Science = South Asian?

Examining stereotyping and perceived employability of South Asian women and men

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Abstract

Past research has established the existence and negative consequences of gender stereotypes in the fields of Science, Technology, Engineering and Mathematics (STEM). Far less is known about the existence and impact of racial stereotypes in STEM, particularly as they interact with gender stereotypes for racial minority women. To address this gap, in the current research I examined science stereotyping of South Asian people, who belong to a rapidly growing ethnic minority group in North America that has been largely excluded from past research. Across five studies, I adopted a multimethod approach, using implicit, indirect, and explicit measures to examine race and gender stereotypes, as well as stereotyping at the intersection of both identities, with a focus on South Asian versus White male and female targets. Across implicit and explicit measures, and with both racially diverse and race specific (South Asian/White; Study 2a) samples, I found evidence of both race (Studies 1a and 1b) and gender (Studies 2a, 2b, 3) stereotyping in STEM, with science being more associated with South Asian (versus White) and male (versus female) targets. The only exception was when South Asian women were paired with White men; in this case evidence was more mixed, as responses consistent with both gender (Study 1b, 2b, 3) and race (Study 2b) stereotyping was found on the implicit measures. The current research also examined the role of science stereotypes in employment recommendations (the indirect measure). Across all studies, targets of South Asian descent were viewed more positively in scientific domains, suggesting the potential for a positive employment bias in these fields. However, in line with compartmentalization models of intersectional stereotyping, perceptions of South Asian men were often more positive than of South Asian women, and this was true across implicit, indirect, and explicit measures. Taken together, these findings suggest that the unique combination of race and gender stereotypes South Asian women face can be context dependent, especially when compared to the experiences of South Asian men, White men, or White women. This research reinforces the need to examine gender and racial stereotyping from an intersectional perspective.

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The fields of Science, Technology, Engineering, and Mathematics (STEM) are often considered respected and prestigious (e.g., Oklahoma State University, 2021; World Economic Forum, 2021). However, these fields continue to have an unequal representation among specific social groups, including those based on gender or race, placing people who belong to one (or more) of these groups at a potential disadvantage. For example, women are generally underrepresented across the various science fields in the American context, making up roughly a third or less of the STEM workforce (National Science Board, 2022). In Canada, similar disparities are seen as women are consistently underrepresented across science fields, for example, making up only 25% of engineers (Frank, 2019). Importantly, research suggests that people who face negative stereotypes within science fields may integrate them into their self-concept, resulting in a host of negative outcomes, including reduced motivation and interest in STEM (Master & Meltzoff, 2020).

One theory supporting this idea, for example, is the State Authenticity as Fit to Environment (SAFE) model (Schmader & Sedikides, 2017), which suggests that people seek to be in environments that validate aspects of their identity, allowing them to feel a sense of authenticity (or "fit") within the situation and/or environment they are in. For underrepresented group members, encountering negative stereotypes about STEM fields can challenge their sense of authenticity and lead to psychological disengagement and avoidance of these stereotyped domains (see also Eccles, 1987; Eccles & Wigfield, 2020; McPherson et al., 2018). In addition, experiencing stereotype threat or feeling a lack of belonging can result in spillover effects, leading to reduced cognitive function or performance on subsequent tasks (Kang & Inzlicht, 2014).

Moreover, research suggests that members of certain racialized minority groups, including people who are Black and Latinx, are not only underrepresented within STEM, but also face additional barriers due to the intersecting nature of their identity (e.g., being a woman and being Black; Fry et al., 2021). Specifically, theory and research suggest that the individual stereotypes associated with each social category (e.g., race, gender, socioeconomic status) can influence each other in nuanced ways, such that the overall effects of the stereotypes depend on which combination of identities is present, and salient, within a given situation (Kang & Bodenhausen, 2015; Petsko & Bodenhausen, 2020; Petsko et al., 2022). In addition, individuals who belong to two or more marginalized groups (e.g., being Black while also being a woman) are more likely to experience additional negative consequences (including "intersectional invisibility"), due to the perception that they are not prototypical members of either identity group (Kang & Bodenhausen, 2015). Hence, the intersection of multiple identities can produce interactive effects, resulting in additive inequalities for the members of specific social groups. In addition, stereotyping at the intersection of two identities (e.g., race and gender) may differ from stereotyping at the intersection of three identities (e.g., race, gender, socioeconomic status), possibly even towards the same targets.

Despite some racial minority groups facing negative stereotypes in STEM fields, additional research suggests that people who are Asian can conversely face positive stereotypes in math and science (Abrams, 2019; Parks & Yoo, 2016; Trytten et al., 2012) and have a *larger* representation in STEM fields than might be expected by chance. According to available statistics, people who self-identify as Asian represent 9% of the workforce in science and engineering occupations, despite representing only 6% of the general working-age population in the United States (National Science Board, 2022). Importantly, however, statistics such as these often fail to account for the diversity of the "Asian" ethnicity, with East Asian, Southeast Asian, and South Asian populations (and, at times, some middle eastern ethnicities) typically grouped together under one umbrella term of "Asian" (Science & Engineering Indicators, 2021; Statistics Canada, 2022). This is problematic as a great deal of research examining the positive "Asian" stereotypes in STEM (such as the Model Minority stereotype, which posits that Asian-Americans are more intelligent and work-oriented; Abrams, 2019; Parks & Yoo, 2016; Trytten et al., 2012) have focused on East Asian targets, leaving it less clear whether other ethnicities, such as people who are of South Asian descent, face comparable stereotypes.

As many racial minority groups continue to be underrepresented in STEM fields, and as no research to date has examined the South Asian population, the current research aims to examine racial and gender stereotyping in STEM, with a specific focus on South Asian (versus White) men and women.[1] Due to the large South Asian population within the Canadian STEM context (Statistics Canada, 2023), and the potential broader association of South Asian under the "Asian" umbrella, it is plausible that a *positive* racial stereotype would exist between South Asian and Science, particularly in comparison to people who are White. However, considering the broad evidence of discrimination towards women, particularly racialized minority women, it remains unclear how South Asian women are perceived within science contexts.

Thus, the goal of the current research was to increase our understanding of racial stereotyping in STEM toward people who are South Asian (versus White), with a focus on South

[1] The current body of research examines targets who could racially be identified as White as well as targets who would be ethnically identified as being of South Asian descent. As the term race (as opposed to ethnicity) has often been used in the literature for targets and people of Asian descent, I use the term race (or race and ethnicity somewhat interchangeably) when referring both to White and South Asian targets and participants.

Asian women whose intersecting racial and gender identities might elicit competing racial (positive) and gender (negative) stereotypes in scientific fields. I made the decision to use White targets as the comparison group, as this is the racial majority and is a group that has been a main focus of previous research in this area. In addition, I also examined the contributing role of socioeconomic status in an exploratory manner (Study 2b). This research makes use of a multi-method approach, with each study including implicit (Implicit Association Test), indirect (hiring bias; except Study 1b), and explicit (self-report) measures to better understand the spontaneous activation, applied implications, and awareness of stereotypes in STEM fields.

Gender Stereotyping in STEM

A mounting body of research has provided evidence for the existence of various stereotypes (e.g., the gender-science stereotype) associating men with academic and intellectual domains, such as math and science, more than women (e.g., Boston & Cimpian, 2018; Cimpian & Leslie, 2017; Lane et al., 2012; Smyth & Nosek, 2015). For example, the concept of "brilliance" has been associated with men (primarily White men), and academic fields (e.g., math and physics) that place greater emphasis on brilliance have been associated with less gender and racial diversity (Cimpian & Leslie, 2017; Storage et al., 2020). However, more specific to STEM fields, "Science = Male" associations have been found with men and women (Nosek et al., 2009; Schmader et al., 2004), science and non-science majors in university (Lapytskaia Aidy et al., 2021; Nosek et al., 2002; Nosek & Smyth, 2011; Rinn et al., 2013), professionals working both within and outside of science fields (Cyr et al., 2021; Smyth & Nosek, 2015), and even among children (Cvencek et al., 2011, 2015a; Galdi et al., 2017; Passolunghi et al., 2014). These stereotypes can have real-world consequences, as both theory and research suggest that gender-science stereotypes are one specific factor that can contribute to unequal representation within STEM fields (Dasgupta et al., 2015; Dennehy & Dasgupta, 2017; Kang & Kaplan, 2019; Lapytskaia Aidy et al., 2021; Llorens et al., 2021; Régner et. al., 2014; Schmader & Sedikides, 2017; Steele & Ambady, 2006; Steele et. al., 2007). Past findings have demonstrated evidence for gender-science stereotyping using self-report measures and using implicit measures (Clark et al., 2021; Handley et al., 2015; Smyth & Noek, 2015; Weisgram et al., 2010), including the Implicit Association Test (IAT; Greenwald et al., 2003) that can assess automatically activated associations and can be less susceptible to socially desirable responding (Block et al., 2018; Cundiff et al., 2013; Nosek et al., 2009; Smyth & Nosek, 2015).

In addition, research further suggests that as children grow, their endorsement of gender-science stereotypes may change and may be moderated by racial group membership. For example, Else-Quest and colleagues (2013) examined math and science attitudes amongst White, Asian, Black, and Latin adolescents (aged 15 – 18) and found evidence for gender-science stereotypes, with male students reporting greater expectations of personal success in math and science than female students. Moreover, O'Brien and colleagues (2015) examined an undergraduate sample of White and Black students, and found that Black women held *weaker* (i.e., lower) implicit gender-science stereotypes than White women. Moreover, they found that Black women intended to pursue STEM degrees at higher rates than White women did, while Black and White men intended to pursue STEM degrees at comparable rates. They hypothesized that this could be due to ethnic variation in implicit gender-science stereotypes between the two groups. Nevertheless, these findings further highlight the variation in science stereotypes across race and gender, particularly across development.

In one high powered study, Smyth and Nosek (2015) examined over 176,000 responses from American citizens[2] on a science-male IAT using *Project Implicit* data (https://implicit.harvard.edu/implicit/), and found that overall, both men and women show an implicit gender-science stereotype, being faster to associate males with science and females with liberal arts, relative to the reverse pairing. They also found that people who themselves are part of stereotype-congruent fields, such as men in STEM fields and women in non-STEM majors (e.g., arts, humanities) showed the strongest implicit gender-science stereotypes, while people in stereotype-incongruent fields (e.g., men in arts fields, women in STEM fields) reported lower stereotypes. Specifically, women working in STEM fields also demonstrated the gender-science stereotype but showed the weakest "science = male" association. Such findings suggest that in addition to cultural and societal influences on stereotype development, personal associations and experiences with science may play a vital role in the level of stereotype awareness and/or endorsement, particularly held by women.

Gender-science stereotypes have also been found cross-nationally (e.g., Nosek et al., 2009; Miller et al., 2015), suggesting that these stereotypes are pervasive and may therefore be particularly difficult to eradicate (although cross-national variability did exist). This may be especially difficult within the workplace, where in multicultural nations such as Canada and the United States, people work alongside co-workers from various ethnicities, who may hold science stereotypes to various degrees. For example, Miller and colleagues (2015) analyzed implicit science stereotypes across sixty-six nations using *Project Implicit* data to determine whether women's representation in science predicted science stereotypes. Although they found that

[2] Although Project Implicit is a public website, participation for the current study was composed of American citizens with at least some college education. The sample was composed of White (81%), Black (6%), Mixed (5%), East Asian (3%), South Asian (2%), and other (3%).

variation exists, overall, men were associated with science significantly more than women. In addition, they found differences in science stereotypes based on the national percentage of women in science fields, as well as based on the amount of exposure to females in science; as the proportion of women in science fields increased, nation-level implicit gender-science stereotypes decreased. While inferring the causal direction of these correlational patterns is difficult, these results are consistent with the possibility that exposure to counter-stereotypical examples from multiple sources might be effective in reducing these biased associations, further supporting the need for increased participation of minority groups, including minority women, within STEM fields.

Impact of Gender Stereotypes on Women's Outcomes

Gender-science stereotypes have also been associated with women's interest and performance in STEM, and have been linked to women's own personal beliefs, attitudes, and job outcomes (Block et al., 2018; Cheryan et al., 2017; Clark et al., 2021; Cyr et al., 2021; Hall et al., 2015, 2018; Handley et al., 2015; LaCosse et al., 2016; Lewis & Sekaquaptewa, 2016; Llorens et al., 2021; Moss-Racusin et al., 2012; Schmader et al., 2004). For example, recent research has been examining the influence of science stereotypes on women's academic and employment recommendations (Jasko et al., 2020; Kang & Kaplan, 2019; Kiefer & Sekaquaptewa, 2007; Lane et al., 2012; Ramsey & Sekaquaptewa, 2011). This research suggests that even among women working within STEM fields, stronger math-gender stereotypes can predict more negative math attitudes, less identification with the field of math, as well as lower math performance (Kiefer & Sekaquaptewa, 2007; Nosek et al., 2002). Although causal conclusions cannot be drawn, these findings are consistent with the possibility that women's own gender stereotypes can have a negative impact on them.

This also appears to be the case among undergraduate women pursuing science degrees. Cundiff and colleagues (2013) examined a large sample of undergraduate students pursuing science majors, using a science-male (humanities-female) IAT. They found that for women, stronger implicit gender-science stereotypes were associated with less science identification and a decreased interest in science careers. Men demonstrated the opposite pattern, with stronger implicit gender-science stereotypes being associated with greater science identification and an increased interest in science careers.

Gender-science stereotypes have additionally been associated with negative outcomes for how women are perceived within academia, with consequences for obtaining employment or funding positions. For example, Schmader and colleagues (2007) analyzed the content of letters of recommendation for male versus female applicants who were applying for either a chemistry or biochemistry faculty position. They found that men and women often had similar qualifications. Despite this, male applicants were often described with more “standout” words (e.g., outstanding, unique, exceptional) relative to women. In addition, Régner and colleagues (2019) examined decisions made by scientific evaluation committees and found that those committees whose members held stronger implicit gender stereotypes were less likely to recommend women for elite research positions. Such results reinforce the importance of examining the downstream consequences of science stereotypes as gender-science stereotypes have the potential to be particularly influential at every institutional level, placing women at consistent disadvantages throughout their academic and professional careers. In short, research suggests that gender stereotypes in STEM emerge early in development, are prevalent among men and women in STEM, and exist across cultures. In addition, both theory and research suggest that these gender stereotypes can negatively predict women's interest, performance, and outcomes in STEM fields.

Racial Stereotyping in STEM

Although a great deal of research has examined gender stereotyping in STEM, far less research has examined racial stereotyping. Despite this, there is some research to suggest that certain racial minority groups, such as Black and Latinx, face negative stereotypes in STEM relative to the White majority (Fry et al., 2021). This race-science stereotype places minority group members at a disadvantage throughout their academic and professional careers (National Science Foundation, 2014a, 2014b; Rojek et al., 2019; Ross et al., 2017). Similar to gender stereotypes, racial stereotypes about science fields and academic ability may also have their roots in childhood, as research suggests that children may be endorsing science stereotypes that differ by race (Copping et al., 2013; Rowley et al., 2007). For example, past research examining pre-adolescent children (aged 11 – 14) suggests that both White and Black children reported the belief that White students are better at academics (including math and science) than Black students (Copping et al., 2013; Evans et al., 2011; Rowley et al., 2007).

Hence, past research examining race-science stereotypes suggests that these racial stereotypes may not only change across age but may also be held to different degrees by various ethnicities, highlighting the continued need to examine the consequences of science stereotypes for minority groups members, some of whom are nevertheless often negatively associated with science fields. By contrast, some research suggests that people who are East Asian can be positively stereotyped in science fields and can encounter a "model minority" stereotype that suggests Asian-Americans are more work-oriented, more intelligent, and better academically (Abrams, 2019; Parks & Yoo, 2016; Trytten et al., 2012). More specifically, the Model Minority stereotype has been found across North America (e.g., Kawai, 2005; Padgett et al., 2020) and suggests that Asian-Americans are stereotyped as a minority group that is generally associated with being successful due to their strong work ethic, ambition, and intelligence (Kawai, 2005; Padgett et al., 2020; Trytten et al., 2012).

Research further suggests that the Model Minority Stereotype may begin to become endorsed from an early age. For example, Cvencek and colleagues (2015) found that American children, from as early as the fifth grade, reported an awareness of the stereotype that Asians are better at math (than White people), and by adolescence, reported a personal endorsement of this stereotype, highlighting the early development of these stereotypes. In addition, research also suggests that East Asians may often be positively associated with scientific fields specifically (Cvencek et al., 2015; Rattan et al., 2017; Shih et al., 1999; Trytten et al., 2012).

For example, in response to a Canadian news article regarding Asian-Canadian students in university, both Asian and non-Asian readers provided comments supporting the competence aspect of this stereotype (Padgett et al., 2020). In addition, Trytten and colleagues (2012) interviewed Asian-American university students, and similarly found support, and acceptance, of the competence and hard work aspect of the Model Minority Stereotype. However, it remains unclear whether the model minority stereotype is applied towards various Asian ethnicities to the same extent. Hence, additional research is needed to further examine whether various Asian ethnicities (such as South Asian individuals) have the model minority stereotype applied to them, particularly within STEM, or science contexts more generally.

Moreover, some research also suggests that the model minority stereotype can have detrimental consequences for Asian Americans, including within academia, such as through negative interactions within STEM classrooms (e.g., being mocked for not receiving the highest grade; having their hard work discounted; McGee, 2018), and socially, such as through being viewed as perpetual foreigners (Armenta et al., 2013). Furthermore, endorsement of the model minority stereotype has, in some cases, been correlated with more negative explicit attitudes towards Asian Americans (Parks & Yoo, 2016).

It remains unclear how the experiences of various ethnic minority groups compare, as some members may face negative stereotypes in STEM while others may benefit from more positive science associations. Nevertheless, initial research suggests that regardless of the connotations, minority group members may be facing detrimental consequences within science fields. For example, using a qualitative research framework, McGee (2018) suggests that both Asian and Black students face comparable negative racial stereotyping, resulting in negative interactions and personal outcomes, within STEM classrooms. Although these two groups are often considered to be at opposite ends of the stereotype spectrum (with Asian-Americans experiencing stereotype *lift* and Blacks experiencing stereotype *threat*), McGee's findings suggest that both of these marginalized groups report similar, harmful interactions, as a result of the racial stereotypes held against their groups. Furthermore, research suggests that the intersection of both race and gender stereotypes have the potential to influence how men versus women are perceived (e.g., Cooley et al., 2018; Eaton et al., 2020; Lei et al., 2020), which can have important implications for their opportunities and outcomes.

Impact of Racial Stereotypes on Social Outcomes

Research suggests that racialized minority group members may experience race-science stereotypes throughout their academic journey, thereby potentially limiting their access to STEM courses and fields (e.g., Rojek et al., 2019; Ross et al., 2017). For example, Stockard and colleagues (2021) examined how the graduate school experience differs for students pursuing a degree in chemistry based on their race and gender. They found that underrepresented minority students reported the least positive experiences, including less financial support, less interpersonal support (including from peers), and fewer positive interactions with their advisor. Despite the increase in negative experiences, underrepresented minority students reported being *more* interested in completing their degree, suggesting that despite additional hurdles, these students may be working to overcome societal and institutional barriers to reap the benefits associated with prestigious STEM degrees.

Stereotypes may further act as barriers preventing students from entering the STEM workforce upon graduation (Eaton et al., 2020; Jasko et al., 2020; Kang et al., 2016). For example, Eaton and colleagues (2020) examined how the intersection of race and gender stereotypes influence academic outcomes for minority (Asian, Latinx, and Black) versus majority (White) post-doctoral students. Using CVs that differed only by the race and gender of the applicant, they found that STEM (Biology and Physics) faculty demonstrated both gender-science and race-science stereotypes. Specifically, faculty rated male applicants overall as more competent than identical female applicants. Moreover, White and Asian applicants were rated as more competent and hireable than Black and Latinx applicants. Such results highlight the need to further examine how intersectional identities contribute to varied experiences, and levels of stereotyping, within STEM. In addition, such results highlight the shared experiences minority groups face cross-nationally, as such barriers are not limited to the North American context. For example, Jasko et al. (2020) compared the job prospects of male versus female recent STEM graduates in Poland. They found that, despite having the same educational background, women were nevertheless less likely to receive a job offer and more likely to receive a lower salary, suggesting that societal and institutional barriers remain in place for marginalized groups. In addition, research suggests that racial minority members may engage in “résumé whitening” practices (e.g., changing the presentation of their legal name; omitting or modifying their previous job experience), in an attempt to combat discrimination, provide cues of assimilation, and to increase their chances of obtaining employment (Kang et al., 2016).

Although evidence suggests that STEM stereotypes exist, and are harmful for many diverse groups, it remains unclear how current social perceptions may contribute to the experiences of South Asian individuals in STEM, who are also classed under “Asian” but are a distinct ethnic group with potentially different, albeit potentially positive, science stereotypes. In addition, it remains unclear how their experiences may differ in terms of employment outcomes. Hence, continued research is needed to further examine the experiences of people who are South Asian, particularly South Asian women, who may experience racial/ethnic stereotyping that is different from South Asian men.

Intersectionality of Gender and Race

The concept of intersectionality has more recently been used to assess how stereotyping and prejudice differentially occur for people who hold specific combinations of social identities (Crenshaw, 1991; Kang & Bodenhausen, 2015; Petsko & Bodenhausen, 2020; Petsko et al., 2022). Intersectionality research builds on the notion that different social stereotypes (e.g., about gender and race) may interact to influence social categorization processes. Specifically, perceivers focus on the various social cues available to them, which combine with their own preconceived biases, to make judgements about others (Kang & Bodenhausen, 2015). Hence, the biases an individual may face are based on their various social identities (e.g., age, gender, race), the multiple group memberships they have, and the social identities that are most salient in that situation (Kang & Bodenhausen, 2015; Petsko & Bodenhausen, 2020; Petsko et al., 2022). Multiple theories have been proposed to explain how intersectional identities are perceived.

According to the *additive model* (Bodenhausen, 2010; Petsko & Bodenhausen, 2020) each social identity has an independent effect that can be summed together to predict bias. For example, a Black woman can face a negative gender stereotype, as well as a negative racial stereotype in STEM. According to the additive model theory, the bias a Black woman faces in STEM could be summed from the bias associated with each individual identity (e.g., being a woman, being Black), leading her to be more negatively perceived than a White woman who faces only one of these negatively stereotyped identities.

The *integration (or compounding) model* instead posits that the biases associated with each individual identity interact in unique ways, depending on the social identities that are present simultaneously (Bodenhausen, 2010; Crenshaw, 1991; Petsko & Bodenhausen, 2020). According to this model, the whole (being a Black woman) is greater than the sum of its parts (being Black and being a woman). A racial minority woman in STEM, for example, would face bias and discrimination to a greater extent than the sum of the individual negative gender and negative racial stereotypes would suggest, due to the interacting nature of the two stigmatized social identities.

Finally, the third theory proposed – that of *category dominance* (Bodenhausen, 2010; Macrae et al., 1995), suggests that when stereotyping is occurring, perceivers pay attention to one specific social identity (i.e., the most dominant one), depending on the situation, context, and their own prejudices, which then dictate the categorization outcome (Bodenhausen, 2010). For example, Connor and colleagues (2023) found that, across multiple studies, gender was a dominant category that exerted influence on implicit evaluations. Hence, within a STEM context, the dominance model suggests that the bias a marginalized woman experiences will depend on which one of her social identities (i.e., gender versus race) becomes most salient to the individual, with gender potentially driving the effects.

Building on the theory of category dominance, more recent research (Petsko & Bodenhausen, 2020) has proposed the idea of *compartmentalization assumptions*, suggesting instead that multiple social identities can co-exist, with different social categories becoming dominant based on the situational social context. Specifically, the compartmentalization assumption proposes that individuals are only able to attend to one identity category (e.g., gender: a woman) or one specific intersection of identities (e.g., race and gender: a South Asian woman) at a time. Within this framework, it is proposed that the specific social context highlights which identity category becomes salient, thereby rendering all other aspects of an individual's identity as not salient within that context. Under this model, different contexts can lead to different aspects of one's identity being salient, resulting in stereotyping that corresponds to gender (e.g., a woman), race (e.g., South Asian) or the unique intersection of both (e.g., South Asian woman).

Intersectionality is an important topic of research to examine, as within each social context, individuals can be categorized in numerous ways based on each of their distinctive social identities. Understanding the role of implicit bias toward multiply categorizable targets will deepen our understanding of bias and discrimination in everyday encounters. In particular, as there is a lack of research examining the unique aspects of South Asian identities, particularly for South Asian women within the STEM context, this is an important, understudied area that warrants additional examination.

Notably, Asian women have been described as being in a unique position as they can face competing stereotypes about their race and gender identities (Rattan et al., 2017; Shih et al., 1999). Despite women facing a negative gender-science stereotype (e.g., Nosek et al., 2002; Steele & Ambady, 2006), Asian women have been found to benefit, under specific circumstances, from a positive race-science stereotype, which associates intelligence and science ability, with people of Asian descent (e.g., Padgett et al., 2020; Rattan et al., 2017). However, across much of this literature, the term Asian has often been used to refer to people who are East Asian, and often specifically Chinese. In addition, past research examining bias towards people who are Asian has often used primarily East Asian targets and/or participants or has not specified the ethnicity of their "Asian" targets. Consistent with this bias, recent research (Goh & McCue, 2021) found that Americans see people who are East Asian or Southeast Asian as more prototypical of Asian than people who are South Asian. Hence, it is important to disaggregate the various ethnicities considered under Asian, particularly within the (North) American context, for people who are South Asian, and South Asian women specifically, as there is a lack of research examining stereotypes about this group.

Similar to people who are East Asian (e.g., Chinese, Japanese, Korean, Taiwanese), people who are South Asian (e.g., Indian, Pakinstani, Bangladeshi, Sri Lankan), are a growing minority group in North America (Statistics Canada, 2021). Yet there remains difficulty in determining the various barriers and exclusions that people who are South Asian face, both within STEM fields and broader society, as data and statistics often fail to consider each unique ethnicity that falls under "Asian" (e.g., Fang, 2022; Kader et al., 2022; Shivaram, 2021). As such, it is possible that when compared to people who are White, people who are South Asian would face a positive Asian stereotype in the sciences. However, there is also research to suggest that, unlike East Asians, people who are South Asian can face different biases in academics, the workplace, and within broader society (e.g., Fang, 2022; Hassan, 2018; Lu, 2022; Lu et al., 2020; Shivaram, 2021).

