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Testing the Impact of Appearance on Individuals Perceived Association with Science, Technology, Engineering, and Math (STEM) Fields

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Testing the Impact of Appearance on Individuals Perceived Association with Science, Technology, Engineering, and Math (STEM) Fields

A dissertation submitted in partial satisfaction of the requirements for Doctor of Philosophy in Psychology

by

Jessica Lee Shropshire

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ABSTRACT OF THE DISSERTATION

Testing the Impact of Appearance on Individuals Perceived Association with Science, Technology, Engineering, and Math (STEM) Fields

by

Jessica Lee Shropshire

Doctor of Philosophy in Psychology

University of California, Los Angeles, 2021

Professor Kerri Johnson, Chair

Women and racial minorities remain underrepresented in Science, Technology, Engineering, and Math (STEM)—career fields historically dominated by White men. This lack of representation results in missed opportunities for individual advancement and the advancement of STEM fields broadly. Here, I propose that a perceived visual mismatch between identity-based appearance cues with STEM domains is one such factor that can help explain marginalized individuals' lack of representation in STEM career fields. Overall, I propose that the extent to which an individual is associated with STEM is driven by visual indices of sex, gender, and race. Study Set 1 examined the role of gendered appearance in STEM-linked career judgments over and above the effect of sex alone. Results indicated that observers associated facial femininity with humanities career fields and facial masculinity with STEM career fields. These patterns occurred for judgments of faces that varied naturally (Study 1a) and that were systematically manipulated (Study 1b). And this pattern replicates in a between-subjects design where participants make independent judgments of STEM or humanities rather than a forced choice categorization between the two (Study 1c). As such, Study Set 1 provides convergent evidence and causal support that being facially feminine weakens STEM associations. Study Set 2 examined whether gendered visual cues similarly affect the perceived association with STEM for Black and Asian men and women or whether the congruence between occupational stereotypes and race stereotypes dictate perceivers career judgments. Results from Study Set 2 implicated both a relation between occupational and race stereotypes as well as gendered visual cues as factors in STEM-linked career judgments. These patterns occurred for judgments of faces that varied naturally (Study 2a) and that were systematically manipulated (Study 2b). Taken together, these results provide new insights into how facial femininity might impact a range of consequential judgments and the role that sex, gendered appearance, and race play in simultaneously impacting individuals' perceived fit within career domains.

The dissertation of Jessica Lee Shropshire is approved.

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Carolyn M. Parkinson

Steven Stroessner

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University of Los Angeles, 2021

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Shropshire, J.L. & Johnson, K.L., (2017, October). *The role of gendered visual cues in male-dominated occupation evaluations.* Paper presented at the Person Memory Interest Group Conference, Boston, MA.

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Chapter 1: Introduction

Women and racial minorities remain underrepresented in Science, Technology, Engineering, and Math (STEM)—career fields historically dominated by White men. This lack of representation results in missed opportunities for individual advancement and the advancement of STEM fields broadly. First, STEM fields are beneficial regarding salary—individuals in STEM career fields make 33% more money relative to individuals in non-STEM career fields (Noonan, 2017). STEM career fields afford more upward social mobility—greater access and opportunity in society. Furthermore, diversity improves the creativity of science itself; bringing new information and perspectives to help answer questions in STEM. Given the opportunity for so much advancement, it is imperative to understand the factors that contribute to the lack of advancement in achieving more diverse representation in STEM. Here, I propose that a perceived visual mismatch between identity-based appearance cues with STEM domains is one such factor that can help explain marginalized individuals' lack of representation in STEM career fields.

Research in social vision highlights the primacy of vision in influencing my evaluations of other people—a greater proportion of the human brain is dedicated to visual processing relative to all other sensory domains combined (Johnson & Adams, 2013). In real-world settings, I make quick and impactful judgments about other people based on a brief cursory glance (Ambady, et al., 2000; Ambady & Rosenthal, 1992). Thus, the importance of visual cues in informing social categorization and consequential evaluations of individuals is likely to be of paramount importance in a STEM domain. Here, I explore the influence of visual indices of gender and race in biasing perceivers' judgments about the type of occupations deemed appropriate within domains historically dominated by (White) men. Specifically, I propose that one mechanism by which this bias occurs is, in part, explained by evidence that perceivers associate male/White-dominated career fields with male and masculine visual traits. Furthermore, I examine whether these gendered associations differentially impact evaluations of STEM associations for men and women of different races. Indeed, previous work indicates that race is inherently gendered such that race and sex categories are not only psychologically confounded but also phenotypically confounded (Carpinella, et al., 2015; Johnson, Freeman, et al., 2012). Thus, it is likely that the same cues that bias categorization in the domain of social identities will also extend to career categorizations.

My dissertation draws on social vision theory and methodology to propose a unique approach to a persistent problem. I aim to examine the role of visual cues in the extent to which individuals are associated with STEM vs. non-STEM career fields. Here, in Chapter 1, I review research indicating that femininity is a devalued trait within the STEM domain broadly and highlight the specific way that visual indices of femininity may influence men vs. women's association with STEM. I then outline the theory and related empirical evidence indicating perceivers construe race as gendered discuss how this theory might impact suitability in STEM for Asian, White, and Black individuals. And, finally, I review theoretical evidence occupational stereotypes intersect with racial stereotypes that are likely to elicit a different pattern of results than those predicted by a race is gendered framework. In Chapters 2 and 3, I present my findings from two sets of studies indicating that visual indices of gender are indeed impactful for the types of careers we deem appropriate for men vs. women. Furthermore, I present partial evidence to indicate that different races will elicit differential suitability with STEM. And that the gendered visual indices that played a role in evaluations of STEM suitability for White individuals will differentially impact evaluations of STEM suitability for Asian and Black individuals.

Femininity is a devalued trait in STEM-domains

Recent popular media coverage on the issue of women's underrepresentation in male-dominated career fields highlights all the ways we have made progress toward greater representation of women (Cummins, 2015). Indeed, at the middle and high school levels, there is an equal gender breakdown in Science, Technology, and Math (STEM) representation for boys and girls (L'Oréal Foundation, 2014). And women's representation in certain STEM-specific domains has increased—women have achieved equal representation for bachelor's degrees in bioscience and social science domains broadly (National Center for Science and Engineering Statistics, 2013). In psychology specifically, women outnumber men in bachelor and doctoral degrees (National Center for Science and Engineering Statistics, 2013). From these statistics, one might entertain the possibility that issues of women's participation in male-dominated arenas have been resolved. And yet, disparities persist. In the STEM domain, women fill close to half of all jobs in the U.S. economy, yet they hold less than a quarter of STEM jobs (Beede, et al., 2011; Hill, et al., 2010). This underrepresentation in the workforce has remained consistent over the past decade (Beede et al., 2011).

Time and expertise in the field do not protect women from attrition: of the fifty percent of women who leave STEM careers for other occupations in the first twelve years, a disproportionate number are women who hold advanced degrees (Glass, et al., 2013). Furthermore, women with STEM degrees are less likely to work in STEM occupations relative to men, and they are more likely to work in education or healthcare (Beede, et al., 2011). Similar patterns exist in technological companies – Google's engineering staff is eighty-three percent male, and Apple's technical team is eighty percent male (Mitchell, 2015). These discrepancies cannot be explained by inferior capabilities. Women perform as well or better on tests and in classes than their male counterparts (Benbow & Stanley, 1982; Bridgeman & Wendler, 1991; Dasgupta, 2011; Kimball, 1989; Stockard & Wood, 1984; Stout, Dasgupta, et al., 2011), and performance is equivalent between boys and girls on standardized tests through high school (Lindberg, et al., 2010). Given equated levels of performance, why are there still such stark differences in representation at various phases of the STEM career? Here, I argue that perceptions of women in male-dominated career fields are imbued with gendered assumptions that have far-reaching implications for women's fit and belonging in historically male-dominated domains.

The barriers women face in STEM

"Three things happen when women are in the lab: you fall in love with them, they fall in love with you, or they cry." These widely publicized words from esteemed biochemist Tim Hunt (Ratcliffe, 2015) illustrate that women continue to face obstacles in STEM fields. This sentiment is pervasive, and it begins at an early age. Tee shirts are marketed to young girls emblazoned with slogans "Allergic to Algebra" and "I'm too pretty to do my homework, I have my brother do it for me" (Bell, 2011; Hughes, 2011). The recently released book *I Can Be a Computer Engineer* portrayed the Barbie character as a clueless game designer who had to rely on men to help her with computer coding (Mitchell, 2015). Women are rarely advised by superiors to continue to graduate school and career fields in STEM, even when they outperform men in classes (Pollack, 2013). And even when women attain esteemed positions in STEM organizations, they are regularly mistaken for administrative assistants (Jordan, 2018). These real-world examples illustrate that women in STEM environments regularly encounter blatantly sexist messages. Also, women must contend with a variety of more subtle messages suggesting that they are ill-suited for STEM pursuits.

One factor that is contributing to women's underrepresentation in STEM is the perceived mismatch between gender-relevant traits and STEM environments. Stereotypes about gender orient girls to be communal (help others, serve humanity, work with people; Konrad, et al., 2000) and boys to be agentic (achieve power, recognition, and mastery; Buck, et al., 2002). Agentic traits align with popular perceptions of historically male-dominated fields. For instance, STEM professions (engineer, scientist, mathematician) are perceived to promote agentic goals and to impede communal goals. Service professions (nursing, social work, teaching), in contrast, are perceived to facilitate communal goals (Diekman, et al., 2010). As such, highlighting communal aspects of STEM fields attracts girls (Diekman et al., 2010), especially when achieving these goals involves working in majority-female teams (Dasgupta, et al., 2015; Goodale, et al., 2018).

This line of research suggests that exposing women to female experts, role-models, and peers is one way to increase feelings of fit and belonging and thus to recruit and retain more women in STEM (Stout et al., 2011). However, while these endeavors focused on creating positive feelings of fit and belonging for women in male-dominated career environments are undoubtedly important, they might not be enough as women consistently encounter messages from perceivers that their biological sex and gender expression are incompatible with male-dominated career fields.

The alleged conflict between femininity and STEM carries consequence

Beliefs and attitudes held by observers and decision-makers likely play a critical role in decreasing women's participation in male-dominated domains. Evidence suggests that observers are regularly biased against women regardless of their performance, and these biases influence critical hiring and funding decisions. For example, given equivalent qualifications, male applicants are often hired over female applications (Moss-Racusin, et al., 2012). In letters of recommendation, writers tend to emphasize research skills and productivity of male applicants but the teaching skills and personal attributes of female applicants (Madera, et al., 2009). Consequently, male applicants are judged to be more serious researchers than female applicants (Trix & Psenka, 2003). Furthermore, even when research productivity is identical, women are deemed less competent than male counterparts and are therefore less likely to receive grant funding (Wenneras & Wold, 1997).

Women who persist through the challenges and ultimately excel in these domains are still subject to censure. Successful female managers are rated low in likeability by coworkers; and this effect is ameliorated only when evidence is provided that this woman has behaved in a communal (i.e., feminine) manner (Heilman & Okimoto, 2007). Lacking femininity can also produce negative outcomes. Women who are judged as lacking femininity are deemed less competent (Etcoff, et al., 2011), less confident, and even likely to receive a lower salary (Nash, et al., 2006). Taken together, this evidence suggests that a closer examination of perceivers' role in these disparities could shed light on how social perceptual biases might contribute to the differential evaluations of masculine men relative to women in STEM.

Women internalize the perceived incompatibility between femininity and STEM, and it influences their participation and engagement. College women indicate the stereotype of the unfeminine woman as a problem for women in their field (Hartman & Hartman, 2008). This perception dictates women's relationship with their femininity in college and career environments. Women describe efforts to avoid dressing and behaving in a stereotypically feminine manner, particularly within STEM domains in which femininity might undermine their perceived competence (Seymour, et al., 1997). When confronted with their knowledge of stereotypes about female mathematicians, women taking college math courses either to eschew their feminine characteristics or to abandon math fields entirely (Pronin, et al., 2004). Indeed, STEM fields are unappealing to women to the extent that they violate feminine gender roles and women report feeling dissimilar from others who fit masculine stereotypes in STEM (Cheryan, et al., 2009). For example, women who view posters of geeky men and women express less interest in computer science fields (Cheryan et al., 2009, 2011).

One protective factor for women identified in this line of work is the impact of female role models. To be sure, female role models in these domains can afford comfort to women (for review, Dasgupta, 2011; Stout, et al., 2011), but even embracing vanguards can be fraught with difficulties. For example, when role models exhibit high levels of femininity, middle school girls tend to feel intimidated by the need to "have it all" (Betz & Sekaquaptewa, 2012). However, when presented with role models who don't exude feminine traits, women's beliefs about their own ability to be successful in STEM domains are undermined (Cheryan, et al., 2011). As such, despite the advantage of female role models generally, their utility is less clear when it comes to whether expressions of femininity are helpful or harmful.

While this line of work has been useful for highlighting the inverse relationship between femininity and STEM and the consequences for women, this work has largely involved behavioral manifestations of femininity – individuals' color preferences (e.g., liking pink vs. liking black), desire for children, and gender-stereotyped expressions of emotion. To date, little work has probed the role of physical appearance and, specifically, gendered visual cues, in judgments of women in male-dominated career fields. Given the pervasive gendered associations with the various male-dominated career domains described above, it is likely that visible cues of sex and gender could elicit differential evaluations of both men and women that align with gendered expectations.

The pervasive impact of gendered visual cues

While multiple sensory modalities inform social evaluations (Freeman, et al., 2012), visible cues prove to be a potent source of information for a variety of socially relevant judgments, including social categorizations. For instance, individuals can discern the race of a face within 100ms of visual exposure and discern sex shortly after (Ito & Urland, 2003, 2005). Faces are a rich source of social information from which we, as perceivers, use to inform rapid social judgments (Todorov, 2017; Todorov, et al., 2015; Zebrowitz, 2006). Face perception permits perceivers to readily identify the sex and identity of an individual (Macrae, et al., 2005). And visual cues to social categories are sufficient to impact evaluations directly, independent of social categorizations (Johnson, et al., 2015). For example, competent faces are more likely to be categorized as men and incompetent faces are more likely to be categorized as women (Oh, et al., 2019). Research in this area also shows that perceivers are not only sensitive to visual information indicating social category membership but also variability within these social categories (Livingston & Brewer, 2002), and such variability impacts evaluative judgments (Freeman, et al., 2008). For instance, greater gender typicality not only impacts gender categorizations but also provokes positive social evaluations (Johnson, et al., 2015). Furthermore, these judgments are likely to occur quickly from merely a cursory glance of an individual (see e.g., Freeman & Johnson, 2016; Johnson, et al., 2015; Macrae & Bodenhausen, 2000) suggesting brief encounters are consequential and potentially bias perceivers evaluations of an individual based on appearance alone (Johnson, Iida, et al., 2012).

Given the importance of visual cues for consequential judgments, visual information might play a particularly critical role as an indicator of suitability for a host of historically male-dominated career domains. Merely sharing visual characteristics with a group fosters affiliation with that group (Chartrand & Lakin, 2013; Kurzban, et al., 2001), and an absence of shared visual characteristics with the representation of scientists tend to erode expectations of fit or belonging in a domain. Thus, understanding the relationship between visual cues of femininity (i.e., jaw shape, cheekbone placement, eye shape, lip fullness) and judgments of STEM suitability might provide a foundation for reducing obstacles to recruitment/retention of women in STEM.

Sex and gender impact career categorization and evaluation specifically

Visible cues to sex (i.e., male versus female) and gender (i.e., masculinity and femininity) are readily discerned (Freeman, et al., 2008; Haxby, et al., 2000; Stangor, et al., 1992; Zebrowitz, 2006) and exert a widespread influence on a range of judgments including judgments of attractiveness and sexual orientation (for review, see Johnson, et al., 2015). Violations in expected gendered appearances are consequential. For instance, men with long hair and females with shorter hair elicit uncertainty in the gender categorization process (Freeman, et al., 2008; Macrae & Martin, 2007), and gendered body motion impacts perceptions of the attractiveness of men and women alike (Johnson & Tassinary, 2007). Indeed, women's bodies were deemed more attractive when they walk with femininity as opposed to masculinity and the opposite is true for men. Similarly, deliberate changes to the gender typicality of targets' gait patterns lead perceivers to systematically miscategorize important identities such as sex and sexual orientation (Lick, et al., 2013).

One domain specifically where visible cues to sex and gender play a critical role in evaluative judgments is in career-relevant domains. For instance, gender-linked judgments of female politicians' faces predict their electoral success (Carpinella, et al., 2016; Hehman, et al.,

2014) and judgments of their competence (Carpinella & Johnson, 2013). Some research produces similar evidence for perceived suitability in STEM. For instance, when asked to draw prototypical scientists and mathematicians, children as young as six tend to draw a man in a lab coat (Chambers, 1983; Steele, 2003). Furthermore, the stereotype linking science with male visual representations persists through adulthood (Chambers, 1983). These early attempts to understand the role of gendered representation of STEM roles indicate male and masculine representations of scientists that emerge early and persist throughout development; however, they cannot pinpoint the specific features that drive these representations. Visual associations with STEM participation have been shown to produce important consequences including, for example, the finding that women who incidentally viewed posters depicting "geeky"-looking men and women computer scientists expressed less interest in entering the field (Cheryan, et al., 2009, 2011).

Considering the pervasive impact of gendered visual cues in a variety of other domains, I propose that gendered appearance may play a critical role in judgments of suitability for STEM pursuits. Do perceivers deem feminine appearing individuals less suitable for STEM careers? Does this perceived suitability vary as a function of the sex of the person being evaluated? The first aim of my dissertation is to provide answers to these questions by examining whether exposing individuals to faces of men and women vary naturally and systematically in their gendered appearance influence the extent to which these individuals are associated with STEM fields broadly and roles within a STEM domain specifically.

