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My Fair Physicist? Feminine Math and Science Role Models Demotivate Young Girls

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Abstract

Women in science, technology, engineering, and mathematics (STEM) are labeled unfeminine, a costly social label that may discourage female students from pursuing these fields. Challenges to this stereotype include feminine STEM role models, but their counterstereotypic-yet-feminine success may actually be demotivating, particularly to young girls. Study 1 showed that feminine STEM role models reduced middle school girls' current math interest, self-rated ability, and success expectations relative to gender-neutral STEM role models and depressed future plans to study math among STEM-disidentified girls. These results did not extend to feminine role models displaying general (not STEM-specific) school success, indicating that feminine cues were not driving negative outcomes. Study 2 suggested that feminine STEM role models' combination of femininity and success seemed particularly unattainable to STEM-disidentified girls. The results call for a better understanding of feminine STEM figures aimed at motivating young girls.

Keywords

stereotype, gender, math motivation, femininity, identity

By age 6, U.S. children asked to draw scientists (Chambers, 1983) or mathematicians (Steele, 2003) tend to draw men. This reflects a cultural expectation that men show more interest and skill in science, technology, engineering, and math (STEM) than women. It also reflects a real and persistent gender gap in academic and professional STEM settings (particularly the hard sciences, computer science, and engineering; American Association of University Women [AAUW], 2010; National Science Foundation [NSF], 2007).

Nevertheless, some women do excel in STEM: in 2007, women obtained 38.4% of bachelor's degrees and 24.2% of jobs in these fields (NSF, 2007). Female students perform as well as male students in high school math and science classes (although not on advanced placement tests; AAUW, 2010). Girls and women have even taken home several recent high-profile awards for scientific prowess, including three first place finishes at Google's inaugural teenage science fair (Chang, 2011) and four MacArthur "Genius" Awards in science fields (MacArthur Foundation, 2011).

Female students can benefit from stereotype-defying role models like these. Interacting with powerful female faculty and reading about famous female leaders weakens women's implicit "male-leader" stereotypes (Dasgupta & Asgari, 2004). The presence of local female politicians boosts Indian girls' grades and career aspirations (Beaman, Duflo, Pande, & Topalova, 2012). STEM role models seem similarly promising. Women do better on math tests after reading about other women's successes, even in non-STEM domains (McIntyre, Paulson, & Lord, 2003), or after learning that their female experimenter is a math whiz (Marx & Roman, 2002). Further, exposure to successful women in science and engineering boosts female STEM students' STEM identification and expectations for achievement in these fields (Stout, Dasgupta, Hunsinger, & McManus, 2011).

Although counterstereotypic role models can inspire, people who disconfirm stereotypes do not necessarily weaken broadly held stereotypes. Instead, stereotype violators are interpersonally punished (Rudman & Fairchild, 2004) or written off as exceptions to the rule (Richards & Hewstone, 2001). They are also subtyped or recategorized into a subset of their social category (Kunda & Oleson, 1995). Subtyping lets people maintain stereotypes in the face of seeming disconfirmation. For instance, women who excel in stereotypically masculine domains are subtyped into a less feminine gender category (e.g., Heilman & Okimoto, 2007). Asserting that only certain

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types of women are good at masculine endeavors helps maintain larger stereotypes about "most" women.

Women who excel in male-dominated STEM fields are similarly subtyped. To maintain the stereotype that women are bad at math, women who succeed in STEM are instead stereotyped as unfeminine. To illustrate, a hypothetical female engineering student was ascribed fewer feminine traits than a student in nursing, a more stereotypically feminine field (Yoder & Schleicher, 1996). German middle schoolers described students who liked physics with fewer feminine and more masculine personality traits than students who liked music (a more female-typed humanities field; Kessels, 2005). The unfeminine-STEM stereotype also applies to appearance, in that wearing makeup seems incompatible with math success (Pronin, Steele, & Ross, 2004).

