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Abstract

To navigate a busy interpersonal landscape, people direct perceptual resources in a motivated fashion that maximizes goals and minimizes threats. While adaptive, these heuristics can also lead to noteworthy biases, including a well-documented memory advantage for ingroup members. Recent research has extended these findings to reveal other motivational biases that emerge early in social perception. When perceivers feel threatened, for example, they are vigilant to outgroup members. Although compelling, evidence for this *vigilance-threat hypothesis* is currently limited to feelings of physical threat and memory for racial outgroups. Here, we extended these findings to a different form of threat—gender identity threat. Four studies documented that straight men who feel insecure about their masculinity have heightened recognition of gender-atypical faces. We therefore argue that gender identity concerns play an important role in social vision, arousing perceptual biases that have implications for how men attend to and remember others in their social environments.

Keywords

facial memory, gender typicality, masculinity threat, outgroup vigilance, vigilance-threat

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Moving through the social world, we encounter many faces that are unfamiliar to us. Although we perceive these faces with minimal effort, they do not necessarily garner equal levels of visual processing. Rather, people use shortcuts and heuristics to direct perceptual resources in a motivated fashion, processing and ultimately remembering some faces better than others. Although research on this topic has traditionally focused on the motivated recognition of ingroup faces, psychologists have recently begun to document situations in which perceivers are apt to remember faces that do not belong to their ingroup—in particular, faces that appear threatening. While these findings offer important theoretical insights

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to psychological research on face perception, extant data are limited to the recognition of racial outgroups that appear physically threatening. Here, we extended these findings by testing whether more existential threats affect person memory. Specifically, we tested how heterosexual men's insecurities about their masculine identity affect their processing and recognition of gender-atypical others.

Social Vision as Motivated Perception

Face perception occurs unconsciously and automatically, but it is not immune to motivational influences (Maner, Miller, Moss, Leo, & Plant, 2012; Skelly & Decety, 2012; van Bavel, Swencionis, O'Connor, & Cunningham, 2012). Quite the opposite, the processing of facial information is heavily influenced by personal motivations, past experiences, and social contexts (Hugenberg, Young, Bernstein, & Sacco, 2010; Young, Hugenberg, Bernstein, & Sacco, 2011). Sometimes these motivational factors promote highly efficient and accurate judgments of others (Ambady, 2010), but at other times they arouse biases that affect the encoding and retrieval of facial information (Hugenberg & Corneille, 2009).

One important factor known to bias face processing is the group membership of the target face. For example, perceivers remember faces better when they depict members of that perceiver's social in-group rather than their social out-groups (Cross, Cross, & Daly, 1971; Malpass & Kravitz, 1969; Young et al., 2011). Such memory biases appear to be particularly sensitive to racial group membership. Indeed, across diverse experimental paradigms (Meissner & Brigham, 2001), target populations (Chance & Goldstein, 1996), and perceiver populations (Sporer, 2001), recognition of racial ingroup members exceeds recognition of racial outgroup members (Hugenberg & Corneille, 2009; Malpass & Kravitz, 1969). Although these effects have been demonstrated most extensively for racial ingroups, similar memory advantages occur for faces that match a perceiver's age (Wright & Stroud, 2002), sex (Wright & Sladden, 2003), and sexual orientation (Rule, Ambady, Adams, & Macrae, 2007).

Ingroup memory advantages occur, at least in part, because the basic cognitive processes guiding face perception foster greater individuation of ingroup relative to outgroup faces (Young et al., 2011). Importantly, this tendency to individuate ingroup faces appears to be driven by interpersonal motivations. Indeed, humans have a fundamental need to belong in their social environments (Baumeister & Leary, 1995), and this need can be met by recognizing ingroup members who signal safety, friendship, and mating potential (Young et al., 2011). Thus, personal motivations to belong are thought to direct perceptual resources toward ingroup members, helping perceivers to remember ingroup members better than outgroup members in order to ensure positive social outcomes for themselves (Young et al., 2011).

If face processing is indeed biased by personal motivations, then we should expect that perceivers not only monitor their social environment for friends, but also for potential foes, depending on their motivational needs at any given moment. For example, when self-protection concerns are salient, perceivers may be especially vigilant to threatening individuals who are not part of their immediate ingroup. This motivation, characterized by the *vigilance-threat hypothesis*, enjoys a lengthy theoretical history. Broadly speaking, the vigilance-threat hypothesis predicts that when perceivers feel threatened, they will direct perceptual resources toward and consequently remember others who could exacerbate or fulfill the threat in question. For example, Allport and Kramer (1946) argued that prejudiced individuals perceive members of racial minority groups as threatening and therefore become attuned to racial minorities in order to detect them and avoid potentially uncomfortable social interactions. More recent empirical work corroborates this notion. In one study, White perceivers who were primed with self-protection concerns were vigilant to Arab and Black male faces, remembering them better than White faces despite spending less time scanning them (Becker et al., 2010). Thus, although early work probing motivational biases in face recognition focused primarily on memory advantages for ingroup members, other

evidence demonstrates memory advantages for outgroup members, especially when they are perceived to be threatening.

Despite some empirical support, studies documenting vigilance-threat effects are scant and restricted to racial minority targets who appear physically threatening. As such, the generalizability of the hypothesis remains unclear. It is possible, for example, that perceivers become perceptually vigilant to specific groups of people not only in response to physical safety threats, but also in response to social identity threats. Broadly speaking, social identity threats occur when people feel uncomfortable with some aspect of their identity, especially an identity that is socially devalued (Major & O'Brien, 2005). One especially potent form of identity threat stems from feelings of gender inadequacy, particularly among men (Bem, 1993). Indeed, men who question the adequacy of their masculinity often feel uncomfortable and exhibit behaviors aimed at helping them reassert a traditionally masculine identity (e.g., Bosson, Prewitt-Freilino, & Taylor, 2005; Bosson, Vandello, Burnaford, Weaver, & Wasti, 2009). Thus, to the extent that gender threats are aversive, we propose that observers may direct perceptual resources toward individuals who could exacerbate their concerns—specifically, gender-atypical others.

Gender Atypicality and Identity Threat

There is some rationale to predict that insecurity about one's masculinity directs perceptual resources toward others who defy gendered expectations. Indeed, men are often motivated to appear masculine, although masculinity is fleeting and difficult to achieve (Vandello, Bosson, Cohen, Burnaford, & Weaver, 2008). Given the personally important yet fickle nature of masculinity, some men feel chronically insecure about their gender identity and are keen to avoid situations that threaten it (Bosson et al., 2005; Bosson et al., 2009). Encounters with gender-atypical others represent one such situation in which masculine identity is threatened. Indeed, Bem (1993) argued that encounters with gender-atypical others make straight perceivers (especially men) self-conscious of their own gendered appearance, in part because such encounters can foster stigma by association. Recent empirical studies have buttressed these claims, revealing that straight men whose masculinity is threatened exhibit especially negative reactions to other men's gender deviations (Glick, Gangl, Gibb, Klumpner, & Weinberg, 2007). In light of this evidence, we argue that men who are insecure with their masculinity may avoid contact with gender-atypical others to prevent further damage to their already tenuous sense of gender identity. Being perceptually vigilant to gender-atypical individuals may help men with insecure masculinity to detect gender atypicality early in the perceptual stream and preemptively avoid such potentially threatening situations.

Men who are insecure with their masculinity may also seek to avoid contact with gay men. A recent series of studies revealed that many straight men feel anxious about being incorrectly labeled as gay and therefore avoid contact with gay individuals (Buck, 2010; Buck, Plant, Ratcliff, Zielaskowski, & Boerner, 2013). These fears about miscategorization appear to be at least somewhat valid: In one study, straight men who interacted with gay men were later avoided and evaluated negatively by straight male peers (Neuberg, Smith, Hoffman, & Russell, 1994). In another study, men who voluntarily interacted with an openly gay man were perceived by others as having gay behavioral tendencies (Sigelman, Howell, Cornell, Cutright, & Dewey, 1991). Thus, some straight men fear that contact with gay men will lead others to miscategorize them as gay, and for this reason, they may wish to avoid contact with gay men. One specific way in which straight men may avoid contact with gay men is by attending to gendered features in those around them. Indeed, perceivers quickly and accurately categorize others' sexual orientations based upon gendered visual cues (Johnson, Gill, Reichman, & Tassinary, 2007; Rule & Ambady, 2008), such that gender-atypical targets (e.g., feminine men) are often categorized as gay (Freeman, Johnson, Ambady, & Rule, 2010; Lick,

Johnson, & Gill, 2013). Insofar as men with insecure masculinity wish to avoid contact with gay men, they may become perceptually attuned to the gender-atypical features that signal gay identities in others, helping them to readily detect individuals who could further threaten their masculine identity.

