Journal of Experimental Social Psychology 110 (2024) 104547

Contents lists available at ScienceDirect

Journal of Experimental Social Psychology

journal homepage: www.elsevier.com/locate/jesp

US cisgender women's psychological responses to physical femininity threats: Increased anxiety, reduced self-esteem☆

Natalie M. Wittlin [1,*], Marianne LaFrance, John F. Dovidio, Jennifer A. Richeson

Department of Psychology, Yale University, 100 College St., New Haven, CT 06510, USA

ARTICLE INFO

Keywords:
Anxiety
Appearance
Femininity
Masculinity
Self-esteem

ABSTRACT

Research has suggested that women, unlike men, do not experience increased anxiety in response to gender stereotypicality threats. That research, however, has not considered the domain of gender stereotypes in which women might be most invested: physical appearance. The present work examines US cisgender women's responses to (bogus) feedback about the femininity of their appearance, which allegedly came from an algorithmic analysis of a photograph or video of their face. Across four experiments ($N = 2494$), women experienced more anxiety (Studies 1a, 1c, and 2) and lower self-esteem (Studies 1c and 2) in response to feedback indicating that their appearance was less feminine than average (i.e., threats) than feedback indicating that their appearance was more feminine than average (i.e., affirmations). Feedback on the femininity of women's appearance, but not personality (Study 2), had an effect on anxiety and self-esteem even when physical attractiveness was affirmed (in the case of anxiety; Study 1a) and when controlling for self-perceived physical attractiveness (in the case of anxiety and self-esteem; Studies 1a, 1c, and 2). Cisgender men, unlike women, experienced increased anxiety—but not reduced self-esteem—in response to masculinity threats across the domains of appearance and personality, though this effect was stronger for appearance (Study 2). A discrepancy between the bogus feedback one received and beliefs about oneself mediated the effects of feedback on anxiety and self-esteem, for women, and on anxiety, for men (Study 2). These results highlight the need to center physical appearance in research on gender stereotyping and its consequences.

"Look like a lady; act like a man; work like a dog." This was the final message of a 1990 *Fortune* magazine piece on how gender discrimination has impeded women's ascent up the corporate ladder (Fierman, 1990). In recent decades, books and articles have advised women to engage in traditionally masculine behaviors to succeed (e.g., Sandberg, 2013; Teague Moreno, 2019), and indeed, women are increasingly participating in traditionally masculine activities (Haines, Deaux, & Lofaro, 2016), pursuing degrees in traditionally masculine fields (Haines et al., 2016), and self-identifying with stereotypically masculine traits (Donnelly & Twenge, 2017), which are generally highly valued (Cejka & Eagly, 1999; Feinman, 1981; Rudman & Glick, 1999). Women are also *decreasingly* self-identifying with stereotypically feminine traits (Donnelly & Twenge, 2017). Furthermore, there is some evidence that associations between women and traditionally feminine personality traits weakened over the course of the 20th century (Bhatia & Bhatia, 2020; but see Eagly, Nater, Miller, Kaufmann, & Sczesny, 2020). Perhaps as a consequence of the high status of masculine personality traits and the increasing acceptance of these traits in women, whereas men, on

☆ This paper has been recommended for acceptance by Dr. Joris Lammers

* Corresponding author.
E-mail addresses: natalie.wittlin@princeton.edu (N.M. Wittlin), marianne.lafrance@yale.edu (M. LaFrance), john.dovidio@yale.edu (J.F. Dovidio), jennifer.richeson@yale.edu (J.A. Richeson).
[1] Present address: Department of Psychology, Princeton University, Peretsman-Scully Hall, Princeton, NJ 08540, USA

https://doi.org/10.1016/j.jesp.2023.104547
Received 3 April 2023; Received in revised form 26 September 2023; Accepted 30 September 2023
Available online 20 October 2023

average, have been shown to experience anxiety and discomfort in response to threats to their psychological gender stereotypicality (i.e., information suggesting that psychologically they are gender counter-stereotypical[2]), women, on average, have not (Steiner, Vescio, & Adams Jr, 2022; Vandello, Bosson, Cohen, Burnaford, & Weaver, 2008; Vescio, Schermerhorn, Gallegos, & Laubach, 2021). Additionally, although both men and women have been shown to experience reduced explicit self-esteem and increased fear of backlash after succeeding on a cross-sex-typed test, as compared to a sex-typed test, these effects have been stronger and more reliable for men than they have been for women (Rudman, Dohn, & Fairchild, 2007; Rudman & Fairchild, 2004). Similarly, although both men and women have been shown to experience anger after scoring like a gender outgroup member, as compared to a gender ingroup member, on a gender-knowledge test, this effect has also been stronger for men than for women (Steiner et al., 2022).

Gender stereotypes, however, comprise a range of qualities, including not only psychological but also physical characteristics, as reflected in *Fortune*'s guidance to "look like a lady." The current research aimed to examine women's psychological responses to threats to their gender stereotypicality within the domain of physical appearance and, in doing so, to broaden the scope of inquiries into the consequences of gender stereotypes, to interrogate the prevailing understanding of gender stereotypicality threats as primarily affecting men, and to shed light on a possible underexamined contributor to negative psychological outcomes in women.

Research exploring femininity threats in women and masculinity threats in men has typically focused on threats to their *psychological* femininity and masculinity, respectively. Specifically, these studies have provided women and men with false feedback about their "gender identity" (defined to participants as their "psychological masculinity or femininity;" J. Vandello, personal communication, January 24, 2017) or simply their performance on a "gender knowledge test" (e.g., Rudman et al., 2007; Rudman & Fairchild, 2004; Vandello et al., 2008; Vescio et al., 2021). They have found that threats to psychological femininity in women are less consequential than threats to psychological masculinity in men—and that psychological femininity threats often have no significant effects on women.

These disparate findings for women and men have shaped the research agenda for the field of social psychology, such that studies of masculinity threat have surged in recent years, whereas studies of femininity threat have stagnated. Threats to the femininity and masculinity of women's and men's *physical appearances*, however, have, to our knowledge, yet to be explored. There are several reasons to believe that appearance-related gender stereotypes would be particularly salient for women and that women would find threats to the gender stereotypicality of their physical appearance uniquely anxiety-provoking.

Physical appearance is often understood to be not merely an important component of the female gender role[3] but indeed its very essence—with society positioning women as objects to be seen and defining them by their body, face, or "to-be-looked-at-ness" (Chrisler & Johnston-Robledo, 2018, pp. 3–4; Mulvey, 1999, p. 837). When people hear someone say that another person is or is not a "real woman," they tend to believe the speaker is referring to something about that person's physical appearance (Colontonio, 2016). Additionally, when women are asked to complete the open-ended sentence, "As a woman," they mention physical appearances more than any other aspect of their experiences (other than gender-based discrimination, which is mentioned at comparable rates; Shea et al., 2014). The societal focus on women's bodies and appearances is so pervasive that women often come to internalize the "gaze" of others, or self-objectify, focusing more on how they look than how they feel (McKinley & Hyde, 1996; Felig et al., 2022; Fredrickson & Roberts, 1997). Women report higher levels of body monitoring or "surveillance" than men do (Frederick, Forbes, Grigorian, & Jarcho, 2007). Additionally, women recall recent autobiographical events, more so than men do, from a third person, rather than a first-person, visual perspective (Huebner & Fredrickson, 1999). Although research on self-objectification and appearance surveillance has tended to focus on the extent to which women monitor their *bodies*, recent work has suggested that women may be particularly prone to monitoring their *faces*, as well (Fauville, Luo, Muller Queiroz, Bailenson, & Hancock, 2021), and may be particularly concerned and dissatisfied with not only their bodies (Calogero & Thompson, 2010) but also their facial appearances (Frederick, Reynolds, Barrera, & Murray, 2022; Ratan, Miller, & Bailenson, 2022).

If looks constitute the essence of one's social role, then looking a certain way—the way women "should" look (i.e., feminine)—is essential to fulfilling that role. Indeed, when people consider whether a woman is feminine overall, physical appearance is the domain that is most salient to them (Aube, Norcliffe, & Koestner, 1995; Spence & Sawin, 1985; but see Helgeson, 1994). Furthermore, in visual sex categorization tasks, only highly feminized faces and bodies are consistently categorized as female (e.g., Armann & Bülthoff, 2012; Davidenko, 2007; Johnson, Iida, & Tassinary, 2012), suggesting that women, more so than men, must appear highly gender stereotypical to be categorized accurately. Finally, masculine-looking women, compared to feminine-looking women, masculine-looking men, and feminine-looking men, are described in overwhelmingly negative terms (Sutherland, Young, Mootz, & Oldmeadow, 2015), suggesting that women must look sufficiently feminine to be judged positively.

Likely as a consequence of the value placed on physical femininity in women, even though behaving in a more counter-stereotypical manner has become increasingly (albeit not yet completely) normative for women in recent decades, the same has arguably not been true for physical counter-stereotypicality. Historically, physical appearance has had a major influence on how women are judged (Burton, Netemeyer, & Lichtenstein, 1995), and this standard remains prominent today Fairygodboss, n.d; Girlguiding, 2013; Univia, 2019). The physical appearances of women in fields as disparate as sports and politics remain highly scrutinized, and women who have a more masculine physical appearance are not only perceived as unattractive but are also criticized, mocked, and censured because they are deemed inadequately physically feminine by virtue of their muscularity, facial or body hair, or clothing (Chalabi, 2017; Clemente, 2016; Jespersen v. Harrah's Operating Co, 2006; Kendall, 2015).

[2] We use the term "counter-stereotypicality," rather than "non-stereotypicality," to refer to characteristics that sit in opposition to those expected of members of a social group. A person can be "non-stereotypical" by virtue of lacking characteristics that are expected of members of one's social group *or* possessing characteristics that sit in opposition to those that are expected. "Counter-stereotypicality" refers solely to the latter. Within the context of gender, which is generally viewed as highly bipolar (with femininity on one end and masculinity on the other; Biernat, 1991), "counter-stereotypicality" refers to femininity in men and masculinity in women. Precedent for drawing a distinction between "non-stereotypicality" and "counter-stereotypicality" can be found in early gender research that distinguished between "cross-typed" (i.e., counter-stereotypical) individuals and "undifferentiated" (i.e., non-stereotypical but not counter-stereotypical) individuals (Bem, 1981).

[3] Many scholars (e.g., Chrisler, 2013; Parent & Moradi, 2010) use the term "feminine gender role," rather than "female gender role," to refer to the collection of expectations people hold of women. These terms are often used interchangeably (e.g., Gillespie & Eisler, 1992). Here, we use "female gender role" because it is most consistent with the terminology used in the literature on precarious manhood (e.g., Vandello & Bosson, 2013).

The pervasiveness of grooming among women and the specific types of grooming that women tend to engage in provide evidence that women are, indeed, invested in appearing physically feminine and therefore that threats to their physical femininity would likely induce anxiety. Women's grooming constitutes not only "beauty work" (Kwan & Trautner, 2009)—that is, labor intended to enhance physical attractiveness—but also femininity work (Chrisler, 2013)—that is, labor intended to enhance physical femininity. Facial characteristics that are generally considered attractive in women—including high contrast between features and skin, smooth skin, and a lack of facial hair—are also more common in women than men (Rhodes, 2006; Rhodes, Hickford, & Jeffery, 2000; Russell, 2009). Thus, when women remove facial hair and apply lipstick and eye makeup, they enhance their physical femininity. And indeed, the majority of women regularly use cosmetics, skin care products, and hair styling products, and up to 96% engage in some form of body hair removal (Harris Poll, 2014; Tiggemann & Hodgson, 2008; Toerien, Wilkinson, & Choi, 2005). Given that physical appearance constitutes a key (if not *the* key) facet of femininity and womanhood, that having a highly feminine appearance is required for categorization as female, and that women invest heavily in femininity work, threats to physical femininity might provoke anxiety in women even if threats to psychological femininity do not. Specifically, by functioning as acceptance threats—that is, social identity threats that make women feel that they are atypical members of their gender group (Branscombe, Ellemers, Spears, & Doosje, 1999; Scaptura & Boyle, 2020) or, in other words, members who are not fulfilling their role—physical femininity threats might serve as threats to women's senses of self and therefore produce psychological distress.

1. The current research

The main goal of the current research was to determine whether women experience greater anxiety in response to threats to the femininity of their physical appearances than affirmations of the femininity of their physical appearances. We focused specifically on cisgender women (i.e., women who were assigned to the female sex at birth) because transgender individuals' experiences with identity denial (in the form of misgendering) are so common and potentially detrimental to psychological wellbeing (Galupo, Pulice-Farrow, & Lindley, 2020; McLemore, 2018) that we did not believe including transgender women in the current studies, which involve threatening participants' physical femininity, could be ethically justified. For ease of communication, we frequently use the terms "women" and (in Study 2) "men" in this manuscript. Readers should keep in mind, however, that our samples consisted solely of cisgender women and (in Study 2) cisgender men in the US.

Given past work on the effects of gender stereotypicality threats on self-esteem (Rudman et al., 2007; Rudman & Fairchild, 2004), we were also interested in whether women experience lower self-esteem in response to threats to the femininity of their physical appearances than affirmations of the femininity of their physical appearances. State anxiety and state self-esteem are moderately to highly negatively correlated (Besser, Flett, Hewitt, & Guez, 2008; Heatherton & Polivy, 1991), and the same situations can threaten both (Spielberger, 1972, p. 490). They are conceptually distinct, however, with the former representing an emotional response to a stimulus and the latter representing an attitude toward the self (Beck, Emery, & Greenberg, 2005, p. 9; Rosenberg, 1962).

The current research also had three additional objectives. The first was to determine whether physical femininity threats can operate independently from physical attractiveness threats—that is, whether women find physical femininity threats anxiety-provoking even when their physical attractiveness (which is typically confounded with physical femininity) has been affirmed and even when statistically controlling for self-perceived physical attractiveness. The second, which we pursued in Study 2, was to understand whether men, too, experience anxiety in response to threats to the masculinity of their appearances. The third was to determine whether the sense that one's identity or sense of self is being denied (Cheryan & Monin, 2005) could help to explain the predicted effect of physical femininity threats on anxiety and potentially self-esteem among women. By examining women's responses to physical femininity threats (and, in the final study, men's responses to physical masculinity threats), we aimed to shed light on potentially harmful consequences of gender stereotypes within the domain of physical appearance.

2. Studies 1a, 1b, and 1c

The primary purpose of Studies 1a-c was to determine whether cisgender women experience more anxiety following feedback indicating that they are less physically feminine than average than feedback indicating that they are more physically feminine than average. Study 1a tested this question. Study 1b sought to assess the robustness of this effect with a slightly different experimental set-up. Study 1c sought to reconcile the inconsistent results of Studies 1a and 1b.

A secondary goal of these studies was to determine whether the predicted effect of physical femininity feedback on state anxiety was the result of women interpreting threats to their physical femininity as threats to their physical attractiveness. For women, physical femininity is considered a key component of—and thus highly predictive of—physical attractiveness (Rhodes, 2006; Rhodes et al., 2000), and physical attractiveness constitutes a gender-intensified prescriptive stereotype for women—that is, a characteristic that is valued in members of both major gender groups but in members of one gender group in particular (Parker, Horowitz, & Stepler, 2017; Prentice & Carranza, 2002). Furthermore, a large majority of women in the U.S., but only a minority of men, report that they face intense pressure to appear physically attractive (Parker et al., 2017). Thus, it is theoretically possible that women would experience anxiety in response to feedback indicating that they are less physically feminine than average because they would interpret this feedback as indicating that they are less physically *attractive* than average and would find the latter anxiety-provoking. However, given that in addition to attractiveness, gender conformity per se is heavily prescribed (e.g., Rudman, 1998) and gender nonconformity censured (Rudman, Moss-Racusin, Glick, & Phelan, 2012), we did not expect that to be the case. Rather, we expected physical femininity threats to be anxiety-provoking for women independent of any threats to attractiveness that they might be thought to represent.

We also sought to explore the possibility that women would experience not only anxiety but also reduced self-esteem in response to threats to their physical femininity, as compared to affirmations of their physical femininity. In past research, men have experienced lower levels of explicit self-esteem after succeeding in a gender counter-stereotypical, as compared to a gender stereotypical, domain (Rudman et al., 2007). Additionally, threats to physical femininity could be interpreted as threats to *identity* —that is, not solely as information that one is not feminine in a very particular way (in terms of their looks) but that they are not feminine or even female on the inside, at their core. And past work has suggested that identity invalidation (i.e., rejection of one's membership in a group of which one considers oneself a part; Cheryan & Monin, 2005) may produce reductions in self-esteem (Garr-Schultz & Gardner, 2019; Townsend, Markus, & Bergsieker, 2009). Thus, we examined whether women who were told that their physical appearance was less feminine than average would experience lower levels of state self-esteem than women who were told their physical appearance was more feminine than average.

2.1. Method

Hypotheses, methods, and analyses for Studies 1b and 1c were preregistered. Preregistrations, data, and analytic code for all studies are

available at https://osf.io/mh7rb/?view_only=0966da2e71074be3b523b2492ff10162. All measures, manipulations, and exclusions are disclosed in the manuscript or Supplementary Materials. Data were analyzed in SPSS.