The unfeminine label carries numerous costs. Women are disliked (Heilman & Okimoto, 2007) and even aggressed against (Rudman & Fairchild, 2004) when they seem insufficiently warm. Women who do not look feminine enough (e.g., who eschew makeup) are seen as less attractive (e.g., Gueguen, 2008), less competent (Etcoff, Stock, Haley, Vickery, & House, 2011), less confident, and likely to earn a lower salary (Nash, Fieldman, Hussey, Leveque, & Pineau, 2006). Unsurprisingly, this negativity colors perceptions of women in unfeminine STEM fields. Students' stories about female engineers contained more negative imagery than stories about female nurses, but stories about male nurses were not more negative than stories about male engineers (Yoder & Schleicher, 1996). Middle school students expected girls excelling in physics to be less popular than girls excelling in music (Kessels, 2005). College women in STEM also seem cognizant of their major's social costs: more female than male engineering students listed the unfemininity stereotype as a problem facing women in their field (Hartman & Hartman, 2008).

The unfeminine STEM image matters because a field's reputation can affect whether students like it. German middle schoolers liked physics less when they felt dissimilar to the "prototypical" physics student (who was seen as relatively unfeminine; Hannover & Kessels, 2004; Kessels, 2005). Some prototypic images are uniquely harmful to women's STEM aspirations. Women, but not men, reported less interest in computer science after exposure to computer science's geeky image, delivered via nearby Star Trek posters (Cheryan, Plaut, Davies, & Steele, 2009) or geeky female or male role models (Cheryan, Siy, Vichayapai, Drury, & Kim, 2011).

Strategies to refute this unfeminine-STEM image include female role models who are not only successful in STEM but also feminine, thus countering stereotypes about ability as well as femininity. Two examples target young girls in particular. Mattel, with cooperation from the Society of Women Engineers, has released pink-laptop-toting "Computer Engineer Barbie," hoping she might "inspire ... girls to explore this important high-tech industry," (www.Mattel.com, n.d.). Mathematician/actor/author Danica McKellar highlights the feminine side of math in three books aimed at middle and high school girls (e.g., "Math Doesn't Suck: How To Survive Middle School Math Without Losing Your Mind Or Breaking A Nail," 2007).

McKellar and Mattel are not the only ones concerned with middle school girls' STEM interests. The AAUW (2010) argues that getting young girls interested in math and science is critical for increasing the number of women in the academic and professional STEM pipeline. Accordingly, middle school girls have been targeted by numerous interventions designed to boost their interest in STEM, whether through academic research (e.g., Good, Aronson, & Inzlicht, 2003), National Science Foundation-funded programs (e.g., Gender in Science and Engineering), or popular culture products like McKellar's books.

Middle school interventions come at an age when girls are uniquely susceptible to gender-STEM stereotypes as well as expectations of ideal femininity. In middle school, girls first begin to question their math abilities relative to boys' (Pajares, 2005; Wigfield, Eccles, MacIver, Reuman, & Midgley, 1991). They also begin to experience stereotype threat in math (Good & Aronson, 2008), which occurs when worries about confirming self-relevant stereotypes harm performance (e.g., Spencer, Steele, & Quinn, 1999). Eleven- to thirteen-year-old girls recalled fewer details of a complex figure when they thought it was a test of geometry rather than memory or drawing, and when they were tested alongside boys rather than other girls (Huguet & Régner, 2007). Similar gender stereotype threat effects have been uncovered in fifth- through eighth graders (Ambady, Shih, Kim, & Pittinsky, 2001; Muzzatti & Agnoli, 2007). Middle school also brings pressure to conform to feminine norms (e.g., Sengupta, 2006). The combined impact of ability and femininity stereotypes may make young girls feel ill-suited for STEM.

The feminine STEM role model is a well-intentioned attempt to counter these negative stereotypes that may not work as intended. An explicitly feminine STEM role model is more contradictory or unexpected than an everyday woman who excels in a male-dominated field. A successful woman in STEM whose femininity goes unremarked upon may still be subtyped as unfeminine, allowing people to reconcile her success with steadfast stereotypes demeaning "most women's" abilities. A very feminine woman in STEM, however, cannot be so easily recategorized. By countering two contradictory stereotypes, feminine STEM role models may seem impossibly successful.

