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Expressing the self or achieving security through academic choices: Implications for gender gaps in STEM pursuit

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Abstract

Gender gaps in representation in Science, Technology, Engineering and Mathematics (STEM) fields persist across many societies, although the size of the gap varies. Based on cultural psychological perspectives, we consider how the culturally ascribed meaning and purpose of academic choice (i.e., as a means of expressing the self or securing one's future) can inform students' STEM interest and motivation as a function of their gender. We argue that a self-expressive construction of academic choice may lead men and women to diverge in their academic choices, since their preferences have been gendered throughout their lives. Specifically, a focus on expressing the self can push women away from STEM, and men toward it, given that it is considered a masculine domain. On the other hand, a security-oriented construction of academic choice may lead men and women to show similar levels of motivation to pursue STEM due to its potential lucrativeness. In two experimental studies, we examined whether temporary activation of goals related to self-expression or future security affect STEM interest and motivation as a function of gender among American students. Study 1 documented that the activation of a self-expressive construction of academic choice led to lower STEM interest and motivation among women compared to a control condition. Activation of security goals led to greater STEM interest and motivation among men only. Study 2 partially replicated this pattern for STEM and Business fields using a regulatory focus manipulation. The studies provide initial evidence for the role of culturally shaped understandings of academic choice in gender gaps in academic motivation. We end with a discussion on the sociocultural shaping of academic choice among both women and men.

Keywords Academic choice · Cultural psychology · Gender differences · Motivation · STEM

The work reported in this paper is based on the first author's doctoral dissertation.

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1 Introduction

Women's underrepresentation in STEM fields reflects a form of social inequality, since social barriers often push women away from these high-status and lucrative fields (Charles, 2011a, b; Cheryan et al., 2009; Freeman, 2004; Hill et al., 2010). Gender discrepancies in STEM participation reproduce gender stratification through pay and status gaps (Charles, 2011a, b; Correll 2004; Croft et al., 2015; Riegle-Crumb, 2005; Wood & Eagly, 2012). Research in social psychology on gender gaps in STEM has focused primarily on the social barriers that push women away from STEM fields by harming their performance and identification. For instance, stereotypes that represent STEM as a domain that requires stereotypically masculine traits and innate forms of "brilliance" commonly associated with males (Carli et al., 2016; Leslie et al., 2015; Nosek et al., 2009) can harm girls' and women's beliefs about competence and efficacy (e.g., Else-Quest et al., 2013; MacPhee et al., 2013; Pajares, 2005; Sikora & Pokropek, 2012), as well as their aspirations and interest (Correll, 2001, 2004). Gendered representations of STEM fields are also likely to be incompatible with career and life goals that women often develop through gender socialization (e.g., Diekman et al., 2010, 2011). Women who develop an interest in STEM despite stereotypes are likely to face situational threats in STEM settings, which can harm their sense of belonging, motivation, and test performance (Cheryan, 2012; Cheryan et al., 2009, 2011; Cheryan & Plaut, 2010; Flore & Wicherts, 2015; Murphy et al., 2007; Nguyen & Ryan, 2008; Steele, 1997; Stoet & Geary, 2012; Walton & Spencer, 2009).

One implication of the rich literature on the social barriers against women's STEM participation is that the gender gap in STEM should be smaller in settings where these barriers are less formidable. Therefore, one might expect the gender gap to be smaller in more gender egalitarian settings, where women face fewer social constraints, and have greater freedom in making academic choices. On the other hand, the gender gap may be larger in less gender egalitarian settings that constrain women's academic options to gender-appropriate fields. However, research provides no support for this pattern. Indeed, some evidence suggests that gender gaps in STEM interest and participation are larger in more economically developed and gender egalitarian nations (Charles, 2011a, b; Charles & Bradley 2009; Charles et al., 2014; Sikora & Pokropek, 2012; Stoet & Geary, 2018). Researchers sometimes refer to these patterns as a paradox (Stoet & Geary, 2018).

As a potential resolution to this paradox, we have proposed a cultural-psychological model of gender gaps in STEM participation (Soylu Yalcinkaya & Adams, 2020) that draws upon theory and research on acts of choice (Kim & Sherman, 2007; Markus & Kitayama, 2003; Savani et al., 2008). This model suggests that sociocultural variation in the construction of academic choice—specifically, as a means of self-expression or investment in future security—would have implications for intentions to pursue STEM that differ as a function of gender (Soylu Yalcinkaya & Adams, 2020). To test this conceptual model, we set out to experimentally activate different constructions of academic choice, and examine their consequences for STEM interest and motivation among American participants.

1.1 A cultural psychological perspective on academic choice

Cultural psychological perspectives (e.g., Adams & Markus 2004; Markus & Hamedani, 2007; Markus & Kitayama, 2010) suggest that engagement with psychological affordances in particular cultural ecologies (e.g., values and beliefs, cultural products, practices, and institutions) shapes habitual tendencies of self and agency. Cultural settings also differ in terms of how they construct individual choice and define normative choices, in parallel with their construction of agency (e.g., Markus & Schwartz 2010; Savani et al., 2008).

