REPORT

PSYCHOLOGY

# Gender stereotypes about intellectual ability emerge early and influence children's interests

Lin Bian,[1,2]* Sarah-Jane Leslie,[3] Andrei Cimpian[1,2]*

**Common stereotypes associate high-level intellectual ability (brilliance, genius, etc.) with men more than women. These stereotypes discourage women's pursuit of many prestigious careers; that is, women are underrepresented in fields whose members cherish brilliance (such as physics and philosophy). Here we show that these stereotypes are endorsed by, and influence the interests of, children as young as 6. Specifically, 6-year-old girls are less likely than boys to believe that members of their gender are "really, really smart." Also at age 6, girls begin to avoid activities said to be for children who are "really, really smart." These findings suggest that gendered notions of brilliance are acquired early and have an immediate effect on children's interests.**

The career aspirations of young men and women are shaped by societal stereotypes about gender (*1*, *2*). For example, the stereotype that men are better than women at mathematics (*3*) impairs women's performance in this domain (*4*, *5*) and undermines their interest in mathematics-intensive fields (*6*, *7*). However, popular beliefs about ability associate not only specific cognitive processes (e.g., mathematical reasoning) with a particular gender but also the overall amount of cognitive ability. It is commonly assumed that high-level cognitive ability (brilliance, genius, giftedness, etc.) is present more often in men than in women (*8*–*11*). This "brilliance = males" stereotype has been invoked to explain the gender gaps in many prestigious occupations (*12*–*15*). However, little is known about the acquisition of this stereotype. The earlier children acquire the notion that brilliance is a male quality, the stronger its influence may be on their aspirations. The four studies reported here ($N$ = 400 children) show that, by the age of 6, girls are less likely than boys to believe that members of their gender are "really, really smart"—a child-friendly way of referring to brilliance. Also at age 6, the girls in these studies begin to shy away from novel activities said to be for children who are "really, really smart." These studies speak to the early acquisition of cultural ideas about brilliance and gender, as well as to the immediate effect that these stereotyped notions have on children's interests.

The stereotypes associating men but not women with brilliance and genius (*8*–*11*) may take a toll on women's careers; fields whose members place a great deal of value on sheer brilliance (e.g., mathematics, physics, philosophy) have lower proportions of women earning bachelor's and doctoral degrees (*12*–*17*). However, investigations of the "brilliance = males" stereotype that focus exclusively on participants of college age or older overlook a critical fact: Cultural messages about the presumed cognitive abilities of males and females are likely to be influential throughout development (*18*, *19*). If children absorb and act on these ideas (*3*, *20*, *21*), then many capable girls are likely to have already veered away from certain fields by the time they reach college. Thus, it is important to investigate the acquisition of the "brilliance = males" stereotype in early childhood, as children enter school and begin to make choices that shape their future career paths.

Study one examined the developmental trajectory of this stereotype in 96 children aged 5, 6, and 7 (32 children per age group; half boys, half girls). Children came mostly from middle-class backgrounds, and 75% were white. (The supplementary materials contain additional demographic information. However, across studies, children's race/ethnicity and socioeconomic status did not significantly moderate the results of interest.) We assessed children's endorsement of the "brilliance = males" stereotype with three tasks, presented in counterbalanced order (see the supplementary materials). In task (i), children were told a brief story about a person who was "really, really smart." No hints as to the protagonist's gender were provided. Children were then asked to guess which of four unfamiliar adults (two men, two women) was the protagonist of the story. In task (ii), children saw several pairs of same- or different-gender adults and guessed which adult in each pair was "really, really smart." In task (iii), children completed three novel puzzles in which they had to guess which objects (e.g., a hammer) or attributes (e.g., smart) best corresponded to pictures of unfamiliar men and women.

