



Associations between empathizing-systemizing cognitive style and mental rotation task performance among homosexual men and women in China



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ABSTRACT

Empathizing-systemizing cognitive style is related to mental rotation ability among heterosexuals. We sought to determine whether there is also an association between a measure of empathizing-systemizing and mental rotation task performance via the Internet among homosexual men and women (372 men and 469 women) in China. We found that systemizing, but not empathizing, scores were positively correlated with mental rotation task performance in both homosexual men and women. When comparing by cognitive style, we found that homosexual individuals with a systemizing cognitive style performed significantly better on the mental rotation task than did those with an empathizing style. Our results indicate a consistency across cultures and sexual orientations in the association between systemizing and mental rotation task performance.

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1. Introduction

Empathizing-systemizing theory is well known in the study of psychological sex differences (Baron-Cohen, 2003; Baron-Cohen, Richler, Bisarya, Gurunathan, & Wheelwright, 2003; Baron-Cohen & Wheelwright, 2004). “Empathizing” refers to the drive to identify others’ mental states and respond to such states with the appropriate emotion (Baron-Cohen, 2003), whereas “systemizing” is the drive to analyze and construct rule-based systems (Baron-Cohen et al., 2003; Wheelwright et al., 2006). According to this theory, the female brain is relatively hardwired to engage in empathizing, whereas the male brain seems hardwired for systematizing (Baron-Cohen, 2003; Baron-Cohen, Knickmeyer, & Belmonte, 2005). The theory further predicts that individuals play different roles—namely, the empathizer or the systemizer. The empathizer intuitively determines how people are feeling and how to treat people with care and sensitivity, whereas the systemizer determines how things work and what the underlying rules are in a given system (which can include anything from a pond, vehicle, computer, or plant, to a library catalogue, musical instrument, math equation, or army unit).

Women tend to score higher than do men on self-report measures of empathizing, whereas men score higher on those of systemizing (Baron-Cohen & Wheelwright, 2004; Baron-Cohen et al., 2003). It

remains unclear, however, how empathizing and systemizing differ according to sexual orientation. One study reported that homosexual men scored significantly higher on measures of empathizing than did heterosexual men (Sargeant, Dickins, Davies, & Griffiths, 2006); in contrast, another study found no differences in empathizing and systemizing scores between homosexual and heterosexual men (Nettle, 2007), but did note that homosexual women scored higher on systemizing measures than did heterosexual women.

There is a similar inconsistency in results regarding the relationship between sexual orientation and mental rotation. Some studies have reported that heterosexual men performed better than did homosexual men in mental rotational tasks (e.g. Rahman & Wilson, 2003), whereas others reported that homosexual women performed better than did heterosexual women (e.g., Peters, Manning, & Reimers, 2007; Rahman & Wilson, 2003). Still other studies have reported no association between sexual orientation and mental rotation task performance (e.g., Gladue & Bailey, 1995). In contrast, researchers have consistently found medium-to-large sex differences, favoring men, in mental rotation task performance; more specifically, men tend to have better mental rotation performance than do women (e.g., Collins & Kimura, 1997; Lippa, Collaer, & Peters, 2010). This has been confirmed via a meta-analysis (Voyer, Voyer, & Bryden, 1995).

Sex differences in certain abilities (e.g., mental rotation) may reflect evolutionary pressures that humans faced in prehistory, including the division of labor between the sexes for hunting/navigation and childcare (Baron-Cohen, 2008; Ecuycer-Dab & Robert, 2004). It is possible that both mental rotation and systemizing exhibit male advantages

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because they reflect sexual selection pressures faced by males (e.g. [Ecuyer-Dab & Robert, 2004](#)). Furthermore, from an evolutionary perspective, systemizing ability may be related to mental rotation because of these male advantages. Indeed, a study among heterosexuals reported an association between a measure of empathizing-systemizing and mental rotation task performance ([Cook & Saucier, 2010](#)). Another study reported that a measure of systemizing was correlated with scores on the non-rotational component, but not the rotational component, of a mental rotation task ([Brosnan, Daggan, & Collomosse, 2010](#)).

Despite evidence for associations between empathizing-systemizing and mental rotation performance ([Brosnan et al., 2010](#); [Cook & Saucier, 2010](#)), past studies were entirely based on Western samples. This makes it unclear whether the associations between empathizing-systemizing and mental rotation have cross-culture consistency. Chinese culture differs considerably from Western cultures, with the former being heavily influenced by Confucianism and considered a collectivistic culture, and the latter being considered primarily individualistic. Collectivistic cultures such as China consider harmony an essential value, which suggests that both Chinese men and women would score high on empathizing; in other words, it is possible that there would be no clear sex differences in empathizing among Chinese individuals, unlike in Western individuals. If the associations between empathizing-systemizing and mental rotation performance are consistent across cultures, the hypothesis that biological factors underlie these associations would be supported ([Lippa, 2008](#)).