1.1.1 Cultural construction of choice

Individualistic and post-materialistic values such as self-expression (e.g., Inglehart & Welzel 2005; Welzel & Inglehart, 2010) inform normative models of choice in "WEIRD" (i.e., Western, Educated, Industrial, Rich, and Democratic; see Henrich et al., 2010) settings that disproportionately constitute hegemonic psychological science. These cultural settings construct the self as an independent source of action (Markus & Kitayama, 1991), and afford an experience of agency as the exertion of will from this independent actor, free from external forces (Markus & Kitayama, 2003; Savani et al., 2008). In these settings, choice is a means for the independent agent to express authentic, personal preferences (e.g., Riemer et al., 2014; Stephens et al., 2011). The contrast here is with the security-oriented values that inform normative models of choice in "Majority World" (Kagitcibasi, 2005, 2007) settings that constitute the larger portion of the world population (e.g., Inglehart & Welzel 2005; Welzel & Inglehart, 2010). These cultural patterns foster an interdependent sense of self and an understanding of agency as the joint product of actor and social context (Markus & Kitayama, 2003; Savani et al., 2008). People tend to understand choice as a means to achieve certain expectations and duties or obligations within a relational network. In these settings, choice does not acquire a special role in representing unique preferences. Indeed, norms and obligations may merge into personal preferences, blurring the boundary between them (Riemer et al., 2014).

We draw upon the literature on the cultural psychology of choice to examine the meaning and purpose that different cultures ascribe to academic choice. The modern individualist lifeways prevalent in WEIRD settings afford both gender egalitarian ideologies and a *self-expressive* construction of academic choice as a means to pursue dreams and passions that reflect one's authentic self. The prominence of this self-expressive construction leads students to prioritize expression and affirmation of authentic, self-defining preferences through their academic choices. The realities of social embeddedness prevalent in many Majority World settings afford both more traditional gender ideologies and a *security-oriented* construction of academic choice as a means to achieve conservative goals of safety and stability. The prominence of this security-oriented construction leads students to prioritize the achievement of financial security and fulfillment of relational/familial expectations. In these settings, students would not expect others to consider their academic choices as a direct reflection of their passions, but as a reflection of the necessities of the broader context.

1.1.2 Implications for gender gaps

Although individualist lifeways promote an experience of an authentic self independent of (and ontologically prior to) social influence, the field of social psychology has demonstrated the extent to which even this supposedly "authentic" self (e.g., preferences, interests, abilities) is a social product that is shaped through gendered social influences (e.g., Adams et al., 2006; Cheryan et al., 2015; Guimond et al., 2006; Leslie et al., 2015; Meyer et al., 2015; Nosek et al., 2009). These studies suggest that a lifetime of engagement with everyday realities that promote explicit and implicit associations between gender and academic fields affords gendered patterns of identification and motivation; simply put, even the authentic self bears the imprint of gender ideology. Accordingly, and somewhat ironically, a cultural emphasis on freedom of self-expression can amplify gender differences to the extent that it leads students to make academic choices in the pursuit of passions or purported authentic preferences that bear the imprint of this gender socialization (e.g., Charles 2011a, b, 2017; Charles & Bradley, 2009; Charles et al., 2014; Cech, 2013).

If local realities explicitly or implicitly associate STEM with stereotypically masculine features, then the pursuit of a STEM field may feel incompatible with a girl's or woman's authentic (gendered) preferences. Furthermore, expectations regarding the expression of the authentic self through academic choices may have consequences for romantic attractiveness. For women, expressing an interest in STEM may hamper romantic relationship goals. For instance, women in the US expressed more negative attitudes toward and less intention to pursue STEM when romantic relationship goals were activated (Park et al., 2011). Endorsement of romantic ideologies seems to be incompatible with the pursuit of careers that yield power and status for women (Rudman & Heppen, 2003). On the other hand, expressing an interest in STEM is likely to be compatible with the expression of a men's self. Indeed, a men's choice of STEM as his academic pursuit can be a way to affirm his masculinity (Croft et al., 2015). As a result, a self-expressive construction of academic choice can feed into a divergence in men's and women's academic choices.

Women may be particularly responsive to the activation of self-expression goals. In mainstream US settings, choice of academic pursuit is often portrayed as a self-expressive act for women in particular (Charles et al., 2014). For instance, in a qualitative study among students in an elite, liberal arts college in the US, female participants did not list any security-oriented reasons (e.g., job availability) for choosing their academic pursuits, but reported focusing solely on liking and enjoyment instead (Mullen, 2014). Moreover, researchers have noted a "culture of romance" in mainstream (White, middle class) American spaces that represents romantic relationships as an integral part of the college experience (Abowitz & Knox, 2003; Gilmartin, 2005; Holland & Eisenhart 1990). This may encourage women to prioritize affirming their feminine attractiveness through their academic choices (e.g., by expressing an aversion toward STEM and an interest in stereotypically feminine fields, Park et al., 2011).