Across tasks and studies, the pictures depicted males and females matched for attractiveness and professional dress (potential cues to intelligence). In each task, we recorded the proportion of relevant trials on which children linked intellectual ability with people of their own gender; these proportions were then averaged into an own-gender brilliance score. As a comparison, we also elicited children's ideas about whether men versus women are "really, really nice." These two traits are differentially linked to gender in common stereotypes (*2*). As the relevant cultural notions are being assimilated, children's responses should likewise differentiate between these traits.

The results suggest that children's ideas about brilliance exhibit rapid changes over the period from ages 5 to 7. At 5, boys and girls associated brilliance with their own gender to a similar extent (Wald $\chi^2$ = 0.02, $P$ = 0.89) (Fig. 1A and table S2). The high scores are consistent with the overwhelming in-group positivity previously observed in boys and (especially) girls across early and middle childhood (*22*, *23*). Despite this strong tendency to view one's gender in a positive light, girls aged 6 and 7 were significantly less likely than boys to associate brilliance with their own gender (Wald $\chi^2$ = 8.10, $P$ = 0.004) (Fig. 1A). Thus, the "brilliance = males" stereotype may be familiar to, and endorsed by, children as young as 6. The stereotype associating females with being nice seems to follow a similar developmental trajectory (Fig. 1B).

In study two, we replicated our initial findings with a larger sample (144 children; 48 per age group). Children in this sample rated both adult and child targets. (Study one included only adult targets.) As before, there was no statistically significant difference in own-gender brilliance scores for 5-year-old boys and girls (Wald $\chi^2$ = 0.01, $P$ = 0.94), but a significant difference emerged starting at age 6 (Wald $\chi^2$ = 9.63, $P$ = 0.002) (Fig. 1C and table S2). This pattern did not differ significantly by whether children rated adult versus child targets (Wald $\chi^2$ = 1.42, $P$ = 0.23).

What might explain the drop in girls' evaluation of their gender's intellectual abilities? Although many factors are likely involved, in study two we tested whether this drop is associated with differences between younger (5-year-old) and older (6- and 7-year-old) girls in their perceptions of their school achievement—information that is, in principle, relevant to judging intelligence. These perceptions were measured with four questions similar to those we used to measure stereotypes (e.g., children had to guess which of four children, two boys and two girls, "gets the best grades in school"). In contrast with the drop in brilliance scores, there was no significant difference between younger and older girls in the likelihood of selecting other girls as having top grades ($t$ = 0.22, $P$ = 0.83) (fig. S1). Older girls were actually more likely to select girls as having top grades than older boys were to select boys

[1]Department of Psychology, University of Illinois, Champaign, IL 61820, USA. [2]Department of Psychology, New York University, New York, NY 10003, USA. [3]Department of Philosophy, Princeton University, Princeton, NJ 08544, USA.
*Corresponding author. Email: linbian2@illinois.edu (L.B.); andrei.cimpian@nyu.edu (A.C.)

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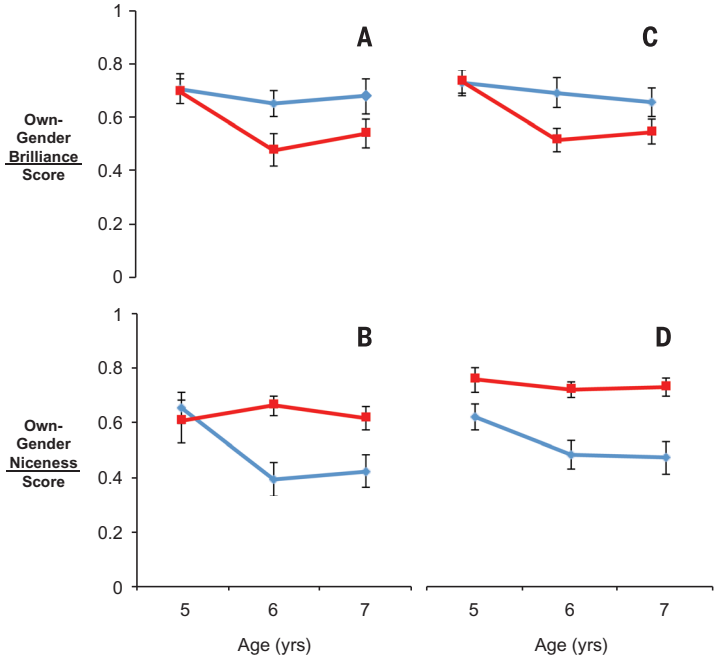