Within STEM jobs specifically, there is some evidence to suggest that the experiences of South Asian men differ from those of South Asian women. For example, while South Asian men obtain leadership positions, South Asian women instead report experiencing discrimination and bias within the workplace that is consistent with the negative experiences of other minority group members (Williams et al., 2022). For instance, South Asian women have been found to report more discrimination, and a greater likelihood of leaving their current company, than White women (Williams et al., 2022), highlighting the need for research examining how the intersection of their specific identities may be treated within STEM, particularly in direct comparison to South Asian men.

In addition, women in STEM have generally been found to face additional stereotypes and barriers in the workplace that their male colleagues do not experience, including a lack of mentors, gendered workplace culture, a lack of support from (often male) colleagues, and the additional need to "prove themselves" (Makarem & Wang, 2013). However, negative experiences appear to occur more frequently, or at greater rates, for marginalized women. Women of color, for example, report experiencing greater levels of bias in the workplace than White women do, resulting in minority women reporting a greater likelihood of leaving their organization (Williams et al., 2022), thereby contributing to additional negative outcomes from the loss of their employment setting. Moreover, the bias experienced in STEM, particularly by minority women, can occur from multiple sources, including other marginalized women (McKinnon & O'Connell, 2020). Hence, STEM workplaces can contribute to hostile environments, warranting further research into the various types of negative experiences of each marginalized group, and the experiences of South Asian women specifically.

Due to a relative lack of research, it is less clear whether positive stereotypes in STEM would be activated and applied to people who are South Asian. For example, it is possible that South Asian men and South Asian women may benefit from positive stereotypes that associate them more with STEM fields than people who are White. On the other hand, given the lack of research on this topic, it seems possible that no positive racial stereotypes in STEM exist, as South Asian people may be viewed as minority members and stereotyped negatively. It is also possible that the intersection of race and gender would combine, resulting in a difference in stereotypes, such that South Asian women are perceived differently from South Asian men.

The Present Research

The goal of the current research is to examine how race-science and gender-science stereotypes are applied to people who are South Asian, a minority group that has been largely excluded from previous research and that is a growing group in North America. Specifically, the current research examined the intersection of race and gender stereotypes to establish and assess how science stereotypes are applied to South Asian men and women, who belong to a racialized minority group, in comparison to White men and women, the racialized majority. Across three main studies (five studies in total), this research took a multi-method approach to understanding the spontaneous activation, application, and awareness of racial and gender stereotyping, by examining people’s responses using implicit (IAT), indirect (hiring recommendations), and explicit (self-reported) measures of stereotyping, with a particular interest in the stereotyping of South Asian women.

For the implicit measure, I used several variations of the Implicit Association Test (IAT; Greenwald et al., 2003) to examine racial and gender stereotyping in science (versus Not Science, Study 1a, 2a; versus Friendly, Study 1b; versus Funny, Study 2b). In addition, across each study, I used indirect measures of stereotyping to examine how often South Asian men and women are recommended for jobs in scientific domains as compared to White men and women. In an exploratory manner, I additionally examined whether a third factor (namely, socioeconomic status) would intersect with race and gender on the indirect measure (Study 2b only). Past research suggests that stereotypes may be used to make decisions when evaluating applications from minority group members with more ambiguous (i.e., both strong and weak) criteria (Hodson et al., 2002). Hence, I examined whether stereotypes would be more salient when evaluating South Asian (versus White) applicants. Finally, racial and gender stereotyping was assessed using self-report measures that asked participants to rate to what extent they themselves associated science with each race and gender group, as well as to what extent they believed most people associate science with each group.

I hypothesized that race-science stereotypes would emerge on the implicit measures (Studies 1a and 1b), with people being relatively faster to associate South Asian (versus White) targets with science. In addition, as past research shows that men are more strongly associated with science than women (Nosek et. al., 2002; Nosek & Smyth, 2011; Smyth & Nosek, 2015), I hypothesized that gender stereotypes would emerge on the implicit measure (Studies 2a and 2b), with people being faster to pair men (versus women) with science. Moreover, across each study, I anticipated that participants would be the fastest to pair science with South Asian men, particularly when they were paired with White women (who face a negative gender and possibly negative race stereotype in comparison). By contrast, as South Asian women face a negative gender, but possibly positive race, stereotype, I was particularly interested in when South Asian women were contrasted with White men. Across each study, I tested whether evidence of racial or gender stereotyping would emerge, and based on category dominance theory, predicted that gender stereotyping in this condition would prevail, with participants being faster to pair White men (versus South Asian women) with science.

On my indirect measures involving job recommendations, I anticipated evidence for race-science stereotypes, such that South Asian applicants would be recommended for science jobs more often than White applicants. However, I also anticipated that gender-science stereotypes would emerge, such that male applicants would be recommended for science jobs to a greater extent than female applicants. Moreover, I anticipated an intersectional advantage favoring South Asian men, such that they would benefit from both stereotypes and would thereby be recommended for science jobs the most out of all applicants. Finally, on the explicit measures, I predicted that participants would show a societal awareness and a personal endorsement of both gender-science (favoring men over women) and race-science (favoring people who are South Asian over people who are White) stereotypes.

Study 1a

Building on previous research examining East Asian populations (Cvencek et al., 2015b; Padgett et al., 2020; Rattan et al., 2017) the goal of Study 1a was to examine race-science stereotypes towards individuals of South Asian descent. For the implicit measure, the focus was on racial stereotyping with participants being randomly assigned to complete a Science/Not Science Implicit Association Test that always had South Asian and White targets in a 2 (South Asian Target: male or female) x 2 (White Target: male or female) between-subjects design. For the indirect measures, participants were randomly presented with one of four vignettes describing an applicant that differed by gender (male or female) and race (from India (i.e., South Asian) or from England (i.e., White)) in a between-subjects design. Finally, for the explicit measures, participants were asked about their race-based (South Asian versus White) and gender-based (male versus female) associations with science.

For the implicit measure, I anticipated finding evidence of racial stereotyping, with participants generally being faster to pair Science with South Asian targets, and Not Science with White targets, relative to the reverse pairing. I also anticipated differences based on the gender of the targets. Specifically, I first predicted a main effect of South Asian Target. Due to gender stereotypes, I anticipated that participants who saw South Asian men (versus South Asian women) would show a greater magnitude of racial stereotyping. Similarly, I predicted a main effect of White Target, such that participants who saw White men would show less racial stereotyping than participants who saw White women, due to the competing gender stereotype associating men with science. Finally, I anticipated an interaction effect, such that the greatest racial stereotyping will occur when South Asian men are paired with White women – and the least will occur when South Asian women are paired with White men. Such a finding would suggest that people are attending to both gender and race throughout the task and that both identities are affecting people's associations. I also tested the competing hypothesis that evidence of racial stereotyping might not emerge when South Asian women were paired with White men.

In addition, I anticipated similar effects to emerge on the indirect measure, such that South Asian applicants would be recommended for jobs more than White applicants, but that gender would moderate this effect, with South Asian men being recommended for jobs more than South Asian women, White men, and White women. Lastly, I anticipated race-science and gender-science stereotypes to emerge on the explicit measures.

Method

This study was pre-registered on OSF and all measures are available online (https://osf.io/wqv48/?view_only=c055fbbdf7414127918e7df5696bc7b7). An a priori power analysis using G-power suggested we would need 256 participants (64 per condition) to detect a small to medium effect size of 0.2 (using Cohen's *d*) with .80 power at the standard .05 alpha error probability. Due to the online nature of this study, the a priori decision was made to oversample. Hence, I aimed to recruit and run 400 participants (with a minimum of 320 participants), resulting in 80-100 participants per condition, depending on the participant pool demand at the point during the term when the study was being run.

Participants

A total of 446 participants (M_{age} = 20-years, SD_{age} = 5-years, range = 18 – 72 years; 273 women, 122 men, 6 non-binary or not disclosed) were recruited for the current study[3]. Of these, 13 were missing all data (i.e., they opened the experiment, but no data were recorded) and 32 participants were excluded as they did not provide post-debriefing consent to use their data. This resulted in a sample of 401 participants. Participants identified as White (n = 116), South Asian (n = 95), Middle Eastern (n = 44), Southeast Asian (n = 32), Black (n = 31), Mixed race (n = 28), East Asian (n = 26), Latin or South American (n = 13), and other (n = 16). Participants included students pursuing non-STEM (n = 238) and STEM (n = 163) fields for their post-secondary studies. The most commonly identified field of study was psychology (n = 133).

Based on the recommended guidelines (Greenwald et al., 2003; Smyth & Nosek, 2015) a total of 10 participants were excluded from analyses on the implicit measure if they had an error

[3] The stopping rule was set for 400 participants, excluding those who were missing data or did not include post-debriefing consent. One additional participant was run in error. To be more consistent with the pre-registrations, it was decided that in subsequent studies the stopping rule would be set to include those with missing data or without post-debriefing consent, as these were already accounted for when outlining the number of required participants.

rate greater than 30%, responded to at least 10% of trials faster than 300 ms (n = 7; Greenwald et al., 2003) or had an average reaction time on all trials that was three standard deviations above (n = 1) or below (n = 2) the mean (Cvencek et al., 2011). An additional 10 participants were missing IAT data, resulting in a final sample for the implicit measure of 381 participants. Participants were excluded on the explicit measures if they failed the attention check questions (i.e., less than 2/3 correct; n = 11). The final sample for the explicit data was 390 participants.

Implicit Stereotyping Measure

Race-Science Ambiguous Categorization Implicit Association Test (AC-IAT). Implicit race-science stereotypes were measured using an Implicit Association Test (IAT; Greenwald et al., 1998; Greenwald et. al., 2003). The IAT was designed to measure cognitive associations between concepts using reaction times. Participants were asked to categorize a series of words and images using one of two computer keys, as quickly and accurately as possible. Headers remained on the screen to serve as a reminder of the correct categorization concepts. A small red X appeared on the bottom of the screen when an incorrect response was given and remained on the screen until the correct response was provided.

Participants were randomly assigned to one of four conditions in a 2 (South Asian Target: male or female) x 2 (White Target: male or female) between-subjects design. In each condition, participants saw headers consisting of two emoji icons (created using the Apple iOS emoji option) representing a White and a South Asian male or female, that were matched for facial features and expressions (see Appendix A for the headers, see Appendix B for examples of each condition). The emoji headers were designed to provide participants with a visual guide for sorting the photo stimuli, without having to explicitly define that they are sorting White versus South Asian targets using a text header. By providing the emoji headers, participants had a clear guide for sorting the stimuli; simultaneously, in the two conditions that differed by both race and gender (i.e., containing White male/South Asian female headers or White female/South Asian male headers), participants could attend primarily to race, gender, or both when sorting the photo stimuli (see Lipman et al., 2021; Steele et al., 2018; Steele & Lipman, 2023 for a similar approach with this Ambiguous-Categorization IAT).

The target images depicting South Asian and White men and women were selected from the Chicago Face Database; all faces were matched for perceived age and attractiveness. Faces were also selected to have similar characteristics (e.g., similar hairstyles) with no distinguishing characteristics (e.g., glasses), and for racial prototypicality based on ratings from the Chicago Face Database codebook (see Appendix C).[4] All faces had a neutral facial expression. The categories of “Science” (i.e., computer science, physics, chemistry, engineering) and “Not Science” (i.e., casual seating, package, chestnuts, effectively) were chosen such that the words in the “Not Science” category began with the same letters as the “Science” words, were approximately of equal length, and were neutral in content in terms of gender and race.

Participants first completed a block containing 20 practice trials. Using the emoji headers, participants were required to press one computer key if the image presented was a South Asian person, and another computer key if the person was White. Participants were presented with four photos of White targets (either all male or all female, with a same-gender emoji, depending on their condition) and four photos of South Asian targets (again either all male or all female, depending on the condition). In a second block, participants similarly sorted words related to the category “Science” (i.e., computer science, physics, chemistry, engineering) and another key if

[4] One face (a South Asian male) was selected despite having some facial hair as his ratings were in line with the other three faces.

the word was related to the category “Not Science” (i.e., casual seating, package, chestnuts, effectively) using the same two computer keys.

Next, participants completed one of two critical blocks. In each critical block participants were presented with 60 trials containing all four concepts (South Asian header, White header, Science and Not Science words) that were grouped in “practice” (20) and “real” (40) critical trials as outlined by Greenwald and colleagues (2003). In one critical block, participants pressed one key to categorize South Asian targets and Science words and pressed the other key to categorize White targets and Not Science words. After one additional practice block, in which South Asian and White faces were sorted again, but the headers were now on the opposite side and the computer keys used to sort these words were reversed, participants completed a second critical block. In the second critical block, participants were again presented with 60 trials (20 “practice” and 40 “real”) containing all four concepts, however they now pressed one computer key if the images were of a White individual or Science word and another key if the images were a South Asian individual or a Not Science word. The order in which the two critical blocks appeared was counter-balanced between participants.

One additional novel aspect of the Ambiguous Categorization IAT (AC-IAT; Steele et al., 2018) is that, following the final critical block, participants were presented with three additional trials of new images (randomly selected from a set of 4) which were incorporated seamlessly into the IAT. These images represented the two groups that the participants had not seen and were of less interest in the two conditions where participants saw targets of the same gender. For example, participants who saw South Asian men and White men throughout the task were presented with 3 final trials containing South Asian women and White women. Here, I anticipated that participants would continue to categorize these targets by race. However, in the two conditions where targets differed by both race and gender (e.g., South Asian women paired with White men), the three new images differed systematically in the opposite way by both gender and race (e.g., South Asian men and White women). These trials are of greater interest as they could serve as a proxy for which aspect of identity (race or gender) participants are primarily attending to by the end of the task. For example, participants who were presented with South Asian women and White men throughout the task would now be shown three final trails containing South Asian men and White women. Participants attending primarily to race would spontaneously sort a South Asian man with the South Asian female header (same race). By contrast, participants attending to gender would sort a South Asian man with the White male header (same gender).

The IAT data were scored using the recommended guidelines by Greenwald et al. (2003). Only the “practice” and “real” critical trials from each of the two critical blocks were used for the analysis. For this study, participant’s data were converted into an IAT *D* Score, such that positive values represent faster responding to a “South Asian + Science” and “White + Not Science” association, as opposed to “White + Science” and “South Asian + Not Science”. The three final spontaneous categorization trials were coded as 1 if the participants sorted by race, and 0 if they instead sorted by gender, resulting in a total score ranging from 0 (all by gender) to 3 (all by race).

Indirect Stereotyping Measure

Science Stereotypes and Employment recommendations. To assess how race-science and gender-science stereotypes influence potential employment recommendations, participants were instructed to “imagine that you work for a recruitment agency, and your job is to help other individuals find employment that matches their skills and experience.” Participants were then randomly presented with one of four vignettes describing an applicant that differed by gender (male or female) and race (from India or from England) in a between-subjects design. All applicants were described as having the same skill set. To assess stereotyping, participants were then asked to indicate how likely they would be (1= Not very likely, 4= Very likely) to recommend that applicant for eight different jobs, in four science fields and in four non-science fields (used as a filler).[5] The average of the four science fields was used to create an overall science employability score, while the average of the four non-science fields was used to create an overall non-science field employability score. Higher scores indicate higher levels of perceived employability.

Explicit Stereotyping Measures

Race-science Stereotypes. Six questions were used to assess participants' race-science stereotypes, on a 7-point Likert scale (1 = Strongly South Asian descent, 7 = Strongly European descent). Specifically, three questions asked participants' about their personal associations (i.e., stereotype endorsement) and three additional questions asked about how much they believe *most people* (i.e., stereotype awareness) associate science with (a) people who are of South Asian descent, as opposed to people who are of European descent, (b) women who are of South Asian descent, as opposed to women who are of European descent, and (c) men who are of South Asian descent, as opposed to men who are of European descent.

Gender-science Stereotypes. Six comparable questions were used to assess participants' stereotype endorsement and stereotype awareness for gender-science stereotypes, on a 7-point

[5] To account for gender stereotypes about specific job fields, both stereotypically-male and stereotypically-female job fields were selected. Specifically, this included two male-dominated science fields (engineering, computer science), two female-dominated science fields (biology, life sciences), two male-dominated non-science fields (business, political science) and two female-dominated non-science fields (teaching, nursing).

Likert scale with (a) 1 = Strongly male, 7= Strongly female reverse-scored; (b) Strongly White men/ White women, (c) Strongly South Asian men/ South Asian women.

Procedure

Participants were recruited for an online study in exchange for course credit at a large Canadian university. After providing consent, participants were randomly assigned to one of four IAT conditions (eight total conditions counterbalanced for order). All participants first completed the race-science IAT using Inquisit software. Upon completion, participants were automatically redirected to the Qualtrics platform and were asked to complete the indirect and explicit measures, followed by additional questions about their science attitudes and STEM interest, and demographic questions (see Appendix D for these questions, and Appendix E for supplemental analyses). Participants were then debriefed and asked to provide post-debriefing consent.

Results

Implicit Measure

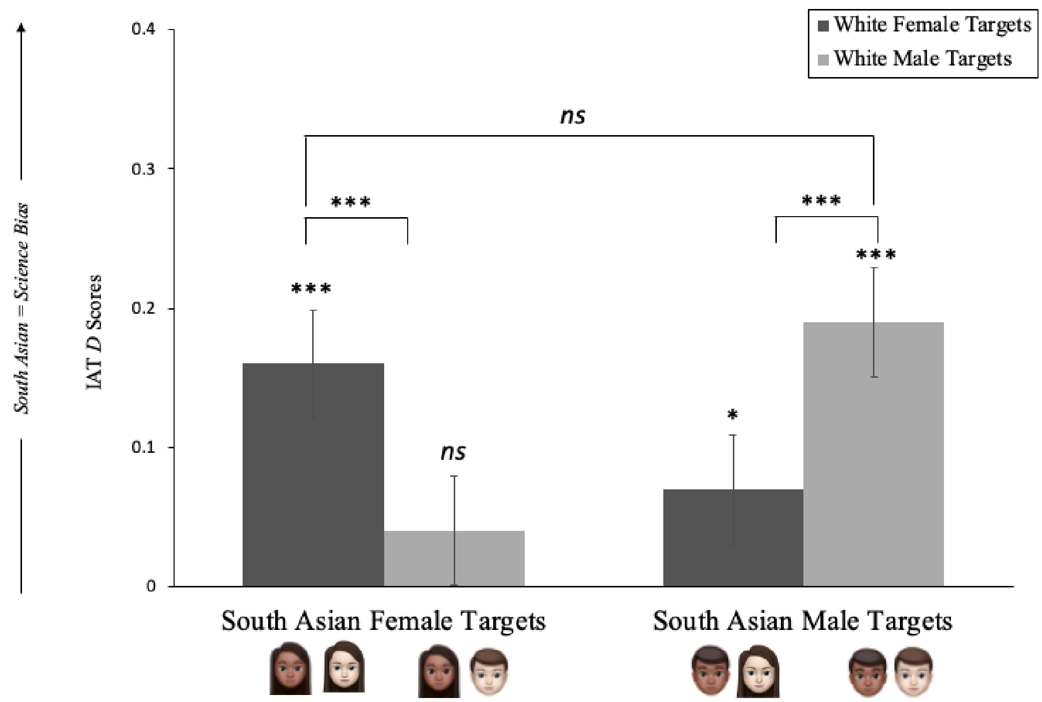
To examine whether racial stereotyping depended on the gender of the targets, I ran a 2 (South Asian Target: male or female) x 2 (White Target: male or female) between-subjects ANOVA. There was no significant main effect of South Asian target, $F(1, 377) = .64$, $p = .42$, $\eta^2_p < .01$, nor of White target, $F(1, 377) = .01$, $p = .93$, $\eta^2_p = .00$. However, a significant interaction effect emerged, $F(1, 377) = 10.01$, $p = .002$, $\eta^2_p = .03$, see Figure 1. To better understand this interaction, I examined the magnitude and direction of stereotyping within and across conditions.

When participants saw targets of the same gender (e.g., White and South Asian men *or* White and South Asian Women), there was evidence of racial stereotyping. Specifically, participants were relatively faster to pair South Asian men with Science and White men with Not

Science (D = .19, SD = .37) and a one-sample t-test comparing this to zero showed that this was significantly different from chance responding, $t(84) = 4.77$, $p < .001$, d = .36.

Figure 1.

Implicit Attitudes by Condition and Target (Study 1a).



Note. Error bars represent the Standard Error. * p < .05, *** p < .001

Similarly, participants were relatively faster to pair South Asian women with science and White women with not science (D = .16, SD = .38), $t(96) = 4.12$, $p < .001$, d = .37. Direct comparisons suggested that the magnitude of racial stereotyping in these two conditions did not differ, $t(182) = .61$, p = .27. When seeing people of the same gender, participants associated science more with people who are South Asian than with people who are White.

In addition, participants who saw South Asian men and White women also showed significant racial stereotyping (D = .07, SD = .35), $t(106) = 1.99$, p = .02, d = .35. Surprisingly, the magnitude of racial stereotyping was *less* in this condition than when the White targets were also men, $t(190) = 2.36$, $p = .01$, $d = .36$. That is, inconsistent with our hypothesis, there was greater racial stereotyping when participants saw South Asian men and White men than when they saw South Asian men and White women. Possible explanations for this finding are provided in the discussion. Importantly, in line with my hypotheses, there was no significant racial stereotyping when South Asian women were paired with White men ($D = .04$, $SD = .37$), $t(89) = 1.04$, $p = .15$, $d = .37$, suggesting that South Asian women's racial identity mitigated gender stereotypes. Participants in this condition also showed less racial stereotyping than participants in the conditions where all targets were women, $t(187) = -2.13$, $p = .02$, $d = .37$. Although South Asian men were more associated with science when paired with either White men or White women, South Asian women were only associated with science more when they were paired with White women, and their association with science decreased when paired with White men.

Finally, I examined the three spontaneous categorization trials on the IAT to assess whether participants were primarily sorting by race or by gender. As would be expected, there was a significant difference in participants sorting primarily by race versus gender across all conditions, $\chi^2(3) = 106.20$, $p < .001$. As would be expected, participants who viewed same-gender targets sorted the majority of the final three trials primarily by race (93% in the South Asian men/White men condition and 87% in the South Asian women/White women condition), see Table 1. That is, participants in these conditions generally continued to sort by race when presented with novel other-gender targets in the final 3 trials. However, when examining the two conditions where targets differed by both race and by gender, participants sorted primarily by gender (53% sorted primarily by gender in the South Asian men/ White women condition; 59% sorted by gender in the South Asian women/ White men condition).

Table 1.

Number of Final Trials Categorized by Race Separated by Condition (Study 1a)

	Majority sorted by race				Majority sorted by gender			
	All by race		Mixed				All by gender	
	3/3		2/3		1/3		0/3	
Condition	*N*	%	*N*	%	*N*	%	*N*	%
South Asian women/White men	31	34%	6	7%	20	22%	33	37%
South Asian women/White women	68	66%	22	21%	8	8%	1	1%
South Asian men/White men	60	68%	22	25%	2	2%	1	1%
South Asian men/White women	36	33%	15	14%	26	24%	30	27%

Notably, in each of the ambiguous categorization conditions, the level of bias did not differ based on how the final trials were categorized. Specifically, for the South Asian men/White women condition, there was no difference in bias for participants who sorted by race (D = .07, SD = .38) or by gender (D = .07, SD = .33), $t(105) = -.02$, p = .49, d = .003 and there was no relation between the number of trials they sorted by race and their bias, $r_\rho(105) = .08$, p = .44. This is perhaps not surprising, as both the racial and gender stereotype favors the South Asian man, so regardless of whether participants are attending to gender or race, South Asian men would be expected to be more easily associated with science. However, for participants in the South Asian women/White men condition, there was similarly no difference in bias, $t(88)$ = .09, p = .47, d = .02, between participants who sorted the final trials by race (D = .04, SD = .35) versus by gender (D = .04, SD = .39), $r_\rho(88) = -.10$, p = .34. This suggests that even when race was salient in the final trials, participants did not show a greater association between South Asian women and science.

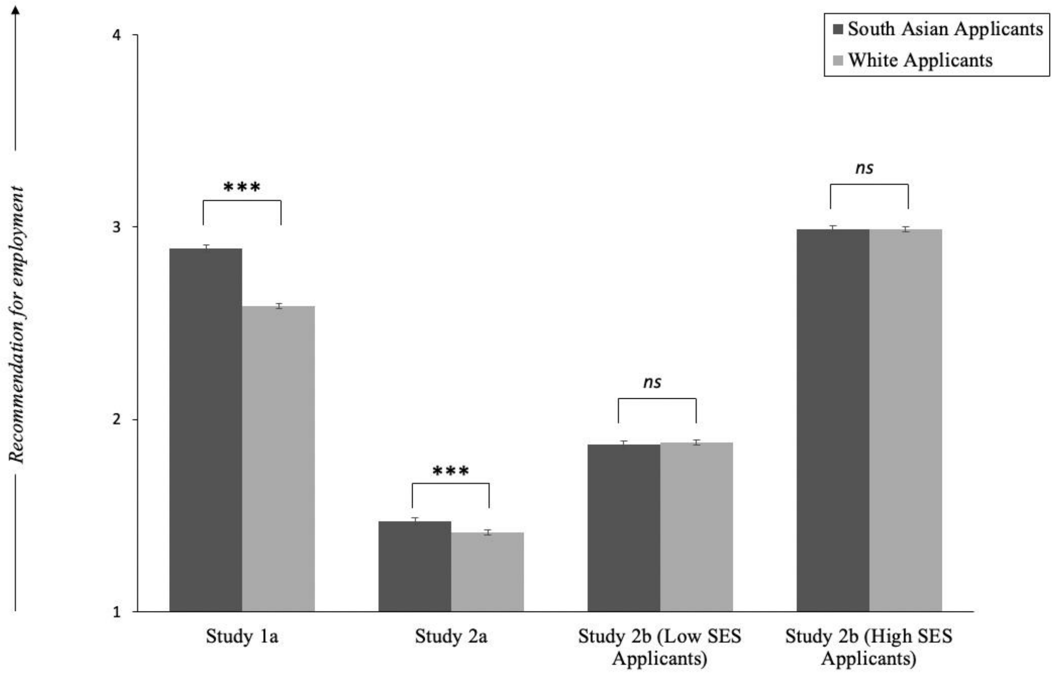
Indirect Measure

Science Stereotypes and Employment recommendations. To test whether job recommendations differed based on the race and/or gender of the applicant, a 2 (Target Gender: Male or Female) x 2 (Target Race: South Asian or White) x 2 (Field: Science or Not Science) mixed ANOVA was run, with the first two factors between-subjects and the last factor within.