In contrast, an emphasis on security goals rather than self-expression is likely to encourage students—male and female alike—to lean toward secure and lucrative fields such as STEM, which provide opportunities to fulfill these goals. However, financial security goals may resonate more strongly with men than women, given gender role expectations about providing for one's family (Croft et al., 2015; Morgan et al., 2001) and the romantic attractiveness of income and status in heterosexual relationships (Eastwick et al., 2014; Michniewicz et al., 2014). For instance, men from upper class backgrounds reported lucrativeness of a field as an important reason for choosing it as a major in college, whereas women did not (Mullen, 2014), suggesting that fulfillment of these goals is important for men in relatively privileged settings, too (e.g., Croft et al., 2015; Diekman et al., 2011; Morgan et al., 2001; Mullen, 2014). Indeed, men in these settings may face greater familial expectations than women to maintain their family's social status through their academic and career choices (Ma, 2009).

1.2 The present research

The present cultural psychological analysis suggests that cultural settings may construct academic choice as (1) an act of unconstrained self-expression through which one asserts their individuality, or (2) a means to achieve security and fulfill normative expectations and responsibilities. In US settings, a self-expressive construction of academic choice is likely to be prevalent (e.g., Kim & Markus 1999; Kim & Sherman, 2007). However, even when students generally consider the fulfillment of passions and dreams through their choice of academic pursuit as important, they are unlikely to ignore security goals altogether. Therefore, we propose that self-expression and security goals can temporarily activate, and affect students' academic intentions. Using college student samples from the US, we conducted two studies to empirically investigate the role of constructions of academic choice (i.e., self-expression or security goals) in students' interest in and motivation to pursue STEM fields.

In Study 1, we experimentally activated a self-expressive or security-oriented construction of academic choice through a written prompt. We then assessed participants' STEM interest and motivation as a function of the manipulation condition and their gender. In Study 2, we conducted a conceptual replication of Study 1 using a manipulation of regulatory focus (i.e., prevention or promotion focus). We also extended Study 1 by investigating the effects of the manipulation on another lucrative field (i.e., Business).

2 Study 1

In Study 1, we experimentally manipulated constructions of academic choice by asking students to focus on self-expression or security goals before indicating their academic intentions. We then examined the effect of the manipulation on STEM interest and motivation as a function of participant gender. The present cultural

psychological analysis suggests an interaction hypothesis (H1), such that constructions of academic choice will influence STEM interest and motivation differently as a function of gender. That is, activation of a self-expressive construction of academic choice will lead to lower STEM interest and motivation compared to a control condition among women (H1a), but higher STEM interest and motivation compared to a control condition among men (H1b). This is because in US settings, women are likely to experience STEM pursuit as incompatible with the expression of their authentic self. To the contrary, men are likely to experience STEM pursuit as compatible with, and even reinforcing, the expression of their self. Conversely, activation of a security-oriented construction of academic choice will lead to greater STEM interest and motivation compared to a control condition, among both women (H1c) and men (H1d). This is because when financial concerns override self-expression goals, even momentarily, both men and women may be drawn to lucrative fields like STEM that have the potential to fulfill these goals.

2.1 Method

2.1.1 Participants

We recruited 330 participants (154 men, 169 women, 7 missing; $M_{age} = 19.31$, $SD_{age} = 1.78$) through the university participant pool to participate in an online survey. Participants received partial course credit for completing the survey. Data collection continued throughout one academic semester. Two hundred and eighty-five participants indicated pursuing a field other than STEM, whereas 42 were STEM majors, and 5 did not indicate their major. Most participants identified as White/Caucasian (75.5%), 8.2% as mixed race or with other racial/ethnic categories, 6.7% as Asian, 4.8% as Hispanic/Latino, and 3.9% as African American/Black. Mean subjective social standing was above the mid-point of the (10-point) scale ($M = 6.58$, $SD = 1.59$).

2.1.2 Procedure

Participants were randomly assigned to a self-expressive academic choice, security-oriented academic choice, or control condition. In the self-expressive academic choice condition, participants read a brief passage stating that personal fulfillment is the primary goal of academic pursuit. The passage emphasized the importance of following one's heart and expressing one's self when choosing an academic pursuit. In the security-oriented academic choice condition, participants read a brief passage stating that economic security is the primary goal of academic pursuit. The passage emphasized the importance of choosing an academic pursuit that has the potential to provide economic security and financial stability in the future. In the control condition, participants read a prompt, which mentioned the need to take into consideration various factors when choosing an academic pursuit, without discussing what

Table 1 Means (and *SD*s) for STEM interest and motivation across conditions and gender in Study 1

	Control	Security	Self-expression	Total
Men	3.18 (1.83)	4.21 (1.68)	3.69 (1.82)	3.73 (1.81)
Women	3.62 (2.05)	3.34 (2.16)	2.65 (1.93)	3.21 (2.08)
Total	3.43 (1.96)	3.75 (1.99)	3.12 (1.94)	3.45 (1.98)

these might be. After the manipulation, all participants completed a questionnaire including the dependent measures.