The Current Research

In summary, the vigilance-threat hypothesis states that people direct perceptual resources toward others who may be personally threatening. Until now, the data supporting this theory have demonstrated heightened recognition of racial outgroup members in situations involving physical threat. We argue that a similar phenomenon may occur in situations involving social identity threat. Specifically, we propose that straight men who feel insecure about their masculinity may remember gender-atypical faces in order to avoid socially contagious interactions and strengthen their feelings of gender identity.

We tested our hypotheses about gender insecurity and memory advantages for gender-atypical faces in a series of four studies. In Study 1, we explored straight men's recognition of male faces that varied in gender typicality. We predicted that, overall, participants would have better memory for gender-atypical male faces relative to gender-typical male faces. In Study 2, we examined whether feelings of gender insecurity moderated this effect, predicting that men who reported chronic insecurity about their masculinity would be especially prone to remember gender-atypical male faces. In Study 3, we probed the specificity of this moderating effect of gender insecurity by testing similar effects among female perceivers. Because contact with gender-atypical men is more socially threatening to men than to women (Bem, 1993; Neuberg et al., 1994), we predicted that the moderating effect of gender insecurity would be unique to male perceivers. Finally, in Study 4, we further probed the specificity of this effect by including both male and female perceivers as well as male and female targets. Relying on the same logic as Study 3, we predicted that the memory advantage for gender-atypical faces would be specific to male perceivers—that is, that women insecure in their femininity would not show heightened recognition of gender-atypical faces, because feminine insecurity is generally not associated with a fear of being categorized as a lesbian via contact with gender-atypical others. Collectively, these studies offer novel insights regarding the generalizability of the vigilance-threat hypothesis, providing new evidence of motivated biases in the early moments of social perception.

Study 1

Method

Participants. Seventy-eight straight men from the United States participated in an online study. Participants were 27.92 years old on average (*SD* = 8.25 years), most were White (73% White, 9% Asian, 9% Black, 4% Latino, 6% biracial), and they hailed from diverse geographic locations (31 states reported).

Stimuli. Stimuli were 48 grayscale facial photographs of men (12 gay gender-typical, 12 gay gender-atypical, 12 straight gender-typical, 12 straight gender-atypical). These faces were a subsample of stimuli from Freeman et al. (2010), in which 10 coders rated the gender typicality of 158 faces (1 = *gender-typical* to 7 = *gender-atypical*). Based on mean scores for each face, we chose the 12 most gender-typical and gender-atypical stimuli for each sexual orientation category to yield the 48 faces just described.[1] Thus, we selected stimulus faces in such a way that they varied orthogonally along two dimensions—gender typicality (*typical, atypical*) and sexual orientation (*gay, straight*). All of the faces were cropped to include hair as a visible cue but to exclude social context. Moreover, all of the faces were White and had no visible tattoos or facial piercings.

Procedure. We recruited Internet users from Amazon Mechanical Turk for a study of facial memory, with no mention of gender or sexual orientation. After providing consent, participants

completed a demographic survey to determine eligibility, indicating their age, sex, sexual orientation, political ideology (1 = *very conservative* to 5 = *very liberal*), education (1 = *less than high school* to 8 = *doctorate*), influence of religion in their life (1 = *no influence* to 5 = *large influence*), and ZIP code. Only heterosexually identified men were invited to continue the study.

After completing the demographic screening, participants previewed 24 faces (6 gay gender-typical, 6 gay gender-atypical, 6 straight gender-typical, 6 straight gender-atypical) in random order. We instructed participants:

> Today, we are interested in your memory for faces. You will see a series of men's faces one at a time. Please look at each face for as long as necessary in order to memorize it. Once you feel that you have memorized a given face, press the arrow at the bottom of your screen to move on to the next one. Later, you will be asked to recall the faces you saw, so please pay careful attention.

After the preview, participants completed a "Where's Waldo" distractor task in which they scanned five cartoon images for 1 minute each to find a small target character hidden in a complex scene. Next, they completed a recognition test during which they viewed all 48 stimulus faces and indicated whether they had seen each face previously (*yes, no*) and their confidence (1 = *not at all confident* to 6 = *very confident*). Finally, participants were debriefed and compensated.

Results and Discussion

Our primary goal in Study 1 was to determine whether straight men exhibited enhanced recognition of gender-atypical relative to gender-typical male faces. As such, we explored how recognition accuracy, confidence, and inspection time (ms for which participants previewed each face) varied as a function of target sexual orientation and gender typicality. Because each participant provided multiple ratings of multiple targets, we analyzed the data with generalized estimating equations (GEEs; Zeger & Liang, 1986), which are multilevel regression models that account for within-subject dependencies in data. Unlike other strategies for analyzing multilevel data (e.g., random coefficient models), GEEs employ quasi-likelihood estimation to treat within-cluster dependency as a nuisance, using a working correlation matrix to correct for this dependency and provide reliable estimates of fixed effects and their standard errors. Thus, because our hypotheses did not concern random effects, GEEs provided a parsimonious analytic approach by allowing us to examine the fixed effects of interest while simultaneously controlling for the nested structure of responses. For continuous outcomes, we specified a normal distribution with an identity link function; for binary outcomes, we specified a binary distribution with a logit link function. For all models, we specified Satterthwaite degrees of freedom and a compound symmetric working correlation structure. We coded accuracy dichotomously (0 = *incorrect*, 1 = *correct*), we effect-coded target sexual orientation (−0.5 = *straight*, 0.5 = *gay*), and we centered target gender typicality at its mean based upon coders' gender ratings of each face from Freeman et al. (2010).[2]

Because we are exploring memory advantages for faces that appear gender-atypical, it is important to consider the role that visual distinctiveness may play in our results. Indeed, although we have theorized that men who are insecure in their masculinity may remember gender-atypical faces in order to preemptively avoid socially contagious interactions, these men might also remember gender-atypical faces because they are distinctive. We addressed this possibility in each of our studies. In Study 1, we used a unique covariate to begin testing whether visual distinctiveness drives any apparent memory advantages for gender-atypical faces. One proxy for perceivers' exposure to gender-atypical people is the base rate of sexual minorities living in a particular area. Indeed, sexual minority individuals are more gender-atypical than their heterosexual peers on average (Bailey & Zucker, 1995), and the size of gay populations varies geographically (Gates, Ost, &

Birch, 2004). If visual distinctiveness accounts for memory advantages for gender-atypical faces, then controlling for exposure to lesbian/gay people should reduce the magnitude of the effect. To test this possibility, we used participants' ZIP codes to compute demographic-level indices of exposure to gender-atypical people, including population size, number of households headed by same-sex couples, and proportion of households headed by same-sex couples in each census district (for additional details, see Lick, Tornello, Riskind, Schmidt, & Patterson, 2012). While these measures are imperfect proxies of participants' exposure to gender-atypical people, they provide an initial test of whether straight men's enhanced memory for gender-atypical faces occurs over and above the visual distinctiveness of those faces, which we build upon in subsequent studies.

Inspection time. We first tested whether perceivers differentially attended to gay and gender-atypical faces during initial processing by regressing inspection time onto target sexual orientation and target gender typicality separately. Neither target sexual orientation nor target gender typicality reliably predicted inspection time, Bs = −0.28 and −0.09, SEs = 0.20 and 0.10, zs = −1.37 and −0.94, ps = .171 and .348, respectively. Thus, participants spent the same amount of time previewing gender-atypical and gender-typical faces, as well as gay and straight faces.

Recognition accuracy. Next, we tested whether recognition accuracy varied as a function of target characteristics. We predicted that, in general, straight men would demonstrate heightened recognition for gay and gender-atypical faces relative to straight and gender-typical faces. Moreover, we expected these biases to be driven by target gender typicality rather than sexual orientation. That is, we predicted that controlling for facial gender typicality would eradicate any apparent memory advantages for gay relative to straight faces, because gendered features are the proximal cues that perceivers use to decode sexual orientation (Freeman et al., 2010; Johnson et al., 2007; Lick et al., 2013).