Intersectional identities bias perception: Race is perceived as gendered

Gender has proven to be of paramount importance for a variety of social evaluative judgments in and of itself. However, in the real world, individuals embody multiple social identities, and these identities simultaneously impact perception. In our society, the junction of male and White represents a default evaluation (Merritt & Harrison, 2006; Smith & Zárate, 1992; Stroessner, 1996; Zárate & Smith, 1990), and as such deviations from these categorical norms stand out to perceivers and elicit rapid categorization. For example, non-dominant racial identities (e.g., Black, not White) facilitate single-category judgments (e.g., race), non-dominant race and gender identities (e.g., Black woman) facilitate combined judgments in which both categories are identified simultaneously (Stroessner, 1996; Zárate & Smith, 1990). Furthermore, the presence of one category of information can also bias the perception of other categorical information. For instance, variations in race typicality influence the likelihood and efficiency of sex categorizations of androgynous faces (Johnson, Iida, et al., 2012). Specifically, as faces change from Black to White to Asian, female categorizations become increasingly likely. And, in faces that are not androgynous, male categorizations were more efficient for Black faces than for White or Asian faces while female categorizations are more efficient for Asian than for White or Black faces. Moreover, just as race can bias sex categorizations, gendered facial cues bias race categorization (Carpinella, et al., 2015). In masculine targets, Black categorizations are more likely and rendered more readily while White categorizations are more likely and rendered more readily in feminine targets. Furthermore, racial cues can bias sex categorizations of bodies in motion (Lick, et al., 2014).

The above studies establish the impact of multiple identities on social categorization simultaneously, other work has extended these findings to evaluative-based outcomes. For instance, the simultaneous perception age and race biases perceived emotions in targets. Perceivers detect anger earlier and perceive it to last longer in young black men relative to older black men and perceived happiness to take longer and disappear earlier in young black men

(Kang & Chasteen, 2009). The opposite occurred for perceptions of white men. And anger is perceived more readily in faces of men than in faces of women overall (Becker, et al., 2007; Hess, et al., 2004; Plant, et al., 2004). Furthermore, Black men and women are judged as more masculine and race stereotypical than same-sex White targets and Black women are evaluated as more physically unattractive in proportion to their perceived masculinity (Goff, et al., 2008).

Research reviewed above on social categorization and stereotyping converge on associations between Black individuals with males/masculinity and Asian individuals with females/femininity. For instance, Black individuals are more likely to compel male categorizations as they are perceived to share a greater degree of physical similarity with masculine features (Johnson, Freeman, et al., 2012), and stereotypes about Black individuals have high conceptual similarity with masculine traits—aggressive, dominant, athletic, and competitive (Bem, 1974; Devine & Elliot, 1995; Galinsky, et al., 2013; Ho & Jackson, 2001; Spence, et al., 1974). Even stating an individual is Black leads participants to produce an image of a male at much higher rates than a female (Schug, et al., 2015). Asian individuals, in contrast, are likely to compel female categorizations as they share a greater degree of similarity with feminine features (Johnson, Freeman, et al., 2012), and stereotypes about Asian individuals overlap with stereotypes about women—shy, family-oriented, soft-spoken (Bem, 1974; Devine & Elliot, 1995; Galinsky, et al., 2013; Karlins, et al., 1969; Spence, et al., 1974). In a male and masculine domain such as STEM, given Black individuals perceived association with male/masculinity and Asian individuals' association with female/femininity, we might expect Black individuals to be perceived as more suitable for careers and roles in STEM and Asian individuals to be perceived as less suitable for careers and roles in STEM as a result. And yet, this prediction is not consistent with observable disparities in STEM representation.

A perceived mismatch between race and occupational stereotypes impact minority representation in STEM

Stereotypes about race independent of gender are likely to facilitate a perceived mismatch between Black individuals and STEM and Asian individuals and STEM. Stereotypes about STEM include a tendency toward extremely intelligent, socially inept, and singularly focused on technology (Barbercheck, 2001; Finson, 2002; Margolis & Fisher, 2002; McDuffie, 2001; Schott & Selwyn, 2000). These are features that overlap with beliefs about the intellectual interest and ability of Asian individuals but do not overlap with beliefs about the intellectual interest and ability of Black individuals. That is, racial stereotypes depicting Asian individuals as intelligent and academically oriented and Black individuals as unintelligent and less academically oriented are pervasive (Ghavami & Peplau, 2013; Steele, 1997). These stereotypes likely arise from the belief that Asian individuals are considered a "model minority" in that they are held up as a model for other minority groups in terms of doing well in school/work and being diligent and efficient (Wong, et al., 1998; Zia, 2001) and this translates to a "model student" stereotype in Asian children (Rosenbloom & Way, 2004). Asian Americans are viewed as better prepared, more motivated, and as having a greater likelihood of career success by Asian and non-Asian students alike (Wong, et al., 1998). Stereotypes of this nature subsequently influence perceiver's beliefs about performance and belonging of different racial groups in STEM domains. Among students with White teachers, Asian students are viewed more positively than White students and Black students are perceived more negatively than both Asian and White students (McGrady & Reynolds, 2013). In a study of Ivy League universities, White students consistently held racial stereotypes about Black individuals as unqualified for the respective Ivy League universities, citing affirmative action or athletic ability as reasons for Black students' attendance and Black students are aware of these perceptions by their White peers (Torres & Charles, 2004).

The representation of various racial groups in STEM domains aligns with expectations derived from stereotypes dictating academic capabilities. In STEM career fields, White and Asian individuals make up 87 percent of the engineering workforce and 84 percent of the computing workforce (Raytheon STEM Index, 2013). Whereas Black and Latinx individuals' overall participation in STEM is lower than it is in the U.S. Workforce (National Center for Science and Engineering Statistics, 2013). Black individuals make up a mere five percent of working scientists (National Center for Science and Engineering Statistics, 2013) and this has been a consistent pattern since the 1970s (Ong, et al., 2011). This lack of representation cannot be accounted for due to lack of interest nor aptitude—in 2004, 19% of Historical Black College (HBCU) graduates were in STEM fields relative to 17% White and 30% Asian at all institutions (National Center for Science and Engineering Statistics, 2013).

Based on these race-based differences in stereotypes and representation in STEM career fields and other STEM-related outcomes, we would predict that race will play a role in the extent to which an individual is deemed suitable for STEM contrary to predictions that would be derived from a race is gendered approach. Specifically, given the overlap in stereotypes about STEM with stereotypes about Asian individuals, it is likely that perceivers will deem Asian individuals, relative to both White and Black individuals, as more suitable for STEM careers. Furthermore, due to the mismatch in stereotypes about STEM with stereotypes about Black individuals, perceivers will likely deem Black individuals, relative to Asian and White individuals, as less suitable for STEM careers.

Both gender and race play a role in STEM attrition

And yet, the assertion discerned from previous research that race and gender are perceptually intertwined cannot be ignored. Indeed, race is inherently gendered such that race and sex categories are not only psychologically confounded but also phenotypically confounded (Carpinella, et al., 2015; Johnson, Freeman, et al., 2012). This reflexive tethering of race and gender is reflected in discrepancies in representation and resource allocation in STEM.

Minority women's overall participation in STEM is lower than it is in the U.S. workforce (National Center for Science and Engineering Statistics, 2016). While the number of Asian and Hispanic women has increased sixfold between 1995 and 2015 and the number of Black women has more than doubled (National Center for Science and Engineering Statistics, 2016), these figures still hover at 10% or lower for Black and Hispanic women and we have yet to achieve even a 1% representation for indigenous women. Furthermore, these statistics cannot account for women's representation in the STEM workforce as a function of race *relative* to men. That is, while relative gains are of note, White men and Asian men still dominate prestigious STEM occupations and acquire higher salaries on average (National Science Board, Science and Engineering Indicators, 2018). To understand why these disparities in representation continue, research has identified the unique barriers faced by minority women as a "double-blind" in which the unique interplay of racism and sexism that minority women face simultaneously (Ong, et al., 2011). Here we suggest that a similar "double-blind" will be expressed in the visual biases of perceivers when evaluating minority women. Specifically, we predict that gender will play a role in exacerbating or attenuating the perceived association with STEM for Black and Asian men and women when compared to White men and women.

Failure to focus on the simultaneous impact of race and gender has proved pernicious for Asian women. Efforts continue in the attempt to recruit minority men and women in STEM throughout the career pipeline, however, when it comes to Asian individuals' representation in

STEM, most consider the problem solved. Asian individuals continue to out represent all other minority groups in the percentage of STEM degrees and percentage of representation in the workforce (National Center for Science and Engineering Statistics, 2016). And Asian individuals are on par with White individuals in median annual salary. So much so that the racial category Asian is no longer considered an underrepresented minority group on NSF's recent statistical report gender and race discrepancies in STEM representation (National Center for Science and Engineering Statistics, 2013, 2016). And yet, Asian women deal with the complex layering of overrepresentation as a function of their race and underrepresentation as a function of their gender (Castro & Collins, 2021). Furthermore, when we look at how things fare representationally for Asian women specifically, we can see that Asian women have yet to attain the parity presumed as a function of their race. The percentage of Asian women employed by colleges and universities who are tenured or who are full professors is the smallest when compared to White women, Black women, and Latinx women (Wu & Jing, 2011). Very small numbers of Asian women advance to full faculty positions, deans, or university presidents in Academia (Wu & Jing, 2011). Furthermore, Asian women in industry are the most likely to hold a graduate degree but the least likely to hold a position within three levels of the CEO relative to White, Black, and Latinx men and women alike (Wu & Jing, 2011). As such, claims that Asian individuals are sufficiently represented in STEM domains might be a blanketed assumption based on outcomes for Asian men but not Asian women. In this dissertation, I examine whether gendered associations differentially impact evaluations of STEM associations for White, Black, and Asian men and women.

The role of gendered appearance in perceptions of career suitability for men and women and men of varying races

Thus far, I reviewed literature on the role of gender and race and how they independently and simultaneously impact perception and evaluation. Specifically, I reviewed evidence derived from a race is perceived as gendered approach as well as an occupational stereotypes approach. For my dissertation, I propose a framework that incorporates empirical evidence from a race is gendered framework as well as an occupational stereotype framework to test how gender and race independently and concurrently influence categorization and evaluative biases in a STEM domain. Here I examine the role of visual cues in the extent to which individuals are associated with STEM vs. non-STEM career fields. Specifically, I probe how expectations for STEM employees to appear male and masculine carries consequence for STEM categorizations and how this pattern changes as a function of the race of the target.

Study Set 1 (Studies 1a-1c) tested the prediction that gender plays a role in exacerbating or attenuating White men and women's perceived association with STEM relative to humanities. Study Set 2 (Studies 2a-2c) tested the prediction that gender plays a different role in career judgments for Black, Asian, and White men and women. More specifically, my hypothesis for Study Set 1 is as follows:

> **Hypothesis 1:** Visual indices of sex (male vs. female) and gender (masculine vs. feminine) will influence whether individuals are seen as more likely to work in STEM vs. humanities fields in the academic domain. Female and feminine individuals will be associated with humanities while male and masculine individuals will be associated with STEM.

As such, Study Set 1 provides a foundation for understanding the role of gendered visual cues independent of sex category membership as well as the role of gender in exacerbating or attenuating the effect of sex on perceived career association in a STEM vs. non-STEM context.

While Study Set 1 focused explicitly on the perceived STEM association of White men and women who vary in gendered appearance, gender will likely play a different role for different races of individuals. If a gendered race framework is correct, the pattern of results would suggest an increase in perceived suitability with STEM for Black targets relative to White and Asian targets due to an overlap between Black phenotypes and male/masculine phenotypes as well as an overlap between Black stereotypes and male/masculine stereotypes. However, if it is true that the overlap between occupational stereotypes and race stereotypes is correct, the pattern of results would suggest an increase in perceived suitability with STEM for Asian targets relative to White and Black targets. This framework is consistent with the base-rate representation of Asian, Black, and White individuals in STEM domains.

While I predict a main effect of race consistent with an occupational stereotype framework, I also predict that gendered phenotypes will play a role in exacerbating or attenuating these racial differences. Specifically, the larger range of feminine phenotypes inherent to Asian individuals' facial appearance likely results in a greater impact of gender on STEM categorizations for Asian individuals relative to Black and White individuals. However, due to a greater latitude of masculine phenotypes inherent to Black individuals' facial appearance, I predict that gender will have a lesser impact on STEM categorizations for Black targets relative to White and Asian targets. More specifically, for Study Set 2 I generated three specific hypotheses:

> **<u>Hypothesis 2</u>:** Relative to White individuals, Asian individuals will elicit an increased association with STEM overall, and Black individuals will elicit a decreased association with STEM relative to both White and Asian individuals.

> **<u>Hypothesis 3:</u>** While I predict racial differences in association with STEM illustrated above, I predict that gendered visual cues (i.e., masculinity vs. femininity) will impact these racial differences. Specifically, I predict that a greater latitude of feminine phenotypes will result in a greater impact of gender on STEM categorizations for Asian individuals relative to Black and White individuals. However, due to a greater latitude of masculine phenotypes for Black targets, I predict that gender will have a lesser impact on STEM categorizations for Black targets relative to White and Asian targets.

Chapter 2: Study Set 1

The studies comprising Study Set 1 tested Hypothesis 1 that gendered facial features play a critical role in the extent to which perceivers associate individuals with STEM fields. In Studies 1a and 1b, I examined the association between sex, gender, and STEM vs. humanities fields in the academic domain.

Study 1a

Study 1a was designed to address the prediction that gendered facial features influence the extent to which perceivers associate White men and women with STEM fields broadly. Specifically, individuals who are male and masculine will elicit more STEM categorizations relative to Humanities categorizations and the opposite for individuals who are female and feminine.

Method

Participants

Based on existing methods to calculate power for multilevel designs (e.g., Scherbaum & Ferreter, 2009), a sample size of 75 affords more than 99% power to detect a medium effect size. I aimed to surpass that number to collect data from 90 participants to ensure adequate power. I was able to recruit eighty-eight undergraduates (75% women, 25% men) through UCLA's Communication Studies Department SONA Pool who participated in exchange for course credit. On average, participants were 18.97 years old (SD=1.04). The majority of the sample identified as Asian (36%) and White (31%); 15% identified as biracial or Other, 13% as Latino, and 5% as Black.

Stimuli

Stimuli consisted of 150 photographs (75 White men, 75 White women) selected randomly from the Chicago Face Database Version 1.0 (Ma, et al., 2015). These faces were standardized in terms of attire and faced the camera with a neutral expression.

Procedure

Participants were told they would be making judgments about a series of faces of various employees, the roles of these various employees were not specified. After providing consent, participants rated each of the photos in two counterbalanced blocks—Perceived Gender (1 = *masculine*, 7 = *feminine*), and Career Judgment (does this person work in *STEM* vs. *humanities)*. Participants then provided demographic information and were debriefed.

Results

For this and all subsequent studies, I used R packages "lme" and "lme4" to analyze the data in a hierarchical linear fashion to account for within-subject and within stimuli dependencies, and I use a standard regression vernacular to describe the results (Bates, et al., 2015; Kuznetsova, et al., 2017). All models included random intercepts and random slopes with maximum likelihood estimation. All coefficients are unstandardized. Unstandardized regression coefficients expressed by beta values offer an unbiased metric of effect size for multilevel models (Ugille, et al., 2012). As such, I interpret unstandardized beta values as effect sizes throughout this paper.

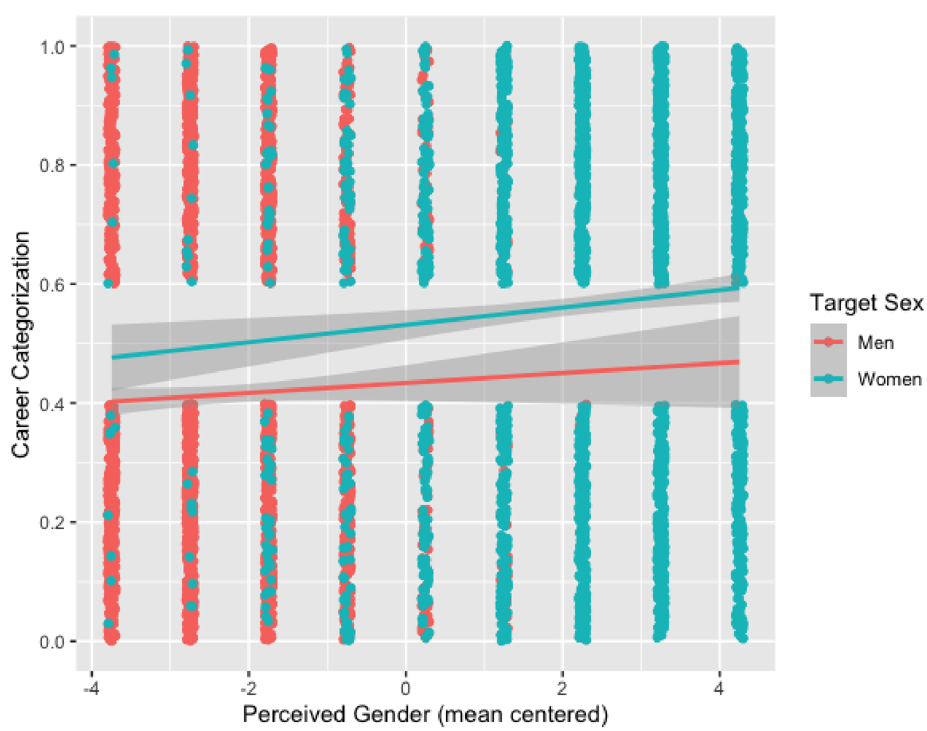
In each set of analyses, I first tested main effects models with crossed random factors; I then tested interaction models without crossed random factors to avoid model overspecification (Judd, et al., 2017). I report unstandardized coefficients throughout. Hereinafter, I numerically code both Target Sex (male targets = 0, females targets = 1) and Career Judgment (STEM=0, humanities=1), and mean-centered Perceived Gender. I also tested potential interactions with

Participant Sex (male participants = 0, female participants = 1); in all studies, Participant Sex did not qualify any effect unless otherwise noted.

To test my predictions about the determinants of Career Judgments (i.e., humanities vs. STEM), I regressed Career Judgment onto Target Sex, Perceived Gender, and their interaction using the techniques described above. As was expected, humanities categorizations were nearly two times more likely for females than for males (see Figure 1), B = 0.69, SE = 0.17, z = 4.12, p < .001, 95% CI [.39, 1.02], OR = 1.98.

Figure 1

Effect of Target Sex and Perceived Gender (mean centered) on Career Judgment in Study 1a.



Note. Higher values of Perceived Gender indicate greater perceived femininity. Higher values of Career Judgment indicate a greater predicted probability of humanities categorizations. Error bars are 95% CI.