2.1.3 Measures

We used 7-point Likert-type scales for all items except subjective social standing, which we measured on a 10-point scale.[1]

2.1.3.1 STEM interest and motivation Two items measured STEM interest and motivation. Students were told to imagine they could choose any academic pursuit at the moment and answer accordingly. The items were, "How interested are you in pursuing Math- and Science-related careers after college", and "How motivated are you to pursue Math- and Science-related careers after college". We computed the mean of the two items to create a composite variable ($r = .95$).

2.1.3.2 Demographics Participants reported their age, gender, identification with a racial category, and current major in an open-ended format. They indicated their subjective social standing on a scale ranging from 1 (worst off) to 10 (best off) using a ladder representing people in the society based on education, income, and occupation (Adler et al., 2000).

2.2 Results

To test H1, we conducted a 3 (Manipulation: Self-expression, Security, Control) × 2 (Gender: Male, Female) Analysis of Variance (ANOVA) on STEM interest and motivation. We excluded participants who indicated majoring in a STEM field from the analysis. Descriptive statistics for STEM interest and motivation as a function of condition and gender appear in Table 1. The main effect of gender was significant, $F(1, 271) = 4.40$, $p = .04$, $\eta^2_p = 0.02$, such that men reported higher STEM interest and motivation than did women. The main effect of the manipulation on STEM interest and motivation was not significant, $F(2, 271) = 2.36$, $p = .09$, $\eta^2_p = 02$. The hypothesized (H1) interaction between the manipulation and gender was significant, $F(2, 271) = 3.84$, $p = .02$, $\eta^2_p = 0.03$ (Fig. 1)[2].

[1] We included measures of authenticity, locus of control, gender essentialism, and implicit theories of intelligence in this study for exploratory purposes as potential control variables. However, these variables were not included in the analyses since they did not show any relationship with the outcome measure.

[2] Y-axis represents marginal means, and error bars represent standard errors, in all figures.

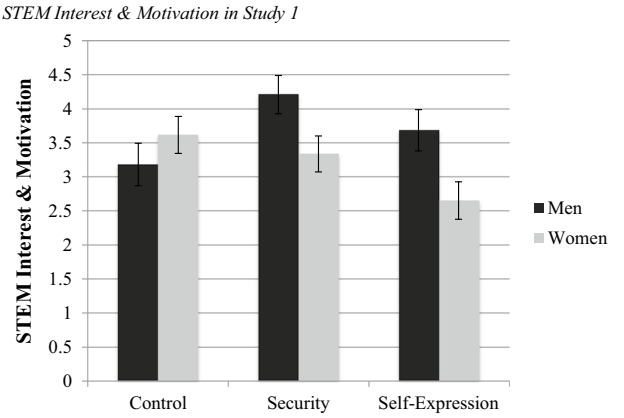

Fig. 1 STEM interest & motivation in Study 1

To decompose the interaction, we examined the simple main effects of gender across the manipulation conditions. The gender difference in STEM interest and motivation was significant in the security and self-expression conditions, Fs(1, 271) = 5.09 and 6.31, ps = 0.02 and 0.02, η^2_ps = 0.02 and 0.02, but not significant in the control condition, $F(1, 271) = 1.10$, $p = .30$, $\eta^2_p = 0.004$. We also examined the simple main effects of the manipulation among women and men separately. The effect of the manipulation was significant among women, $F(2, 271) = 3.28$, $p = .04$, $\eta^2_p = 0.02$, and marginal among men, $F(2, 271) = 2.99$, $p = .05$, $\eta^2_p = 0.02$.

To test hypotheses H1a–H1d, we conducted simple contrasts between experimental conditions and the control condition for women and men separately. In keeping with H1a, women reported lower STEM interest and motivation in the self-expression condition compared to the control condition ($M_{diff} = 0.97$, $SE = 0.39$, $p = .01$, Cohen's $d = 0.48$). In keeping with H1b, self-expression goals led men to report greater STEM interest and motivation compared to the control condition; however, this pattern was not statistically significant ($M_{diff} = -0.50$, $SE = 0.44$, $p = .25$, Cohen's $d = 0.27$). Contrary to H1c, security goals did not affect women's STEM interest and motivation compared to the control condition ($M_{diff} = 0.28$, $SE = 0.38$, $p = .46$, Cohen's $d = 0.13$). However, in keeping with H1d, security goals did lead men to report greater STEM interest and motivation compared to the control condition ($M_{diff} = -1.03$, $SE = 0.42$, $p = .01$, Cohen's $d = 0.58$).

2.3 Discussion

Study 1 examined the effect of activation of a self-expressive or security-oriented construction of academic choice on STEM interest and motivation. Results provided partial support for the hypotheses. An emphasis on self-expression goals led female participants to report lower STEM interest and motivation, whereas male participants reported slightly (but non-significantly) higher STEM interest and motivation. This pattern is in keeping with the idea that self-expression is incompatible with

STEM interest for women, but not for men. On the other hand, an emphasis on security goals led male participants, but not female participants, to report higher STEM interest and motivation.