To test these hypotheses, we first regressed accuracy onto target sexual orientation and target gender typicality separately. Perceivers were 15% more likely to accurately recall gay men's faces relative to straight men's faces, B = 0.14, SE = 0.07, z = 2.04, p = .042, OR = 1.15, and 21% more likely to accurately recall gender-atypical relative to gender-typical faces, B = 0.19, SE = 0.04, z = 5.47, p < .001, OR = 1.21. We then regressed accuracy onto target sexual orientation and target gender typicality simultaneously. As expected, participants remained 20% more likely to accurately recall gender-atypical relative to gender-typical faces when controlling for target sexual orientation, B = 0.18, SE = 0.04, z = 4.89, p < .001, OR = 1.20. However, controlling for target gender typicality reduced the effect of target sexual orientation to nonsignificance, B = 0.06, SE = 0.07, z = 0.85, p = .396, OR = 1.06. That is, gender atypicality fully accounted for straight men's enhanced memory for gay male faces. Thus, the memory advantages we observed were driven by targets' gendered features rather than their sexual orientations per se.

To test the robustness of these effects, we conducted a final analysis that controlled for all demographic variables collected during the study (i.e., participant age, political ideology, education, religiosity, population size, and proportion/number of same-sex couples in the census district). We were particularly interested in whether the density of sexual minorities in a given environment helped to explain our effects. Although we did not have a priori hypotheses about the association of other demographic variables (e.g., age) with straight men's memory for gender-atypical faces, we controlled for all of the other background variables we collected in order to provide a conservative test of the generality of our findings. After controlling for these covariates, the effect of target gender typicality on accuracy remained significant and of similar magnitude as before, B = 0.20, SE = 0.04, z = 5.37, p < .001. Collectively, these findings indicate that straight men have upwardly biased recognition of gender-atypical relative to

gender-typical male faces, which is independent from target sexual orientation, all perceiver characteristics measured during the study, and the density of sexual minorities in participants' local environments.

Recognition confidence. We conducted an identical series of analyses to explore recognition confidence. Although we did not have strong a priori hypotheses, we included these analyses as an exploratory test of whether perceivers have explicit knowledge of their memory advantage for gender-atypical faces. Confidence ratings were similar for gay and straight faces, $B = 0.04$, $SE = 0.04$, $z = 1.11$, $p = .265$, but were significantly higher for gender-atypical relative to gender-typical faces, $B = 0.12$, $SE = 0.03$, $z = 4.49$, $p < .001$. After controlling for the effect of target sexual orientation, participants continued to report more confidence when recognizing gender-atypical relative to gender-typical faces, $B = 0.12$, $SE = 0.03$, $z = 4.19$, $p < .001$, and this effect also remained significant after controlling for all covariates listed in the previous analyses, $B = 0.16$, $SE = 0.03$, $z = 5.85$, $p < .001$. Thus, straight men were not only more accurate when recalling gender-atypical relative to gender-typical male faces, but they were also more confident in their judgments.

In aggregate, results from Study 1 supported our hypothesis that straight men exhibit upwardly biased memory for gender-atypical male faces. This bias occurred despite the fact that we instructed participants to memorize the faces and gave them unlimited time to do so. In fact, the men in this study seem to have processed gender-atypical faces with special efficiency, as they previewed them for the same amount of time as gender-typical faces yet remembered them better in a subsequent memory test. Furthermore, these findings were robust to controls for perceiver demographics and exposure to sexual minorities in daily life, who on average tend to appear gender-atypical. Thus, Study 1 provided initial evidence that straight men generally remember gender-atypical faces better than gender-typical faces.

Study 2

Study 1 revealed that straight men have upwardly biased recognition of gender-atypical male faces. We now turn to our second prediction—namely, that this bias is driven by feelings of gender insecurity among perceivers. Researchers have long known that some men feel chronically insecure about their masculinity (Eisler & Skidmore, 1987), and that such insecurity predicts diverse social outcomes, including risk taking (Eisler, 1995), violence (Jakupcak, Lisak, & Roemer, 2002), and negative evaluations of gender-atypical others (Glick et al., 2007). Here, we tested whether gender insecurity is also associated with memory biases in face perception. In light of recent research about straight men's fears of stigma by association (Buck, 2010; Buck et al., 2013), we predicted that men who were insecure about their masculinity would be vigilant to gender-atypical male faces. Furthermore, based on results from Study 1, we did not expect men to have notable memory advantages for gay men's faces. Instead, we expected any memory effects related to targets' sexual orientations to be driven primarily by target gender atypicality, as gendered features are the proximal cues perceivers use to infer that men are gay.

Method

Participants. One hundred five straight men from the United States participated in an online study. Participants were 28.85 years old on average ($SD = 9.44$ years), most were White (77% White, 10% Asian, 3% Black, 6% Latino, 4% biracial), and they hailed from diverse geographic locations (33 states reported).

Stimuli. Stimuli were identical to Study 1.

Procedure. We recruited Internet users from Amazon Mechanical Turk for a series of ostensibly unrelated tasks, with no mention of gender or sexual orientation. After providing consent, participants completed the demographic survey described in Study 1, and only heterosexually

identified men continued with the study. Eligible participants then completed a series of filler surveys in counterbalanced order, which included a measure of gender insecurity (Masculine Gender Role Stress [MGRS]; Eisler & Skidmore, 1987) on which they rated the stressfulness (1 = *not at all stressful* to 7 = *very stressful*) of 40 situations (e.g., "Being perceived by someone as gay"). Total scores indicated participants' overall levels of gender insecurity (Cronbach's $\alpha = .93$), with subscales indicating fears of physical inadequacy, emotional inexpressiveness, subordination to women, intellectual inferiority, and performance failure (Cronbach's αs = .81, .79, .90, .81, and .87, respectively).

Next, participants completed a face recognition task, which we changed from Study 1 in order to test the robustness of our effects under different encoding conditions. Unlike Study 1, in which participants previewed each face for as long as they wished, participants in Study 2 viewed 24 faces in random order for 1 s each, with no mention of an impending memory test. We instructed participants: "Today, we are interested in your impressions of men's faces. First, you will see each of the faces so that you know what they look like. Please pay careful attention, even though you will not provide any judgments yet." After previewing the faces, participants played a "Where's Waldo" distractor task before a surprise recognition test that was identical to Study 1.

Results and Discussion

We explored the moderating role of gender insecurity in men's recognition of gender-atypical others using GEEs. Analytic procedures and coding strategies were identical to Study 1.

Preliminary analyses. We first aimed to replicate our finding that straight men are more accurate and confident when recognizing gender-atypical men's faces relative to gender-typical men's faces. To do so, we regressed accuracy onto target sexual orientation and target gender typicality separately. Perceivers recalled gay and straight men's faces with similar levels of accuracy, $B = -0.03$, $SE = 0.06$, $z = -0.55$, $p = .586$, OR = 0.97, but they were more likely to accurately recall gender-atypical faces relative to gender-typical faces, $B = 0.10$, $SE = 0.04$, $z = 2.69$, $p = .007$, OR = 1.11. After accounting for the effect of target sexual orientation, target gender typicality remained strongly predictive of accuracy, $B = 0.11$, $SE = 0.04$, $z = 2.94$, $p = .003$, OR = 1.12, and this effect persisted after accounting for all covariates, $B = 0.12$, $SE = 0.04$, $z = 3.05$, $p = .002$, OR = 1.13.

As before, we conducted a series of regressions to explore associations between target characteristics and recognition confidence. Perceivers reported similar confidence in their ability to recognize gay and straight men's faces, $B < 0.01$, $SE = 0.03$, $z = 0.10$, $p = .924$, but they reported significantly greater confidence when recognizing gender-atypical relative to gender-typical faces, $B = 0.14$, $SE = 0.02$, $z = 6.40$, $p < .001$. After controlling for the effect of target sexual orientation, target gender typicality continued to predict confidence, $B = 0.15$, $SE = 0.02$, $z = 6.60$, $p < .001$, and this effect remained significant after accounting for all other covariates, $B = 0.15$, $SE = 0.02$, $z = 6.71$, $p < .001$. Overall, these results replicated and extended our initial findings by demonstrating that straight men have heightened ability and confidence when recognizing gender-atypical male faces, even when they were uninformed of an impending memory test and when we controlled for personal and environmental characteristics (e.g., density of sexual minorities in a given ZIP code).