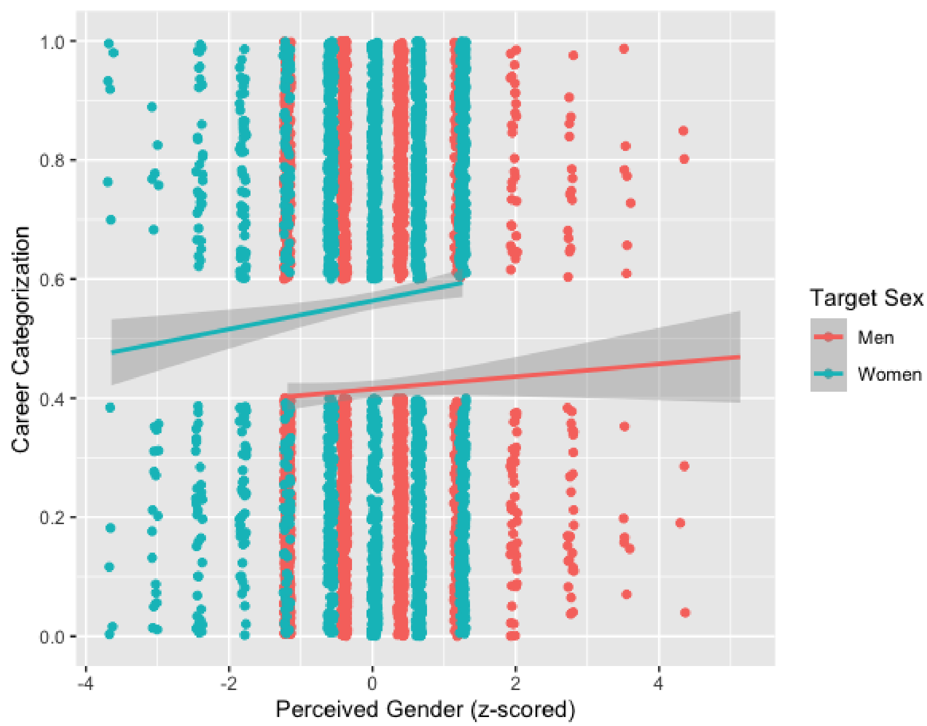
In addition, humanities categorizations were also increasingly likely as faces were judged to be more feminine: for every unit increase in Perceived Gender, humanities categorizations were 8% more likely, $B = 0.09$, $SE = 0.03$, $z = 3.35$, $p = .001$, 95% CI[.03, .14], $OR = 1.08$. The interaction of Target Sex and Perceived Gender was not significant, $B = -0.06$, $SE = 0.05$, $z = -1.30$, $p = 0.19$, 95% CI[-.15, .03], indicating that the judged femininity of both male and female targets' faces influenced Career Judgment judgments.

Of course, what it means to be perceived as a highly feminine man is likely distinct from what it means to be perceived as a highly feminine woman. That is, a rating of seven on the gender scale means something different when participants are evaluating a man vs. a woman. This assertion is consistent with previous research on shifting standards (see Biernat & Thompson, 2011 for review; Biernat & Manis, 1994; Biernat, Mannis, & Nelson, 1991) indicating that stereotypes about a group provide judgment standards for evaluating individual members within a group and, as a result, standards for evaluating different individuals shift as a function of one's social category membership. As such, for my data, it is likely that the standards for evaluating what it means to be feminine (or masculine) for a woman will shift when evaluating the standards for what it means to be feminine (or masculine) for a man. One way to visualize these shifting standards is to equate the gender scales for men vs. women by producing a z score separately for men and women. By visualizing the data in this way, I can assess a within sex distribution of percepts. As such, I conducted my analyses again having calculated a z-score of Perceived Gender for judgments of men and a z-score of Perceived Gender for judgments of women and then combining them for the purpose of the subsequent analyses. Having done this transformation, Perceived Gender rather than reflecting perceived deviations in masculine and feminine appearance now reflect deviations in perceived gender-typicality.

For this set of analyses, I regressed Career Judgment into Target Sex, Perceived Gender (z-scored), and their interaction. As noted above, the effect of Target Sex was significant, B = 0.69, SE = 0.17, z = 4.12, p < .001, 95% CI [.39, 1.02], OR = 1.98. As ratings of Perceived Gender (now z-scored) increased, there was a marginally stronger association with humanities than STEM, *B* = 0.08, *SE* = 0.04, *z* = 1.91, *p* = 0.059, 95% CI[-.002, .16]. However, the interaction of Target Sex and Perceived Gender on Career Judgment was not significant, *B* = -.07, *SE* = 0.06, *z* = -1.03, *p* = .30, 95% CI[-.19, .06] (Figure 2). While the interaction of Target Sex and Perceived Gender here was not significant, the pattern of data reflected in Figure 2 suggests that shifting standards may be applicable such that the range of gender evaluations is utilized differently in career categorization for men vs. women.

Figure 2

Effect of Target Sex and Perceived Gender (z-scored) on Career Judgment in Study 1a.



Note. Negative values of Perceived Gender indicate greater gender-atypicality for women and positive values of Perceived Gender indicate greater gender-atypicality for men. Higher values of Career Judgment indicate a greater predicted probability of humanities categorizations. Error bars are 95% CI.

Participant Sex

As predicted, the interaction of Participant Sex with Target Sex on Career Judgment was not significant, $B = -.04$, $SE = .25$, $z = -.18$ $p = .86$, 95% CIs [-.53, .44], nor was the interaction of Participant Sex with Perceived Gender on Career Judgment, $B = .01$, $SE = .05$, $z = .16$ $p = .87$, 95% CIs [-.09, .10]. Thus, participant sex did not play a significant role in career judgments.

Overall, Study 1a provided support for my prediction suggesting that perceivers utilize both sex and gender typicality when categorizing a target's likely career as a humanities or STEM discipline. As such, Study 1 provides an important replication and extension of prior work (Banchefsky, et al., 2016) by extending the observation to faces that are standardized and that are not gleaned from STEM department faculty lists. This is an important point in that it rules out the possibility that self-chosen modifications in gendered visual appearance (which might have contributed to the results of this previous study) can account for my findings (Seymour, et al., 1997). Furthermore, these findings provide convergent evidence to show that facial femininity elicits an increased association with humanities and a decreased association with STEM careers.

While these findings are consistent with my and others' predictions about how perceived femininity might affect a target's associations with STEM, relying on natural variation in gendered appearance hinders my ability to make claims about the causal role of gendered facial features. Although my stimulus set was designed to control for some sources of variability (e.g., cosmetic use and clothing choices), other factors nevertheless varied freely. In Study 1b, I systematically manipulated the gendered appearance of faces to ensure a more systematic and calibrated manipulation of gendered cues.

Study 1b

In Study 1a, perceptions of both sex and gender played a role in career categorizations of White faces, such that being female or feminine undermined one's perceived association with STEM. In Study 1b, I sought to corroborate this finding and strengthen my predictive power by systematically varying the gender (masculinity and femininity) of the stimulus faces.

Method

Participants

I again ran my study for two weeks and I was able to recruit one hundred and twenty-four undergraduates (70% women, 30% men) through UCLA's Communication Studies Department SONA Pool who participated in exchange for course credit. On average, participants were 18.94 years old (SD=1.23). The majority of the sample identified as Asian (37%), White (25%), and Latino (23%); 10% identified as biracial or Other, and 5% as Black.

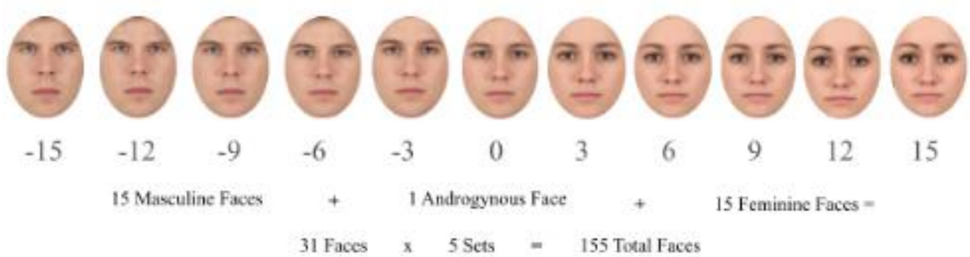
Stimuli

I generated a new set of faces using images from the Chicago Face Database (Ma, et al., 2015). Specifically, I selected 25 male and 25 female faces that were labeled in the database as Caucasian/White and had normed ratings of being classified as Caucasian/White at over 80% of the time (Ma et al., 2015). From these images, I generated five base faces per sex (male and female) by randomly selecting five faces and morphing those five faces together (e.g., five female faces were morphed together to generate one female base face image). This morphing was conducted using FantaMorph software (Version 5; Abrosoft Co., Beijing, China).

To create gender continuums, I then randomly paired a male and female base face and used FantaMorph to morph the two base faces together. I varied the degree of morph by 10% increments and then extended beyond the original gender of the composite faces to 150%. Using this method, I generated faces anchored by hyper-female (150% female) and hyper-male (150% male) faces. This produced 15 masculine-typed faces, 15 feminine-typed faces, plus the original and androgynous composite for a total of 31 faces. I replicated this process five times to yield a total of 155 faces for my stimulus set (see Figure 3).

Figure 3

Example subset of a full morphing anchor from the stimulus set in Study Set 1.



Note. Values range from -15 (hyper-masculinity) to 15 (hyper-femininity) in increments of 1 (10%). Here, faces are presented in morphing increments of three due to space constraints.

Procedure

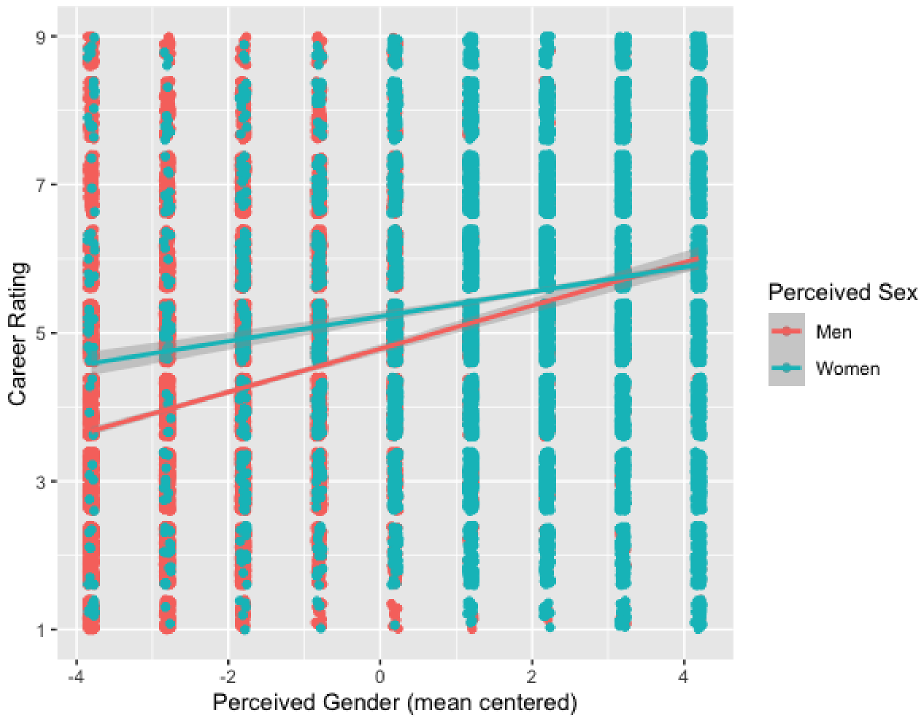
Again, participants were told they would be making judgments about a series of faces of various employees, the roles of these various employees were not specified. After providing consent, participants rated each of the photos in three counterbalanced blocks—Perceived Sex (*male* vs. *female*), Perceived Gender (1 = *masculine*, 7 = *feminine*), and Career Judgment (1 = *STEM,* 9 = *humanities).* Notably, Study 1b used a continuous measure of Career Judgment rather than forcing a binary categorization to test for generalizability. Participants also provided demographic information after the study and were debriefed.

Results

As in Study 1a, I tested the prediction that female and feminine faces would show a stronger association with humanities relative to male and masculine faces by regressing Career Judgment onto Perceived Gender, Perceived Sex, and their interaction. Replicating the effects observed in Study 1a, faces categorized as female, relative to male, showed a stronger association with humanities than with STEM, $B = 1.35$, $SE = 0.13$, $t(124.19) = 10.29$, $p < .001$, 95% CI[1.09, 1.61]. Similarly, as ratings of Perceived Gender (mean-centered) increased, there was a stronger association with humanities than STEM, $B = 0.29$, $SE = 0.03$, $t(123.20) = 11.11$, $p < .001$, 95% CI[.24, .34]. The interaction of Perceived Sex and Perceived Gender on Career Judgment was significant, $B = -.11$, $SE = 0.02$, $t(13809.21) = -6.29$, $p <.001$, 95% CI[-.14, -.08] (see Figure 4).

Figure 4

Effect of Perceived Sex and Perceived Gender (mean centered) on Career Judgment in Study 1b.



Note. Higher values of Perceived Gender indicate greater perceived femininity. Higher values of Career Judgment indicate a greater association with humanities relative to STEM. Error bars are 95% CI.

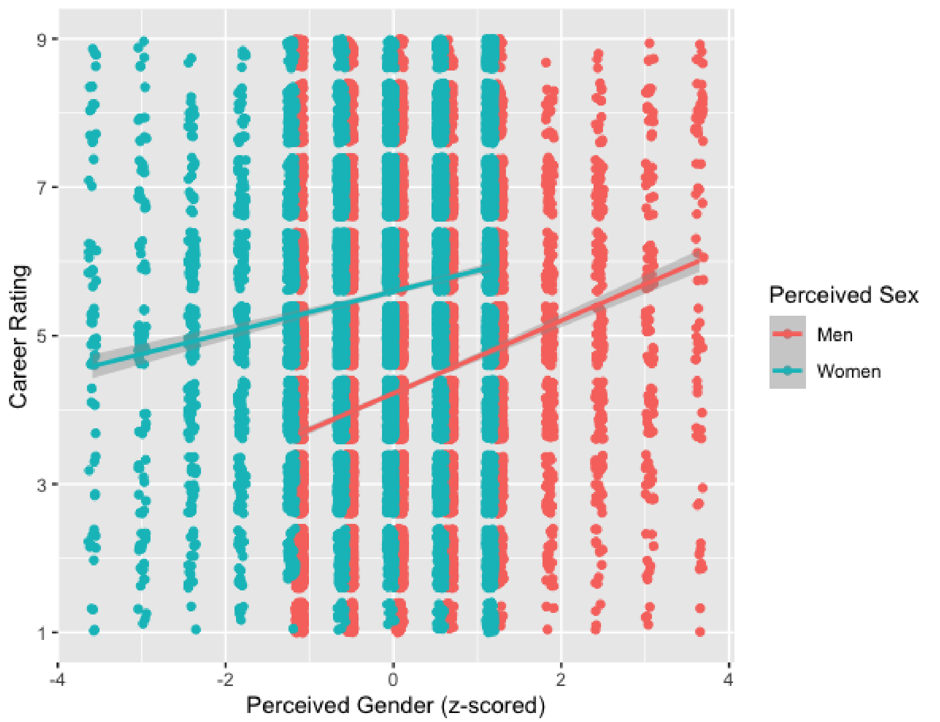
Among faces judged to be female, faces that were rated as more feminine were also more strongly associated with humanities than STEM, $B = 0.18$, $SE = 0.02$, $t(167.64) = 7.70$, $p < .001$, 95% CI[.14, .22]. Among faces judged to be male, faces that were rated as more feminine were even more strongly associated with humanities than STEM, $B = 0.29$, $SE = 0.02$, $t(154.13) = 12.60$, $p < .001$, 95% CI[.25, .34].

Again, however, what it means to be perceived as a highly feminine man is likely distinct from what it means to be perceived as a highly feminine woman. As such, I again calculated a z score of Perceived Gender separately for men and women and then combined these values on a single scale for the sake of analyses. I regressed Career Judgment into Perceived Sex, Perceived Gender (z-scored), and their interaction. As noted above, faces categorized as female, relative to male, showed a stronger association with humanities than with STEM, *B* = 1.35, *SE* = 0.30, *t*(6.02) = 4.51, *p* = .004, 95% CI[.72, 1.98]. Similarly, as ratings of Perceived Gender (z-scored) increased, there was a stronger association with humanities than STEM, *B* = 0.42, *SE* = 0.04, *t*(123.48) = 9.43, *p* < .001, 95% CI[.33, .51]. The interaction of Perceived Sex and Perceived Gender on Career Judgment was significant, *B* = -.18, *SE* = 0.03, *t*(13822.18) = -6.23, *p* <.001, 95% CI[-.24, -.13] (see Figure 5). Among faces judged to be female, faces that were rated as more gender-typical were also more strongly associated with humanities than STEM, *B* = 0.31, *SE* = 0.09, *t*(168.20) = 7.72, *p* <.001, 95% CI[.23, .39]. Among faces judged to be male, faces that were rated as more gender-atypical were even more strongly associated with humanities than STEM, *B* = 0.49, *SE* = 0.04, *t*(153.78) = 12.57, *p* <.001, 95% CI[.42, .57] (Figure 5).

The significant interaction reflected in Figure 5 suggests that shifting standards are applicable such gender evaluations is utilized differently in career categorization for men vs. women. More specifically, increases in gender atypicality elicited a greater proportion of STEM categorizations for women and a greater proportion of humanities categorizations for men. And, in this figure, a mean of zero represents the categorical differences in Career Judgment as a function of Perceived Sex. That is, gender average men are elicit a greater proportion of STEM than humanities ratings. And gender average women elicit a greater proportion of humanities than STEM ratings.

Figure 5

Effect of Perceived Sex and Perceived Gender (z-scored) on Career Judgment in Study 1b.



Negative values of Perceived Gender indicate greater gender-atypicality for women and positive values of Perceived Gender indicate greater gender-atypicality for men. Higher values of Career Judgment indicate a greater predicted probability of humanities categorizations. Error bars are 95% CI.