Our findings were in line with the argument that self-expression goals may have a stronger effect on women than men, whereas security goals may have a stronger effect on men than women. Given that our sample consisted of mostly White, upper or upper-middle class American students, activation of self-expression goals, rather than security goals, may resonate with the women in our sample (Charles et al., 2014). On the other hand, activation of security goals may resonate more strongly with men than women, potentially due to societal gender role expectations, which dictate that men prioritize financial success and status (e.g., Croft et al., 2015; Eastwick et al., 2014; Michniewicz et al., 2014; Morgan et al., 2001; Mullen, 2014).

Another possible explanation for why the activation of a security-oriented construction did not lead to greater STEM interest among women is that concerns about facing hostility or obstacles, or experiencing a lack of belongingness in STEM, may lead women to think that they might not be able to achieve financial security through pursuit of a STEM career (Cheryan & Plaut, 2010; Hall et al., 2015; van Veelen et al., 2019). In other words, even when women are motivated to act based on security goals, they may not show a tendency to choose STEM, if they believe it does not promise lucrative career opportunities for a woman. In this case, women may look for other lucrative options that are relatively less gendered, where they would have a better chance of succeeding in fulfilling security goals.

To summarize, the findings of Study 1 provided initial support for the argument that a self-expressive construction of academic choice can push women, but not men, away from STEM in mainstream US settings, where STEM is considered a masculine domain. The results further suggest that men, but not women, were responsive to the activation of a security-oriented construction of academic choice, and reported greater interest in STEM.

3 Study 2: Promotion and prevention focus

The aim of Study 2 was to conduct a conceptual replication of Study 1 using a regulatory focus (i.e., promotion and prevention focus) manipulation. Regulatory focus refers to the strategies that individuals use to progress toward a desired end-state, or goal, and away from an undesired reference point (Higgins et al., 1994). An individual can approach states that match their desired end-state; or avoid states that do not match the desired end-state (Crowe & Higgins, 1997). Promotion focus is an approach strategy, which orients individuals toward advancement, growth, and accomplishment, whereas prevention focus is an avoidance strategy, which orients individuals toward security, safety, and responsibilities (Crowe & Higgins, 1997). Promotion focus and prevention focus are conceptually similar to self-expression and security goals, respectively. Promotion focus is conducive to goals such as self-fulfillment and pursuit of dreams and desires through academic choice. Prevention focus is conducive to goals such as fulfillment of material obligations and expectations

arising from one's social roles and relationships. Therefore, in Study 2, we temporarily activated promotion or prevention focus as an alternative way of activating self-expression and security goals, and tested the same hypotheses as in Study 1.

Study 2 also extended Study 1 by examining Business interest and motivation as an outcome. Women are underrepresented in leadership roles in Business fields, as negative stereotypes about women's leadership abilities persist (Eagly & Karau, 2002; Emerson & Murphy, 2015). Nonetheless, participation of women in Business and related fields has steadily increased in the US in recent decades, to a larger extent than their participation in STEM has (Diekman et al., 2010). Therefore, Business fields are relatively less male-dominated than STEM fields, but similar in terms of potential lucrativeness. We tested the same hypotheses with Business interest and motivation as the outcome, considering that women may perceive these fields as a viable option for building lucrative careers, when security goals are activated.

3.1 Methods

3.1.1 Participants

We recruited 294 participants (107 men, 175 women, and 12 missing, $M_{age} = 19.24$, $SD_{age} = 2.96$) through the participant pool of our university. Participants received partial course credit for completing the survey. Data collection continued throughout one academic semester. Most participants identified as White/Caucasian (71.1%), 13.3% as Asian, 4.8% as Latino, 4.4% as African American/Black, and 3% as mixed race or with other racial/ethnic categories. Fifty-six participants indicated pursuing a STEM major, and 81 indicated majoring in Business or related fields (Finance, Marketing, or Economics). Ten participants were undecided about their major, and the rest indicated pursuing majors that were not STEM or Business-related.

3.1.2 Procedure

Participants were randomly assigned to a promotion focus, prevention focus, or control condition. To manipulate regulatory focus, we used an existing method (e.g., Kirmani & Zhu, 2007; Pham & Avnet 2004). In the promotion focus condition, participants read a prompt asking them to think about their past and current hopes, dreams, and aspirations, and list two examples of each. In the prevention focus condition, participants read a prompt asking them to think about their past and current duties, obligations, and responsibilities, and list two examples of each. In the control condition, participants were asked to write briefly about their typical day and their ideal day. After the manipulation, all participants completed a questionnaire including the dependent measures.

Table 2 Means (and *SD*s) for STEM interest and motivation across conditions and gender in Study 2

	Control	Prevention	Promotion	Total
Men	2.76 (0.93)	3.39 (1.19)	3.14 (1.15)	3.06 (1.10)
Women	2.63 (1.03)	2.89 (1.28)	2.32 (1.01)	2.62 (1.13)
Total	2.68 (0.99)	3.02 (1.27)	2.61 (1.13)	2.76 (1.14)

Table 3 Means (and *SD*s) for Business interest and motivation across conditions and gender in Study 2

	Control	Prevention	Promotion	Total
Men	3.33 (1.62)	4.32 (1.64)	4.57 (1.02)	4.05 (1.56)
Women	3.49 (1.88)	3.51 (1.76)	3.07 (1.87)	3.35 (1.83)
Total	3.44 (1.80)	3.73 (1.76)	3.40 (1.82)	3.53 (1.79)

3.1.3 Measures

We measured all items using 7-point Likert-type scales.