The main effect of Field, $F(1, 386) = 3.19$, $p = .08$, $\eta^2 < .01$, and the main effect of Target Gender, $F(1, 386) = .48$, $p = .49$, $\eta^2 < .01$, were not significant. However, the main effect of Target Race was significant, $F(1, 386) = 4.76$, $p = .03$, $\eta^2 = .01$. South Asian applicants ($M = 2.84$, $SD = .62$) were more likely to be recommended across all job fields than White applicants ($M = 2.71$, $SD = .55$). The interaction between Target Race and Field was also significant, $F(1, 386) = 23.27$, $p < .001$, $\eta^2 = .06$. Simple main effects analyses revealed a significant effect of Target Race for Science jobs, $F(1, 386) = 15.78$, $p < .001$, $\eta^2 = .04$, such that participants were more likely to recommend South Asian applicants ($M = 2.89$, $SD = .78$) for science jobs than White applicants ($M = 2.59$, $SD = .72$), see Figure 2. The simple main effect for non-science jobs was not significant, $F(1, 386) = .42$, $p = .52$, $\eta^2 < .01$. Furthermore, the interaction between Target Gender and Field was significant, $F(1, 386) = 7.03$, $p < .01$, $\eta^2 = .02$.

Figure 2.

Employment Ratings for Science Fields by Race.

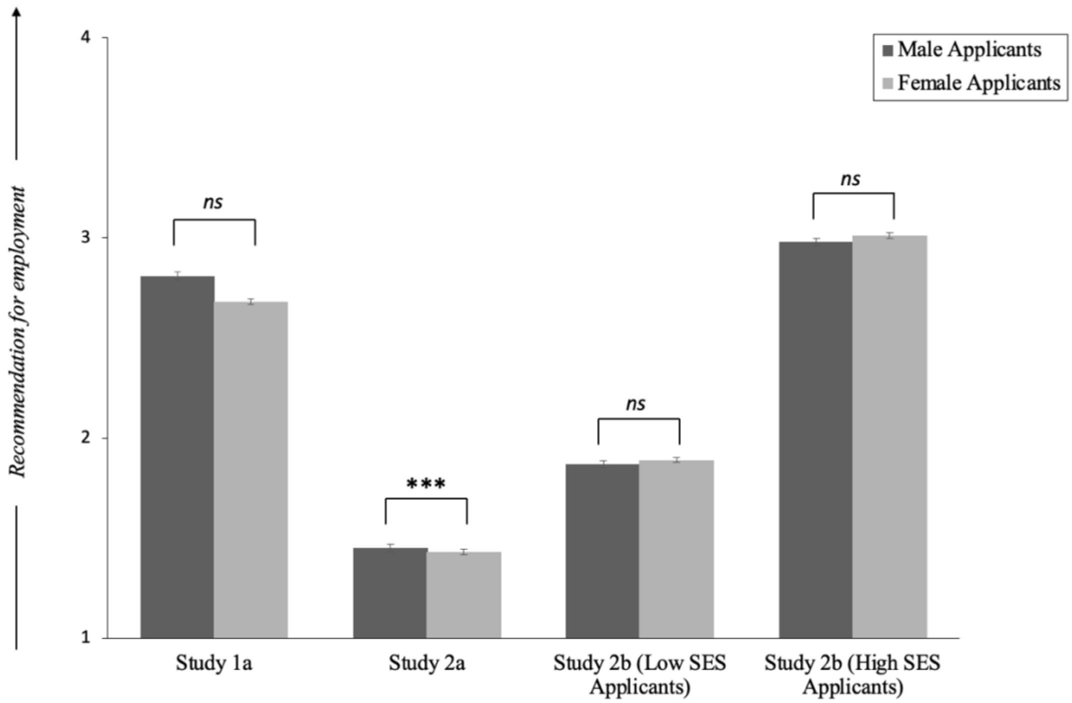


Note. Error bars represent the Standard Error. A 4-point scale was used, with 1=Not very Likely, and 4=Very likely to recommend for each job. In Study 1a, participants rated one vignette varying across race and gender. In Study 2a, participants rated four separate vignettes, one for each race and gender combination. In Study 2b, participants rated two vignettes (one South Asian, one White) for low socioeconomic status applicants, and rated two vignettes (one South Asian, one White) for high socioeconomic status applicants. *** $p < .001$

Simple main effects revealed a marginally significant effect of Target Gender for Science jobs, $F(1, 386) = 3.18$, $p = .08$, $\eta^2 < .01$, such that participants were more likely to recommend male applicants ($M = 2.81$, $SD = .73$) for science jobs than female applicants ($M = 2.68$, $SD = .79$), see Figure 3.

Figure 3.

Employment Ratings for Science Fields by Gender.



Note. Error bars represent the Standard Error. The same vignette criteria were used, as described in Figure 2. *** $p < .001$

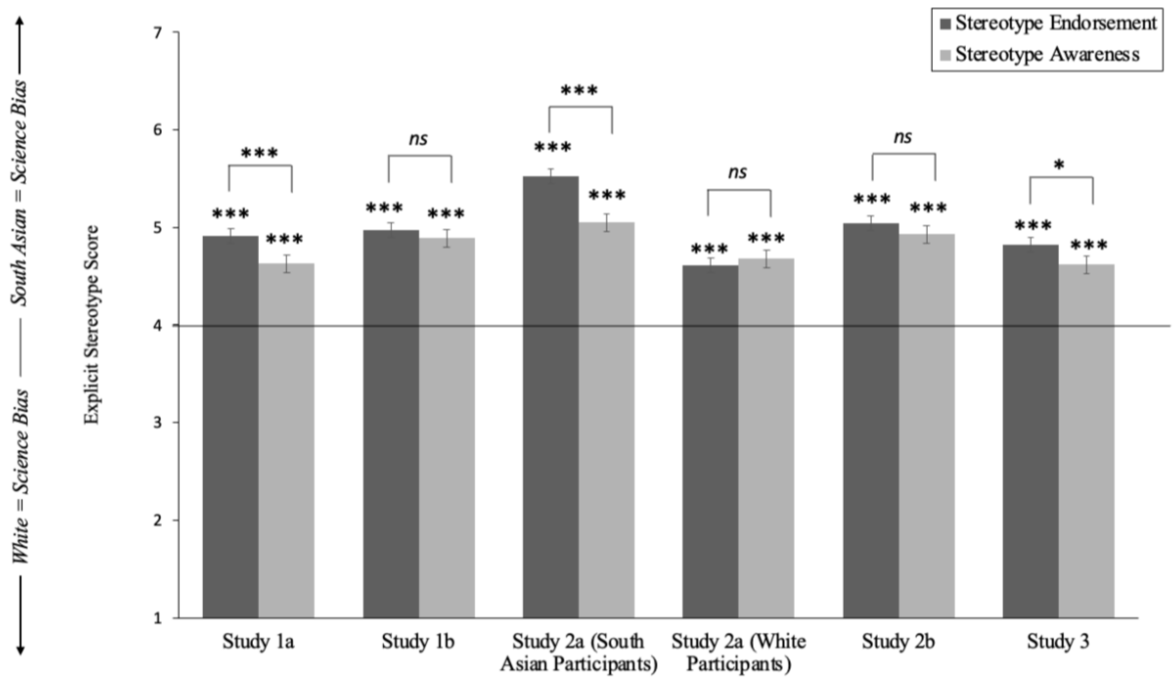
Once again, the simple main effect for non-science jobs was not significant, $F(1, 386) = .70$, $p = .40$, $\eta^2 < .01$. Finally, the interaction between Target Race and Target Gender, $F(1, 386) = .51$, $p = .48$, $\eta^2 < .01$, as well as the three-way interaction, $F(1, 386) = .56$, $p = .46$, $\eta^2 < .01$, were not significant. Overall, these results suggest that race and gender may impact recommendations in science.

Explicit measures

Race-Science stereotypes. To examine whether race-science stereotyping emerged on the explicit measure, I first ran a paired samples *t* test using participants' responses to compare how much *they* associate, and how much they believe *most people* associate, science with people who are South Asian as compared to people who are White. Participants reported a significant difference in what they believed ($M = 4.91$, $SD = 1.39$) and what they felt most people believed ($M = 4.63$, $SD = 1.69$), $t(389) = 3.70$, $p < .001$, $d = 1.53$, with participants themselves associating people of South Asian descent with science more than they believe most people do, see Figure 4.

Figure 4.

Awareness versus Endorsement of Race-Science Stereotypes.



Note. Error bars represent the Standard Error. Scores above 4 (scale midpoint) indicate significant race-science stereotyping (South Asian > White). * $p < .05$, *** $p < .001$.

One-sample t-tests confirmed that participants personally associate ($M = 4.91$, $SD = 1.39$), $t(389) = 12.96$, $p < .001$, $d = 1.39$, and believe most people associate ($M = 4.63$, $SD = 1.69$), $t(389) = 7.30$, $p < .001$, $d = 1.69$, South Asian people with Science more than people who are White. In addition, to examine whether race-science stereotypes were moderated by the gender of the targets (i.e., White men versus South Asian men; White women versus South Asian women), I ran a 2 (Belief Source: Self or Other) x 2 (Target Gender: Men or Women) within-subjects ANOVA. There was a significant main effect of Belief Source, $F(1, 388) = 67.00$, $p < .001$, $\eta^2 = .15$, such that participants' personal beliefs ($M = 4.75$, $SD = 1.46$) were more stereotype-consistent than their thoughts about other people's beliefs ($M = 4.25$, $SD = 1.61$). The main effect of Target Gender, $F(1, 388) = .51$, $p = .48$, $\eta^2 < .01$, as well as the two-way interaction, $F(1, 388) = 1.38$ $p = .24$, $\eta^2 < .01$, were both not significant.

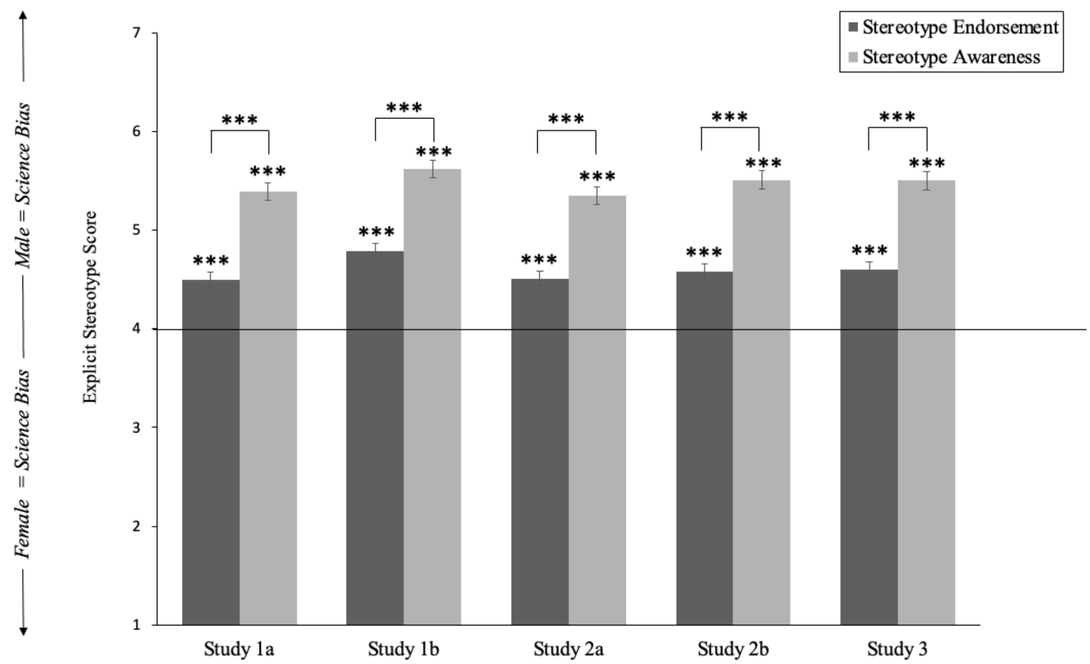
A series of one sample *t*-tests comparing the race-science questions against 4 (i.e., the scale midpoint) confirmed that participants endorsed a race-science stereotype, and this was true whether participants were asked about South Asian versus White *men* ($M = 4.75$, $SD = 1.49$), $t(388) = 9.85$, $p < .001$, $d = 1.49$ or South Asian versus White *women* ($M = 4.75$, $SD = 1.44$), $t(389) = 10.29$, $p < .001$, $d = 1.44$. They also believed that most people endorsed this stereotype, both for South Asian versus White *men* ($M = 4.29$, $SD = 1.69$), $t(389) = 3.44$, $p < .001$, $d = 1.69$, and for South Asian versus White *women* ($M = 4.19$, $SD = 1.52$), $t(389) = 2.46$, $p = .01$, $d = 1.52$. Together these results suggest that participants have an explicit, positive association between South Asian people and science, in comparison to White people and science.

Gender-science stereotypes. To examine whether gender-science stereotyping emerged, I ran a paired samples *t* test comparing participants' responses to how much *they* associate, versus how much they believe *most people* associate, science with men over women. Participants reported a significant difference in what they believed ($M = 4.50$, $SD = 1.26$) versus what most people believed ($M = 5.39$, $SD = 1.32$), $t(389) = -13.37$, $p < .001$, $d = 1.33$, such that participants believed most people associate science with men to a greater extent than they themselves do, see Figure 5. However, one-sample *t*-tests confirmed that participants both personally associate ($M =$

4.50, *SD* = 1.26), *t*(389) = 7.82, *p* < .001, *d* = 1.26, and believe most people associate (*M* = 5.39, *SD* = 1.32), *t*(389) = 20.82, *p* < .001, *d* = 1.32, science more with men than with women.

Figure 5.

Awareness versus Endorsement of Gender-Science Stereotypes.



Note. Error bars represent the Standard Error. Scores above 4 (scale midpoint) indicate significant gender-science stereotyping (men > women). *** $p < .001$

Furthermore, to examine whether gender-science stereotypes were moderated by the race of the targets, a 2 (Belief Source: Self or Other) x 2 (Target Race: South Asian or White) within-subjects ANOVA was run. The main effect of Belief Source was significant, $F(1, 389) = 69.92$, $p < .001$, $\eta^2_p = .15$, with participants reporting the belief that *most people* endorse stronger gender-science stereotypes (*M* = 4.84, *SD* = 1.45) than they themselves do (*M* = 4.27, *SD* = 1.50). In addition, there was a significant main effect of Target Race, $F(1, 389) = 17.94$, $p < .001$, $\eta^2_p = .04$, such that participants differed in their endorsement of gender-science stereotypes depending on whether they were asked about South Asian men and women as opposed to White men and women. Specifically, participants reported a stronger gender-science association with White men over White women (M = 4.70, SD = 1.42) as opposed to South Asian men over South Asian women (M = 4.41, SD = 1.54). There was no significant interaction effect, $F(1, 389) = .12$, p = .73, $\eta^2_p = .00$. Hence, participants reported the explicit belief that science stereotypes favor men (over women), however, this gender stereotype was greater when participants were asked about White men and women as opposed to South Asian men and women.

Discussion

The current study is the first to examine science stereotypes towards South Asian targets and establishes the presence of race-science stereotypes favoring people who are South Asian. The current findings across implicit, indirect, and explicit measures suggest that South Asian men face a positive racial stereotype, being associated with science and science fields to a greater extent than both White women and White men (i.e., the majority group most commonly examined in past research). Although research has consistently found men to be more associated with science than women (Lane et al., 2012; Lapytskaia Aidy et al., 2021; Nosek et al., 2002, 2009; Rinn et al., 2013; Schmader et al., 2004; Smyth & Nosek, 2015), the current research provides evidence that race-science stereotypes also exist. In this case, similar to East Asian men, South Asian men were more associated with science than White men, and not *less*, as some previous research with other minoritized groups has found (Copping et al., 2013; Rowley et al., 2007). South Asian women, on the other hand, were not as consistently associated with science as South Asian men. Racial stereotyping did emerge when South Asian women were compared to White women on the Implicit Association Test; however, this stereotyping was no longer found when the comparison group was White men.

Moreover, the findings on the indirect stereotyping measure suggest that race-science stereotypes may have implications for employment recommendations, as demonstrated by the finding that South Asian applicants were more likely to be recommended for science job fields than White applicants. Hence, these findings suggest that South Asian individuals, a minority group currently underrepresented in STEM fields, may have the potential to benefit from a positive racial stereotype. Finally, on the explicit measure there was consistent evidence of both gender and racial stereotyping; however, gender stereotyping was decreased when South Asian (versus White) men and women were compared, suggesting that people might have been taking both gender and racial stereotypes into account when making their assessments.

Overall, these findings are consistent with the compartmentalization model of intersectional stereotyping, as they suggest that participants were likely attending to the unique intersection of both race *and* gender for each target, as evidenced by the differences in levels of stereotyping that emerged for South Asian men in contrast to White men versus White women, as well as the differences in levels of stereotyping that occurred when participants compared South Asian women and White men versus White women. In each case, no consistent baseline levels of stereotyping emerged, suggesting instead that participants were attending to the intersection of both identities (i.e., race and gender) within each specific context.

One surprising finding to emerge was that greater racial stereotyping was found on the IAT when South Asian men were compared to White men as opposed to White women. This may have emerged because of people’s (and especially women’s) tendency to have a more positive association with women as opposed to men (Dunham et al., 2015). Given that the sample was primarily women, they might have had a harder time pairing women with the negation of “not” (as in the case of “not science”). An alternative possibility is that when targets differed by both gender and race (as was the case when seeing South Asian men and White women) the task was more cognitively demanding, leading to decreased stereotyping. I examined these possibilities in Study 1b.

Study 1b

The goal of Study 1b was to replicate and extend the effects of Study 1a using a different comparison on the implicit measure. In Study 1b, I built off of previous research by using a new comparison group, specifically by comparing “Science” and “Friendly” on the IAT (Storage et al., 2020). The category of “Friendly” was selected as it has been used in an IAT previously (“Brilliance”/“Friendly” IAT; Storage et al., 2020); it provides a comparable alternative category that is unrelated to “Science” but nevertheless provides an equal valence that is both positive and is potentially not associated with either racial group (Greenwald et al., 2021).

In this study, I tested the same hypotheses as in Study 1a, specifically, that I would find evidence of a race-science stereotype associating people who are South Asian with science to a greater extent than people who are White. In addition, I examined whether the magnitude of stereotyping would be the greatest when the target groups were South Asian men with White women, and the least (and possibly reversed) when the target groups were South Asian women with White men. That is, as Study 1b used a comparison that was not a negation (i.e., Friendly as opposed to "*Not* Science"), I hypothesized that the previously expected pattern would now emerge. Specifically, as “friendly” is a stereotypically feminine trait (Storage et al., 2020), I anticipated that this would make it easier to pair the male target with “science” and the female target with “friendly”, thereby leading to a stronger difference in associations between South Asian men/ White women, and South Asian women/ White men. One notable difference is that

Study 1b included only implicit and explicit (i.e., no indirect) measures, with some modifications to the measures.

Method

This study was pre-registered on OSF and all measures are available online (https://osf.io/bfepz/?view_only=5f4e4b6c6e064f3ca3e79de6e4f04b29). The a priori power analysis was identical to Study 1a.

Participants

A total of 400 undergraduate students were recruited online in exchange for course credit[6]. Participants were immediately excluded if they did not provide post-debriefing consent to use their data (*n* = 34). One additional participant was excluded as they did not complete the implicit measure and did not meet inclusion criteria on the explicit measures. This resulted in a final sample of 365 participants (M_{age} = 22-years, *SD* = 7-years, range 18 - 70; 270 women, 91 men, 4 non-binary or not disclosed). Participants identified as Middle Eastern (*n* = 61), Black (*n* = 54), White (*n* = 50), East Asian (*n* = 48), Southeast Asian (*n* = 45), South Asian (*n* = 43), Mixed Race (*n* = 32), South or Latin American (*n* = 19), Other (*n* = 12), or undisclosed (*n* = 1).

A total of 13 participants were excluded from the implicit measure if they responded to at least 10% of trials faster than 300 ms (*n* = 5), had an error rate greater than 30% (*n* = 7) or had an average reaction time on all trials that was three standard deviations below the mean (*n* = 1). The final sample for the IAT consisted of 352 participants. For the explicit measures, a total of 4 participants were excluded as they failed the attention check questions (i.e., less than 2/3 correct). The final sample for the explicit measures consisted of 361 participants.

[6] Of these 400 participants, a total of 36 had a technical issue resulting in some form of duplicate data. This typically occurred because the implicit measure did not load on the first attempt. For each of these participants, their first implicit data were retained and combined with their first explicit data.

Implicit Measure

Science-Friendly Ambiguous Categorization Implicit Association Test (AC-IAT).

The same photo stimuli were used for this IAT, with the exception that the photographs of the South Asian women were color corrected to be a shade darker, to better align with the color balance of the South Asian male photos and the emoji headers (see Appendix F). Participants were randomly assigned to one of four conditions in a 2 (South Asian Target: male or female) x 2 (White Target: male or female) between-subjects design. Participants first completed a block containing 20 practice trials of photo images. However, in the second block, participants now sorted words related to the category "Science" (i.e., computer science, physics, chemistry, engineering) and "Friendly" (i.e., very friendly, kind, outgoing, agreeable) using the same two computer keys. In the critical blocks, participants were asked to categorize the words and images with all four headers (South Asian header, White header, Science and Friendly) that was again grouped in "practice" (20) and "real" (40) critical trials as outlined by Greenwald and colleagues (2003). As in Study 1a, higher scores indicated a relatively faster association between "South Asian + Science" and (for this study) "White + Friendly".

Explicit Measures

Participants were presented with a shortened version of the explicit questionnaire from Study 1a, which included several modifications. First, participants were only asked four questions about their race-science and gender-science stereotypes. Specifically, they were asked how much they associate men and women, and people of South Asian versus European descent, with science, on a 7-point Likert scale. They were asked to indicate how much they believe *most people* associate these groups with science on the same two questions. Following this, they were asked the same four questions, but instead how much they associate each group with "Friendly".

In addition, participants were asked to answer a series of questions about their beliefs of how much *most people* associate South Asian men, South Asian women, White men, White women (1= not at all, 7= extremely) with “science” and with “friendly”. Following this, they were asked to indicate how much they associate each group (1= not at all, 7= extremely) with each of the 10 words used in the IAT (friendly, very friendly, kind, outgoing, agreeable, science, computer science, chemistry, physics, and engineering). Lastly, pilot questions for a future IAT asked participants about their associations between each group and being funny.[7]

Procedure

Study 1b followed the same procedure as Study 1a, except upon completion of the explicit measures, participants were only asked demographic questions.

Results

Implicit Measure

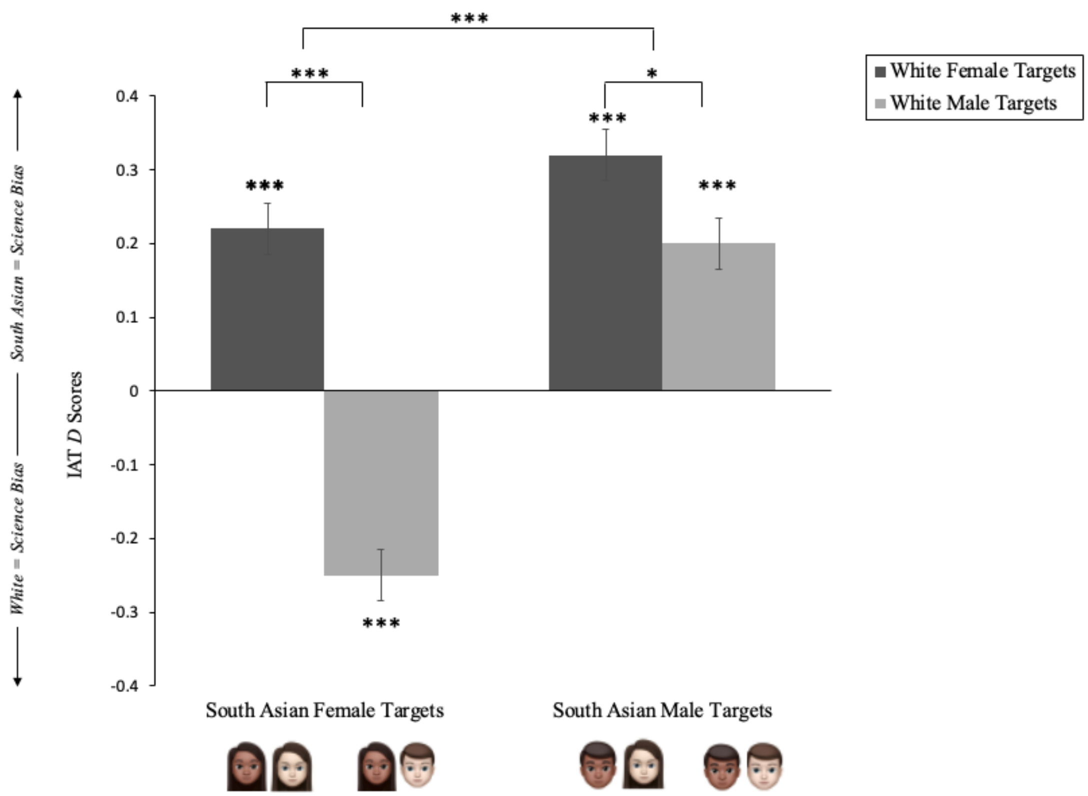
To examine whether race-science stereotypes differed by the gender of targets, I ran a 2 (South Asian Target: male or female) x 2 (White Target: male or female) between-subjects ANOVA. Unlike Study 1a, there was a significant main effect of South Asian Target, $F(1, 347) = 57.46$, $p < .001$, $\eta^2_p = .14$, and a significant main effect of White Target, $F(1, 347) = 65.87$, $p < .001$, $\eta^2_p = .16$, which were qualified by a significant interaction effect, $F(1, 347) = 23.55$, $p < .001$, $\eta^2_p = .06$, see Figure 6. As in Study 1a, when participants saw targets of the same gender (e.g., South Asian and White men *or* South Asian and White women), there was evidence of racial stereotyping. Specifically, participants were relatively faster to pair South Asian men with science and White men with friendly ($D = .20$, $SD = .34$), as evidenced by a one-sample *t*-test

[7] To pilot potential words for the IAT for Study 2b, participants were asked (1= not at all, 7= extremely) about their associations between each group and words related to being funny (funny, very funny, entertaining, hilarious, witty).

(comparing against zero) showing this was significantly different from chance responding, $t(92) = 5.62$, $p < .001$, $d = .34$.

Figure 6.

Implicit Attitudes by Condition and Target (Study 1b).