These findings support the hypothesis that facial femininity is detrimental to the association with STEM careers for both males and females. Here, the penalty for facial femininity is even stronger among faces judged to be male, however, these results also suggest that femininity vs. masculinity are evaluated differently for men vs. women. Taken together, these findings provide further evidence to suggest that both sex and gendered features are important cues that perceivers use to distinguish between likely humanities vs. STEM careers. Effects were consistent with those found in Study 1a even though I used systematically manipulated stimulus faces and assessed categorization judgments with a continuous scale. Despite these procedural variations, both studies demonstrated a “femininity penalty” for judgments of both men and women that extends prior models that primarily focused on impediments to women's career success.

Objective Gender

I tested the impact of my manipulation of gender more broadly by regressing Career Judgment onto Objective Gender (coded from -15 to 15 with negative values indicating greater masculinity and positive values indicating greater femininity), Perceived Sex, and their interaction. Once again, faces judged to be female, relative to male, were more strongly associated with humanities than with STEM careers, $B = 1.35$, $SE = 0.30$, $t(6.02) = 4.511$, $p = .004$, 95% CI[.72, 1.98]. Objective Gender was not strongly associated with Career Judgment, $B = 0.06$, $SE = 0.03$, $t(4.19) = 1.83$, $p = .14$, 95% CI[-.01, .13] possibly because of its weak association with Perceived Gender. However, the interaction between Perceived Sex and Objective Gender was strong and significant, $B = -0.03$, $SE = 0.004$, $t(3708) = -6.96$, $p < .001$, 95% CI[-.04, -.02]. Tests of the simple slopes showed that increases in Objective Gender corresponded to stronger associations with humanities than with STEM, *B*s = .05 and .01, *SE*s = .002 and .003, *t*s(6853.70 and 6191.48) = 16.90 and 4.55, both *p*s < .001, 95%, CI[.04, .05] and [.008, .02] for faces judged to be male and female, respectively. Thus, facial femininity corresponded to decreased STEM association for both males and females.

Participant Sex

Perceived Gender. The interaction of Participant Sex with Perceived Sex on Career Judgment was not significant, , $B = -.15$, $SE = .29$, $t(122.10) = -.51$ $p = .61$, 95% CIs [-.71, .42], nor was the interaction of Participant Sex with Perceived Gender on Career Judgment, , $B = -.02$, $SE = .06$, $t(121.49) = -.48$ $p = .64$, 95% CIs [-.14, .09].

Objective Gender. The interaction of Participant Sex with Perceived Sex on Career Judgment was not significant, , $B = -.15$, $SE = .29$, $t(122.10) = -.51$ $p = .61$, 95% CIs [-.71, .42], nor was the interaction of Participant Sex with Perceived Gender on Career Judgment, , B = -.01, SE = .01, t(121.97) = -1.10 p = .28, 95% CIs [-.03, .01].

Participant sex did not play a significant role in the relation between Perceived Gender and Career Judgment nor in the relation between Objective Gender and Career Judgment.

These findings show that facial femininity not only affects judgments of women. Indeed, facial femininity also influences the perceived association of men with STEM careers. For women, a lack of femininity/increased masculinity appears to foster a stronger association with STEM. These findings provide continuing evidence to suggest that while Sex plays an important role in career associations, gendered variations *within* each sex are also paramount.

Study 1c

In Studies 1a and 1b, perceptions of both sex and gender played a role in career categorizations of individual faces, such that being female or feminine undermined one's perceived association with STEM. Up until this point, I measured career association as a forced categorization or a degree of rating between STEM and Humanities. I chose humanities as an alternative to STEM because women who leave STEM fields often do so in favor of humanities fields (American Academy of Arts and Sciences, 2015). In Study 1c, I sought to test this presumed difference systematically by implementing a between-subjects design where participants made ratings either for STEM or humanities.

Method

Participants

I again ran my study for two weeks and I was able to recruit eighty-six undergraduates (76% women, 24% men) through UCLA's Communication Studies Department SONA Pool who participated in exchange for course credit. On average, participants were 20.59 years old

(SD=2.92). The majority of the sample identified as Asian (36%), White (28%), and Latino (17%); 16% identified as biracial or Other, and 2% as Black (one participant elected to not report their race). Condition 1 consisted of 43 participants and Condition 2 also consisted of 43 participants.

Stimuli

For this study, I used the same set of morphed faces described in Study 1b—155 faces morphed from extremely masculine to extremely feminine.

Procedure

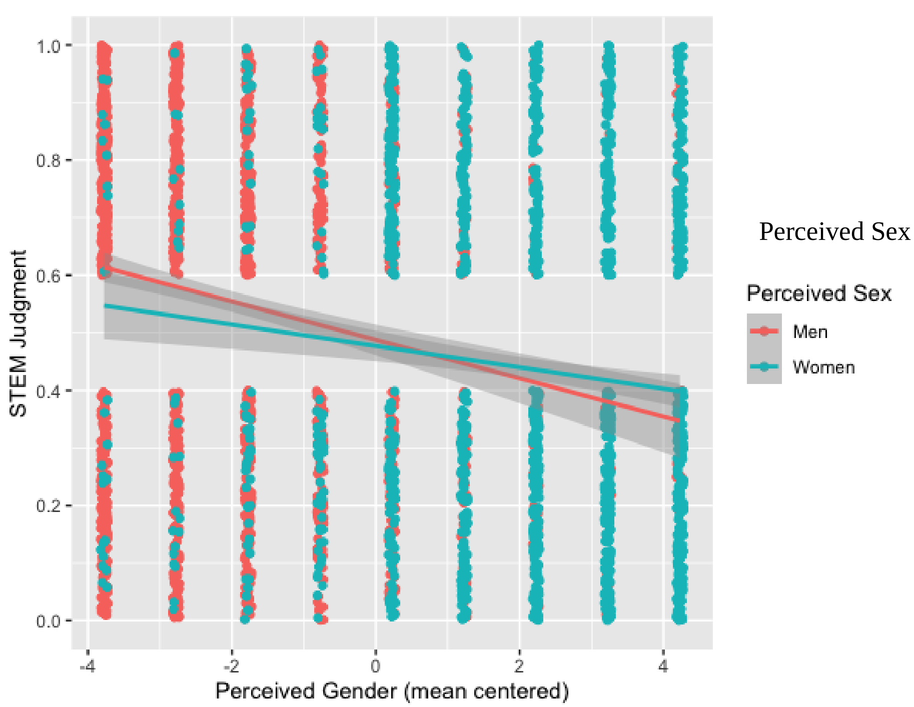
Again, participants were told they would be making judgments about a series of faces of various employees, the roles of these various employees were not specified. After providing consent, participants rated each of the photos in two counterbalanced blocks—Perceived Sex (*male* vs. *female*), Perceived Gender (1 = *masculine*, 7 = *feminine*). However, this time, participants were randomly assigned to one of two conditions. In Condition 1, participants were asked whether this person worked in a STEM Field (1 = *Yes,* 0 = *No)* and in Condition 2, participants were asked whether this person worked in Humanities Field (1 = *Yes,* 0 = *No*). Participants also provided demographic information after the study and were debriefed.

Results

As in Studies 1a and 1b, I tested the prediction that female and feminine faces would show a stronger association with humanities relative to male and masculine faces. I tested this prediction separately for Condition 1 and Condition 2. First, I analyzed the findings for Condition 1, I regressed STEM Judgment onto Perceived Gender, Perceived Sex, and their interaction. Replicating the effects observed in Studies 1a and 1b, faces categorized as female, relative to male, elicited fewer yes than no STEM categorizations, $B = -.60$, $SE = .26$, $z = -2.32$, *p* = .02, 95% CI[-1.11, -.09], *OR* = .55. Similarly, as ratings of Perceived Gender (mean-centered) increased, there were also fewer yes than no STEM categorizations, *B* = -.16, *SE* = .06, *z* = -2.84, *p* = .005, 95% CI[-.27, .05], *OR* = .85. The interaction of Perceived Sex and Perceived Gender on Career Judgment was significant, *B* = .08, *SE* = .04, *z* = 2.16, *p* = .03, 95% CI[.01, .16] (see Figure 6). Surprisingly, among faces judged to be female, the effect of gender was not significant, *B* = -.07, *SE* = .05, *z* = -1.33, *p* = .18, 95% CI[-.16, .03]. Among faces judged to be male, however, faces that were rated as more feminine were elicited fewer yes than no STEM categorizations, *B* = -.15, *SE* = .05, *z* = -2.98, *p* = .003, *OR* = .86, 95% CI[-.25, -.05], *OR* = .86.

Figure 6

Effect of Perceived Sex and Perceived Gender on STEM Judgment in Study 1c.



Note. Higher values of Perceived Gender indicate greater perceived femininity. Higher values of STEM Judgment indicate a greater predicted probability of yes relative to no STEM categorizations. Error bars are 95% CI.

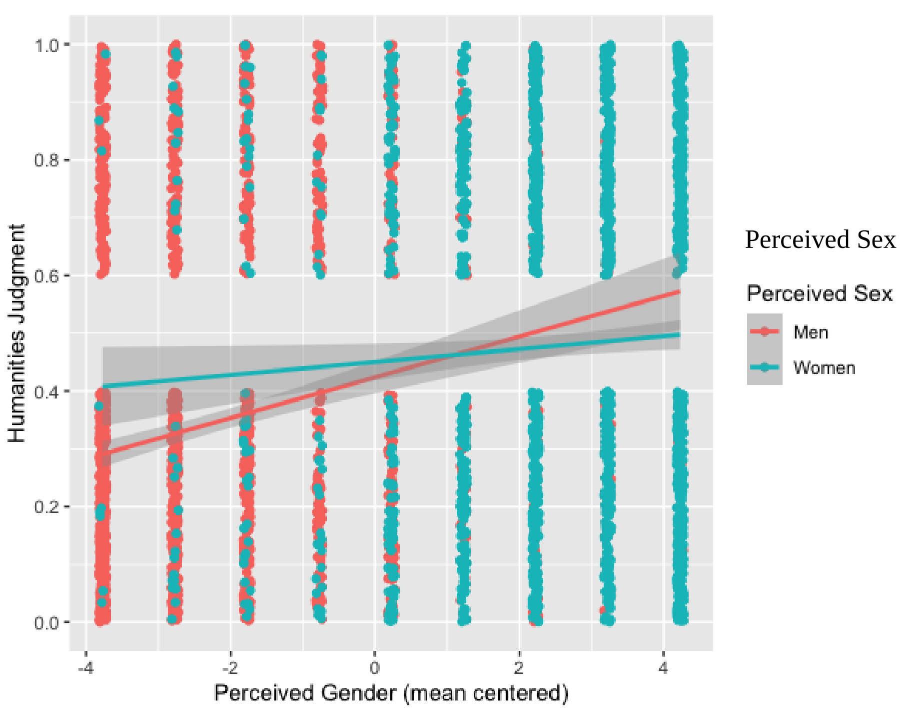
Again, however, what it means to be perceived as a highly feminine man is likely distinct from what it means to be perceived as a highly feminine woman. As such, I again calculated a z score of Perceived Gender separately for men and women and then combined these values on a single scale for the sake of analyses. I regressed STEM Judgment into Perceived Sex, Perceived Gender (z-scored), and their interaction. As noted above, faces categorized as female, relative to male, elicited a smaller proportion of yes than no STEM categorizations, $B = -.60$, $SE = .26$, $z = -2.32$, $p = .02$, 95% CI[-1.11, -.09]. The effect of Perceived Gender on STEM Judgment, however, was not significant, $B = -0.11$, $SE = 0.08$, $z = -1.42$, $p = .15$, 95% CI[-.36, .56]. I'll note here that this nonsignificant main effect of Perceived Gender does not reflect a failed replication as Perceived Gender now signifies perceived gender-typicality vs. atypicality rather than masculinity vs. femininity.

The interaction of Perceived Sex and Perceived Gender on STEM Judgment was significant, $B = .14$, $SE = 0.07$, $z = 2.02$, $p = .04$, 95% CI[.004, .29]. Among faces judged to be female, the effect of Perceived Gender was not significant, $B = -0.12$, $SE = 0.09$, $z = -1.33$, $p = .18$, 95% CI[.23, .39]. Among faces judged to be male, gender atypical faces elicited a greater proportion of yes STEM categorizations than no, $B = -0.26$, $SE = 0.09$, $z = -2.91$, $p = .004$, 95% CI[-.44, -.08], $OR = .87$. Again, this significant interaction reflected in Figure 6 suggests that shifting standards are applicable such that the range of gender evaluations applied to STEM judgments is different for men vs. women.

I then analyzed the findings for Condition 2 by regressing Humanities Judgment onto Perceived Gender, Perceived Sex, and their interaction. Faces categorized as female, relative to male, elicited more yes than no Humanities categorizations, *B* = .57, *SE* = .27, *z* = 2.09, *p* = .04, 95% CI[.03, 1.11], *OR* = 1.76. Similarly, as ratings of Perceived Gender (mean-centered), there were also more yes than no Humanities categorizations, *B* = .14, *SE* = .05, *z* = 2.76, *p* = .006, 95% CI[.04, .25], *OR* = 1.15. The interaction of Perceived Sex and Perceived Gender on Career Judgment was significant, *B* = -.16, *SE* = .04, *z* = -3.98, *p* < .001, 95% CI[-.24, -.08], (see Figure 7). Surprisingly, among faces judged to be female, the effect of gender was not significant, *B* = .06, *SE* = .04, *z* = 1.23, *p* = .22, 95% CI[-.03, .14]. Among faces judged to be male, however, faces that were rated as more feminine elicited a greater proportion of yes than no Humanities categorizations, *B* = .21, *SE* = .04, *z* = 4.81, *p* < .001, 95% CI[.12, .30], *OR* = 1.24.

Figure 7

Effect of Perceived Sex and Perceived Gender on Humanities Judgment in Study 1c.



Note. Higher values of Perceived Gender indicate greater perceived femininity. Higher values of Humanities Judgment indicate a greater predicted probability of yes relative to no humanities categorizations. Error bars are 95% CI.

Again, however, what it means to be perceived as a highly feminine man is likely distinct from what it means to be perceived as a highly feminine woman. As such, I again calculated a z score of Perceived Gender separately for men and women and then combined these values on a single scale for the sake of analyses. I regressed Humanities Judgment into Perceived Sex, Perceived Gender (z-scored), and their interaction. As noted above, faces categorized as female, relative to male, elicited a greater proportion of yes than no humanities categorizations, $B = .57$, $SE = .27$, $z = 2.09$, $p = .04$, 95% CI[.03, 1.11], $OR = 1.76$. Similarly, as ratings of Perceived Gender (z-scored) increased, there were a greater proportion of yes humanities categorizations than no, $B = 0.17$, $SE = 0.07$, $z = 2.45$, $p = .01$, 95% CI[.33, .51], $OR = 1.19$. The interaction of Perceived Sex and Perceived Gender on Humanities Judgment was significant, $B = -.27$, $SE = 0.07$, $z = -3.78$, $p <.001$, 95% CI[-.42, -.13]. Among faces judged to be female, the effect of Perceived Gender was not significant, $B = 0.11$, $SE = 0.08$, $z = 1.27$ $p = 0.20$, 95% CI[.22, .54]. Among faces judged to be male, gender atypical faces elicited a greater proportion of yes humanities categorizations than no, $B = 0.38$, $SE = 0.08$, $z = 4.76$, $p <.001$, 95% CI[.22, .54], $OR = 1.46$. Again, this significant interaction reflected in Figure 6 suggests that shifting standards are applicable such that the range of gender evaluations applied to humanities judgments is different for men vs. women.

Objective Gender

As in Studies 1a and 1b, I tested the prediction that female and feminine faces would show a stronger association with humanities relative to male and masculine faces. I tested this prediction separately for Condition 1 and Condition 2. First, I analyzed the findings for Condition 1, I regressed STEM Judgment onto Objective Gender, Perceived Sex, and their interaction. Replicating the effects observed in Studies 1a and 1b, faces categorized as female, relative to male, elicited fewer yes than no STEM categorizations, *B* = -.60, *SE* = .26, *z* = -2.32, *p* = .02, 95% CI[-1.11, -.09], *OR* = .55. Similarly, as ratings of Objective Gender increased, there were also fewer yes than no STEM categorizations, *B* = -.03, *SE* = .01, *z* = -3.03, *p* = .002, 95% CI[-.05, -.01], *OR* = .97. The interaction of Perceived Sex and Perceived Gender on Career Judgment was not significant, *B* = -.02, *SE* = .01, *z* = -1.74, *p* = .08, 95% CI[-.03, .002].

I then analyzed the findings for Condition 2 by regressing Humanities Judgment onto Perceived Gender, Perceived Sex, and their interaction. Faces categorized as female, relative to male, elicited more yes than no Humanities categorizations, *B* = .57, *SE* = .27, *z* = 2.09, *p* = .04, 95% CI[.03, 1.11], *OR* = 1.76. Similarly, as ratings of Objective Gender increased in femininity, there were also more yes than no Humanities categorizations, *B* = .04, *SE* = .01, *z* = 4.13, $p <$ .001, 95% CI[.02, .06], *OR* = 1.04. The interaction of Perceived Sex and Objective Gender on Career Judgment was not significant, *B* = -.01, *SE* = .01, *z* = -.64, *p* = .53, 95% CI[-.02, .01]. Objective Gender did play a significant role in career judgments supporting the prediction that femininity is associated with humanities relative to STEM.

Participant Sex

Perceived Gender. For Condition 1, the interaction of Participant Sex with Perceived Sex on STEM Judgment was not significant, *B* = .47, *SE* = .59, *z* = .80, *p* = .42, 95% CIs [-.68, 1.63], nor was the interaction of Participant Sex with Perceived Gender on STEM Judgment, *B* = .14, *SE* = .13, *z* = 1.05 *p* = .29, 95% CIs [-.12, .40]. For Condition 2, the interaction of Participant Sex with Perceived Sex on Humanities Judgment was not significant, *B* = 1.11, *SE* = .61, *z* = 1.85, *p* = .06, 95% CIs [-.07, 2.29]. However, the interaction of Participant Sex with Perceived

Gender on Humanities Judgment was significant, B = .24, SE = .12, z = 2.11, p = .03, 95% CIs [.02, .47]. For participants who identified as men, the effect of Perceived Gender on Humanities Categorizations was not significant, B = -.03, SE = .10, z = -.32, p = .75, 95% CIs [-.23, .17]. For participants who identified as women, the effect of Perceived Gender on Humanities Categorizations was significant such that as Perceived Gender increased in femininity, there was a greater proportion of yes than no humanities categorizations, B = .21, SE = .06, z = 3.70, p < .001, 95% CIs [.10, .32]. Interestingly, participants who identified as women showed a bias to associate femininity with humanities while participants who identified as men did not.