2.1.1. Participants and design

Participants were recruited online via Amazon's Mechanical Turk (MTurk, Study 1a) and Prolific Academic (Studies 1b and 1c). Participants in Study 1a were paid $1.00, and participants in Studies 1b and 1c, which were longer, were paid $1.84.

Physical femininity feedback served as the key independent variable across these studies. In all three studies, some participants were told that their facial appearance was more feminine than average (affirmation) and other were told that their facial appearance was less feminine than average (threat). Studies 1a and 1b also included a control condition, in which participants received no information about their facial femininity. Additionally, Studies 1a and 1b included a physical attractiveness feedback manipulation, through which participants were told that their facial appearance was more attractive than average (affirmation) or received no information about their facial attractiveness (control). In Study 1c, participants were randomly assigned to see or not see a list of physical features that supposedly determine whether someone's facial appearance is feminine or masculine. (In Study 1a, all participants saw these lists of features, along with a list of features said to determine when someone's facial appearance is attractive; in Study 1b, no participants saw these lists.)

We powered Studies 1a and 1b it to detect an effect of $f = 0.2$, which is the average effect size for social psychology studies (Faul, Erdfelder, Lang, & Buchner, 2007; Richard, Bond, & Stokes-Zoota, 2003). An a priori power analysis (G*Power 3.1; Faul et al., 2007) indicated that to detect an interaction between physical femininity feedback and physical attractiveness feedback with 80% power and α of 0.05, a sample of 244 participants would be needed. Based on previous studies with MTurk samples, we estimated that 15% of participants in Study 1a would fail the attention checks and recruited 289 participants. An additional nine participants ended up completing the study for a total of 296. We ended up needing to exclude 27% of participants from Study 1a, so we estimated that 334 participants would need to be recruited for Study 1b. An additional seven participants ended up completing Study 1b for a total of 341. In Study 1c, we sought to determine whether excluding descriptions of facial characteristics that make someone appear feminine or masculine would "knock out" the predicted effect of physical femininity feedback. Therefore we powered Study 1c to detect an effect half the size of the main effect observed in Study 1a (Ledgerwood, 2019, 2020).[4] An a priori power analysis (Faul et al., 2007) indicated that a sample of $N = 404$ would be needed to detect this interaction with 80% power and α of 0.05. We anticipated that 20% of recruited participants would be ineligible, fail an attention check, and/or not upload a valid photograph. (Because participants in this study were only given one type of feedback, we anticipated that fewer would be excluded for failing the attention check than in Studies 1a and 1b). Therefore, we recruited 505 participants.

After excluding participants who were not cisgender women (i.e., who did not identify as female and/or who were not assigned to the female sex at birth),[5] did not upload valid photographs, failed one or more attention checks, indicated that they intended some of their responses as jokes, and/or, in Studies 1b and 1c, clearly believed that the feedback they received was not produced by image analysis software, we were left with sample sizes of 216 for Study 1a, 246 for Study 1b, and 458 for Study 1c. Participant demographic characteristics are reported in Table 1. Sensitivity power analyses (G*Power 3.1; Faul et al., 2007) indicated that we were powered to detect two-way interactions with effect sizes of $f = 0.21$ (Study 1a), $f = 0.20$ (Study 1b), and $f = 0.13$ (Study 1c) with 80% power and $\alpha = 0.05$. In other words, we were not powered to detect interactive effects with effect sizes smaller than $f = 0.21$, $f = 0.20$, and $f = 0.13$, respectively.

2.1.2. Procedure

After reading the consent form, answering a series of question to confirm that they had carefully read the form, and agreeing to participate, participants were instructed to upload a photograph of themselves and then center it with crosshairs in the middle. (Participants were shown an image demonstrating how they should center the

Table 1
Participant demographics.

	Study 1a	Study 1b	Study 1c	Study 2
	No. (%)			
Gender				
Female	216 (100.00%)	246 (100.00%)	458 (100.00%)	822 (52.22%)
Male	0 (0.00%)	0 (0.00%)	0 (0.00%)	752 (47.78%)
Race / ethnicity				
Black or African American	15 (6.94%)	23 (9.35%)	43 (9.39%)	126 (8.01%)
East Asian	3 (1.39%)	10 (4.07%)	20 (4.37%)	88 (5.59%)
Hispanic or Latino/a	5 (2.31%)	10 (4.07%)	21 (4.59%)	112 (7.12%)
Middle Eastern or Arab American	0 (0.00%)	0 (0.00%)	1 (0.22%)	11 (0.70%)
Native American or Alaska Native	0 (0.00%)	1 (0.41%)	1 (0.22%)	3 (0.19%)
Native Hawaiian or Pacific Islander	1 (0.46%)	0 (0.00%)	0 (0.00%)	2 (0.13%)
South Asian	0 (0.00%)	2 (0.81%)	7 (1.53%)	52 (3.30%)
White, Caucasian (included in 1a, 1b), or European American (included in 1c, 2)	175 (81.02%)	180 (73.17%)	333 (72.71%)	1068 (67.85%)
Other race/ethnicity [a]	1 (0.46%)	1 (0.41%)	5 (1.09%)	7 (0.44%)
Multiracial/ethnic	16 (7.41%)	19 (7.72%)	27 (5.90%)	105 (6.67%)
Sexual orientation				
Straight / heterosexual	186 (86.11%)	178 (72.36%)	326 (71.18%)	1211 (76.94%)
Gay / lesbian / homosexual	4 (1.85%)	12 (4.88%)	19 (4.15%)	73 (4.64%)
Bisexual	22 (10.19%)	49 (19.92%)	94 (20.52%)	234 (14.87%)
Unsure	2 (0.93%)	2 (0.81%)	8 (1.75%)	24 (1.52%)
Other sexual orientation [b]	2 (0.93%)	5 (2.03%)	11 (2.40%)	32 (2.03%)
Age [M (SD)]	37.13 (11.96)	33.37 (11.16)	33.43 (11.70)	31.08 (11.00)

[a] For a breakdown of participants whose race/ethnicity did not fall into one of the above categories, see Supplementary Materials.
[b] For a breakdown of participants whose sexual orientation did not fall into one of the above categories, see Supplementary Materials.

[4] This power analysis was based on an effect size obtained through a preliminary analysis of Study 1a data, which focused on four of the six items in the state anxiety measure and which was completed before the data were fully cleaned ($f = 0.28$), rather than final analyses ($f = 0.21$).

[5] In all studies, participants were asked to report the sex they were assigned at birth, on their original birth certificate, and their gender identity. All transgender, nonbinary, agender, and gender diverse individuals who enrolled in these studies ($n = 24$ across studies) were excluded prior to participation but paid as though they had participated.

photograph.)[6] After uploading the photograph, they were told that their photograph was being analyzed by image analysis software, about which they were given information (see Supplementary Materials for study materials). Participants in all studies were told that the software uses a neural network to assess the masculinity/femininity of one's facial appearance, compared to the appearances of others in one's gender and age group. In Studies 1a and 1b, they were also told that the software assesses the attractiveness of one's facial appearance, also compared to the appearances of others in one's gender and age group.

In Study 1a, we provided participants with lists of the facial features that allegedly play the greatest role in determining the perceived masculinity/femininity of one's appearance. These features were taken from research on sex differences in facial appearances (Johnson et al., 2012; Rhodes, 2006). Participants were also provided with lists of the facial features that allegedly play the greatest role in determining the perceived attractiveness of one's appearance. These features were taken from research on physical attractiveness (Abu Arqoub & Al-Khateeb, 2011; Bashour, 2006; Fink, Neave, Manning, & Grammer, 2006; Johnston et al., 2005; Little, Jones, & Debruine, 2011; Trujillo, Jankowitsch, & Langlois, 2014). Because we aimed to tease apart the effects of femininity feedback and attractiveness feedback, we omitted physically feminine features from the list of physically attractive features and instead focused on features that are not overtly gendered.

In Study 1b, participants did not see any lists of features, and in Study 1c, they were randomly assigned to see or not see the list of features said to play the greatest role in determining the perceived masculinity/femininity of one's facial appearance.

In all three studies, participants were then presented with the "results" of the software's analysis of their photograph (see Supplementary Materials for study materials). They were randomly assigned to the physical femininity affirmation condition (in which they were told their appearance was "more feminine than 73% of females in [their] age group"[7]), the physical femininity threat condition (in which they were told their appearance was "less feminine than 73% of females in [their] age group"), or, in Studies 1a and 1b, the physical femininity control condition (in which they were told that an error had occurred and their physical femininity could not be analyzed). These results were modified from those used by Vandello et al. (2008).

In Studies 1a and 1b, participants were also randomly assigned to the physical attractiveness affirmation condition (in which they were told their appearance was "more attractive than 85% of females in [their] age group") or the physical attractiveness control condition (in which they were told that an error had occurred and their physical attractiveness could not be analyzed).

After reviewing their results, participants were instructed to complete measures of state anxiety (primary dependent variable in all three studies), state self-esteem (exploratory dependent variable in Studies 1b and 1c), and self-perceived attractiveness (manipulation check in Studies 1a and 1b and covariate in all three studies), as well as a manipulation check. Participants also completed other exploratory measures, which are described in the Supplementary Materials. Additionally, participants reported demographic information (see Table 1) and completed an attention check. All measures were completed after the manipulation.

In Study 1a, we asked participants whether they thought the results they had received were accurate and legitimate. Because we later realized that these were leading questions, we did not use responses to these questions as a basis for exclusion. In Studies 1b and 1c, we probed for participant suspicion using a series of questions that asked them to describe their thoughts, feelings, and/or reservations about the results they had received, as well as to report what they thought the study was testing and any additional comments they had. Responses to these questions were coded for suspicion by two coders using the following coding scheme: 0 = no indication of suspicion; 1 = participant suspects that the feedback might not have been produced by image analysis software and/or there is some indication that the participant is suspicious; 2 = participant seems certain that the feedback was not produced by image analysis software. A two-way random effects model indicated high inter-rater reliability (Study 1b intraclass correlation coefficient [*ICC*] = 0.87, 95% *CI* [0.84, 0.90]; Study 1c ICC = 0.85, 95% *CI* [0.82, 0.87]). Participants were excluded if both coders rated their suspicion level as 2.

Studies 1b and 1c also included a series of "beta testing" questions about the software, which were intended to bolster the credibility of the manipulation.

After completing the study, participants read a debriefing form and answered a series of questions to confirm that they had carefully read and understood the form. Finally, they completed a self-affirmation induction exercise (Cohen, Garcia, Apfel, & Master, 2006) to help them psychologically recover from potential threats to their positive sense of self.

2.1.3. Measures

Correlations among all measured variables are presented as Supplementary Materials.

State anxiety (Studies 1a-1c). Participants completed the 6-item short form version of the State-Trait Anxiety Inventory (Marteau & Bekker, 1992), in which they were asked to indicate, on a 4-point scale (1 = *Not at all*, 2 = *Somewhat*, 3 = *Moderately*, 4 = *Very much*), the extent to which each of six statements, including "I feel calm" (R) and "I am worried," represented how they felt at the moment. This scale demonstrated high internal reliability (Study 1a: $\alpha = 0.87$; Study 1b: $\alpha = 0.86$; Study 1c: $\alpha = 0.89$).

State self-esteem (Studies 1b and 1c). Participants rated their agreement with 10 statements taken and modified from the State Self-Esteem Scale (Heatherton & Polivy, 1991) on a scale of 1 (*Not at all*) to 5 (*Extremely*). Statements included "I feel confident" and "I am worried about how I am regarded" (R). This scale demonstrated high internal reliability (Study 1b: $\alpha = 0.94$; Study 1c: $\alpha = 0.94$). State self-esteem was highly correlated with state anxiety in Study 1b, $r(244) = -0.59$, $p < .001$, and 1c, $r(456) = -0.65$, $p < .001$.

Self-perceived physical attractiveness (Studies 1a-1c). Self-perceived physical attractiveness was measured using a single-item, 7-point measure. Participants rated their physical attractiveness on a scale ranging from "*I am not very physically attractive" to "I am very physically attractive*" (Wade, 2000).[8] We also measured self-perceived sexual attractiveness and attractiveness of personality for exploratory purposes (see Supplementary Materials).

Self-perceived physical femininity (Studies 1a-1c). We assessed the effectiveness of the physical femininity manipulation by asking participants to rate the femininity of their physical appearance, compared to the average female in their age group, on a 7-point scale ranging from "*Much less feminine*" to "*Much more feminine*."

[6] Three, 21, and nine participants in Studies 1a, 1b, and 1c, respectively, spontaneously reported a potential issue with their photograph or the photo uploading process (e.g., they had uploaded a rotated photograph or their photograph was rotated after they uploaded it). We re-ran our primary analyses with these participants excluded, and the results did not change.

[7] We used the terms "female" (and "male," in Study 2) rather than "woman" (and "man") in our study materials to be inclusive of both participants who identified as "women" (and "men") and those who identified as "girls" (and "boys" or "guys") (Chrisler, 2013).

[8] In Study 1a, participants also completed the Self-Perceived Sexual Attractiveness scale (SPSA; Amos & McCabe, 2015). This measure was included solely for use in an undergraduate senior thesis and therefore was not analyzed for the current manuscript.

2.2. Results

2.2.1. Manipulation check: Self-perceived physical femininity

As intended, there was a main effect of physical femininity feedback on self-perceived physical femininity in all three studies, such that participants in the threat condition perceived themselves as less physically feminine than participants in the affirmation condition. In Studies 1a and 1b, which included a control condition, self-perceived physical femininity among participants in the control condition fell between—and differed from—self-perceived physical femininity in the two experimental conditions (affirmation and threat). There was no effect of physical attractiveness feedback on self-perceived physical femininity in either of the studies in which this feedback was given (Studies 1a and 1b). (Detailed results are included as Supplementary Materials.)

2.2.2. Manipulation check: Self-perceived physical attractiveness

Unexpectedly, there were no significant effects of physical attractiveness feedback on self-perceived physical attractiveness in either of the studies in which this feedback was given (Studies 1a or 1b), though in Study 1a, the results were trending in the expected direction, with participants in the affirmation condition perceiving themselves as somewhat more physically attractive than participants in the control condition. There were also no effects of physical femininity feedback on self-perceived physical attractiveness in Studies 1a, 1b, or 1c. (Detailed results are included as Supplementary Materials.)

Self-perceived physical femininity and self-perceived physical attractiveness were moderately to highly correlated, $r(214) = 0.33$, $p < .001$ (Study 1a), $r(244) = 0.42$, $p < .001$ (Study 1b), $r(456) = 0.34$, $p < .001$ (Study 1c).

2.2.3. Primary analyses: State anxiety

We ran a series of between-subjects analyses of variance (ANOVAs) with physical femininity feedback as an independent variable for all three studies, physical attractiveness feedback as an independent variable for the studies in which this feedback was given (Studies 1a and 1b), lists of physical features as an independent variable for the study in which this was manipulated (Study 1c), and state anxiety as the dependent variable for all three studies.

As predicted, there was a medium-size effect of physical femininity feedback on state anxiety in Study 1a, $F(2,210) = 4.68$, $p = .010$, $f = 0.21$, and Study 1c, $F(1, 454) = 20.52$, $p < .001$, $f = 0.21$, such that participants in the threat condition (Study 1a: $M = 1.91$, $SD = 0.67$; Study 1c: $M = 2.06$, $SD = 0.72$) reported higher levels of state anxiety than participants in the affirmation condition (1a: $M = 1.60$, $SD = 0.61$; Tukey's HSD $p = .006$; 1c: $M = 1.77$, $SD = 0.67$) (see Table 2 for means from all studies; see Fig. 1 for a visual representation of state anxiety in the physical femininity threat and affirmation conditions in all studies). In Study 1a, there was no difference in levels of state anxiety between participants in the threat condition and those in the control condition ($M = 1.71$, $SD = 0.59$; Tukey's HSD $p = .181$) nor between participants in the control condition and those in the affirmation condition (Tukey's HSD $p = .595$). In contrast, in Study 1b, there was no main effect of physical femininity feedback on state anxiety, $F(2, 240) = 0.34$, $p = .715$, $f = 0.05$. For more conservative tests of our hypothesis, we re-ran all three primary analyses as analyses of covariance (ANCOVAs) with self-perceived physical attractiveness included as a covariate (see Supplementary Materials). This did not meaningfully change the results.[9]

In Study 1a, there was no effect of physical attractiveness feedback on state anxiety, $F(1,210) = 2.67$, $p = .104$, $f = 0.11$, nor an interactive effect of physical femininity feedback and physical attractiveness feedback on state anxiety, $F(2, 210) = 0.09$, $p = .915$, $f = 0.03$. Because we sought to determine whether physical femininity threats produced anxiety even in the presence of affirmations of physical attractiveness, we broke down the data by physical attractiveness feedback condition. We found that participants whose physical femininity was threatened reported significantly higher levels of state anxiety than those whose physical femininity was affirmed within both the physical attractiveness control condition ($M = 1.98$, $SD = 0.73$ vs. $M = 1.65$, $SD = 0.70$; $t(79) = -2.03$, $p = .046$, $d = 0.45$) and the physical attractiveness affirmation condition ($M = 1.83$, $SD = 0.58$ vs. $M = 1.56$, $SD = 0.54$; $t(81) = -2.20$, $p = .030$, $d = 0.49$).

