotypically masculine classroom to be less safe (weighted $r = -.15$, $z = -4.28$, $p < .001$, 95% CI $[-.22, -.08]$) and expected less belonging, professor support, and worse classroom climate in this environment. In the neutral classroom, women perceived less threat than did men (weighted $r = -.08$, $z = -2.36$, $p = .018$, 95% CI $[-.15, -.01]$). Men did not differ in their perceptions of safety (weighted $r = -.06$, $z = -1.56$, $p = .118$, 95% CI $[-.13, .01]$), threat (weighted $r = .04$, $z = 1.02$, $p = .305$, 95% CI $[-.03, .11]$), belonging, perceived professor support, or classroom climate when seeing the stereotypically masculine (vs. neutral) classroom.

Furthermore, when women saw the stereotypically masculine (vs. neutral) classroom, they reported less intended engagement (weighted $r = -.23$, $z = -6.63$, $p < .001$, 95% CI $[-.30, -.17]$), interest in future learning (weighted $r = -.17$, $z = -4.64$, $p < .001$, 95% CI $[-.23, -.10]$), and intentions to recruit others into that space (weighted $r = -.21$, $z = -5.98$, $p < .001$, 95% CI $[-.28, -.14]$). Women (vs. men) also reported less intended engagement (weighted $r = -.12$, $z = -3.39$, $p < .001$, 95% CI $[-.19, -.05]$) and interest in learning (weighted $r = -.13$, $z = -3.54$, $p < .001$, 95% CI $[-.20, -.06]$) when they saw the stereotypically masculine classroom. In sum, the meta-analysis showed that women perceived the stereotypically masculine (vs. neutral) classroom to be less safe and reported less intentions to engage, learn in, and recruit others into this environment.

Study 3

The studies so far used the STEP scale to assess perceptions of safety and threat in classroom settings. But how valid is the STEP scale outside of academic contexts? To address this question, Study 3 examined perceptions of safety and threat in another common, everyday environment: the gym. We expected people to perceive the gym environment as less safe (and/or more threatening) when they saw unwelcoming cues (e.g., dark colors, less light) compared to welcoming cues (e.g., bright colors, lots of light).

Past research has shown that ambient darkness connotes threat and vulnerability to harm (Neuberg et al., 2011), whereas spaces that are open with natural light (Snethen et al., 2021) and warm colors elicit states of relaxation and protection (Tomassoni et al., 2015). For example, participants showed greater self-disclosure in a counseling setting with soft, warm lighting versus a space with grey, cement walls and cold, fluorescent lighting (Chaikin et al., 1976). Based on such findings, we expected that when people perceive gym cues to be less safe (i.e., less welcoming, inclusive) and/or more threatening (i.e., more judgmental, intimidating), they would report less intended engagement, interest in joining the gym, and intentions to recruit others to the gym.

Further, we expected women to perceive less safety (and/or more threat) in the unwelcoming gym than men, based on past work suggesting that gyms are often perceived as hyper-masculine (Coen et al., 2018; Craig & Liberti, 2007) and women worldwide tend to be less physically active than men (The Lancet Public Health, 2019). In the present study, unwelcoming cues in the physical environment may contribute to less perceived safety (and/or greater threat), especially for women, which may reduce their interest and intentions to engage in this environment (see Figure 8).

Finally, we tested whether perceived safety and threat uniquely predicted the outcomes above and beyond perceptions of the space appearing masculine versus feminine or general affect, to demonstrate the STEP scale is distinct from gender prototypicality or positive and negative affect.

Participants and Procedure

Participants ($N = 411$) were students from the Introductory Psychology Participant Pool at a large university in the USA who completed the "Study of Environmental Perceptions" for course credit (see Table 1 for demographics). A sensitivity analysis indicated our analyzed sample size provided adequate power ($>.80$) to detect a small Gender $\times$ Gym Condition interaction effect ranging from $.07 < f < .09$ depending on the outcome.

Participants were informed that researchers were interested in studying people's thoughts and perceptions of different environments. Using a within-subjects design, participants saw a photo of a gym with either

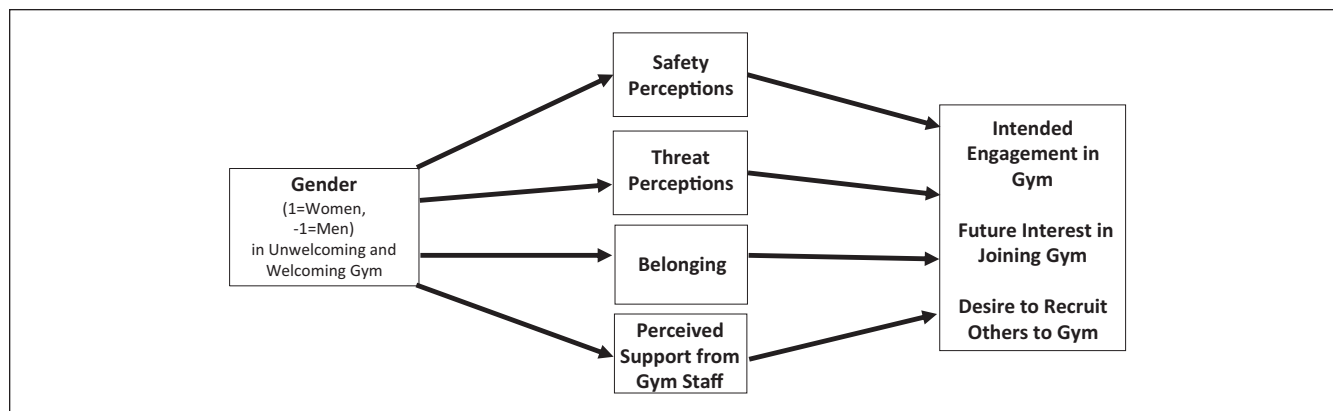


Figure 8. Proposed mediation model predicting dependent measures (Study 3).

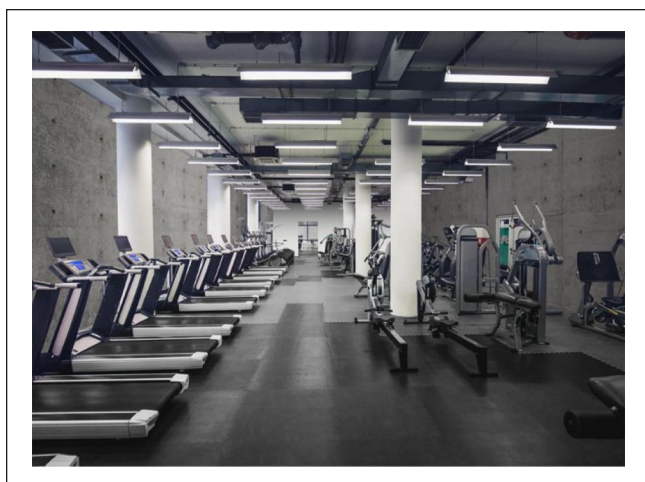


Figure 9. Unwelcoming gym environment (Study 3).

unwelcoming cues (e.g., dark colors, few windows, little light; see Figure 9) or *welcoming cues* (e.g., bright colors, windows, lots of light; see Figure 10). Order of images was counterbalanced across participants.

Mediator Measures

Perceptions of Safety and Threat. After viewing each photo, participants reported their overall, gut-level impressions of each environment using the STEP scale to measure perceived safety (e.g., welcoming, inclusive, 16 items,⁶ $\alpha_{\text{welcoming_gym}} = .96$; $\alpha_{\text{unwelcoming_gym}} = .97$) and threat (e.g., critical, intimidating, 15 items, $\alpha_{\text{welcoming_gym}} = .97$; $\alpha_{\text{unwelcoming_gym}} = .94$) from 1 = *not at all* to 5 = *very*.

Belonging in the Gym. Participants completed the same belonging items as before upon seeing each gym photo (16 items, $\alpha_{\text{welcoming_gym}} = .95$; $\alpha_{\text{unwelcoming_gym}} = .95$).

Perceived Support from Gym Staff. Participants responded to the prompt: “I believe the gym staff in this environment would. . .” followed by items such as, “Give me good

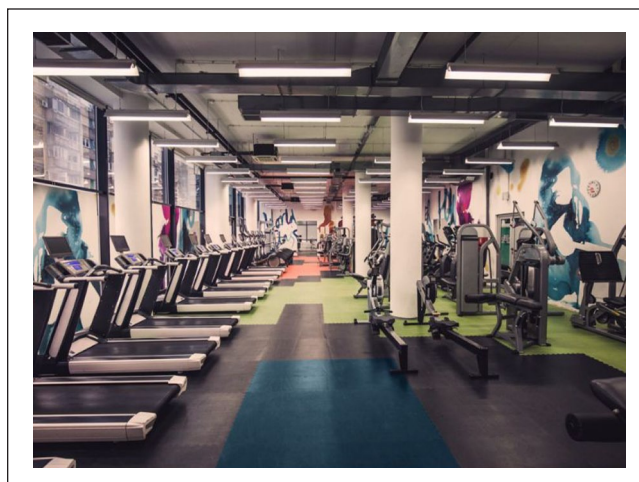


Figure 10. Welcoming gym environment (Study 3).

advice” and “Care about me” from 1 = *not at all* to 7 = *very much* (adapted from Markland & Tobin, 2010; 15 items, $\alpha_{\text{welcoming_gym}} = .97$; $\alpha_{\text{unwelcoming_gym}} = .97$).

Dependent Measures

Intended Gym Engagement. After seeing each gym photo, participants responded to items such as, “How engaged would you be in this gym?” and “How much would you try to meet your fitness goals at this gym?” from 1 = *not at all* to 7 = *very much* (7 items, $\alpha_{\text{welcoming_gym}} = .86$; $\alpha_{\text{unwelcoming_gym}} = .90$).

Future Interest in Joining Gym. Participants responded to items such as: “What is the likelihood that you would sign up for a membership in this gym?” and “How interested would you be in working out in this environment in the future?” from 1 = *not at all* to 7 = *very* (2 items, $r(409)_{\text{welcoming_gym}} = .87, p < .001$; $r(409)_{\text{unwelcoming_gym}} = .90, p < .001$).

Intentions to Recruit Others to Gym. Participants reported their intentions to recruit others to the gym from 1 = *not at all*

Table 9. Zero-Order Correlations Among Variables (Study 3).

Variable	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
1. Gender	—	-.13**	-.06	-.17***	-.06	.03	.06	.07	-.21***	-.02	-.27***
2. Safety	-.38***	—	-.39***	.68***	.54***	.54***	.53***	.53***	.33***	-.08	.43***
3. Threat	.25***	-.47***	—	-.44***	-.23***	-.26***	-.26***	-.34***	.03	.41***	-.24***
4. Belonging	-.46***	.77***	-.60***	—	.52***	.68***	.64***	.63***	.32***	.18***	.33***
5. Perceived gym staff support	-.33***	.66***	-.36***	.65***	—	.62***	.54***	.55***	.23***	-.11*	.31***
6. Intended gym engagement	-.32***	.70***	-.40***	.73***	.73***	—	.76***	.68***	.32***	-.05	.36***
7. Future interest in joining gym	-.36***	.72***	-.43***	.74***	.67***	.81***	—	.77***	.24***	-.04	.32***
8. Intentions to recruit others to gym	-.38***	.69***	-.46***	.72***	.67***	.73***	.83***	—	.18***	-.11*	.33***
9. Positive affect	-.21***	.47***	-.14**	.38***	.35***	.44***	.39***	.33***	—	.32***	.24***
10. Negative affect	-.02	.05	.24***	-.10*	.03	.06	.02	-.02	.32***	—	.18***
11. Perceived masculinity-femininity	.03	.12*	-.11*	.06	.13**	.04	.02	.02	.08	.00	—

Notes. Gender was coded as 1 = women, -1 = men. Non-binary participants ($n = 6$) were coded as missing. Perceived masculinity-femininity of the gym was on a scale from 1 = very masculine to 7 = very feminine. Correlations among measures appear above the diagonal for the welcoming gym and below the diagonal for the unwelcoming gym.

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

likely to 7 = very likely. Sample items were: “How likely would you be to talk to other people about going to this gym?” and “How likely would you be to encourage people to go to this gym?” (3 items, $\alpha_{\text{welcoming gym}} = .67$; $\alpha_{\text{unwelcoming gym}} = .77$).

Covariates

Perceptions of Masculinity/Femininity of Gym. Participants responded to the question: “How masculine or feminine do you perceive this environment to be?” from 1 = very masculine to 7 = very feminine to see whether men and women rated the gym environments in a gendered way ($M_{\text{welcoming gym}} = 4.40$, $SD = 1.16$; $M_{\text{unwelcoming gym}} = 2.88$, $SD = 1.46$).

Positive and Negative Affect. Participants indicated how they felt right now by completing the 20-item Positive and Negative Affect Schedule (PANAS, Watson et al., 1988) from 1 = Very slightly or not at all to 5 = Extremely. Items were averaged together for positive affect ($\alpha = .91$) and negative affect ($\alpha = .93$).