Gender insecurity. Our primary goal in Study 2 was to test whether gender insecurity moderated straight men's recognition of gender-atypical male faces. Indeed, we have argued that feelings of masculine insecurity may direct observers' perceptual resources in a fashion that avoids further threat, leading gender-insecure men to recognize gender-atypical faces with especially high accuracy. To test this hypothesis, we regressed accuracy onto target gender typicality, total MGRS score, and their interaction. The expected

two-way interaction emerged, $B < 0.01$, $SE < 0.01$, $z = 1.97$, $p = .049$ (see Figure 1). We decomposed this interaction by examining the simple slope of target gender typicality on accuracy centered at one standard deviation above and below the mean of the MGRS scale. Men lower in gender insecurity were no more likely to recognize gender-atypical relative to gender-typical faces, $B = 0.02$, $SE = 0.05$, $z = 0.34$, $p = .736$, OR = 1.02. However, men higher in gender insecurity were 17% more likely to accurately recognize gender-atypical relative to gender-typical targets, $B = 0.16$, $SE = 0.05$, $z = 3.12$, $p = .002$, OR = 1.17. We also tested whether this effect obtained for each subscale of the MGRS. Identical trends emerged for the Physical Inadequacy, Emotional Inexpressiveness, and Performance Failure subscales of the MGRS (Table 1). Thus, as gender insecurity increased, straight men displayed better memory for gender-atypical male faces relative to gender-typical male faces.

Although we did not have a priori hypotheses about the effect of gender insecurity on confidence ratings, we conducted additional analyses to explore this possibility. We regressed confidence onto target gender typicality, total MGRS score, and their interaction. The two-way interaction was not significant, $B < -0.01$, $SE < 0.01$, $z = -0.64$, $p = .522$. These findings suggest that men with insecure masculinity were vigilant to gender-atypical male faces, though they may not have realized this was the case, as confidence ratings did not vary as a function of gender insecurity.

In sum, Study 2 provided additional support for our hypothesis that straight men exhibit heightened recognition of gender-atypical compared to gender-typical male faces. Although this effect is interesting in and of itself, the mechanisms underlying this memory advantage are the key focus of our current work. Study 2 identified one such mechanism, demonstrating that men's feelings of gender insecurity moderate their memory for gender-atypical male faces. Across multiple subscales, as men felt increasingly insecure of their masculinity, they showed enhanced recognition of gender-atypical male faces. In fact,

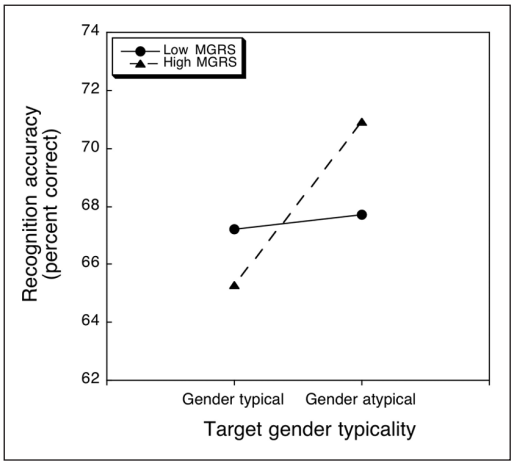

Figure 1. Recognition accuracy as a function of masculine gender role stress (± 1 *SD*) and target gender typicality (± 1 *SD*) in Study 2.

this memory advantage only emerged among those men relatively high in masculine insecurity (i.e., 1 *SD* above the mean). The fact that men who felt more secure in their masculinity did not show enhanced memory for gender-atypical faces suggests that the effect is not driven by the visual distinctiveness of gender-atypical faces alone.

It is interesting to note that gender insecurity did not moderate men's confidence in their recognition of gender-typical versus gender-atypical faces. This suggests that, although men who were insecure in their masculinity were apt to remember gender-atypical faces, they may have had little insight into this process. In fact, the point-biserial correlation between accuracy and confidence was quite modest in the current study ($r = .19$). Our data could not pinpoint precise reasons for the relatively weak association between accuracy and confidence ratings, though we are reassured by the fact that accuracy and confidence ratings were also weakly correlated in previous studies of face perception (Rule, Ambady, Adams, & Macrae, 2008). Furthermore, while certainly intriguing, this finding was tangential to our primary interest in recognition accuracy. On that point, the results of Study 2 were quite clear, revealing that masculinity threat predicts men's enhanced recognition of gender-atypical male faces.

Table 1. Interactions and simple slopes between target gender typicality and MGRS in Study 2.

MGRS subscale	*B*	*SE*	*z*	*p*
Physical inadequacy	−0.01	< 0.00	−1.83	.067
1 *SD* low	0.04	0.05	0.70	.482
1 *SD* high	0.17	0.05	3.18	.002
Emotional inexpressiveness	−0.01	< 0.00	−1.78	.075
1 *SD* low	0.03	0.05	0.68	.499
1 *SD* high	0.15	0.05	3.06	.002
Performance failure	−0.01	< 0.00	−2.61	.009
1 *SD* low	0.02	0.05	0.43	.671
1 *SD* high	0.17	0.05	3.67	<.001
Subordination to women	< –0.01	< 0.00	−1.13	.260
1 *SD* low	0.06	0.06	1.09	.275
1 *SD* high	0.15	0.05	2.99	.003
Intellectual inferiority	< –0.01	< 0.00	−0.58	.559
1 *SD* low	0.07	0.05	1.39	.165
1 *SD* high	0.12	0.05	2.21	.027

Study 3

Studies 1 and 2 supported our prediction that straight men are vigilant to gender-atypical male faces, especially when they feel insecure about their masculinity. These initial tests of our hypotheses were restricted to male perceivers because the proposed effect was highly specific. That is, we aimed to test *men's* responses to gender-atypical *male* faces, given the robust literature linking masculinity threat to men's behavioral responses to other men (Glick et al., 2007; Neuberg et al., 1994). Still, it remains important to test the sex specificity of these effects. If the memory advantage for gender-atypical faces is indeed uniquely related to men's gender insecurity, as we have theorized, then women's recognition accuracy should show no systematic bias favoring gender-atypical men's faces. This pattern of results would also help to rule out the more general possibility that visual distinctiveness drives the memory advantage for gender-atypical faces. Study 3 accomplished these goals by examining associations between gender insecurity and biased recognition of gender-atypical male faces among both male and female perceivers. We predicted that gender insecurity would moderate memory advantages for gender-atypical male faces among men, but not women. If correct, these findings will provide additional evidence for our claim that masculine insecurity uniquely predicts men's recognition of gender-atypical male faces.

Method

Participants. Two hundred thirty straight Internet users from the United States (113 men) participated in an online study. Participants were 34.40 years old on average (*SD* = 11.61 years), and most were White (77% White, 10% Asian, 7% Black, 3% Latino, 2% biracial).[3]

Stimuli. Stimuli were identical to those used in Studies 1 and 2.

Procedure. Procedures were identical to Study 2 with one exception: Here, we recruited both men and women who completed sex-specific forms of the Gender Role Stress Scale. Men completed the Masculine Gender Role Stress Scale (MGRS; Eisler & Skidmore, 1987) as described in Study 2. Total scores indicated overall levels of masculine insecurity (Cronbach's α = .93), with subscales measuring fears of physical inadequacy, emotional inexpressiveness, subordination to women,

intellectual inferiority, and performance failure (Cronbach's αs = .84, .81, .91, .81, .91, respectively). Women completed the Feminine Gender Role Stress Scale (FGRS; Gillespie & Eisler, 1992), rating the stressfulness (1 = *not at all stressful* to 7 = *very stressful*) of 39 situations (e.g., "Feeling less attractive than you once were"). Total scores indicated overall levels of feminine insecurity (Cronbach's α = .92), with subscales measuring fears of unemotional relationships, being perceived as unattractive, victimization, behaving assertively, and not being nurturing (Cronbach's αs = .83, .87, .73, .81, .81, respectively).