In Study 1b, in contrast, there was a main effect of physical attractiveness feedback on state anxiety, $F(1, 240) = 8.32$, $p = .004$, $f = 0.18$, such that participants in the attractiveness control condition ($M = 2.00$, $SD = 0.63$) reported higher levels of state anxiety than participants in the attractiveness affirmation condition ($M = 1.75$, $SD = 0.60$). We again broke down the data by physical attractiveness feedback condition and found no effect of physical femininity feedback among participants in the physical attractiveness control condition, $F(2,130) = 1.07$, $p = .347$, $f = 0.13$, or participants in the physical attractiveness affirmation condition, $F(2,110) = 0.52$, $p = .594$, $f = 0.10$. There was no interactive effect of physical femininity feedback and physical attractiveness feedback on state anxiety, $F(2, 240) = 1.29$, $p = .276$, $f = 0.10$.

In Study 1c, in which no physical attractiveness feedback was given, there was no main effect of listing physical features that supposedly determine whether someone's facial appearance is feminine or masculine on state anxiety, $F(1, 454) = 2.55$, $p = .111$, $f = 0.07$. There was also no interactive effect of physical femininity feedback and listing physical features on state anxiety, $F(1, 454) = 0.24$, $p = .622$, $f = 0.02$. Physical femininity feedback had a significant effect on state anxiety when the lists of physical features were present, $F(1, 224) = 7.41$, $p = .007$, $f = 0.18$, and absent, $F(1,230) = 13.93$, $p < .001$, $f = 0.25$.

2.2.4. Exploratory analyses: State self-esteem

We ran 2 × 2 ANOVAs for the studies in which state self-esteem was measured (Studies 1b and 1c) with physical femininity feedback as an independent variable and state self-esteem as the dependent variable in both. For Study 1b, physical attractiveness feedback was the other independent variable, and for Study 1c, lists of physical features was the other independent variable.

In Study 1b, there was no main effect of physical femininity feedback, $F(2, 240) = 0.16$, $p = .849$, $f = 0.04$, on state self-esteem (see Table 3 for means; see Fig. 2 for a visual representation of state self-esteem in the physical femininity threat and affirmation conditions in all studies). There was also no main effect of physical attractiveness feedback, $F(1, 240) = 3.13$, $p = .078$, $f = 0.11$, nor an interaction between physical femininity feedback and physical attractiveness

Table 2
Effects of Feedback about Physical Appearance on State Anxiety.

	Threat	Affirmation	Control
	M (SD)	M (SD)	M (SD)
Study 1a			
Women	1.91 (0.67)[a]	1.60 (0.61)[b]	1.71 (0.59)[ab]
Study 1b			
Women	1.87 (0.64)[a]	1.86 (0.62)[a]	1.94 (0.65)[a]
Study 1c			
Women	2.06 (0.72)	1.77 (0.67)	–
Study 2			
Women	2.15 (0.67)	1.83 (0.64)	–
Men	1.89 (0.62)	1.67 (0.60)	–

Note. Means on the same row that share a superscript (e.g., [a]) are not significantly different from one another.

[9] Because the modal state anxiety score in Studies 1a-c was 1, indicating no anxiety, and the distributions of state anxiety were positively-skewed, we also transformed state anxiety into a binary variable with 1 = anxiety present and 0 = anxiety absent and ran binary logistic regressions (pre-registered for Studies 1b and 1c) to determine whether physical femininity feedback had an effect on whether participants reported any state anxiety. See Supplementary Materials.

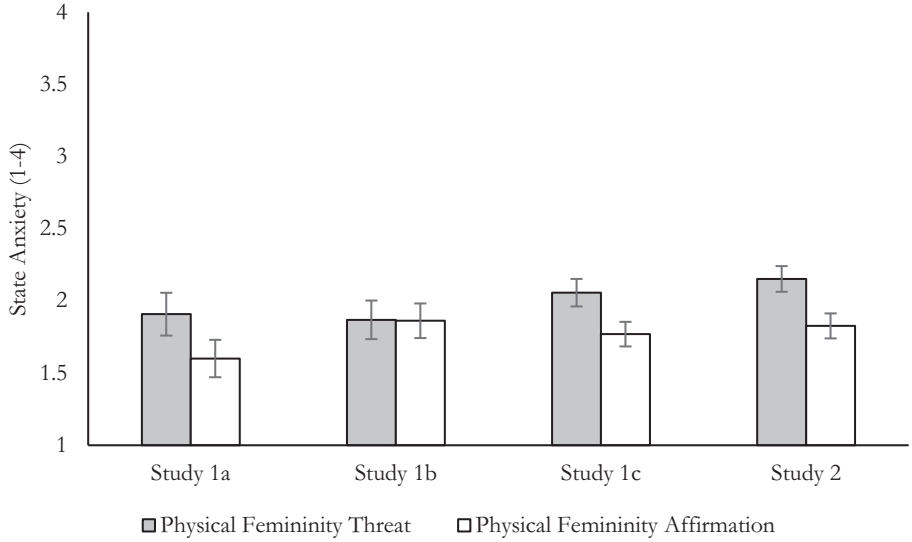

Fig. 1. Mean state anxiety scores for women whose physical femininity was threatened and affirmed. Error bars represent 95% confidence intervals.

Table 3
Effects of Feedback about Physical Appearance on State Self-Esteem.

	Threat	Affirmation	Control
	M (SD)	M (SD)	M (SD)
Study 1a			
Women	–	–	–
Study 1b			
Women	3.48 (0.99)[a]	3.51 (0.89)[a]	3.41 (1.03)[a]
Study 1c			
Women	3.26 (1.01)	3.61 (0.92)	–
Study 2			
Women	3.11 (0.99)	3.56 (0.92)	–
Men	3.58 (0.91)[a]	3.70 (0.93)[a]	–

Note. Means that share a superscript (e.g., [a]) are not significantly different from other means on the same row.

feedback, $F(2, 240) = 2.52$, $p = .083$, $f = 0.14$. We also re-ran this analysis as an ANCOVA, with self-perceived physical attractiveness included as a covariate (see Supplementary Materials). This did not meaningfully change the results. In Study 1c, in contrast with Study 1b, there was a main effect of physical femininity feedback on state self-esteem (see Table 3), $F(1, 454) = 14.91$, $p < .001$, $f = 0.18$, such that participants in the threat condition reported lower levels of state self-esteem ($M = 3.26$, $SD = 1.01$) than participants in the affirmation condition ($M = 3.61$, $SD = 0.92$).

In Study 1c, there was no main effect of listing physical features on state self-esteem, $F(1, 454) = 0.35$, $p = .552$, $f = 0.03$, nor an interaction between physical femininity feedback and listing physical features, $F(1, 454) = 0.18$, $p = .669$, $f = 0.02$. For a more conservative analysis, we re-ran this analysis as an ANCOVA, with self-perceived physical attractiveness included as a covariate (see Supplementary Materials). Again, this did not meaningfully change the results.

3. Studies 1a, 1b, & 1c discussion

In two of three studies, we found evidence that cisgender women experience more anxiety in response to threats to their physical femininity than affirmations of their physical femininity and that the effect of physical femininity feedback on anxiety cannot be explained by an assumption that a threat to one's physical femininity constitutes a threat to one's physical attractiveness.

In Study 1a, in which participants were given lists of physical

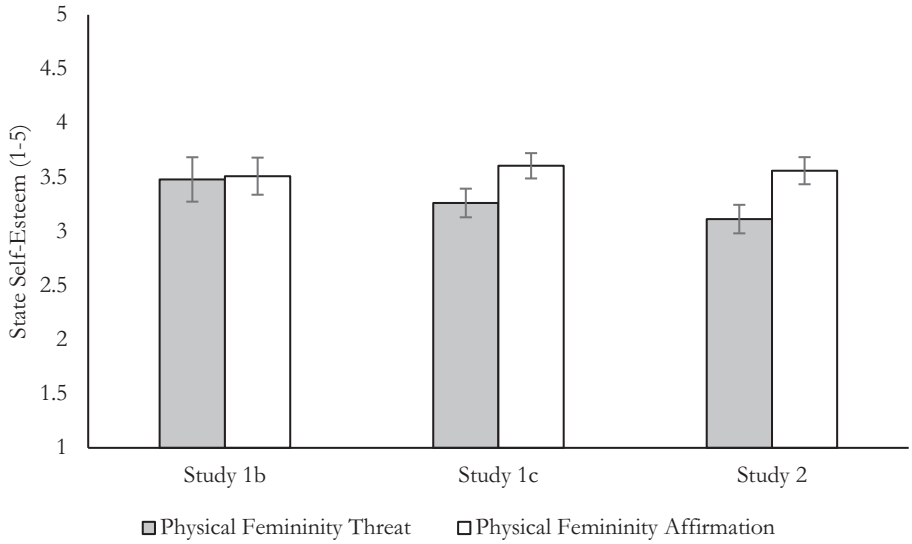

Fig. 2. Mean state self-esteem scores for women whose physical femininity was threatened and affirmed. Error bars represent 95% confidence intervals.

features upon which assessments of physical femininity were said to be based, women whose physical femininity was threatened reported higher levels of state anxiety than women whose physical femininity was affirmed. This effect held even when participants were told they were highly physically attractive and even when controlling for self-perceived physical attractiveness. Levels of state anxiety among women who received no feedback on their femininity fell between (but did not significantly differ from) levels of state anxiety among women in the two experimental conditions, suggesting that the effect of physical femininity feedback may have been driven by *both* women whose physical femininity was threatened *and* women whose physical femininity was affirmed. In other words, affirming feedback and threatening feedback seemed to move women's levels of state anxiety in opposite directions.

In Study 1b, in which participants were not given lists of physical features upon which assessments of physical femininity were said to be based, women whose physical femininity was threatened *did not* experience higher levels of state anxiety than those whose physical femininity was affirmed. Furthermore, physical femininity feedback had no effect on state self-esteem.

Study 1c sought to reconcile the discrepant results of Studies 1a and 1b by examining whether physical femininity threats only produce anxiety when women are presented with lists of the facial features that supposedly play the greatest role in determining assessments of physical femininity and masculinity and that frame physical masculinity and femininity as opposites (i.e., as two ends of a single spectrum) and femininity as the absence of masculinity (as in Study 1a but not 1b). Contrary to our prediction, women whose physical femininity was threatened reported higher levels of state anxiety than those whose physical femininity was affirmed regardless of whether they saw these lists of physical features. As in Studies 1a and 1b, physical femininity feedback did not affect self-perceived physical attractiveness, and as in Study 1a, the effect of physical femininity feedback on state anxiety held even when controlling for self-perceived physical attractiveness. Additionally, in Study 1c, participants whose physical femininity was threatened reported lower levels of state self-esteem than those whose physical femininity was affirmed, even when controlling for self-perceived physical attractiveness, which was highly predictive of state self-esteem. Thus, this study provided further evidence that threats to physical femininity in particular—rather than implied threats to physical attractiveness—produce anxiety, as well as reduced self-esteem, in women.

4. Study 2

Studies 1a-c focused exclusively on women and their responses to threats to the femininity of their physical appearances. In Study 2, we expanded our focus to include both women *and* men and threats to both physical *and* psychological gender stereotypicality. In doing so, we sought to determine (i) whether, among women, increased anxiety and reduced self-esteem following gender stereotypicality threats are unique to the domain of physical appearance and (ii) whether increased anxiety and reduced self-esteem following physical gender stereotypicality threats are unique to women.

Past research has demonstrated that women do not experience anxiety in response to threats to their *psychological* femininity (Vandello et al., 2008; Vescio et al., 2021). However, this past work employed a slightly different paradigm than the one used here and was conducted with a different sample. Therefore, it was unclear whether within the same sample of women and with comparable paradigms we would observe that women indeed experience anxiety—and potentially reduced self-esteem—in response to threats to their *physical* but not their *psychological* femininity.

Furthermore, although studies have examined men's psychological and behavioral responses to threats to their *psychological* masculinity (e.g., Dahl, Vescio, & Weaver, 2015; Willer, Rogalin, Conlon, & Wojnowicz, 2013) and physical strength (Cheryan, Cameron, Katagiri, & Monin, 2015), they have not, to our knowledge, examined men's responses to threats to the masculinity of their *physical appearance*. Thus, it is unclear whether men, like women, experience anxiety in response to feedback indicating that their physical appearance is less gender stereotypical than average. Is increased anxiety following physical gender stereotypicality threats, relative to affirmations, a phenomenon unique to women, whose physical appearances are frequently subjected to commentary and critique (Heith, 2003, p. 126), or is this a phenomenon experienced by women and men alike?

Some non-experimental evidence suggests that men may, indeed, experience such anxiety. For example, adolescent boys with high levels of babyfacedness (which largely overlaps with facial femininity; Dinnerstein & Weitz, 1994; Friedman & Zebrowitz, 1992) tend to be colder and more academically competent and to engage in more criminal behavior than peers with more mature (and thus masculine) facial appearances (Zebrowitz, Andreoletti, Collins, Lee, & Blumenthal, 1998; Zebrowitz, Collins, & Dutta, 1998). Behaving in a stereotypically masculine manner may be a strategy that babyfaced boys and men use to cope with the anxiety associated with appearing physically feminine. Additionally, when men's psychological masculinity is threatened, they have been shown to not only espouse stereotypically masculine attitudes and behave in a stereotypically masculine manner (Bosson & Vandello, 2011; Glick, Gangl, Gibb, Klumpner, & Weinberg, 2007; Willer et al., 2013) but also to overestimate their height (Cheryan et al., 2015). Further, the more anger men experience in response to psychological masculinity threats, the more masculine they present their faces as in a self-image task (Steiner et al., 2022). In other words, men seem to exaggerate their physical masculinity in response to psychological masculinity threats. Together, these findings suggest that men may, indeed, be concerned about appearing physically masculine and may therefore experience anxiety, just as women do, in response to threats to their gender stereotypicality within the domain of physical appearance.

However, psychological and behavioral masculinity may be more heavily prescribed for men than physical masculinity is. In a 2017 nationally representative survey of U.S. adults, participants were asked "what traits society values most in men and women" (Parker et al., 2017). In reference to women, the plurality of responses (35%) referred to physical appearance (and attractiveness in particular), whereas in reference to men, a plurality (33%) referred to honesty and morality—and only 11% referred to physical appearance. Furthermore, research on precarious manhood has suggested that whereas womanhood is a *physical* status, manhood is a *social* status that is only attained when men behave in a sufficiently masculine manner and take on sufficiently masculine roles—and that can be lost at any moment if men fail to live up to social expectations (Vandello & Bosson, 2013).

The primary goal of Study 2 was to compare cisgender women's and men's responses to threats to the gender stereotypicality of their physical appearances and personalities. We predicted that among women, those whose physical femininity was threatened would experience higher levels of state anxiety than those whose physical femininity was affirmed but that those whose psychological femininity was threatened would *not* experience higher levels of state anxiety than those whose psychological femininity was affirmed. We predicted that among men, those whose psychological masculinity was threatened would experience higher levels of state anxiety than those whose psychological masculinity was affirmed. We also predicted that among men, those whose physical masculinity was threatened would not experience higher levels of state anxiety than those whose physical masculinity was affirmed. This latter prediction was more tentative than the others, however, because, as described earlier, we also had reason to believe that men might, indeed, find threats to their physical masculinity anxiety-provoking.

A secondary goal of Study 2 was to explore a possible mediator of the predicted effects of femininity and masculinity threats on state anxiety (and potentially state self-esteem). Although across Studies 1a-c we found strong evidence that women experience anxiety in response to physical femininity threats, compared to affirmations, we did not

explore potential mechanisms underlying this observed effect, and to our knowledge, past research has not explored mechanisms underlying the relationship between masculinity threats and anxiety in men. To fully understand experiences with gender stereotypicality threats and eventually pave the way for interventions to mitigate the harmful consequences of these threats, it is important to determine *why* these threats produce anxiety and possibly reduced self-esteem.

Women and men may experience threats to their femininity and masculinity, respectively, as threats to their identity, and experiences with identity invalidation have been linked to increased stress and anxiety (Albuja, Gaither, Sanchez, Straka, & Cipollina, 2019; Murray, Neal-Barnett, Demmings, & Stadulis, 2012) and reduced self-esteem (Garr-Schultz & Gardner, 2019; Townsend et al., 2009). Thus, we explored felt identity invalidation as a potential mediator of the predicted relationship between gender stereotypicality threat and state anxiety and the possible relationship between gender stereotypicality threat and state self-esteem.

Mediation analysis cannot directly demonstrate that an effect of gender stereotypicality threat on identity invalidation *causes* increased anxiety or reduced self-esteem (MacKinnon, Fairchild, & Fritz, 2007). It can, however, provide preliminary evidence for felt identity invalidation as a mechanism underlying the potential effects of gender stereotypicality threat on both anxiety and self-esteem. Thus, it is an important starting point for investigations into the psychological mechanisms by which gender stereotypicality threats, relative to affirmations, produce negative psychological consequences.