Role models whose success seems unmatchable can make students feel threatened rather than motivated, leading to negative self-evaluations and distancing from the role model's field of success (Lockwood & Kunda, 1997). Middle school girls already report seeing adult scientists as "too good" or "too smart" to be feasible role models (Buck, Plano Clark, Leslie-Pelecky, Lu, & Cerda-Lizarraga, 2008). At an age when stereotypes about gender (Halim & Ruble, 2010) and scientists (Buck, Leslie-Pelecky, & Kirby, 2002) are rather rigid, being a feminine woman in STEM may seem particularly unlikely. Feminine STEM role models might therefore fail to motivate this population. Although very high-achieving role models (e.g., Madeline Albright) can improve college women's stereotype-relevant outcomes (e.g., leadership; Dasgupta & Asgari, 2004), young girls may be more sensitive to the perceived unattainability of role models' achievements. Since they hold a less clearly defined sense of self and a foggier picture of what careers entail (Buck et al., 2008), it may be critical that young girls be able to concretely imagine themselves in the role model's place.

Importantly, role model effects may differ depending on girls' identification with STEM. Specifically, two lines of research imply that feminine STEM role models might least motivate girls who already disidentify with STEM (or do not care for math and science). First, role models may be most helpful for people who can picture themselves achieving the role models' success (Stout et al., 2011). Individuals' imagined ''future selves'' are strongly related to their present self-concepts. For instance, students who already perform well in school find it easier to imagine themselves performing well in the future (Oyserman & Fryberg, 2006). Girls who do not currently identify with STEM may not picture themselves pursuing STEM in the future, making role models' STEM success feel that much less attainable for them. Second, work on the representativeness heuristic shows that events feel less likely when they defy our expectations (Kahneman & Tversky, 1972). In light of the unfeminine-STEM stereotype, feminine STEM success may seem unexpected and thus unlikely. It may seem even more unexpected (and even less likely) to girls who already do not expect success in STEM. STEM-disidentified girls are thus expected to feel least motivated by feminine STEM role models.

In contrast, STEM-identified girls probably feel more capable than STEM-disinterested girls of one day attaining the STEM success of accomplished scientists—even feminine ones—because they earn better grades (Simpkins, Davis-Kean, & Eccles, 2006) and hold higher expectations for themselves in these fields (Oyserman & Fryberg, 2006). Consequently, feminine role models may not shake STEM-identified girls' future plans. STEM-identified girls' future plans may also be buffered because they have more positive impressions of women in STEM (given their common academic interest). However, because *feminine* women in STEM should not be uniquely appealing to this population, STEM-identified girls' less negative outcomes should arise from stronger expectations of similar success rather than more positive role model ratings.

Although we predict divergent effects for STEM-identified and disidentified girls' future math plans, all girls' current ratings of ability may suffer in the face of the feminine STEM role model. Whereas STEM-identified girls might be able to imagine future selves that are as successful as more advanced role models, no one can speed up their current abilities or achievements to match the role models' (Lockwood & Kunda, 1997). As a result, girls may feel that they currently pale in comparison to doubly counterstereotypic role models, regardless of their STEM identification. In support of this possibility, comparing oneself to a more successful other can decrease current academic self-ratings without affecting predicted future success (Kemmelmeier & Oyserman, 2001).

Study 1 exposes middle school girls varying in STEM identification to role models who display either STEM success or general academic success (not STEM-specific), and who are either feminine or ''gender-neutral.'' Girls then report how likely they are to study math in the future and rate their current math interest, ability, and short-term success expectancies (Simpkins et al., 2006). Feminine STEM role models are expected to weaken future math plans relative to gender-neutral counterparts, but only among girls who disidentify with math or science. It is hypothesized that feminine STEM role models will also decrease the current self-ratings of all girls, as no student can immediately catch up to a role model's success. Finally, because STEM is uniquely branded ''unfeminine,'' gender-neutral feminine role models should not affect math-related outcomes, arguing against the possibility that feminine STEM role models reduce math aspirations via mere feminine cues (e.g., Steele & Ambady, 2006). Study 2 then tests the hypothesis that STEM-disidentified girls respond more negatively to feminine STEM role models because they view feminine STEM success as particularly unattainable.