3.1.3.1 STEM interest and motivation We used six items to measure interest and motivation in Technology, Math and Science, and Engineering fields. The items were, "I am interested in Technology-related [Math and Science/Engineering] fields" and "If I could choose any career to pursue in the future, I would choose a Technology-related [Math and Science/Engineering] career." We computed the mean of all six items to create a composite variable ($\alpha = 0.80$).

3.1.3.2 Business interest and motivation We measured interest in and motivation to pursue Business-related fields using two items. The items were "I am interested in Economics/Marketing/Business Administration" and "If I could choose any career to pursue in the future, I would choose a career in Economics/Marketing/Business Administration." We computed the mean of the two items to create a composite variable ($r = .89$).

3.1.3.3 Demographics Participants indicated their age, gender, identification with a racial category, and current major in an open-ended format.[3]

3.2 Results

To test Hypothesis 1, we conducted 3 (Manipulation: Promotion Focus, Prevention Focus, Control) × 2 (Gender: Male, Female) ANOVAs on each set of interest and motivation variables (STEM and Business). We excluded participants who indicated pursuing a STEM or Business major from the respective analyses. Descriptive

[3] Due to a procedural error, we did not measure subjective social standing.

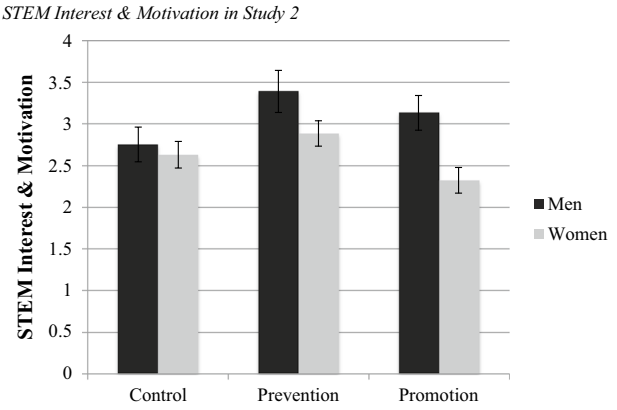

Fig. 2 STEM Interest & motivation in Study 2

statistics for STEM interest and motivation and Business interest and motivation as a function of condition and gender appear in Tables 2 and 3.

3.2.1 STEM interest and motivation

The main effect of gender on STEM interest and motivation was significant, $F(1, 220) = 9.29$, $p < .001$, $\eta^2_p = 0.04$, such that men reported higher STEM interest and motivation than did women. The main effect of the regulatory focus manipulation was marginal, $F(2, 220) = 5.27$, $p = .05$, $\eta^2_p = 0.03$. Prevention focus led participants to report higher STEM interest and motivation compared to the control condition ($M_{diff} = -0.45$, $SE = 0.20$, $p = .02$, Cohen's $d = 0.30$), whereas promotion focus did not significantly affect participants' responses compared to the control condition ($M_{diff} = 0.06$, $SE = 0.18$, $p = .84$, Cohen's $d = 0.06$). Contrary to H1, the interaction between gender and the manipulation was not significant, $F(2, 220) = 1.74$, $p = .18$, $\eta^2_p = 02$ (Fig. 2).

Nonetheless, to test Hypotheses 1a-1d, we conducted simple contrasts between the experimental conditions and the control condition for women and men separately. Contrary to H1a, promotion focus did not significantly affect women's STEM interest and motivation compared to the control condition ($M_{diff} = 0.31$, $SE = 0.22$, $p = .17$, Cohen's $d = 0.30$); however, the pattern was in the expected direction. Contrary to H1b, promotion focus did not significantly affect men's STEM interest and motivation compared to the control condition ($M_{diff} = -0.38$, $SE = 0.29$, $p = .20$, Cohen's $d = 0.36$); however, the pattern was in the expected direction. Likewise, contrary to H1c, although prevention focus did not affect women's responses compared to the control condition ($M_{diff} = -0.26$, $SE = 0.22$, $p = .25$, Cohen's $d = 0.22$), the pattern was in the expected direction. Finally, in keeping with H1d, prevention focus led men to report marginally higher STEM interest and motivation compared to the control condition ($M_{diff} = -0.64$, $SE = 0.33$, $p = .05$, Cohen's $d = 0.60$).