4.1. Method

Hypotheses, methods, and analyses for this study were preregistered. All measures, manipulations, and exclusions are disclosed in the manuscript or Supplementary Materials.

4.1.1. Participants and design

This study utilized a 2 (participant gender: female, male) x 2 (domain: physical appearance, personality) x 2 (feedback: affirmation, threat) factorial design. Participants were randomly assigned to a domain and a feedback condition. Participants were recruited through Prolific and paid $2.28 for their participation.

We predicted a three-way interaction, such that cisgender women would experience anxiety in response to threats to the femininity of their physical appearance but not threats to the femininity of their personality, whereas cisgender men would experience anxiety in response to threats to the masculinity of their personality but not threats to the masculinity of their physical appearance. In Study 1c, women whose physical femininity was threatened experienced more anxiety than those whose physical femininity was affirmed. Therefore, to determine whether this effect would be eliminated when the domain switched from physical appearance to personality, we powered our study to detect an effect half the size of the main effect from Study 1c (Ledgerwood, 2019, 2020).[10] A power analysis using *G*Power* determined that a sample of $N = 938$ would be needed to detect this interaction with 80% power. We expected the opposite result for men—that those whose masculinity within the domain of personality was threatened would experience more anxiety than those whose masculinity within the domain of personality was affirmed but that this effect would be eliminated when the domain switched from personality to physical appearance. Thus we needed 938 men to detect this interaction with 80% power, for a total sample size of 1876. Based on Study 1c, we anticipated that approximately 16% of recruited participants would be ineligible, fail an attention check, and/or not upload a valid video. Therefore, we attempted to enroll 2234 participants.

After excluding responses from participants who had already participated, as well as participants who were not cisgender women or men, dropped out before being assigned to a condition, did not upload valid videos, failed the attention check (which required that they accurately recall whether they received feedback on their physical appearance or their personality and whether that feedback indicated that they were more, less, or as feminine [or masculine] as the average person in their gender and age group), and/or clearly believed that the feedback they received was not produced by video analysis software, as determined by pre-registered criteria, we were left with a sample size of 1574 (see Table 1 for participant demographics). The number of exclusions was high but not unreasonably so given that this was an online study in which participants were asked to use an embedded video recorder on their computer. Sensitivity power analyses (G*Power 3.1; Faul et al., 2007) indicated that we were powered to detect two two-way interactions (in women and men) with effect sizes of $f = 0.10$ (with 80% power and $\alpha = 0.05$).

4.1.2. Procedure

The procedure was similar to that of Study 1c, with a few changes, all of which are noted here. In this study, participants were instructed to record videos, rather than upload photographs, of themselves. Videos were recorded using an embedded recorder from addpipe.com.

Additionally, because this study sought to compare responses to feedback about one's gender stereotypicality in two distinct domains, participants were told that the software uses a neural network to assess the femininity/masculinity of either one's facial appearance, in the physical appearance condition, or one's personality, in the personality condition, compared to others in one's gender and age group. In the physical appearance condition, participants were told the software "broke down each recording into its visual components" and saw an outline of a face with boxes over different areas of the face (browbone, eyes, cheeks, mouth, and jaw). In the personality condition, participants were told the software "broke down each recording into its verbal and vocal components" and saw an image of sound waves with boxes over different sections of waves. Participants in this study did not see any lists of characteristics that supposedly determine masculinity/femininity.

Finally, Study 2 included items assessing felt identity invalidation, described in the Measures section, and gender identity (see Supplementary Materials). These items were administered following the measures of state anxiety and state self-esteem.

We probed for participant suspicion using the same criteria used in Studies 1b and 1c, which were pre-registered for this study. These responses were coded for suspicion by three coders. One coder coded responses from all participants; the other two coders coded responses from half of the participants. Two-way random effects models indicated acceptable inter-rater reliability ($ICC_1 = 0.78$, 95% *CI* [0.75, 0.81]; $ICC_2 = 0.79$, 95% *CI* [0.77, 0.82]). As in Studies 1b and 1c, participants were excluded if both coders rated their suspicion level as 2.

4.1.3. Measures

For correlations among all measured variables, see Supplementary Materials.

State anxiety. As in Studies 1a-c, participants completed the 6-item short form version of the State-Trait Anxiety Inventory (Marteau & Bekker, 1992). The scale demonstrated high internal reliability ($\alpha = 0.86$).

State self-esteem. As in Studies 1b and 1c, participants rated their agreement with 11 items taken and modified from the State Self-Esteem Scale (Heatherton & Polivy, 1991). This scale demonstrated high internal reliability ($\alpha = 0.94$). State self-esteem was highly correlated with state anxiety, $r(1571) = -0.67$, $p < .001$.

Felt identity invalidation. We use the term "felt identity invalidation" to refer to the sense that one's internal sense of self or membership in a

[10] This power analysis was based on an effect size obtained through a preliminary analysis of Study 1c data, which focused on four of the six items in the state anxiety measure and which was completed before the data were fully cleaned ($f = 0.18$), rather than final analyses ($f = 0.21$).

group of which one considers oneself a part is denied or not recognized by others (Cheryan & Monin, 2005). Participants rated their agreement with 13 statements on a scale of 1 (*strongly disagree*) to 7 (*strongly agree*). A factor analysis using principal axis factoring with oblimin rotation indicated that all of the reverse-scored items that asked about gender identity invalidation loaded onto the first factor, all of the regularly-scored items that asked about gender identity invalidation loaded onto the second factor, and all of the items that asked about global identity invalidation loaded onto the third factor. An item about results-identity discrepancy did not load onto any of these three factors. We did not, however, interpret the first two factors as necessarily conceptually distinct; rather, it seemed possible that the distinction between the reverse-scored and regularly-scored gender identity invalidation items was a result of shared method variance within each of these clusters of items. The correlation matrix revealed that correlations between the reverse-scored and regularly-scored gender identity invalidation items ranged from 0.34 to 0.50. We thus deemed them sufficiently correlated to include together in a single scale, which left the felt *global* identity invalidation items and the results-identity discrepancy item to be measured separately. We describe these three groups of identity invalidation items below.

Felt gender identity invalidation. Participants rated their agreement with three sets of three statements: "I feel validated as a female [male]" (R) (also "as feminine [masculine]" and "as a woman [man]"); "I feel that my identity as a female [male] is recognized by others" (R) (also "my identity as feminine [masculine]" and "my identity as a woman [man]"); "I am concerned that others do not recognize my 'femaleness' ['maleness']" (also "my femininity [masculinity]" and "my womanhood [manhood]"). These nine items demonstrated high internal reliability ($\alpha = 0.91$).

Felt global identity invalidation. Participants rated their agreement with the following statements: "I feel that my identity is recognized by others" (R); "I do not feel that other people see me for who I really am;" "Other people's sense of who I am aligns with who I feel I am" (R). These items demonstrated acceptable internal reliability ($\alpha = 0.75$).

Results-identity discrepancy. Participants rated their agreement with the statement "I feel like the results I received are consistent with my beliefs about who I really am" (R) (adapted from Bosson, Weaver, & Prewitt-Freilino', 2012 measure of threats to belonging and coherence).

Self-perceived femininity/masculinity. We assessed the effectiveness of the manipulations by asking participants to rate the femininity (for women) or masculinity (for men) of their physical appearance and personality, compared to the average person in their gender and age group, on 7-point scales ranging from "*Much less feminine [masculine]*" to "*Much more feminine [masculine]*."

4.2. Results

For clarity of presentation, we report only those results that are most relevant to the aims of this study. For example, when main effects are qualified by two-way interactions and two-way interactions are qualified by three-way interactions, only the highest-order interactions are reported. Additional results can be found in the Supplementary Materials.

4.2.1. Manipulation checks

As intended, there was an effect of feedback on self-perceived gender stereotypicality (femininity or masculinity) within the relevant domain (physical appearance for those who received feedback on their physical appearance and personality for those who received feedback on their personality), such that participants in the affirmation condition reported higher levels of gender stereotypicality than participants in the threat condition. (Detailed results are included as Supplementary Materials.)

4.2.2. Primary analyses: State anxiety

We conducted a 2 × 2 × 2 ANOVA with participant gender, domain, and feedback as the independent variables and state anxiety as the dependent variable. Although this ANOVA did not reveal a significant participant gender x domain x feedback interaction, $F(1, 1566) = 1.87$, $p = .171$, $f = 0.03$, we broke down our sample by participant gender, as preregistered, because our sample was powered to detect two two-way interactions (one within women and one within men), rather than a three-way interaction. (Indeed, a sensitivity power analysis [G*Power 3.1; Faul et al., 2007] indicated that we were only powered to detect a three-way interaction with an effect size of $f = 0.07$ with 80% power and $\alpha = 0.05$).

Among men, there was no domain x feedback interaction, $F(1, 748) = 1.14$, $p = .286$, $f = 0.04$—only a main effect of feedback, $F(1, 748) = 14.04$, $p < .001$, $f = 0.14$, such that those whose masculinity was threatened reported higher levels of anxiety ($M = 1.87$, $SD = 0.62$) than those whose masculinity was affirmed ($M = 1.70$, $SD = 0.62$). Surprisingly and contrary to our prediction, further pre-registered analyses revealed that the effect of feedback on anxiety was only significant for participants who received feedback on the masculinity of their appearance, $F(1, 389) = 12.69$, $p < .001$, $f = 0.18$ (see Table 2 for means), though the effect for feedback on the masculinity of their personality was in the predicted direction, albeit not statistically significant, $F(1, 359) = 3.28$, $p = .071$, $f = 0.10$.

Among women, we observed the predicted domain x feedback interaction, $F(1, 818) = 8.96$, $p = .003$, $f = 0.10$. Within the domain of physical appearance, participants whose femininity was threatened reported levels of anxiety higher ($M = 2.15$, $SD = 0.67$) than those of participants whose femininity was affirmed ($M = 1.83$, $SD = 0.64$), $F(1, 425) = 26.30$, $p < .001$, $f = 0.25$ (see Table 2). Within the domain of personality, there was no effect of feedback, $F(1, 393) = 0.58$, $p = .446$, $f = 0.04$. Within this domain, participants whose femininity was threatened reported levels of anxiety comparable ($M = 1.88$, $SD = 0.68$) to those of participants whose femininity was affirmed ($M = 1.83$, $SD = 0.64$).[11] Results for anxiety are depicted in Fig. 3.

For more conservative tests of our hypotheses, we re-ran these ana-

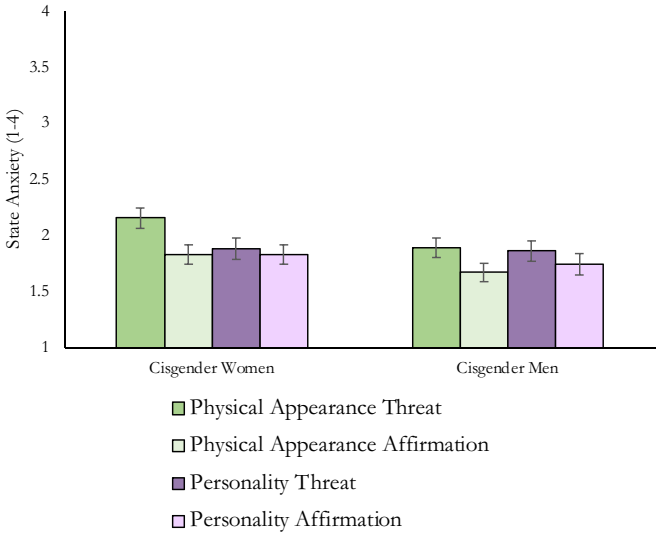

Fig. 3. Mean state anxiety scores for women and men whose femininity/masculinity was threatened or affirmed. Error bars represent 95% confidence intervals.

[11] As preregistered, we also ran two binary logistic regressions, one for women and one for men, to examine whether domain, feedback, and/or the interaction between these variables influenced the likelihood that participants would report any state anxiety. See Supplementary Materials.

lyses as analyses of covariance (ANCOVAs) with self-perceived physical attractiveness included as a covariate (see Supplementary Materials). This did not meaningfully change the results.

4.2.3. Exploratory analyses: State self-esteem

We conducted another 2 × 2 × 2 ANOVA to examine the effects of participant gender, domain, feedback, and the interactions among these variables on state self-esteem. This ANOVA revealed a three-way interaction, $F(1, 1565) = 5.87$, $p = .016$, $f = 0.06$. There was a significant domain x feedback interaction among female, $F(1, 818) = 14.66$, $p < .001$, $f = 0.13$, but not male, $F(1, 747) = 0.13$, $p = .716$, $f = 0.01$, participants. There was also no main effect of feedback among men, $F(1, 747) = 2.05$, $p = .153$, $f = 0.05$. Women whose physical femininity was threatened reported lower levels of state self-esteem ($M = 3.11$, $SD = 0.99$) than women whose physical femininity was affirmed ($M = 3.56$, $SD = 0.92$), $F(1, 425) = 23.15$, $p < .001$, $f = 0.23$. However, there was no effect of feedback (threat vs. affirmation) on self-esteem among women who received feedback on the femininity of their personality, $F(1, 393) = 0.41$, $p = .525$, $f = 0.03$. Means for self-esteem among participants who received feedback on their physical appearance are presented in Table 3. Results for self-esteem are depicted in Fig. 4.

For more conservative tests, we again re-ran these analyses as ANCOVAs with self-perceived physical attractiveness included as a covariate (see Supplementary Materials).

4.2.4. Exploratory analyses: Felt identity invalidation

We began by looking at the effects of participant gender, domain, and feedback on different aspects of felt identity invalidation (a potential mediator).

Felt gender identity invalidation. We conducted a 2 × 2 × 2 ANOVA to examine the potential effects of participant gender, domain, and feedback—and the interactions among these variables—on felt gender identity invalidation. The ANOVA revealed a main effect of feedback, $F(1, 1565) = 26.05$, $p < .001$, $f = 0.13$, such that those whose gender

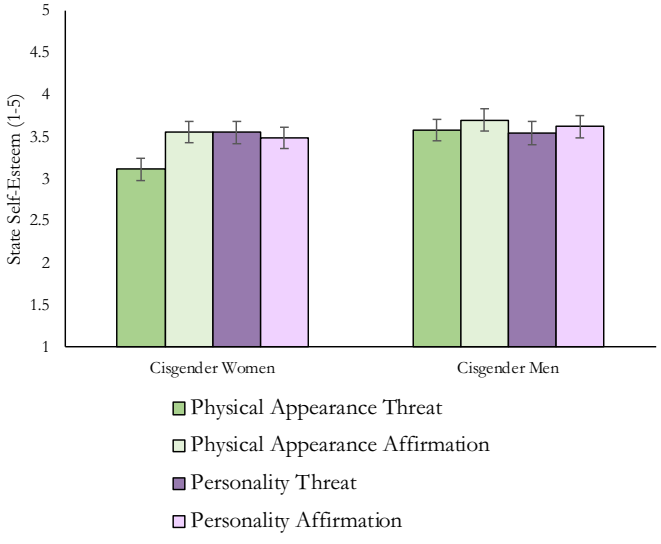

Fig. 4. Mean state self-esteem scores for women and men whose femininity/masculinity was threatened or affirmed. Error bars represent 95% confidence intervals.

stereotypicality was threatened reported higher levels of felt gender identity invalidation ($M = 2.47$, $SD = 1.24$) than those whose gender stereotypicality was affirmed ($M = 2.17$, $SD = 1.02$).

There was no participant gender x domain x feedback interaction, $F(1, 1565) = 0.07$, $p = .795$, $f = 0.01$—and no domain x feedback interaction among women or men ($ps > 0.35$).

All other results for felt gender identity invalidation are presented as Supplementary Materials.

Felt global identity invalidation. We also conducted a 2 × 2 × 2 ANOVA to examine the potential effects of participant gender, domain, and feedback—and the interactions among these variables—on felt global identity invalidation. This ANOVA revealed no significant effects ($ps > 0.08$). We broke the sample down by gender and found no evidence for domain x feedback interactions among women or men ($ps > 0.75$).

Results-identity discrepancy. We conducted another 2 x 2 x 2 ANOVA to examine the potential effects of participant gender, domain, and feedback—and the interactions among these variables—on participants' sense that the feedback they received was inconsistent their beliefs about who they really are. The ANOVA revealed a three-way participant gender x domain x feedback interaction, $F(1, 1566) = 9.99$, $p = .002$, $f = 0.07$.

A two-way ANOVA revealed a domain x feedback interaction among men, $F(1, 748) = 11.31$, $p < .001$, $f = 0.11$. Among men who received feedback on their personality, there was an effect of feedback, $F(1, 359) = 43.73$, $p < .001$, $f = 0.35$, such that those whose gender stereotypicality was threatened felt a greater discrepancy between their results and identity ($M = 3.97$, $SD = 1.82$) than those whose gender stereotypicality was affirmed ($M = 2.78$, $SD = 1.59$). There was an even stronger effect of feedback among men who received feedback on their appearance, $F(1, 389) = 157.90$, $p < .001$, $f = 0.64$, such that again, those whose gender stereotypicality was threatened felt a greater discrepancy between their results and identity ($M = 4.43$, $SD = 1.72$) than those whose gender stereotypicality was affirmed ($M = 2.44$, $SD = 1.40$).