**Fig. 1. Results of studies one and two.** Boys' (blue) and girls' (red) stereotype scores in study one (**A** and **B**) and study two (**C** and **D**), by age group (5- versus 6- versus 7-year-olds). Error bars represent ± 1 SE.

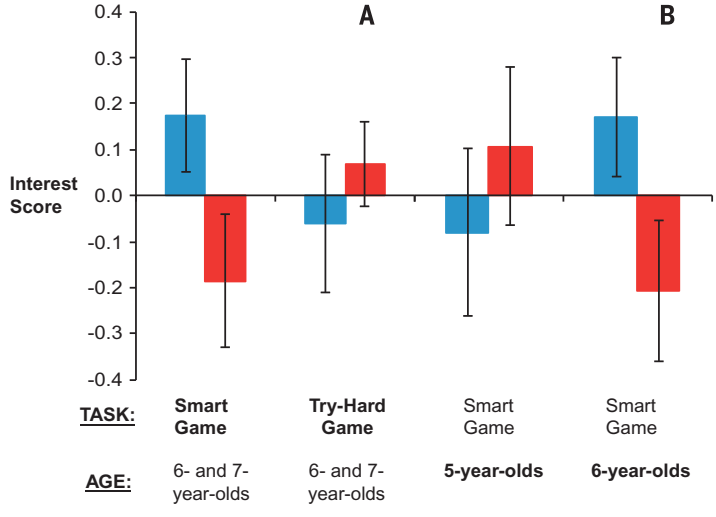


**Fig. 2. Results of studies three and four.** Boys' (blue) and girls' (red) interest (average of standardized responses to four questions) in novel games in study three (**A**) and study four (**B**). The main independent variable for each study (task in study three, age in study four) is shown in bold. Error bars represent ± 1 SE.

($t$ = 4.41, $P$ < 0.001), consistent with the reality that girls get better grades in school than boys at this age (*24*). Nevertheless, there was no significant correlation between girls' perceptions of school achievement and their perceptions of brilliance ($r$ = 0.11, $P$ = 0.34; for boys: $r$ = 0.38, $P$ = 0.001). Thus, girls' ideas about who is brilliant are not rooted in their perceptions of who performs well in school. [However, other aspects of children's experiences in school, such as teachers' attitudes and biases (*25*, *26*), may still be implicated in the development of this stereotype.]

In study three, we investigated whether children's gendered beliefs about brilliance shape their interests. Sixty-four children aged 6 and 7 (half boys, half girls) were introduced to two novel games, one said to be for "children who are really, really smart" and the other for "children who try really, really hard" (counterbalanced; see the supplementary materials). Children were then asked four questions to measure their interest in these games (e.g., "Do you like this game, or do you not like it?"). Girls were less interested than boys in the game for smart children (Wald $\chi^2$ = 4.02, $P$ = 0.045) but not in the game for hard-working children (Wald $\chi^2$ = 0.53, $P$ = 0.47) (Fig. 2A and table S3).

To test whether the gender differences in interest are related to children's beliefs about brilliance, we measured these beliefs with two items adapted from study one. Indeed, as with the 6- and 7-year-olds from the first two studies, girls' own-gender brilliance perceptions were lower than boys' ($t$ = 2.40, $P$ = 0.020). Moreover, these stereotyped beliefs mediated the relationship between children's gender and their interest in the game for brilliant (versus persistent) children: indirect effect = −0.11, 95% confidence interval = [−0.33, −0.004] (fig. S2). Thus, young children's emerging notions about who is likely to be brilliant are one of the factors that guide their decisions about which activities to pursue.