Study 1

Method

Participants. One hundred and ninety-three U.S. sixth- and seventh-grade girls participated on classroom laptops in exchange for a youth magazine and a chance at a $100 lottery. Participants' parents provided informed consent for their children prior to the experimental session, and the girls assented to participate before the session began. Fourteen participants quit the study before completing the first attitude scale, 33 participants were dropped for failing the manipulation check (described below), and 2 participants were dropped for scoring three standard deviations below the mean on the first attitude scale, leaving 144 participants in the final analysis.[1]

Ninety-two girls were in the sixth grade and 52 in the seventh. The majority of the girls were White ($n = 67$), followed by 19 Black, 11 Asian, 3 Latina, and 29 reporting multiple races or providing another response. Fifteen girls did not provide their race. The average age was 11.56 years ($SD = .67$).

Procedure and materials. A female experimenter administered the computerized study during students' regular class time. Participants first reported their three favorite school subjects: 54.2% chose math, science, or both, and were coded as STEM-identified. Participants then read magazine-type interviews with three female university students displaying feminine (e.g., wearing pink clothes and makeup, likes reading fashion magazines) or gender-neutral appearance and characteristics (e.g., wearing dark-colored clothes and glasses, likes reading). Role models also displayed either STEM success (e.g., called engineering star, praised by chemistry professor, attained summer math research position) or general school success (e.g., called freshman star, praised by field-unspecified professor, attained field-unspecified summer research position).[2] Role models were demographically similar to participants (i.e., same gender, attended local university) and were college rather than middle school aged so that a perceived lack of "time to catch up" would not impact girls' expectations of similar success (Lockwood & Kunda, 1997). This yielded a 2 (STEM-identification) × 2 (domain) × 2 (femininity) design. After reading about the role models, participants completed the following measures.

Manipulation check. Participants first completed a manipulation check questionnaire asking them to recall the three role models' names, majors (confirming that girls noticed the role models' domain of success), and hobbies (confirming that girls noticed the role models' degree of femininity). Participants who did not correctly recall the major and hobby of two of the three girls were excluded from analyses.

Role model positivity and perceived similarity. Participants then evaluated the role models' general positivity on 7-point scales (likable, smart, friendly, and hardworking; $M = 6.22$, $SD = .91$, $\alpha = .87$), and their perceived similarity to the role models on a 7-point scale ($M = 4.65$, $SD = 1.59$).

Future plans. Participants then used 7-point scales to rate their likelihood of taking high school math ($M = 5.48$, $SD = 1.60$) and English ($M = 5.86$, $SD = 1.48$), attending college ($M = 6.78$, $SD = .86$), and taking college math ($M = 5.77$, $SD = 1.37$). Self-reported likelihood of taking high school and college math correlated ($r = .56$, $p < .001$) and were combined into a single "future plans" measure.

Current self-ratings. Next, participants used 7-point scales to report their current math interest, ability, and short-term success expectancies (9 items, e.g., How good at math are you? and Do you find working on math assignments (boring/interesting)? Simpkins et al., 2006; $M = 5.06$, $SD = 1.04$, $\alpha = .88$).

Demographics. Finally, participants reported their age, grade, gender, and race/ethnicity.

Results

Future plans. A 2 × 2 × 2 factorial analysis of covariance tested the influence of role model domain, role model femininity, and girls' STEM identification (covarying out likelihood of attending college) on participants' likelihood of taking future math classes. Likelihood of attending college was a significant covariate, $F(1, 128) = 4.21$, $p = .04$.[3] Significant effects of STEM identification, $F(1, 128) = 25.70$, $p < .001$, and role model femininity, $F(1, 128) = 5.90$, $p = .02$, and a marginal effect of domain, $F(1, 128) = 3.29$, $p = .07$, emerged.