Another two-way ANOVA revealed an even stronger domain x feedback interaction among women, $F(1, 818) = 68.77$, $p < .001$, $f = 0.25$. Among women who received feedback on their personality, there was an effect of feedback, $F(1, 393) = 24.09$, $p < .001$, $f = 0.25$, such that those whose gender stereotypicality was threatened felt a greater discrepancy between their results and identity ($M = 3.51$, $SD = 1.83$) than those whose gender stereotypicality was affirmed ($M = 2.66$, $SD = 1.62$). There was an even stronger effect of feedback among women who received feedback on their appearance, $F(1, 425) = 373.44$, $p < .001$, $f = 0.94$, such that those whose gender stereotypicality was threatened felt a greater discrepancy between their results and identity ($M = 4.84$, $SD = 1.59$) than those whose gender stereotypicality was affirmed ($M = 2.15$, $SD = 1.25$).

All other results for felt results-identity discrepancy are presented as Supplementary Materials.

4.2.5. Exploratory analyses: Mediation

Of the potential mediators, the one with a pattern of results most similar to that of state anxiety (and self-esteem, in women) was results-identity discrepancy. Therefore, we ran a series of analyses using the PROCESS Macro for SPSS (Hayes, 2013a, 2013b) to determine whether results-identity discrepancy mediated (i.e., helped to statistically explain) the interactive effects of domain and feedback on both state anxiety and state self-esteem in women and the main effect of feedback on state anxiety in men. We used bootstrapping with 5000 samples to estimate bias corrected confidence intervals for the indirect effects. We did not conduct mediation analyses with felt gender identity invalidation or felt global identity invalidation as mediators given that there were no interactive effects of domain and feedback on either of these variables.

We began by looking at women and tested a moderated mediation model (Model 7) with feedback (threat = 1, affirmation = 0) as the predictor variable, state anxiety as the outcome variable, results-identity discrepancy as the mediator, and domain (appearance = 1, personality = 0) as a moderator of the effect of feedback on results-identity discrepancy. As shown in Fig. 5, we observed indirect effects of feedback on anxiety through results-identity discrepancy among both participants who received feedback on their appearance and participants

who received feedback on their personality, but this indirect effect was stronger for those in the appearance condition ($b = 0.27$, 95% *CI* [0.19, 0.35]) than those in the personality condition ($b = 0.08$, 95% *CI* [0.05, 0.13]), supporting moderated mediation (index = 0.18; 95% *CI* [0.12, 0.25]). Within the domain of physical appearance, switching from affirming to threatening feedback resulted in a 0.27-point increase in anxiety on a 4-point scale mediated by results-identity discrepancy. Within the domain of personality, switching from affirming to threatening feedback resulted in a 0.08-point increase in anxiety on a 4-point scale mediated by results-identity discrepancy. There was no direct effect of feedback on state anxiety ($b = 0.02$, 95% *CI* [−0.08, 0.12]), indicating that results-identity discrepancy largely accounted for the observed effect of feedback on anxiety.

We then conducted these analyses with state self-esteem as the outcome variable. As shown in Fig. 6, we observed indirect effects of feedback on self-esteem through results-identity discrepancy among both participants who received feedback on their appearance and participants who received feedback on their personality, but this indirect effect was stronger for those in the appearance condition ($b = -0.38$, 95% *CI* [−0.50, −0.27]) than those in the personality condition ($b = -0.12$, 95% *CI* = −0.18, −0.07), again supporting moderated mediation (index = −0.26; 95% *CI* [−0.37, −0.17]). Within the domain of physical appearance, switching from affirming feedback to threatening feedback resulted in a 0.38-point reduction in self-esteem on a 5-point scale mediated by results-identity discrepancy. Within the domain of personality, switching from affirming feedback to threatening feedback resulted in a 0.12-point reduction in self-esteem on a 5-point scale, mediated by results-identity discrepancy. As with state anxiety, there was no direct effect of feedback on state self-esteem ($b = 0.05$, 95% *CI* [−0.09, 0.20]), indicating that results-identity discrepancy largely accounted for the observed effect of feedback on self-esteem.

We next turned to men. Because men showed a main effect of feedback on state anxiety but no moderation of this effect by domain, we tested a simple mediation model (Model 4) with feedback as the predictor variable, state anxiety as the outcome variable, and results-identity discrepancy as the mediator. As shown in Fig. 7, we observed an indirect effect of feedback on anxiety through results-identity discrepancy ($b = 0.10$, 95% *CI* [0.05, 0.15]), supporting mediation. Switching from affirming feedback to threatening feedback resulted in a 0.10-point increase in anxiety on a 4-point scale mediated by results-identity discrepancy. There was no direct effect of feedback on state anxiety ($b = 0.07$, 95% *CI* [−0.03, 0.17]), indicating that results-identity discrepancy largely accounted for the observed effect of feedback on self-esteem.

Because we had not observed an effect of feedback on state self-esteem among men, we did not further probe this relationship.

4.3. Discussion

Study 2 replicated and extended the results of Studies 1a and 1c by comparing cisgender women's and men's psychological responses to gender stereotypicality threats within the domains of physical appearance and personality. As predicted, women experienced greater state anxiety when the femininity of their physical appearance, but not their personality, was threatened than when it was affirmed. Contrary to our prediction that men would show the opposite pattern of results for state anxiety, we found that men experienced state anxiety in response to masculinity threats across domains. Surprisingly, when we broke down the results by domain (as pre-registered), we observed that the effect of feedback on anxiety was only truly significant among men who received feedback on their physical appearance (though it was also marginally significant among men who received feedback on their personality). This result should be interpreted with caution, however, as there was no interaction between feedback and domain among men—only a main effect of feedback.

Additionally, women experienced lower levels of state self-esteem when the femininity of their physical appearance, but not their personality, was threatened than when it was affirmed. Unlike women, men did not report different levels of state self-esteem when their masculinity was threatened versus when it was affirmed. Given that having high self-esteem is a gender-intensified prescriptive stereotype for men (Prentice & Carranza, 2002), it is possible that in the wake of masculinity threats, men asserted their self-esteem as a form of compensation—that is, a means of restoring their sense of masculinity after it had been threatened.

A secondary goal of Study 2 was to explore potential mediators of the effects of gender stereotypicality feedback on state anxiety and state self-esteem in women and state anxiety in men. We found that among both women and men, those whose gender stereotypicality was threatened reported a discrepancy between their results and their sense of self across domains, though this effect was stronger among those who had received feedback on their appearance than those who had received feedback on their personality. This difference between domains was particularly strong among women. Because this pattern of results mirrored that for state anxiety (and state self-esteem, in women), we tested results-identity discrepancy as a mediator of the relationships between feedback and both state anxiety and state self-esteem. We found preliminary evidence that among women, the effect of feedback on results-identity discrepancy, moderated by domain, mediated the effects of feedback on both state anxiety and state self-esteem. We also found preliminary evidence that among men, the effect of feedback on results-identity discrepancy mediated the effect of feedback on state anxiety. The results of these mediation analyses should be interpreted with caution, however, given that we did not use a validated measure to assess the discrepancy participants experienced between the feedback they received and their sense of self.

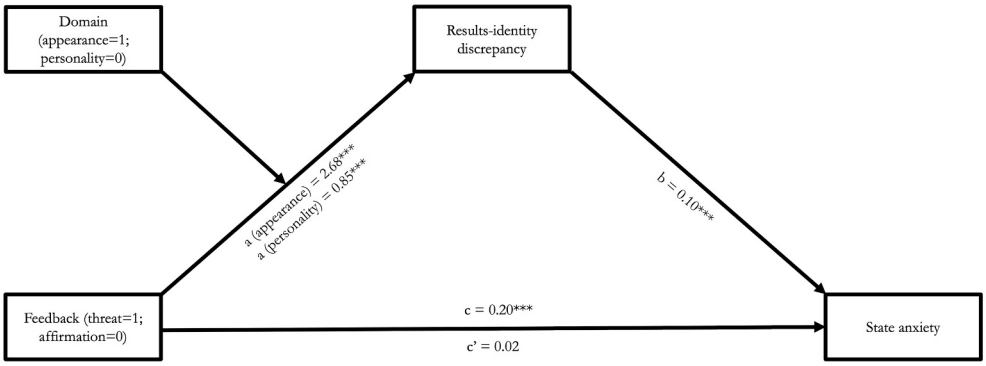

Fig. 5. Domain moderates the effect of condition on results-identity discrepancy, which mediates the effect of condition on state anxiety among women. ***$p < .001$.

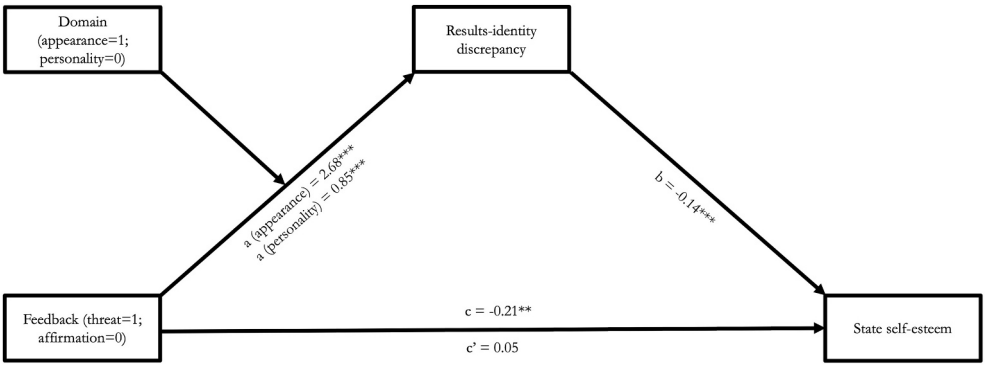

Fig. 6. Domain moderates the effect of condition on results-identity discrepancy, which mediates the effect of condition on state self-esteem among women. ***$p <$ .001 **$p <$ .01.

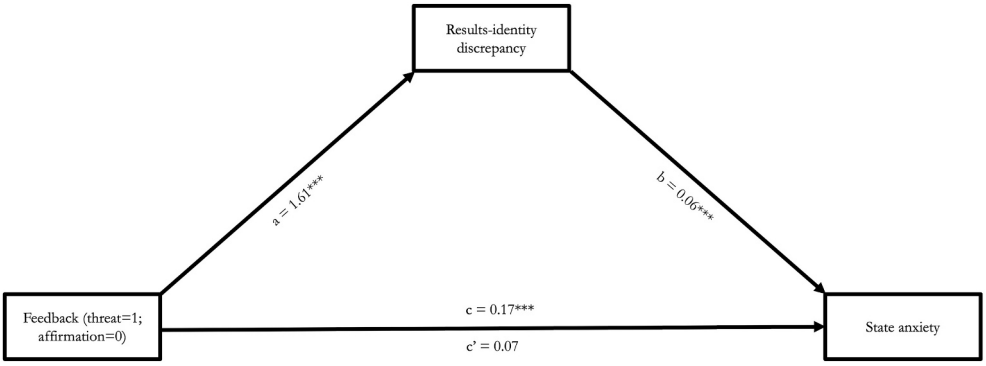

Fig. 7. Results-identity discrepancy mediates the effect of condition on state self-esteem among men. ***$p <$ .001.

The results of Study 2 demonstrate that both women and men experience anxiety in response to threats to the gender stereotypicality of their appearances. Furthermore, these results demonstrate that whereas for men, the effect of masculinity threat on anxiety extends across domains (both personality and physical appearance), for women, the effect of femininity threat on anxiety is limited to the domain of physical appearance. For both women and men, however, the effect of gender stereotypicality threat on anxiety is stronger within the domain of physical appearance than the domain of personality.

These results also demonstrate that threats to femininity of physical appearance, but not femininity of personality, produce reduced self-esteem in women. Threats to masculinity in either domain, however, do not produce reduced self-esteem (or at least self-reported self-esteem) in men, potentially because self-esteem is considered a masculine trait (Prentice & Carranza, 2002) and thus assertions of self-esteem may serve to restore men's sense of masculinity in the wake of such threats (Bosson, Vandello, Burnaford, Weaver, & Arzu Wasti, 2009).

Finally, the results of Study 2 provide preliminary evidence that a sense of identity invalidation—and specifically, the feeling that the feedback one received does not align with one's sense of self—may help to explain the negative psychological consequences (increased state anxiety and reduced state self-esteem) of gender stereotypicality threats.

5. Internal mini meta-analysis

Because we observed the predicted effect of physical femininity feedback on state anxiety among women in Studies 1a, 1c, and 2, but not Study 1b, we conducted an internal meta-analysis of all four studies to assess the robustness of this effect (Fabrigar & Wegener, 2016). We used the procedures outlined by Goh, Hall, and Rosenthal (2016) to calculate mean effect size (Cohen's *d*). For Studies 1a and 1b, we limited our analyses to participants in the physical femininity affirmation and threat conditions and collapsed across physical attractiveness feedback conditions. For Study 1c, we collapsed across lists of physical features (present and absent) conditions. As depicted in Fig. 8, across the four studies, we found a main effect of physical femininity feedback on state anxiety among women, $d = 0.39$, $Z = 6.74$, $p < .001$, 95% *CI* [0.27, 0.50], such that women whose physical femininity was threatened reported higher levels of state anxiety than women whose physical femininity was affirmed.

Because we also observed an effect of physical femininity feedback on state self-esteem among women in Studies 1c and 2, but not Study 1b, we conducted an internal meta-analysis to assess the robustness of this effect across the three studies in which state self-esteem was measured. As depicted in Fig. 9, across these three studies, we found a main effect of physical femininity on state self-esteem among women, $d = -0.34$, $Z = -5.55$, $p < .001$, 95% *CI* [−0.46, −0.22], such that women whose physical femininity was threatened reported lower levels of state self-esteem than women whose physical femininity was affirmed.

For exploratory purposes, we also conducted internal meta-analyses to determine whether there was evidence that physical femininity feedback affects state anxiety or self-esteem among non-heterosexual women, who are often rated as more physically masculine than heterosexual women (Johnson, Gill, Reichman, & Tassinary, 2007; Lyons, Lynch, Brewer, & Bruno, 2014; Rieger, Linsenmeier, Gygax, Garcia, & Bailey, 2010) and who may be more likely than heterosexual women to have an intentionally masculine gender presentation (Halberstam, 1996; Rubin, 2006). We also conducted internal meta-analyses to determine whether there was evidence that physical femininity feedback affects state anxiety or self-esteem among women of color. These meta-analyses were consistent with the meta-analyses that included the full sample of women. They indicated that across these studies, non-heterosexual women and women of color indeed experienced higher levels of state anxiety and lower levels of state self-esteem when their physical

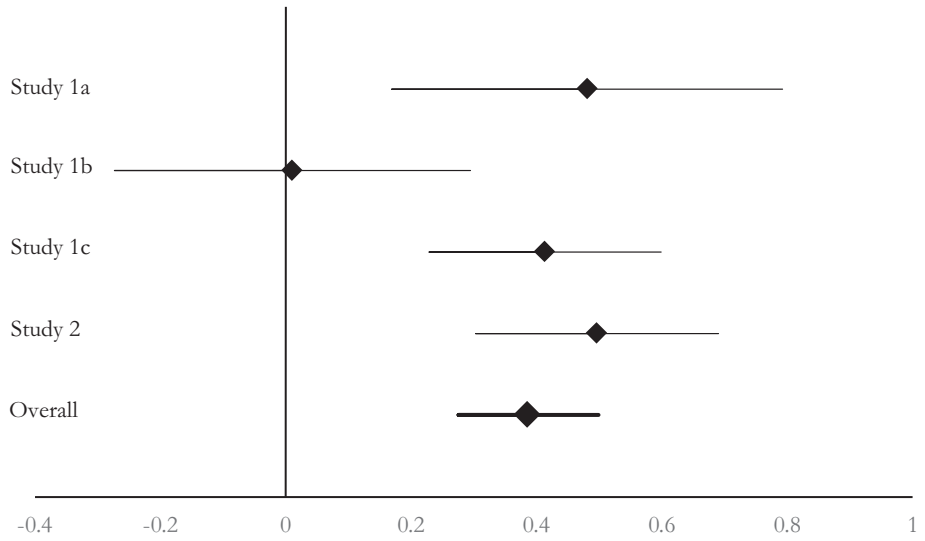

Fig. 8. Effect sizes (Cohen's d) for the effect of physical femininity feedback on state anxiety among women across studies. Error bars represent 95% confidence intervals.