Results and Discussion

We explored the moderating role of gender insecurity in biased recollections of gender-atypical male faces among both men and women using GEEs. Our analytic procedures were identical to Study 2 with one exception: Because the items and subscales differed across the MGRS and FGRS, we centered each measure within its respective sex category (i.e., MGRS centered within men, FGRS centered within women) and examined specific contrasts rather than multiway interactions to improve the clarity of our interpretation.

Preliminary analyses. In a series of preliminary analyses, we tested for basic differences in recognition accuracy as a function of targets' sexual orientations and gendered appearances. First, we regressed accuracy onto target sexual orientation. Results indicated no significant differences in recognition of gay and straight men's faces in the sample overall, $B = 0.02$, $SE = 0.04$, $z = 0.51$, $p = .612$. Next, we regressed accuracy onto target gender typicality. Again, results indicated no significant differences in recognition of gender-typical relative to gender-atypical men's faces in the sample overall, $B = 0.03$, $SE = 0.03$, $z = 1.21$, $p = .226$. Thus, as a whole, participants recognized gender-typical and gender-atypical faces of both gay and straight men with similar accuracy.

Next, we tested whether perceiver sex moderated the gender typicality effect of interest. Specifically, we regressed accuracy onto perceiver sex, target gender typicality, and their interaction. The two-way interaction was not significant, $B = -0.04$, $SE = 0.05$, $z = -0.71$, $p = .475$. We conducted a parallel analysis to examine participants' confidence in their recognition. Again, the two-way interaction was not significant, $B < 0.01$, $SE = 0.03$, $z = -0.12$, $p = .905$. The reliability of these effects did not change when controlling for all demographic variables collected during the study (ps > .274). Thus, men and women had similar levels of accuracy and confidence in their recognition of gender-atypical men's faces. It is important to note, however, that our hypotheses were specific to insecure men's recognition of gender-atypical male faces; as such, we would not necessarily expect sample-wide effects to emerge.

Gender insecurity. To test our primary hypothesis, we examined how gender insecurity predicted face recognition among male and female perceivers. We predicted that gender insecurity would be associated with better recognition of gender-atypical faces relative to gender-typical faces among men but not women.[4] Because the items in the MGRS and FGRS differed, we centered the scales within their respective sex categories (i.e., MGRS centered within men, FGRS centered within women) and examined specific contrasts of interest—namely, the two-way interaction between gender insecurity and target gender typicality within each sex category.

Among women, the two-way interaction between gender insecurity and target gender typicality was not significant, $B < 0.01$, $SE < 0.01$, $z = 1.28$, $p = .199$. Among men, however, the two-way interaction between gender insecurity and target gender typicality was significant, $B < 0.01$, $SE < 0.01$, $z = 3.23$, $p = .001$ (see Figure 2). We decomposed this interaction by examining simple slopes of target gender typicality centered at 1 standard deviation above and below the mean of gender insecurity. Men higher in gender insecurity showed better recognition of gender-atypical relative to gender-typical faces, $B = 0.14$, $SE = 0.04$, $z = 3.32$, $p = .001$. Men lower in gender insecurity showed no difference in their recognition of

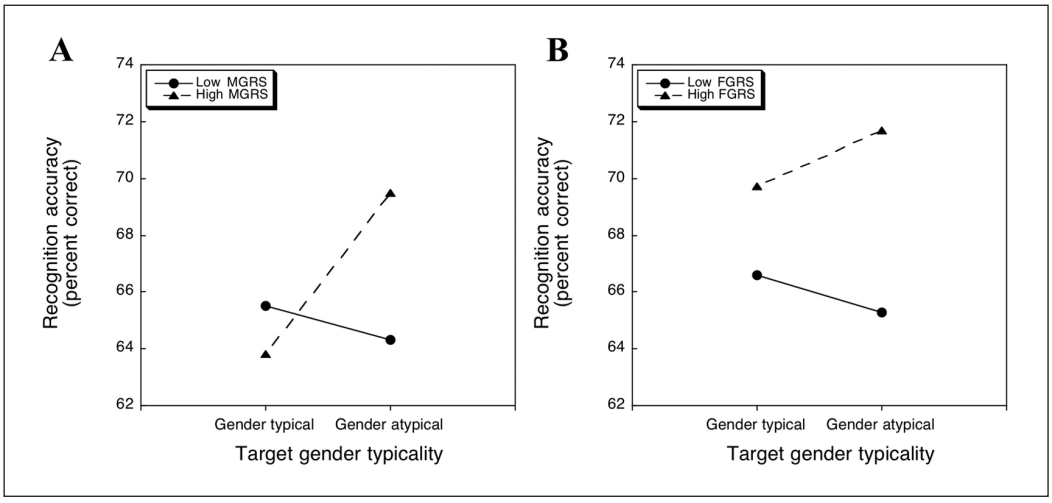

Figure 2. Recognition accuracy among men as a function of masculine gender role stress (± 1 *SD*) and target gender typicality (± 1 *SD*; 2A), and among women as a function of feminine gender role stress (± 1 *SD*) and target gender typicality (± 1 *SD*; 2B) in Study 3.

Table 2. Interactions and simple slopes between target gender typicality and MGRS in Study 3.

MGRS subscale	*B*	*SE*	*z*	*p*
Physical inadequacy	< 0.01	<0.00	2.78	.006
1 *SD* low	−0.03	0.04	−0.77	.438
1 *SD* high	0.13	0.05	2.81	.005
Emotional inexpressiveness	< 0.01	<0.00	0.54	.586
1 *SD* low	0.03	0.05	0.63	.527
1 *SD* high	0.07	0.05	1.35	.178
Performance failure	0.01	<0.00	2.05	.041
1 *SD* low	−0.01	0.04	−0.18	.855
1 *SD* high	0.10	0.05	2.25	.025
Subordination to women	0.01	<0.00	2.22	.026
1 *SD* low	−0.02	0.05	−0.42	.672
1 *SD* high	0.12	0.04	2.96	.003
Intellectual inferiority	0.01	<0.00	−4.13	< .001
1 *SD* low	−0.07	0.04	−1.73	.083
1 *SD* high	0.17	0.04	3.93	< .001

gender-atypical relative to gender-typical faces, $B = -0.05$, $SE = 0.04$, $z = -1.05$, $p = .296$. Identical trends emerged for the Physical Inadequacy, Performance Failure, Intellectual Inferiority, and Subordination to Women subscales of the MGRS (Table 2). Thus, as gender insecurity increased, straight men displayed better memory for gender-atypical faces relative to gender-typical male faces.

We also regressed confidence onto gender insecurity, target gender typicality, and their interaction within each sex category. The two-way interactions were not significant for men or women, *B*s = 0.04 and 0.03, *SE*s = 0.03 and 0.04,

zs = 1.61 and 0.76, ps = .107 and .450. Thus, as in our previous study, gender insecurity did not moderate the confidence with which participants recalled gender-atypical male faces.

Collectively, these findings supported our hypothesis that gender insecurity moderates men's, but not women's, recognition of gender-atypical faces. As such, Study 3 demonstrates the sex specificity of the effect we are investigating. While gender insecurity leads to better social memory in general, it is especially predictive of men's recognition of gender-atypical male faces. Because we did not observe a significant main effect of target gender atypicality in the sample overall, and because women did not show a similar pattern of heightened recognition for gender-atypical men when they felt insecure of their gender identity, we argue that these effects cannot be explained by visual distinctiveness alone. Rather, men's gender insecurity uniquely enables them to remember gender-atypical male faces.

Study 4

Studies 1–3 revealed that straight men (but not straight women) are vigilant to gender-atypical male faces when they feel insecure about their gender identity. While this pattern of effects supported our hypotheses and replicated across multiple independent samples, two points deserve further scrutiny. First, because we were interested primarily in memory advantages for gender-atypical faces as they related to masculinity threat, our initial studies included only male targets. However, it remains possible that women who are insecure in their gender also have preferential memory for gender-atypical others, but only when recognizing other women. That is, the effects we have observed may be specific to one's sex category ingroup, such that gender-insecure men remember gender-atypical men and gender-insecure women remember gender-atypical women. While possible, we do not expect this to be the case, because femininity threats have not been linked to a fear of socially contagious interactions with gender-atypical women in prior work.