Results

Table 9 shows the correlations among the study variables. Results of mixed-model ANOVAs with Gender (women vs. men) as a between-subjects factor and Gym Condition (unwelcoming, welcoming) as a within-subjects factor showed significant main effects of Gym Condition and Gender $\times$ Gym Condition interactions for perceived safety, threat, and the dependent measures (see Table 10, Figures 11 and 12). Specifically, women reported less engagement, interest in joining, and intentions to recruit others to the gym when they saw the unwelcoming (vs. welcoming) gym. Also, when viewing the unwelcoming gym, women perceived less safety, greater threat, less engagement, interest in joining, and intentions to recruit others, compared to men who saw this environment. When viewing the welcoming gym, the

only significant difference was that women perceived less safety than men in this environment.

Next, we ran a mixed-model ANOVA to see whether women and men differed in their perceptions of how masculine versus feminine the gyms seemed (Table 11). There was a significant Gender $\times$ Condition interaction, such that women rated the unwelcoming gym as more masculine/less feminine than the welcoming gym and rated the unwelcoming gym as more masculine than did men. Men also rated the unwelcoming gym as more masculine/less feminine than the welcoming gym. Men and women did not differ in their perceptions of the welcoming gym being masculine or feminine.

Mediation Analyses

Finally, we conducted mediation analyses using Hayes' (2022) PROCESS (Model 4) to test for indirect effects of Gender (entered as the independent variable X) in the unwelcoming and welcoming gym (see Figure 13) on the dependent measures. Table 12 reports the results.

Intended Gym Engagement. When viewing the unwelcoming gym, there was a significant indirect effect of safety for women (vs. men), such that women who perceived less safety reported less intended gym engagement. No significant indirect effects of safety or threat emerged in the welcoming gym condition.

Future Interest in Joining Gym. When viewing the unwelcoming gym, there was a significant indirect effect of safety for women (vs. men), such that less perceived safety predicted less interest in joining the gym. There were no significant indirect effects of safety or threat in the welcoming gym condition.

Intentions to Recruit Others to Gym. When seeing the unwelcoming gym, there was a significant indirect effect of safety for women (vs. men), such that less perceived safety

Table 10. Results of Mixed-Model ANOVAs, Descriptive Statistics, and Pairwise Comparisons (Study 3).

Study variable	Safety		Threat		Intended engagement in gym		Future interest in joining gym		Intentions to recruit others condition	
Gym condition	$F(1, 403) = 314.59$, $p < .001$, $\eta_p^2 = .44$		$F(1, 403) = 198.69$, $p < .001$, $\eta_p^2 = .33$		$F(1, 403) = 60.74$, $p < .001$, $\eta_p^2 = .13$		$F(1, 403) = 43.61$, $p < .001$, $\eta_p^2 = .10$		$F(1, 403) = 75.02$, $p < .001$, $\eta_p^2 = .16$	
Gender $\times$ Gym Condition	$F(1, 403) = 33.55$, $p < .001$, $\eta_p^2 = .08$		$F(1, 403) = 34.77$, $p < .001$, $\eta_p^2 = .08$		$F(1, 403) = 49.56$, $p < .001$, $\eta_p^2 = .11$		$F(1, 403) = 64.81$, $p < .001$, $\eta_p^2 = .14$		$F(1, 403) = 63.54$, $p < .001$, $\eta_p^2 = .14$	
Means (SDs)										
Gender	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men
Gym condition										
Unwelcoming	2.51 (1.02)	3.32 (.97)	2.98 (.97)	2.50 (.89)	3.71 (1.54)	4.66 (1.25)	3.30 (1.84)	3.92 (1.76)	3.51 (1.53)	4.66 (1.28)
Welcoming	3.72 (.86)	3.94 (.79)	1.98 (.89)	2.09 (.87)	4.78 (1.18)	4.72 (1.21)	4.15 (1.79)	4.07 (1.84)	4.88 (1.22)	4.71 (1.32)
	Safety		Threat		Intended engagement in gym		Future interest in joining gym		Intentions to recruit others to gym	
Pairwise comparisons	Women versus men		Women versus men		Women versus men		Women versus men		Women versus men	
Unwelcoming gym	$[-1.00, -.61]$, $p < .001$		$[-.31, .67]$, $p < .001$		$[-1.22, -.67]$, $p < .001$		$[-1.80, -1.08]$, $p < .001$		$[-1.42, -.87]$, $p < .001$	
Welcoming gym	$[-.37, -.05]$, $p = .010$		$[-.28, .07]$, $p = .240$		$[-.17, .30]$, $p = .568$		$[-.11, .54]$, $p = .196$		$[-.08, .42]$, $p = .176$	
	Unwelcoming versus welcoming gym		Unwelcoming versus welcoming gym		Unwelcoming versus welcoming gym		Unwelcoming versus welcoming gym		Unwelcoming versus welcoming gym	
Women	$[-1.36, -1.07]$, $p < .001$		$[-.86, 1.14]$, $p < .001$		$[-1.27, -.87]$, $p < .001$		$[-1.80, -1.22]$, $p < .001$		$[-1.60, -1.14]$, $p < .001$	
Men	$[-.76, -.47]$, $p < .001$		$[-.27, .55]$, $p < .001$		$[-.25, .15]$, $p = .592$		$[-.14, .43]$, $p = .304$		$[-.29, .17]$, $p = .624$	

Notes. Gender was treated as a between-subjects factor and gym condition as a within-subjects factor. Intentions to recruit=recruit others to join the gym. For pairwise comparisons, 95% confidence intervals for mean differences appear in brackets next to p-values. Bolded values are significant. Degrees of freedom vary as some participants did not complete all measures.

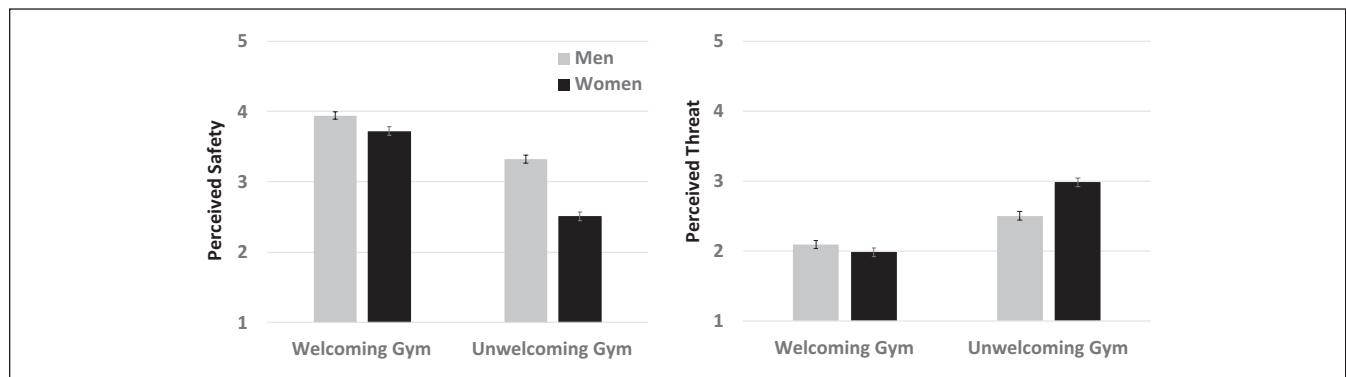
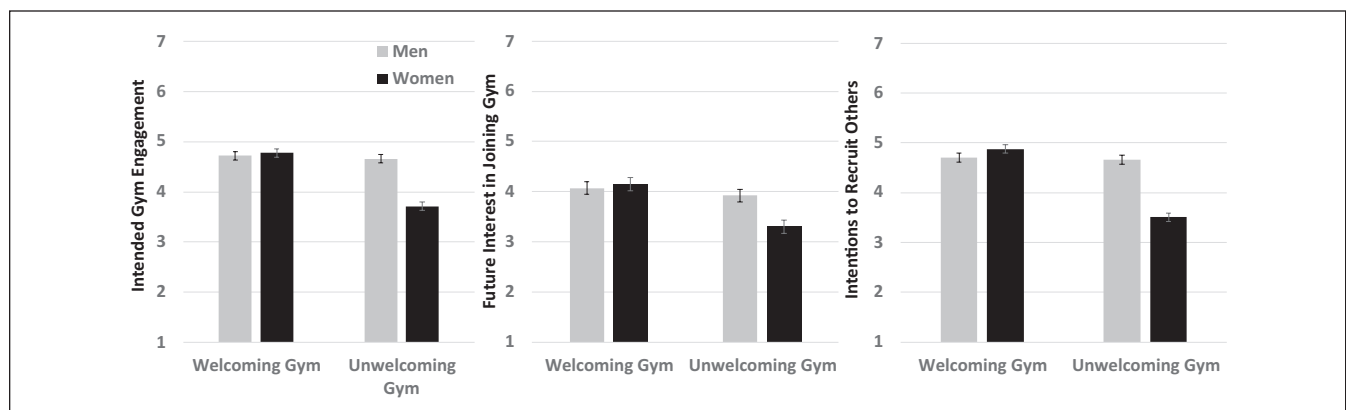
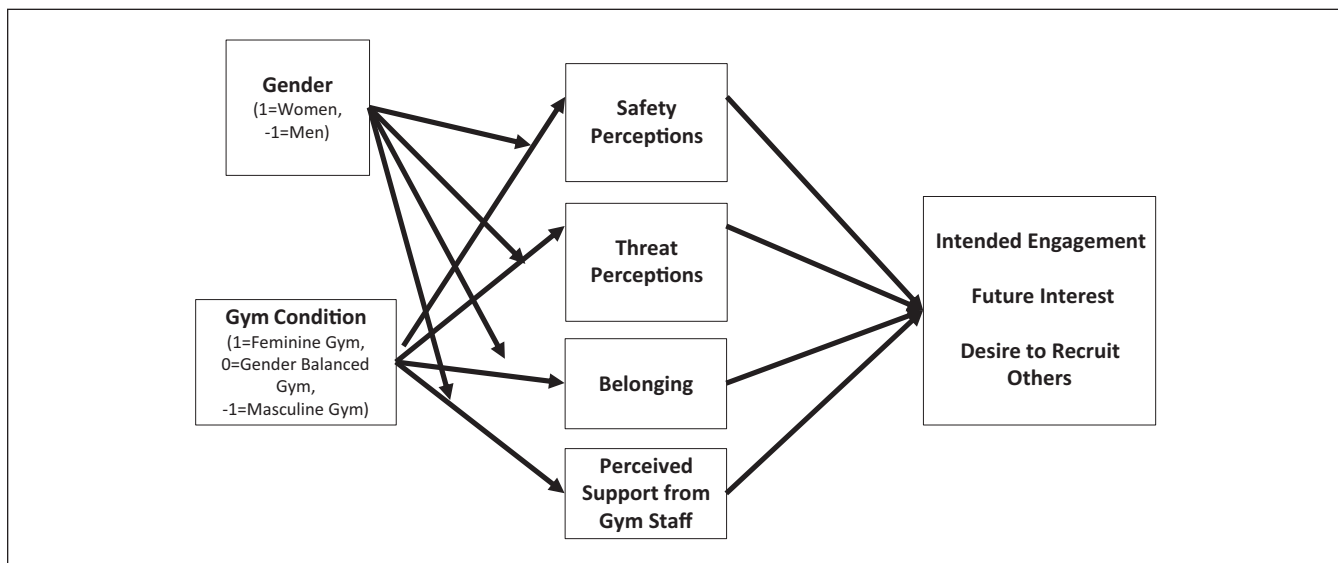
**Figure 11.** Study 3 results for perceptions of safety and threat by gym condition and participant gender. Error bars reflect the standard error around the mean of each condition.**Figure 12.** Study 3 results for intended engagement in gym, interest in joining gym, and intentions to recruit others to them by gym condition and participant gender. Error bars reflect the standard error around the mean of each condition.

Table 11. Results of Mixed-Model ANOVA, Descriptive Statistics, and Pairwise Comparisons Predicting Ratings of Gym as Masculine Versus Feminine (Study 3).

Gym condition	$F(1, 402) = 323.33, p < .001, \eta_p^2 = .45$		
Gender $\times$ Gym Condition	$F(1, 402) = 26.58, p < .001, \eta_p^2 = .06$		
	Means (SDs)		
Gender	Women	Men	
Gym condition			
Unwelcoming	2.49 (1.45)	3.28 (1.35)	
Welcoming	4.43 (1.18)	4.36 (1.15)	
Pairwise comparisons	Women versus men	Unwelcoming versus welcoming gym	
Unwelcoming gym	$[-1.07, -.52], p < .001$	Women	$[-2.18, -1.71], p < .001$
Welcoming gym	$[-.16, .30], p = .540$	Men	$[-1.31, -.85], p < .001$

Notes. Gender was treated as a between-subjects factor and gym condition was a within-subjects factor. Lower scores reflect rating of the gym as more masculine; higher scores reflect rating of the gym as more feminine. For pairwise comparisons, 95% confidence intervals for mean differences appear in brackets next to p -values. Bolded values are significant.