Note. Error bars represent the standard error. * *p < .05*, *** *p < .001*

Similarly, participants were relatively faster to pair South Asian women with science and White women with friendly ($D = .22$, $SD = .31$), $t(91) = 6.81$, $p < .001$, $d = .31$. Direct comparisons suggested that the magnitude of racial stereotyping in these two conditions did not differ, $t(183) = -.41$, $p = .34$. As expected, and consistent with Study 1a, when seeing people of the same gender, participants again associated science more with people who are South Asian, and friendly more with people who are White, relative to the reverse pairing.

Also consistent with Study 1a, participants who saw South Asian men and White women showed significant racial stereotyping (*D* = .32, *SD* = .34), $t(87) = 8.73$, $p < .001$, $d = .34$, being faster to pair South Asian men with science and White women with friendly, relative to the reverse pairing. Direct comparisons further suggested that the level of stereotyping was greater in this condition, where participants saw South Asian men and White women, compared to both the same-gender male condition, where participants saw South Asian men and White men, (*D* = .20, *SD* = .34), $t(179) = -2.33$, $p = .01$, $d = .34$, and the same gender female condition, where participants saw South Asian women and White women, (*D* = .22, *SD* = .31), $t(178) = 2.04$, $p = .02$, $d = .34$. That is, the greatest race-science stereotyping occurred when participants saw South Asian men paired with White women.

However, participants who saw South Asian women and White men showed the opposite pattern. Unlike Study 1a, participants were significantly faster to pair White men with science and South Asian women with friendly, relative to the reverse pairing (*D* = -.25, *SD* = .36), $t(77) = -6.08$, $p < .001$, $d = .36$, and this differed from each of the three other conditions, *t*s > 5.62, *p* < 001. While South Asian men were more associated with science (versus friendly) when paired with either White men or women, South Asian women were only associated with science when they were paired with same-gender White women. By contrast, South Asian women were less associated with science (and more associated with friendly) when paired with White men.

Lastly, I examined the three spontaneous categorization trials to assess whether participants were primarily sorting by race or by gender. As expected, there was a significant difference in whether participants sorted primarily by race or gender across conditions, $\chi^2(3) = 128.68$, $p < .001$. As would be expected, participants who viewed same-gender targets sorted the majority of the final three trials primarily by race (87% in the South Asian men/ White men condition and 91% in the South Asian women/White women condition). However, when examining the two ambiguous conditions where targets differed by both race and gender, participants consistently demonstrated a preference to sort by gender, rather than by race (65% sorted primarily by gender in the South Asian men/White women condition; 67% sorted by gender in the South Asian women/White men condition), see Table 2.

In addition, in each of the two ambiguous categorization conditions, the level of bias did not differ depending on how the final trials were categorized. For the South Asian Men/White Women condition, there was no difference in bias for participants who sorted by race (D = .33, SD = .35) or by gender (D = .31, SD = .34), $t(86) = -.18$, $p = .43$, $d = .04$, and there was no relation between how they sorted the final trials and their bias, $r_\rho(86) = .04$, $p = .69$. Similarly, for the South Asian Women/White Men condition, there was no difference in bias for participants who categorized by race (D = -.23, SD = .32) or by gender (D = -.26, SD = .39), $t(76) = -.41$, $p = .43$, $d = .10$, across the final trials, $r_\rho(76) = .00$, $p = .98$.

Table 2

Number of Final Trials Categorized by Race Separated by Condition (Study 1b)

	Majority sorted by race				Majority sorted by gender			
	All by race		Mixed				All by gender	
	3/3		2/3		1/3		0/3	
Condition	*N*	%	*N*	%	*N*	%	*N*	%
South Asian women/ White men	19	23%	8	10%	15	18%	40	49%
South Asian women/ White women	57	60%	29	31%	7	7%	2	2%
South Asian men/ White men	66	67%	21	21%	6	6%	5	5%
South Asian men/ White women	19	21%	13	14%	18	20%	40	44%

This is less surprising for participants viewing South Asian men and White women, as both the racial and gender stereotype favors the South Asian man. However, this suggests that even when race was salient in the final trials, participants did not show a greater association between South Asian women and science, suggesting South Asian women are not benefitting from a positive racial stereotype.

Explicit Measures

Race-science stereotypes. Unlike Study 1a, participants did not differ in their ratings of what they believed, and what most people believed, $t(360) = .83$, $p = .20$, see Figure 4. However, one-sample *t* tests comparing against 4 (i.e., the midpoint) confirmed that participants personally associated ($M = 4.97$, $SD = 1.38$), $t(360) = 13.29$, $p < .001$, $d = 1.38$, and believed most people associate ($M = 4.89$, $SD = 1.75$), $t(360) = 9.72$, $p < .001$, $d = 1.75$, science more with people who are South Asian over people who are White.

Gender-science stereotypes. Consistent with Study 1a, participants reported that most people associate science with men over women ($M = 5.62$, $SD = 1.28$), $t(360) = -11.22$, $p < .001$, $d = 1.40$, to a greater extent than they themselves associate science with men ($M = 4.79$, $SD = 1.33$) over women, see Figure 5. Despite this difference, one-sample *t* tests comparing against 4 (i.e., the midpoint) confirmed that participants personally associate, $t(360) = 11.35$, $p < .001$, $d = 1.33$, and believe *most people* associate, $t(360) = 23.98$, $p < .001$, $d = 1.28$, science with men more than women.

To examine how participants' awareness of racial stereotypes might be moderated by target gender, a 2 (Race: South Asian or White) x 2 (Gender: Male or Female) within-subjects ANOVA was conducted using ratings of *most people's* associations with science between each of these four groups. There was a significant main effect of Race, $F(1, 344) = 15.57$, $p < .001$,

$\eta^2_p = .04$, such that, consistent with the expected racial stereotypes, participants felt that most people would associate people who are South Asian ($M = 4.81$, $SD = 1.42$) with science to a greater extent than people who are White ($M = 4.48$, $SD = 1.22$). There was also a significant main effect of Gender, $F(1, 344) = 211.03$, $p < .001$, $\eta^2_p = .38$, such that men ($M = 5.09$, $SD = 1.33$) were associated with science to a greater extent than women ($M = 4.19$, $SD = 1.30$). The interaction between Race and Gender was not significant, $F(1, 344) = 2.75$, $p = .10$, $\eta^2_p = .01$.

Finally, a 2 (Race: South Asian or White) x 2 (Gender: Male or Female) within-subjects ANOVA was conducted using averaged scores for each individual science-related term that had been used in the IAT (i.e., science, computer science, chemistry, physics, and engineering). A significant main effect of Race, $F(1, 360) = 124.65$, $p < .001$, $\eta^2_p = .26$ and a main effect of Gender, $F(1, 360) = 429.03$, $p < .001$, $\eta^2_p = .54$, again emerged, however these were qualified by a significant interaction effect, $F(1, 360) = 4.05$, $p = .045$, $\eta^2_p = .01$. Simple main effects analyses revealed that participants reported the belief that *most people* associate South Asian men ($M = 5.45$, $SD = 1.19$) with science terms more than White men ($M = 4.75$, $SD = 1.26$; $p < .001$), and associate science terms with South Asian women ($M = 4.30$, $SD = 1.40$) more than White women ($M = 3.45$, $SD = 1.21$; $p < .001$). Moreover, participants associated South Asian men with science ($M = 5.45$, $SD = 1.19$) more than both South Asian women ($M = 4.30$, $SD = 1.40$; $p < .001$) and White women ($M = 3.45$, $SD = 1.21$; $p < .001$). Importantly, White men were associated with science more than South Asian women ($p < .001$). Overall, these results suggest that South Asian men are consistently being associated with science to a greater extent than all other targets, including White men, possibly because both their gender and race are associated with positive stereotypes. In addition, this suggests that South Asian women are experiencing a small benefit from the positive racial stereotype, relative to White women, although this appears to be attenuated based on the negative gender stereotype they face.

Friendly Stereotypes. Participants reported that *most people* associate friendly with people who are White as opposed to South Asian (M = 4.45, SD = 1.48) to a greater extent than they do personally (M = 3.65, SD = 1.40), $t(361) = -9.47$, $p < .001$, d = 1.60. One-sample t tests comparing against 4 (i.e., the midpoint) confirmed that participants personally associate friendly (M = 3.65, SD = 1.40) more with South Asian people $t(360) = -4.71$, $p < .001$, d = 1.40, while believing that most people associate friendly more with White people (M = 4.45, SD = 1.48), $t(360) = 5.79$, $p < .001$, d = 1.48, suggesting a lack of consistent race stereotypes about friendliness. In addition, participants did not differ in their personal gender associations with friendly and what they thought most people believed, $t(360) = -.47$, $p = .32$. However, one sample t tests confirmed that participants personally associate (M = 5.10, SD = 1.31), $t(360) = 16.00$, $p < .001$, d = 1.31, and believe most people associate, (M = 5.14, SD = 1.41), $t(360) = 15.39$, $p < .001$, d = 1.41, friendly more with women than with men.

A similar pattern of results was found using the friendly ratings for each group. A 2 (Race: South Asian or White) x 2 (Gender: men or women) within-subjects ANOVA revealed a significant main effect of Gender, $F(1, 359) = 22.53$, $p < .001$, $\eta^2_p = .06$, such that participants believed *most people* associate women (M = 4.69, SD = 1.34) with friendly to a greater extent than men (M = 3.95, SD = 1.40). The main effect of Race, $F(1, 360) = 2.49$, $p = .12$, $\eta^2_p = .01$, as well as the interaction effect, $F(1, 360) = .06$, $p = .80$, $\eta^2_p = .00$, were both not significant.[8] Overall, these results suggest a consistent gender stereotype that women, regardless of race, are more associated with friendly, while the evidence for a racial stereotype was more mixed.

[8] Additional analyses examining the association between terms related to friendly and each gender/racial group can be found in Appendix G.

Additional measures. A series of questions additionally asked participants to associate each gender and racial group with traits related to "funny." There was a significant difference in ratings across both race and gender[9], however, these results are not the primary focus of this study and were included as pilot questions for Study 2b (see Appendix H).

Discussion

The results of Study 1b provide additional support for a positive racial stereotype associating people who are South Asian with science. Consistent with the findings from Study 1a, which provided evidence for race-science stereotypes, on the implicit measure from this study, participants were faster to associate science with people who are South Asian, and friendly with people who are White, when they viewed same-gender targets. Notably, the positive racial stereotype was also found when South Asian men were compared to White women, suggesting that regardless of the gender of the White comparison group, South Asian men are more associated with science (versus friendly). However, participants in the South Asian women/White men condition showed an opposite pattern of associations from all other conditions, instead being faster to associate White men with science and South Asian women with friendly. This finding suggests that South Asian women face less consistent race-science stereotyping based on the intersection of their race and gender identities. As Study 1a found no significant difference between South Asian women and White men on the implicit measure, the current results further suggest that context may play an important role in these associations.

In addition, participants also reported race-science stereotypes favoring people who are South Asian on the explicit measures. Furthermore, participants reported that both South Asian men and South Asian women are associated with science, but consistent with the implicit

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[9] White men were significantly associated with being funny ($p < .001$) while South Asian men were not ($p = .24$). Women, regardless of race, were significantly associated with being *less* funny ($p < .001$).

findings, South Asian men were most associated with science. Although South Asian women were as well, this was to a lesser extent than White men. These findings are consistent with the possibility that South Asian men are benefitting from positive racial and gender stereotypes, favoring them in science. Specifically, the current findings suggest that the combination of race and gender for South Asian men provides them with unique positive stereotypes within science. Moreover, the evidence suggests that South Asian women are in a position where the combination of their race and gender identities results in associations with science that fluctuate depending on the social context (i.e., if they are compared against White *men* versus *women*). These results again provide support for the compartmentalization model of stereotyping, as the findings suggest that participants were attending to both the race and the gender of each target group. However, this also suggests that perhaps, in line with category dominance models (Bodenhausen, 2010), South Asian women are more likely to be categorized by their gender – a question that is examined further in Studies 2 and 3. Consistent with previous research (Storage et al., 2020), there was also evidence that women were more associated with the concept of friendly than men. However, racial stereotypes were less consistent. It is possible that the findings on the IAT were driven, at least in part, by having a competing category that is more associated with women. That is, in the two conditions where targets differed by both gender and race, participants might have found it easier to pair science with the men in part because it was also easier to pair the concept of friendly with women. I address this possibility in Study 2 (and most directly in Study 2b).

Study 2a

The goal of Study 2 was to extend the previous findings to further assess the magnitude of science stereotypes towards people who are South Asian. Specifically, Study 2 (a and b) had an emphasis on examining gender-science stereotypes on the implicit measure, and further tests the implications of science stereotypes on employment recommendations through the indirect measures. In Study 2a, I once again tested the Science/Not Science associations on the IAT, however, this time I tested whether gender stereotypes are moderated by target race in a 2 (Male Target Race: South Asian or White) x 2 (Female Target Race: South Asian or White) between-subjects design. The two conditions where targets differ by both race and gender are identical to Study 1a; the other two conditions now examine the consistency of gender-science stereotyping (as opposed to race-science stereotyping), when the targets are same-race (e.g., South Asian men versus women; White men versus women). Unlike Study 1, the IAT was scored such that higher scores indicate greater gender stereotyping.

I hypothesized that gender-science stereotyping would emerge in each condition, with men (regardless of race) being associated with science more than women. Moreover, I anticipated race-science stereotypes to moderate effects, such that South Asian men would be associated with science more than White men. In the two conditions where targets differed across both race and gender, I anticipated that South Asian men would benefit from positive racial and gendered associations with science and would be associated with science to a greater extent than women. Of greater interest, I tested whether gender stereotyping would be less pronounced for South Asian women, and whether (due to competing racial stereotypes) gender stereotyping would be attenuated when South Asian women were paired with White men.

In addition, to test whether social and cultural influences play a role in the endorsement of science stereotypes, specifically in the endorsement of the "South Asian + Science" association, Study 2a recruited only White and South Asian participants. Some research has found differences in the perceptions and experiences of South Asian versus White women in

STEM (Adya, 2008); as such, I examined whether the magnitude of stereotyping differed depending on the race of the participant and tested the possibility that South Asian participants would associate South Asian targets (over White targets) with science to a greater extent than White participants. In addition, I expanded the indirect measure by using four separate vignettes (rather than one) to test the impact of race and gender on employment recommendations.

Method

This study was pre-registered on OSF and all measures are available online (https://osf.io/y59d3/?view_only=62417c5438a64fc9a9911a2de8a9731f). For the current study, we recruited only South Asian and White participants, based on their self-identified responses on the pre-screen measures. An a priori power analysis using G-power suggested I would need 512 participants (64 per condition) to detect a medium effect size of .20 with .80 power at the standard .05 alpha error probability. Due to the online nature of this study, the a priori decision was made to oversample, aiming to recruit at least 640 (and at most 800), with a minimum of 320 South Asian and 320 White participants. Initially, the decision was made to aim for 800 participants, however, participation began slowing for South Asian participants at the end of the Fall 2022 semester. At that point, and without looking at the data, the decision was made to stop once 360 White and 360 South Asian participants (720 participants total) had been recruited.

Participants

A total of 720 participants were recruited, including 360 South Asian (M_{age} = 20-years, SD_{age} = 4.2-years, range = 18 – 65 years; 253 women, 76 men, 4 non-binary or not disclosed) and 360 White (M_{age} = 20-years, SD_{age} = 6-years, range = 18 - 70 years; 261 women, 72 men, 6 non-binary or not disclosed) participants. Participation was restricted to individuals who had indicated that they belonged to one of these racial/ethnic groups on a pre-screening questionnaire administered to all eligible students at the start of term, and who had lived in Canada for at least five years. Participants were immediately excluded if they did not provide post-debriefing consent to use their data (South Asian *n* = 29; White *n* = 25) or if they self-identified as non-South Asian (Middle Eastern, East Asian; *n* = 2) or non-White (Mixed Race; *n* = 3) during the demographic section of the study. [10] One additional South Asian participant was excluded from all measures as they met the exclusion criteria for both the implicit and explicit measures. This resulted in a sample of 331 South Asian participants, and 335 White participants.

Based on the recommended guidelines (Greenwald et al., 2003; Smyth & Nosek, 2015), participants were excluded from the implicit measure as they responded to at least 10% of trials faster than 300 ms (South Asian *n* = 7; White *n* = 3), responded to less than 70% of trials correctly (South Asian *n* = 2; White *n* = 2), had an average reaction time on all trials that was three standard deviations above (South Asian *n* = 1) or below (White *n* = 2) the mean, or were missing only the IAT data (South Asian *n* = 2; White *n* = 3), leaving a total of 319 South Asian participants and 325 White participants with implicit data. For the explicit measures, participants were excluded if they failed the attention check questions (i.e., answered less than 2/3 correct; South Asian *n* = 7; White *n* = 3). The final sample for the explicit measures consisted of 324 South Asian and 332 White participants.

Implicit Measures

Gender-science Ambiguous Categorization Implicit Association Test (AC-IAT). The same IAT structure and stimuli was used from Study 1a, however, the conditions differed by gender. Specifically, participants were randomly assigned to one of four conditions in a 2 (Male Target Race: South Asian or White) x 2 (Female Target Race: South Asian or White) between-

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[10] For those participants who had multiple attempts or duplicate data, only the first attempt was kept (*n* = 23 for South Asian participants and *n* = 24 for White participants).

subjects design. The IAT data were again scored using the recommended guidelines by Greenwald and colleagues (2003); however in this study positive values represent a “Male + Science” and “Female + Not Science” association, whereas negative values represent a “Female + Science” and “Male + Not Science” association. Also, in this IAT, all spontaneous trials were now coded such that higher scores indicated sorting by gender.

Indirect Measures

Science Stereotypes and Employment recommendations. Participants were presented with a similar indirect measure to Study 1a, with several modifications designed to increase our understanding of science stereotypes impacting job recommendations. To assess how race-science and gender-science stereotypes influenced potential employment recommendations, participants were instructed to “imagine that you work for a recruitment agency, and your job is to help other individuals find employment that matches their skills and experience.” Participants were randomly presented with four separate unique vignettes, presented in the same consecutive order, but each was matched with one of the possible race/gender combinations (i.e., South Asian man, South Asian woman, White man, White woman) in random order. Two of the vignettes described “soft skills” that are applicable to all jobs and could be applied to either men or women (e.g., “has good communication skills, has experience working in a team setting, and is adaptable and self-motivated”), while the other two vignettes described more general skills that are not directly applicable to any job, and could again be applied to men or women (e.g., “speaks more than one language, has several different hobbies, and has good conflict management skills”). See Appendix I for more details.

Following each of the vignettes, participants were asked to indicate how likely they would be (1= Not very likely, 4= Very likely) to recommend that applicant for eight different jobs (the same eight jobs from Study 1a). Two separate composite scores were created based on the field of employment (Science or Not Science). Higher scores indicate higher levels of perceived employability.[11]

Explicit Measures

Race-science and Gender-science Stereotypes. The same set of six questions (as Study 1a) was used to assess race-science stereotypes, and the same set of six questions was used to assess gender-science stereotypes.

Procedure

The procedure was identical to Study 1a, however, this study was only made available to participants who self-identified as White or South Asian in their pre-screening questionnaire.

Results

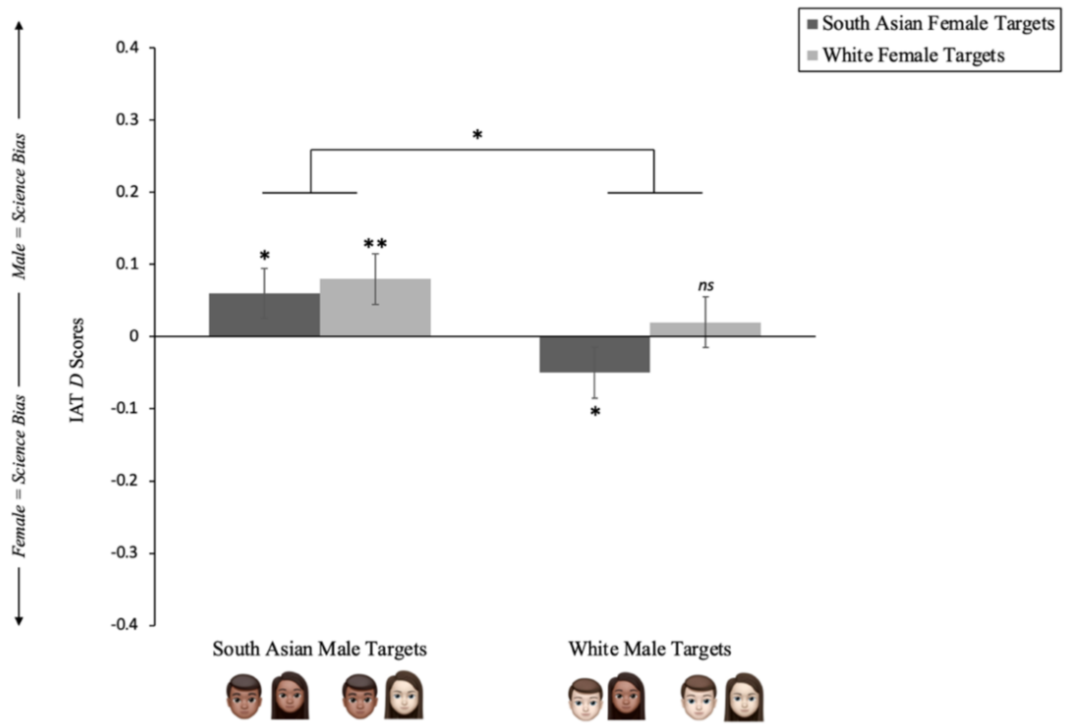
Implicit Measure

To examine whether gender-science stereotyping differed based on the race of targets, I ran a 2 (Participant Race: South Asian or White) x 2 (Male Target: South Asian or White) x 2 (Female Target: South Asian or White) between-subjects ANOVA. There was a significant main effect of Male Target, $F(1, 551) = 5.66$, $p = .02$, $\eta^2_p = .01$, such that South Asian men were associated with science ($D = .06$, $SD = .38$) to a greater extent than White men ($D = -.02$, $SD = .37$). The main effect of Female target, $F(1, 551) = 1.58$, $p = .21$, $\eta^2_p < .01$, as well as the main effect of Participant Race, $F(1, 551) = .01$, $p = .92$, $\eta^2_p < .01$, were not significant. In addition, all interactions were not significant, $F's < .36$, $p's > .55$, see Figure 7.

[11] In an exploratory manner following the job recommendation questions, participants were asked to indicate "how prestigious of a job" and "how respectable of a job field" they believed each candidate was looking for, and to indicate the salary they believed each candidate was aiming for. These additional questions aimed to further assess how science stereotypes may contribute to any differences in employment recommendations (see Appendix J).

Figure 7.

Implicit Attitudes by Condition and Target (Study 2a).



Note. Error bars represent the Standard Error. * $p < .05$, ** $p < .01$

One-sample *t* tests comparing against 0 (i.e., no bias) revealed that, for South Asian male targets, participants showed consistent evidence for gender stereotyping, being faster to pair the South Asian men with Science (*t*s > 1.87, *ps* < .03). However, for White male targets, consistent gender stereotypes did not emerge. Rather, when South Asian women were paired with White men, the opposite effect emerged and South Asian women were instead associated with science ($t(163) = -1.82$, $p = .04$, $d = .36$). This finding is consistent with the possibility that women's positively stereotyped racial identity was salient. Very unexpectedly, given the vast literature finding science-gender stereotyping, no evidence of gender stereotyping emerged in the White men/White women condition ($t(157) = .54$, $p = .30$).

Following this, I examined how the three spontaneous categorization trials were sorted to assess whether participants were primarily sorting by race or by gender. There was a significant difference in how participants sorted the final trials across conditions, $\chi^2(3) = 85.10$, $p < .001$. When viewing same-race targets, participants sorted the majority of the final three trials primarily by gender (95% in the South Asian men/South Asian women condition and 93% in the White men/White women condition).

When examining the two conditions where targets differed by both race and gender, participants again demonstrated a preference to sort by gender, rather than by race (63% sorted primarily by gender in the White women/ South Asian men condition; 66% sorted by gender in the White men/South Asian women condition), see Table 3.

Table 3

Number of Final Trials Categorized by Gender Separated by Condition (Study 2a)

	Majority sorted by gender						Majority sorted by race	
	All by gender		Mixed				All by race	
	3/3		2/3		1/3		0/3	
Condition	*N*	%	*N*	%	*N*	%	*N*	%
South Asian women/ White men	77	46%	33	20%	19	11%	40	24%
South Asian women/ South Asian men	93	57%	62	38%	8	5%	1	1%
White women/ White men	81	49%	70	42%	11	7%	3	2%
White women/ South Asian men	60	36%	43	26%	23	14%	40	24%

Once again, in line with Study 1a, the level of bias did not differ depending on how the final trials were categorized. In the White Men/South Asian women condition, there was no difference in bias whether participants sorted by gender (*D* = -.06, *SD* = .34) or by race (*D* = -.03, *SD* = .42), *t*(162) = .60, *p* = .47, *d* = .27, on the final three trials, $r_\rho(162) = -.04$, *p* = .59.

Similarly, in the South Asian men/White women condition, there was no difference in bias, *t*(162) = .76, *p* = .22, *d* = .12, whether participants sorted by gender (*D* = .06, *SD* = .38) or by race (*D* = .11, *SD* = .33), $r_\rho(162) = -.10$, *p* = .19.

Indirect Measure

To examine whether employment recommendations differed based on the race and/or gender of the applicant, a 2 (Target Race: South Asian or White) x 2 (Target Gender: Male or Female) x 2 (Field: Science or Non-science) within-subjects ANOVA was run.[12] There was a significant main effect of Target Race, *F*(1, 664) = 6.69, *p* = .01, $\eta^2_p = .01$, as well as a significant main effect of Field, *F*(1, 664) = 513.90, *p* < .001, $\eta^2_p = .44$, which was qualified by a significant interaction effect, *F*(1, 664) = 52.45, *p* < .001, $\eta^2_p = .07$. Participants were more likely to recommend South Asian applicants for science fields (*M* = 1.47, *SD* = .38) than White applicants (*M* = 1.41, *SD* = .38; *p* < .001), and to recommend White applicants (*M* = 1.63, *SD* = .29) for non-science fields than South Asian applicants (*M* = 1.61, *SD* = .31; *p* = .02).