Objective Gender. For Condition 1, as indicated above, the interaction of Participant Sex with Perceived Sex on STEM Judgment was not significant, B = .47, SE = .59, z = .80, p = .42, 95% CIs [-.68, 1.63]. The interaction of Participant Sex with Objective Gender on STEM Judgment was, however, significant, B = .05, SE = .02, z = -2.11, p = .03, 95% CIs [.004, .09]. For participants who identified as men, as Objective Gender increased in femininity, there was a smaller proportion of yes than no STEM Categorizations, B = -.07, SE = .02, z = -3.56 p < .001, 95% CIs [-.11, -.03]. For participants who identified as women, the same pattern emerged but the effect was smaller than for participants who identified as men, B = -.02, SE = .01, z = -2.01 p = .04, 95% CIs [-.05, -.001]. For Condition 2, the interaction of Participant Sex with Perceived Sex on Humanities Judgment was, as indicated above, not significant, B = 1.11, SE = .61, z = 1.85, p = .06, 95% CIs [-.07, 2.29], nor was the interaction of Participant Sex with Objective Gender on Humanities Judgment, , B = .01, SE = .02, z = .45, p = .65, 95% CIs [.02, .06]. Here, participants who identified as men and participants who identified as women both exhibited a bias to associate femininity with humanities, however participants who identified as men showed a stronger bias than did participants who identified as women.

These findings support the prediction that there are male and masculine gendered associations with STEM and female and feminine associations with humanities. So much so that when participants are assigned to make judgments about whether someone is STEM independent of whether or not someone belongs to Humanities, a full crossover in gender biases emerges. Interestingly, the effect sizes for the main effect of Perceived Sex and Perceived Gender for Condition 1 vs. Condition 2 suggest that the bias to associate women and femininity with humanities is even stronger than the bias to associate men and masculinity with STEM. As such, the fact that women leave STEM fields for humanities fields for droves is perhaps unsurprising. Furthermore, this pattern of data suggests that my decision to pit these two career fields against each other within the same block of judgments as I did in Studies 1a and 1b was theoretically and methodologically sound.

In three studies, I found that both sex and gendered appearance affect STEM-linked career associations. Observers associated the femininity of both women's and men's faces with humanities and facial masculinity with STEM. I demonstrated these associations using natural variation as well as digitally manipulated faces, providing evidence from multiple sources that facial femininity weakens perceived association with STEM. Critically, I find it is not only the sex category (i.e., woman vs. man) but also variation within sex (i.e., feminine vs. masculine) that operate to reduce STEM associations for *both* men and women. Furthermore, I found evidence that a decreased association with STEM accompanies a strengthened association with humanities suggesting that humanities fields harbor gender stereotypes that are prescriptive in how men and women must appear to fit, however, these prescriptions, while they affect both men and women, do not affect men and women identically. Indeed, consistent with work on shifting standards, the impact of gendered evaluations is likely distinct for men and women (see Biernat

& Thompson, 2011 for review). Finally, this pattern is not merely a tradeoff between STEM vs. humanities as gendered-driven appearance expectations emerge even when I measured STEM and humanities career associations independent from one another. As such, this work provides important new insights into how facial femininity might impact a variety of consequential judgments of both women and men.

However, while these findings have been seminal in experimentally testing the role offender in STEM evaluations, I tested these predictions in a stimulus set of solely White faces. And yet, race is likely to play a role in evaluations of STEM association due to differential representation in STEM fields depending on one's sex and race. As such, it is important to extend the understanding of the role of gendered visual cues to incorporate visual cues of race and the impact of social categorization and career association with visual information for both race and gender

Study Set 1 Summary

In three studies, I found that both sex and gendered appearance affect STEM-linked career associations. Observers associated the femininity of both women's and men's faces with humanities and facial masculinity with STEM. I demonstrated these associations using natural variation as well as digitally manipulated faces, providing evidence from multiple sources that facial femininity weakens perceived association with STEM. Critically, I find it is not only the sex category (i.e., woman vs. man) but also variation within sex (i.e., feminine vs. masculine) that operate to reduce STEM associations for *both* men and women although the degree and nature of this gendered influence operates differently for men vs. women. As such, this work provides important new insights into how facial femininity might impact a variety of consequential judgments of both women and men.

However, while these findings have been seminal in experimentally testing the role offender in STEM evaluations, I tested these predictions in a stimulus set of solely White faces. And yet, race is likely to play a role in evaluations of STEM association due to differential representation in STEM fields depending on one's sex and race. As such, it is important to extend the understanding of the role of gendered visual cues to incorporate visual cues of race and the impact of social categorization and career association with visual information at the intersection of race and gender

Chapter 3: Study Set 2

Results from Study Set 1 indicate that perceivers utilized both sex and gender typicality when categorizing a target's likely association with humanities or STEM disciplines. While these findings reveal insights into the role of gendered visual cues in White faces, it remains unclear how these gendered visual cues will operate for individuals who vary in race (i.e., Asian, and Black individuals). That is, how might gendered appearance play a role in the presence of visual indices of race that are likely to enhance the extent to which an individual is associated with STEM (i.e., Asian individuals) or decrease the extent to which an individual is associated with STEM (i.e., Black individuals)? Study Set 2 tests Hypotheses 2-3. By investigating the role of gendered visual cues in evaluation for different racial groups, I can test the role of intersecting race and gender cues that are likely to impact categorical and career-based judgments.

Study 2a

Method

Participants

I again ran the study for two weeks and I was able to recruit ninety-seven undergraduates (78% women, 22% men) through UCLA's Communication Studies Department SONA Pool who participated in exchange for course credit. On average, participants were 20.15 years old (SD=1.29). The majority of the sample identified as Asian (35%); 31% identified as White, 16% as Latino, 8% as Black, and 9% as biracial or Other.

Stimuli

Stimuli consisted of 150 photographs (25 White men, 25 White women, 25 Asian men, 25 Asian women, 25 Black men, 25 Black women) selected randomly from the Chicago Face Database Version 1.0 (Ma, et al., 2015). These faces were standardized in terms of attire and faced the camera with a neutral expression.

Procedure

Just as in Studies 1a-1b, participants were told that they will be making judgments about a series of faces of various employees, the roles of these various employees were not specified. After providing consent, participants rated each of the photos in three counterbalanced blocks—Perceived Sex (*male* vs. *female*), Perceived Gender (1 = *masculine*, 7 = *feminine*), and Career Judgment (does this person work in *STEM* vs. *humanities).* Participants then provide demographic information and were debriefed.

Results and Discussion

I implemented the same analysis structure as previous studies, using R packages "lme" and "lme4" to analyze the data in a hierarchical linear fashion to account for within-subject and within stimuli dependencies, and I will again use a standard regression vernacular to describe the results (Bates, et al., 2015; Kuznetsova, et al., 2017). As in Study Set 1, I numerically coded both Perceived Sex (male targets = 0, females targets = 1) and Career Judgment (STEM=0, humanities=1), and mean-centered Perceived Gender. Target Race (1 = Asian, 2 = Black, and 3 = White) was dummy coded. I also tested potential interactions with Participant Sex (male participants = 0, female participants = 1) and Participant Race (1 = Asian, 2 = Black, 3 = Latino, 4 = White, 5 = Biracial/Other; dummy coded); in all studies, Participant Sex nor Participant Race qualified any effect unless otherwise noted.

Replication Analyses

I expected to replicate the findings from Study Set 1 about the role of gender cues in career evaluations for men and women. To test this prediction, I first sought to replicate the effect of Perceived Sex, Perceived Gender, and their interaction on Career Judgment. The effect of Perceived Sex on Career Judgment was significant such that humanities categorizations were 50% more likely for women than men, $B = 0.45$, $SE = 0.11$, $z = 4.01$, $p < .001$, 95% CI[.23, .66], $OR = 1.56$. Furthermore, faces rated as more feminine elicited a greater proportion of humanities categorizations: for every one unit increase in Perceived Gender, humanities categorizations were 6% more likely, $B = 0.06$, $SE = 0.01$, $z = 3.57$, $p < .001$, 95% CI[.03, .10], $OR = 1.06$. The interaction of Perceived Sex and Perceived Gender was not significant, $B = -0.04$, $SE = 0.04$, $z = -1.05$, $p =.29$, 95% CI[-.11, .03].

Consistent with Study Set 1, sex and gender independently predict career associations such that being female and feminine elicits were STEM categorizations. These findings persist in a stimulus set that includes not only White faces but also Asian and Black faces. Having established the replicability of the sex and gender effects, Intext sought to test the role of target race independently and simultaneously with sex and gender in career judgments.

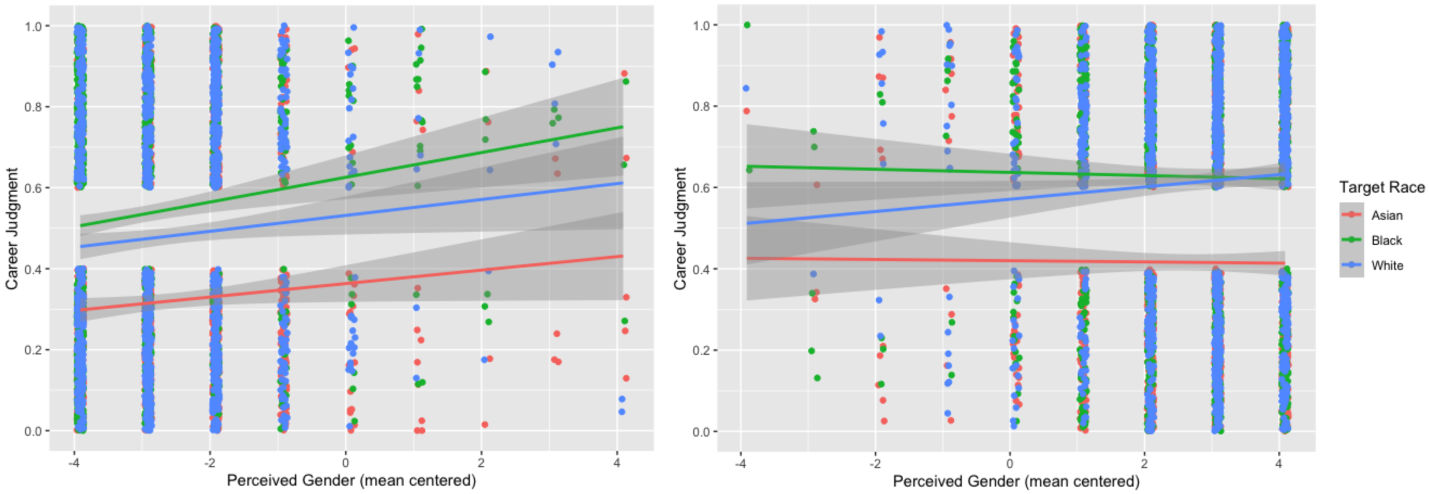
Focal Analyses

I then tested my focal predictions that there are racial differences in the extent to which faces are associated with STEM and that these racial differences are influenced by variation in gendered appearance. To test this prediction, I first regressed Career Judgment onto Target Race, Perceived Gender, and their interaction. Consistent with my predictions, the main effect of Target Race was significant, $\chi 2$ (2) = 41.25, $p < .001$.[1]Asian individuals elicited a greater proportion of STEM categorizations than White individuals, $B = -0.82$, $SE = 0.13$, $z = -6.14$, $p < .001$, 95% CI[-1.08, -.56], $OR = 0.44$ and Black individuals, $B = -0.99$, $SE = 0.15$, $z = -6.44$, $p < .001$, 95% CI[-1.29, -.69], $OR = 0.37$: humanities categorizations were nearly 60% less likely for Asian individuals relative to White individuals and nearly 65% less likely for Asian individuals relative to Black individuals . Surprisingly, there was no significant difference in Career Judgment for Black vs. White individuals, $B = 0.17$, $SE = 0.12$, $z = 1.43$, $p = .15$, 95% CI[-.06, .40], although the pattern was in the predicted direction such that Black individuals elicited fewer STEM categorizations relative to White individuals. As noted earlier, faces rated as more feminine elicited a greater proportion of humanities categorizations, $B = 0.06$, $SE = 0.01$, $z = 3.57$, $p < .001$, 95% CI[.03, .10], $OR = 1.06$. However, the interaction of Target Race and Perceived Gender did not prove significant, $\chi 2$ (2) = .97, $p = .62$ (see Figure 8).

Figure 8

Effect of Target Race and Perceived Gender (mean centered) on Career Judgment for Men vs. Women Study 2a.

[1]Throughout Study Set 2, I used likelihood ratio tests to estimate the significance of all main effects and interactions involving the 3-level categorical predictor variable Target Race. To test for significant main effects, I estimated the intercept only model and compare it to the estimated model including the main effect. To test for significant interactions, I estimated the main effect only model and comparing it to the model including the interaction. The LR test compares the log likelihoods of these two models. If this test is significant, then the less restrictive model (the one with more variables) is said to predict the data significantly better than the more restrictive model. The resulting test statistic is a chi-squared distribution with degrees of freedom equal to the difference in the number of parameters between the two models.



Note. Higher values of Perceived Gender indicate greater perceived femininity. Higher values of Career Judgment indicate a greater predicted probability of humanities relative to STEM. The figure on the left represents the relation between Target Race and Perceived Gender (mean centered) for faces categorized as men and the right graph represents the relation for faces categorized as women. Error bars are 95% CI.

I then regressed Career Judgment onto Perceived Sex, Target Race, and their interaction. As stated above, the effect of Perceived Sex on Career Judgment was significant: humanities categorizations were 50% more likely for women than men, $B = 0.45$, $SE = 0.11$, $z = 4.01$, $p < .001$, 95% CI[.23, .66], $OR = 1.56$ as was the effect of Target Race on Career Judgment, $\chi2$ (2) = 41.25, $p < .001$. However, the interaction of Perceived Sex and Target Race on Career Judgment was not significant, $\chi2$ (2) = 1.30, $p = .52$. Furthermore, the three-way interaction of Target Race, Perceived Sex, and Perceived Gender was also not significant, $\chi2$ (7) = 5.11, $p = .65$[2].

Perceived Gender Analyses Z-scored

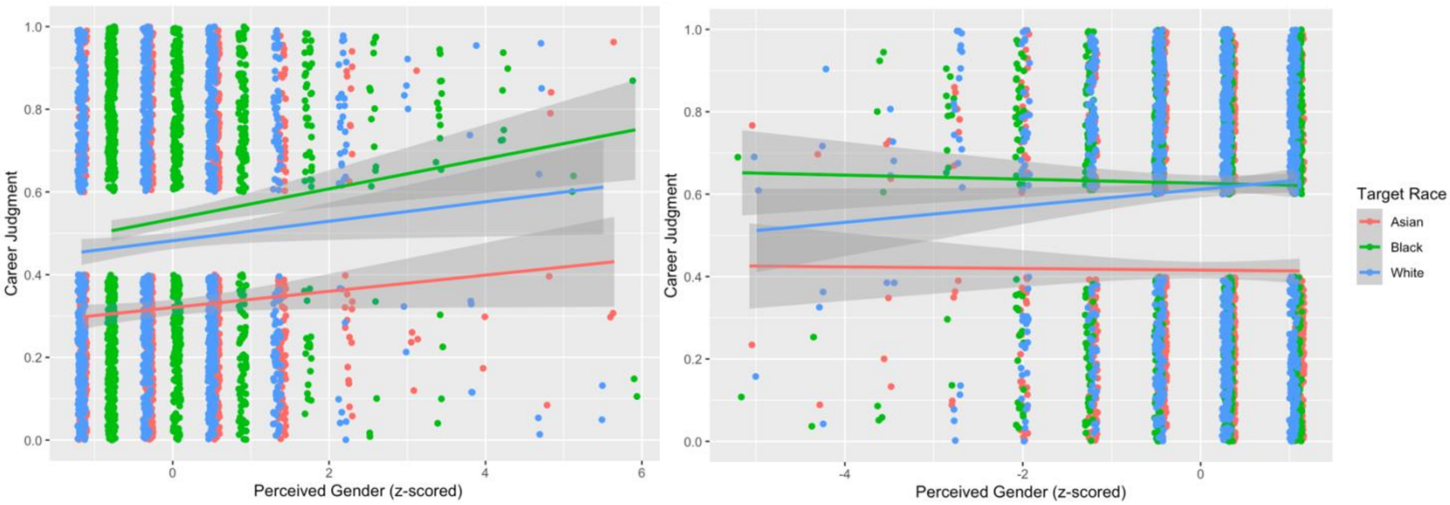
Here I again address the shifting standards such that gendered ratings are likely to be perceived and applied differently for men vs. women by calculating a separate z score of the

Perceived Gender variable for Asian men, Black men, White men, Asian women, Black women, and White women. I then combined these scores into one variable to conduct the following analyses. As noted above, faces categorized as female, relative to male, showed a stronger association with humanities than with STEM, *B* = 0.45, *SE* = 0.11, *z* = 4.01, *p* < .001, 95% CI[.23, .66], *OR* = 1.56. And the main effect of Target Race was significant, $\chi 2$ (2) = 41.25, *p* < .001. However, the main effect of Perceived Gender (z-scored) was not significant, *B* = 0.06, *SE* = 0.03, *z* = 1.87, *p* = .06, 95% CI[-.003, .11]. Again, I'll note here that this nonsignificant main effect of Perceived Gender does not reflect a failed replication as Perceived Gender now signifies perceived gender-typicality vs. atypicality rather than masculinity vs. femininity.

The interaction of Perceived Sex and Perceived Gender (z-scored) on Career Judgment was not significant, *B* = -.06, *SE* = 0.05, *z* = -1.28, *p* = .20, 95% CI[-.13, .04]. The interaction of Target Race and Perceived Gender (z-scored) on Career Judgment was not significant, $\chi 2$ (2) = 1.52, *p* = .46 nor was the 3-way interaction of Perceived Sex, Target Race, and Perceived Gender on Career Judgment, $\chi 2$ (7) = 4.71, *p* = .70 (see Figure 9). However, while this interaction was not significant, the pattern of data (see Figure 9) again reflects that there are shifting standards for men vs. women's career evaluations as a function of perceived gender and, even a shifting standard for Black vs. White individual's association with STEM as a function of both sex and gender.