**Figure 13.** Proposed moderated mediation model (Study 4).

predicted less intentions to recruit others to the gym. There were no significant indirect effects of safety or threat in the welcoming gym condition.

Do Effects Remain When Controlling for Covariates?

Even after controlling for how masculine versus feminine the gyms seemed and for positive and negative affect, results of mediation analyses remained significant. Specifically, when women saw the unwelcoming gym, there were significant indirect effects of perceived safety in predicting intended gym engagement, interest in joining the gym, and desire to recruit others. When women saw the welcoming gym, there

were no significant indirect effects of safety or threat in predicting the outcomes (see Table S1 in Supplemental Materials for full results).

Discussion

Extending beyond the academic setting, Study 3 used the STEP scale to assess perceptions of safety and threat in an unwelcoming gym environment (with dark colors, little light) versus a welcoming gym (with bright colors, lots of light). Results showed that perceiving the unwelcoming gym as less safe led women in particular to report less intended engagement, interest in joining, and intentions to recruit others to the gym. Men also reported less intentions to recruit

Table 12. Results of Mediation Analyses Predicting Dependent Variables in Unwelcoming and Welcoming Gym Environment (Study 3).

a Path	Unwelcoming gym			Welcoming gym		
	Effect	p-Value	95% CI	Effect	p-Value	95% CI
Gender → safety	-.40	<.001	[-.50, -.31]	-.11	.010	[-.19, -.03]
Gender → threat	.24	<.001	[.15, .33]	-.05	.240	[-.14, .03]
Gender → belonging in gym	-.62	<.001	[-.74, -.50]	-.19	<.001	[-.29, -.08]
Gender → perceived support from gym staff	-.47	<.001	[-.60, -.34]	-.06	.256	[-.18, .05]
b Path						
DV: Intended gym engagement						
Safety → intended gym engagement	.27	<.001	[.14, .40]	.05	.440	[-.08, .19]
Threat → intended gym engagement	.07	.206	[-.04, .18]	.10	.053	[-.00, .20]
Belonging in gym → intended gym engagement	.43	<.001	[.31, .54]	.60	<.001	[.47, .67]
Perceived support from gym staff → intended gym engagement	.40	<.001	[.31, .48]	.36	<.001	[.28, .44]
DV: Future interest in joining gym						
Safety → future interest in joining gym	.52	<.001	[.33, .70]	.21	.049	[.00, .41]
Threat → future interest in joining gym	.01	.892	[-.14, .16]	.14	.076	[-.01, .29]
Belonging in gym → future interest in joining gym	.51	<.001	[.35, .68]	.77	<.001	[.61, .92]
Perceived support from gym staff → future interest in joining gym	.36	<.001	[.25, .48]	.35	<.001	[.22, .47]
DV: Intentions to recruit others to gym						
Safety → intentions to recruit others	.31	<.001	[.17, .45]	.14	.084	[-.02, .29]
Threat → intentions to recruit others	-.08	.181	[-.20, .04]	-.06	.278	[-.18, .05]
Belonging in gym → intentions to recruit others	.36	<.001	[.23, .49]	.51	<.001	[.39, .62]
Perceived support from gym staff → intentions to recruit others	.31	<.001	[.22, .40]	.30	<.001	[.20, .39]
c Path (total effect)						
Gender → intended gym engagement	-.47	<.001	[-.61, -.34]	.03	.568	[-.08, .15]
Gender → future interest in joining gym	-.72	<.001	[-.90, -.54]	.11	.196	[-.06, .27]
Gender → intentions to recruit others	-.57	<.001	[-.71, -.43]	.09	.176	[-.04, .21]
c' Path (direct effect)						
Gender → intended gym engagement (with all mediators in model)	.07	.149	[-.02, .16]	.17	<.001	[.10, .25]
Gender → future interest in joining gym (with all mediators in model)	-.03	.697	[-.16, .11]	.30	<.001	[.18, .42]
Gender → intentions to recruit others (with all mediators in model)	-.06	.273	[-.16, .05]	.21	<.001	[.12, .30]
ab Path (indirect effect)						
Gender → safety → intended gym engagement	-.11		[-.18, -.05]	-.01		[-.03, .01]
Gender → threat → intended gym engagement	.02		[-.01, .05]	-.01		[-.02, .00]
Gender → belonging in gym → intended gym engagement	-.26		[-.36, -.18]	-.11		[-.17, -.04]
Gender → perceived support from gym staff → intended gym engagement	-.19		[-.26, -.12]	-.02		[-.06, .02]
DV: Future interest in joining gym						
Gender → safety → future interest in joining gym	-.21		[-.31, -.12]	-.02		[-.06, .00]
Gender → threat → future interest in joining gym	.00		[-.03, .04]	-.01		[-.03, .00]
Gender → belonging in gym → future interest in joining gym	-.32		[-.45, -.19]	-.14		[-.23, -.06]
Gender → perceived support from gym staff → future interest in joining gym	-.17		[-.26, -.09]	-.02		[-.07, .02]
DV: Intentions to recruit others to gym						
Gender → safety → intentions to recruit others	-.13		[-.20, -.06]	-.01		[-.04, .00]
Gender → threat → intentions to recruit others	-.02		[-.05, .01]	-.01		[-.00, .02]
Gender → belonging in gym → intentions to recruit others	-.22		[-.35, -.13]	-.09		[-.15, -.04]
Gender → perceived support from gym staff → intentions to recruit others	-.15		[-.23, -.08]	-.02		[-.05, .01]

Notes. Gender was coded as 1 = women, -1 = men. Effects reflect unstandardized beta coefficients. Bolded values are significant. 95% CI = 95% confidence interval.

others to the unwelcoming gym, but their perceptions of safety and threat and subsequent intentions did not differ as a function of the gym they saw. Also, as in our previous studies, lower perceived safety as measured by the STEP scale predicted the outcomes, rather than increased perceptions of threat.

In contrast to Study 1, which showed environments with objects conveying stereotypically masculine cues, we did not explicitly include stereotypically masculine items in the current study. However, when we asked participants to rate how masculine or feminine the gym was that they saw, both men and women perceived the unwelcoming gym to be more

masculine. Certain environments may be viewed as more masculine than feminine by default (Cheryan & Markus, 2020). Thus, even minimal cues of safety, such as bright colors and lights, may serve to attenuate disparities, such as reducing gender differences in intentions to engage in, join, and recruit others to the gym.

Notably, even after controlling for perceptions of how masculine or feminine the gyms seemed or how much participants felt positive and negative affect in general, results of mediation analyses remained significant: Women who saw the unwelcoming (but not welcoming) gym environment perceived less safety, which predicted less engagement,

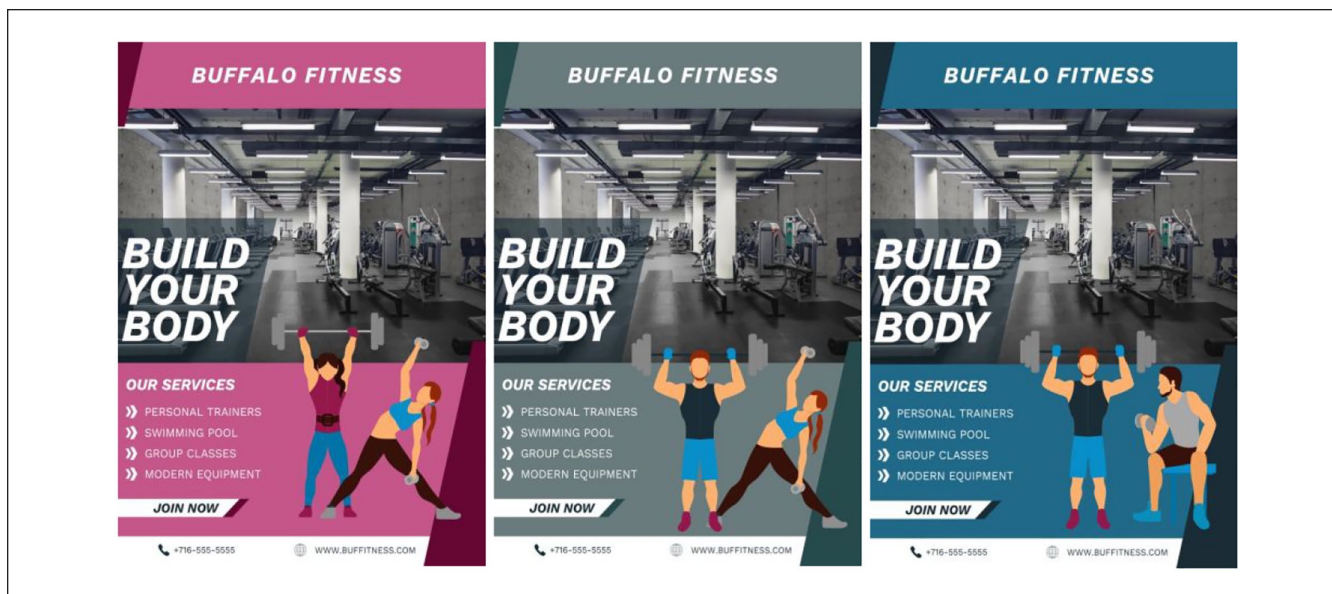


Figure 14. Gym advertisements with feminine (left), gender-balanced (middle), or masculine (right) social cues (Study 4).

interest in joining, and intentions to recruit others to the gym. Thus, beyond mere perceptions of a space appearing masculine or feminine or feeling positive or negative affect in general, perceptions of safety showed unique predictive validity in predicting motivation, interest, and behavioral intentions.

Study 4

Whereas Study 3 focused on perceptions of safety and threat upon seeing a gym with unwelcoming or welcoming physical cues, Study 4 examined perceived safety and threat in a gym environment by varying *social cues*. Given that gyms are often perceived as hypermasculine (Coen et al., 2018; Craig & Liberti, 2007), the presence of masculine social cues may reinforce the perception that gyms are spaces intended for men, not for women. On the other hand, the presence of feminine social cues in a gym may signal safety for women in this traditionally male-dominated space. Accordingly, in the present study, we hypothesized that masculine social cues (vs. feminine or gender-balanced social cues) in a gym environment would predict less perceived safety (and/or more threat) especially for women, which would reduce their intentions to engage in this environment (see Figure 13). In addition, as in Study 3, we examined whether perceived safety and threat using the STEP scale uniquely predicted the outcomes above and beyond feelings of positive and negative affect in general.

Participants and Procedure

Participants ($N = 715$) were Introductory Psychology students at a large university in the USA who completed the “Study of Environmental Perceptions” in exchange for course credit (see Table 1 for demographics). A sensitivity analysis indicated

that our sample size provided adequate power ($>.80$) to detect a small Gender $\times$ Gym Condition interaction effect of $f = .12$ depending on the outcome variable.

Participants were informed that researchers were interested in studying people’s thoughts and perceptions of different environments. Using a between-subjects design, participants saw an advertisement for a gym displaying the same unwelcoming gym image from Study 3 along with showing two people working out. The gym ads contained *feminine social cues* (two women working out), *gender-balanced social cues* (a man and woman working out), or *masculine social cues* (two men working out; see Figure 14).

Mediator Measures

After viewing one of the three gym ads, participants responded to the same mediator measures as in Study 3: perceived safety (18 items, $\alpha = .96$), threat (15 items, $\alpha = .93$) using the STEP scale, sense of belonging in the gym (16 items, $\alpha = .94$), and perceived support from the gym staff (15 items, $\alpha = .96$).

Dependent Measures

Participants then responded to the same dependent measures as in Study 3: intended gym engagement (7 items, $\alpha = .88$), future interest in joining the gym (2 items, $r[707] = .86$, $p < .001$), and intentions to recruit others to the gym (3 items, $\alpha = .75$).

Covariate

Positive and Negative Affect. As in Study 3, participants completed the 20-item PANAS (Watson et al., 1988). Items were averaged together for positive affect ($\alpha = .91$) and negative affect ($\alpha = .88$).

Table 13. Zero-Order Correlations Among Variables (Study 4).

Variable	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1. Gender	—									
2. Safety	-.21***	—								
3. Threat	.09*	-.46***	—							
4. Belonging	-.35***	.73***	-.50***	—						
5. Perceived gym staff support	-.17***	.67***	-.40***	.61***	—					
6. Intended gym engagement	-.24***	.68***	-.38***	.70***	.67***	—				
7. Future interest in joining gym	-.18***	.65***	-.37***	.69***	.60***	.76***	—			
8. Intentions to recruit others to gym	-.13***	.67***	-.41***	.65***	.63***	.70***	.77***	—		
9. Positive affect	-.17***	.48***	-.12**	.45***	.43***	.46***	.44***	.43***	—	
10. Negative affect	-.12***	-.07	.27***	-.19***	-.05	-.09*	-.05	-.07	.10**	—

Notes. Gender was coded as 1 = women, -1 = men.

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

Table 14. Results of ANOVAs, Descriptive Statistics, and Pairwise Comparisons (Study 4).