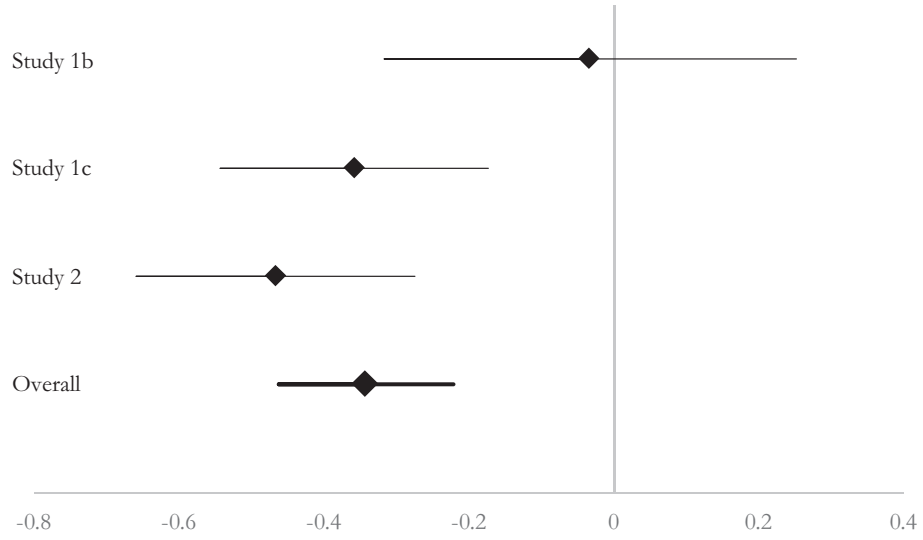

Fig. 9. Effect sizes (Cohen's d) for the effect of physical femininity feedback on state self-esteem among women across studies. Error bars represent 95% confidence intervals.

femininity was threatened than when it was affirmed. Detailed results are presented in the Supplementary Materials. Further, we conducted exploratory analyses to determine if there was evidence that the observed effects of masculinity threats held among non-heterosexual men and men of color. We found that they did. As detailed in the Supplementary Materials, both non-heterosexual men and men of color reported higher levels of state anxiety, but not lower levels of self-esteem, when their masculinity was threatened, compared to when it was affirmed. This effect was not moderated by domain but again was only statistically significant within the domain of physical appearance.

6. General discussion

Past research has suggested that whereas men experience increased anxiety in response to threats to their masculinity, women do not experience increased anxiety in response to threats to their femininity (Vandello et al., 2008). That research, however, has focused on threats to *psychological* masculinity and femininity. In the current studies, we found that cisgender women in the US experience increased anxiety, as well as reduced self-esteem, in response to threats to the femininity of their *physical appearance* (relative to affirmations of the femininity of their physical appearance). Additionally, we found evidence that whereas cisgender men experience anxiety in response to gender stereotypicality threats across two different domains (physical appearance and personality), cisgender women's anxiety response is limited to the domain of physical appearance. Finally, the current studies provided preliminary evidence that a feeling of identity invalidation—and specifically, a discrepancy between the feedback one received and one's beliefs about who one really is—may explain why gender stereotypicality threats within the domain of physical appearance induce anxiety and reduced self-esteem in cisgender women and why gender stereotypicality threats across domains induce anxiety in cisgender men.

Given that the only effects we consistently tested and observed across studies were those of physical femininity feedback on state anxiety and state self-esteem, we focus on these findings throughout the remainder of our discussion. These findings challenge the notion that unlike men, women do not experience anxiety in response to threats to their gender stereotypicality. They suggest that women may not, in fact, be less

concerned with being feminine than men are with being masculine. Rather, whereas men seem to be concerned with achieving and maintaining masculinity across domains (i.e., in terms of both personality and appearance), women may be concerned with achieving and maintaining femininity within the domain of physical appearance in particular.

At a theoretical level, the current results broaden prevailing understandings of gender stereotypes—and of femininity in particular—and support the notion that appearances are central to the female gender role (Chrisler & Johnston-Robledo, 2018, pp. 3–4). Although nearly 40 years ago, Deaux and Lewis (1984) suggested that gender stereotypes comprise four domains—personality traits, role behaviors, occupations, and physical appearance—the majority of the literature on gender stereotypes has continued to focus primarily (albeit not exclusively) on psychological forms of gender stereotypes. Studies on *threats* to gender stereotypicality in particular have given participants feedback on their masculinity and femininity on the basis of their knowledge, personality, interests, or task performance (Frederick et al., 2017; Hunt, Fasoli, Carnaghi, & Cadinu, 2016; Lee-Won, Tang, & Kibbe, 2017; Rudman & Fairchild, 2004). Thus, the conclusions that have been drawn from these studies are limited by their focus on one domain of gender stereotypicality. Given our finding that women do indeed experience anxiety—and reduced self-esteem—in response to threats to the gender stereotypicality of their *physical appearances*, the current studies serve as a call to gender researchers to expand the scope of their inquiry to include all four domains of stereotypes that Deaux and Lewis (1984) proposed. Furthermore, they suggest that research on appearance-related gender stereotypes should move beyond a focus on physical attractiveness (Prentice & Carranza, 2002) to a broader examination of the pressure on women to appear feminine.

Although the current studies present a new perspective on the previous finding that men, but not women, experience anxiety in response to threats to their gender stereotypicality and suggest that women *do* indeed experience such anxiety, as well as reduced self-esteem, our findings should not be interpreted as disputing other theories and evidence that have sought to explain this earlier finding. Our results are not, for example, inconsistent with previous accounts suggesting that manhood but not womanhood is a precarious social status (Vandello & Bosson, 2013), that masculinity within the domains of personality, role behaviors, and occupations is higher status than femininity (Feinman, 1981), or that femininity in men is more associated with presumptions of same-gender sexual orientation than masculinity in women is (McCreary, 1994). Nor, however, do our results directly support any of these accounts. Rather, they exist in parallel with previous explanations for men and women's discrepant responses to feedback indicating that they are counter-stereotypical.

At a practical level, the current findings help to elucidate the lived experiences of women by pointing to a previously underexplored contributor to anxiety and low self-esteem in women. They may also help to explain the great deal of resources—in terms of both time (Today/AOL, 2014) and money (Harris Poll, 2014)—that women spend on femininity work, including facial hair removal (Toerien et al., 2005) and cosmetic application (Today/AOL, 2014). Thus, these results have the potential to inform interventions that can improve women's psychological well-being. Specifically, they suggest that discussion of the pressure on women to appear physically feminine and the negative psychological consequences of believing one is physically counter-stereotypical should be incorporated into guidelines for clinical practice with women (American Psychological Association, Girls and Women Guidelines Group, 2018), just as the pressure on men to act in a sufficiently masculine manner is addressed in guidelines for clinical practice with men (American Psychological Association, Boys and Men Guidelines Group, 2018). The current results also suggest that beyond contributing to women's insecurities about body shape and size (Grabe, Ward, & Hyde, 2008), advertisements for beauty products and procedures—such as cosmetics and hair removal—may reinforce women's anxiety about not appearing sufficiently feminine.

Although the current work has several important theoretical and practical implications, it also has several limitations that highlight key areas for future research. First, our samples consisted primarily of White women (69%–81%). Given that racial stereotypes are highly gendered (Galinsky, Hall, & Cuddy, 2013; Goff, Thomas, & Jackson, 2008) and that definitions of femininity in the United States are highly Eurocentric (Cole, 2009; Collins, 2004), women's responses to threats to their femininity likely vary as a function of race. For example, Black women are thought of by many as non-prototypical women (Thomas, Dovidio, & West, 2014) and are often perceived as more physically masculine than White women (Goff et al., 2008; Lei, Leshin, & Rhodes, 2020). Thus, they likely experience more chronic threats to their femininity than women of other racial groups do. Because across the current studies only 103 Black women received feedback on the femininity of their physical appearance, we did not have adequate power to determine whether this feedback affected their levels of anxiety (we could detect $d = 0.55$ with 80% power) or self-esteem (we could detect $d = 0.60$ with 80% power). Future research would benefit from a more racially diverse sample and an oversampling of Black women to examine how women of different races respond to threats to their physical femininity. Future research would also benefit from a sample that is more diverse in terms of age, as the mean age for participants in the current studies ranged from 33 to 37. Given the large overlap in what constitutes a "feminine" appearance and a "youthful" appearance (Dinnerstein & Weitz, 1994; Friedman & Zebrowitz, 1992), we might also expect to see different responses to physical femininity threats among women who are older and who might therefore also face more chronic threats to their femininity. Future research with more diverse samples would benefit from the use of alternative paradigms, however, as threatening the femininity of women whose femininity is chronically threatened could cause undue psychological distress.

Given this concern about threatening the femininity of women whose femininity is chronically threatened, we excluded transgender women from the current research and focused exclusively on cisgender women. Although this decision limits the generalizability of the current findings, past work has already documented at least some transgender women's desire to appear physically feminine (Anderson, Irwin, Brown, & Grala, 2020; Sevelius, 2013). Further, transgender women have reported that physically feminizing procedures increase the alignment between their external appearance and their internal sense of self (Dubov & Fraenkel, 2018; Owen-Smith et al., 2018). The sorts of femininity threats that transgender women tend to experience are often different not only in degree but also in kind from the sorts of femininity threats that cisgender women tend to experience. Threats to cisgender women's femininity generally take the form of stereotypicality or prototypicality threats; they suggest that a woman is not "woman-like" in the way most women are or in the way women "ought" to be. Threats to transgender women's femininity, on the other hand, often suggest that a woman is not only insufficiently "woman-like" but also that in a very literal sense, she is not a woman. Future work can explore the extent to which transgender and cisgender women's experience with femininity threats (and affirmations) are best understood with a single theoretical framework or with distinct theoretical frameworks.

The current research also focused exclusively on people with binary gender identities—that is, women and men. Whether nonbinary people experience gender stereotypicality threats remains an open question. It is unclear whether people hold distinct stereotypes about nonbinary people as a group and if so, whether any of these stereotypes are prescriptive. Indeed, nonbinary people are often thought to not be a legitimate social group (Burke et al., 2023); therefore, people might not hold specific stereotypes about them. More research into stereotypes of nonbinary people would need to be conducted before research into nonbinary people's experiences with gender stereotypicality threats could take place.

Another limitation of the current research is its focus on facial appearances. There are numerous distinct elements of physical gender

stereotypicality, including but not limited to facial appearance, overall appearance, hair style, amount of body hair, and body shape (Aube et al., 1995; Cejka & Eagly, 1999; Deaux & Lewis, 1983; Kagan, 1964; Myers & Gonda, 1982; Spence & Sawin, 1985). It is certainly possible—and indeed likely—that women would respond differently to threats to different aspects of their physical femininity. In the current studies we opted to focus on facial femininity for both theoretical and practical reasons. To draw a clear distinction between physical and psychological femininity feedback, we wanted to focus on an aspect of appearance that is not closely tied to one's personality. Additionally, we wanted to focus on an aspect of appearance about which randomly assigned feedback would be reasonably plausible. Finally, extensive research has been conducted on consequences of facial femininity and masculinity and has demonstrated that complex inferences and judgments are often made on the basis of facial appearance (Zebrowitz & Montepare, 2014). Thus, facial appearance was an ideal target for feedback in these studies. In the future, however, researchers could expand upon the current studies by examining whether our results extend to feedback on the femininity of women's *bodily* appearances.

Additionally, the current set of studies focused solely on psychological consequences of gender stereotypicality threats—and on anxiety and self-esteem in particular. Future work would benefit from examining other possible psychological responses to gender stereotypicality threats, including anger (Spielberger, Jacobs, Russell, & Crane, 1983) and negative body image (Grogan, 2016, p. 4). Future work would also benefit from examining behavioral consequences of physical femininity threats—and, specifically, on potential compensatory assertions of femininity (Cheryan & Monin, 2005). Just as men engage in traditionally masculine behaviors following threats to their psychological masculinity (e.g., Berke, Reidy, Miller, & Zeichner, 2017; Bosson & Vandello, 2011; Parent, Kalenkoski, & Cardella, 2018; Talley & Bettencourt, 2008), women may engage in physical feminization (e.g., cosmetic application, use of photo editing applications, etc.) following threats to their physical femininity. Given the associations between femininity and thinness (Mahalik et al., 2005), one possible form of behavioral compensation that would be particularly important to consider is disordered eating, which disproportionately affects women and girls (Neumark-Sztainer, Wall, Larson, Eisenberg, & Loth, 2011). Examinations of potential compensation in the wake of physical femininity threats can help to elucidate how women cope with this anxiety-inducing and self-esteem-diminishing experience.

Furthermore, although Study 2 provided initial evidence that a sense of identity invalidation may help to explain the effects of threats to gender stereotypicality on state anxiety and self-esteem, this finding must be explored further before firm conclusions can be drawn about the psychological mechanisms underlying the observed effects. The measures of felt identity invalidation used in this study were not validated scales, and the measure of results-identity discrepancy, which mediated the effect of gender stereotypicality threats on anxiety and self-esteem, consisted of a single item: "I feel like the results I received are consistent with my beliefs about who I really am" (R). Although this item asked participants to report the extent to which the feedback they received was discrepant with their beliefs about *who* they really are (i.e., their identity or sense of self), participants may have interpreted this item as referring to their beliefs about what their appearance or personality is like (i.e., whether the results they received were accurate). In the future, researchers should therefore develop and validate a more formal measure of felt identity invalidation to more reliably establish whether the feeling that one's internal sense of self is not being recognized can account for the negative psychological effects of gender stereotypicality threats.

Future work could also explore variability in psychological and behavioral responses to physical femininity threats—and the mechanisms underlying them. Recent theoretical work on masculinity threats suggests that when these threats produce discrepancies between men's actual and *ideal* selves, they trigger *internal* motivations to resolve these discrepancies and thus *internalized* responses (such as anxiety), whereas when these threats produce discrepancies between men's actual and *ought* selves, they trigger *external* motivations to resolve these discrepancies and thus *externalized* responses (such as aggression) (Stanaland, Gaither, & Gassman-Pines, 2023). In the current research, we focused solely on internalized responses to femininity threats and did not distinguish between actual-ideal and actual-ought discrepancies—only the discrepancy participants experienced between the results they received and their internal sense of self. By considering different possible self-discrepancies and responses to physical femininity threats, researchers could contribute to a deeper understanding of why physical femininity threats are distressing to different women and how different women respond to these threats.

Finally, the current studies did not definitively rule out the possibility that threats to women's physical femininity might produce increased anxiety and reduced self-esteem at least in part because they are interpreted as threats to women's physical attractiveness—or that outside of a lab setting, physical femininity threats might be distressing partially for this reason. Indeed, facial femininity is understood to be a key component of facial attractiveness in women (Rhodes, 2006; Rhodes et al., 2000). In the current studies, we took steps to mitigate this potential confound. Nonetheless, the possibility that women interpreted physical femininity feedback as inherently reflective of their physical attractiveness—and that this interpretation contributed to the relative increase in anxiety and reduction in self-esteem in response to femininity threats, compared to femininity affirmations—cannot be completely ruled out. To further explore this possibility, researchers could capitalize on recent work suggesting that facial sexual dimorphism (i.e., femininity in women and masculinity in men) and facial attractiveness, though naturally confounded, are indeed dissociable (Nakamura & Watanabe, 2020).

7. Conclusions

Although past work has demonstrated that women do not experience anxiety in response to threats to their psychological femininity, the present studies reveal that women do, indeed, experience heightened levels of anxiety—as well as reduced levels of self-esteem—in response to threats to the femininity of their physical appearance. Furthermore, the current studies provide evidence that these effects are not the result of women interpreting threats to their physical femininity as threats to their physical attractiveness. Rather, they may result from a sense of identity invalidation that threats to gender stereotypicality evoke, though more research is needed to determine whether this is indeed the case. Finally, these studies reveal that men experience anxiety (but not reduced self-esteem) in response to masculinity threats across the domains of personality and physical appearance—but that this effect is particularly strong in the case of threats to physical masculinity. Overall, the current research highlights the central role that expectations about women and men's physical characteristics, in additional to their psychological characteristics, play in in the dynamics and consequences of gender stereotyping.

Open practices

This article earned an Open Data badge for transparent practices. Preregistrations, data, and analytic code are available at https://osf.io/mh7rb/?view_only=0966da2e71074be3b523b2492ff10162.

Declaration of Competing Interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

Natalie M. Wittlin reports financial support was provided by American Psychological Association. Natalie M. Wittlin reports financial support was provided by Society for the Psychological Study of Social

Issues.

Data availability

Data/code are available on OSF.

Acknowledgements

Research reported in this manuscript was supported by an American Psychological Association Dissertation Research Award and a Society for the Psychological Study of Social Issues Grant-in-Aid. The authors would like to thank Andre Faria, Sidney Hirschman, Alejandro Jaco, Joy Lian, Katelyn Reese, and Jasmine Rios for their coding assistance.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jesp.2023.104547.

References

Abu Arqoub, S. H., & Al-Khateeb, S. N. (2011). Perception of facial profile attractiveness of different antero-posterior and vertical proportions. *European Journal of Orthodontics, 33*(1), 103–111. https://doi.org/10.1093/ejo/cjq028

Albuja, A. F., Gaither, S. E., Sanchez, D. T., Straka, B., & Cipollina, R. (2019). Psychophysiological stress responses to bicultural and biracial identity denial. *Journal of Social Issues, 5*(4), 1165–1191. https://doi.org/10.1111/josi.12347

American Psychological Association, Boys and Men Guidelines Group. (2018). APA guidelines for psychological practice with boys and men. Retrieved from http://www.apa.org/about/policy/psychological-practice-boys-men-guidelines.pdf.

American Psychological Association, Girls and Women Guidelines Group. (2018). APA guidelines for psychological practice with girls and women. Retrieved from http://www.apa.org/about/policy/psychological-practice-girls-women.pdf.