Second, Studies 2 and 3 both revealed that gender insecurity moderated men's memory for gender-atypical male faces, such that men who were relatively more insecure in their masculinity were especially likely to remember gender-atypical men. Because we assessed gender insecurity with an individual difference measure, we believe that these findings capture a phenomenon related to relatively chronic feelings of gender identity threat. Importantly, however, both of these studies measured masculinity threat *before* the preview and recognition phases. It therefore remains possible that our measurement of gender insecurity primed masculinity threat and subsequently influenced the memory effects we observed. This sort of priming effect would not invalidate our findings, but it would indicate that merely thinking about their gender identity made masculinity concerns salient for some men and subsequently affected their recall of gender-atypical faces. In light of these possibilities, it would be useful to determine whether the impact of masculinity threat on recognition represents a stable or more transitory process.

Study 4 addressed both of these issues simultaneously. Specifically, we built upon our previous studies by testing recognition memory among both male and female perceivers who viewed both male and female targets that varied in gender typicality. Importantly, all perceivers responded to measures of gender insecurity, but they were randomly assigned to do so either before or after completing the facial memory task. In this way, we were able to systematically test whether pondering one's gender insecurity causes some individuals to remember gender-atypical faces, and whether these effects generalize across male and female targets.

Method

Participants. One hundred eighty-eight straight Internet users from the United States (72 men) participated in an online study. Participants were 39.04 years old on average (SD = 13.96 years), and most were White (74% White, 6% Asian, 11% Black, 6% Latino, 3% biracial).

Stimuli. Stimuli were 80 grayscale facial photographs that varied between target by sex, sexual orientation, and gender typicality (10 gay gender-typical men, 10 gay gender-atypical men, 10 straight gender-typical men, 10 straight gender-atypical men, 10 lesbian gender-typical women, 10 lesbian gender-atypical women, 10 straight gender-typical women, 10 straight gender-atypical women). As before, these faces were a subsample of stimuli from Freeman et al. (2010), in which 10 coders rated the gender typicality of 158 faces (1 = *gender typical* to 7 = *gender atypical*). Based upon mean scores for each face, we chose the 10 most gender-typical and gender-atypical stimuli for each sex and sexual orientation category to yield the 80 faces described before. As in our previous studies, all of the faces were cropped to include hair as a visible cue but to exclude external context. Furthermore, all of the faces were White and had no visible tattoos or facial piercings.

Procedure. We recruited male and female Internet users from Amazon Mechanical Turk for a series of ostensibly unrelated tasks, with no mention of gender or sexual orientation. After providing consent, participants completed the demographic survey described in Study 1, and only heterosexually identified individuals were invited to continue the study. Eligible participants were then randomly assigned to complete the gender insecurity measures before or after the face recognition task. As in Study 3, men completed the Masculine Gender Role Stress Scale (MGRS; Eisler & Skidmore, 1987). Total scores indicated overall level of masculine insecurity (Cronbach's α = .94), with subscales measuring fears of physical inadequacy, emotional inexpressiveness, subordination to women, intellectual inferiority, and performance failure (Cronbach's αs = .84, .78, .93, .81, .91, respectively). Women completed the Feminine Gender Role Stress Scale (FGRS; Gillespie & Eisler, 1992). Total scores indicated overall level of feminine insecurity (Cronbach's α = .94), with subscales measuring fears of unemotional relationships, being perceived as unattractive, victimization, behaving assertively, and not being nurturing (Cronbach's αs = .89, .89, .82, .89, .85, respectively). Procedures for the face recognition paradigm itself were identical to Studies 2 and 3 with one exception—all participants saw both male and female faces that varied by sexual orientation and gender typicality. Thus, the factors that differentiated Study 4 from our previous studies were that (a) both male and female participants viewed both male and female targets, and (b) participants reported their level of gender role stress either before or after the face recognition task.

Results and Discussion

We again explored the moderating role of gender insecurity in biased recollections of gender-atypical faces using GEEs. Our analytic procedures were similar to Study 3 with two exceptions. First, we included the timing of the gender role stress measure in our analyses (effect-coded: −0.5 = *before recognition task*, 0.5 = *after recognition task*; hereafter, test period). Second, we included each target's sex category in our analyses (effect-coded: −0.5 = *male*, 0.5 = *female*; hereafter, target sex). All other analytic procedures and coding strategies were identical to Study 3.

Preliminary analyses. In a series of preliminary analyses, we tested for basic differences in recognition accuracy as a function of targets' sexual orientations and gendered appearances. First, we regressed accuracy onto target sexual orientation. Results indicated more accurate recall of gay relative to straight faces in the sample overall, B = 0.19, SE = 0.03, z = 5.87, p < .001. Importantly, this effect was moderated by target sex, B = −0.45, SE = 0.06, z = −7.23, p < .001. We decomposed this interaction by examining simple slopes of target sexual orientation within each sex category. Participants had better memory for gay relative to straight male targets, B = 0.41, SE = 0.05, z = 8.96, p < .001, but sexual orientation was unrelated to their memory for female targets, B = −0.03, SE = 0.04, z = −0.74, p = .460.

We then regressed accuracy onto target gender typicality. Results indicated that participants had better memory for gender-atypical relative to

gender-typical faces in the sample overall, $B = 0.03$, $SE = 0.01$, $z = 2.33$, $p = .020$. Again, however, this effect was moderated by target sex, $B = -0.17$, $SE = 0.03$, $z = -5.20$, $p < .001$, which we probed by examining simple slopes of target gender typicality within each sex category. Participants had better memory for gender-atypical relative to gender-typical male targets, $B = 0.16$, $SE = 0.03$, $z = 5.71$, $p < .001$, but gender typicality was unrelated to their memory for female targets, $B = -0.01$, $SE = 0.02$, $z = -0.50$, $p = .617$.

Next, we tested whether perceiver sex moderated the gender typicality effect of interest. Specifically, we regressed accuracy onto perceiver sex, target sex, target gender typicality, and all interactions. The three-way interaction was not significant, $B = 0.02$, $SE = 0.07$, $z = 0.28$, $p = .780$. This finding indicates that both male and female perceivers exhibited better memory for gender-atypical male faces relative to gender-typical male faces, but not for female faces.

We conducted a parallel set of analyses to examine participants' confidence in their recognition. First, we regressed confidence onto target sexual orientation. Results indicated more confident recall of gay relative to straight faces in the sample overall, $B = 0.09$, $SE = 0.02$, $z = 4.57$, $p < .001$. Importantly, this effect was moderated by target sex, $B = -0.08$, $SE = 0.04$, $z = -2.14$, $p = .032$, which we probed by examining simple slopes of target sexual orientation centered within each sex category. Similar to the findings for accuracy, participants were more confident in their memory for gay relative to straight male targets, $B = 0.14$, $SE = 0.03$, $z = 4.81$, $p < .001$, but target sexual orientation was not as strongly related to their confidence for recognition of female targets, $B = 0.05$, $SE = 0.03$, $z = 1.68$, $p = .092$.

Next, we regressed confidence onto target gender typicality. Results indicated no significant association between these factors overall, $B = -0.02$, $SE = 0.01$, $z = -1.47$, $p = .141$, though the effect was moderated by target sex, $B = -0.05$, $SE = 0.02$, $z = -2.35$, $p = .019$. Participants were more confident in their memory for gender-atypical relative to gender-typical male targets, though this effect was not statistically reliable, $B = 0.02$, $SE = 0.02$, $z = 1.40$, $p = .162$. Participants were somewhat more confident in their memory for gender-typical relative to gender-atypical female targets, $B = -0.02$, $SE = 0.01$, $z = -1.93$, $p = .053$.

Finally, we tested whether perceiver sex moderated the gender typicality effect of interest. Specifically, we regressed confidence onto perceiver sex, target sex, target gender typicality, and all interactions. The three-way interaction was not significant, $B = -0.03$, $SE = 0.04$, $z = -0.67$, $p = .501$. This indicates that both male and female perceivers had somewhat greater confidence in their memory for gender-atypical relative to gender-typical male faces, and gender-typical relative to gender-atypical female faces.

Gender insecurity. Next, we turned to our focal questions, testing whether gender insecurity moderated face recognition of male and female targets among both male and female perceivers. As in Study 3, the items in the MGRS and FGRS differed, so we centered each measure within its respective sex category (i.e., MGRS centered within men, FGRS centered within women) and examined specific contrasts of interest—namely, the four-way interaction between target sex, target gender typicality, gender insecurity, and test period within each sex category.