Study variable	Safety		Threat		Intended engagement		Future interest		Intentions to recruit	
Gender	$F(1, 702) = 30.59$, $p < .001$, $\eta_p^2 = .04$		$F(1, 702) = 5.90$, $p = .015$, $\eta_p^2 = .01$		$F(1, 701) = 41.88$, $p < .001$, $\eta_p^2 = .06$		$F(1, 701) = 23.93$, $p < .001$, $\eta_p^2 = .03$		$F(1, 701) = 11.19$, $p < .001$, $\eta_p^2 = .02$	
Gym ad condition	$F(2, 702) = 3.12$, $p = .045$, $\eta_p^2 = .01$		$F(2, 702) = 4.18$, $p = .016$, $\eta_p^2 = .01$		$F(2, 701) = 1.70$, $p = .184$, $\eta_p^2 = .01$		$F(2, 701) = 3.30$, $p = .038$, $\eta_p^2 = .01$		$F(2, 701) = 3.36$, $p = .035$, $\eta_p^2 = .01$	
Gender $\times$ Gym ad Condition	$F(2, 702) = 5.56$, $p = .004$, $\eta_p^2 = .02$		$F(2, 702) = 3.14$, $p = .044$, $\eta_p^2 = .04$		$F(2, 701) = 2.58$, $p = .077$, $\eta_p^2 = .01$		$F(2, 701) = 11.73$, $p < .001$, $\eta_p^2 = .03$		$F(2, 701) = 7.61$, $p < .001$, $\eta_p^2 = .02$	
Means (SDs)										
Gender	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men
Gym ad										
Masculine	2.84 (.97)	3.51 (.87)	2.24 (.89)	1.94 (.78)	3.97 (1.48)	4.83 (1.25)	3.23 (1.90)	4.49 (1.59)	3.90 (1.48)	4.65 (1.39)
Feminine	3.29 (.92)	3.41 (.78)	1.84 (.84)	1.90 (.79)	4.37 (1.40)	4.70 (1.06)	4.27 (1.76)	4.04 (1.82)	4.59 (1.38)	4.38 (1.41)
Balanced	3.19 (.92)	3.53 (.86)	2.10 (.89)	1.88 (.75)	4.27 (1.20)	4.95 (1.16)	3.80 (1.74)	4.71 (1.61)	4.34 (1.31)	4.85 (1.32)
Pairwise comparisons	Safety		Threat		Intended engagement		Future interest		Intentions to recruit	
Gender	Women versus men		Women versus men		Women versus men		Women versus men		Women versus men	
Gym ad										
Masculine	$[-.89, -.44]$, $p < .001$		$[.09, .51]$, $p = .005$		$[-1.18, -.53]$, $p < .001$		$[-1.70, -.81]$, $p < .001$		$[-1.11, -.40]$, $p < .001$	
Feminine	$[-.35, .11]$, $p = .309$		$[-.28, .15]$, $p = .561$		$[-.661, -.002]$, $p = .049$		$[-.21, .69]$, $p = .303$		$[-.15, .57]$, $p = .252$	
Balanced	$[-.57, -.11]$, $p = .004$		$[.00, .43]$, $p = .050$		$[-1.02, -.36]$, $p < .001$		$[-1.37, -.47]$, $p < .001$		$[-.87, -.15]$, $p = .006$	
Gym ad	Masculine versus feminine		Masculine versus feminine		Masculine versus feminine		Masculine versus feminine		Masculine versus feminine	
Women	$[-.66, -.23]$, $p < .001$		$[.20, .60]$, $p < .001$		$[-.71, -.09]$, $p = .011$		$[-1.47, -.62]$, $p < .001$		$[-1.03, -.36]$, $p < .001$	
Men	$[-.14, .34]$, $p = .416$		$[-.19, .26]$, $p = .750$		$[-.22, .47]$, $p = .487$		$[-.02, .92]$, $p = .062$		$[-.10, .64]$, $p = .157$	
	Masculine versus balanced		Masculine versus balanced		Masculine versus balanced		Masculine versus balanced		Masculine versus balanced	
Women	$[-.57, -.12]$, $p = .002$		$[-.06, .35]$, $p = .175$		$[-.62, .02]$, $p = .069$		$[-1.00, -.13]$, $p = .011$		$[-.80, -.10]$, $p < .011$	
Men	$[-.25, .22]$, $p = .875$		$[-.16, .27]$, $p = .629$		$[-.46, .21]$, $p = .448$		$[-.69, .23]$, $p = .329$		$[-.57, .16]$, $p = .272$	
	Feminine versus balanced		Feminine versus balanced		Feminine versus balanced		Feminine versus balanced		Feminine versus balanced	
Women	$[-.13, .32]$, $p = .392$		$[.47, -.05]$, $p = .014$		$[-.22, .43]$, $p = .522$		$[.04, .92]$, $p = .033$		$[-.11, .59]$, $p = .174$	
Men	$[-.36, .12]$, $p = .325$		$[-.20, .24]$, $p = .878$		$[-.59, .09]$, $p = .145$		$[-1.14, -.21]$, $p = .004$		$[-.84, -.11]$, $p = .012$	

Notes. Balanced = gender-balanced gym ad condition. Intended engagement = intended engagement in the gym. Future interest = future interest in joining the gym. Intentions to recruit = intentions to recruit others to the gym. For pairwise comparisons, 95% confidence intervals for mean differences appear in [brackets] next to p -values. Bolded values are significant.

Results

Table 13 reports correlations among the study variables. We first ran a series of ANOVAs examining main effects of Gym Condition (coded as 1 = feminine gym, 2 = masculine gym, 3 = gender-balanced gym), participant Gender (1 = women, -1 = men), and their interaction in predicting perceived safety, threat, and the dependent measures. Results showed significant effects of Gender, Gym Condition, and significant Gender $\times$ Gym Condition interactions for perceived safety, threat,

intended gym engagement (marginally significant), future interest in joining the gym, and intentions to recruit others to the gym (see Table 14, Figures 15 and 16).

Women (but not men) reported less safety, greater threat, less future interest in joining the gym, and less intentions to recruit others to the gym when they saw the gym with masculine (vs. feminine) social cues. Women (but not men) also reported less safety, less future interest, and less intentions to recruit others when they saw the masculine (vs. gender-balanced) gym. Women (but not men) also perceived less threat

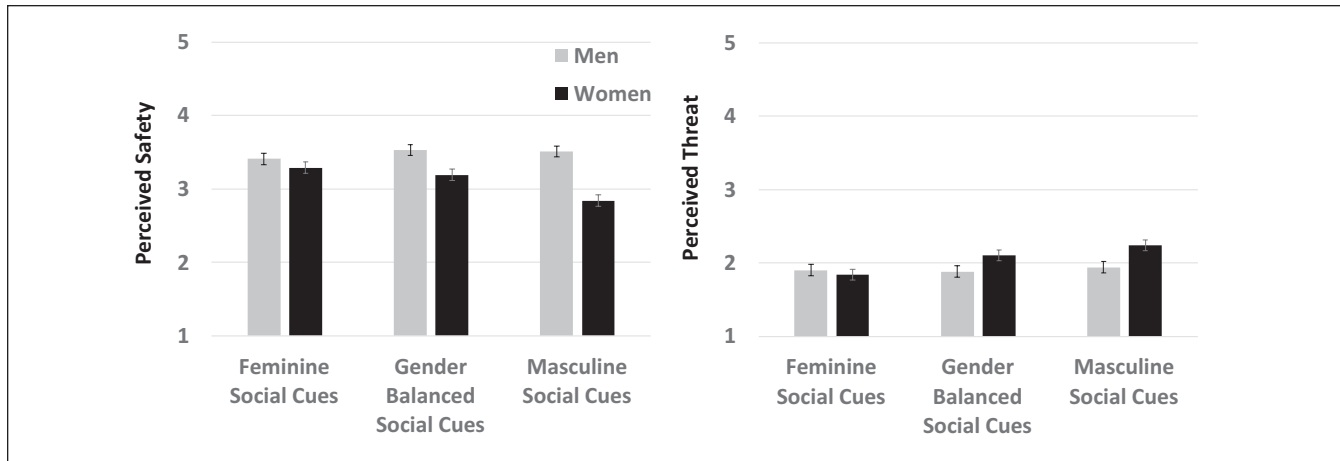


Figure 15. Study 4 results for perceptions of safety and threat by gym advertisement condition and participant gender. Error bars reflect the standard error around the mean of each condition.

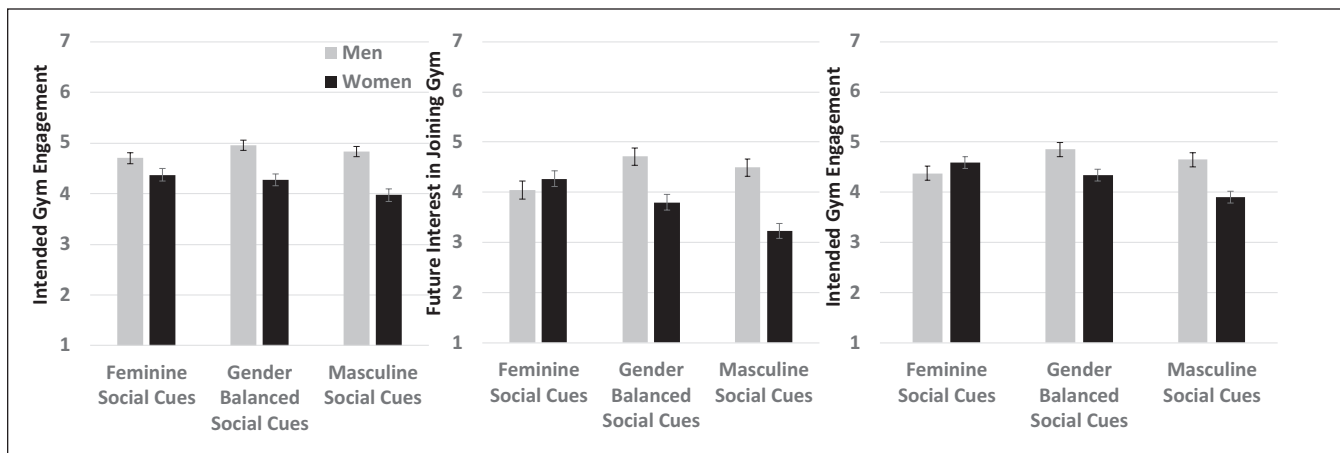


Figure 16. Study 4 results for intended engagement in gym, future interest in joining gym, and intentions to recruit others to the gym by gym advertisement condition and participant gender. Error bars reflect the standard error around the mean of each condition.

and reported greater interest when they saw the feminine (vs. gender-balanced) gym. Men (but not women) reported less intentions to recruit others to the gym when they saw the feminine (vs. gender-balanced) gym.

Do Effects Remain When Controlling for Covariates?

Even after controlling for positive and negative affect, the Gender $\times$ Gym Condition interaction remained significant for perceived safety, interest, and intentions to recruit others to the gym (see Table S2 in Supplemental Materials for results).

Moderated Mediation

Finally, we ran moderated mediation analyses using Hayes' (2022) PROCESS macro version 4.2 (Model 8), which allowed us to test indirect effects of gym condition on the

outcome measures through each mediator in parallel (see Figure 13). Table 15 reports the results.

Intended Gym Engagement. The index of moderated mediation was significant only for perceived safety, belonging, and gym staff support when comparing the masculine (vs. feminine) gym condition. When comparing the masculine (vs. gender-balanced) gym conditions, the index of moderated mediation was significant only for perceived safety. When comparing the feminine (vs. gender-balanced) gym conditions, only belonging and perceived gym staff support showed significant moderated mediation.

Future Interest in Joining Gym. The index of moderated mediation was significant only for perceived safety, belonging, and gym staff support when comparing the masculine (vs. feminine) gym condition, and for belonging and gym staff support when comparing the feminine (vs. gender-balanced) gym condition.

Table 15. Results of Moderated Mediation Analyses Predicting Dependent Variables (Study 4).