There was no significant main effect of Target Gender, *F*(1, 664) = .87, *p* = .35, $\eta^2_p < .01$, however, the interaction between Target Gender and Field was significant, *F*(1, 664) = 20.98, *p* < .001, $\eta^2_p = .03$, although this was qualified by a three-way interaction between Target Race, Target Gender, and Field, *F*(1, 664) = 6.79, *p* = .01, $\eta^2_p = .01$. To decompose this interaction, a 2

[12] This was initially run with Participant Race as a factor. The only effect involving participants' race to emerge was an interaction between Participant Race and Field, *F*(1, 664) = 17.04, *p* < .001, $\eta^2_p = .03$, such that South Asian participants (*M* = 1.47, *SD* = .37) were more likely to recommend applicants for science fields than White participants (*M* = 1.41, *SD* = .39; *p* = .01); there was no difference in how likely South Asian (*M* = 1.62, *SD* = .30) versus White participants (*M* = 1.62, *SD* = .30; *p* = .88) were to recommend applicants for non-science fields. As this was not the main question of interest, the results without Participant Race as a factor are presented, but exploratory analyses separately by Participant Race are available on the OSF.

(Target Gender: Male or Female) x 2 (Field: Science or Non-science) within-subjects ANOVA was run for each group of applicants.

For South Asian applicants, the main effect of Target Gender was not significant, F(1, 665) = .01, p = .93, $\eta^2_p < .01$; however, both a main effect of Field , $F(1, 665) = 184.38$, $p < .001$, $\eta^2_p = .22$, and the interaction between Target Gender and Field, $F(1, 665) = 24.05$, $p < .001$, $\eta^2_p = .04$, were significant. South Asian men (*M* = 1.49, *SD* = .38) were more likely to be recommended for science jobs than South Asian women (*M* = 1.45, *SD* = .38; *p* = .01), whereas South Asian women (*M* = 1.63, *SD* = .30) were more likely to be recommended for non-science job fields than South Asian men (*M* = 1.58, *SD* = .31; *p* = .002).

For White applicants, the main effect of Field was significant, $F(1, 665) = 512.02$, $p < .001$, $\eta^2_p = .44$, such that, regardless of gender, applicants were more likely to be recommended for non-science (*M* = 1.63, *SD* = .29) than science jobs (*M* = 1.41, *SD* = .38). The main effect of Target Gender, $F(1, 665) = 1.59$, $p = .21$, $\eta^2_p < .01$, and the interaction effect, $F(1, 665) = 2.18$, $p = .14$, $\eta^2_p < .01$, were both not significant. Overall, these results suggest that South Asian applicants are more likely to be recommended for science jobs, but South Asian men specifically seem to benefit the most from these recommendations.

Explicit Measure

Race-science stereotypes. To examine whether any differences emerged in South Asian versus White participants' perceptions of race-science stereotypes, I ran a 2 (Participant Race: South Asian or White) x 2 (Belief Source: Personal or Most People) mixed ANOVA. There was a significant main effect of Participant Race, $F(1, 654) = 43.57$, $p < .001$, $\eta^2_p < .06$, and a significant main effect of Belief Source, $F(1, 654) = 11.74$, $p < .001$, $\eta^2_p = .02$, which was qualified by a significant interaction effect, $F(1, 664) = 22.45$, $p < .001$, $\eta^2_p = .03$. Specifically, there was a significant difference in South Asian participants' ratings of what they believed versus what most people believed, $t(323) = 5.50$, $p < .001$, such that South Asian participants reported that they themselves associate South Asian people with science ($M = 5.52$, $SD = 1.27$) to a greater extent than most people do ($M = 5.05$, $SD = 1.68$; $p < .001$). By contrast, White participants did not differ in their ratings, $t(331) = -.88$, $p = .19$, see Figure 4. Nevertheless, one-sample t tests comparing against 4 (i.e., the midpoint) confirmed that White participants personally associated ($M = 4.60$, $SD = 1.14$), $t(334) = 9.68$, $p < .001$, $d = 1.14$, and believed most people associate ($M = 4.68$, $SD = 1.58$), $t(334) = 7.91$, $p < .001$, $d = 1.58$, science more with people who are South Asian over people who are White. Additional comparisons examining whether science-race stereotypes were moderated by target gender are provided in Appendix K.

Gender-science stereotypes. To examine whether participants' perceptions of gender-science stereotypes differed, I ran a 2 (Participant Race: South Asian or White) x 2 (Belief Source: Personal or Most People) mixed ANOVA. The main effect of Participant Race was significant, $F(1, 654) = 6.05$, $p = .01$, $\eta^2_p < .01$, such that South Asian participants ($M = 4.82$, $SD = 1.42$) reported *lower* gender-science stereotypes than White participants ($M = 5.04$, $SD = 1.25$). There was also a significant main effect of Belief Source, $F(1, 654) = 281.90$, $p < .001$, $\eta^2_p = .30$, such that participants believed most people endorse the "male = science" stereotype ($M = 5.35$, $SD = 1.39$) to a greater extent than they personally do ($M = 4.51$, $SD = 1.28$). The interaction was not significant, $F(1, 654) = .34$, $p = .56$, $\eta^2_p < .01$, see Figure 5.

Finally, to examine whether gender-science stereotypes were moderated by the race of the targets, a 2 (Participant Race: South Asian or White) x 2 (Belief Source: Self or Other) x 2 (Target Race: South Asian or White) mixed ANOVA was run. There was a significant main effect of Participant Race, $F(1, 654) = 13.30$, $p < .001$, $\eta^2_p = .02$, of Belief Source, $F(1, 654) =$

69.46, $p < .001$, $\eta^2_p = .10$, and of Target Race, $F(1, 654) = 31.60$, $p < .001$, $\eta^2_p = .05$. The interactions between Participant Race and Belief Source, $F(1, 654) = .43$, $p = .51$, $\eta^2_p < .01$, Participant Race and Target Race, $F(1, 654) = .01$, $p = .94$, $\eta^2_p = .00$, and between Belief Source and Target Race, $F(1, 654) = .32$, $p = .57$, $\eta^2_p = .00$, were not significant. However, the three-way interaction (between Participant Race, Target Race, and Belief Source) was significant, $F(1, 654) = 9.01$, $p < .01$, $\eta^2_p = .01$, hence, follow-up analyses were run within Participant Race.

For South Asian participants, there was a significant interaction effect between Target Race and Belief Source, $F(1, 330) = 4.07$, $p = .04$, $\eta^2_p = .01$, such that South Asian participants personally associated South Asian men and women relatively equally with science ($M = 4.02$, $SD = 1.69$) while personally associating science more with White men than White women ($M = 4.41$, $SD = 1.42$). However, South Asian participants believed most people associate White men (over women) with science ($M = 4.66$, $SD = 1.55$) to a greater extent than most people associate South Asian men (over women) with science ($M = 4.48$, $SD = 1.68$). These results suggest that South Asian participants had stronger explicit "South Asian + science" associations, that were applied to both South Asian men *and* to South Asian women.

For White participants, the interaction effect between Target Race and Belief Source was not significant, $F(1, 334) = 3.36$, $p = .07$, $\eta^2_p = .01$. However, the main effect of Target Race was significant, with people who are White ($M = 4.85$, $SD = 1.68$) being associated with science more than people who are South Asian ($M = 4.55$, $SD = 1.35$). The main effect of Belief Source was also significant, such that White participants believed most people ($M = 4.91$, $SD = 1.37$) endorse stronger science stereotypes than they themselves do ($M = 4.48$, $SD = 1.31$). These results suggest that, unlike South Asian participants, White participants reported an explicit association between "White + science" and believed this stereotype is endorsed by *most people.*

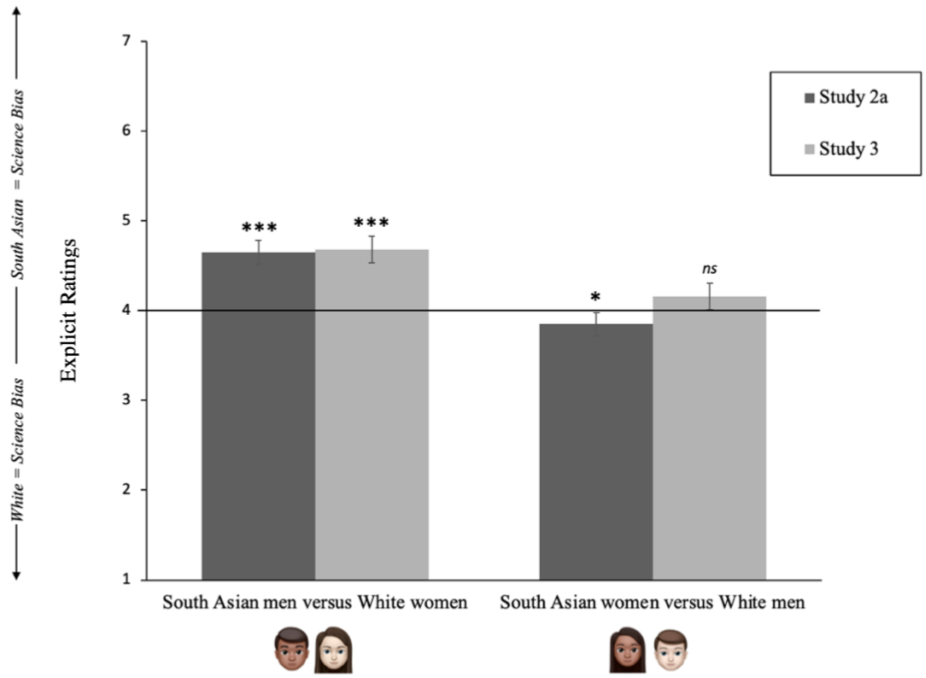
Additional intersectional comparisons. Finally, I examined whether participants' associations with science depended on the intersection of the race and gender identity of the target. Using one-sample *t* tests (comparing against 4), I compared participants' responses for how much they personally associate science specifically with White men versus South Asian women, and again specifically with South Asian men versus White women.[13] There was a marginally significant difference in participants' association with science between White men and South Asian women, $t(323) = -1.64$, $p = .05$, $d = 1.62$, such that participants reported associating science with White men slightly more than South Asian women ($M = 3.85$, $SD = 1.62$). However, there was a significant difference in their association with science between South Asian men and White women, $t(324) = 8.41$, $p < .001$, $d = 1.39$, with South Asian men being associated with science to a greater extent than White women ($M = 4.65$, $SD = 1.39$), see Figure 8. Once again, these results suggest that, when compared against White men (who face a positive gender, and some positive race associations with science), South Asian women are facing negative gender stereotypes and experiencing diminished associations with science.

Additional measures. Additional results based on questions assessing participants' perceptions of prestige and pay among various science job fields, alongside questions about their personal science attitudes are provided in Appendix L.

[13] To examine whether responses differed based on participant race, I ran a 2 (Participant Race: South Asian or White) x 2 (Response: Question 1 or Question 2) mixed ANOVA, with the first factor as between-subjects and the second as within-subjects. The main effect of Participant Race was not significant, $F(1, 79) = .05$, $p = .83$, hence, comparisons were collapsed across all participants.

Figure 8

Explicit Science Associations Across Race and Gender



Note. Error bars represent the Standard Error. * p = .05, *** p < .001.

Discussion

The current study used a sample of South Asian and White undergraduate students to directly examine whether race may be a moderator in participants' levels of science stereotypes and employment recommendations, specifically towards South Asian (i.e., a minority group) and White (i.e., the majority group) targets. Results showed that participants, regardless of race, consistently associated South Asian men with science across implicit, indirect, and explicit measures as compared to each of the other groups (i.e., South Asian women, White men, White women). Specifically, on the implicit measure, participants demonstrated a bias toward associating South Asian men with science. Moreover, on the indirect measure, both South Asian and White participants were more likely to recommend South Asian applicants for science (versus non-science) jobs. However, South Asian men specifically were recommended for science jobs more often than South Asian women. Finally, on the explicit measures, both South Asian and White participants demonstrated race-science and gender-science stereotypes, however, South Asian participants specifically were more likely to associate both South Asian *men* and South Asian *women* with science.

The results from the current study suggest that the predominant stereotype in society appears to associate South Asian men specifically with science, and this appears to be endorsed both by the in-group (i.e., South Asian participants) as well as more broadly by the out-group (i.e., White participants). This is an interesting finding that warrants continued research, considering some past research comparing White males against other minority group targets, including primarily Black and Latin men, has emphasized White men as the dominant group traditionally stereotyped as being good at science. The current research suggests that this may no longer be the case, and future research should further examine the changing nature of this stereotype. However, additional research is needed to replicate these findings using an IAT that does not include a negation (i.e., Not science) in the header. Despite the recent recommendations from Greenwald and colleagues (2021) that a negation can be used in a header, it is also recommended for both categories to be easily categorized, which might not have been true for the non-science items. In addition, it seems possible that due to the positive associations that people have with women, pairing female targets with a “not” category proved more challenging.

Moreover, the current results further suggest that for in-group members (i.e., South Asian participants), South Asian women appear to be receiving some benefit, or positive association, with science. However, for out-group members (i.e., White participants), it appears that South

Asian women are being associated with science when asked about their race more broadly, yet once their intersectional identity becomes salient, gender stereotypes appear to become more prominent, diminishing some of the positive racial associations between South Asian women and science. Further research is needed to examine the impact of gender stereotypes, particularly in combination with women of different ethnicities, to further test whether they would benefit from any positive racial associations with science. Nevertheless, these results once again suggest that these science stereotypes may be in line with the compartmentalization model of intersectionality, as evidenced by the differences in stereotype endorsement depending on the target's race and gender, as well as depending on the participants' own race.

Study 2b

The goal of Study 2b was to replicate and extend these findings using a novel comparison on the implicit measure. Specifically, building on Study 1b, which asked participants to categorize science and friendly, in Study 2b I asked participants to categorize science and funny on the Implicit Association Test, to further examine how associations with science may differ across race and gender. "Funny" was chosen as it is stereotypically male (Storage et al., 2020; see Appendix H for pilot analyses from Study 1b), thereby allowing me to test whether gender-science stereotypes persist under conditions of two male-dominated categories. Specifically, as both "funny" and "science" should be associated with the male targets (as opposed to the female targets), if participants have an association between female and science (for example, in the case of South Asian women and science), then it should be easier in that condition to pair the male target with funny and the female target with science (than it would for the reverse pattern; female + funny and male + science).

In addition, the current study aimed to replicate the findings from Study 2a, using a series of comparable vignettes that now had a socioeconomic status component. Socioeconomic status was selected as an additional variable to further evaluate the implications of each intersectional identity for employment recommendations. In Study 2b, I examined the influence of high versus low wealth cues on employment recommendations separately, allowing for the intersection of each gender and racial identity to be examined under each condition. Specifically, to assess how science stereotypes interacted with socioeconomic status to influence potential employment recommendations, participants were asked to read a series of vignettes describing various job applicants who differed in their level of education and work experience. Varying the level of education and work experience was used as a proxy to gauge socioeconomic status, such that applicants with lower levels of education (and less work experience) were associated with lower socioeconomic status.

Past research suggests that there is a wealth bias; for example, past research using implicit measures has shown that individuals prefer upper-class (over lower-class) individuals (Connor et al., 2023). Moreover, research suggests that perceptions of wealth may interact with other aspects of one's identity to influence bias (Connor et al., 2023; Tine & Gotlieb, 2013). More importantly, there is evidence to suggest that, when evaluating ambiguous applications (i.e., containing both strong and weak criteria), individuals (especially those higher in prejudice) may use stereotypes to make their decision (Hodson et al., 2002). Hence, within the context of the current study, I wanted to examine whether stereotypes would emerge when participants evaluate applicants with a low versus high perceived socioeconomic status, and whether any differences in stereotyping would emerge between the two. Specifically, if participants associate South Asian individuals with science (to a greater extent than they do White and science), then I anticipated participants would have an easier time recommending South Asian applicants for science fields. For high socioeconomic status applicants, it may be easier to justify the decision to recommend South Asian applicants for science fields, however, as the White applicants also have higher qualifications, this may lead to more comparable recommendations across both groups. However, in the case of low socioeconomic status applicants, their qualifications and criteria may be more ambiguous, thereby leading participants to rely on their stereotypes to make their decision. Hence, using applicants that varied in the level of socioeconomic status provided an additional test of the robustness of this stereotype.

Finally, I made use of the same explicit questionnaire as Study 2a, to test the persistence of science stereotypes on employment recommendations. In line with Study 2a, I again anticipated that gender-science stereotypes would emerge in each condition, however, I also anticipated that the race of the targets would have an effect. Specifically, I anticipated that South Asian men would be associated more easily with science than White men, leading to a main effect of Male Target. Similarly, I anticipated that the association with science will be greater for South Asian women over White women. As such, I also expected a main effect of Female Target. In addition, I tested the competing hypothesis that the intersection of South Asian women's race and gender identities would result in a unique stereotyping condition (due to the competing masculine concept of funny), whereby when compared against White men, South Asian women would be more likely to be paired with science (versus funny) than White men.

Method

This study was pre-registered on OSF and all measures are available online (https://osf.io/wcxef/?view_only=043c9513a9da4677bf370087aa2789a1). Study 2b was not restricted to any specific ethnicities, and hence, only approximately 400 participants were recruited. The a priori power analysis was identical to Study 1a.

Participants

A total of 403 participants (M_{age} = 20-years, SD_{age} = 5.6-years, range = 18 – 65 years; 281 women, 92 men, 4 non-binary or not disclosed) completed the current study. Participation was restricted to individuals who had lived in Canada for at least five years.[14] Participants were immediately excluded if they did not provide post-debriefing consent to use their data (n = 25) and one participant was excluded as they met the exclusion criteria for both the implicit and explicit measures[15]. The final sample consisted of 377 participants. Participants identified as White (n = 77), South Asian (n = 70), Middle Eastern (n = 63), Black (n = 46), Southeast Asian (n = 44), East Asian (n = 34), Mixed race (n = 28), Latin or South American (n = 10), and other (n = 5). The most commonly identified field of study was psychology (n = 112).

Based on the recommended guidelines, a total of 8 participants were excluded from the implicit measure if they responded to at least 10% of trials faster than 300 ms (n = 4), responded to less than 70% of trials correctly (n = 1), had an average reaction time on all trials that was three standard deviations below the mean (n = 1), or were missing only the IAT data (n = 2). The final sample for the IAT consisted of 369 participants. For the explicit measures, a total of 11 participants were excluded, as they failed the attention check questions (i.e., answered less than 2/3 correct). The final sample for the explicit measures consisted of 366 participants.

Implicit Measures

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[14] 400 individual time slots were opened on the URPP. If the system showed that a participant did not complete the study in its entirety, a new time slot was opened. This occurred three times in error, resulting in a total of 403 participants who took part in the study.

[15] For those participants who had multiple attempts or duplicate data, only the first attempt was kept (n = 23).

Science-Funny Ambiguous Categorization Implicit Association Test (AC-IAT). The same stimuli and procedure were used as in Study 1b, however, participants were presented with the novel category of "Funny" (very funny, witty, hilarious, entertaining), as it also provided a comparable alternative category (i.e., stereotypically male) that is unrelated to "Science" while simultaneously providing another distinct category (Greenwald et al., 2021). Higher scores indicated a faster association between "Men + Science" and "Women + Funny."

Indirect Measures

Science Stereotypes and Employment recommendations. Participants were presented with a similar set of vignettes as in Study 2a, however, the descriptions of the soft skills were modified, such that all four vignettes now provided a set of skills applicable to most jobs, and additional information about the applicant was included (e.g., level of education) to make socioeconomic status salient. Participants were randomly presented with two vignettes, one describing a White (male or female) applicant and one describing a South Asian (male or female) applicant, with low socioeconomic status qualifications (i.e., college diploma and limited work experience). Participants were also presented with two vignettes describing an applicant (one White, one South Asian) with high socioeconomic status qualifications (i.e., graduate degree, extensive work experience).[16] Following each vignette, participants indicated how likely they would be (1= Not very likely, 4= Very likely) to recommend that applicant for four science jobs (and four non-science jobs used as a filler). Based on the exploratory results of Study 2a (see Appendix M), the two highest and two lowest rated science jobs were selected.

Explicit Measures

All explicit questions were identical to Study 2a.

[16] Participants additionally viewed one vignette designed as a filler, describing either a White male or a South Asian female with moderate qualifications (i.e., undergraduate degree, moderate experience).

Procedure

Study 2b followed the same procedure as Study 2a.

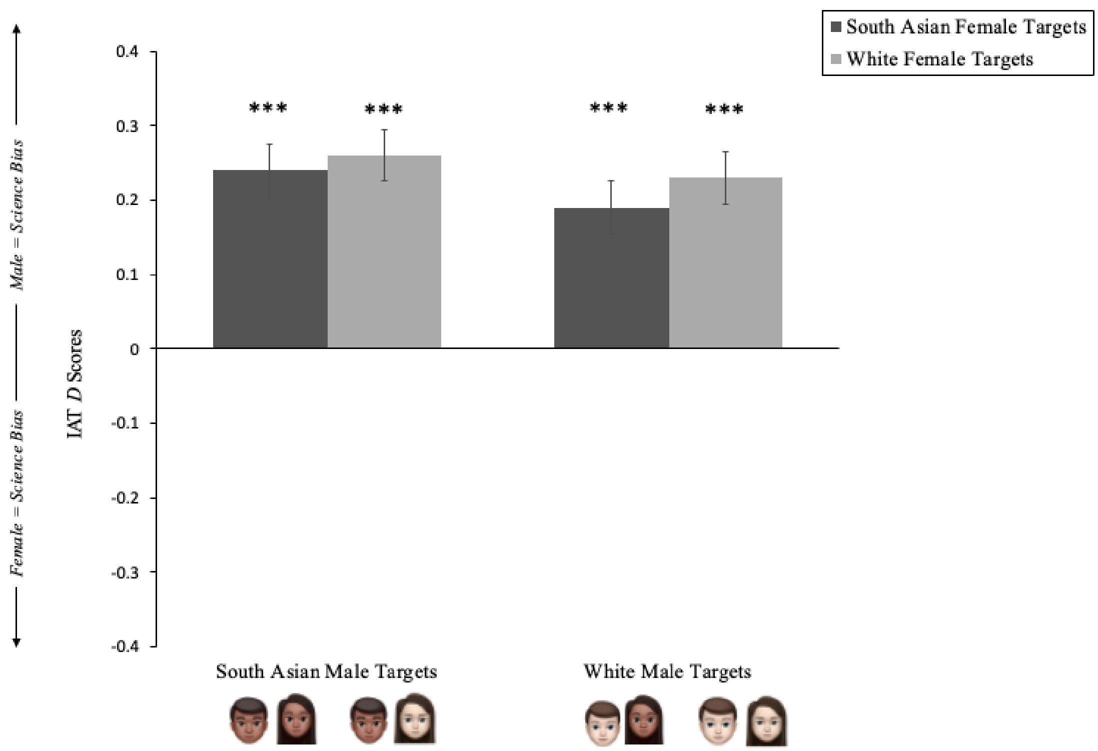
Results

Implicit Measure

A 2 (Male Target: South Asian or White) x 2 (Female Target: South Asian or White) between-subjects ANOVA was run. The main effects of Male target, $F(1, 365) = 1.22$, $p = .27$, $\eta^2_p < .01$, and of Female Target, $F(1, 365) = .55$, $p = .46$, $\eta^2_p < .01$, as well as the interaction effect, $F(1, 365) = .08$, $p = .78$, $\eta^2_p < .01$, were all not significant, see Figure 9.

Figure 9.

Implicit Attitudes by Condition and Target (Study 2b)



Note. Error bars represent the Standard Error. *** $p < .001$

However, unlike Study 2a, one sample *t* tests revealed that across each condition, participants were significantly faster to associate science with men and women with funny, relative to the reverse pairing, *t*s > 5.29, *p*s < .001, *d*s < .35.

Following this, I examined the three spontaneous categorization trials to assess whether participants were primarily sorting by race or by gender. There was a significant difference across conditions, χ^2 (3) = 40.61, *p* < .001. Participants who viewed same-race targets sorted the majority of the final three trials primarily by gender (93% in the South Asian men/South Asian women condition and 91% in the White men/White women condition). Moreover, when examining the two conditions where targets differed by both race and gender, participants also demonstrated a preference to sort by gender, rather than by race (63% sorted primarily by gender in the White women/ South Asian men condition; 65% sorted by gender in the White men/South Asian women condition), see Table 4.

Table 4.

Number of Final Trials Categorized by Gender Separated by Condition (Study 2b)

	Majority sorted by gender					Majority sorted by race		
	All by gender		Mixed				All by race	
	3/3		2/3		1/3		0/3	
Condition	*N*	%	*N*	%	*N*	%	*N*	%
South Asian women/ White men	40	43%	18	19%	7	8%	25	27%
South Asian women/ South Asian men	37	43%	42	49%	6	7%	0	0%
White women/ White men	61	58%	34	32%	8	8%	1	1%
White women/ South Asian men	39	43%	20	22%	10	11%	21	23%

Finally, as in each of the previous studies, in each of the two ambiguous categorization conditions, the level of bias did not differ depending on how the final trials were categorized. For the South Asian Men/White women condition, there was no difference in bias between participants who sorted by gender (*D* = .25, *SD* = .32) versus by race (*D* = .26, *SD* = .36), *t*(88) = .03, *p* = .49, *d* = .006, and no relation between the number of trials sorted by gender and their bias, $r_\rho(88) = .11$, *p* = .30. Similarly, for the White Men/South Asian women condition, there was no difference in bias, *t*(88) = -1.07, *p* = .15, *d* = .24, between participants who sorted by gender (*D* = .22, *SD* = .34) versus by race (*D* = .14, *SD* = .33), $r_\rho(88) = .17$, *p* = .11. Hence, regardless of whether participants were primarily attending to gender or race by the final trials, the levels of bias again did not differ.

Indirect Measure

To examine whether any characteristics of the applicant influenced participants' recommendations for jobs, I ran a 2 (South Asian Target: Male or Female) x 2 (White Target: Male or Female) x 2 (Field: Science or Not Science) mixed ANOVA separately for applicants described as being low SES versus for those described as having higher SES.

Low Socioeconomic Status applicants. There was a significant main effect of Field, $F(1, 371) = 435.84$, $p < .001$, $\eta^2_p = .54$, such that participants were overall more likely to recommend applicants for non-science fields (*M* = 2.45, *SD* = .64) than for science fields (*M* = 1.88, *SD* = .70). There was no significant main effect of South Asian Target, $F(1, 371) = .24$, $p = .63$, $\eta^2_p < .01$, nor of White Target, $F(1, 371) = 1.83$, $p = .18$, $\eta^2_p < .01$. However, the interaction between Field and South Asian Target was significant, $F(1, 371) = 6.95$, $p < .01$, $\eta^2_p = .02$. South Asian men were recommended for non-science jobs (*M* = 2.43, *SD* = .64) more often than for science jobs (*M* = 1.93, *SD* = .70; $p < .001$). Similarly, South Asian women (*M* = 2.47, *SD* = .65) were also recommended for non-science jobs more often than for science jobs (*M* = 1.82, *SD* = .71; $p < .001$). Despite the significant interaction, South Asian men and South Asian women were recommended for both non-science jobs, $F(1, 371) = .39$, $p = .53$, $\eta^2_p < .01$, and for science jobs, $F(1, 371) = 2.06$, $p = .15$, $\eta^2_p < .01$ at similar rates.