A three-way interaction qualified these effects, $F(1, 128) = 9.21$, $p < .01$, $d = .54$. A simple interaction analysis revealed that the role-model-femininity by domain interaction was significant for STEM-disidentified girls, $F(1, 133) = 10.23$, $p < .01$, $d = .55$, but not STEM-identified girls, $F < 1$. Simple effects analyses related to STEM-disidentified girls revealed that feminine STEM role models ($M = 4.04$) in comparison to gender-neutral STEM role models ($M = 5.57$) decreased the

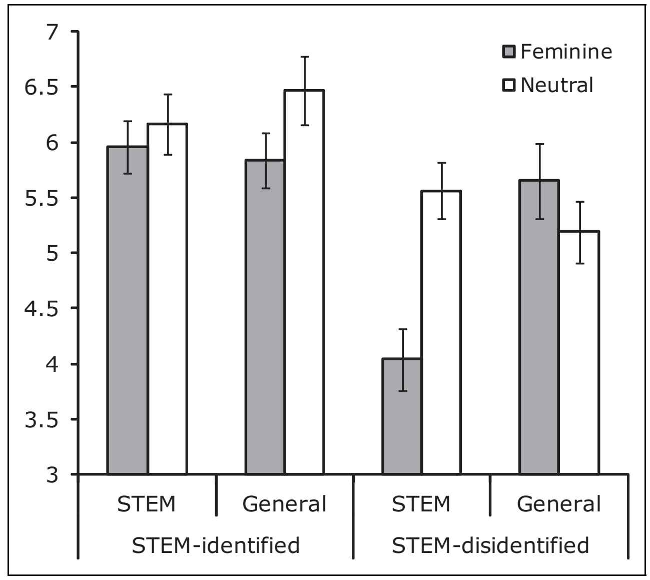

Figure 1. Future math plans by role model domain, role model femininity, and participant science, technology, engineering, and mathematics (STEM)-identification (Study 1). *Note.* Estimated marginal means and standard errors predicted from analysis of covariance (ANCOVA) with covariate "likelihood of attending college."

likelihood that these girls expected to take math in high school and college, $F(1, 131) = 11.14$, $p = .001$, $d = .58$. Furthermore, for STEM-disidentified girls, feminine general role models ($M = 5.65$) and gender-neutral general role models ($M = 5.19$) did not differ in the extent to which they influenced the likelihood that these girls expected to take math in high school and college, $F(1, 131) = 1.2$, $p = .29$ (see Figure 1). Plans to take English (a field lacking negative female stereotypes) showed no main or interactive effect of role model or STEM identification, all Fs < 1.35.

Current self-ratings. A 2 × 2 × 2 factorial analysis of variance (ANOVA) tested the influence of role model domain, role model femininity, and girls' STEM identification on current math self-ratings. A significant STEM-identification effect, $F(1, 136) = 15.80$, $p < .001$, indicated higher current math self-ratings among STEM-identified girls ($M = 5.33$) than STEM-disidentified girls ($M = 4.75$). A significant role model femininity effect, $F(1, 136) = 11.59$, $p = .001$, was qualified by a role-model-femininity by domain interaction, $F(1, 136) = 8.90$, $p = .003$, $d = .51$. Simple effects analyses revealed that feminine STEM role models ($M = 4.50$) in comparison to gender-neutral STEM role models ($M = 5.53$) decreased current self-ratings of math interest, ability, and short-term success expectancies, $F(1, 141) = 18.06$, $p < .001$, $d = .72$. Feminine general role models ($M = 5.07$) and gender-neutral general role models ($M = 5.17$), however, did not differ in the extent to which they influenced current self-ratings, $F(1, 141) = .02$, $p = .90$ (see Figure 2). No other interactions emerged, all Fs < 1. Notably, participants' ratings of future plans and current self-ratings were significantly correlated, $r(141) = .50$ ($p < .001$).