X → M path		Masculine vs. Feminine Gym			Feminine vs. Balanced Gym			Masculine vs. Balanced Gym		
		Effect	p-value	95% CI	Effect	p-value	95% CI	Effect	p-value	95% CI
Condition → safety		-.18	.032	[-.34, -.02]	.01	.940	[-.16, .17]	-.18	.027	[-.34, -.02]
Condition → threat		.22	.004	[.07, .37]	.12	.111	[-.03, .27]	.10	.198	[-.05, .25]
Condition → belonging		-.20	.052	[-.41, .00]	.08	.430	[-.12, .29]	-.29	.006	[-.49, -.08]
Condition → perceived support		-.14	.194	[-.34, .07]	.17	.123	[-.04, .37]	-.30	.004	[-.51, -.09]
Moderating Effect of W on X → M Path		Masculine vs. Feminine Gym			Feminine vs. Balanced Gym			Masculine vs. Balanced Gym		
		Effect	p-value	95% CI	Effect	p-value	95% CI	Effect	p-value	95% CI
Gender × Condition → Safety		-.28	<.001	[-.44, -.11]	-.11	.177	[-.28, .05]	-.16	.047	[-.33, -.00]
Gender × Condition → Threat		.19	.015	[.04, .34]	.14	.069	[-.01, .29]	.05	.556	[-.11, .20]
Gender × Condition → Belonging		-.39	<.001	[-.59, -.18]	-.29	.006	[-.50, -.09]	-.09	.368	[-.30, .11]
Gender × Condition → Perceived Support		-.31	.003	[-.52, -.11]	-.30	.005	[-.51, -.09]	-.01	.921	[-.22, .20]
M → Y path (with all variables in the model)		Effect	p-value	95% CI						
Safety → intended engagement		.30	<.001	[.19, .40]						
Threat → intended engagement		.03	.486	[-.06, .12]						
Belonging → intended engagement		.40	<.001	[.32, .48]						
Perceived support → intended engagement		.36	<.001	[.28, .43]						
Safety → future interest		.38	<.001	[.22, .54]						
Threat → future interest		-.06	.361	[-.07, .19]						
Belonging → future interest		.65	<.001	[.53, .77]						
Perceived support → future interest		.33	<.001	[.22, .44]						
Safety → intentions to recruit		.40	<.001	[.28, .53]						
Threat → intentions to recruit		-.07	.184	[-.17, .03]						
Belonging → intentions to recruit		.35	<.001	[.25, .44]						
Perceived support → intentions to recruit		.32	<.001	[.24, .40]						
Index of Moderated Mediation										
		Safety	Threat	Belonging		Perceived Support				
DV: intended engagement										
Masculine vs. feminine gym		-.16 [-.30, -.06]	.01 [-.02, .05]	-.31 [-.50, -.13]		-.22 [-.39, -.07]				
Feminine vs. balanced gym		-.07 [-.17, .03]	.01 [-.02, .04]	-.23 [-.41, -.07]		-.22 [-.38, -.07]				
Masculine vs. balanced gym		-.10 [-.21, -.00]	.00 [-.01, .03]	-.08 [-.25, .09]		-.01 [-.15, .14]				
DV: future interest										
Masculine vs. feminine gym		-.21 [-.38, -.07]	.02 [-.03, .08]	-.50 [-.81, -.23]		-.21 [-.38, -.06]				
Feminine vs. balanced gym		-.08 [-.22, .04]	.02 [-.02, .07]	-.38 [-.65, -.13]		-.20 [-.37, -.06]				
Masculine vs. balanced gym		-.12 [-.28, .00]	.01 [-.02, .04]	-.12 [-.40, .14]		-.01 [-.14, .13]				
DV: intentions to recruit										
Masculine vs. feminine gym		-.22 [-.38, -.09]	-.03 [-.08, .01]	-.27 [-.45, -.12]		-.20 [-.38, -.07]				
Feminine vs. balanced gym		-.09 [-.23, .04]	-.02 [-.07, .01]	-.20 [-.36, -.06]		-.19 [-.36, -.06]				
Masculine vs. balanced gym		-.13 [-.28, .00]	-.01 [-.04, .02]	-.07 [-.22, .08]		-.01 [-.14, .12]				
Conditional Indirect Effects of Condition on Dependent Variables										
		Safety	Threat	Belonging		Perceived Support				
DV: Intended Engagement										
Masculine vs. Feminine Gym										
Men		.03 [-.04, .10]	.00 [-.01, .02]	.07 [-.05, .20]		.06 [-.05, .18]				
Women		-.13 [-.24, -.06]	.01 [-.02, .05]	-.23 [-.37, -.11]		-.16 [-.27, -.06]				
Feminine vs. Balanced Gym										
Men		.04 [-.03, .11]	-.00 [-.01, .01]	.15 [.03, .27]		.17 [.06, .29]				
Women		-.03 [-.11, .04]	.01 [-.02, .04]	-.08 [-.20, .03]		-.05 [-.16, .06]				
Masculine vs. Balanced Gym										
Men		-.01 [-.07, .06]	.00 [-.01, .02]	-.08 [-.19, .04]		-.10 [-.22, -.00]				
Women		-.10 [-.19, -.03]	.00 [-.01, .03]	-.15 [-.28, -.04]		-.11 [-.22, .01]				
DV: Future Interest										
Masculine vs. Feminine Gym										
Men		.04 [-.05, .13]	.00 [-.02, .03]	.12 [-.07, .33]		.06 [-.04, .17]				
Women		-.17 [-.30, -.07]	.02 [-.03, .08]	-.38 [-.59, -.18]		-.15 [-.27, -.05]				
Feminine vs. Balanced Gym										
Men		.04 [-.04, .13]	-.00 [-.02, .02]	.24 [.06, .44]		.15 [.05, .27]				
Women		-.04 [-.13, .05]	.02 [-.02, .06]	-.14 [-.32, .04]		-.05 [-.15, .05]				
Masculine vs. Balanced Gym										
Men		-.01 [-.10, .08]	.00 [-.01, .03]	-.12 [-.32, .06]		-.10 [-.21, -.00]				
Women		-.13 [-.25, -.03]	.01 [-.01, .04]	-.25 [-.45, -.06]		-.10 [-.22, -.00]				
DV: Intentions to Recruit										
Masculine vs. Feminine Gym										
Men		.04 [-.05, .14]	-.00 [-.02, .02]	.06 [-.04, .18]		.06 [-.04, .17]				
Women		-.18 [-.30, -.08]	-.03 [-.07, .01]	-.21 [-.34, -.09]		-.14 [-.25, -.05]				
Feminine vs. Balanced Gym										
Men		.05 [-.04, .14]	.00 [-.02, .02]	.13 [.03, .24]		.15 [.05, .26]				
Women		-.04 [-.14, .05]	-.02 [-.05, .01]	-.07 [-.18, .02]		-.04 [-.14, .05]				
Masculine vs. Balanced Gym										
Men		-.01 [-.10, .09]	-.00 [-.03, .01]	-.07 [-.18, .03]		-.09 [-.19, -.00]				
Women		-.14 [-.26, -.04]	-.01 [-.04, .01]	-.13 [-.25, -.03]		-.10 [-.21, -.01]				

Notes. The feminine gym condition was coded as the reference group for the masculine versus feminine gym and feminine versus gender-balanced gym condition. The gender-balanced gym condition was coded as the reference group for the masculine versus gender-balanced gym condition. Gender was coded as 1 = women, -1 = men. DV = dependent variable. Balanced = gender- balanced condition. Intended engagement=intended engagement in the gym. Future interest = future interest in joining the gym. Intentions to recruit = intentions to recruit others to the gym. Paths reflect unstandardized coefficients with 95% confidence intervals in brackets. Bolded values are significant. X = gym condition; Y = DV; M = mediator; W = moderator (participant gender).

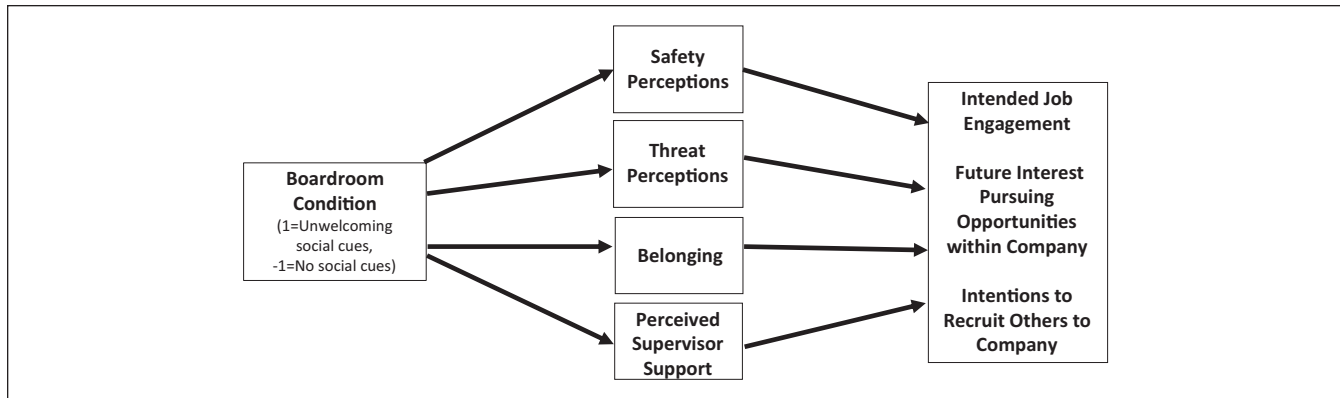


Figure 17. Proposed mediation model predicting dependent measures (Study 5).

Intentions to Recruit Others to Gym. The index of moderated mediation was significant only for perceived safety, belonging, and gym staff support when comparing the masculine (vs. feminine) gym condition, and for belonging and gym staff support when comparing the feminine (vs. gender-balanced) gym condition.

Discussion

In contrast to Study 3, the current study used the STEP scale to examine perceptions of safety and threat in gym environments containing social cues. Notably, the mere presence of men in the gym led women to perceive less safety than seeing the gym with feminine social cues (two women working out) or gender-balanced cues (a man and woman working out). Women also reported less interest in joining the gym and intentions to recruit others to the gym when they saw the masculine (vs. gender-balanced) gym. Portraying men working out in the gym environment may have reinforced the idea that gyms are default masculine spaces, prompting women to report less desire to enter this setting. Including women in the feminine and gender-balanced gym ads, however, led women to perceive greater safety in the environment.

Interestingly, women's perceptions of safety, intended engagement, and intentions to recruit others to the gym did not differ when comparing the feminine versus gender-balanced gym conditions. Such findings suggest that the presence of just one woman was sufficient to increase women's perceptions of safety in the gym. And, although men reported less intentions to recruit others to the feminine (vs. gender-balanced) gym, their perceptions of safety and threat did not influence their responses, which did not differ significantly across gym conditions.

Importantly, even after controlling for positive and negative affect, women still perceived less safety when seeing the masculine (vs. feminine) gym and also perceived the gym as less safe when they saw the masculine (vs. gender-balanced) gym ad, which predicted less intended engagement in the gym, interest in joining the gym, and intentions to recruit others to the gym. Thus, consistent with our earlier studies,

lowered perceptions of safety, rather than increased perceptions of threat, uniquely predicted the outcomes.

Study 5

In the studies so far, the environment affected participants' perceptions of safety in predicting the outcomes, but not perceptions of threat. In the final study, we sought to shift people's sense of threat by showing participants an image of a corporate environment intended to elicit threat. Specifically, participants were asked to imagine entering a boardroom where they would be interviewed for a job they applied for. The threat condition showed four men with judgmental expressions seated at a large table across from the participant, whereas the control condition showed the same room (with the same physical features) but with no social cues (no men). We hypothesized that participants who saw the boardroom with the judgmental-looking evaluators would report greater perceived threat as assessed by the STEP scale, which would predict less intended job engagement, less interest in pursuing opportunities within the company, and less desire to recruit others to work there (see Figure 17).

Another aim of this study was to rule out alternative explanations by controlling for measures that may be related to safety and threat perceptions. Specifically, we controlled for participants' self-concept, goal, and social fit (within the company) as assessed by the State Authenticity to Fit in the Environment scale (SAFE model; Aday et al., 2024; Schmader & Sedikides, 2018), positivity and negativity ratings of the situation using relevant DIAMONDS subscales (Rauthmann & Sherman, 2016), and the overall appeal and favorability of the environment. We also explored whether women, compared to men, would report greater threat and/or less safety when seeing the boardroom with the judgmental-looking men compared to the same room with no social cues.

Participants and Procedure

Participants were a combination of students ($N = 69$) from the Introductory Psychology Participant Pool at a large

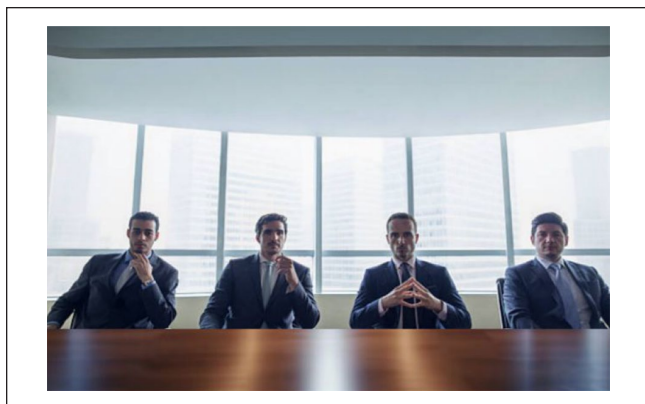


Figure 18. Boardroom with unwelcoming social cues (Study 5).

university in the USA who completed the study for course credit and adults ($N = 585$) from Research Match, an online platform that recruits volunteers from across the USA to participate in studies (see Table 1 for demographics). Participants were asked to imagine they had applied to work at a company and were going to enter a boardroom to be interviewed for the job where they would be asked questions about their past work experiences, qualifications, and why they were well suited for the position. They then imagined walking into the room and saw an image with either *unwelcoming social cues* (i.e., four men seated across the table with judgmental expressions; see Figure 18) or the same room with *no social cues* (i.e., empty chairs with no people; see Figure 19).