Another gap in the literature regarding the associations between empathizing-systemizing and mental rotation performance ([Brosnan et al., 2010](#); [Cook & Saucier, 2010](#)) is that all previous studies showing such associations included heterosexual individuals. Homosexual individuals tend to have the opposite-sex profile for both empathizing-systemizing ([Sargeant et al., 2006](#); [Zheng & Zheng, 2015](#)) and mental rotation performance ([Rahman & Wilson, 2003](#)), although the findings are somewhat conflicting on this point. There do appear to be variations in empathizing-systemizing and mental rotation among homosexual individuals; however, it remains unclear whether these variations are simultaneous and in the same direction among homosexual individuals.

Based on this background, we explored the association between empathizing-systemizing and mental rotation among homosexual individuals in China. If such an association does exist, as has been found among heterosexual individuals, then it will be evidence of a covariance between empathizing-systemizing and mental rotation among homosexual men and women.

2. Method

2.1. Participants

[Table 1](#) shows the demographic composition of our sample by sex. Participants were 372 homosexual men and 469 homosexual women. The mean age of the sample was 23.0 years ($SD = 5.5$; range: 16–56). The majority (51%) of the sample were full-time employees, while the

remaining 49% were students. Furthermore, 54 (6.4%) participants had a junior high school education or less, 235 (27.9%) had a high school education, 492 (58.5%) held a bachelor's degree, and 60 (7.1%) had received a postgraduate education or higher.

2.2. Procedure

This study was conducted online via a Chinese survey website (www.sojump.com). Participants were recruited from several Chinese websites catering to homosexual men and women, including various forums and QQ (a popular chat software in China) groups. Only participants who were 16 years of age or older were included in the present study. The internet protocol (IP) addresses of the respondents were used to identify and exclude duplicate questionnaires. Participants initially completed a questionnaire on their demographic information and empathizing-systemizing scores, after which they completed the mental rotation task.

2.3. Measures

2.3.1. Sex and sexual orientation

Participants reported their sex using a drop-down menu that asked them to select one of two responses: *male* or *female*. Sexual orientation was assessed via 3 items. First, participants answered the question “What is your sexual orientation?” by selecting one of 3 response options from a drop-down menu: *heterosexual*, *homosexual*, or *bisexual*. They then went on to answer the questions “How sexually attracted are you to men?” and “How sexually attracted are you to women?” using 7 radio buttons corresponding to a 7-point Likert-type scale; response options ranged from 1 (*not at all*) to 7 (*very*).

Some of the participants showed inconsistencies in their responses to the 3 items assessing sexual orientation. Thus, we employed the following screening system to avoid possibly obfuscation of our results: To be classified as *homosexual*, a man/woman had to describe himself/herself as *homosexual* in the first item and had to report a greater amount of sexual attraction to the same sex than to the opposite sex on the other 2 items. Participants who described themselves as *heterosexual* or *bisexual* were excluded from the data analysis entirely.

2.3.2. Empathizing-systemizing

We used two abbreviated 8-item scales to assess empathizing and systemizing, based on the original scales created by [Baron-Cohen et al. \(2003\)](#) and [Baron-Cohen and Wheelwright \(2004\)](#), respectively. Example empathizing items are “I really enjoy caring for other people” and “I can easily tell if someone else is interested or bored with what I am saying.” Example systemizing items are “I rarely read articles or web pages about new technology” and “I am fascinated by how machines work.” For each item, the statement would appear on the screen with 4 response options: *strongly agree*, *agree*, *disagree*, and *strongly disagree*. Following the scoring procedure adopted in previous studies ([Baron-Cohen et al., 2003](#)), “strongly agree” responses were given two points, “agree” responses one point, and “strongly disagree” and “disagree” responses zero points. We then calculated the total score of each measure by summing the item scores, with the range in possible scores being 0–16. The Chinese versions of the systemizing and empathizing scales were obtained from the Autism Research Center's website (<http://www.autismresearchcentre.com>); the original Chinese versions were developed by Cheng and Hung of National Yan-Ming University. The Cronbach's alpha coefficients for the systemizing scale for homosexual men and women were 0.73 and 0.71, respectively, while those for the empathizing scale were 0.74 and 0.75.

2.3.3. Mental rotation

A short, 6-item three-dimensional (3D) mental rotation test, selected from a mental rotation stimulus library ([Peters & Battista, 2008](#)), was

Table 1
Demographic variables by sex.

	Homosexual men $n = 372$	Homosexual women $n = 469$
Age (in years)		
M	23.8	22.3
SD	5.5	5.3
Educational level N (%)		
Junior high school or less	21 (5.6)	33 (7.0)
Senior high school	83 (22.3)	152 (32.4)
College	236 (63.4)	256 (54.6)
Postgraduate or higher	32 (8.6)	28 (6.0)
Occupation N (%)		
Students	178 (47.8)	237 (50.5)
Employed	194 (52.2)	232 (49.5)

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