In addition, the interaction between Field and White Target was significant, $F(1, 371) = 6.01$, $p = .02$, $\eta^2_p = .02$. White men were recommended for non-science fields (*M* = 2.44, *SD* = .67) more than for science fields (*M* = 1.80, *SD* = .70; $p < .001$). White women were also recommended for non-science job fields (*M* = 2.46, *SD* = .62) more often than for science job fields (*M* = 1.95, *SD* = .70; $p < .001$). However, while White men and White women were recommended for non-science fields at similar rates, $F(1, 371) = .08$, $p = .78$, $\eta^2_p < .01$, surprisingly, White men were recommended for science jobs significantly *less* than White women were, $F(1, 371) = 4.53$, $p = .03$, $\eta^2_p = .01$.

Finally, the interaction between South Asian Target and White Target was not significant, $F(1, 371) = .24$, $p = .62$, $\eta^2_p < .01$ and the three-way interaction was also not significant, $F(1, 371) = .20$, $p = .65$, $\eta^2_p < .01$. Overall, these results suggest that for applicants who are perceived as being low SES, they are overall less likely to be recommended for science jobs. In addition, South Asian men and women are recommended for both science and non-science job fields at similar rates, suggesting that for low SES applicants, there is no gender stereotype impacting South Asian women.

High Socioeconomic Status applicants. There was a significant main effect of Field, $F(1, 371) = 5.89$, $p = .02$, $\eta^2_p = .02$, such that participants were again overall more likely to recommend applicants for non-science fields (*M* = 3.08, *SD* = .58) than for science fields (*M* = 2.99, *SD* = .75). There was no significant main effect of South Asian Target, $F(1, 371) = .05$, $p =$

.82, $\eta^2_p = .00$, nor of White Target, $F(1, 371) = .01$, $p = .93$, $\eta^2_p = .00$. The interaction between Field and South Asian Target was not significant, $F(1, 371) = .09$, $p = .77$, $\eta^2_p = .00$, however, the interaction between Field and White Target was marginally significant, $F(1, 371) = 3.43$, $p = .065$, $\eta^2_p < .01$. In addition, the interaction between South Asian Target and White Target, $F(1, 371) = .46$, $p = .50$, $\eta^2_p = .00$, and the three-way interaction, $F(1, 371) = .52$, $p = .47$, $\eta^2_p < .01$, were both not significant.

Finally, a comparison for the effect of socioeconomic status on field recommendations, using a 2 (Field: Science or Non-science) x 2 (SES: Low or High) within-subjects ANOVA revealed a significant main effect of Field, $F(1, 373) = 179.63$, $p < .001$, $\eta^2_p = .33$, and a main effect of SES, $F(1, 373) = 527.86$, $p < .001$, $\eta^2_p = .59$, which was qualified by a significant interaction effect, $F(1, 373) = 149.58$, $p < .001$, $\eta^2_p = .29$. Simple main effects comparisons revealed a significant difference in job recommendations for low SES applicants, such that they were more likely to be recommended for non-science ($M = 2.45$, $SD = .64$) than science ($M = 1.88$, $SD = .70$) jobs, although high SES applicants were also more likely to be recommended for non-science ($M = 3.08$, $SD = .57$) than science jobs ($M = 2.99$, $SD = .75$; $p = .02$), this difference was less in comparison (see Figures 2 and 3).

Explicit Measures

Race-science stereotypes. In line with the findings of Study 1b, participants again did not differ in their ratings of what they believed, and what most people believed, $t(365) = 1.29$, $p = .10$. Participants personally associated ($M = 5.04$, $SD = 1.42$), $t(365) = 13.95$, $p < .001$, $d = 1.42$, and believed most people associate ($M = 4.93$, $SD = 1.86$), $t(365) = 9.54$, $p < .001$, $d = 1.86$, science with people who are South Asian over people who are White, see Figure 4.

Following this, to examine whether gender stereotypes differed by target race, I ran a 2 (Race: South Asian or White) x 2 (Gender: Male or Female) repeated-measures ANOVA using participants' ratings of how much *most people* associate each group across each of the science words used in the IAT (i.e., the average rating across science, computer science, chemistry, physics, and engineering). There was a significant main effect of Race, $F(1, 363) = 179.60$, $p < .001$, $\eta^2_p = .33$, such that South Asian people ($M = 5.00$, $SD = 1.25$) were associated with science terms to a greater extent than people who are White ($M = 4.08$, $SD = 1.19$). The main effect of Gender was also significant, $F(1, 363) = 438.98$, $p < .001$, $\eta^2_p = .55$, with men ($M = 5.14$, $SD = 1.17$) being associated with science terms to a greater degree than women ($M = 3.94$, $SD = 1.28$). The interaction was not significant, $F(1, 363) = 1.82$, $p = .18$, $\eta^2_p = .01$. These findings provide additional evidence for a stereotype associating people who are South Asian with scientific concepts more generally. However, the lack of a significant interaction suggests that South Asian women experience positive racial associations with science in specific contexts.

Gender-science stereotypes. Participants believed that most people associate science with men ($M = 5.51$, $SD = 1.39$), $t(365) = -11.64$, $p < .001$, $d = 1.51$, to a greater extent than they themselves associate science with men ($M = 4.58$, $SD = 1.33$) over women; however participants both personally associated science ($M = 4.58$, $SD = 1.33$), $t(365) = 8.39$, $p < .001$, $d = 1.33$, and believed that *most people* associate science ($M = 5.51$, $SD = 1.39$), $t(365) = 20.78$, $p < .001$, $d = 1.39$, significantly more with men than with women, see Figure 5. Moreover, to further examine how participants' awareness of gender stereotypes may be moderated by race, a 2 (Race: South Asian or White) x 2 (Gender: Male or Female) within-subjects ANOVA was conducted using ratings of *most people's* associations between each group and the word "science."

There was a significant main effect of Race, $F(1, 365) = 33.30$, $p < .001$, $\eta^2_p = .08$, and a significant main effect of Gender, $F(1, 365) = 201.90$, $p < .001$, $\eta^2_p = .36$, which was qualified by a significant interaction effect, $F(1, 365) = 9.80$, $p < .01$, $\eta^2_p = .03$. Among males, South Asian men ($M = 5.38$, $SD = 1.19$) were associated with science more than White men ($M = 5.02$, $SD = 1.28$; $p < .001$) whereas among women, South Asian women ($M = 4.64$, $SD = 4.64$) were associated with science more than White women ($M = 4.06$, $SD = 1.30$; $p < .001$), although this difference was greater than the comparison for men. Finally, a paired samples *t* test comparing White men and South Asian women revealed a significant difference, $t(365) = 3.43$, $p < .001$, such that White men ($M = 5.02$, $SD = 1.28$) were associated with science to a greater extent than South Asian women ($M = 4.64$, $SD = 1.47$).

Funny stereotypes. Participants reported that *most people* associate funny with people who are White as opposed to South Asian ($M = 4.10$, $SD = 1.44$) to a greater extent than they do personally ($M = 3.89$, $SD = 1.33$), $t(365) = -2.91$, $p = .002$, $d = 1.44$. One-sample *t* tests comparing against 4 (i.e., the midpoint) showed that participants personally associate funny more with South Asian people ($M = 3.89$, $SD = 1.33$), $t(365) = -1.65$, $p = .05$, $d = 1.33$, whereas there was no difference in their beliefs about who most people associate funny with more ($M = 4.10$, $SD = 1.44$), $t(365) = 1.38$, $p = .08$, $d = 1.44$, suggesting a lack of consistent race stereotypes. In addition, there was evidence of gender stereotypes with a significant difference in what participants personally believed, and what they thought most people believed, $t(365) = -13.30$, $p < .001$, such that participants believed most people associate funny more with males than females ($M = 5.62$, $SD = 1.19$) to a greater extent than they themselves do ($M = 4.56$, $SD = 1.43$). Despite this difference, one sample *t* tests comparing against 4 (i.e., the midpoint) confirmed that participants personally associate ($M = 4.56$, $SD = 1.43$), $t(365) = 7.52$, $p < .001$, $d = 1.43$, and believe most people associate, ($M = 5.62$, $SD = 1.19$), $t(365) = 26.11$, $p < .001$, $d = 1.19$, funny with men more than with women.

This gendered association was further confirmed by a 2 (Race: South Asian or White) x 2 (Gender: men or women) within-subjects ANOVA that used ratings of how funny South Asian men, South Asian women, White men, White women are as the dependent variable. There was a significant main effect of Race, $F(1, 365) = 32.09$, $p < .001$, $\eta^2_p = .08$, and a significant main effect of Gender, $F(1, 365) = 230.26$, $p < .001$, $\eta^2_p = .39$. However, the interaction effect was also significant, $F(1, 365) = 13.13$, $p < .001$, $\eta^2_p = .04$.[17] Simple main effects analyses revealed that White men were associated with being funny ($M = 4.76$, $SD = 1.46$) to a greater extent than South Asian men ($M = 4.19$, $SD = 1.29$; $p < .001$), White women ($M = 3.63$, $SD = 1.34$; $p < .001$) and South Asian women ($M = 3.32$, $SD = 1.35$; $p < .001$).

Discussion

The goal of the current study was to extend the findings of Study 1b by using two male-dominated fields as comparison groups on the implicit measure. Specifically, participants were asked to associate South Asian men, South Asian women, White men and White women with science versus with funny. Using two traditionally male comparison groups allowed me to examine how the intersection of race and gender influenced perceptions of science stereotypes, specifically targeted towards women (who are not associated with either domain).

Consistent with previous gender-science stereotyping, participants demonstrated an association between men and science. Specifically, on the implicit measure, participants were faster to associate science with men (over women), regardless of race, suggesting that gender-science stereotypes may be more pervasive within society than other traditionally male

[17] Additional analyses, comparing each gender/racial group across a series of terms related to funny are provided in Appendix J.

stereotypes (e.g., funny = male). Moreover, South Asian and White men were equally associated with science on the IAT, despite the fact that White men were rated as being the most associated with funny, the competing category.

Moreover, on the indirect measure, participants were more likely to recommend all applicants for non-science fields, regardless of race or gender. However, applicants with a perceived lower socioeconomic status were more likely to be recommended for non-science fields than those applicants with a higher perceived socioeconomic status, suggesting that perceptions of socioeconomic status may be an additional barrier for STEM fields, across both race and gender. Finally, on the explicit measures, participants reported personal beliefs in line with race-science and gender-science stereotypes. Consistent with the three previous studies, participants also reported the belief that *most people* hold race-science and gender-science stereotypes that associate science with South Asian individuals to a greater extent than White individuals, and with men more than with women.

In addition, when examining the stereotypically male domain of being “funny”, the current study found that participants personally reported the belief that they associate funny with South Asian (versus White) individuals, while reporting that *most people* instead associate funny with White (over South Asian) individuals. Participants nevertheless reported that White men are associated with funny the most, whereas South Asian women were least associated with funny. Lastly, participants personally associated, and believed most people associate, funny with men more than with women. These findings are in line with prior research examining stereotypes about humour, which suggests that men are associated with humour and are considered to be funnier, whereas woman are often associated with being less funny (Mickes et al., 2012). As such, this provided a conservative test of gender-science stereotyping, and yet this stereotype was nevertheless found.

Although the findings associating males predominantly with science are consistent with gender stereotypes, and thereby support dominance models of intersectional stereotyping, the current findings are also in line with the compartmentalization model. Specifically, the current findings suggest that the context (in this case, two male-dominated categories) may have played a significant role in participants' perceptions of each target group, and in this case, their associations between each male (versus female) target and science.

Study 3

The goal of Study 3 is to extend the previous findings by using new implicit and indirect measures. Specifically, Study 3 used the Brief IAT (BIAT) to once again assess science stereotypes, with a focus on the intersectional aspects of South Asian women's identities in science. The BIAT requires less time to complete and makes use of a focal category; my focal category consisted of "Science" although "not science" words (in line with Studies 1a and 2a) were used as a filler for comparison. The BIAT also focused specifically on the South Asian women versus White men condition, allowing for a more direct examination of the intersection of race and gender stereotypes for South Asian women. Building on the previous use of vignettes, Study 3 used a different, established indirect measure (the Judgment Bias Task; Axt et al., 2018) to assess employment recommendations. Similar to the IAT, the JBT is composed of multiple trials, and asks participants to press one of two computer keys to accept or reject an applicant. My explicit measures were similar to those in Study 1a, with minor differences detailed below.

As the BIAT focuses on one key category throughout the task, and was similar in many ways to Studies 1a and 2a, I predicted that the association with science (versus not science) would be greater for South Asian women than for White men; however, in line with the findings of Studies 1b and 2b, I also tested the competing hypothesis that gender (versus racial) stereotyping would emerge. On the JBT, I anticipated that evidence of race-science stereotyping would emerge, such that South Asian applicants would be accepted for a prestigious science fellowship more often than White applicants. Similarly, I anticipated that evidence of gender-science stereotyping would be found, such that male applicants would be accepted significantly more often than female applicants for a prestigious science fellowship. In addition, I anticipated a significant interaction to emerge between race and gender stereotypes on the JBT, resulting in South Asian males being selected the most often, and White women being selected the least often. Finally, on the explicit measures, I predicted that participants would again show both an awareness and an endorsement of gender-science and race-science stereotypes.

Method

This study was pre-registered on OSF and all measures are available online (https://osf.io/qb3s7/?view_only=68361049c8984cd8b7606773f5939756). Our stopping rule was 400 participants.[18]

Participants

A total of 414 participants (M_{age} = 19-years, SD_{age} = 3.4-years, range = 17 – 47 years; 250 women, 92 men, 5 non-binary or not disclosed) completed the current study[19]. Participation

[18] Although this study had one condition on the implicit measure, as can be seen in the pre-registration, our a priori power analysis was (erroneously) conducted as though there were four conditions. As such, we decided on a stopping rule of 400 participants.
[19] A total of 433 data attempts were made. However, 19 of these were duplicate attempts (e.g., opening the study on multiple devices) and only the first attempt was kept. In addition, 400 individual time slots were opened on the URPP. If the system showed that a participant did not complete the study and credit was not assigned, a new time slot was opened. This occurred 14 times in error, resulting in 414 participants who participated in the study.

was restricted to individuals who had lived in Canada for at least five years. Participants were immediately excluded if they did not provide post-debriefing consent to use their data (*n* = 67). The final sample consisted of 347 participants. Participants identified as White (*n* = 63), Middle Eastern (*n* = 56), South Asian (*n* = 54), Black (*n* = 44), Mixed race (*n* = 39), East Asian (*n* = 31), Southeast Asian (*n* = 31), Latin or South American (*n* = 17), and other (*n* = 12). The most commonly identified field of study was psychology (*n* = 135).

On the implicit measure, the recommended guidelines (Greenwald et al., 2003; Nosek et al., 2014) were used for *D* score calculation and participant exclusions. A total of 33 participants were excluded from the implicit measure if they responded to at least 10% of trials faster than 300 ms (*n* = 23; Nosek et al., 2014) or were missing only the BIAT data (*n* = 10). The final sample for the BIAT consisted of 314 participants. Based on the recommended guidelines for the Judgement Bias Task (Axt et al., 2018) a total of 16 participants were excluded from this measure. Participants were excluded if they accepted < 20% or > 80% of the applicants, suggesting a failure to follow the instructions to accept approximately half of all applicants (*n* = 11), or if they were missing just their JBT data (*n* = 5). The final sample for the JBT consisted of 331 participants. For the explicit measures, a total of 5 participants were excluded, as they failed the attention check questions (i.e., answered less than 2/3 correct). The final sample for the explicit measures consisted of 342 participants.

Implicit Measures

South Asian female – White male/ Science Brief Implicit Association Test. The Brief Implicit Association Test (BIAT; Sriram & Greenwald, 2009) is composed of two main blocks (using combined task headers), and 80 total trials. Participants were presented with two targets (i.e., South Asian female, White male) and two attributes (i.e., Science, Not Science). However, in the BIAT, one attribute is the focal category throughout the procedure (e.g., Science). In line with the regular IAT, higher scores indicate an association between the first-listed category and the focal attribute (e.g., South Asian female and Science). The BIAT has been shown to have good internal consistency and to be comparable to the regular IAT (Sriram & Greenwald, 2009).

Participants were first presented with a set of instructions highlighting one target (e.g., South Asian female) and the focal attribute (i.e., Science), and displaying all exemplars of these (i.e., the photo stimuli and words) that would be presented throughout the first block. They were told to press one key for the focal items (e.g., pictures of South Asian females and Science words), and to press another key for anything else. Photos of the other target (e.g., White male) and words from the non-focal attribute (e.g., Not Science) were used as fillers throughout the task. Following the initial instructions, participants were presented with four blocks, each consisting of twenty trials. In each block, participants were presented with all four stimuli (e.g., South Asian female, White male, Science words, Not Science words). The order of the pairings (e.g., South Asian female + Science first) switched between blocks (i.e., White male + Science), such that participants were presented with one stereotype-consistent block, followed by one stereotype-inconsistent block (or vice versa) twice, for a total of 80 trials. Each exemplar was presented in the center of the screen and an “X” appeared on the screen if the answer was incorrect, prompting participants to press the correct response key to continue.

The BIAT is scored similarly to the standard IAT, producing a *D* score (Sriram & Greenwald, 2009). In this BIAT, participants were assigned to one condition, and always viewed photos of South Asian women and White men. In line with Studies 1a and 2a, participants were presented with the same photo stimuli and word selection (i.e., for Science and Not Science words). The order in which the blocks were presented was counterbalanced between participants. Finally, higher scores indicate an association between "South Asian women + science".

Indirect Measures

The Judgement Bias Task (JBT). The Judgement Bias Task (JBT; Axt et al., 2018) is designed to provide an objective magnitude of social bias. The JBT has a flexible structure and can be used to measure a variety of biases. This task includes numerous trials and, according to Axt et al. (2018) can provide an objective means of identifying whether bias occurred. Although the JBT is not considered an implicit measure, it has been suggested that the results are a function of implicit processes.

In a JBT, participants are presented with 64 profiles and are told they will need to make decisions regarding each profile (such as whether they should be accepted for a committee) based on several criteria. Each profile contains multiple criteria, including criteria relevant for decision-making, alongside some irrelevant criteria. Some profiles are intentionally created to have stronger (or more positive) criteria, thereby making them better candidates. Participants are asked to weigh all criteria equally when making their decision. The JBT responses can then be used to assess participants' sensitivity to the criteria and examine whether any bias (i.e., toward candidates with specific characteristics) emerged. The JBT has been found to be reliable across multiple studies (Axt et al., 2018; for examples of studies that have used the JBT, see Axt and colleagues (2019), Atwood & Axt (2021), and Axt and colleagues (2023)).

In the current study, similar to Axt and colleagues (2018; Study 1a), participants were told that they would "play the role of a selection committee member". In this study, they were to select applicants for a prestigious science fellowship. Participants were told that they would be presented with applicants, and that it was their job to decide who to accept and who to reject.

Each applicant was presented with a photo, accompanied by four pieces of information. This included their science GPA (for science classes, such as biology and chemistry), their humanities GPA (for classes such as English and arts), the quality of their letters of recommendation (poor, fair, good, or excellent), and their overall interview score (out of 100) from a purported prior round of interviews in the application process (see Appendix N for example profiles). Participants were asked to attend to all four criteria and were asked to reject approximately half of the applicants. Participants were told each application would be presented briefly, one at a time, and were asked to select the most qualified candidates. To give participants an overview of the applicants, participants were first presented with each of the 64 applications consecutively for one second each. Participants were then presented, in random order, with each applicant one application at a time, and were asked to press one computer key to accept that candidate, or a second computer key if they wanted to reject that candidate. There was no time limit to make their decision.

Applications varied based on race (South Asian or White), gender (male or female), and qualification (i.e., higher grades and scores versus lower grades and scores). Applications were created such that for each race and gender group (i.e., South Asian men, South Asian women, White men, White women) there were 8 high qualified and 8 low qualified applications, for a total of 64 applications. Specifically, profiles for the JBT were created using all four criteria, with each criterion being valued out of four, for a total score out of 16. The high qualification profiles had a score summing to 14, whereas the low qualification profiles had scores summing to 13. This difference allowed the profiles to be distinct enough to allow potential bias to be detected, while simultaneously not being too distinct for the participants to identify (for more information on how to score or analyze the JBT, see https://osf.io/qkah5).

The JBT is scored using signal detection theory, which analyzes the criterion (c) and the sensitivity (*d'*) of the task. Criterion refers to the threshold at which a profile is rejected and the threshold at which a profile is accepted, hence, a participant with a lower criterion value would be more lenient with accepting profiles, whereas a participant with a higher criterion value would be more stringent with accepting profiles. Sensitivity refers to the participants' ability to distinguish between the two levels of profiles (i.e., high vs low qualifications), hence, a participant with high sensitivity would be more accurate at accepting more qualified profiles. By computing both sensitivity and criterion values for each category (i.e., South Asian male, South Asian female, White male, White female), this allowed me to assess whether participants were better at discriminating between the levels of profiles in one category over others, and whether the criterion for acceptance differed between the categories.

Explicit Measures

Race-science and Gender-science Stereotypes. In line with Study 1a, the same set of six questions was used to assess race-science stereotypes, and the same set of six questions was used to assess gender-science stereotypes.

Procedure

As in previous studies, participants were recruited for an online study in exchange for course credit. Participants first completed the Judgement Bias Task online using Inquisit software, followed by the Brief-IAT (also using Inquisit software), and then the explicit questionnaire using the Qualtrics platform. Once they completed the questionnaire, participants were debriefed and asked to provide post-debriefing consent for the use of their data.

Results

Brief Implicit Association Test.

As all participants completed a BIAT comparing their association of White men versus South Asian women with science, a one-sample *t* test comparing against 0 (i.e., no bias) was run using all the *D* scores. The effect was significantly different from 0, $t(313) = -4.72$, $p < .001$, $d = .48$. Participants were, on average, faster to associate science with White men than with South Asian women ($D = -.13$, $SD = .48$).

Judgement Bias Task.

The overall accuracy (i.e., accepting more qualified applicants and rejecting less qualified applicants) was 68.97% ($SD = .07$), providing some evidence that responding was above chance. The average acceptance rate throughout the task was close to the recommended 50% (M = 50.62%, $SD = .12$).[20] This provides some evidence that participants understood the task and followed instructions accordingly.

Bias in response criterion. To examine whether any differences occurred in criterion scores (i.e., the extent to which a participant is strict versus lenient in accepting or rejecting applicants) between each group, a 2 (Race: South Asian or White) x 2 (Gender: Male or Female) within-subjects ANOVA was run. There was a significant main effect of Race, $F(1, 330) = 5.52$, $p = .02$, $\eta^2_p = .02$, such that the criterion score was lower for South Asian applicants ($M = -.04$, $SD = .49$) than for White applicants ($M = .01$, $SD = .48$). This suggests a bias towards accepting South Asian applicants, regardless of their qualification. The main effect of Gender was also significant, $F(1, 330) = 4.08$, $p = .04$, $\eta^2_p = .01$, such that the criterion was lower for women ($M = -.04$, $SD = .48$) than for men ($M = .00$, $SD = .49$). This suggests a preference towards

[20] The overall accuracy for each group was as follows: South Asian men (M = 69.32%, $SD = .12$), and South Asian women (M = 69.60%, $SD = .12$), White men (M = 68.81%, $SD = .11$), White women (M = 68.15%, $SD = .12$). The average acceptance rate for each group was as follows: South Asian men (M = 50.96%, $SD = .16$), South Asian women (M = 51.89%, $SD = .17$), White men (M = 48.90%, $SD = .16$), White women (M = 50.74%, $SD = .16$).

accepting women, regardless of their qualification.[21] Finally, the interaction was not significant, $F(1, 330) = .46$, $p = .50$, $\eta^2_p = .00$.[22]

Bias in sensitivity scores. To examine whether any differences occurred in sensitivity rates (i.e., the ability to correctly distinguish between higher versus lower qualified applicants), a 2 (Race: South Asian or White) x 2 (Gender: Male or Female) within-subjects ANOVA was run. The main effect of Race, $F(1, 330) = 2.64$, $p = .11$, $\eta^2_p < .01$, main effect of Gender, $F(1, 330) = .09$, $p = .77$, $\eta^2_p = .00$, and interaction, $F(1, 330) = .79$, $p = .38$, $\eta^2_p < .01$, were not significant, suggesting that participants were able to comparably distinguish the more qualified applicants from the less qualified applicants, regardless of the race or gender of the applicants. Additional analyses examining the hit rate and false alarm rate can be found in Appendix O.

Explicit Measures.

Race-science stereotypes. Once again, participants reported a significant difference in what they believed ($M = 4.82$, $SD = 1.37$) and what they felt most people believed ($M = 4.62$, $SD = 1.75$), $t(340) = 2.23$, $p = .01$, $d = 1.73$, with participants themselves associating South Asian individuals with science to a greater extent than most people do. One-sample *t*-tests confirmed that participants both personally associate ($M = 4.82$, $SD = 1.37$), $t(340) = 11.10$, $p < .001$, $d = 1.37$, and believe most people associate ($M = 4.61$, $SD = 1.75$), $t(341) = 6.49$, $p < .001$, $d = 1.75$, South Asian people with Science to a greater extent than people who are White.

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[21] Although the criterion was higher towards White (than South Asian) applicants, and towards men (than women), as the criterion score was close to, or at, 0, this suggests that participants were equally likely to correctly accept (i.e., accept more qualified) and to correctly reject (i.e., reject less qualified) White applicants and male applicants; participants were overall more lenient towards South Asian and female profiles, but more accurate at identifying the qualifications of White and male applicants.

[22] In an exploratory manner, I compared the criterion score for each group, directly against each other group, to test whether any differences emerged. White men had a higher criterion score ($M = .03$, $SD = .49$) than all other groups combined ($M = -.04$, $SD = .38$), $t(330) = 2.88$, $p < .01$, $d = .43$, suggesting that participants were the most strict in evaluating White male applicants. However, there were no significant differences in criterion between all other groups, *t*'s < 1.23 *p's* > .11, *d's* < .52.

