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## Cognitive consistency and math–gender stereotypes in Singaporean children



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### ABSTRACT

In social psychology, cognitive consistency is a powerful principle for organizing psychological concepts. There have been few tests of cognitive consistency in children and no research about cognitive consistency in children from Asian cultures, who pose an interesting developmental case. A sample of 172 Singaporean elementary school children completed implicit and explicit measures of math–gender stereotype (*male = math*), gender identity (*me = male*), and math self-concept (*me = math*). Results showed strong evidence for cognitive consistency; the strength of children's math–gender stereotypes, together with their gender identity, significantly predicted their math self-concepts. Cognitive consistency may be culturally universal and a key mechanism for developmental change in social cognition. We also discovered that Singaporean children's math–gender stereotypes increased as a function of age and that boys identified with math more strongly than did girls despite Singaporean girls' excelling in math. The results reveal both cultural universals and cultural variation in developing social cognition.

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### Introduction

Cognitive consistency refers to an intra-individual psychological pressure to self-organize one's beliefs and identities in a balanced fashion. Despite the widespread influence of the concept of cognitive consistency in theories of adult social psychology, there has been relatively little research on cognitive consistency in Asian countries and none with Asian children. It is currently unknown whether the

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principles of cognitive consistency operate across diverse age groups and cultures. Asian cultures such as Singapore pose an interesting test of theory because consistency is a drive to balance representations bearing on the *self*, and Singapore is classified as a “collectivist” culture with less emphasis on the individual than in Western cultures (Brewer & Chen, 2007). We assessed the math–gender stereotypes held by Singaporean elementary school students, along with their math self-concepts and gender identity, to provide the first developmental test of cognitive consistency in an Asian society.

On standardized math assessments, Singaporean children outperform North American children. Based on two standardized international evaluations of school achievement, the Trends in International Mathematics and Science Study (TIMSS) and the Program of International Student Assessment (PISA), Singaporean children rank near the top of the international rankings. For example, Singapore has participated in every cycle of TIMSS testing (1995–2007), and its elementary and middle school students—both boys and girls—were among the top three in the world in mathematics in each assessment. Moreover, Singaporean girls scored higher than Singaporean boys. The math–gender stereotypes of Singaporean elementary school children have not been assessed. Thus, we do not know whether Singaporean girls—who are among the world leaders in math achievement (including both genders)—hold the pervasive North American stereotype that “math is for boys.”

In North American children (hereafter “American”), there is a strongly held stereotype about who does math. Both boys and girls demonstrate stereotypical beliefs that mathematics is associated more with males than with females (Ambady, Shih, Kim, & Pittinsky, 2001; Cvencek, Meltzoff, & Greenwald, 2011; Gunderson, Ramirez, Levine, & Beilock, 2012; Heyman & Dweck, 1998; Steele, 2003). Traditionally, these stereotypical beliefs about gender and math have been measured through explicit measures, for example, by explicitly asking children how much they *like* math or who they think is *good at math* and relying on their self-report (e.g., Eccles, Wigfield, Harold, & Blumenfeld, 1993; Herbert & Stipek, 2005; Heyman & Legare, 2004; Lummis & Stevenson, 1990).

More recently, psychologists have adopted testing procedures that do not rely on verbal self-report but instead tap more unconscious, implicit, and automatic aspects of cognition (Bargh, 1994; Devine, 1989; Jacoby, 1991). The implicit measurement of social cognition derives from social psychology literature (Greenwald & Banaji, 1995; Greenwald et al., 2002), and recently implicit methods have been adapted for use with young children (e.g., Baron & Banaji, 2006; Cvencek, Greenwald, & Meltzoff, 2011; Killen, McGlothlin, & Henning, 2008). In this framework, children who strongly associate the category *math* with *boy* (relative to *girl*) can be said to exhibit the math–gender stereotype, at least at an implicit level. It has been proposed that the implicit social cognition may be shaped by early developmental experiences to a greater extent than the explicit cognition (Liben & Bigler, 2002; Rudman, 2004), which suggests a value of using both types of measures to explore development. In the current experiment, we assessed math–gender stereotypes using *both* implicit and explicit measures with the *same* children in Singapore.

According to Steele’s (2003) stereotype stratification model, it possible that one might not find evidence of children having a stereotype about boys’ and girls’ math ability because targets of a negative stereotype might think of themselves as belonging to a subgroup to which the negative stereotype does not apply. One of our foci in this study was assessing children’s implicit associations between a social group and an academic domain (i.e., *boy = math*). This does not prejudge whether or not children have the explicit belief that boys *like* math or whether they personally endorse the stereotype about the math *ability* of boys and girls. Our implicit measure may be more akin to the formulation that *math = boys* or math “goes with” boys than it is about “liking” or a reflection on the underlying “ability” of boys versus girls. These constructs may or may not overlap, and admittedly there is no magic bullet for assessing math–gender stereotypes in the developmental literature at this time.

Cvencek, Meltzoff et al. (2011) showed that math–gender stereotypes emerge by second grade in American children, and these stereotypes do not significantly change through fifth grade. Aside from Lummis and Stevenson’s (1990) study, which was restricted to explicit (self-report) measures, there have been no other investigations of math–gender stereotypes in Asian elementary school children, and there is no such work using implicit measures.

Studying the development of math–gender stereotypes and math self-concepts in Singaporean children presents an interesting test for theory because of Singaporean children’s excellence in mathematics (Mullis, Martin, & Foy, 2008). Two alternatives are equally plausible. On the one hand,

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