Amos, N., & McCabe, M. P. (2015). Conceptualizing and measuring perceptions of sexual attractiveness: Are there differences across gender and sexual orientation? *Personality and Individual Differences, 76*, 111–122. https://doi.org/10.1016/j.paid.2014.11.057

Anderson, A. D., Irwin, J. A., Brown, A. M., & Grala, C. L. (2020). "Your picture looks the same as my picture": An examination of passing in transgender communities. *Gender Issues, 37*(1), 44–60. https://doi.org/10.1007/s12147-019-09239-x

Armann, R., & Bülthoff, I. (2012). Male and female faces are only perceived categorically when linked to familiar identities - and when in doubt, he is a male. *Vision Research, 63*, 69–80. https://doi.org/10.1016/j.visres.2012.05.005

Aube, J., Norcliffe, H., & Koestner, R. (1995). Physical characteristics and the multifactorial approach to the study of gender characteristics. *Social Behavior and Personality: An International Journal, 23*(1), 69–82. https://doi.org/10.2224/sbp.1995.23.1.69

Bashour, M. (2006). History and current concepts in the analysis of facial attractiveness. *Plastic and Reconstructive Surgery, 118*(3), 741–756. https://doi.org/10.1097/01.prs.0000233051.61512.65

Beck, A. T., Emery, G., & Greenberg, R. L. (2005). *Anxiety disorders and phobias: A cognitive perspective*. Basic Books.

Bem, S. L. (1981). Gender schema theory: A cognitive account of sex typing. *Psychological Review, 88*(4), 354–364. https://doi.org/10.1037/0033-295X.88.4.354

Berke, D. S., Reidy, D. E., Miller, J. D., & Zeichner, A. (2017). Take it like a man: Gender-threatened men's experience of gender role discrepancy, emotion activation, and pain tolerance. *Psychology of Men & Masculinity, 18*(1), 62–69. https://doi.org/10.1037/men0000036

Besser, A., Flett, G. L., Hewitt, P. L., & Guez, J. (2008). Perfectionism, and cognitions, affect, self-esteem, and physiological reactions in a performance situation. *Journal of Rational-Emotive & Cognitive-Behavior Therapy, 6*(3), 206–228. https://doi.org/10.1007/s10942-007-0067-0

Bhatia, N., & Bhatia, S. (2020). Changes in gender stereotypes over time: A computational analysis. *Psychology of Women Quarterly*. https://doi.org/10.1177/0361684320977178. Advance online publication.

Biernat, M. (1991). Gender stereotypes and the relationship between masculinity and femininity: A developmental analysis. *Journal of Personality and Social Psychology, 61*(3), 351–365. https://doi.org/10.1037/0022-3514.61.3.351

Bosson, J. K., & Vandello, J. A. (2011). Precarious manhood and its links to action and aggression. *Current Directions in Psychological Science, 20*(2), 82–86. https://doi.org/10.1177/0963721411402669

Bosson, J. K., Vandello, J. A., Burnaford, R. M., Weaver, J. R., & Arzu Wasti, S. (2009). Precarious manhood and displays of physical aggression. *Personality and Social Psychology Bulletin, 35*(5), 623–634. https://doi.org/10.1177/0146167208331161

Bosson, J. K., Weaver, J. R., & Prewitt-Freilino, J. L. (2012). Concealing to belong, revealing to be known: Classification expectations and self-threats among persons with concealable stigmas. *Self and Identity, 11*(1), 114–135. https://doi.org/10.1080/15298868.2010.513508

Branscombe, N. R., Ellemers, N., Spears, R., & Doosje, B. (1999). The context and content of social identity threat. In N. Ellemers, R. Spears, & B. Doosje (Eds.), *Social identity: Context, commitment, content* (pp. 35–58). Wiley-Blackwell.

Burke, S. E., Jaurique, A., Valen, B., Wittlin, N. M., Ess, M., & LaFrance, M. (2023). *Forms of psychological bias against transgender women and men and people with nonbinary gender identities. PsyArXiv*. https://doi.org/10.31234/osf.io/cpha2

Burton, S., Netemeyer, R. G., & Lichtenstein, D. R. (1995). Gender differences for appearance-related attitudes and behaviors: Implications for consumer welfare. *Journal of Public Policy & Marketing, 14*(1), 60–75. https://doi.org/10.1177/074391569501400106

Calogero, R. M., & Thompson, J. K. (2010). Gender and body image. In J. Chrisler, & D. McCreary (Eds.), *Handbook of gender research in psychology: Volume 2: Gender research in social and applied psychology* (pp. 153–184).

Cejka, M. A., & Eagly, A. H. (1999). Gender-stereotypic images of occupations correspond to the sex segregation of employment. *Personality and Social Psychology Bulletin, 25*(4), 413–423. https://doi.org/10.1177/0146167299025004002

Chalabi, M. (2017, November 30). *Female facial hair: If so many women have it, why are we so deeply ashamed?* The Guardian. https://www.theguardian.com/fashion/2017/nov/30/female-facial-hair-if-so-many-women-have-it-why-are-we-so-deeply-ashamed.

Cheryan, S., Cameron, J. S., Katagiri, Z., & Monin, B. (2015). Manning up: Threatened men compensate by disavowing feminine preferences and embracing masculine attributes. *Social Psychology, 46*(4), 218–227. https://doi.org/10.1027/1864-9335/a000239

Cheryan, S., & Monin, B. (2005). "Where are you really from?": Asian Americans and identity denial. *Journal of Personality and Social Psychology, 89*(5), 717–730. https://doi.org/10.1037/0022-3514.89.5.717

Chrisler, J. C. (2013). Womanhood is not as easy as it seems: Femininity requires both achievement and restraint. *Psychology of Men & Masculinity, 14*(2), 117–120. https://doi.org/10.1037/a0031005

Chrisler, J. C., & Johnston-Robledo, I. (2018). *Woman's embodied self: Feminist perspectives on identity and image*. American Psychological Association.

Clemente, D. (2016, November 7). *A president in a pantsuit?* The Conversation. https://theconversation.com/a-president-in-a-pantsuit-68286.

Cohen, G. L., Garcia, J., Apfel, N., & Master, A. (2006). Reducing the racial achievement gap: A social-psychological intervention. *Science, 313*(5791), 1307–1310. https://doi.org/10.1126/science.1128317

Cole, E. R. (2009). Intersectionality and research in psychology. *American Psychologist, 64*(3), 170–180. https://doi.org/10.1037/a0014564

Collins, P. H. (2004). *Black sexual politics: African Americans, gender, and the new racism*. Routledge.

Colontonio, A. F. (2016). *Is womanhood precarious? Interpretations of and attributions associated with gender status [unpublished honors thesis]*. University of South Florida.

Dahl, J., Vescio, T., & Weaver, K. (2015). How threats to masculinity sequentially cause public discomfort, anger, and ideological dominance over women. *Social Psychology, 46*(4), 242–254. https://doi.org/10.1027/1864-9335/a000248

Davidenko, N. (2007). Silhouetted face profiles: A new methodology for face perception research. *Journal of Vision, 7*(4), 1–17. https://doi.org/10.1167/7.4.6, 6.

Deaux, K., & Lewis, L. L. (1983). Components of gender stereotypes. *Psychological Documents, 13*(25) (Ms. No. 2583).

Deaux, K., & Lewis, L. L. (1984). Structure of gender stereotypes: Interrelationships among components and gender label. *Journal of Personality and Social Psychology, 46*(5), 991–1004. https://doi.org/10.1037/0022-3514.46.5.991

Dinnerstein, M., & Weitz, R. (1994). Jane Fonda, Barbara Bush and other aging bodies: Femininity and the limits of resistance. *Feminist Issues, 14*(2), 3–24. https://doi.org/10.1007/BF02685654

Donnelly, K., & Twenge, J. M. (2017). Masculine and feminine traits on the Bem sex-role inventory, 1993–2012: A cross-temporal meta-analysis. *Sex Roles, 76*(9–10), 556–565. https://doi.org/10.1007/s11199-016-0625-y

Dubov, A., & Fraenkel, L. (2018). Facial feminization surgery: The ethics of gatekeeping in transgender health. *The American Journal of Bioethics, 18*(12), 3–9. https://doi.org/10.1080/15265161.2018.1531159

Eagly, A. H., Nater, C., Miller, D. I., Kaufmann, M., & Sczesny, S. (2020). Gender stereotypes have changed: A cross-temporal meta-analysis of US public opinion polls from 1946 to 2018. *American Psychologist, 75*(3), 301–315. https://doi.org/10.1037/amp0000494

Fabrigar, L. R., & Wegener, D. T. (2016). Conceptualizing and evaluating the replication of research results. *Journal of Experimental Social Psychology, 66*, 68–80. https://doi.org/10.1016/j.jesp.2015.07.009

Fairygodboss. The grim reality of being a female job seeker. https://d207ibygpg2z1x.cloudfront.net/raw/upload/v1518462741/production/The_Grim_Reality_of_Being_A_Female_Job_Seeker.pdf.

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

Fauville, G., Luo, M., Muller Queiroz, A. C., Bailenson, J. N., & Hancock, J. (2021). *Nonverbal mechanisms predict zoom fatigue and explain why women experience higher levels than men; SSRN scholarly paper ID 3820035*. Rochester, NY, USA: Social Science Research Network.

Feinman, S. (1981). Why is cross-sex-role behavior more approved for girls than for boys? A status characteristic approach. *Sex Roles, 7*, 289–300.

Felig, R. N., Jordan, J. A., Shepard, S. L., Courtney, E. P., Goldenberg, J. L., & Roberts, T. A. (2022). When looking 'hot' means not feeling cold: Evidence that self-objectification inhibits feelings of being cold. *British Journal of Social Psychology, 61*(2), 455–470. https://doi.org/10.1111/bjso.12489

Fierman, J. (1990, July 30). *Why women still don't hit the top* (pp. 40–48). Fortune Magazine. Retrieved August 28, 2020, from https://archive.fortune.com/magazines/fortune/fortune_archive/1990/07/30/73852/index.htm.

Fink, B., Neave, N., Manning, J. T., & Grammer, K. (2006). Facial symmetry and judgements of attractiveness, health and personality. *Personality and Individual Differences, 41*(3), 491–499. https://doi.org/10.1016/j.paid.2006.01.017

Frederick, D. A., Forbes, G. B., Grigorian, K. E., & Jarcho, J. M. (2007). The UCLA body project I: Gender and ethnic differences in self-objectification and body satisfaction among 2,206 undergraduates. *Sex Roles, 57*, 317–327. https://doi.org/10.1007/s11199-007-9251-z

Frederick, D. A., Reynolds, T. A., Barrera, C. A., & Murray, S. B. (2022). Demographic and sociocultural predictors of face image satisfaction: The US Body Project I. *Body Image, 41*, 1–16. https://doi.org/10.1016/j.bodyim.2022.01.016

Frederick, D. A., Shapiro, L. M., Williams, T. R., Seoane, C. M., McIntosh, R. T., & Fischer, E. W. (2017). Precarious manhood and muscularity: Effects of threatening men's masculinity on reported strength and muscle dissatisfaction. *Body Image, 22*, 156–165. https://doi.org/10.1016/j.bodyim.2017.07.002

Fredrickson, B. L., & Roberts, T. A. (1997). Objectification theory: Toward understanding women's lived experiences and mental health risks. *Psychology of Women Quarterly, 21*(2), 173–206. https://doi.org/10.1111/j.1471-6402.1997.tb00108.x

Friedman, H., & Zebrowitz, L. A. (1992). The contribution of typical sex differences in facial maturity to sex role stereotypes. *Personality and Social Psychology Bulletin, 18*(4), 430–438. https://doi.org/10.1177/0146167292184006

Galinsky, A. D., Hall, E. V., & Cuddy, A. J. C. (2013). Gendered races: Implications for interracial marriage, leadership selection, and athletic participation. *Psychological Science, 24*(4), 498–506. https://doi.org/10.1177/0956797612457783

Galupo, M. P., Pulice-Farrow, L., & Lindley, L. (2020). "Every time I get gendered male, I feel a pain in my chest": Understanding the social context for gender dysphoria. *Stigma and Health, 5*(2), 199–208. https://doi.org/10.1037/sah0000189

Garr-Schultz, A., & Gardner, W. (2019). "It's just a phase": Identity denial experiences, self-concept clarity, and emotional well-being in bisexual individuals. *Self and Identity*, 1–17. https://doi.org/10.1080/15298868.2019.1625435

Gillespie, B. L., & Eisler, R. M. (1992). Development of the feminine gender role stress scale: A cognitive-behavioral measure of stress, appraisal, and coping for women. *Behavior Modification, 16*(3), 426–438. https://doi.org/10.1177/01454455920163008

Girlguiding. (2013). Girls' attitudes survey 2013: What girls say about...Equality for girls. https://www.girlguiding.org.uk/globalassets/docs-and-resources/research-and-campaigns/girls-attitudes-survey-2013.pdf.

Glick, P., Gangl, C., Gibb, S., Klumpner, S., & Weinberg, E. (2007). Defensive reactions to masculinity threat: More negative affect toward effeminate (but not masculine) gay men. *Sex Roles, 57*(1–2), 55–59. https://doi.org/10.1007/s11199-007-9195-3

Goff, P. A., Thomas, M. A., & Jackson, M. C. (2008). "Ain't I a woman?": Towards an intersectional approach to person perception and group-based harms. *Sex Roles, 59*(5–6), 392–403. https://doi.org/10.1007/s11199-008-9505-4

Goh, J. X., Hall, J. A., & Rosenthal, R. (2016). Mini meta-analysis of your own studies: Some arguments on why and a primer on how. *Social and Personality Psychology Compass, 10*(10), 535–549. https://doi.org/10.1111/spc3.12267

Grabe, S., Ward, L. M., & Hyde, J. S. (2008). The role of the media in body image concerns among women: A meta-analysis of experimental and correlational studies. *Psychological Bulletin, 134*(3), 460–476. https://doi.org/10.1037/0033-2909.134.3.460

Grogan, S. (2016). *Body image: Understanding body dissatisfaction in men, Women and Children*. Routledge.

Haines, E. L., Deaux, K., & Lofaro, N. (2016). The times they are a-changing … or are they not? A comparison of gender stereotypes, 1983–2014. *Psychology of Women Quarterly, 40*(3), 353–363. https://doi.org/10.1177/0361684316634081

Halberstam, J. (1996). Lesbian masculinity or even stone butches get the blues. *Women & Performance: A Journal of Feminist Theory, 8*(2), 61–73. https://doi.org/10.1080/07407709608571231

Hayes, A. F. (2013a). *Model templates for PROCESS for SPSS and SAS*. The Guilford Press. Retrieved from http://www.afhayes.com/public/templates.pdf.

Hayes, A. F. (2013b). *The PROCESS macro for SPSS and SAS (version 2.13) [software]*.

Heatherton, T. F., & Polivy, J. (1991). Development and calidation of a scale for measuring state self-esteem. *Journal of Personality and Social Psychology, 60*(6), 895–910. https://doi.org/10.1037/0022-3514.60.6.895

Heith, D. J. (2003). The lipstick watch: Media coverage, gender, and presidential campaigns. In R. P. Watson, & A. Gordon (Eds.), *Anticipating madam president (p. 126)*. Lynne Rienner.

Helgeson, V. S. (1994). Prototypes and dimensions of masculinity and femininity. *Sex Roles, 31*(11–12), 653–682. https://doi.org/10.1007/BF01544286

Huebner, D. M., & Fredrickson, B. L. (1999). Gender differences in memory perspectives: Evidence for self-objectification in women. *Sex Roles, 41*(5–6), 459–467. https://doi.org/10.1023/A:1018831001880

Hunt, C. J., Fasoli, F., Carnaghi, A., & Cadinu, M. (2016). Masculine self-presentation and distancing from femininity in gay men: An experimental examination of the role of masculinity threat. *Psychology of Men & Masculinity, 17*(1), 108–112. https://doi.org/10.1037/a0039545

Jespersen v. Harrah''s Operating Co. (2006). *444 F.3d 1104* (9th Cir).

Johnson, K. L., Gill, S., Reichman, V., & Tassinary, L. G. (2007). Swagger, sway, and sexuality: Judging sexual orientation from body motion and morphology. *Journal of Personality and Social Psychology, 93*(3), 321–334. https://doi.org/10.1037/0022-3514.93.3.321

Johnson, K. L., Iida, M., & Tassinary, L. G. (2012). Person (mis)perception: Functionally biased sex categorization of bodies. *Proceedings of the Royal Society B: Biological Sciences, 279*(1749), 4982–4989. https://doi.org/10.1098/rspb.2012.2060

Johnston, D. J., Hunt, O., Johnston, C. D., Burden, D. J., Stevenson, M., & Hepper, P. (2005). The influence of lower face vertical proportion on facial attractiveness. *European Journal of Orthodontics, 27*(4), 349–354. https://doi.org/10.1093/ejo/cji023

Kagan, J. (1964). Acquisition and significance of sex typing and sex role identity. *Review of Child Development Research, 1*, 137–167.