To examine whether race-science stereotypes differed based on the gender of the targets (e.g., South Asian versus White men; South Asian versus White women), a 2 (Belief Source: Personal or Most People) x 2 (Target Gender: Male or Female) within-subjects ANOVA was run. There was a significant main effect of Belief Source, $F(1, 340) = 32.47$, $p < .001$, $\eta^2_p = .09$, such that participants' personal beliefs ($M = 4.68$, $SD = 1.44$) were more stereotype-consistent than their thoughts about other people's beliefs ($M = 4.28$, $SD = 1.68$). The main effect of Target Gender was not significant, $F(1, 340) = 1.70$, $p = .19$, $\eta^2_p = .01$, however, the interaction was significant, $F(1, 340) = 4.90$, $p = .03$, $\eta^2_p = .01$. Specifically, participants reported that they themselves associate South Asian men (over White men) with science ($M = 4.69$, $SD = 1.49$) to a greater extent than most people do ($M = 4.18$, $SD = 1.79$; $p < .001$). In addition, participants reported that they themselves associate South Asian women (over White women) with science ($M = 4.67$, $SD = 1.39$) to a greater extent than most people do ($M = 4.38$, $SD = 1.57$; $p < .001$), however, this difference was less than the comparison between men. Hence, regardless of the gender of targets, South Asian individuals were associated with science to a greater extent than people who are White, ts > 1.82, $ps < .04$.

Gender-science stereotypes. Participants reported a significant difference in what they believed ($M = 4.60$, $SD = 1.33$) and what they felt most people believed ($M = 5.50$, $SD = 1.38$), $t(341) = -11.28$, $p < .001$, $d = 1.48$, such that participants believed most people associate science with men to a greater extent than they themselves do. However, one-sample t-tests confirmed that participants both personally associate ($M = 4.60$, $SD = 1.33$), $t(341) = 8.30$, $p < .001$, $d = 1.33$, and believe most people associate ($M = 5.50$, $SD = 1.38$), $t(341) = 20.10$, $p < .001$, $d = 1.38$, science more with men than with women.

To examine whether gender-science stereotypes differed based on race (i.e., South Asian men versus women; White men versus women), a 2 (Belief Source: Personal or Most People) x 2 (Target Race: South Asian or White) within-subjects ANOVA was run. There was a significant main effect of Belief Source, $F(1, 340) = 15.30$, $p < .001$, $\eta^2_p = .04$, such that participants reported that most people ($M = 4.75$, $SD = 1.55$) endorse stronger gender-science stereotypes than they themselves ($M = 4.48$, $SD = 1.51$) do. There was also a significant main effect of Target Race, $F(1, 340) = 41.52$, $p < .001$, $\eta^2_p = .11$, such that participants differed in their endorsement of gender-science stereotypes depending on whether they were asked about South Asian versus White men and women, with participants reporting a stronger gender-science association with White men over White women ($M = 4.88$, $SD = 1.46$) as opposed to South Asian men over South Asian women ($M = 4.36$, $SD = 1.60$). Lastly, the interaction was not significant, $F(1, 340) = .15$, $p = .70$, $\eta^2_p = .00$.

Science stereotypes at the intersection of race and gender. Finally, to examine whether participants' associations with science depended on the race and/or gender of the target, participants were asked how much they associate science specifically with South Asian men versus White women, and again specifically with White men versus South Asian women. One-sample *t* tests (comparing against 4) were run separately for each question. There was a significant difference in participants' association with science between South Asian men and White women, $t(132) = 5.47$, $p < .001$, $d = 1.44$, such that South Asian men were associated with science to a greater extent than White women were ($M = 4.68$, $SD = 1.44$). However, there was no significant difference in participants' association with science between White men and South Asian women ($M = 4.16$, $SD = 1.67$), $t(132) = 1.09$, $p = .14$, $d = 1.67$, suggesting again that the gender stereotypes South Asian women face may be reducing a positive racial association with science, see Figure 8.

Discussion

The goal of the current study was to use two new measures (the BIAT and the JBT) to further examine science stereotypes towards South Asian versus White men and women. As the BIAT is a shortened measure (compared to the IAT), it has been suggested that it has an improved scoring algorithm, thereby providing a more sensitive estimate of bias, as well as improved convergent validity through higher correlations with other implicit and explicit measures of bias (Nosek et al., 2014). In addition, the JBT was used to assess cognitive biases in a more indirect way than the previous use of vignettes. By presenting participants with numerous application profiles, I was able to examine judgements of these ambiguous stimuli to determine science biases. In addition, the JBT can be used to mimic real-world situations (such as science fellowship applications), making it an assessment tool that may provide ecological validity.

On the BIAT, participants were faster to associate science with White men over South Asian women, and this finding is in line with the results of Studies 1b and 2b, suggesting once again that South Asian women may not be benefitting from a positive racial stereotype associating them with science, at least on these implicit measures. In addition, these results provide some support for the category dominance theory, suggesting that participants may be categorizing South Asian women by their dominant gender stereotype, rather than their race, or a unique combination of gender and race. However, these effects appear to be specific to the South Asian women/White men condition, warranting further research into how specific comparison groups influence stereotype endorsement.

However, on the Judgement Bias Task, participants demonstrated a bias towards accepting South Asian applicants regardless of their qualification and were also more accurate in accepting qualified South Asian applicants, while being stricter in their criteria for accepting White applicants. This is in line with race-science stereotypes, providing support for the association between South Asian and science on this indirect measure. However, contrary to my hypotheses, participants were more lenient in accepting female (over male) applicants, suggesting a bias for accepting women, regardless of their qualifications. Aside from this lower criterion for female applicants, participants were equally good at distinguishing between men and women on the JBT. These results are contrary to gender-science stereotypes, suggesting instead the current sample had a positive bias favouring women and science. Considering that the majority (72%) of participants identified as female, and over a third (39%) of the sample majored in psychology (i.e., a scientific discipline), this result may have been influenced by participants' positive association, or identification with, science more generally.

Finally, in contrast to past findings associating White men with science, in the current study participants demonstrated the highest criterion scores towards White men only, suggesting participants were the strictest in evaluating White male applicants (as compared to White women, South Asian men, and South Asian women). Considering that White male targets have often been the dominant comparison group on comparable measures, it is possible that participants were aware of this association to some extent and were thereby more critical of White male applicants' criteria. Finally, on the explicit measure, we replicated previous studies as participants once again reported science stereotypes favoring South Asian individuals with science, and associating men with science.

General Discussion

The goal of this dissertation is to establish the presence and magnitude of science stereotypes towards men and women who are South Asian, while simultaneously examining how the intersectional aspect of South Asian identities may influence implicit and explicit race-science and gender-science stereotypes, and employment recommendations. Across each of the studies, there was evidence of both a race-science (South Asian > White) and a gender-science (men > women) stereotype. However, the current set of studies showed differences in the associations with science between South Asian men and South Asian women.

The positive stereotyping of South Asian men in science was generally robust. In both Studies 1 (a and b) and 2 (a and b), I found that South Asian men were associated with science to a greater extent than South Asian women, White men, and White women on our implicit measures. This was the case on the implicit measure when the comparison group was Not Science (Study 1a, Study 2a) or Friendly (Study 1b). In addition, when participants were asked to categorize Science and Funny on the IAT (Study 2b), which are two traditionally male-stereotyped domains (Storage et al., 2020), participants were again faster to pair science with South Asian men compared to South Asian women and White women; however in this study men were more associated with science, regardless of whether the men were South Asian or White, suggesting the possibility that by using an alternative category that is primarily associated with men (e.g., funny) may lessen the corresponding associations with science in comparison.

The current results provide a novel contribution to the existing body of research. South Asian men were associated with science to a greater extent than White men, suggesting the possibility that certain minority group members may be associated with STEM domains to a greater extent than previously thought, and above and beyond associations with the dominant outgroup (i.e., White men). In addition, these results are consistent with the Model Minority Stereotype, suggesting the possibility that South Asian men may also be viewed positively in academic domains such as science, in line with the Model Minority Stereotype. Alternatively, it seems possible that any association between South Asian and science is largely based on a South Asian male stereotype. The results are consistent with the possibility that South Asian men are benefitting from both a positive racial stereotype and a positive gender stereotype, associating them with science and scientific fields. In line with the compartmentalization model, it seems possible that both positive identities are being combined together, leading South Asian men specifically to benefit most from a positive association with science.

Importantly, the results also suggest that this positive association can have the potential to provide practical benefits, as South Asian men were more likely to be recommended for jobs, especially science jobs. This is a novel aspect to this research, and builds on the current body of literature, as past findings have focused on the positive associations between science and White (Lane et al., 2012; Nosek et al., 2002; Nosek & Smyth, 2011) or East Asian men (O'Brien et al., 2020; Trytten et al., 2012). Instead, the current findings suggest that South Asian men may experience racial stereotypes within STEM that are more positive, and potentially more beneficial, than those of White men. To examine whether this is the case within the workplace, further research is needed to examine in greater depth any potential benefits South Asian men may be experiencing from a positive association with science (e.g., increased rates of employment, higher pay). Additional research is needed to further compare these associations with science between South Asian versus East Asian men, as it is possible not only that these associations will differ, but that employment outcomes may differ as well.

By examining the intersectional aspect of South Asian identities, and in line with the compartmentalization model of stereotyping, the current set of studies found that South Asian women do not experience positive racial stereotypes comparable to South Asian men. Rather, South Asian women experience a unique combination of social categories, including a negative gender stereotype that diminishes any positive racial associations between South Asian women and science. Specifically, in the current body of research, when South Asian women were compared against men in general (i.e., to South Asian *or* White men) on either implicit or explicit measures, responses were often more consistent with negative gender stereotypes as opposed to positive racial stereotypes. However, these differences fluctuated based on the social context, with South Asian women being less associated with science when the comparison was friendly (Study 1b) or funny (Study 2b), but not when the comparison was Not Science (Study 1a, 2a). The only exception to this was on the BIAT (Study 3), although this may have been due to the nature of the BIAT, and participants being asked to sort one (as opposed to two on the regular IAT) categories at a time.

More specifically, when participants were asked to categorize South Asian women versus White men, the White men were most often associated with science. South Asian women were not associated with science (versus Not Science; Study 1a), even when the comparison was against a male-dominated domain (funny; Study 2b) that should have made it easier to pair the South Asian women with science and the White males with the comparison (i.e., funny). Moreover, when comparing against a female-stereotyped domain in a Science versus Friendly IAT (Study 1b), South Asian women were instead associated with friendly, in line with gender stereotypes (Storage et al., 2020). Finally, when asked to categorize only White male and South Asian female faces on the Brief-IAT (Study 3), White men were again associated with science more than South Asian women. The only exception to these findings was when recruitment was restricted to South Asian and White participants (Study 2a), as this was the only study in which science was associated more with South Asian women (than White men) on the implicit measure. Although there were some inconsistencies in the findings with South Asian women, it remains possible that South Asian women may be categorized predominantly by their gender when the comparison group is men. Additional research is needed to further test the dominance model of stereotyping within the context of STEM, particularly for racialized minority women, such as South Asian women.

However, when compared against White *women,* a group that also faces negative gender stereotypes in science, South Asian women were instead associated with science to a greater extent than White women, suggesting they did experience a positive racial association with science. This was the case consistently on the explicit measures, and occurred on the implicit measure when the comparison group was Not Science (Study 1a) or Friendly (Study 1b). Moreover, in line with the compartmentalization model, the current findings suggest that South Asian women face a unique set of intersectional identities, which create experiences within science fields that differ from those of South Asian men or White women. Specifically, when compared against South Asian men on explicit measures, South Asian women experienced a decrease in the gender-science stereotype, suggesting they instead experienced some positive racial benefits associated with the race-science stereotype. This was in direct contrast to White women, who, when compared against White men, experienced greater gender stereotyping. In addition, South Asian women experienced a positive racial association with science on our indirect measure, as South Asian applicants (i.e., men *and* women) were more likely to be recommended for science job fields than White candidates (Study 1a, 2a). However, in some cases, South Asian women were recommended for science fields *less* often than South Asian men (Study 2a).

Notably, I additionally found that socioeconomic status interacted with race and gender (Study 2b), such that applicants with a lower socioeconomic status were more likely to be recommended for non-science jobs, regardless of their race or gender. This suggests that perceptions of socioeconomic status may be an additional barrier for entering or persisting within STEM fields, regardless of race and/or gender. Past research examining the influence of multiple identities suggests that income level may be a strong aspect of one's identity, as individuals with multiple (i.e., race, gender, and low-income) marginalized identities were found to experience the strongest effects of stereotype threat on a mathematics test (Tine & Gotlieb, 2013). Future research should further examine the relationship between socioeconomic status and other aspects of one's identity, particularly for minority groups, who are already experiencing barriers to entering STEM fields, or additional barriers, adverse interactions, and negative outcomes within the workplace (Makarem & Wang, 2013; McKinnon & O'Connell, 2020; Williams et al., 2022). For example, future research can build upon the methods used by (Connor et al., 2023) who utilized full-body images on the IAT to assess how one's attire (as a proxy for socioeconomic status) influences categorization outcomes.

Moreover, by examining both personal endorsement and societal awareness of science stereotypes, this research aimed to compare how individual attitudes may differ from perceptions of overall trends in society. Across our explicit measures, we found that participants consistently associated people who are South Asian with science, and also reported the belief that *most people* do as well, suggesting both a personal endorsement of a "South Asian + science" association and a societal awareness of this overarching belief. In addition, this research was the first to directly compare the implicit and explicit stereotypes of South Asian versus White participants (Study 2a). The current findings suggest that, among South Asian participants, there appears to be an especially strong association between South Asian *men* and science, above and beyond the association with White men or South Asian women. In addition, on the Judgement Bias Task, an indirect measure used to examine science stereotypes (Study 3), participants were more likely to accept South Asian applicants regardless of their level of qualification. By contrast, participants demonstrated the highest criterion scores towards White male applicants, suggesting that participants were the strictest in evaluating White males. Building on past research associating White men with science (Lane et al., 2012; Nosek et al., 2002; Nosek & Smyth, 2011), these results may suggest that the “White male + science” association remains dominant in participants’ minds, potentially explaining why they evaluated White males more strictly than the other groups. However, additional research is needed to further examine how South Asian versus White men are evaluated across a series of science contexts (e.g., in different STEM subfields, across different types of application processes).

Despite the potential benefits accompanying the “South Asian + science” association, there is nevertheless the possibility that people who are South Asian may experience various forms of bias or discrimination in, or prior to entering, the workplace (Eaton et al., 2020; Kang et al., 2016; McGee, 2018; Ross et al., 2017; Stockard et al., 2021). This may be particularly the case for South Asian women, as some research has found differences in the experiences of South Asian men versus women in employment settings (Williams et al., 2022). In the current body of research, across multiple samples, there was consistent evidence for a positive association between South Asian and science on explicit measures. In addition, there was an explicit, positive association between South Asian and funny (Study 2b) whereby participants reported associating people who are South Asian with funny to a greater extent than most people do. It seems possible, then, that participants may have engaged in some degree of socially desirable responding on the explicit measures. Hence, despite the positive racial associations with science consistently found for South Asian targets, additional research is needed to examine the practical implications of these results, and whether this race-science stereotype provides any practical benefits, or mitigates any experiences of bias, in professional employment settings. For example, future research may use audit studies to compare the hiring rates for South Asian versus White men across various STEM positions. Alternatively, future research can compare the salaries of South Asian versus White men across comparable STEM occupations. If possible, future research should examine these differences across various social and cultural contexts, as it is possible that the stereotypes associated with each group within science domains may differ not only across nations, but across cities (e.g., rural versus metropolitan) as well.

Taken together, the current findings suggest that a positive stereotype associating South Asian men with science exists, and this appears to be endorsed both by the in-group (i.e., South Asian participants) as well as more broadly by the out-group (i.e., White, and racially diverse, participants). This is a novel aspect to this research that warrants further examination, particularly as it contradicts past research using White male targets, which suggested this group is consistently associated with science (Lane et al., 2012; Nosek et al., 2002; Nosek & Smyth, 2011). In addition, the current research builds on past findings examining East Asian targets (Cvencek et al., 2015; Padgett et al., 2020; Rattan et al., 2017; Shih et al., 1999), and suggests that South Asian targets, and South Asian men specifically, experience a comparable, positive stereotype in science domains. However, additional research is needed to further examine how South Asian targets compare directly against East Asian targets, and whether other ethnicities grouped under "Asian" experience similar positive associations with science, or whether any differences in associations emerge across the various ethnicities.

Overall, the current results suggest that the unique intersectional identity of each group plays a significant role in the experiences they have within STEM fields, such that South Asian women are perceived distinctively from either South Asian men or White women (two groups they have one common identity with), as well as from White men. These results suggest that the intersection of one's race and gender identities is unique to each race/gender combination, further highlighting the need to examine the experiences of specific minority groups (e.g., South Asian men and women) separately from their aggregated minority (i.e., "Asian") counterparts. Such research would assist in clarifying how the experiences of various minority group members differ not only from the majority outgroup, but also from other minority group members, thereby contributing to an increased theoretical understanding of intersectionality and its' impact on lived experiences. In addition, the current findings provide additional support for the compartmentalization model of intersectional stereotyping, highlighting the important role context may play in perceptions of stereotypes towards intersecting identities. Future research should also continue examining the unique experiences of racialized and marginalized women, including South Asian women within STEM, as each group may be experiencing a different set of stereotypes, barriers, and outcomes, particularly in contrast to minority men.

Limitations

Across each of the studies, participants were undergraduate students. Although there was age variability across all samples, it is likely that the majority of people in each sample had limited experience with professional workplace settings. As it is important to examine societal beliefs more broadly, across all ages and work experiences, future research should use a more diverse sample, both in age and in occupation. For example, research could compare the science stereotypes of young adults who chose not to pursue post-secondary education against those who did, as students who chose to pursue post-secondary studies may have increased exposure to STEM and individuals within science fields (including teachers and peers), potentially influencing their attitudes and beliefs (Simpkins et al., 2020; Starr & Simpkins, 2021).

In addition, as our sample consisted of undergraduate students, they likely had limited exposure to workplace settings, particularly to professional STEM environments. Although our findings suggest that there may be a positive bias associating South Asian individuals (South Asian men specifically) with science jobs, it is important to further examine this in the context of STEM professionals who are responsible for making hiring decisions and/or interacting with co-workers who are South Asian. Hence, future research should further examine the "South Asian + Science" association among working professionals currently employed within STEM fields, particularly those responsible for hiring decisions (such as managers or Human Resources representatives). This is particularly important as past research suggests that the workplace experiences of South Asian women, particularly those born outside of the North-American context, may differ significantly from American-born women (Adya, 2018; Tariq & Syed, 2017). Although some research suggests that South Asian women face heightened discrimination based on the intersection of their gender, race, and other (such as religious) identities (Tariq & Syed, 2017) other research found that South Asian women report experiencing less gender stereotyping than White women, and report fewer beliefs consistent with gender stereotypes (Adya, 2018). As research examining the intersectional identities of South Asian individuals has been more limited, further research is needed to parse apart differences in both the beliefs and lived experiences of women belonging to various racial groups currently working within STEM fields.

An additional limitation of this research was the use of the Implicit Association Test (or Brief-IAT; Study 3) to measure implicit stereotypes due to the ongoing debate surrounding the validity of the IAT. Critics have noted one limitation of the IAT is that it makes specific categories salient; as the IAT is a relative category-based measure, critics have argued it can make the stereotype-incongruent categories salient, thereby leading participants to become aware of their slower reaction times (Brownstein et al., 2019; Gawronski et al., 2022; Williams & Steele, 2019). It is worth noting though that in Studies 1 and 2, a novel variation of the IAT, specifically the ambiguous-categorization IAT (Lipman et al., 2021; Steele et al., 2018, Steele & Lipman, 2023) was used; and in Study 3 the BIAT (Sriram & Greenwald, 2009) was used.

By introducing additional stimuli at the end of the IAT, the AC-IAT attempts to address the question of whether categorization – by race, gender, or both - is driving the effects. Surprisingly, in this study, the final trials did not provide much insight, as people who appeared to be primarily attending to race by the end of the task showed no difference in bias from those who were attending primarily to gender. Although speculative, this result hints at the possibility that these results reflected associations with intersecting identities (e.g., South Asian women; White men) as opposed to the dominance of gender (women versus men) or race (White versus South Asian).

In addition, despite the critiques of this measures, there is also research to suggest that the Implicit Association Test is a suitable measure of implicit attitudes, particularly as it captures associations individuals may not have conscious awareness of. Proponents of the IAT suggest that it can provide important insights into various automatically activated associations towards specific social categories, and that it may be useful for capturing associations participants may not be willing to express openly, thereby making it an objective measurement tool to study bias (Greenwald et al., 1998; Nosek et al., 2005).

Critics have noted additional limitations of the IAT, including whether it measures implicit bias as suggested and whether it can adequately predict behaviour for real-world interventions (Brownstein et al., 2019; Gawronski et al., 2022). There is some, albeit mixed, evidence to suggest that implicit measures, such as the IAT, can adequately assess implicit bias in society (e.g., the bias of crowds model; Payne et al., 2017) and has been correlated with explicit measures to various degrees, providing evidence that the IAT *can* be used to predict behaviours (e.g., Brownstein et al., 2019; Greenwald et al., 2009; Hofmann et al., 2005). Finally, in line with open science practices, all studies were pre-registered prior to data collection, and all IAT data was handled according to recommended best practices (e.g., Greenwald et al., 2003). Moreover, to gain a more comprehensive understanding of science stereotypes and to mitigate any concerns surrounding the practicality of the IAT, the current research made additional use of indirect and explicit measures in conjunction with the IAT. Across multiple studies, there was consistent evidence of science stereotypes favoring people who are South Asian, and South Asian men specifically. Nevertheless, future research should use a variety of implicit and indirect measures, with different samples, to further understand unconscious beliefs and behaviours related to science and STEM fields.

Conclusions

The current set of studies are the first to specifically examine both South Asian targets and South Asian participants. The current findings provide novel insight into science stereotypes, specifically by examining how race-science and gender-science stereotypes may be differentially attended to, depending on the race and/or gender of the targets being presented. These results suggest that the "White male + science" association may be outdated or may not be as prominent as once thought under certain conditions, such as when White men are compared against South Asian men. In addition, this research emphasizes the importance of examining the multiple aspects of one's identity, as the unique combination of each identity may influence access to, and sense of belonging within, STEM fields, as well as important employment recommendations, such as hiring decisions.

An additional important aspect of this research, that builds on the current literature, was the novel use of South Asian targets. Specifically, by examining stereotypes towards a minority group that has been largely overlooked in the literature, the current research not only established the presence of new and important science stereotypes, but also highlights the importance of diversifying the race/ethnicity of both the targets and the participants being used in research studies. To have a more comprehensive understanding of societal stereotypes and individual experiences with STEM, it is important to examine the diverse ethnicities pursuing STEM fields, as well as those more broadly present within society, which may be facing unexamined barriers to entering STEM fields.

Finally, the current results suggest that examining people's intersectional identities may be of great importance in understanding current hiring practices and employment recommendations. As minority group members have been found to face additional barriers and stereotypes within academia and the workplace (Makarem & Wang, 2013; McKinnon & O'Connell, 2020; Williams et al., 2022), it is important to examine the practical implications of science stereotypes, and their contribution to employment recommendations for different group members, as this has numerous implications for socioeconomic status and quality of life outcomes in our increasingly diverse society.

Overall, the current research provides a novel, important contribution to our current understanding of stereotypes towards “Asians” in STEM, as well as towards minority groups pursuing science fields more broadly. By incorporating these findings into the current body of knowledge, these results have the potential to make an important contribution towards our theoretical understanding of intersectional identities, and guiding future research to further examine under-studied populations across a variety of science contexts.

In addition, by integrating the current findings with our current understanding of STEM trends, the current research has the potential for significant knowledge mobilization opportunities. Sharing these novel findings with academic institutions may inspire additional theoretical and practical research into how science stereotypes are not only applied to various minority group members (e.g., men versus women), but also how they contribute to any differences in tangible outcomes, such as within employment (e.g., hiring) or academic (e.g., graduate school acceptance) settings. Moreover, the current research findings may be shared with schools, government organizations, and businesses, such that, when combined with other statistics and research, may contribute to a deeper understanding of current trends, and how they contribute to the lived experiences of various ethnic group members. Combining these findings with other research towards “Asian” stereotypes may also assist in new trends and policy developments becoming more inclusive, and more tailored towards the unique experiences of minority men and women. Finally, by increasing public awareness surrounding the role of race and gender biases in academic and employment recommendations, the current (and future) research can continue to contribute to the reduction of science stereotypes, increasing the representation of minority groups within STEM fields.