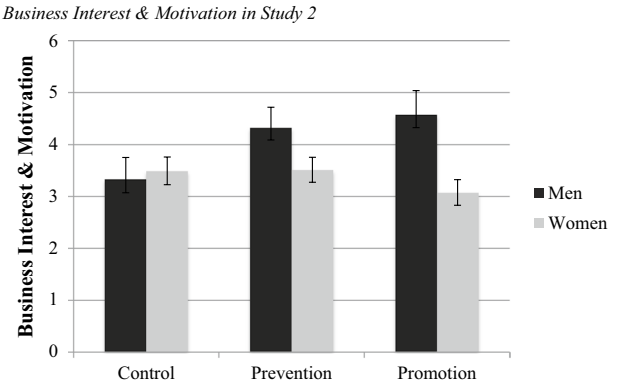

Fig. 3 Business interest & motivation in Study 2

3.2.2 Business interest and motivation

The main effect of gender on Business interest and motivation was significant, $F(1, 192) = 6.35$, $p = .01$, $\eta^2_p = 0.03$, such that men reported higher Business interest and motivation than did women. The main effect of the manipulation was not significant, $F(2, 192) = 1.23$, $p = .30$, $\eta^2_p = 0.01$. The hypothesized (H1) interaction between gender and the manipulation was not significant, $F(2, 192) = 2.68$, $p = .07$, $\eta^2_p = 0.03$ (Fig. 3).

Nonetheless, to test Hypotheses 1a-1d, we conducted simple contrasts between the experimental conditions and the control condition for women and men separately. Simple contrasts showed that in keeping with H1a, women reported lower Business interest and motivation in the promotion focus condition compared to the control condition, but this pattern was not statistically significant ($M_{diff} = 0.42$, $SE = 0.36$, $p = .25$, Cohen's $d = 0.22$). In keeping with H1b, promotion focus led men to report marginally higher Business interest and motivation compared to the control condition ($M_{diff} = -1.24$, $SE = 0.62$, $p = .05$, Cohen's $d = 0.73$). Contrary to H1c, prevention focus did not affect women's responses compared to the control condition ($M_{diff} = -0.02$, $SE = 0.36$, $p = .95$, Cohen's $d = 0.01$). In keeping with H1d, prevention focus led men to report higher Business interest and motivation compared to the control condition, but this effect was not statistically significant ($M_{diff} = -0.99$, $SE = 0.57$, $p = .08$, Cohen's $d = 0.61$).

3.3 Discussion

In Study 2, we intended to conceptually replicate Study 1 using a regulatory focus manipulation. Whereas the manipulation in Study 1 focused specifically on factors to consider when making academic choices, the regulatory focus manipulation in Study 2 did not include any direct reference to academics. The manipulation focused broadly on hopes and aspirations or responsibilities and obligations, without

specifying a domain or context. Although the pattern of results was generally in line with what we observed in Study 1, most did not reach statistical significance.

One limitation of Study 2 is that the sample size in this study was smaller than Study 1 due to constraints of the participant pool, leading to lower power. Another caveat to note is that because the manipulation prompts were not specific to academics, participants may have interpreted them in different ways than we intended, or have considered different life domains in response to the prompt. An inspection of participants' open-ended responses to the manipulation prompts suggested that some referred to hopes and aspirations regarding their future careers, whereas others focused on personal matters related to relationships or hobbies, which may have diluted the effect of the manipulation.

We examined Business interest and motivation in an attempt to consider one alternative explanation for the lack of an effect of security goals on STEM interest and motivation among women in Study 1. More specifically, we reasoned that women may respond to security goals (i.e., prevention focus in Study 2) by reporting greater interest in a field that is lucrative but relatively less strongly gendered than STEM, where they may see a better chance of success for themselves. This would suggest that prevention focus would lead women to show greater interest in Business; however, we did not find evidence for this pattern.

4 General discussion

We drew upon cultural psychological perspectives to examine the consequences of cultural constructions of academic choice for academic interest and motivation (Soylu Yalcinkaya & Adams, 2020). Our studies were inspired by the cross-national variation in the size of the gender gap in STEM participation, which shows that the gender gap in STEM participation does not disappear in relatively developed and gender egalitarian parts of the world (Charles, 2011a; Charles & Bradley 2009; Charles et al., 2014; Sikora & Pokropek, 2012; Stoet & Geary, 2018). This may be partly because in these settings, the society portrays academic choice as a means to express one's true, authentic self. Ironically, this may encourage students to express academic preferences that have indeed been gendered through their experiences within the society (e.g., Charles 2011a, b, 2017; Charles & Bradley, 2009; Charles et al., 2014; Cech, 2013; Soylu Yalcinkaya & Adams, 2020). On the other hand, in relatively less developed and less gender egalitarian Majority World settings, academic choice may not be seen as a means to express the self; instead, it is often considered as a means to achieve future security, for both men and women (Soylu Yalcinkaya & Adams, 2020).

These two cultural constructions of academic choice that we have identified broadly map onto two sets of goals (i.e., self-expression and security) that individuals are likely to prioritize when forming their intentions to pursue particular academic fields. Although the cultural setting may emphasize one of these sets of goals based on the dominant construction of academic choice, students are likely to be familiar with both. Therefore, we set out to test the consequences of a momentary

activation of self-expression or security goals among participants in a setting that generally affords a self-expressive construction of academic choice (i.e., the US).