Figure 9

Effect of Target Race and Perceived Gender (z-scored) on Career Judgment for Men vs. Women Study 2a.



Note. Negative values of Perceived Gender indicate greater gender-atypicality for women and positive values of Perceived Gender indicate greater gender-atypicality for men. Higher values of Career Judgment indicate a greater predicted probability of humanities relative to STEM. The figure on the left represents the relation between Target Race and Perceived Gender (z-scored) for faces categorized as men and the right graph represents the relation for faces categorized as women. Error bars are 95% CI.

Target Sex

Replication Analyses. I expected to replicate the findings from Study Set 1 and 2 as well as the findings from the Perceived Sex analyses about the role of gender cues in career evaluations for men and women. To test this prediction, I first tested the effect of Target Sex, Perceived Gender, and their interaction on Career Judgment. The effect of Target Sex on Career Judgment was significant such that women elicited a greater proportion of humanities categorizations than men, $B = .47$, $SE = .12$, $z = 4.09$, $p < .001$, 95% CIs [.25, .70], $OR = 1.60$. As noted earlier in the document, faces rated as more feminine elicited a greater proportion of humanities categorizations on average, $B = .06$, $SE = .01$, $z = 3.57$, $p < .001$, 95% CIs [.03, .10]. However, consistent with the interaction of Perceived Sex and Perceived Gender, the interaction of Target Sex and Perceived Gender was not significant, $B = -.04$, $SE = .04$, $z = -.99$, $p = .32$, 95% CIs [-.11, .04].

Focal Analyses. Similarly, as stated above, the effect of Target Sex on Career Judgment was significant, $B = .47$, $SE = .12$, $z = 4.09$, $p < .001$, 95% CIs [.25, .70], $OR = 1.60$, as was the effect of Target Race on Career Judgment, $\chi 2$ (2) = 41.25, $p < .001$. However, consistent with the interaction of Perceived Sex and Target Race, the interaction of Perceived Sex and Target Race on Career Judgment was not significant, $\chi 2$ (2) = .54, $p = .76$. Furthermore, the three-way interaction of Target Race, Target Sex, and Perceived Gender was also not significant $\chi 2$ (7) = 5.52, $p = .60$.

Participant Sex as a Moderator

To test for the effect of Participant Sex on Career Judgment, I regressed Career Judgment onto Participant Sex, Perceived Sex, and the interaction. The effect of Participant Sex on Career Judgment was not significant, $B = .09$, $SE = .11$, $z = .80$, $p = .42$, 95% CIs [-.13, .31]. The effect of Perceived Sex, as noted above, was significant, $B = .45$, $SE = .11$, $z = 4.01$, $p < .001$, 95% CIs [.23, .66], $OR = 1.56$. The interaction of Participant Sex and Perceived Sex on Career Judgment was also not significant, $B = -.14$, $SE = .20$, $z = -.71$, $p = .48$, 95% CIs [-.54, .25].

I then I regressed Career Judgment onto Participant Sex, Perceived Gender, and their interaction. Again, Participant Sex on Career Judgment was not significant, $B = .09$, $SE = .11$, $z = .80$, $p = .42$, 95% CIs [-.13, .31] and the effect of Perceived Gender was significant, $B = .06$, $SE = .01$, $z = 3.57$, $p < .001$, 95% CIs [.03, .10]. The interaction of Participant Sex and Perceived Gender on Career Judgment was not significant, $B = -.03$, $SE = .03$, $z = -.90$, $p = .38$, 95% CIs [-.09, .04].

Finally, I regressed Career Judgment onto Participant Sex, Target Race, and their interaction. As noted above, the effect of Participant Sex on Career Judgment was not significant, $B = .09$, $SE = .11$, $z = .80$, $p = .42$, 95% CIs [-.13, .31], and the effect of Target Race was significant, $\chi2$ (2) = 41.25, $p < .001$. The interaction of Participant Sex and Target Race on Career Judgment was not significant, $\chi2$ (2) = 1.82, $p = .40$.

Participant Race as a Moderator

To test for the effect of Participant Race on Career Judgment, I regressed Career Judgment onto Participant Race, Perceived Sex, and the interaction. The effect of Participant Race on Career Judgment was not significant, $\chi2$ (4) = 2.82, $p = .59$. The effect of Perceived Sex, as noted above, was significant, $B = .45$, $SE = .11$, $z = 4.01$, $p < .001$, 95% CIs [.23, .66], OR = 1.56. The interaction of Participant Race and Perceived Sex on Career Judgment was also not significant, $\chi2$ (4) = 8.01, $p = .09$.

I then I regressed Career Judgment onto Participant Race, Perceived Gender, and their interaction. Again, as noted above, Participant Race on Career Judgment was not significant, $\chi2$ (4) = 2.82, $p = .59$, and the effect of Perceived Gender was significant, $B = .06$, $SE = .01$, z = 3.57, $p < .001$, 95% CIs [.03, .10]. The interaction of Participant Race and Perceived Gender on Career Judgment was not significant, $\chi2$ (2) = 7.83, $p = .09$.

Finally, I regressed Career Judgment onto Participant Race, Target Race, and their interaction. As noted above, the effect of Participant Race on Career Judgment was not significant, $\chi2$ (4) = 2.82, $p = .59$, and the effect of Target Race was significant, $\chi2$ (2) = 41.25, $p < .001$. The interaction of Participant Race and Target Race on Career Judgment was not significant, $\chi2$ (8) = 4.68, $p = .79$.

I found partial evidence to suggest that target race differences do play a role in career judgments—Asian individuals elicit more STEM categorizations, however, there was no difference in STEM association between Black and White targets. In addition, I did not find that gender played an interactive role with race. Indeed, the interaction of target race and perceived gender was not significant nor, surprisingly, was the interaction of target race with perceived sex. As such, these findings provide evidence to show that women and individuals who are facially feminine elicit an increased association with humanities across racial groups while Asian individuals stand out as eliciting an increased association with STEM relative to Black and White individuals. Furthermore, the role of gender as a function of race does not appear to play a significant role. I unpack this finding more in Study 2b where I used a stimulus set that systematically varies the gendered appearance of Asian, Black, and White targets separately.

Study 2b

In Study 2b, I sought to again test the prediction that race, and gender play an independent and interactive role in career associations. This prediction was partially confirmed in Study 2a in that relative to White and Black individuals, Asian individuals did elicit an increased association with STEM overall. However, in Study 2b I again tested my prediction, this time strengthening my predictive power by systematically varying the gender (masculinity and femininity) of the stimulus faces.

Method

Participants

I again opened the study for two weeks to reach the desired number of participants. Ninety undergraduates (62% women, 38% men) through UCLA's Communication Studies Department SONA Pool participated in exchange for course credit. On average, participants were 20.22 years old (SD=1.38). The majority of the sample identified as White (41%); 26% identified as Asian, 12% as Latino, 8% as Black, and 13% as biracial or Other.

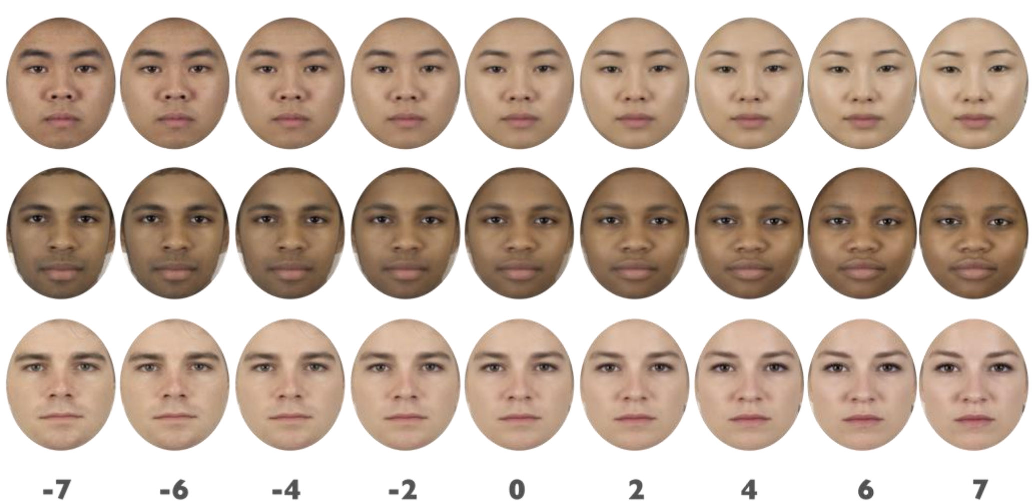
Stimuli

I generated a new set of faces using images from the Chicago Face Database (Ma, et al., 2015). Specifically, I randomly selected 25 male and 25 female faces for each race of interest—White Black, and Asian. From these images, I generated five base faces per sex (male and female) by randomly selecting five faces and morphing those five faces together (e.g., five female faces were morphed together to generate one female base face image). This morphing was conducted using Morpheus Photo Morpher Software (Version 3.17 Standard).

To create gender continuums for each race, I then randomly paired a male and female base face and used Morpheus to morph the two base faces together (i.e., pair an Asian male with an Asian female, a Black male with a Black female, and a White male with a White female). I varied the degree of morph in 15 increments to create composite faces that varied from 100% masculinity to 100% femininity for each race. Using this method, I produced 7 masculine-typed faces, 7 feminine-typed faces, plus the original and androgynous composite for a total of 15 faces for each morph. I replicated this process five times to yield a total of 75 faces for each target race for a total of 225 faces (75 White, 75 Black, and 75 Asian, see Figure 9) for my stimulus set.

Figure 10

Subset of a full morphing anchor from the stimulus set in Study 2a.



Note. Values range from -7 (100% masculinity) to 7 (100% femininity) in increments of 1 resulting in 7 masculine typed faces, 7 feminine typed faces, and 1 androgynous face. There were five sets of morphs for each race resulting in 75 Asian faces, 75 Black faces, and 75 White faces for a total of 225 faces. Here, faces are presented in odd-numbered morphing increments due to space constraints.

Procedure

Again, participants will be told that they will be making judgments about a series of faces of various employees, the roles of these various employees will not be specified. After providing consent, participants will rate each of the photos in three counterbalanced blocks—Perceived Sex (*male* vs. *female*), Perceived Gender (1 = *masculine*, 7 = *feminine*), and Career Judgment (*STEM vs humanities).*

Results and Discussion

I implemented the same analytic structure as in Study Set 1 and Study 2a.

Replication Analyses

I expected to replicate the findings from Study Set 1 and Study 2a about the role of gender cues in career evaluations for men and women. To test this prediction, I first sought to replicate the effect of Perceived Sex, Perceived Gender, and their interaction on Career Judgment. The effect of Perceived Sex on Career Judgment was significant such that humanities categorizations were nearly 80% more likely for women than men, $B = 0.58$, $SE = 0.10$, $z = 5.88$, $p < .001$, 95% CI[.39, .77], $OR = 1.78$. Furthermore, higher-rated femininity elicited a greater proportion of humanities categorizations: for every one unit increase in Perceived Gender, humanities categorizations were 14% more likely, $B = 0.13$, $SE = 0.02$, $z = 6.00$, $p < .001$, 95% CI[.08, .17], $OR = 1.14$. The interaction of Perceived Sex and Perceived Gender was not significant, $B = -0.02$, $SE = 0.02$, $z = -1.20$, $p = .23$, 95% CI[-.06, .02]. Consistent with Study 2a, sex and gender independently predict career associations such that being female and feminine elicits were STEM categorizations when collapsing across the race of the target. Having established the replicability of sex and gender in predicting career judgments irrespective of race, I then tested the role of target race independently and concurrently with sex and gender in career judgments

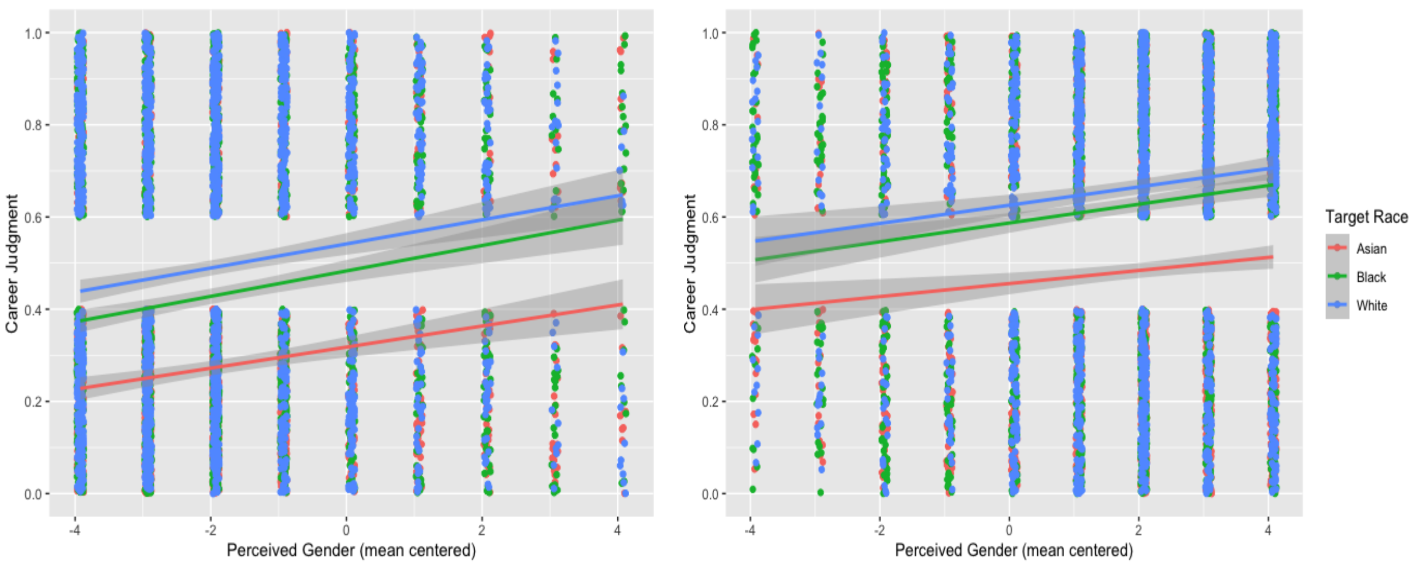
Focal Analyses

To test my focal predications, I first regressed Career Judgment onto Target Race, Perceived Gender, and their interaction. Consistent with my predictions, the main effect of Target Race was significant, $\chi2$ (2) = 30.49, *p* < .001. Asian individuals elicited a greater proportion of STEM categorizations than White individuals, *B* = -1.03, *SE* = 0.17, *z* = -5.86, *p* < .001, 95% CI[-1.37, -.68], *OR* = .36 and Black individuals, *B* = -.81, *SE* = 0.20, *z* = -4.08, *p* < .001, 95% CI[-1.20, -.42], *OR* = .44: humanities categorizations were more than 60% less likely for Asian relative to White individuals and nearly 55% less likely for Asian relative to Black individuals. Consistent with Study 2a findings, there was no significant difference in Career Judgment for Black vs. White individuals, *B* = -0.21, *SE* = 0.15, *z* = -1.44, *p* = .15, 95% CI[-.50, .08]. As noted earlier, faces rated as more feminine elicited a greater proportion of humanities categorizations: for every one unit increase in Perceived Gender, humanities categorizations were 14% more likely, *B* = 0.13, *SE* = 0.02, *z* = 6.00, *p* < .001, 95% CI[.08, .17], *OR* = 1.14. Consistent with my predictions, the interaction of Target Race and Perceived Gender was significant, $\chi2$ (2) = 6.47, *p* = .04 (see Figure 10). Asian individuals perceived as more feminine elicit a greater proportion of humanities categorizations: for every one unit increase in Perceived Gender, humanities categorizations were 23% more likely, *B* = 0.21, *SE* = 0.03, *z* = 7.78, *p* < .001, 95% CI[.15, .26], *OR* = 1.23. Black individuals perceived as more feminine elicit a greater proportion of humanities categorizations: for every one unit increase in

Perceived Gender, humanities categorizations were 18% more likely, *B* = 0.16, *SE* = 0.03, *z* = 6.29, *p* < .001, 95% CI[.11, .21], *OR* = 1.18. White individuals perceived as more feminine elicit a greater proportion of humanities categorizations: for every one unit increase in Perceived Gender, humanities categorizations were nearly 80% more likely, *B* = 0.16, *SE* = 0.03, *z* = 6.31, *p* < .001, 95% CI[.11, .21], *OR* = 1.77.

Figure 11

Effect of Target Race and Perceived Gender (mean centered) on Career Judgment for Men vs. Women Study 2b.



Note. Higher values of Perceived Gender indicate greater perceived femininity. Higher values of Career Judgment indicate a greater predicted probability of humanities relative to STEM. The figure on the left represents the relation between Target Race and Perceived Gender (mean centered) for faces categorized as men and the right graph represents the relation for faces categorized as women. Error bars are 95% CI.

I then regressed Career Judgment onto Target Race, Perceived Sex, and their interaction. As stated above, the effect of Perceived Sex on Career Judgment was significant: humanities categorizations are nearly 80% more likely for women than men, *B* = 0.58, *SE* = 0.10, *z* = 5.88,

$p < .001$, 95% CI[.39, .77], *OR* = 1.78, as was the effect of Target Race on Career Judgment, $\chi 2$ (2) = 30.49, $p < .001$. Consistent with our, the interaction of Perceived Sex and Target Race on Career Judgment was significant, $\chi 2$ (2) = 13.98, $p = .001$. When looking at the simple effects for each race broken down by sex: Asian women elicit a greater proportion of humanities categorizations compared to Asian men: humanities categorizations were more than two times more likely for Asian women than Asian men, $B = 0.78$, $SE = 0.12$, $z = 6.53$, $p < .001$, 95% CI[.55, 1.01], *OR* = 2.18. Furthermore, Black women elicit a greater proportion of humanities categorizations compared to Black men: humanities categorizations were more than two times more likely for Black women than Black men, $B = 0.78$, $SE = 0.12$, $z = 6.53$, $p < .001$, 95% CI[.55, 1.01], *OR* = 2.18. And White women elicit a greater proportion of humanities categorizations compared to White men: humanities categorizations were almost two times more likely for White women than White men, $B = 0.67$, $SE = 0.12$, $z = 5.60$, $p < .001$, 95% CI[.43, .90], *OR* = 1.94.