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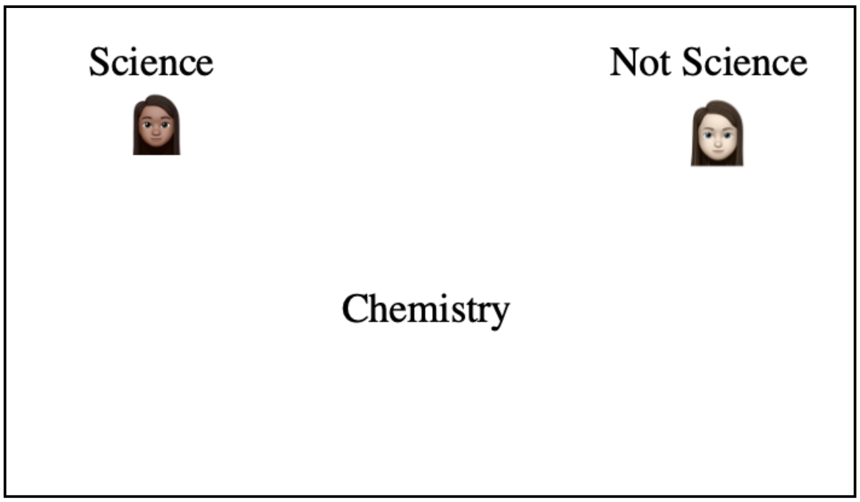
Appendix A: Emoji Stimuli Created for the IAT

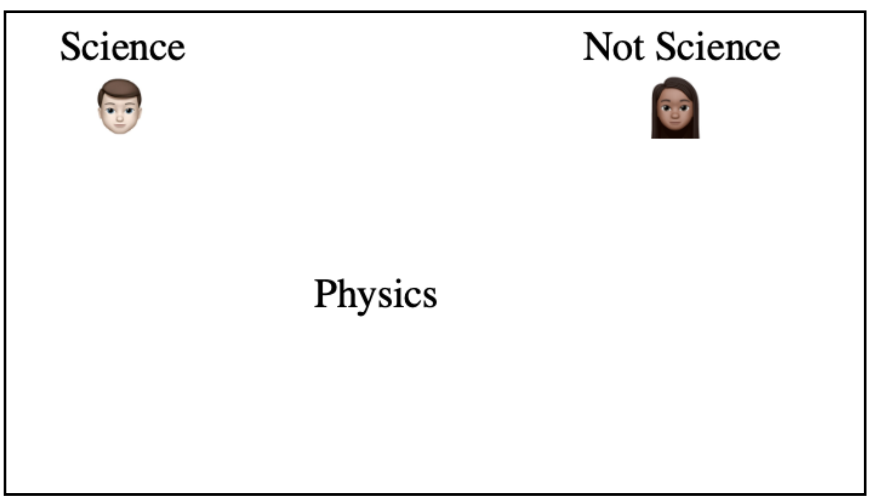
South Asian female header, South Asian male header, White female header, White male header

Appendix B: Example Conditions for the IAT

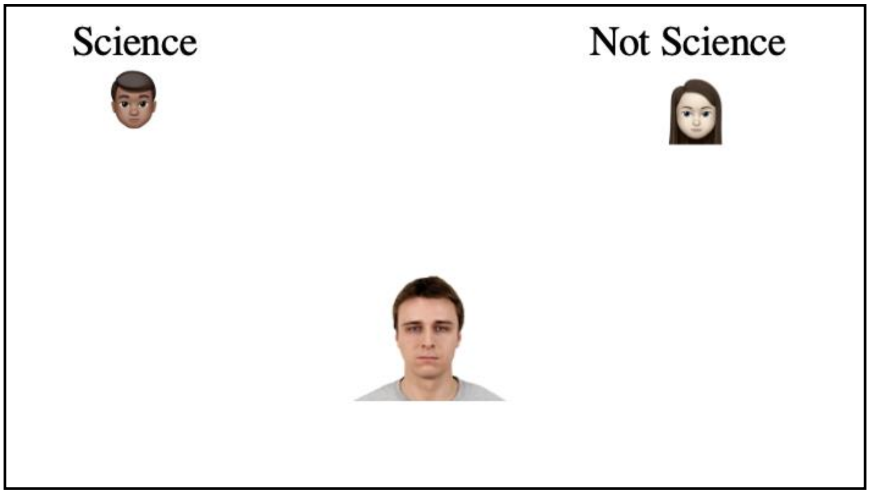
Example IAT for the South Asian women/White women condition:



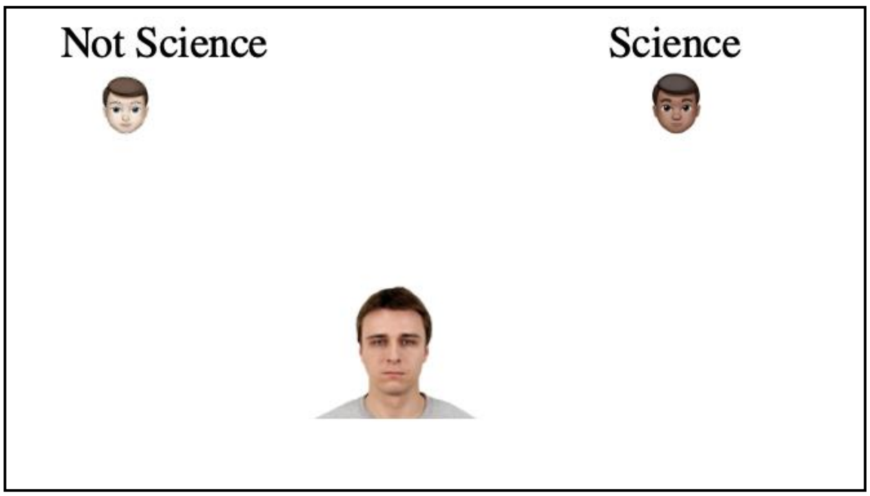
Example IAT for the South Asian women/White men condition:



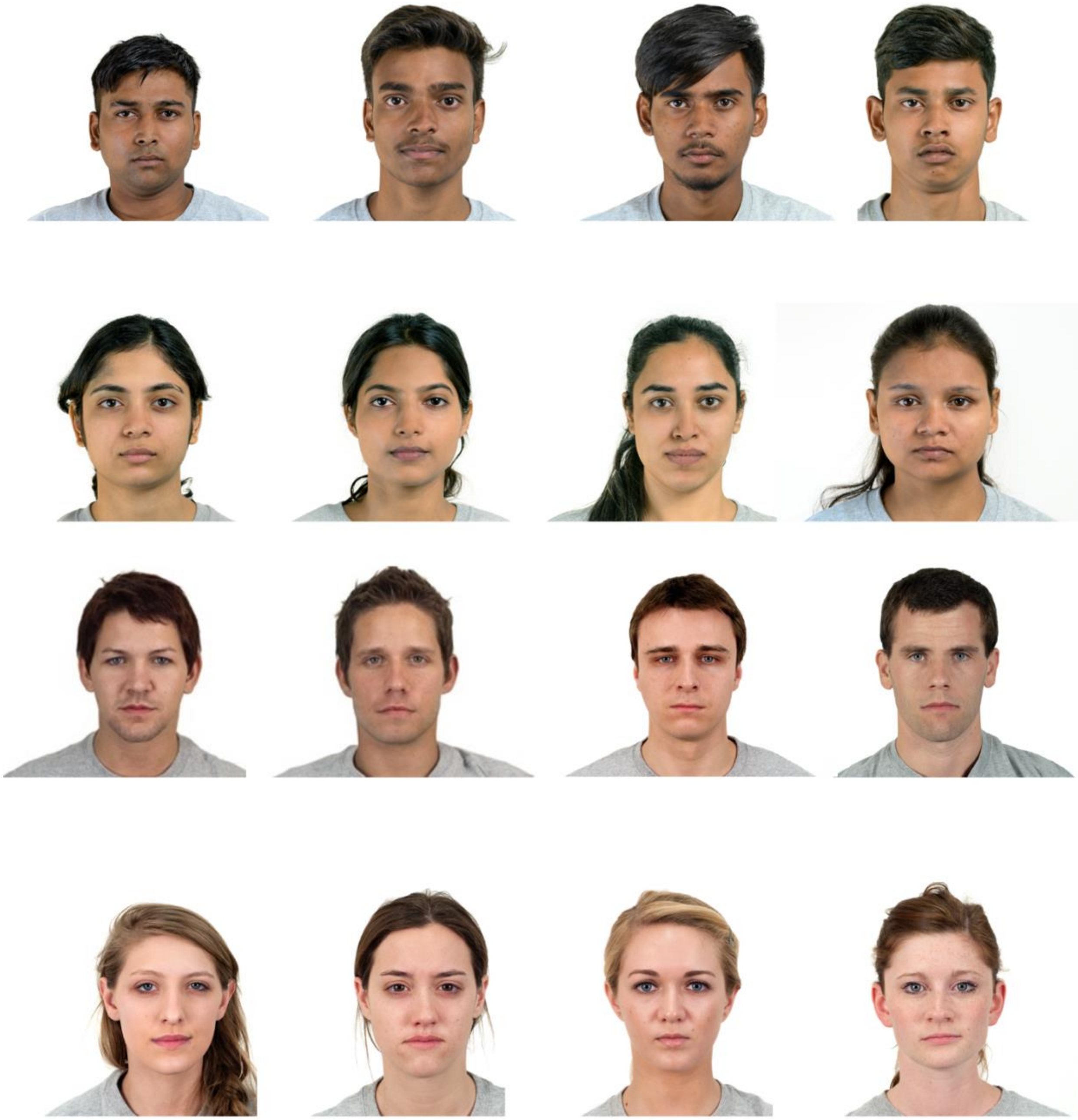
Example IAT for the South Asian men/White women condition:



Example IAT for the South Asian men/White men condition:



Appendix C: Target Faces Used on the IAT



Left to right, the code for each image in the Chicago Face database is as follows:
South Asian men: CFD-IM-725-142-N, CFD-IM-715-013-N, CFD-IM-716-316-N, CFD-IM-698-011-N
South Asian women: CFD-IF-642-295-N, CFD-IF-631-363-N, CFD-IF-626-375-N, CFD-IF-693-172-N
White men: CFD-WM-006-002-N, CFD-WM-004,010-N, CFD-WM-245-123-N, CFD-WM-203-023-N
White women: CFD-WF-212-050-N, CFD-WF-230-158-N, CFD-WF-233-112-N, CFD-WF-234-086-N

Appendix D: Additional Measures for Study 1a

Science Attitudes. Personal attitudes towards science were measured using three questions, using a 7-point Likert scale. Participants were asked to "rate their attitude towards science" (1= Strongly Dislike, 7= Strongly Like; reverse-scored) and to indicate how much they agree with the following statements: "I am good at science compared to other people" and "science has always come pretty easy to me" (1= Strongly Agree, 7= Strongly Disagree).

STEM Interest. To assess explicit interest in STEM fields generally, participants were asked two separate two-part questions. Participants were first asked to indicate (yes or no) whether they are currently pursuing a degree within a STEM field. For those participants who answered yes, they were skipped to the following question. For those who answered no, they were asked to select, from a series of options, reasons why they chose not to pursue a degree within a STEM field. Participants were also given the option to type in their own response. Secondly, participants were asked to indicate (yes or no) if they wish they *had* pursued a degree within a STEM field. Those who answered no were skipped to the demographics, while those who answered yes were asked to indicate, from a series of options, reasons why they wish they had pursued STEM. Participants were again given the option of typing in their own response if the pre-selected reasons were insufficient. All response options are also listed on the OSF.

Demographics. Participants were asked to indicate their age, gender, race, major and year of study, and to indicate how many years they have lived in Canada. Participants were also asked to select, from a series of options, their race/ethnicity as well as their family's cultural heritage. Participants were asked if they consider themselves to be South Asian through ancestry, ethnicity, or other affiliation. As a manipulation check, participants were asked to describe what they believed the study was about, what they believed the experimenter expected to happen, and if they used any strategies throughout the study (i.e., to categorize the faces and words). Participants were specifically asked to describe any strategies they used, whether their strategies differed throughout the duration of the study, and whether they specifically chose to categorize the faces (i.e., for the IAT) by race, gender, or both race and gender. Lastly, participants were asked to describe any concerns they had regarding the study, and asked to provide post-consent debriefing, allowing us to use their data for analysis.

Appendix E: Study 1a Additional Analyses

Personal science attitudes. The three questions were averaged to create an overall personal science attitudes score (with higher scores = more negative attitudes). A one-sample *t* test (comparing against 4, the mid-point) confirmed that this sample of participants had attitudes that were significantly more favorable towards science, ($M = 3.75$, $SD = 1.39$), $t(389) = -3.58$, $p < .001$, $d = 1.39$.

Overall science attitudes and experiences. For participants who indicated they were not pursuing a STEM degree ($n = 236$), I examined their selected reason(s) for not pursuing a STEM field. The majority of participants ($n = 98$) indicated they did not enjoy STEM courses, or that they were concerned about their ability to perform in STEM courses ($n = 76$). Participants also indicated they enjoyed STEM but preferred non-STEM courses ($n = 48$), or that they were not accepted to a STEM program ($n = 21$). Some reported that they were concerned about their ability to fit in in STEM ($n = 15$) or were discouraged from pursuing STEM fields ($n = 14$). Although descriptive, these preliminary results suggest that some participants were aware of potential stereotypes surrounding science (i.e., ability to perform and/or fit in) prior to choosing their post-secondary major, and this may have directly or indirectly influenced their decision.

Furthermore, 164 participants indicated they wished they had pursued a STEM field (instead of a degree within a non-STEM field) due to potential career opportunities ($n = 116$), potential salary opportunities ($n = 90$), and new interest in STEM ($n = 61$). Participants also indicated increased knowledge of STEM through exposure to other individuals ($n = 51$), the media ($n = 47$), STEM courses ($n = 36$) and to individuals within STEM ($n = 28$). These descriptive results suggest that, with increased exposure to STEM, participants may develop greater interest in these fields, potentially reducing their stereotypes surrounding science.

Appendix F: Color Correction for South Asian Female Faces

Note: These are the South Asian female faces, as taken from the Chicago Face Database, used in Study 1a.

Note: These are the South Asian female faces, which were color corrected to be in line with the South Asian male faces as well as the emoji header, used in the implicit measures for Studies 1b – 3.

Appendix G: Study 1b Additional Friendly Analyses

I examined how much participants believe *most people* associate each group (i.e., White men, White women, South Asian men, South Asian women) averaged across a series of friendly terms used in the IAT (i.e., friendly, very friendly, kind, outgoing, agreeable) using a 2 (Race: South Asian or White) x 2 (Gender: Male or Female) within-subjects ANOVA. There was a significant main effect of Gender, $F(1, 359) = 129.97$, $p < .001$, $\eta^2_p = .27$, such that participants believed *most people* associate women ($M = 4.59$, $SD = 1.15$) with friendly to a greater extent than men ($M = 4.06$, $SD = 1.19$). In addition, there was a significant main effect of Race, $F(1, 359) = 19.93$, $p < .001$, $\eta^2_p = .05$, such that participants believed *most people* associate people who are White ($M = 4.46$, $SD = 1.21$) with friendly to a greater extent than people who are South Asian ($M = 4.19$, $SD = 1.12$). However, the interaction between race and gender was not significant, $F(1, 359) = .02$, $p = .90$, $\eta^2_p = .00$. Overall, these results suggest a consistent gender stereotype that women, regardless of race, are more associated with friendly. However, the evidence for a racial stereotype was more mixed.

Appendix H: Study 1b Additional Analyses

A series of questions asked participants to rate South Asian men, South Asian women, White men and White women across five terms related to being funny (funny, very funny, entertaining, hilarious, witty) as pilot data for study 2b. As the concept of funny is stereotyped as being traditionally more masculine, I anticipated that men would be rated as being funnier than women, but also tested whether any racial differences would emerge in associations with funny.

The five questions were averaged to create a composite score for each group, and a 2 (Race: South Asian or White) x 2 (Gender: Male or Female) within-subjects ANOVA was run. The main effect of Race, $F(1, 360) = 18.10$, $p < .001$, $\eta^2_p = .05$, and the main effect of Gender, $F(1, 360) = 68.05$, $p < .001$, $\eta^2_p = .16$ were both significant, but were qualified by a significant interaction effect, $F(1, 360) = 5.89$, $p = .02$, $\eta^2_p = .02$. White men ($M = 4.31$, $SD = 1.29$) were rated as being more funny than South Asian men ($M = 3.96$, $SD = 1.23$; $p < .001$). White women ($M = 3.86$, $SD = 1.25$) were rated as being more funny than South Asian women ($M = 3.66$, $SD = 1.25$; $p = .01$), however, this difference was less than the difference between men.

To further examine the differences in associations between funny and each group, a series of one-sample *t* tests were run on the composite scores. White men were associated with funny ($M = 4.31$, $SD = 1.29$), $t(360) = 4.50$, $p < .001$, $d = 1.29$. South Asian men, however, were not significantly associated with being funny, ($M = 3.96$, $SD = 1.23$), $t(360) = -.70$, $p = .24$, $d = 1.23$. Women were not significantly associated with being funny. Rather, White women were significantly associated with being less funny, ($M = 3.86$, $SD = 1.25$), $t(360) = -2.11$, $p = .02$, $d = 1.25$, while South Asian women, ($M = 3.66$, $SD = 1.25$), were rated as being the least funny, $t(360) = -5.14$, $p < .001$, $d = 1.25$. Hence, only White men were rated as being funny, whereas South Asian funny were viewed neutrally. Women, regardless of race, were rated as not funny.

Appendix I: Study 2a Vignettes

Vignette Version 1:

You meet with a male (female) client who was born and raised in Canada, and whose family is originally from England (India). Based on his (her) file, (s)he has moderate reading and writing skills, good problem-solving abilities, and is able to work both independently and in a team setting.

Vignette Version 2:

You meet with a male (female) client who was born and raised in Canada, but whose family is originally from Pakistan (United Kingdom). Based on his file, he has good communication skills, has experience working in a team setting, and is adaptable and self-motivated.

Vignette Version 3:

You meet with a male (female) client who was born and raised in Canada, and whose family is originally from Ireland (Bangladesh). Based on his file, he has various volunteer experience, with good time management skills, and is punctual and flexible.

Vignette Version 4:

You meet with a male (female) client who was born and raised in Canada, and whose family is originally from the Netherlands (Sri Lanka). Based on his file, he speaks more than one language, has several different hobbies, and has good conflict management skills.

Note: Vignettes 3 and 4 were intended to provide a description based on soft skills and miscellaneous experience that is not directly relevant to any position. By not providing any “job skills” the intention is to see if people’s biases are stronger, or more activated, by the race and gender of the applicant.

Appendix J: Additional Measures in Study 2a Pilot Testing for Study 2b

To provide some pilot testing for Study 2b, participants were randomly presented with four (out of eight) different science jobs and asked to indicate how prestigious (1=very prestigious, 7= not very prestigious) and how respected of a field (1= very respected, 7= not very respected) each job is. They were additionally asked to indicate what they believed the average salary for each job to be ($0 through to over $100,000) and to indicate if they associated each job more with South Asian or White individuals. Based on online articles (Hoff, 2022; Indeed Editorial Team, 2021; Smith & Cortes, 2022), I selected four higher-paying (i.e., computer scientist, research scientist, microbiologist, and space scientist) and four lower-paying (i.e., health technician, science teacher, food scientist, and environmental scientist) science jobs. Participants were randomly presented with two high-paying and two low-paying positions. I anticipated that the high-paying jobs would be rated as being more prestigious and respected, that participants would report a higher average salary for these positions, and that they would be more associated with South Asian individuals. Results are provided in Appendix I.

Appendix K: Additional Explicit Analyses for Study 2a

To examine whether race-science stereotypes were moderated by the gender of the targets (e.g., White men versus South Asian men; White women versus South Asian women) a 2 (Participant Race: South Asian or White) x 2 (Belief Source: Self or Other) x 2 (Target Gender: Men or Women) mixed ANOVA was run. There was a significant main effect of Participant Race, $F(1, 654) = 19.51$, $p < .001$, $\eta^2_p = .03$, a significant main effect of Belief Source, $F(1, 654) = 89.03$, $p < .001$, $\eta^2_p = .12$, and a significant Participant Race by Belief Source interaction, $F(1, 654) = 89.03$, $p < .001$, $\eta^2_p = .12$. Specifically, South Asian participants' personal beliefs ($M = 5.11$, $SD = 1.45$) were more stereotype-consistent than their thoughts about other people's beliefs ($M = 4.42$, $SD = 1.67$; $p < .001$), and this difference in beliefs was to a greater extent than that expressed by White participants, despite White participants' personal beliefs ($M = 4.51$, $SD = 1.19$) also being more stereotype-consistent than their thoughts about other people's beliefs ($M = 4.24$, $SD = 1.49$; $p < .001$). All other main effects and interactions were not significant, F's < 1.47, p's > .22.

Appendix L: Study 2a Additional Analyses

Personal science attitudes. In line with Study 1a, the same three questions asked participants about their science attitudes and were averaged to create an overall science attitudes score (with higher scores = more negative science attitudes). A one-sample *t* test (against 4, the mid-point) confirmed that participants had attitudes that were significantly different from the midpoint, (M = 3.48, SD = 1.40), $t(665) = -9.57$, $p < .001$, $d = 1.40$, suggesting the participants in the current sample also had more favorable attitudes towards science.[23]

Exploratory questions about science fields and prestige status. In an exploratory manner, participants were asked to evaluate two (out of four) science fields that are typically of lower-pay (science teacher, food scientist, environmental scientist, health technician) and two (out of four) science fields that typically have higher pay (space scientist, microbiologist, research scientist, computer scientist). Specifically, participants were asked to rate how prestigious (1 = not very prestigious, 5 = extremely prestigious) and how respected (1 = not very respected, 5 = extremely respected) the field is, what they think the average salary is for someone in this field ($0 - $200,000), and to indicate how much they associate the field with people who are of South Asian versus European (i.e., White) descent (1 = strongly European descent, 7 = Strongly South Asian descent). As Study 2a data collection had not finished prior to the start of data collection for Study 2b, these questions were used as pilot data, and a partial sample was analyzed for Study 2b.[24] The full results are analyzed below.

Of the lower-paying science fields, the health technician was rated as somewhat prestigious (M = 3.33, SD = 1.05), somewhat respected (M = 3.46, SD = 1.02), was not

[23] Personal science attitudes were also analyzed separately for White versus South Asian participants, but the results were comparable, hence, they were collapsed by participant race.
[24] Based on the data from an initial, smaller sample of participants who had completed Study 2a, the fields of food scientist, space scientist, microbiologist, and computer scientist were chosen.

associated primarily with any race (*M* = 3.96, *SD* = 1.09), and with an average salary of $86, 268 (*SD* = 31, 807). An environmental scientist was ranked as somewhat prestigious (*M* = 3.09, *SD* = .95), somewhat respected (*M* = 3.18, *SD* = .94), was associated slightly with European descent (*M* = 3.33, *SD* = 1.09), and with an average salary of $81, 770 (*SD* = 27, 399). Food scientists were ranked as somewhat prestigious (*M* = 2.68, *SD* = .99), somewhat respected (*M* = 2.70, *SD* = .97), was not associated with either race (*M* = 3.96, *SD* = 1.09), and with an average salary of $74, 900 (*SD* = 25, 048). Lastly, a science teacher was rated as somewhat prestigious (*M* = 2.57, *SD* = 1.01), somewhat respected (*M* = 2.92, *SD* = .97), was slightly associated with European descent (*M* = 3.34, *SD* = 1.21), and with an average salary of $72, 990 (*SD* = 26, 107).

Of the higher-paying science fields, a space scientist was rated as very prestigious (*M* = 4.08, *SD* = .78), very respected (*M* = 4.05, *SD* = .78), was not associated with either race (*M* = 3.80, *SD* = 1.41), and with an average salary of $104, 556 (*SD* = 35, 994). A computer scientist was rated as very prestigious (*M* = 3.73, *SD* = .87), very respected (*M* = 3.82, *SD* = .80), was associated slightly with South Asian descent (*M* = 5.15, *SD* = 1.26), with an average salary of $102, 586 (*SD* = 34, 124). A microbiologist was rated as very prestigious (*M* = 3.73, *SD* = .89), very respected (*M* = 3.76, *SD* = .84), was not associated with either race (*M* = 3.89, *SD* = 1.24), with an average salary of $94, 963 (*SD* = 35, 252). Lastly, a research scientist was rated as very prestigious (*M* = 3.71, *SD* = .83), very respected (*M* = 3.78, *SD* = .84), was not associated with either race (*M* = 3.92, *SD* = 1.19), with an average salary of $90, 929 (*SD* = 30, 584).

Appendix M: Study 2b Additional Funny Analyses

I examined how much participants believe *most people* associate each group (i.e., White men, White women, South Asian men, South Asian women) averaged across a series of funny terms (i.e., funny, very funny, witty, hilarious, entertaining) using a 2 (Race: South Asian or White) x 2 (Gender: Male or Female) within-subjects ANOVA. Once again, there was a significant main effect of Race, $F(1, 364) = 41.62$, $p < .001$, $\eta^2_p = .10$, and a significant main effect of Gender, $F(1, 364) = 190.78$, $p < .001$, $\eta^2_p = .34$. This was qualified by a significant interaction between race and gender, $F(1, 364) = 30.48$, $p < .001$, $\eta^2_p = .08$.

Once again, simple main effects analyses revealed that White men were associated with funny terms ($M = 4.76$, $SD = 1.46$) more than South Asian men ($M = 4.76$, $SD = 1.29$; $p < .001$), while White women ($M = 3.63$, $SD = 1.34$) were associated with funny terms more than South Asian women ($M = 4.32$, $SD = 1.35$; $p < .001$). However, the differences in ratings for funny terms was greater between men, than between women, suggesting that White men are perceived as being a lot more funny than South Asian men (and women in general), whereas although women are perceived as not being funny, South Asian women are rated as being less funny than White women are.

Appendix N: Sample JBT profiles (Study 3)

Example high qualification profiles:

Science GPA:	3.7
Overall GPA:	3.6
Recommendation Letters:	Excellent
Research Proposal Score:	67.5

Science GPA:	3.9
Overall GPA:	3.8
Recommendation Letters:	Good
Research Proposal Score:	82.5

Science GPA:	3.2
Overall GPA:	3.9
Recommendation Letters:	Excellent
Research Proposal Score:	72.5

Science GPA:	3.3
Overall GPA:	3.2
Recommendation Letters:	Excellent
Research Proposal Score:	87.5

Example low qualification profiles:

Science GPA:	3.3
Overall GPA:	3.2
Recommendation Letters:	Good
Research Proposal Score:	87.5

Science GPA:	3.1
Overall GPA:	3.5
Recommendation Letters:	Excellent
Research Proposal Score:	60

Science GPA:	3.0
Overall GPA:	3.1
Recommendation Letters:	Excellent
Research Proposal Score:	72.5

Science GPA:	3.6
Overall GPA:	3.5
Recommendation Letters:	Good
Research Proposal Score:	72.5

Appendix O: Hit Rates and False Alarm Rates for the JBT

Hit Rates. To further examine whether any bias in response criterion emerged, I tested whether there were any differences in the hit rate (i.e., correctly accepting more qualified applicants) between each group using a 2 (Race: South Asian or White) x 2 (Gender: Male or Female) within-subjects ANOVA. There was a significant main effect of Race, $F(1, 330) = 8.29$, $p = .004$, $\eta^2_p = .03$, such that the hit rate was significantly higher for South Asian applicants ($M = 70.23\%$, $SD = .15$) than for White applicants ($M = 67.66\%$, $SD = .16$). However, the main effect of Gender, $F(1, 330) = 2.10$, $p = .15$, $\eta^2_p = .01$, as well as the interaction effect, $F(1, 330) = .001$, $p = .98$, $\eta^2_p = .00$, were both not significant, suggesting that participants were best at correctly accepting South Asian applicants with high qualifications.

False Alarm Rates. To further examine whether bias in sensitivity scores emerged, I examined the false alarm rates (i.e., incorrectly accepting less qualified applicants). Specifically, I examined whether the false alarm rate differed across groups in a 2 (Race: South Asian or White) x 2 (Gender: Male or Female) within-subjects ANOVA. The main effect of Race, $F(1, 330) = .69$, $p = .41$, $\eta^2_p < .01$, the main effect of Gender, $F(1, 330) = 2.65$, $p = .10$, $\eta^2_p = .01$, and the interaction effect, $F(1, 330) = .97$, $p = .33$, $\eta^2_p < .01$, were all not significant, suggesting that participants were able to identify the low qualification profiles accurately across both race and gender.