Our studies provided some initial evidence that self-expression and security goals may influence academic interest and motivation differently among men and women. In Study 1, we directly manipulated construction of academic choice by asking participants to focus on self-expression or security goals before indicating their STEM interest and motivation. Study 2 aimed to conceptually replicate and extend Study 1 by testing the effect of experimental activation of an orientation toward hopes and desires (i.e., promotion focus), or obligations and responsibilities (i.e., prevention focus) on STEM and Business interest and motivation.

We found partial support for our hypotheses. Among women, focusing on dreams and desires with regards to academics led to lower interest in STEM in Study 1, as hypothesized. This pattern is in line with the argument that showing an interest in STEM may not feel compatible with the expression of the feminine self. A less specific prompt asking participants to consider hopes and desires in general led to a similar, but non-significant pattern for STEM in Study 2. Across the two studies, activation of security goals (or prevention focus) did not have an effect on women's STEM or Business interest and motivation.

Among men, one pattern that consistently emerged, in line with our hypothesis, was that security goals, or a prevention focus, led to greater interest and motivation in STEM and Business fields. This pattern is in line with the argument that goals related to financial security may resonate with men, given gender role expectations (e.g., Croft et al., 2015; Diekman et al., 2011; Morgan et al., 2001; Mullen, 2014). However, men did not respond to the self-expression or promotion manipulations by showing greater interest in STEM or Business. It might be that although these fields are compatible with the expression of men's gendered self, they are not necessarily exemplars of self-expressive academic or career pursuits. In other words, when the emphasis is on hopes and desires, men may not be dreaming about pursuing lucrative but rather challenging STEM or Business fields. However, due to normative pressures, they may be less likely than women to steer away from these fields.

The participants in our samples were majority-White, middle- or upper middle-class, American university students. These participants represent a relatively privileged portion of the US society based on racial and social class background. An important direction for future work is to examine the consequences of an experimental activation of a self-expressive or security-oriented construction of academic choice among diverse samples. Whereas women in our samples may be more ready to engage self-expressive goals through academic pursuit, students from relatively disadvantaged backgrounds may be more responsive to security goals. As a result, women from relatively disadvantaged backgrounds (due to intersecting minority racial identities and socioeconomic status) may be more responsive to the security or prevention focus manipulations, as they might be able to switch to a security-oriented mindset more spontaneously. More generally, the patterns that these studies documented are unlikely to reflect a universal experience of women. For instance, there is evidence suggesting that femininity may be constructed differently in White and African American spaces, which may have consequences in terms of the perceived incompatibility between STEM pursuit and self-expression among women

(e.g., Cole & Zucker 2007). In African American spaces, such traits as strength, resilience, assertiveness, and self-reliance are not regarded as masculine or incompatible with femininity (Cole & Zucker, 2007; Hanson, 2006; Harris 1996; Settles, 2006). Since mainstream stereotypes commonly associate these characteristics with STEM pursuit (Carli et al., 2016), STEM pursuit may be understood as compatible with femininity in predominantly African American spaces. Experimental activation of self-expressive goals may not push African American women away from STEM pursuit, as it did White women in the current samples.

4.1 Limitations

One limitation of the present research is that our samples consisted of university students, most of which have already chosen their majors, and our sample sizes were very limited due to constraints of the participant pool. We asked them to imagine what field they would pursue under different circumstances, and excluded participants who had already chosen to major in a field that our dependent measures focused on. However, high school students would provide a more appropriate population to examine the consequences of our manipulations. In addition, future research may look into interest and motivation in a broader set of academic fields that very in terms of lucrativeness and enjoyableness, as well as the extent to which they are gendered. Another limitation of our studies is that we did not include potential moderators such as gender identification or self-stereotyping. People who are more strongly identified with their gender category or those who show a greater tendency to self-stereotype may report more gender-stereotypical responses when self-expression goals are active. Finally, we did not directly measure possible mediators of the effect of reminders of a particular construction of academic choice on STEM interest and motivation such as perceived compatibility between STEM and one's self.

4.2 Conclusion

The current work expands social psychological research on gender gaps in STEM by drawing upon cultural psychological perspectives. Our focus in the current studies on men's, in addition to women's, responses to the manipulations reflects our goal of questioning the sociocultural processes that guide both women's and men's tendencies. Cultural psychological perspectives are useful in challenging the implicit androcentric tendency of research, which questions why or how women's STEM outcomes fall short of men's, whereas taking men's outcomes as just natural (e.g., Adams et al., 2015; Hegarty & Pratto, 2001). It is important for work on gender differences in academic interests and participation to consider men's STEM outcomes in addition to women's, and question men's overrepresentation in these fields in addition to women's underrepresentation. We emphasize the sociocultural shaping (e.g., through particular cultural understandings of the meaning and purpose of academic choice) of both women's and men's interest in STEM (and potentially other fields). Our research suggests that the cultural construction of choice itself can play

a role in the emergence of gender gaps by shaping students' considerations in academic decisions, sometimes in unexpected directions.

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