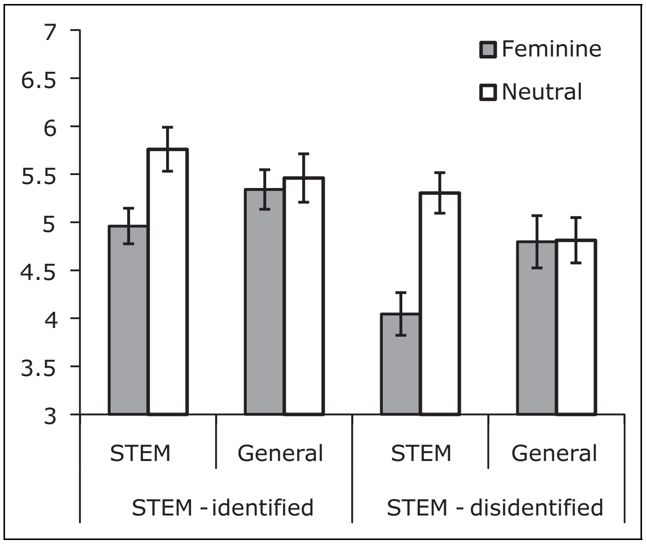

Figure 2. Current self-rated math interest, ability, and success expectancies by role model domain, role model femininity, and participant science, technology, engineering, and mathematics (STEM)-identification (Study 1).

Role model positivity and perceived similarity. Role models' positivity ratings were tested with a 2 (femininity) × 2 (domain) × 2 (STEM identification) ANOVA. Role models were rated equivalently positively, regardless of femininity, domain, or girls' STEM identification, all *F*s < 1. The same 2 × 2 × 2 ANOVA model tested girls' ratings of how similar they felt to the role models. STEM-identified participants viewed themselves as marginally more similar ($M = 4.86$) to the role models than STEM-disidentified girls ($M = 4.4$), $F(1, 134) = 2.70$, $p = .10$, but neither role model femininity nor domain yielded significant effects (all *p*s > .17).

Discussion

As hypothesized, feminine STEM role models weakened future plans to study math among girls who did not identify with STEM. They also decreased all girls' current self-rated math interest, ability, and short-term success expectations. Because feminine general role models did not have these effects, feminine cues were likely not driving feminine STEM role models' effects (Steele & Ambady, 2006). Moreover, girls felt equally positively toward and similar to all of the role models. This argues against the idea that girls connect better with feminine women. It also suggests that participants' reactions to our role models were not driven by perceived dissimilarity. This contrasts with past evidence that role models weaken stereotypes only when they seem similar to readers (Asgari, Dasgupta, & Stout, 2012) and that "geeky" role models reduce interest in computer science because participants feel dissimilar to them (Cheryan et al., 2011).

Study 2 investigates why STEM-disidentified girls were least motivated by feminine STEM role models. Role models are more inspiring when their success feels attainable (Lockwood & Kunda, 1997; Stout et al., 2011). Young girls may not expect STEM role models to be female (Buck et al., 2002) or feminine (Kessels, 2005), and what is unexpected often feels unlikely (Kahneman & Tversky, 1972). Further, STEM-disidentified girls may not incorporate STEM into their future selves (Oyserman & Fryberg, 2006). They may see success in an unlikely field (STEM) from unlikely figures (feminine women) as less probable than STEM-identified girls. We posit that feminine STEM success will seem less attainable than gender-neutral STEM success only to STEM-disidentified girls. Because general role models did not yield unique effects in Study 1, Study 2 only examines STEM role models.

Study 2

Method

Participants. Forty-five U.S. sixth- and seventh-grade girls participated in a procedure similar to that of Study 1. Two participants failed the manipulation check and one failed to answer the outcome variables, leaving 42 participants in the final analysis. Students participated either in their classroom ($n = 34$) or at a community fair ($n = 8$). Twenty students were White, four Asian, three Black, and nine chose multiple races or provided another response. Four did not provide their race. The average age was 11.38 years ($SD = .83$). They were compensated with Silly Bandz, a popular children's bracelet.

Procedure and materials. Participants reported their three favorite school subjects (45.2% were STEM-identified), then read a paper version of Study 1's feminine or gender-neutral STEM role model interviews. This yielded a 2 (STEM identification) × 2 (role model femininity) design.

Participants were asked to recall the role models' names, majors, and hobbies, providing a manipulation check using the same cutoff as in Study 1. Participants then used a 7-point Likert-type scale (1 = *not at all likely/strongly disagree*, 7 = *very likely/strongly agree*) to answer two questions. First, they rated their likelihood of one day emulating their assigned role models' success (i.e., "How likely do you think it is that you could be both as successful in math/science AND as feminine or girly as these students by the end of high school?"). Second, they indicated their agreement with the following statement: "Do being good at math and being girly go together?" Unfortunately, procedural error prevented 20% of the sample from receiving the latter question. Finally, participants provided demographic information.