In study four, we compared 5- and 6-year-old boys' and girls' interest in novel games said to be "for children who are really, really smart" (96 children; 48 per age group; half boys, half girls). We predicted that 5-year-old boys' and girls' interest in these games would not differ because their ideas about brilliance are not yet differentiated (Fig. 1, A and C). In contrast, 6-year-old girls' interest was predicted to be lower than boys', in line with the results of study three. We found no significant gender differences in interest among 5-year-olds (Wald $\chi^2$ = 0.55, $P$ = 0.46) and a trend in the predicted direction among 6-year-olds (Wald $\chi^2$ = 3.66, $P$ = 0.056) (Fig. 2B and table S3). Combining the samples of 6- and 7-year-olds from studies three and four with a random-effects meta-analysis (*27*), we estimated the magnitude of the difference in boys' versus girls' interest toward the game for brilliant children to be $d$ = 0.51, 95% confidence interval = [0.13, 0.88], $P$ = 0.008.

We considered two possible alternative explanations for the results of studies one to four. First, because boys are sometimes held back from entering the formal schooling system (*28*), their understanding of intellectual ability may be delayed relative to girls' (*29*), which may inflate boys' confidence about their brilliance (*30*). However, the boys and girls in our sample did not enter school at different ages (e.g., the average chronological age for first-grade boys and girls was 6.87 and 6.72 years, respectively; $t$ = 1.28, $P$ = 0.20). Moreover, own-gender brilliance scores did not differ for boys who had already entered first grade versus those who had not ($M_{before}$ = 0.70 versus $M_{after}$ = 0.67; $t$ = 0.33, $P$ = 0.74), but these scores differed for girls ($M_{before}$ = 0.71 versus $M_{after}$ = 0.56; $t$ = 2.16, $P$ = 0.037). Second, because women are subject to stronger modesty norms than men (*31*), perhaps 6- and 7-year-old girls' lower interest in the games for brilliant children (studies three and four) was due to an increase in concerns about modesty. Contrary to this alternative, children in the age range we tested are notoriously boastful about their abilities (*30*). Moreover, the difference in boys' versus girls' interest in the brilliance games was specifically mediated by their perceptions about brilliance, pinpointing these stereotyped perceptions (rather than modesty) as the underlying mechanism. Notably, our measure of the "brilliance = males" stereotype is not susceptible to the modesty explanation: Modesty norms dictate that a woman should not boast about her own smarts (*32*, *33*), whereas we asked children to judge whether other people were smart.

It will be important to test whether these findings extend beyond a middle-class, majority-white U.S. cultural context and to comprehensively investigate the sources of the "brilliance = males" stereotype in children's environments. Nevertheless, the present results suggest a sobering conclusion: Many children assimilate the idea that

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brilliance is a male quality at a young age. This stereotype begins to shape children's interests as soon as it is acquired and is thus likely to narrow the range of careers they will one day contemplate.

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## SUPPLEMENTARY MATERIALS

www.sciencemag.org/content/355/6323/389/suppl/DC1
Materials and Methods
Supplementary Text
Figs. S1 and S2
Tables S1 to S5
References (*34*, *35*)

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Lin Bian, Sarah-Jane Leslie and Andrei Cimpian

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**Emergent attitudes toward brilliance**

The distribution of women and men across academic disciplines seems to be affected by perceptions of intellectual brilliance. Bian *et al.* studied young children to assess when those differential perceptions emerge. At age 5, children seemed not to differentiate between boys and girls in expectations of "really, really smart"—childhood's version of adult brilliance. But by age 6, girls were prepared to lump more boys into the "really, really smart" category and to steer themselves away from games intended for the "really, really smart."

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