Among women, the four-way interaction was not significant, $B < 0.01$, $SE < 0.01$, $z = 0.12$, $p = .901$. This suggests that effects involving the three factors of theoretical interest—target sex, target gender typicality, and gender insecurity—did not vary as a function of the timing (pretest vs. posttest) of the FGRS. Therefore, we collapsed across test period and dropped it from the model to examine the three-way interaction between target gender typicality, target sex, and gender insecurity. This interaction was also not significant, $B < 0.01$, $SE < 0.01$, $z = -0.25$, $p = .850$, indicating that the primary pattern of interest—the interaction between target gender typicality and participants' gender insecurity—did not vary as a function of the target's sex (male vs. female). Therefore, we collapsed across target sex

and dropped it from the model to examine the two-way interaction between target gender typicality and gender insecurity. Yet again, the interaction was not significant, $B < 0.01$, $SE < 0.01$, $z = -0.25$, $p = .803$ (see Figure 3). Therefore, in a final analysis, we examined the simple association between accuracy and target gender typicality among female perceivers. Results indicated that, in general, women had better accuracy for gender-atypical relative to gender-typical targets, $B = 0.04$, $SE = 0.02$, $z = 2.29$, $p = .022$. It is worth reiterating, however, that this effect was not moderated by women's gender insecurity, the time at which they reported their gender insecurity, or target sex. Instead, women's memory for gender-atypical faces appears to be a more general effect that was unrelated to the gender identity threats we have explored here.

We conducted an identical series of analyses among men. We began by regressing accuracy onto target sex, target gender typicality, gender insecurity, test period, and all interactions. The four-way interaction was not significant, $B < 0.01$, $SE < 0.01$, $z = -1.30$, $p = .193$. This indicates that effects involving the three factors of theoretical interest—target sex, target gender typicality, and gender insecurity—did not vary as a function of the timing (pretest vs. posttest) of the MGRS. Therefore, we collapsed across test period and dropped it from the model to examine the three-way interaction between target gender typicality, target sex, and gender insecurity. This interaction was also not significant, $B < 0.01$, $SE < 0.01$, $z = 0.45$, $p = .651$, indicating that the primary pattern of interest—the interaction between target gender typicality and gender insecurity—did not vary as a function of the target's sex (male vs. female). Therefore, we collapsed across target sex and dropped it from the model to examine the two-way interaction between target gender typicality and gender insecurity. This predicted interaction was marginally significant, $B = 0.001$, $SE = 0.001$, $z = 1.72$, $p = .086$ (Figure 3). We decomposed the interaction by examining simple slopes centered at one standard deviation above and below the mean on gender insecurity. Men who were lower in gender insecurity showed no preferential memory for gender-typical or gender-atypical others, $B = 0.01$, $SE = 0.02$, $z = 0.39$, $p = .696$. Men who were higher in gender insecurity, on the other hand, showed better memory for gender-atypical relative to gender-typical others, $B = 0.10$, $SE = 0.05$, $z = 2.02$, $p = .043$. Similar two-way interactions emerged for the Emotional Inexpressiveness and Performance Failure subscales of the MGRS (Table 3). Thus, as gender insecurity increased, straight men displayed better memory for gender-atypical faces relative to gender-typical faces of both sexes, regardless of when masculinity threat was measured.[5]

Collectively, results from Study 4 replicated and built upon our previous studies in several important ways. We again found that gender insecurity moderated men's, but not women's, recognition of gender-atypical faces. Moreover, we found that this effect was similar for male and female targets. That is, men with insecure masculinity showed preferential memory for both gender-atypical men and gender-atypical women, revealing that men's vigilance to gender atypicality transcends sex category boundaries. Finally, we found that this vigilance effect was robust to the timing of the gender threat measure, suggesting that the priming of identity threat probably did not produce our findings. In sum, relatively stable feelings of gender insecurity appear to uniquely explain men's (but not women's) memory advantages for gender-atypical faces of both sexes.

General Discussion

Across four studies, we found that straight men have a robust tendency to remember gender-atypical faces. Study 1 revealed that heightened recognition of gender-atypical male faces occurs when men have unlimited time to scan faces and are instructed to prepare for a memory test. Study 1 also demonstrated that men's initial processing of gender-atypical faces is efficient, taking the same amount of time as their processing of gender-typical faces but yielding more accurate results. Study 2 replicated and extended these

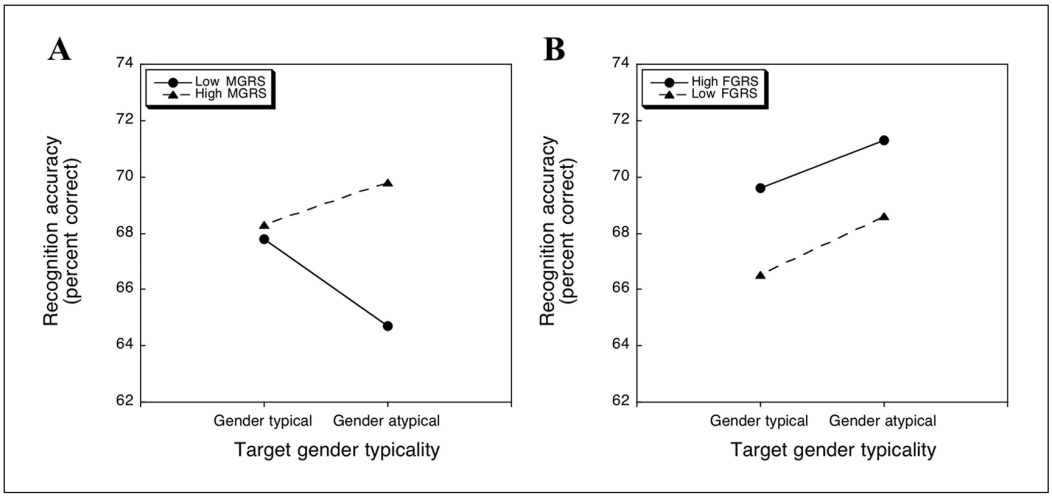

Figure 3. Recognition accuracy among men as a function of masculine gender role stress (± 1 *SD*) and target gender typicality (± 1 *SD*; 3A), and among women as a function of feminine gender role stress (± 1 *SD*) and target gender typicality (± 1 *SD*; 3B) in Study 4.

Table 3. Interactions and simple slopes between target gender typicality and MGRS in Study 4.

MGRS Subscale	*B*	*SE*	*z*	*p*
Physical inadequacy	< 0.01	< 0.00	0.78	.436
1 *SD* low	< 0.01	0.03	0.11	.914
1 *SD* high	0.04	0.03	1.27	.204
Emotional inexpressiveness	0.01	< 0.00	1.74	.082
1 *SD* low	−0.03	0.04	−0.73	.467
1 *SD* high	0.07	0.03	2.06	.040
Performance failure	0.01	< 0.00	2.26	.024
1 *SD* low	−0.03	0.03	−0.83	.406
1 *SD* high	0.07	0.03	2.61	.009
Subordination to women	< 0.01	< 0.00	0.80	.426
1 *SD* low	< 0.00	0.03	0.07	.947
1 *SD* high	0.04	0.03	1.20	.229
Intellectual inferiority	< 0.01	< 0.00	1.26	.207
1 *SD* low	−0.01	0.03	−0.29	.772
1 *SD* high	0.05	0.03	1.62	.105

results, indicating that the memory advantage for gender-atypical male faces also occurred when men were uninformed about an impending recognition test. Furthermore, Study 2 revealed that gender insecurity moderated men's recognition of gender-atypical faces, such that men who were relatively insecure about their masculinity were especially likely to remember gender-atypical male faces. In these initial studies, the memory advantage for gender-atypical faces remained significant after accounting for perceivers' demographic characteristics (e.g., age, education, political ideology) as well as the density of sexual minority people in participants' communities.

Because lesbian/gay people tend to be more gender-atypical than their straight peers, these findings provide indirect evidence that visual distinctiveness does not fully explain straight men's enhanced recognition of gender-atypical male faces.