Results and Discussion

A 2 × 2 factorial ANOVA tested the effects of STEM identification and role model femininity on self-reported likelihood of achieving the role models' success. A significant STEM identification by role-model-femininity interaction emerged, $F(1, 38) = 5.31$, $p = .03$, $d = .75$. Simple effects analyses showed that STEM-disidentified girls felt significantly less likely to one day achieve the feminine role models' level of femininity

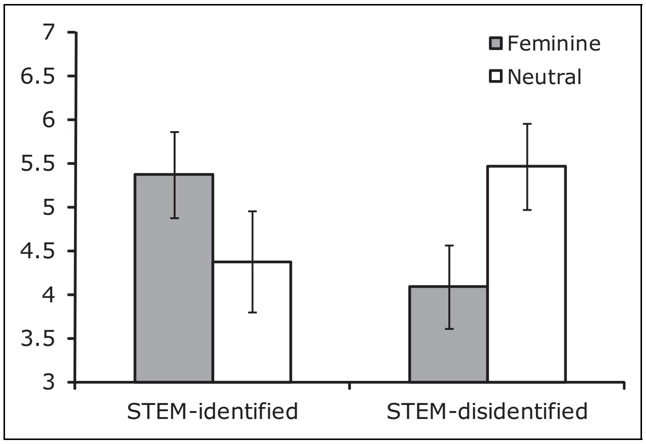

Figure 3. Likelihood of attaining role model femininity and science, technology, engineering, and mathematics (STEM) success by role model femininity and participant STEM identification (Study 2).

and STEM success ($M = 4.08$) compared to gender-neutral role models ($M = 5.46$), $F(1, 39) = 4.15$, $p < .05$, $d = .64$. STEM-identified girls felt equivalently likely to achieve feminine and gender-neutral role models' successes, $F(1, 39) = 1.81$, $p = .19$ (see Figure 3).

Although not all girls received this item, a 2 (STEM identification) × 2 (femininity) ANOVA revealed a marginal main effect of STEM identification on participants' agreement that STEM success and femininity "go together," $F(1, 30) = 3.70$, $p = .06$. STEM-disidentified girls ($M = 3.5$) agreed less than STEM-identified girls ($M = 4.36$). The interaction was not significant, $F(1, 30) = 1.2$, $p = .28$, suggesting that STEM-disidentified girls may generally see feminine STEM success as incongruous.

Girls who did not identify with STEM rated feminine STEM success as less attainable than gender-neutral STEM success. They also rated femininity and STEM as somewhat less compatible than STEM-identified girls did, regardless of role model, further suggesting that they see feminine women in STEM as particularly incongruous. This supports work on future selves as well as the representativeness heuristic. When STEM-disidentified girls, whose future selves were likely unrelated to math, compared themselves to an uncommonly feminine woman in STEM, they discounted their own likelihood of achieving comparable success.

General Discussion

These studies offer evidence that feminine STEM role models can demotivate rather than inspire middle school girls. Study 1 showed that feminine STEM role models made middle school girls feel less capable and interested in math. Troublingly, feminine STEM role models also made STEM-disinterested girls feel less likely to study math in the future. This suggests that feminine STEM role models may most negatively impact girls who already disidentify with STEM, and who might benefit most from interventions that pique interest in these fields. In Study 2, STEM-disidentified girls saw success in both domains as least attainable, suggesting that their demotivation was related to the perceived unlikelihood of combining femininity and STEM success.