When looking at the simple effects for this interaction broken down by sex for each race: for individuals categorized as men, Asian men elicited a greater proportion of STEM categorizations (relative to humanities categorizations) compared to both White men, $B = -1.32$, $SE = 0.18$, $z = -7.54$, $p < .001$, 95% CI[-1.66, -.98], *OR* = 0.27 and Black men, $B = -1.04$, $SE = 0.20$, $z = -5.14$, $p < .001$, 95% CI[-1.43, -.64], *OR* = 0.35: humanities categorizations are more than 70% less likely for Asian men relative to White men and 65% less likely for Asian men relative to Black men. Black men elicited a marginally greater proportion of STEM categorizations compared to White men: humanities categorizations were 25% less likely for Black men relative to White men, $B = -0.28$, $SE = 0.14$, $z = -2.00$, $p = .046$, 95% CI[-.56, -.005], *OR* = 0.75. For individuals categorized as women, Asian women elicited a greater proportion of

STEM categorizations compared to both White women, *B* = -0.95, *SE* = 0.17, *z* = -5.51, $p < .001$, 95% CI[-1.29, -.61], *OR* = 0.39 and Black women, *B* = -0.79, *SE* = 0.20, *z* = -3.96, $p < .001$, 95% CI[-1.17, -.40], *OR* = 0.46: humanities categorizations were nearly 60% less likely for Asian women relative to White women and nearly 55% less likely for Asian women relative to Black women. Surprisingly, there was no significant difference in Career Judgment between Black women and White women, *B* = -0.16, *SE* = 0.14, *z* = -1.16, *p* = .25, 95% CI[-.44, .11], *OR* = 0.85.

Furthermore, the three-way interaction of Target Race, Perceived Sex, and Perceived Gender was also significant, $\chi 2$ (7) = 20.84, *p* = .004. For Asian faces, the two-way interaction of Perceived Sex and Perceived Gender was marginally significant, *B* = -0.07, *SE* = 0.04, *z* = -1.97, *p* = .048, 95% CI[-.15, -.003] such that for Asian men's faces, higher perceived femininity elicited a greater proportion of humanities categorizations: for every one unit increase in Perceived Gender, humanities categorizations were 17% more likely, *B* = 0.16, *SE* = 0.03, *z* = 4.97, $p < .001$, 95% CI[.10, .22], *OR* = 1.17. For Asian women's faces, greater femininity also elicited a greater proportion of humanities categorizations: for every one unit increase in Perceived Gender, humanities categorizations were only 9% more likely, *B* = 0.09, *SE* = 0.03, *z* = 3.03, *p* = .002, 95% CI[.03, .14], *OR* = 1.09. However, for Black faces, the two-way interaction of Perceived Sex and Perceived Gender was not significant, *B* = -0.04, *SE* = 0.03, *z* = -1.08, *p* = .28, 95% CI[-.10, .29]. Nor was the two-way interaction of Perceived Sex and Perceived Gender significant for White faces, *B* = -0.01, *SE* = 0.03, *z* = -.39, *p* = .70, 95% CI[-.08, .05].

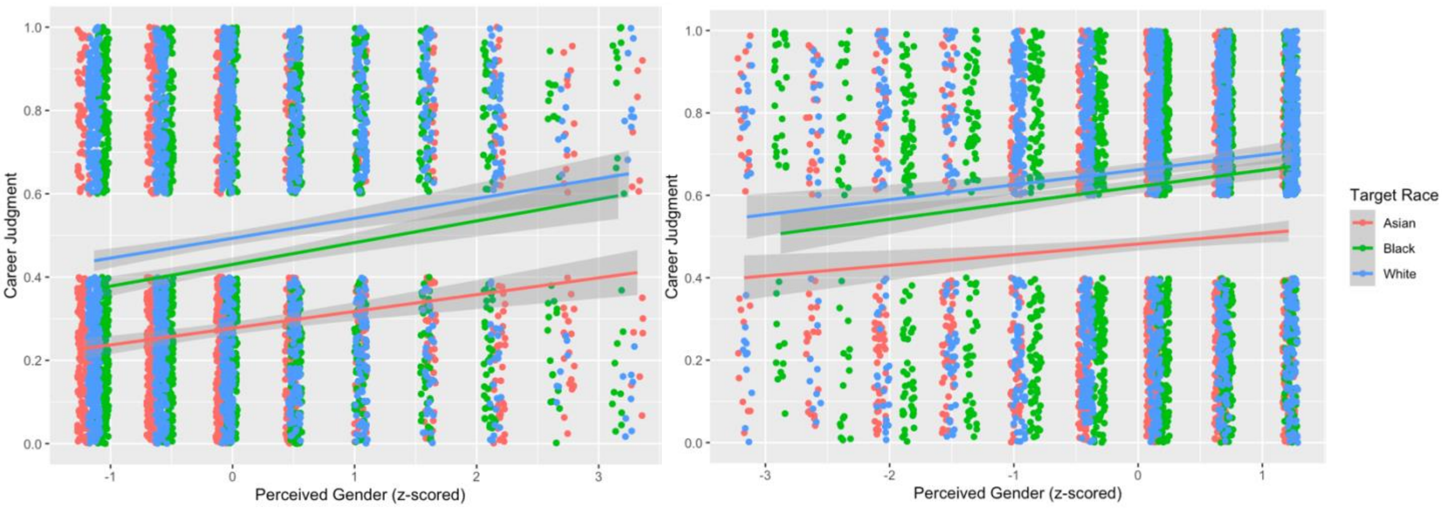
I again found consistent but partial support for my prediction indicating that target race differences do play a role in career judgments—Asian individuals elicit more STEM categorizations, however, there was no difference in STEM association between Black and White targets. In addition, in this study, I did find support for my prediction that gender plays an interactive role with race. For Asian, Black, and White targets greater perceived femininity is associated with more humanities career judgments. However, this effect was larger for White individuals and smaller for Asian individuals. Consistent with my prediction, this effect was the smallest for Black individuals. Asian women, Black women, and White women all elicit a greater association with humanities relative to their male counterparts—this effect is strongest for Asian and Black women relative to Asian and Black men respectively than they are for White women relative to White men. Furthermore, Asian men elicit an increased association with STEM relative to White men and Black men. Consistent with the main effect of race, Black men nor Black women elicit a decreased association with STEM relative to White men and women, indeed Black men even elicit an increased association with STEM relative to White men. Finally, the three-way interaction of sex, gender, and race proved significant. Surprisingly, the bias to associate perceived visual femininity with humanities was stronger for Asian men than Asian women. However, there were no significant sex differences that emerged for Black or White targets.

Perceived Gender Analyses Z-scored

Here I again address the shifting standards such that gendered ratings are likely to be perceived and applied differently for men vs. women, particularly for men and women of different races. I calculated the Perceived Gender z-scored measure using the same parameters outlined in Study 2a. As noted above, faces categorized as female, relative to male, showed a stronger association with humanities than with STEM, $B = 1.35$, $SE = 0.30$, $t(6.02) = 4.51$, $p = .004$, 95% CI[.72, 1.98]. And the main effect of Target Race was significant, $\chi2$ (2) = 30.49, $p < .001$. The main effect of Perceived Gender (z-scored) was also significant, $B = 0.11$, $SE = 0.03$, $z = 3.49$, $p < .001$, 95% CI[.05, .18]. The interaction of Perceived Sex and Perceived Gender (z-scored) on Career Judgment was not significant, $B = -.04$, $SE = 0.04$, $z = -1.11$, $p = .27$, 95% CI[-.11, .03] nor was the interaction of Target Race and Perceived Gender (z-scored) on Career Judgment, $\chi 2$ (2) = 0.56, $p = .75$. However, the 3-way interaction of Target Race, Perceived Sex, and Perceived Gender (z-scored) on Career Judgment was significant, $\chi 2$ (7) = 20.04, $p = .005$ (see Figure 12). For Asian individuals, the two-way interaction of Perceived Sex and Perceived Gender (z-scored) was not significant, $B = -0.13$, $SE = 0.07$, $z = -1.91$, $p = .06$, 95% CI[-.26, .003] nor was the two-way interaction for Black individuals, $B = -0.06$, $SE = 0.06$, $z = -1.01$, $p = .31$, 95% CI[-.19, .06]. For White individuals, two-way interaction of Perceived Sex and Perceived Gender was also not significant, $B = -0.02$, $SE = 0.06$, $z = -.37$, $p = .71$, 95% CI[-.14, .10]. However, while each of these 2-way interactions were not significant, the pattern of data (see Figure 12) again reflects that there are shifting standards for men vs. women's career evaluations as a function of perceived gender.

Figure 12

Effect of Target Race and Perceived Gender (z-scored) on Career Judgment for Men vs. Women Study 2b.



Note. Negative values of Perceived Gender indicate greater gender-atypicality for women and positive values of Perceived Gender indicate greater gender-atypicality for men. Higher values of Career Judgment indicate a greater predicted probability of humanities relative to STEM. The figure on the left represents the relation between Target Race and Perceived Gender (z-scored) for faces categorized as men and the right graph represents the relation for faces categorized as women. Error bars are 95% CI.

Objective Gender Analyses

For all findings throughout Study Set 2, Objective Gender was coded from -7 to 7 with negative values indicating increases in morphed masculinity and positive values indicating increases in morphed femininity.

Replication Analyses. I aimed to replicate the findings from Study Set 1 as well as the findings from the Perceived Gender analyses in Study 2a and the Perceived Gender results section above about the role of gender cues in career evaluations for men and women. To test this prediction, I first tested the effect of Perceived Sex, Objective Gender, and their interaction on Career Judgment. The effect of Perceived Sex on Career Judgment was significant as noted above such that women elicited a greater proportion of humanities categorizations than men, B = 0.58, SE = 0.10, z = 5.88, p < .001, 95% CI[.39, .77], OR = 1.78. Furthermore, the effect of

Objective Gender on Career Judgment was significant such that faces morphed to appear more feminine elicited a greater proportion of humanities categorizations, $B = 0.10$, $SE = 0.01$, $z = 7.01$, $p < .001$, 95% CI[.07, .12], $OR = 1.10$. However, the interaction of Perceived Sex and Objective Gender was significant, $B = -0.04$, $SE = 0.02$, $z = -2.78$, $p = .005$, 95% CI[-.07, -.01] (see Figure 8). For faces categorized as men, higher objective femininity elicited a greater proportion of humanities categorizations, $B = 0.09$, $SE = 0.01$, $z = 5.96$, $p < .001$, 95% CI[.06, .11], $OR = 1.09$. For faces categorized as women, higher objective femininity elicited a greater proportion of humanities categorizations, $B = 0.04$, $SE = 0.01$, $z = 2.94$, $p = .003$, 95% CI[.01, .07], $OR = 1.04$.

Focal Analyses. To test my key predictions for Objective Gender, I regressed Career Judgment onto Objective Gender, Target Race, and their interaction. As stated above, the effect of Objective Gender on Career Judgment was significant, $B = 0.10$, $SE = 0.01$, $z = 7.01$, $p < .001$, 95% CI[.07, .12], $OR = 1.10$., as was the effect of Target Race on Career Judgment, $\chi2$ (2) = 30.49, $p < .001$. However, consistent with the interaction of Perceived Gender and Target Race, the interaction of Objective Gender and Target Race on Career Judgment was marginally significant, $\chi2$ (2) = 6.07, $p = .048$.

Consistent with my prediction, Asian individuals morphed to be more feminine elicited a greater proportion of humanities categorizations, $B = 0.13$, $SE = 0.02$, $z = 8.28$, $p < .001$, 95% CI[.10, .16], $OR = 1.14$. Furthermore, Black individuals morphed to be more feminine elicited a greater proportion of humanities categorizations, $B = 0.11$, $SE = 0.02$, $z = 6.76$, $p < .001$, 95% CI[.07, .14], $OR = 1.11$. Finally, White individuals morphed to be more feminine also elicited a greater proportion of humanities categorizations, $B = 0.11$, $SE = 0.02$, $z = 2.31$, $p = .02$, 95% CI[.07, .13], $OR = 1.11$.

The three-way interaction of Target Race, Perceived Sex, and Objective Gender was also significant $\chi 2$ (7) = 35.43, $p < .001$. For Asian faces, the two-way interaction of Perceived Sex and Objective Gender was marginally significant, *B* = -0.07, *SE* = 0.02, *z* = -3.08, *p* = .002, 95% CI[-.12, -.03] such that for Asian men's faces, greater morphed femininity elicited a greater proportion of humanities categorizations, *B* = 0.12, *SE* = 0.02, *z* = 5.99, $p < .001$, 95% CI[.08, .17], *OR* = 1.13. For Asian women's faces, greater morphed femininity also elicited a greater proportion of humanities categorizations, *B* = 0.05, *SE* = 0.02, *z* = 2.95, *p* = .003, 95% CI[.02, .09], *OR* = 1.05. However, for Black faces, the two-way interaction of Perceived Sex and Objective Gender was not significant, *B* = -0.04, *SE* = 0.02, *z* = -1.74, *p* = .08, 95% CI[-.08, .004]. And, for White faces, the two-way interaction of Perceived Sex and Objective Gender was significant, *B* = -0.06, *SE* = 0.02, *z* = 2.82, *p* = .004, 95% CI[-.11, -.02] such that for White men's faces, greater visual femininity elicited a greater proportion of humanities categorizations, *B* = 0.11, *SE* = 0.02, *z* = 6.23, $p < .001$, 95% CI[.08, .15], *OR* = 1.12. For White women's faces, greater morphed femininity also elicited a greater proportion of humanities categorizations, *B* = 0.05, *SE* = 0.02, *z* = 2.48, *p* = .01, 95% CI[.01, .09], *OR* = 1.05.

Participant Sex as a Moderator

To test for the effect of Participant Sex on Career Judgment, I regressed Career Judgment onto Participant Sex, Perceived Sex, and the interaction. The effect of Participant Sex on Career Judgment was not significant, *B* = -.10, *SE* = .20, *z* = -.53, *p* = .60, 95% CIs [-.49, .28]. The effect of Perceived Sex, as noted above, was significant, *B* = .58, *SE* = .10, *z* = 5.88, $p < .001$, 95% CIs [.39, .77], *OR* = 1.78. The interaction of Participant Sex and Perceived Sex on Career Judgment was also not significant, *B* = .16, *SE* = .19, *z* = .83, *p* = .40, 95% CIs [-.21, .53].

I then I regressed Career Judgment onto Participant Sex, Perceived Gender, and their interaction. Again, Participant Sex on Career Judgment was not significant $B = -.10$, $SE = .20$, $z = -.53$, $p = .60$, 95% CIs [-.49, .28] and the effect of Perceived Gender was significant, $B = .13$, $SE = .02$, $z = 6.00$, $p < .001$, 95% CIs [.08, .17], $OR = 1.14$. The interaction of Participant Sex and Perceived Gender on Career Judgment was not significant, $B = .01$, $SE = .04$, $z = .20$, $p = .84$, 95% CIs [-.07, .09].

As a next step I regressed Career Judgment onto Participant Sex, Objective Gender, and their interaction. Again, Participant Sex on Career Judgment was not significant, $B = -.10$, $SE = .20$, $z = -.53$, $p = .60$, 95% CIs [-.49, .28], and the effect of Objective Gender was significant, $B = .10$, $SE = .01$, $z = 7.01$, $p < .001$, 95% CIs [.07, .12], $OR = 1.10$. The interaction of Participant Sex and Objective Gender on Career Judgment was not significant, $B = .01$, $SE = .02$, $z = .52$, $p = .60$, 95% CIs [-.04, .06].

Finally, I regressed Career Judgment onto Participant Sex, Target Race, and their interaction. As noted above, the effect of Participant Sex on Career Judgment was not significant, $B = -.10$, $SE = .20$, $z = -.53$, $p = .60$, 95% CIs [-.49, .28], and the effect of Target Race was significant, $\chi 2\ (2) = 30.49$, $p < .001$. The interaction of Participant Sex and Target Race on Career Judgment was also not significant, $\chi 2\ (2) = 4.61$, $p = .10$.

Participant Race as a Moderator

To test for the effect of Participant Race on Career Judgment, I regressed Career Judgment onto Participant Race, Perceived Sex, and the interaction. The effect of Participant Race on Career Judgment was not significant, $\chi 2\ (4) = 3.75$, $p = .44$. The effect of Perceived Sex, as noted above, was significant, $B = .58$, $SE = .10$, $z = 5.88$, $p < .001$, 95% CIs [.39, .77], $OR = 1.78$. The interaction of Participant Race and Perceived Sex on Career Judgment was significant, $\chi 2\ (4) = 10.17$, $p = .04$. Asian participants indicated a greater proportion of humanities categorizations than STEM for faces categorized as women, $B = .71$, $SE = .18$, $z = 3.90$, $p < .001$, 95% CIs [.36, 1.07], $OR = 2.04$. For Black participants, the effect of Perceived Sex on Career Judgment is not significant, $B = -.18$, $SE = .32$, $z = -.56$, $p = .58$, 95% CIs [-.82, .46]. Latino participants indicated a greater proportion of humanities categorizations than STEM for faces categorized as women, $B = 1.09$, $SE = .26$, $z = 4.24$, $p < .001$, 95% CIs [.59, 1.60], $OR = 2.98$. White participants indicated a greater proportion of humanities categorizations than STEM for faces categorized as women, $B = .47$, $SE = .14$, $z = 3.29$, $p < .001$, 95% CIs [.19, .75], $OR = 1.56$. And, finally, Biracial/Other participants indicated a greater proportion of humanities categorizations than STEM for faces categorized as women, $B = .56$, $SE = .24$, $z = 2.27$, $p = .02$, 95% CIs [.08, 1.03], $OR = 1.74$. Participants who identify as Asian, Latino, White, and Biracial/Other indicated the predicted pattern of results associating women with humanities while Black participants did not. Latino participants showed the strongest association followed by Asian participants, then Biracial/Other participants, then White participants. However, these participant race differences were likely driven, at least in part, by lack of representation for all racial categories except for White and Asian participants.