Mediator Measures

While looking at the image, participants completed the same measures as in our previous studies assessing perceived safety (18 items, $\alpha = .95$) and threat in the environment (15 items, $\alpha = .95$), belonging (16 items, $\alpha = .92$), and perceived supervisor support (e.g., “How much would you feel like your supervisor cares about their employees in this workplace?” 3 items, $\alpha = .92$).

Covariates

State Authenticity as Fit to the Environment. Participants completed three subscales of the SAFE model (Aday et al., 2024) to assess their sense of fit within the corporate environment they saw in the photo. The subscales measured *self-concept fit* (e.g., “This company would feel right for who I am”; 5 items, $\alpha = .95$), *goal fit* (e.g., “I feel that this company is a place that would allow me to realize my own goals”; 5 items, $\alpha = .89$), and *social fit* (e.g., “When I’m around my coworkers at this company, I would feel like I could act natural”; 5 items, $\alpha = .87$) from 1 = *strongly disagree* to 7 = *strongly agree*.

Positivity and Negativity of the Situation. Participants reported their perceptions of the situation they were asked to imagine in the photo by completing the positivity and negativity

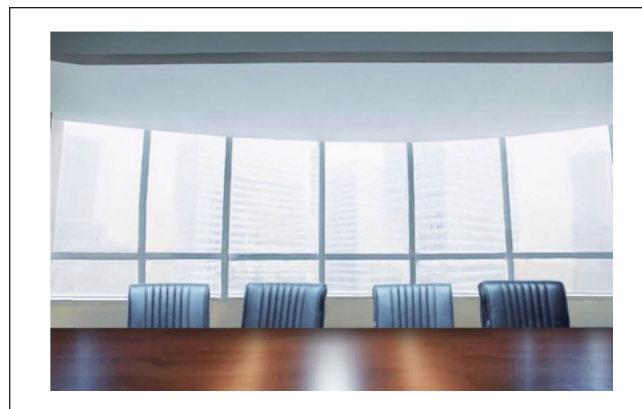


Figure 19. Boardroom with no social cues (Study 5).

subscales of the DIAMONDS scale, which stands for Duty, Intellect, Adversity, Mating, Positivity, Negativity, Deception, and Sociality from 1 = *not at all* to 7 = *totally*. Sample items for positivity were “The situation is joyous and exuberant” (3 items, $\alpha = .85$) and for negativity, “The situation could elicit feelings of tension” (3 items, $\alpha = .89$).

Overall Appeal of Environment. Participants were asked to look at the photo of the room and rate the general appeal of the space (e.g., “nice,” “aesthetically appealing,” “favorable”; 7 items, $\alpha = .94$) from 1 = *not at all* to 7 = *very*.

Dependent Measures

Intended Job Engagement. Items assessing intended engagement from the previous studies were adapted to the corporate environment to ask questions such as, “How engaged would you be at this company?” and “How much would you actively participate at this company?” from 1 = *not at all* to 7 = *very much* (5 items, $\alpha = .91$).

Interest in Pursuing Opportunities Within Company. Participants reported their interest in future growth opportunities at the company: “How interested would you be in seeking a promotion in this workplace environment in the future?” “How interested would you be in potentially taking on leadership roles in this workplace environment in the future?” from 1 = *not at all* to 7 = *very* (3 items, $\alpha = .95$).

Intentions to Recruit Others to Company. Participants reported their desire to recruit others to the workplace: “How likely would you be to talk to other prospective employees about joining this company?” “How likely would you be to encourage prospective workers to apply to work at this company?” from 1 = *not at all likely* to 7 = *very likely* (3 items, $\alpha = .75$).

Results

Table 16 shows correlations among the study variables. We next conducted a series of ANOVAs with gender of

Table 16. Zero-Order Correlations Among Variables (Study 5).

Variable	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.
1. Gender	—	-.23***	.10	-.41***	-.21***	-.20***	-.22***	-.23***	-.28***	-.27***	-.30***	-.25***	.17**	-.17**
2. Safety	-.09	—	-.53***	.67***	.53***	.39***	.59***	.56***	.49***	.63***	-.49***	.60***	-.49***	.60***
3. Threat	.09	-.55***	—	-.42***	-.28***	-.29***	-.38***	-.47***	-.42***	-.47***	-.37***	.46***	.46***	-.42***
4. Belonging	-.18**	.64***	-.69***	—	.60***	.49***	.48***	.55***	.73***	.65***	.68***	.64***	-.52***	.62***
5. Perceived supervisor support	-.14*	.58***	-.60***	.71***	—	.48***	.43***	.54***	.62***	.65***	.57***	.43***	-.43***	.51***
6. Intended job engagement	-.13*	.44***	-.44***	.57***	.51***	—	.68***	.51***	.46***	.63***	.48***	.26***	-.26***	.40***
7. Future interest in company	-.18**	.42***	-.48***	.56***	.53***	.72***	—	.57***	.48***	.56***	.44***	.26***	-.27***	.41***
8. Intentions to recruit others	-.14*	.50***	-.57***	.66***	.62***	.63***	.64***	—	.55***	.60***	.55***	.36***	-.41***	.48***
9. Self-concept fit	-.19***	.60***	-.56***	.78***	.71***	.58***	.63***	.64***	—	.69***	.67***	.56***	-.53***	.61***
10. Goal fit	-.17**	.54***	-.53***	.69***	.70***	.71***	.68***	.68***	.77***	—	.65***	.44***	-.44***	.54***
11. Social fit	-.11*	.48***	-.54***	.67***	.63***	.50***	.50***	.59***	.69***	.67***	—	.44***	-.43***	.46***
12. Positivity of situation	-.07	.57***	-.49***	.58***	.57***	.40***	.42***	.50***	.63***	.54***	.52***	—	-.48***	.59***
13. Negativity of situation	.10	-.40***	.57***	-.61***	-.49***	-.35***	-.34***	-.47***	-.52***	-.50***	-.53***	-.51***	—	-.56***
14. Overall appeal of environment	-.09	.65***	-.58***	.72***	.63***	.58***	.58***	.66***	.70***	.64***	.51***	.64***	-.48***	—

Notes. Gender was coded as 1 = women, -1 = men. Correlations among measures appear above the diagonal for the unwelcoming boardroom ($n = 324$) and below the diagonal for the control condition ($n = 311$). $p < .05$. ** $p < .01$. *** $p < .001$.

Table 17. Results of ANOVAs, Descriptive Statistics, and Pairwise Comparisons (Study 5).

Study variable	Safety	Threat	Intended job engagement	Future interest	Intentions to recruit others
Gender	$F(1, 631) = 15.52$, $p < .001$, $\eta_p^2 = .02$	$F(1, 631) = 5.67$, $p = .018$, $\eta_p^2 = .01$	$F(1, 631) = 18.23$, $p < .001$, $\eta_p^2 = .03$	$F(1, 631) = 26.73$, $p < .001$, $\eta_p^2 = .04$	$F(1, 631) = 21.25$, $p < .001$, $\eta_p^2 = .03$
Boardroom Condition	$F(1, 631) = 97.45$, $p < .001$, $\eta_p^2 = .13$	$F(1, 631) = 55.91$, $p < .001$, $\eta_p^2 = .08$	$F(1, 631) = 10.99$, $p < .001$, $\eta_p^2 = .02$	$F(1, 631) = 9.57$, $p = .002$, $\eta_p^2 = .02$	$F(1, 631) = 13.56$, $p < .001$, $\eta_p^2 = .02$
Gender $\times$ Boardroom Condition	$F(1, 631) = 1.65$, $p = .200$, $\eta_p^2 = .00$	$F(1, 631) = .01$, $p = .917$, $\eta_p^2 = .00$	$F(1, 631) = 1.21$, $p = .271$, $\eta_p^2 = .00$	$F(1, 631) = .38$, $p = .538$, $\eta_p^2 = .00$	$F(1, 631) = .99$, $p = .321$, $\eta_p^2 = .00$
Means (SDs)					
Gender					
Women	1.90 (.75)	3.18 (1.02)	4.41 (1.42)	3.96 (1.89)	3.48 (1.37)
Men	2.14 (.77)	2.98 (.95)	4.92 (1.27)	4.78 (1.72)	4.01 (1.24)
Condition					
Unwelcoming social cues	1.67 (.61)	3.43 (.90)	4.34 (1.43)	3.94 (1.91)	3.40 (1.27)
No social cues	2.14 (.77)	2.80 (1.00)	4.79 (1.33)	4.47 (1.79)	3.87 (1.39)
Pairwise comparisons					
Gender					
Women versus men	$[-.35, -.12]$, $p < .001$	$ [.03, .36]$, $p = .018$	$[-.74, -.27]$, $p < .001$	$[-1.13, -.51]$, $p < .001$	$[-.75, -.30]$, $p < .001$
Condition					
Unwelcoming social cues versus no social cues	$[-.71, -.47]$, $p < .001$	$ [.46, .78]$, $p < .001$	$[-.63, -.16]$, $p < .001$	$[-.80, -.18]$, $p = .002$	$[-1.40, -.20]$, $p < .001$

Notes. Future interest = future interest in pursuing opportunities within the company. Intentions to recruit = intentions to recruit others to the company. For pairwise comparisons, 95% confidence intervals for mean differences appear in [brackets] next to p -values. Bolded values are significant.

participant (women vs. men) and boardroom condition (unwelcoming social cues vs. no social cues) as between-subjects factors. Results showed significant main effects of Gender and Condition, but no significant Gender $\times$ Condition interactions for perceived safety, threat, and the dependent measures. Table 17 reports the results. Women (vs. men), as well as those who saw the boardroom with unwelcoming (vs. no) social cues, perceived less safety, greater threat, and reported less intended engagement, future interest, and desire to recruit others to the company. When controlling for belonging in the company, perceived supervisor support, state authenticity from self-concept fit, goal fit, and social fit, positivity and negativity of the situation, and overall appeal of the space, seeing the boardroom with unwelcoming (vs. no) social cues still significantly predicted less safety, $F(1, 622) = 22.30$, $p < .001$, $\eta_p^2 = .04$, and greater threat in the environment, $F(1, 622) = 10.25$, $p = .001$, $\eta_p^2 = .02$.

Mediation Analyses

Next, we conducted mediation analyses using Hayes' (2022) PROCESS (Model 4) to test for indirect effects of boardroom condition on the dependent variables via the mediators, controlling for the covariates (see Figure 17). Table 18 reports the results.⁷

Intended Job Engagement. Results showed only a significant indirect effect of belonging, such that participants who saw the boardroom with unwelcoming social cues reported less belonging, which predicted less intended job engagement.

Future Interest in Pursuing Opportunities Within Company. There were no significant indirect effects of perceived safety, threat, belonging, or supervisor support in predicting future interest in the company.

Intentions to Recruit Others to Company. Results showed only a significant indirect effect of threat, such that participants who saw the boardroom with unwelcoming social cues perceived greater threat, which predicted less desire to recruit others to the company.

Discussion

Consistent with the previous studies, Study 5 provided evidence for the validity of the STEP scale. Overall, participants perceived a corporate boardroom environment with unwelcoming social cues to be less safe, more threatening, and reported less intended engagement, interest in the company, and intentions to recruit others to join the company compared to those who saw the same room with no social cues. Although women overall reported these perceptions and intentions more compared to men, we did not find women in particular to view the unwelcoming boardroom to be less safe or more threatening than did men. However, we did find both women and men perceived greater threat in the boardroom with unwelcoming social cues (vs. no social cues), which was related to less desire to recruit others to the company. Thus, it seems that the room with unwelcoming social cues was viewed as threatening for all participants.

Table 18. Results of Mediation Analyses Predicting Dependent Variables Controlling for Covariates (Study 5).

a Path	Effect	p-Value	95% CI
Condition → safety	-.11	<.001	[-.16, -.07]
Condition → threat	.10	.002	[.04, .17]
Condition → belonging in company	-.05	.042	[-.10, -.00]
Condition → perceived supervisor support	.05	.197	[-.02, .12]
b Path			
DV: Intended job engagement			
Safety → intended job engagement	-.03	.744	[-.20, .14]
Threat → intended job engagement	.02	.698	[-.09, .14]
Belonging in company → intended job engagement	.21	.007	[.06, .35]
Perceived supervisor support → intended job engagement	.03	.507	[-.06, .13]
DV: Future interest			
Safety → future interest	-.15	.215	[-.38, .09]
Threat → future interest	-.11	.178	[-.27, .05]
Belonging in company → future interest	.17	.104	[-.04, .38]
Perceived supervisor support → future interest	.03	.694	[-.11, .16]
DV: Intentions to recruit others			
Safety → intentions to recruit others	-.15	.053	[-.31, .00]
Threat → intentions to recruit others	-.12	.025	[-.22, -.02]
Belonging in company → intentions to recruit others	.13	.064	[-.01, .27]
Perceived supervisor support → intentions to recruit others	.13	.003	[.04, .22]
c Path (total effect)			
Condition → intended job engagement	.01	.763	[-.07, .10]
Condition → future interest	.06	.302	[-.06, .19]
Condition → intentions to recruit others	.06	.122	[-.02, .14]
c' Path (direct effect)			
Condition → intended job engagement (all mediators in model)	.02	.715	[-.07, .11]
Condition → future interest (all mediators in model)	.07	.304	[-.06, .19]
Condition → intentions to recruit others (all mediators in model)	.06	.160	[-.02, .14]
ab Path (indirect effect)			
DV: Intended job engagement			
Condition → safety → intended job engagement	.00		[-.01, .02]
Condition → threat → intended job engagement	.00		[-.01, .02]
Condition → belonging in company → intended job engagement	-.01		[-.03, -.00]
Condition → perceived supervisor support → intended job engagement	.00		[-.01, .01]
DV: Future interest			
Condition → safety → future interest	.02		[-.01, .05]
Condition → threat → future interest	-.01		[-.03, .01]
Condition → belonging in company → future interest	-.01		[-.02, .00]
Condition → perceived supervisor support → future interest	.00		[-.01, .01]
DV: Intentions to recruit others			
Condition → safety → intentions to recruit others	.02		[-.00, .04]
Condition → threat → intentions to recruit others	-.01		[-.03, -.00]
Condition → belonging in company → intentions to recruit others	-.01		[-.02, .00]
Condition → perceived supervisor support → intentions to recruit others	.01		[-.00, .02]

Notes. Condition was coded as 1 = unwelcoming social cues, -1 = no social cues. Future interest = interest in pursuing opportunities within company. Intentions to recruit others = intentions to recruit others to company. Effects reflect unstandardized betas. Bolded values are significant. 95% CI = 95% confidence interval. Covariates = self-concept, goal, and social fit, positivity and negativity of the situation, overall appeal of environment.