These findings extend work on counterstereotypic role models by examining figures that counter multiple stereotypes. Women who defy ability stereotypes can improve college students' outcomes (e.g., Marx & Roman, 2002), even when they are incredibly successful (Dasgupta & Asgari, 2004). The present work raises the possibility that role models who counter competing stereotypes (i.e., women can be good at math or be feminine, but not both) are less effective. Young girls may see their success as particularly difficult to emulate, given their belief that women in STEM are "too good" to be role models (Buck et al., 2008) and their rigid stereotypes about gender (Halim & Ruble, 2010) and scientists (Buck et al., 2002). Some research suggests that role models who represent an unattainable standard make audiences feel threatened rather than inspired (Lockwood & Kunda, 1997) perhaps this is particularly true for adolescents viewing doubly counterstereotypic role models.

This work also suggests that counterstereotypic role models' influence depends in part on students' future academic selves. Feminine STEM role models were least motivating to girls who already disliked STEM. In Study 2, these girls saw feminine STEM role models' success as especially unlikely, perhaps because they already saw STEM as an unlikely pursuit (Oyserman & Fryberg, 2006). Rather than opening these girls' minds to new possibilities, the feminine STEM role model seemed to shut them further. This result echoes stereotype threat's ability to make people prefer the safe and known over the risky and unknown, whether by inducing prevention focus (Seibt & Forster, 2004) or inhibiting new problem-solving strategies (Carr & Steele, 2009).

Academic choice is shaped by two kinds of stereotypes: those about students' own identities (e.g., gender stereotypes; Wigfield et al., 1991) and those about given fields (e.g., unfeminine or geeky STEM images; Cheryan et al., 2009; Kessels, 2005). The unfeminine-STEM stereotype merits particular attention because it may uniquely weaken women's STEM interest, just as the similarly socially costly "geeky" label does (e.g., Cheryan et al., 2009; Cheryan et al., 2011). Recent work further demonstrates how STEM's seeming incompatibility with femininity can derail women's math achievement. When women aspired to appear attractive and desirable to men (feminine goals), they engaged in fewer math-related behaviors (Park, Young, Troisi, & Pinkus, 2011). Some have tried to highlight STEM's compatibility with femininity (e.g., McKellar, 2007), but even well-intentioned efforts may actually push girls away from STEM.

Given its focus on middle school girls, the present research cannot speak to feminine STEM role models' effects on high school or college women. Older students may have seen more diverse examples of women in science, making femininity seem more compatible with STEM success. Future work might test whether older students see feminine STEM role models' success as more attainable and thus motivating. Additionally, studying women of diverse ages and backgrounds might reveal what besides attainability is driving feminine STEM role model effects. Women of different races may conceptualize femininity differently (Cole & Zucker, 2007). Older students may "bifurcate" or compartmentalize their feminine identities in order to maintain interests in math (Pronin et al., 2004). Future research should illuminate what underlies feminine STEM role models' effects and how far they extend.

Despite these limitations, our role models produced changes of notable effect size in sixth- and seventh graders' math interest, ability, and success expectancies; factors that predict future STEM attitudes and participation (Simpkins et al., 2006). Other role model interventions have improved middle schoolers' STEM-related outcomes (e.g., Good et al., 2003; Plant, Baylor, Doerr, & Rosenberg-Kima, 2009). Submitting STEM role models to *Pygmalion*-style feminine makeovers, however, may do more harm than good. A more fine-tuned approach is needed to benefit girls with different levels of STEM interest and to protect current STEM self-concepts.

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Notes

1. Chi-square analyses revealed that neither STEM identification, $\chi^2(1, N = 193) = 0.15$, $p = .70$, nor condition, $\chi^2(3, N = 193) = 1.81$, $p = .62$, predicted participants' likelihood of being dropped.
2. In pretesting, feminine role models were rated more feminine than gender-neutral role models, $t(15) = 5.91$, $p < .001$, but equivalently math-competent, $t(15) = -.85$, $p = .41$.
3. The same $2 \times 2 \times 2$ ANOVA found a marginal three-way interaction on likelihood of attending college, $F(1, 130) = 3.46$, $p = .065$. The simple femininity-by-domain interaction was significant only for STEM-disidentified participants, $F(1, 135) = 4.56$, $p = .04$. A simple effects analysis revealed that feminine STEM role models made these girls feel less likely to attend college ($M = 6.35$) than gender-neutral STEM role models ($M = 6.95$), $F(1, 133) = 4.20$, $p = .04$.

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