Kendall, E. N. (2015, July 14). *Female athletes often face the femininity police – especially Serena Williams*. The Guardian. https://www.theguardian.com/commentisfree/2015/jul/14/serena-williams-female-athletes-femininity-police.

Kwan, S., & Trautner, M. N. (2009). Beauty work: Individual and institutional rewards, the reproduction of gender, and questions of agency. *Sociology Compass, 3*(1), 49–71.

Ledgerwood, A. (2019, July 19). *Practical best practices for psychological science. Summer Institute for social and personality psychology*. New York, NY: New York University.

Ledgerwood, A. (2020). New developments in research methods. In R. F. Baumeister, & E. J. Finkel (Eds.), *Advanced social psychology* (2nd ed., pp. 39–62). Oxford University Press.

Lee-Won, R. J., Tang, W. Y., & Kibbe, M. R. (2017). When virtual muscularity enhances physical endurance: Masculinity threat and compensatory avatar customization among young male adults. *Cyberpsychology, Behavior and Social Networking, 20*(1), 10–16. https://doi.org/10.1089/cyber.2016.0418

Lei, R. F., Leshin, R. A., & Rhodes, M. (2020). The development of intersectional social prototypes. *Psychological Science, 31*(8), 911–926. https://doi.org/10.1177/0956797620920360

Little, A. C., Jones, B. C., & Debruine, L. M. (2011). Facial attractiveness: Evolutionary based research. *Philosophical Transactions of the Royal Society, B: Biological Sciences, 366*(1571), 1638–1659. https://doi.org/10.1098/rstb.2010.0404

Lyons, M., Lynch, A., Brewer, G., & Bruno, D. (2014). Detection of sexual orientation ("gaydar") by homosexual and heterosexual women. *Archives of Sexual Behavior, 43*(2), 345–352. https://doi.org/10.1007/s10508-013-0144-7

MacKinnon, D. P., Fairchild, A. J., & Fritz, M. S. (2007). Mediation analysis. *Annual Review of Psychology, 58*, 593–614. https://doi.org/10.1146/annurev.psych.58.110405.085542

Mahalik, J. R., Morray, E. B., Coonerty-Femiano, A., Ludlow, L. H., Slattery, S. M., & Smiler, A. (2005). Development of the conformity to feminine norms inventory. *Sex Roles, 52*, 417–435. https://doi.org/10.1007/s11199-005-3709-7

Marteau, T. M., & Bekker, H. (1992). The development of a six-item short-form of the state scale of the Spielberger state—Trait anxiety inventory (STAI). *British Journal of Clinical Psychology, 31*(3), 301–306. https://doi.org/10.1111/j.2044-8260.1992.tb00997.x

McCreary, D. R. (1994). The male role and avoiding femininity. *Sex Roles, 31*(9–10), 517–531. https://doi.org/10.1007/BF01544277

McKinley, N. M., & Hyde, J. S. (1996). The objectified body consciousness scale: Development and validation. *Psychology of Women Quarterly, 20*(2), 181–215. https://doi.org/10.1111/j.1471-6402.1996.tb00467.x

McLemore, K. A. (2018). A minority stress perspective on transgender individuals' experiences with misgendering. *Stigma and Health, 3*(1), 53–64. https://doi.org/10.1037/sah0000070

Mulvey, L. (1999). Visual pleasure and narrative cinema. In L. Braudy, & M. Cohen (Eds.), *Film theory and criticism: Introductory readings* (5th ed., pp. 833–844). Oxford University Press.

Murray, M. S., Neal-Barnett, A., Demmings, J. L., & Stadulis, R. E. (2012). The acting white accusation, racial identity, and anxiety in African American adolescents. *Journal of Anxiety Disorders, 26*(4), 526–531. https://doi.org/10.1016/j.janxdis.2012.02.006

Myers, A. M., & Gonda, G. (1982). Utility of the masculinity–femininity construct: Comparison of traditional and androgyny approaches. *Journal of Personality and Social Psychology, 43*(3), 514–523. https://doi.org/10.1037/0022-3514.43.3.514

Nakamura, K., & Watanabe, K. (2020). A new data-driven mathematical model dissociates attractiveness from sexual dimorphism of human faces. *Scientific Reports, 10*(1), 1–11.

Neumark-Sztainer, D., Wall, M., Larson, N. I., Eisenberg, M. E., & Loth, K. (2011). Dieting and disordered eating behaviors from adolescence to young adulthood: Findings from a 10-year longitudinal study. *Journal of the American Dietetic Association, 111*(7), 1004–1011.

Owen-Smith, A. A., Gerth, J., Sineath, R. C., Barzilay, J., Becerra-Culqui, T. A., Getahun, D., … Goodman, M. (2018). Association between gender confirmation treatments and perceived gender congruence, body image satisfaction, and mental health in a cohort of transgender individuals. *The Journal of Sexual Medicine, 15*(4), 591–600. https://doi.org/10.1016/j.jsxm.2018.01.017

Parent, M. C., Kalenkoski, C. M., & Cardella, E. (2018). Risky business: Precarious manhood and investment portfolio decisions. *Psychology of Men & Masculinity, 19*(2), 195–202. https://doi.org/10.1037/men0000089

Parent, M. C., & Moradi, B. (2010). Confirmatory factor analysis of the conformity to feminine norms inventory and development of an abbreviated version: The CFNI-45. *Psychology of Women Quarterly, 34*(1), 97–109. https://doi.org/10.1111/j.1471-6402.2009.01545

Parker, B. Y. K., Horowitz, J., & Stepler, R. (2017). *On gender differences, no consensus on nature vs. nurture. Pew Research Center, Dec 5* (pp. 1–7). http://www.pewsocialtrends.org/2017/12/05/americans-are-divided-on-whether-differences-between-men-and-women-are-rooted-in-biology-or-societal-expectations/.

Harris Poll. (2014). Cosmetic & grooming product consumers increasingly looking to online merchants. Retrieved from https://theharrispoll.com/new-york-n-y-december-18-2014-as-shopping-habits-shift-and-change-the-purchase-channels-for-grooming-and-cosmetic-staples-become-increasingly-varied-and-it-may-be-only-a-matte/.

Prentice, D. A., & Carranza, E. (2002). What women and men should be, shouldn't be, are allowed to be, and don't have to be: The contents of prescriptive gender stereotypes.

Psychology of Women Quarterly, 26(4), 269–281. https://doi.org/10.1111/1471-6402.t01-1-00066
Ratan, R., Miller, D. B., & Bailenson, J. N. (2022). Facial appearance dissatisfaction explains differences in zoom fatigue. *Cyberpsychology, Behavior and Social Networking, 25*(2), 124–129.
Rhodes, G. (2006). The evolutionary psychology of facial beauty. *Annual Review of Psychology, 57*(1), 199–226. https://doi.org/10.1146/annurev.psych.57.102904.190208
Rhodes, G., Hickford, C., & Jeffery, L. (2000). Sex-typicality and attractiveness: Are supermale and superfemale faces super-attractive? *British Journal of Psychology, 91*(1), 125–140. https://doi.org/10.1348/000712600161718
Richard, F. D., Bond, C. F., & Stokes-Zoota, J. J. (2003). One hundred years of social psychology quantitatively described. *Review of General Psychology*. https://doi.org/10.1037/1089-2680.7.4.331
Rieger, G., Linsenmeier, J. A., Gygax, L., Garcia, S., & Bailey, J. M. (2010). Dissecting "gaydar": Accuracy and the role of masculinity–femininity. *Archives of Sexual Behavior, 39*(1), 124–140. https://doi.org/10.1007/s10508-008-9405-2
Rosenberg, M. (1962). The association between self-esteem and anxiety. *Journal of Psychiatric Research, 1*(2), 135–152. https://doi.org/10.1016/0022-3956(62)90004-3
Rubin, G. (2006). Of catamites and kings: Reflections of butch, gender, and boundaries. In S. Stryker, & S. Whittle (Eds.), *The transgender studies reader* (pp. 471–481). Routledge.
Rudman, L. A. (1998). Self-promotion as a risk factor for women: The costs and benefits of counterstereotypical impression management. *Journal of Personality and Social Psychology, 74*(3), 629–645. https://doi.org/10.1037/0022-3514.74.3.629
Rudman, L. A., Dohn, M. C., & Fairchild, K. (2007). Implicit self-esteem compensation: Automatic threat defense. *Journal of Personality and Social Psychology, 93*(5), 798–813. https://doi.org/10.1037/0022-3514.93.5.798
Rudman, L. A., & Fairchild, K. (2004). Reactions to counterstereotypic behavior: The role of backlash in cultural stereotype maintenance. *Journal of Personality and Social Psychology, 87*(2), 157–176. https://doi.org/10.1037/0022-3514.87.2.157
Rudman, L. A., & Glick, P. (1999). Feminized management and backlash toward agentic women: The hidden costs to women of a kinder, gentler image of middle managers. *Journal of Personality and Social Psychology, 77*(5), 1004–1010. https://doi.org/10.1037/0022-3514.77.5.1004
Rudman, L. A., Moss-Racusin, C. A., Glick, P., & Phelan, J. E. (2012). Reactions to vanguards: Advances in backlash theory. In P. Devine, & A. Plant (Eds.), *Vol. 45. Advances in experimental social psychology* (pp. 167–227). Academic Press.
Russell, R. (2009). A sex difference in facial contrast and its exaggeration by cosmetics. *Perception, 38*(8), 1211–1219. https://doi.org/10.1068/p6331
Sandberg, S. (2013). *Lean in: Women, work, and the will to lead*. Knopf.
Scaptura, M. N., & Boyle, K. M. (2020). Masculinity threat,"Incel" traits, and violent fantasies among heterosexual men in the United States. *Feminist Criminology, 15*(3), 278–298. https://doi.org/10.1177/1557085119896415
Sevelius, J. M. (2013). Gender affirmation: A framework for conceptualizing risk behavior among transgender women of color. *Sex Roles, 68*(11–12), 675–689. https://doi.org/10.1007/s11199-012-0216-5
Shea, M., Wong, Y. J., Wang, S., Wang, S., Jimenez, V., Hickman, S. J., & LaFollette, J. R. (2014). Toward a constructionist perspective of examining femininity experience: The development and psychometric properties of the subjective femininity stress scale. *Psychology of Women Quarterly, 38*(2), 275–291. https://doi.org/10.1177/0361684313509591
Spence, J. T., & Sawin, L. L. (1985). Images of masculinity and femininity: A reconceptualization. In V. E. O'Leary, R. Kesler Unger, & B. S. Wallston (Eds.), *Women, gender, and social psychology* (pp. 35–660). Routledge.
Spielberger, C. D. (1972). Conceptual and methodological issues in anxiety research. In C. D. Spielberger (Ed.), *2. Anxiety: Current trends in theory and research* (p. 490). Academic Press.
Spielberger, C. D., Jacobs, G., Russell, S., & Crane, R. S. (1983). Assessment of anger: The state-trait anger scale. *Advances in Personality Assessment, 2*, 161–189.
Stanaland, A., Gaither, S., & Gassman-Pines, A. (2023). When is masculinity "fragile"? An expectancy-discrepancy-threat model of masculine identity. *Personality and Social Psychology Review*. https://doi.org/10.1177/10888683221141176
Steiner, T. G., Vescio, T. K., & Adams, R. B., Jr. (2022). The effect of gender identity and gender threat on self-image. *Journal of Experimental Social Psychology, 101*, 104335.
Sutherland, C. A. M., Young, A. W., Mootz, C. A., & Oldmeadow, J. A. (2015). Face gender and stereotypicality influence facial trait evaluation: Counter-stereotypical female faces are negatively evaluated. *British Journal of Psychology, 106*(2), 186–208. https://doi.org/10.1111/bjop.12085
Talley, A. E., & Bettencourt, B. A. (2008). Evaluations and aggression directed at a gay male target: The role of threat and antigay prejudice. *Journal of Applied Social Psychology, 38*(3), 647–683. https://doi.org/10.1111/j.1559-1816.2007.00321.x
Teague Moreno, L. (2019). *Boss up!: This ain't your mama's business*. Thomas Nelson.
Thomas, E. L., Dovidio, J. F., & West, T. V. (2014). Lost in the categorical shuffle: Evidence for the social non-prototypicality of black women. *Cultural Diversity and Ethnic Minority Psychology, 20*(3), 370–376. https://doi.org/10.1037/a0035096
Tiggemann, M., & Hodgson, S. (2008). The hairlessness norm extended: Reasons for and predictors of women's body hair removal at different body sites. *Sex Roles, 59*(11–12), 889–897. https://doi.org/10.1007/s11199-008-9494-3
Today/AOL. (2014). Ideal to real body image survey. https://www.aol.com/article/2014/02/24/loveyourselfie/20836450/.
Toerien, M., Wilkinson, S., & Choi, P. Y. L. (2005). Body hair removal: The "mundane" production of normative femininity. *Sex Roles, 52*(5–6), 399–406. https://doi.org/10.1007/s11199-005-2682-5
Townsend, S. S. M., Markus, H. R., & Bergsieker, H. B. (2009). My choice, your categories: The denial of multiracial identities. *Journal of Social Issues, 65*(1), 185–204. https://doi.org/10.1111/j.1540-4560.2008.01594.x
Trujillo, L. T., Jankowitsch, J. M., & Langlois, J. H. (2014). Beauty is in the ease of the beholding: A neurophysiological test of the averageness theory of facial attractiveness. *Cognitive, Affective, & Behavioral Neuroscience, 14*(3), 1061–1076. https://doi.org/10.3758/s13415-013-0230-2
Univia. (2019). Beauty business: Nearly 1,000 employees weigh in on workplace professionalism. https://www.univia.com/Home/beauty-biases.
Vandello, J. A., & Bosson, J. K. (2013). Hard won and easily lost: A review and synthesis of theory and research on precarious manhood. *Psychology of Men & Masculinity, 14*(2), 101–113. https://doi.org/10.1037/a0029826
Vandello, J. A., Bosson, J. K., Cohen, D., Burnaford, R. M., & Weaver, J. R. (2008). Precarious manhood. *Journal of Personality and Social Psychology, 95*(6), 1325–1339. https://doi.org/10.1037/a0012453
Vescio, T. K., Schermerhorn, N. E., Gallegos, J. M., & Laubach, M. L. (2021). The affective consequences of threats to masculinity. *Journal of Experimental Social Psychology, 97*, 104195. https://doi.org/10.1016/j.jesp.2021.104195
Wade, T. J. (2000). Evolutionary theory and self-perception: Sex differences in body esteem predictors of self-perceived physical and sexual attractiveness and self-esteem. *International Journal of Psychology, 35*(1), 36–45. https://doi.org/10.1080/002075900399501
Willer, R., Rogalin, C. L., Conlon, B., & Wojnowicz, M. T. (2013). Overdoing gender: A test of the masculine overcompensation thesis. *American Journal of Sociology, 118*(4), 980–1022. https://doi.org/10.1086/668417
Zebrowitz, L. A., Andreoletti, C., Collins, M. A., Lee, S. Y., & Blumenthal, J. (1998). Bright, bad, babyfaced boys: Appearance stereotypes do not always yield self-fulfilling prophecy effects. *Journal of Personality and Social Psychology, 75*(5), 1300–1320. https://doi.org/10.1037/0022-3514.75.5.1300
Zebrowitz, L. A., Collins, M. A., & Dutta, R. (1998). The relationship between appearance and personality across the life span. *Personality and Social Psychology Bulletin, 24*(7), 736–749. https://doi.org/10.1177/0146167298247006
Zebrowitz, L. A., & Montepare, J. M. (2014). Faces and first impressions. In J. Bargh, & G. Borgida (Eds.), *Handbook of personality and social psychology: Vol. 1. Attitudes and social cognition*. American Psychological Association. https://doi.org/10.1037/14341-008.

Update

Journal of Experimental Social Psychology
Volume 113, Issue , July 2024, Page

DOI: https://doi.org/10.1016/j.jesp.2024.104627

Journal of Experimental Social Psychology 113 (2024) 104627

Contents lists available at ScienceDirect

Journal of Experimental Social Psychology

journal homepage: www.elsevier.com/locate/jesp

Corrigendum to "US cisgender women's psychological responses to physical femininity threats: Increased anxiety, reduced self-esteem" [Journal of Experimental Social Psychology 110(2024) 104547]

Natalie M. Wittlin *, Marianne LaFrance, John F. Dovidio, Jennifer A. Richeson

Department of Psychology, Yale University, 100 College St., New Haven, CT 06510, USA

Corrigendum Text.

On p. 5 (2.1.3. Measures, State self-esteem), the article states, "Participants rated their agreement with 10 statements taken and modified from the State Self-Esteem Scale (Heatherton & Polivy, 1991) on a scale of 1 (Not at all) to 5 (Extremely)." As indicated later in the article, however, this measure actually included 11 statements. This sentence should therefore read, "Participants rated their agreement with 11 statements taken and modified from the State Self-Esteem Scale (Heatherton & Polivy, 1991) on a scale of 1 (Not at all) to 5 (Extremely)."

DOI of original article: https://doi.org/10.1016/j.jesp.2023.104547.

* Corresponding author.
E-mail address: natalie.wittlin@princeton.edu (N.M. Wittlin).

https://doi.org/10.1016/j.jesp.2024.104627

Available online 10 May 2024