Unlike our previous studies, perceptions of safety did not uniquely predict the outcomes in the present study. A possible reason for this lack of findings is that our earlier studies presented only physical cues (Studies 1–3) or

physical cues with inanimate social cues devoid of facial expressions (Study 4). In contrast, participants in the current study were presented with a salient social cue: a group of men wearing suits with judgmental facial expressions.

Given this evaluative cue, it makes sense that participants' perceptions of threat, rather than safety, uniquely predicted the outcomes (i.e., less desire to recruit others into the work environment).

Contrary to predictions, perceptions of threat did not significantly predict intended engagement or interest in the company. One possible reason for this is that we controlled for a host of other related variables in the current study, such as the perceived positivity and negativity of the situation, feelings of state authenticity from self-concept, goal, and social fit within the environment, and the overall appeal of the space. After controlling for these six other variables, it makes sense that the overall variance explained by perceptions of threat and safety in predicting the outcomes would be diminished. Also, we did not give participants information about the type of job or work they would be doing in this environment, which could have weakened the link between perceptions of threat and intended engagement and interest in the position.

General Discussion

The present research found that perceptions of safety and threat are measurable, empirically related but separable constructs, and predict outcomes beyond belonging and perceived support from others within that environment. Importantly, people's gestalt impressions of environments predicted whether they wanted to be involved with and engaged in that space, their interest in pursuing opportunities in that space, and their intentions to recruit others to join them.

The STEP scale was designed to assess people's overall, gut-level reactions to a given environment. Using this scale, perceptions of safety and threat can be measured at an initial stage—when entering a space for the first time—as well as over time, as individuals are exposed to and process multiple cues in the environment. As predicted by the social evaluative model of threat (Park, Naidu, et al., 2023), people's perceptions of threat are likely to be influenced by their pre-existing expectations and motivations to detect threat. Accordingly, we expected members of underrepresented groups to perceive less safety and/or greater threat in certain environments, with downstream consequences for their intended engagement, future interest, and intentions to recruit others within that setting.

In Studies 1 and 2, women who saw a STEM classroom containing stereotypically masculine (vs. neutral) objects rated the environment as being less safe. Decreased perceptions of safety, in turn, predicted decreased intentions to engage in that space (e.g., less desire to participate), less interest in future learning in that environment, and less desire to encourage other students to join that environment. Results of an internal meta-analysis confirmed these results and also showed that women (vs. men) perceived the classroom with neutral objects to be less threatening. Notably, these findings

emerged even after controlling for sense of belonging, perceived professor support, and perceptions of the classroom climate.

Study 3 extended beyond the academic environment to examine another common space: the gym. By changing subtle cues in the gym environment, such as the presence of dark versus bright colors and varying the amount of light in the room, we were able to influence and assess people's perceptions of safety and threat within that environment. Women perceived less safety in the unwelcoming gym containing dark colors and little light, compared to the welcoming gym containing bright colors and lots of light. Even after controlling for how masculine versus feminine the gyms seemed, women's decreased perceptions of safety, as measured by the STEP scale, uniquely predicted less intended engagement, interest in joining, and desire to recruit others to the unwelcoming gym. Thus, even in the absence of social cues, physical cues may play an important role in shaping people's overall impressions of a space as safe or not, which is distinguishable from perceptions of threat.

Whereas Studies 1 to 3 manipulated physical cues in the environment (e.g., objects, colors, lighting), Study 4 varied social cues within the same physical environment. Specifically, women and men saw a gym advertisement with unwelcoming physical cues, as in Study 3, but containing social cues that were either masculine (two men working out), feminine (two women working out), or gender-balanced (a man and woman working out). Results showed that women perceived less safety when seeing the gym with masculine (vs. feminine or gender-balanced) social cues, which predicted less intended engagement, interest in joining, and desire to recruit others to the gym. These findings were specific to decreased perceptions of safety, rather than increased perceptions of threat, remained significant even after controlling for positive and negative affect, and emerged for women in particular who may view gyms as default masculine spaces. Importantly, women did not differ in their perceptions of safety when they saw an unwelcoming gym with two women working out, or just one woman working out next to a man, suggesting that the mere presence of one woman boosted perceptions of safety in the gym.

Finally, Study 5 sought to demonstrate the unique predictive validity of the threat subscale of the STEP scale. In that study, social evaluative threat was heightened by having participants imagine going for a job interview in a boardroom and seeing a group of men showing judgmental expressions, versus entering the same boardroom but with no people in it. Consistent with hypotheses, when participants saw the boardroom with the salient social cue, they perceived greater threat, less safety, and reported less intended engagement, interest, and intentions to recruit others to work at the company. Furthermore, those who saw the unwelcoming boardroom perceived greater threat, which predicted less desire to recruit others to join this environment. Notably, this finding emerged even after controlling for related variables, such as

feelings of state authenticity from self-concept, goal, and social fit, perceptions of the positivity and negativity of the situation, and the overall appeal of the space. In contrast to our previous studies, perceptions of safety did not show predictive validity, and gender differences did not emerge. Perhaps the unwelcoming environment elicited sufficient threat such that everyone perceived the space to be critical, chilly, and intimidating.

In sum, the environments people were exposed to shifted their perceptions of safety and threat—as assessed by the STEP scale—in the expected directions. However, what differed across studies was whether perceptions of safety or threat uniquely predicted the outcomes. Overall, perceptions of safety more consistently predicted the dependent measures than perceptions of threat, except for in Study 5 in which threat (but not safety) showed unique predictive validity. There are a few possible reasons for this.

In any given environment, a range of cues are present, and some cues capture attention more than others. In Studies 1 to 3, only physical cues were manipulated (e.g., objects in a classroom, lighting, and colors in a gym). With these cues, perceptions of safety (and not threat) predicted intended engagement, interest, and desire to recruit others into that space. In these studies, there was no salient cue of social evaluation; that is, there were no people nor immediate cues in the environment suggesting they could be negatively evaluated by others in these spaces. Although men and women were added as social cues to the gym environment in Study 4, they were inanimate figures and did not show any facial expressions. Thus, similar to Studies 1 to 3, only perceptions of safety (and not threat) of the STEP scale uniquely predicted the outcomes.

Together, these findings suggest that in the absence of salient cues conveying the possibility of negative social evaluation, people may generally perceive environments in terms of whether they are safe (i.e., welcoming, inclusive, supportive) or not. Consistent with this idea, research on person perception shows that when forming first impressions, people tend to evaluate others based on perceptions of warmth and trustworthiness, which then guides their tendency to approach or avoid others (Fiske et al., 2007). Future research could examine how different types of cues—and the relative salience of such cues in real-world contexts—convey safety and threat and shape downstream outcomes.

Are Safety and Threat Distinct or Bipolar Constructs?

We conceptualize safety and threat—as measured by the STEP scale—as distinct constructs, rather than opposite ends of a single continuum. Although safety and threat were found to be moderately related to each other in the current studies, a two-factor solution was a significantly better fit than a single bipolar factor, and the factor correlations between safety

and threat were not so high as to suggest empirical redundancy (Study 1: $r = -.57$; Study 2: $r = -.56$; Study 3: $r_{\text{welcoming_gym}} = -.39$, $r_{\text{unwelcoming_gym}} = -.47$; Study 4: $r = -.46$; Study 5: $r = -.60$, all $ps < .001$). Moreover, whereas Studies 1 to 4 showed only decreased safety perceptions, and not increased threat perceptions mediated the effects of environment on the dependent measures, Study 5 showed increased threat, rather than decreased safety, mediated the effects of environment on intentions to recruit others.

Overall, these findings suggest that safety and threat are separable constructs, rather than a unidimensional scale, as movement on one measure did not necessarily alter responses on the other measure. If safety and threat were opposite ends of a single pole, then we might expect to see lowered perceptions of safety correspond to increased perceptions of threat and vice versa, which we did not find in the present studies.

Viewing safety and threat as distinct constructs allows us to envision environments where both perceptions could be activated simultaneously. For example, upon visiting one's childhood home, one could perceive both a welcoming, inclusive environment (safety) and a critical, intimidating space (threat) based on objects or social cues in that environment. As another example, one could enter a workplace and perceive both safety and threat depending on the cues in that space. For instance, walking down the hallway one might see a coworker whose presence conveys a welcoming, inclusive atmosphere, but could also see their critical boss who may simultaneously signal a threatening, socially evaluative environment. In short, people are likely to perceive spaces as safe and/or threatening depending on the most salient features of a given environment. Furthermore, perceptions of safety and threat are likely to be amplified depending on motivation and expectations to detect threat (e.g., based on one's group membership; Park, Naidu, et al., 2023).

The psychological literature reveals several examples of constructs that at first glance may appear to be bipolar opposites but may also be conceptualized as distinct constructs. For example, positive and negative affect—often thought of as bipolar opposites—can also be viewed as independent constructs (Cacioppo & Berntson, 1994). For instance, people can feel happy and sad simultaneously upon graduating from college or moving out of one's college dormitory (Larsen et al., 2001). People can also hold ambivalent attitudes toward objects or behaviors, such as drinking alcohol (Cacioppo et al., 1997; Conner & Armitage, 2008) or feeling both positively and negatively toward their romantic partners (McNulty et al., 2019; Zayas & Shoda, 2015; Zoppolat et al., 2024). People can also hold positive attitudes (vs. negative attitudes) toward group members, such as showing in-group favoritism but not outgroup derogation (Tajfel et al., 1971).

Another example of seemingly related yet distinct constructs is masculinity and femininity. Whereas some researchers believe masculinity and femininity are opposite ends of a single pole (Constantinople, 1973; Perrett et al., 1998;

Rhodes, 2006), others suggest masculinity and femininity are separable constructs that can be measured and coexist. For example, individuals can possess both masculine and feminine traits (i.e., androgyny; Bem, 1974) and can also perceive facial impressions of androgyny (Hester et al. 2021). Viewing masculinity and femininity as distinct constructs is consistent with contemporary views regarding masculine versus feminine cultures in STEM (Cheryan et al., 2017) and the theory of the “Big Two” whereby masculinity and femininity—as independent dimensions—are assumed to underlie many social cognitive processes (Martin & Slepian, 2021). Indeed, as Hester et al. (2021) note, “concepts that are ‘opposites’ semantically are not necessarily psychological opposites” (p. 1159).

Finally, research on minority stress suggests that a lack of social safety—that is, lacking social connection and acceptance—may be just as important in predicting health outcomes as the presence of stress that comes from being a member of a minoritized or stigmatized group (Diamond & Alley, 2022). Along similar lines, the present research found a lack of perceived safety—perceiving the environment to be less welcoming, inclusive, and supportive as measured by the STEP scale—predicted the outcomes in Studies 1 to 4, rather than increased perceptions of threat.

In sum, the extant literature suggests a number of constructs—such as affect, attitudes, perceptions of oneself and others—can be viewed as distinct constructs, rather than opposite ends of a single pole. Similarly, we conceptualize perceptions of safety and threat in the environment as distinct constructs that have unique predictive validity. Just as people can hold positive, negative, or both positive and negative emotions and attitudes toward objects, actions, and other people, they can form overall, gut-level impressions of environments reflecting safety, threat, or both of these perceptions simultaneously.

Why Is It Important to Assess Perceptions of Safety and Threat in Environments?

As shown in the current research, not all cues are perceived to be safe or threatening for all individuals. In the current studies, women (but not men) perceived the environment to be less safe when they saw a room containing stereotypically masculine objects (Studies 1–2), but not neutral objects. These findings make sense in light of past research, which found that women and girls felt less belonging in stereotypically masculine STEM environments (Cheryan et al., 2009; Master et al., 2016). Importantly, however, our work suggests that women may be less inclined to engage in and learn in environments that are stereotypically masculine not because they perceive the environment to be more *threatening* per se, but because they do not perceive the space to be safe (i.e., not very welcoming, inclusive).