Although our initial studies could not definitively rule out distinctiveness as a factor underlying men's biased recognition of gender-atypical faces, the specific patterns of moderation that we uncovered do just that. For example, Study 3 revealed that gender insecurity predicted men's but not women's recognition of gender-atypical male faces. In particular, we found that participants who were relatively insecure with their gender identity had better memory for men's faces in general, but that such insecurity predicted memory for gender-atypical faces only among men. Study 4 further buttressed these findings, again showing that gender insecurity predicted men's but not women's recognition of gender-atypical faces. Study 4 also revealed that this effect is somewhat broader than that revealed in our initial studies, insofar as gender insecurity was associated with men's recognition of both gender-atypical male and female faces. Thus, while visual distinctiveness might help to explain baseline differences in perceivers' recognition of gender-atypical versus gender-typical others, it cannot explain the specific pattern of effects we observed here. Instead, it appears that men's memory for gender-atypical faces is tethered to their feelings of gender insecurity.

Collectively, our findings offer several theoretical contributions to existing research on motivated face recognition. First, they extend the vigilance-threat hypothesis by demonstrating that perceivers exhibit memory advantages not only for racial outgroup members (Young et al., 2011), but also for gender-atypical individuals. As such, these findings contribute to a small but growing literature demonstrating that memory advantages are not exclusive to ingroup members, especially when feelings of threat are salient. Our findings also extend evidence for the vigilance-threat hypothesis beyond feelings of physical threat, suggesting that perceptual vigilance also occurs in situations of gender identity threat. This point is both timely and relevant, given the growing body of social psychological research on the consequences of identity threats (Steele, Spencer, & Aronson, 2002).

Our studies also illuminate pathways for continued research on the vigilance-threat hypothesis. For example, the current studies documented memory advantages related to a type of identity threat: gender insecurity. While these data do not allow us to generalize to other threats, they raise the intriguing possibility that other forms of identity threat may lead to memory biases for specific targets. Armed with these insights, researchers are now poised to investigate this possibility in greater detail to determine whether and when diverse identity threats compel perceptual vigilance and recognition biases for members of particular social groups.

Aside from their contributions to research on motivated social memory, our studies also dovetail nicely with recent findings related to precarious manhood. Previous research revealed that straight men are highly motivated to protect their masculinity (Bosson et al., 2005; Bosson et al., 2009), which makes them deeply concerned about being mislabeled as gay (Bosson, Taylor, & Prewitt-Freilino, 2006). Other research has shown that straight men's concerns about being mislabeled as gay are associated with social avoidance of gay men and lesbians (Buck et al., 2013). The current findings unite these two bodies of work, highlighting a perceptual mechanism that straight men may exploit when attempting to protect their masculinity: straight men who experience gender insecurity become vigilant to gender-atypical targets, processing them efficiently and recognizing them accurately, which may help them to dodge socially contagious interactions and foster more traditionally masculine impressions among observers. The fact that these memory advantages emerged for both gender-atypical male and female targets is especially intriguing, but perhaps not surprising. Indeed, it seems likely that gender-insecure men would aim to avoid both gender-atypical men and women, albeit for different reasons. As described before,

contact with gender-atypical male targets makes gender-insecure male perceivers fear being labeled as gay via stigma by association (Buck et al., 2013). Contact with gender-atypical female targets might elicit concerns about appearing low in masculinity by virtue of a comparison between one's own appearance and a gender-atypical woman's appearance. Collectively, then, the current studies bridge recent findings from research about precarious manhood and social contagion. In particular, they suggest that memory advantages for gender-atypical male faces may enable straight men to preemptively avoid social situations that threaten an already tenuous sense of masculinity.

The current findings also contribute to classic theories about gender identity insofar as the association between gender insecurity and biased recognition of gender-atypical faces was specific to men. These findings are consistent with the broader literature on gender threats, which has suggested that the psychological effects of gender insecurity are especially pronounced for men (Bem, 1993). Our work builds upon this assumption within the domain of social vision, demonstrating that gender insecurity strongly guides men's, but not women's, allocation of perceptual resources toward gender-atypical others. Of course, it remains possible that gender insecurity affects women's perceptual processes in ways that do not involve face memory, but tests of this possibility await future study.

It is worth noting that, in all of our studies, straight men's enhanced recognition of male faces was driven by target gender atypicality rather than sexual orientation per se. Although internally consistent, these findings are at odds with a previous study in which straight men recognized straight faces better than gay faces (i.e., an ingroup memory advantage; Rule et al., 2007). There are several reasons why this discrepancy may have occurred, chief among them being differences in stimuli across studies. We selected our stimuli to include both gender-typical and gender-atypical features within each sexual orientation category. Rule et al. (2007) were specifically interested in memory advantages related to sexual orientation, and therefore did not test effects involving gender typicality. This leaves open the possibility that their stimuli covaried in sexual orientation and gender typicality, whereas ours differed along these dimensions orthogonally, allowing distinct patterns to emerge. Another important point is that Rule et al. (2007) recruited college undergraduates, whereas we recruited adults in midlife from Amazon Mechanical Turk. It may be the case that straight undergraduates are especially motivated to affiliate with ingroup members and are therefore more attuned to straight male faces than gay male faces. On the other hand, older straight men may be especially prone to feel threatened by gender-atypical others and are therefore more attuned to gender-atypical faces than to gender-typical faces. Of course, these possibilities are speculative, so it would be hasty to conclude that target sexual orientation is completely unrelated to the memory biases observed here. Indeed, gender typicality and sexual orientation are tightly linked, such that gender-atypical cues provide a basis for perceivers to infer that a target is gay (Freeman et al., 2010; Johnson et al., 2007; Lick et al., 2013). While our data clearly demonstrated that gender-insecure men were attending to gender-atypical facial cues, this may have been because they associated those cues with homosexuality and were vigilant to targets who potentially identified as gay. The relative importance of perceptions of gender atypicality versus sexual orientation for face recognition biases therefore remains an intriguing and open question for future research.

In summary, the current studies offer novel insights into motivational processes operating during the early stages of person perception. Straight men unconsciously attend to gendered facial cues, processing gender-atypical others with remarkable efficiency when they have an insecure sense of their own masculinity. This biased form of face recognition highlights a previously unexplored outcome of masculinity threat, highlighting a perceptual means by which straight men may avoid gender-atypical and gay men in their immediate social environments.

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Notes

1. Although the faces varied in their gendered appearance, they were unambiguously male. It is unlikely that participants mistook any of these faces to be women, especially given perceivers' near-perfect ability to make accurate sex categorizations based upon facial features (Brewer & Lui, 1989).
2. We also conducted signal detection analyses (Stanislaw & Todorov, 1999) to test perceivers' sensitivity to gender-atypical faces. However, these analyses required us to dichotomize the gender-typical versus gender-atypical faces rather than relying on continuous ratings, which resulted in a dramatic loss of power. Moreover, nearly all of the effects replicated using the signal detection framework, so the analyses were largely redundant. For these reasons, we do not report our signal detection analyses in the main body of the text, but have made the results available in an electronic supplement to this article.
3. Due to a programming error, we did not collect ZIP code data in this study.
4. At the request of an anonymous reviewer, we also tested the basic association between gender insecurity and recognition accuracy, regardless of perceiver sex. Although not a primary focus of the current paper, this analysis may provide further evidence for our theory that gender identity threats are broadly associated with face recognition. To test this possibility, we first created a gender insecurity variable that did not differentiate between male and female perceivers. Because men and women responded to different numbers of items about gender role stress, we averaged the scores within each sex category (i.e., MGRS / 40; FGRS / 39) and then combined the scores into a single gender insecurity variable, on which higher scores indicated more insecurity. Then, we regressed accuracy onto gender insecurity. A reliable effect emerged, $B = 0.10$, $SE = 0.05$, $z = 2.21$, $p = .033$, indicating that perceivers who were insecure about their gender identity were more likely to accurately recognize men's faces overall. Similar effects did not obtain for self-reported confidence: Perceivers showed similar confidence in their face recognition ability regardless of their gender insecurity, $B = -0.02$, $SE = 0.10$, $z = -0.23$, $p = .819$. Thus, in general, perceivers who were insecure in their gender had enhanced facial memory. Broadly speaking, this analysis buttresses our claim that identity threats are associated with social vigilance, regardless of targets' gendered appearances.
5. We conducted a parallel series of analyses to examine confidence in face memory based upon target sex, target gender typicality, gender insecurity, and test period. None of the two-, three-, or four-way interactions were significant for either men or women (all ps > .15), so we do not report them here to preserve space.

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