I then I regressed Career Judgment onto Participant Race, Perceived Gender, and their interaction. Again, as noted above, Participant Race on Career Judgment was not significant, $\chi2$ (4) = 3.75, $p = .44$, and the effect of Perceived Gender was significant, $B = .13$, $SE = .02$, $z = 6.00$, $p < .001$, 95% CIs [.08, .17], $OR = 1.14$. The interaction of Participant Race and Perceived Gender on Career Judgment was not significant, $\chi2$ (2) = 6.89, $p = .14$.

As a next step I regressed Career Judgment onto Participant Race, Objective Gender, and their interaction. Again, Participant Race on Career Judgment was not significant, $\chi2$ (4) = 3.75, $p = .44$, and the effect of Objective Gender was significant, $B = .10$, $SE = .01$, $z = 7.01$, $p < .001$, 95% CIs [.07, .12], *OR* = 1.10. The interaction of Participant Race and Objective Gender on Career Judgment was not significant, $\chi2$ (4) = 7.41, $p = .12$.

Finally, I regressed Career Judgment onto Participant Race, Target Race, and their interaction. As noted above, the effect of Participant Race on Career Judgment was not significant, $\chi2$ (4) = 3.75, $p = .44$, and the effect of Target Race was significant, $\chi2$ (2) = 30.49, $p < .001$. The interaction of Participant Race and Target Race on Career Judgment was not significant, $\chi2$ (8) = 6.90, $p = .55$.

As such, these findings provide converging evidence to show that women and individuals who are facially feminine elicit an increased association with humanities (necessitating a decreased association with STEM) regardless of race. So strong is this gender bias that Asian women and Asian men and women who appear more visually feminine prompt a decreased association with STEM that is normally conferred as a function of their race. Interestingly, White individuals seem to be the most impacted by the perceived degree of femininity, and Black individuals the least impacted. However, being a woman still elicits a biased association with humanities for all races of women. But the bias to associate visual femininity with humanities was stronger for Asian men than Asian women.

Chapter 4: General Discussion and Conclusion

General Discussion

In five studies I have provided comprehensive evidence that appearance-based cues to gender and race play a critical role in observers' judgments of career suitability. In Study Set 1, I provided evidence indicating gendered appearance affects STEM-linked career judgments over and above the effect of sex alone. Observers associated facial femininity with humanities career fields and facial masculinity with STEM career fields. These patterns occurred for judgments of stimuli that varied naturally and that were systematically manipulated and regardless of whether participants are making forced categorizations between STEM vs. Humanities or independent groups of participants are assessing STEM and Humanities suitability independently, providing convergent evidence and more causal support that being facially feminine weakens STEM associations.

Critically, perceived gender (i.e., femininity/masculinity or typicality/atypicality) affected careers associations for *both* men and women. In Study Set 2, I replicated the effects of sex and gender weakening one's association with STEM in a stimulus set that consisted of not only White individuals but Black and Asian individuals as well. I discovered a femininity penalty for all racial groups such that feminine appearance elicited a decreased association with STEM for Asian, Black, and White individuals alike. Also, I provided evidence of an overall racial difference in the perceived association with STEM vs. humanities fields such that Asian individuals were perceived as more associated with STEM relative to White and Black individuals merely as a function of their facial appearance. While I did not find a consistent pattern in terms of how race interacted with gender for Black men and women relative to other races, I did find that Black women are categorized as STEM less frequently and Humanities more so relative to Black men. Furthermore, I did find that Asian women are categorized as STEM less frequently and Humanities more so relative to Asian men. And a three-way interaction of sex, gender, and race revealed that there was a feminine penalty in STEM associations for Asian men and women alike that mirrors the patterns we saw for White men and women in Study Set 1.

As such, this work provides new insights into how facial femininity might impact a range of consequential judgments and the role that sex, gendered appearance, and race play in simultaneously impacting individuals' perceived fit within career domains.

Theoretical Advances

Collectively, these studies provide several important theoretical advances. First, these findings add to existing literature baring the importance of appearance in impacting observers' decisions about people's suitability in STEM domains. Existing research has established the negative impact of feminine expressions in male-dominated career fields (Betz & Sekaquaptewa, 2012; Pronin, et al., 2004). While such research has been useful for highlighting the inverse relationship between femininity and STEM and the consequences therein, this work has largely involved behavioral manifestations of femininity – individuals' color preferences (e.g., liking pink vs. liking black), desire for children, and gender-stereotyped expressions of emotion. To date, little work has probed the role of physical appearance and, specifically, gendered visual cues, in judgments of women in male-dominated career fields. Here, I provide convergent evidence that appearance-based cues to sex and gender play a role in weakening women and facially feminine individuals' association with male-dominated career fields.

Knowledge of the impact of displays of femininity in the workplace has led to the implementation of suggestions for short-term interventions focused on empowering women in ways that involve behavioral changes (e.g., Sharyl Sandberg's "Lean In" strategies). And yet, these interventions aimed at altering women's behavior fall short in utility as a way of mitigating the bias measured herein as individuals cannot merely alter their facial appearance. Furthermore, these interventions, while empowering women momentarily, are temporary solutions for an otherwise biased and sometimes hostile environment. My findings highlight that perceivers and their appearance-driven biases are an important part of the STEM environment. Other interventions aimed at improving diversity in workplace environments have focused on reducing bias and prejudice at the individual level. These methods often include increasing intergroup contact and shifting implicit attitudes to combat bias and prejudice (Dasgupta & Greenwald, 2001; Devine, et al., 2012; Pettigrew & Tropp, 2006). However, individuals typically have little awareness of behaving in discriminatory ways (Dovidio, 2001) and these methods rarely consider the perceptual bias that precedes the expression of attitudes. Indeed, in my results, participants leave written feedback suggesting that they are offended at the suggestion of "matching" employees to their respective careers based on gender and race. And yet, participants demonstrated a perceptual bias regardless of their explicit opinions. This suggests that if we are going to intervene at the level of individual/perceiver biases, we need to take perceptual biases into account. At present, existing interventions do not account for these appearance-driven perceptual biases. And yet, observers hold mental images of categories that spontaneously spring to mind during the evaluative process. These mental images have been reinforced over time as a function of the status quo of visual representation within a given field (i.e., STEM). As such, people hold deeply engrained and pernicious assumptions about who belongs in a group and why based on visual exposure. In other words, given that gender and racial diversity has been historically lacking in STEM, this is shaped mental representations and visual images on the part of perceivers that are lacking in gender and racial diversity and as such will continue to influence explicit evaluations of individuals until these visual representations are shifted. By shifting visual representation, I can change perceivers' mental representation and shift subsequent evaluations.

Previous research in vision sciences has demonstrated success at shifting perceptual biases by a process termed adaptation aftereffects. In this domain of research, brief exposure to a class of stimuli can substantially shift norms, thereby resulting in perceptual changes (Clifford & Rhodes, 2005; Webster, et al., 2004). When applied to face perception, evidence indicates that perceivers assess an individual's face for a given category relative to their mental representation for what they consider to be the average of that category. We can shift perceivers' mental representation of a category by changing their visual exposure (Rhodes, Jeffery, et al., 2007; Rhodes, Maloney, et al., 2007; Rhodes, Robbins, et al., 2005). For instance, in as little as three minutes of visual exposure to faces that are exaggerated in gendered appearance, perceivers exposed to faces exaggerated in their femininity substantially view feminine faces as more normative whereas perceivers exposed to faces exaggerated in their masculinity view masculine faces as more normative (Lick & Johnson, 2014). Furthermore, these visual adaptations directly impact explicit evaluations. For instance, perceivers rate faces more similar to their visual average as more attractive (Anzures, et al., 2009; Leopold & Bondar, 2005; Rhodes et al., 2003; Rhodes, Haberstadt, et al., 2005). Visual adaptations can also reduce bias. Exposure to gendered stimuli mitigates gender-linked prejudices (Lick & Johnson, 2014). And, in the domain of weight bias, shifting perceivers' perception of the average body size reduces explicit prejudice toward overweight individuals (Lick, 2015). Thus, visual cues can be used not only as a tool to measure prejudice but also as a tool for reducing prejudice. We can both measure and shift perceptual biases and subsequent evaluations outside of perceivers' awareness by merely exposing them to visual cues that differ from their concept of what is average. And, by exposing them to visual cues that are different from their concept of what is average, we can shift their perceptual average to be more inclusive.

Enhancing diversity by way of increasing visual representation not only serves as an effective strategy to mitigate perceiver bias but can also benefit outreach efforts targeting promising STEM students. When assessing unknown groups of individuals, people can accurately discern the number of men vs. women in the group from a glance lasting no more than a second (Alt, et al., 2019; Goodale, et al., 2018). And, as the number of men in the group increased, so too do perceptions about the potential for hostility (Alt, et al., 2019) and likelihood to harbor sexist norms (Goodale et al., 2018). Furthermore, observers not only make assumptions about the features of the group itself but also their ability to fit and belong within that group. Merely sharing visual characteristics (e.g., jaw shape, cheekbone placement) with a group fosters affiliation with that group (Chartrand & Lakin, 2013; Kurzban, et al., 2001), and an absence of shared visual characteristics with visible STEM exemplars, in contrast, can diminish expectations of fit or belonging in a domain. Indeed, while both men and women feel a greater sense of belonging in groups dominated by members of their same sex, this effect is considerably stronger for women than men (Goodale et al., 2018). While experimental, these findings suggest that when individuals walk into a workplace environment, they likely make a host of assumptions about their ability to fit in and be successful in that workplace from a mere cursory glance even before any verbal interaction arises. Thus, understanding the relationship between visual cues of femininity and judgments of STEM suitability provides a foundation for reducing obstacles to recruitment/retention of underrepresented individuals in STEM.

The main focus for improving recruitment and retention in the STEM domain has centered on how to attract greater numbers of individuals from various underrepresented groups. A wealth of research in this domain has addressed the need to improve diversity between categories (i.e., increase the number of women relative to men or increase the number of Black individuals relative to White individuals in various environments; for review see Casad, et al., 2018). Here, my work suggests the need to think about diversity not only between social categories but also within social categories. For instance, my findings demonstrate that variation in gendered visible cues *within* categories (and not merely features differentiating them) can impact career-linked judgments. More specifically, these findings show that the impact of gendered appearance is not limited to women but also affects men. That is, given that femininity is a devalued trait within the STEM domain, perceivers implement a gender penalty for men who appear more visually feminine. Thus, variation in gendered appearance for men decreases their perceived association with STEM. As such, presuming that men as more associated with STEM because of their sex is a missed opportunity for variations within that social category that make them more or less susceptible to prejudice.

Furthermore, my results found measurably different expressions of biases as a function of both the race and gender of the target. For example, my results indicate that perceivers perceive Asian men and women differently as a function of not only their sex but also their gendered appearance. This finding aligns with previous research to suggest that reducing Asian women's experience in STEM to merely the function of their race misses an important part of their continued underrepresentation in STEM at different points in the career pipeline (Wu & Jing, 2011). And yet, Asian women are continually presumed to have achieved parity in STEM at every stage of the STEM career pipeline due to their race. However, my results suggest that to make this presumption is to miss out on the nuanced perception of Asian women by virtue of stereotypes at the junction of their race and sex and even gendered appearance.

While my data support the argument that specific stereotypes about Asian women become visible when accounting for race, sex, and gender, stereotypes about Black women, in contrast, did not. Previous research contends that Black women's status as both Black and a woman renders them intersectionally invisible in many domains (Purdie-Vaughns & Eibach, 2008; Remedios & Snyder, 2018; Sesko & Biernat, 2010). As such, I expected black women to be similarly rendered in a STEM domain as a function of their appearance. From this perspective, Black women would suffer negative consequences as a function of both their race and their sex of a presumed lack of fit within STEM. However, my findings support the possibility that judgments of Black women closely resemble judgments of Black men. And the only time when Black women are judged as less associated with STEM fields is in comparison to Black men. These findings are supported by existing literature suggesting that while Black women have unique experiences as the junction of their race and gender, perceivers do not stereotype them as such. Analyses of the simultaneous impact of racial/ethnic and gender stereotypes find that while White women are stereotyped as intelligent, Black women are stereotyped as unintelligent along with Black men, and Black Americans in general (Ghavami & Peplau, 2013). In line with these results, race is the more salient category dimension in the social perception of Black women, as observers more readily categorize Black women as “Black” than as “women” (Stroessner, 1996). Also, race and gender appear to be so inextricably intertwined (i.e., race is gendered) that they exert a mutual influence on one another throughout the judgment process. Specifically, the categories Black and male share both stereotypic and phenotypic content. Consequently, sex and race judgments of Black women are less efficient than the same judgments of Asian or White women (Carpinella et al., 2015). As such, it makes sense that my sex and gender findings proved strongest and most consistent for White and Asian women relative to the findings for Black women.

Given that race may be more salient than gender in perceptions of Black women, perhaps the tradeoff between careers in STEM fields relative to careers in Humanities fields is not salient for perceivers in how they think about categorizing Black women nor Black men. It was initially surprising that my results did not yield a race difference in STEM vs. humanities associations for Black individuals relative to White individuals more generally. We know that Black men and women are more at risk for leaving college entirely when they drop out of STEM relative to their White peers (twenty-six percent of Black STEM majors leave their institution without receiving a degree relative to only 13% of White STEM majors; Riegle-Crumb, et al., 2019). And yet, while the proportion of STEM degrees awarded to Black students has been falling since 2014, Black men and women's share of the college-age population has held steady at 14 percent (National Center for Science and Engineering Statistics, 2016). So, what are the career fields that Black men and women are leaving STEM fields to pursue? Black men and women are more likely to receive bachelor's degrees in humanities relative to their White peers. More specifically, Black men and women are the most likely to complete bachelor's degrees related to protective services and social work (Libassi, 2018). This suggests that while measuring the perceived association with STEM vs. humanities may seem like a measurable tradeoff of perceiver bias toward Black men and women at the outset, perhaps we need to measure associations with specific career fields where Black men and women are leaving STEM in favor of to probe perceivers bias.

Limitations and Future Directions

Throughout my studies, I was able to recruit nearly equal numbers of Asian and White participants. However, I was unable to recruit sufficient representations for all other racial groups. I acknowledge the drawbacks of this lack of representation, particularly for Black participants given that I was measuring perceptions of different races of individuals' faces that included Black men and women. As such, one might venture that one potential interpretation of my findings could be that this is merely an ingroup effect such that the groups of participants who are represented are more likely to associate their respective groups with STEM. I did not find a consistent pattern in Participant Race as a moderator for any of my findings, however, I cannot anticipate how Black participants would respond given insufficient representation. I feel that participants historically underrepresented in participation pools should be sufficiently represented, particularly for studies in which race is a measurement of interest. However, for the biases measured herein, given the disproportionate representation of White and Asian men in decision-making roles in STEM domains, it is likely that measuring the bias of Asian and White individuals accurately reflects the limiting biases perpetuated throughout STEM domains.

Despite these limitations in sample diversity, these findings offer several promising future directions. First, my findings highlight the ubiquity by which my visual perception of others affects critical judgments about STEM careers. Visual representations of scientists are likely to affect real-world outcomes. Previous work has found that femininity is implicated in career judgments of existing STEM faculty (Banchefsky et al., 2016). How such factors impact evaluative judgments of job performance remains unknown. To be sure, my finding that female/feminine targets are judged as humanities employees to a greater degree than STEM employees might impose opportunity costs for involvement in projects within STEM domains, thereby impacting career advancement. Furthermore, to the extent that we consider these opportunity costs not merely for women more generally but specifically for women of color, there would likely be a compounding effect on career advancement. Within academia, such factors might lead to biases in materials that are important for academic personnel reviews (e.g., course evaluations, grant funding, published papers). Thus, these findings offer a foundation for probing meaningful downstream consequences.

Furthermore, here I explored how biases in visual perception are consequential for career judgments for individuals who vary in gender and race, categories that harbor disparities in STEM environments. These biases in visual perception might provide important insights for other social identities historically underrepresented in STEM. For example, STEM environments continue to prove hostile for sexual minorities and sexual minorities continue to be underrepresented in STEM domains (Freeman, 2018, 2020). Indeed, LGBTQ people are 17-21% less represented in STEM than would be expected (Cech, 2015; Cech & Pham, 2017) and male undergraduates from sexual minorities are more likely to leave STEM than their straight counterparts (Hughes, 2018). We know very little about the factors that contribute to the attrition of sexual minorities throughout the STEM pipeline, and I know even less about how individuals' experiences in STEM are affected by the intersection of their gender, race, and sexuality. My research provides a promising path forward for informing how sexual minorities might be deemed ill-suited for STEM by perceivers based on various aspects of their appearance. For instance, gendered appearance has proved an important mechanism for understanding the prejudice expressed toward sexual minorities. More specifically, when people defy gendered expectations, perceivers have difficulty processing these individuals and as a result evaluate said individuals less favorably (Lick & Johnson, 2015). In the context of sexuality, this difficulty in processing helps explain prejudice toward sexual minorities (Lick, et al., 2015). As such, it is likely that variations in gendered appearance drive presumptions of sexual orientation which, in turn, comprise similar presumptions of career fit or lack thereof in a STEM domain.

Conclusion

My dissertation applied the role of appearance-based cues to understand a persistent problem, namely, the lack of sufficient gender and racial representation in STEM. I propose that appearance-based cues drive perceiver bias in decreasing associations of these at-risk groups with STEM. This research provides empirical-based evidence for this assertion, enhancing knowledge of perceiver-driven biases that likely impact hiring, salary, and funding decisions with brief visual exposure.

Furthermore, these results imply that a broader representation of STEM exemplars, both between and within sex categories and between and within racial groups, could aid efforts to construct more inclusive categorical representations. Specifically, enhancing the diversity of representations both between (i.e., women and racial minorities) and within social categories (i.e., women racial minorities who vary in gendered appearance) can serve to mitigate bias in the mind of the observer. The current research recognizes the heretofore underappreciated role of facial characteristics of gender and race in accounting for judgments of STEM suitability. The findings highlight the importance of gendered features in accounting both for differential judgments of career fit for Black, Asian, and White men and women and also for variation in gendered appearance within each of these groups. These insights should prove valuable in identifying means for weakening associations between White male-gendered appearance and STEM fields and other male-dominated occupations.

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