Even when presenting cues that were not explicitly tied to gender stereotypes (e.g., amount of lighting, dark vs. bright

colors in a gym), women perceived the space to be less safe, which predicted less intentions to engage in that space (Study 3). Such findings suggest that some environments may be perceived, by default, as less welcoming or inclusive to members of certain groups (e.g., women and gyms). However, adding cues of safety in an environment may help to offset or undo these effects; indeed, adding bright colors and natural light to make a gym seem welcoming attenuated gender differences in perceptions of safety and threat in Study 3. Also, whereas women who saw an unwelcoming gym with masculine social cues (two men working out) perceived less safety and in turn, reported less intended gym engagement, interest, and less desire to recruit others to the gym, adding feminine, or gender-balanced social cues (i.e., showing at least one woman working out in the gym) served to ameliorate these effects.

If people perceive environments to be unsafe, efforts could be made to improve their experience, especially for members of underrepresented groups who may doubt their belonging or ability in certain settings. Along these lines, women who received positive feedback (i.e., the written comment, “Good job!”) on a math test from a perceived gatekeeper showed increased self-efficacy, belonging, and interest in math versus when they received their score only (Park et al., 2018). Even when women merely imagined receiving a positive verbal response from STEM instructors when asking a question in a STEM context, they felt greater self-efficacy and belonging, which predicted greater intentions to join the lab and recruit other students to join (Park, O’Brien, et al., 2023). Thus, even minimal cues in the environment may be able to boost perceptions of safety and/or reduce threat.

Finally, while some individuals may be more likely to perceive cues of safety or threat than others, certain environments may contain salient cues that affect everyone, regardless of group membership. Indeed, Study 5 found that both men and women perceived greater threat when they saw a boardroom with evaluative social cues (men in suits with judgmental expressions) versus a room with no social cues.

Isn’t the Literature Already Saturated With Threat Measures? Why Another One?

There exists an array of threat measures in the literature ranging from physiological measures (e.g., cortisol, heart rate; Seery, 2013) to cognitive and emotional appraisals of threat (e.g., perceived stress, negative affect; Lazarus & Folkman, 1984), acute responses to threat (e.g., sense of belonging, evaluative concerns; Murphy et al., 2007), threats involving a conflict between a stigmatized identity and a situation (Slepian & Jacoby-Senghor, 2021), and threats targeting individual, relational, or group identities (Park, Naidu, et al., 2023, for a review).

Historically, research on stereotype threat and social identity threat has focused on situations in which members of

stigmatized or marginalized groups experience heightened concerns about being negatively stereotyped or devalued by others based on their group membership (Adams et al., 2006; Branscombe et al., 1999; Davies et al., 2002; Ellemers et al., 2002; Murphy et al., 2007; Schmader et al., 2015; Spencer et al., 2016; Steele et al., 2002; Walton et al., 2015). These studies, however, *assumed* that threat occurred, based on self-reports of decreased belonging (Cheryan et al., 2009; Good et al., 2012; Murphy et al., 2007), trust (Purdie-Vaughns et al., 2008), or interest in pursuing a domain (Murphy et al., 1999). For example, measures of identity-threat involve asking participants to think about their recent social interactions or situations in which they felt other people treated them differently based on their social identity (Slepian & Jacoby-Senghor, 2021).

In contrast, the STEP scale *makes no mention of participants' identity* when asking participants to complete the scale; other people do not need to be present for individuals to perceive a space as safe or threatening. Rather, the STEP scale focuses on one's overall, gut-level impressions of an *environment*, which may or may not be tied to identity-based concerns about being negatively evaluated based on one's group membership, which is at the core of social identity threats.

On the flip side, research on identity-safety typically examines how cues in the environment convey to members of marginalized groups that their social identities are valued and will not be discriminated against (Chaney & Sanchez, 2018; Cipollina & Sanchez, 2023; Davies et al., 2005; Johnson et al., 2019; Murphy et al., 2007; Pietri et al., 2018; Purdie-Vaughns et al., 2008). Identity safety cues can include environmental cues, minority representation, diversity philosophy and procedures, and identity-safety information (Kruk & Matsick, 2021). For example, seeing diversity statements (Chaney et al., 2016) and gender-inclusive organizational cues (Chaney & Sanchez, 2018) mitigates concerns of being negatively stereotyped or mistreated by others based on one's group membership. Again, however, whereas previous research on identity safety focused on stigmatized social identities, the STEP scale measures people's overall impressions of the safety or threatening nature of the environment itself, which may or may not involve one's identity being salient or relevant in that space. And, while the present studies only focused on physical cues (Studies 1–3) and social cues (Studies 4–5), the STEP scale was designed to measure people's overall, gut-level perceptions of any cues in the environment—whether they be physical, social, verbal, or nonverbal cues—as safe or threatening.

In sum, past work on identity-threat and identity-safety focused on the anticipation of or experience of being devalued or mistreated by others based on one's marginalized group membership, or conversely, how cues in the environment convey to members of stigmatized groups that their identities are valued and respected. Although the STEP scale may also capture some of these concerns based on one's

identity, the intended purpose of the STEP scale is to measure the extent to which individuals perceive the overall *environment itself* to be safe or threatening, which may or may not be relevant to or influenced by their social identities.

Indeed, past research never directly assessed people's overall impressions of the environment, which is what the STEP scale measures. When people experience threat, such as women under stereotype threat in which negative stereotypes about their group are activated regarding their math ability, they are likely to underperform and disengage (Schmader et al., 2015; Spencer et al., 2016). In the current Studies 1 and 2, women saw a photo of a classroom containing stereotypically masculine or neutral objects. In this case, stereotype threat is unlikely to have occurred, given that women were not in a high-stakes performance situation in which their quantitative abilities would be evaluated. If we had only measured belonging, intended academic engagement, and interest in learning—all *responses* to threat—we may have incorrectly assumed that exposure to the stereotypically masculine environment was threatening and therefore, reduced women's reports on these measures.

However, including the STEP scale in the present studies revealed more nuanced findings. Rather than increasing perceptions of threat, women who saw the stereotypically masculine classroom perceived the space to be less safe than the classroom containing neutral items. Thus, based on women's overall impressions of the stereotypically masculine environment, they did not perceive the space to be more threatening (i.e., critical, intimidating), but as less safe (i.e., less welcoming, inclusive). The STEP scale can be used to assess perceptions of safety and threat in initial encounters with environments as well as following exposure to or immersion in environments over time. Certain objects, artifacts, or even the lighting or colors of a room may signal anticipated inclusion or lack thereof.

Also, as people enter and join environments, they may be exposed to a richer set of cues, such as the dialogue, actions, and normative beliefs communicated by others within that environment. At this stage, people may recalibrate their perceptions of threat and/or safety based on these additional cues. For example, a student deciding which college to attend may form an initial gut-level impression based on cues they are exposed to during their campus visit. If students perceive the environment overall to be welcoming and inclusive, they may be more likely to attend that college. However, if the student were to later enroll in a STEM course containing social cues conveying low perceived safety or high threat, they may be less likely to participate in class, show less interest in pursuing this domain, and discourage other students from taking a course in this setting.

The STEP scale differs in important ways from other existing measures. For example, the Situational Affordances for Adaptive Problems (SAAPs) scale assesses people's desire to fulfill fundamental social motives such as

self-protection, disease avoidance, affiliation, mate-seeking, mate retention, status, and caring for kin (Brown et al., 2015). Whereas the SAAP measures the importance of core motives in a given situation (e.g., “In this situation. . .” “getting along with others is important”; “maintaining status and/or respect from others is important”), the STEP scale measures gut-level impressions of a space in terms of how safe or threatening the space seems.

Finally, we do not think the STEP scale is merely a manipulation check. As mentioned earlier, researchers in past work often inferred threat because participants reported decreased trust, comfort, or belonging in certain settings (e.g., Cheryan et al., 2009; Murphy et al., 2007; Purdie-Vaughns et al., 2008). However, the present studies found that perceptions of safety (not threat) predicted motivation and behavioral intentions in Studies 1 to 4 and threat (not safety) predicted intentions to recruit others in Study 5. Thus, the STEP scale provides an important theoretical and empirical advance by showing that perceptions of safety are distinct from threat, can be reliably measured, and predict outcomes beyond existing measures of belonging or perceived support from others within a space (Studies 1–5), positive and negative affect (Studies 3–4), feelings of state authenticity from fitting in in the environment, perceived positivity and negativity of the situation, and the overall appeal of a space (Study 5). Importantly, the STEP scale goes beyond assessing *responses* to threat by revealing nuances in the detection of safety and threat processes that then influence whether people want to approach or avoid a particular environment.

Limits on Generality and Future Directions

The overarching aim of the present studies was to establish the factor structure of the STEP scale and examine its relation to other measures of threat responses. Specifically, we examined perceptions of safety and threat in the classroom (Studies 1–2), gym (Studies 3–4), and corporate workplace (Study 5). We note, however, that our conclusions were drawn from mostly college students and adults in the USA with most participants identifying as White or Asian/Asian American. Thus, it will be important to validate the STEP scale in other populations to see whether the way we measured safety and threat is consistent with how people with other identities or backgrounds perceive safety and threat in the environment in the way we have conceptualized these constructs.

A limitation of the present studies is they relied on self-report dependent measures, rather than behavioral measures (e.g., time spent in a space), and showed participants images of hypothetical spaces, rather than exposing them to actual environments in the lab or in day-to-day life. Despite these limitations, we found converging evidence for the predictive validity of the STEP scale, showing that perceptions of safety differ from perceptions of threat, and depending on what cues were presented, these perceptions uniquely predicted a range

of outcomes. Future studies would benefit from using more intensive approaches, such as experience sampling methods and longitudinal designs to examine how perceived safety and threat fluctuate across real-world contexts and over time.

For example, research could extend beyond static features of the environment to investigate how dynamic cues, such as verbal or nonverbal cues in real-time affect perceptions of safety and threat. Research could also use the STEP scale in contexts beyond the ones studied here, such as in organizations, neighborhoods, communities, healthcare settings, stores, churches, virtual spaces, or any environment in which perceptions of safety and threat may shape people’s motivation, interest, and behavior. The current studies therefore offer a generative starting point to explore many future directions examining how a range of cues shape people’s overall impressions of safety and threat in the environment.

Researchers could also examine how adding cues of safety to a space could help boost perceptions of safety and/or decrease perceptions of threat, especially for members of marginalized or stigmatized groups. For example, past work has shown that exposure to gender-inclusive policies in organizations decreased social identity threat among women in engineering, and this was partially due to having more positive interactions with men in these contexts (Hall et al., 2018). Such findings suggest that positive conversations with outgroup members may serve as a safety cue to transform perceptions of the environment for members of underrepresented groups, such as women in STEM.

Attempts to increase safety must be perceived as sincere, however, because disingenuous attempts to make an environment seem safe may inadvertently exacerbate marginalized group members’ concerns about being negatively evaluated and decrease their interest in joining the organization (Kroeper et al., 2022). Future studies could also examine how intersectional identities, such as gender, ethnicity, and sexual orientation shape perceptions of environments as safe or threatening depending on which identity is salient in a given context.

Conclusion

When people enter a space, they are likely to notice cues of safety—conveying a welcoming, inclusive environment—or threat—conveying a critical, emotionally harmful environment. These overall, gut-level impressions often shape people’s subsequent motivations and intentions to join and engage in that space. To this end, we developed and validated the STEP scale to assess people’s perceptions of safety and threat in the environment and established its predictive validity above and beyond other existing measures. Future research could expand upon these findings to examine safety and threat perceptions across a wide range of contexts, with different types of cues, thereby enhancing understanding of both basic processes and nuances of perceiving environments in everyday life.

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Supplemental Material

Supplemental material is available online with this article.

Notes

1. The STEP scale is intended to assess psychological perceptions of safety and threat, which differs from perceptions of *physical* safety and threat. Although there is thought to be an overlap between psychological and physical pain (Eisenberger & Lieberman, 2004; MacDonald & Leary, 2005), we focus specifically on measuring people's perceptions of the environment as safe or threatening in a psychological sense in the present research.
2. In Figures 1 and 2, only the image of the classroom and the items were shown to participants, not the captions describing the specific items (e.g., "Star Trek poster and figurine").
3. Across studies, participants saw photos of the spaces (i.e., classrooms, gyms) which appeared at the top of the screen while they completed the relevant measures.
4. Given the low number of non-binary gender participants in Studies 1 to 3, these data were not included in analyses.
5. The meta-analytic interaction between participant gender and classroom condition was marginally significant for perceived threat ($p = .051$) and for classroom climate ($p = .053$) and should therefore be interpreted with caution.
6. Due to a programming error, the last two items of the STEP scale ("open," "bright") were omitted from Study 3.
7. We did not conduct moderated mediation analyses for Study 5 because the ANOVA results showed no significant Gender $\times$ Condition interactions.

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