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The relationship between computer-game preference, gender, and mental-rotation ability

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Abstract

This study examined how computer-game preference relates to mental-rotation test (MRT) performance and to gender differences. Subjects were 861 German secondary-school children (mean age = 14.67; range 10–20 years). Latent class analysis with the data of a computer-game preference scale revealed three types of players: "non-players", "action-and-simulation game players" and "logic-and-skill-training game players". Large gender differences were found with respect to class assignment. More females than males were found in the "logic-and-skill-training game player" class (82.9%) and in the class of "non-players" (81.9%). Males in contrast were overrepresented (81.7%) in the class of "action-and-simulation game players". As expected, males on average outperformed females in mental-rotation test performance ($d = 0.63$). Furthermore, ANOVA results indicated mean differences in mental-rotation ability between action-and-simulation players and non-players (partial $\eta^2 = .01$) as well as age differences (partial $\eta^2 = .04$). With boys, non-players on average had lower MRT scores than action-and-simulation game players. For females, computer-game preference was unrelated to MRT performance. Results are discussed within a nature–nurture-interactionist framework of gender differences in spatial abilities.

Keywords: Spatial ability; Mental-rotation; Computer-games; Gender differences

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1. Introduction

Gender differences in spatial abilities are well established (Harris, 1981; McGee, 1979). They depend upon many factors like the subdimension of spatial ability (e.g., mental-rotation or visualization), the speed requirement of the test or the test instruction. One of the largest and most reliable gender differences in favour of males can be found in mental-rotation. Here the effect sizes *d* range from .56 to over 1.10 (e.g., Halpern, 2000; Linn & Peterson, 1985; Voyer, Voyer, & Bryden, 1995).

However, the causes of these differences still remain unclear. Explanations have usually been cast in terms of the nature–nurture controversy (McGee, 1979). On the nature side of the issue biological factors such as genetics, brain lateralization or sex hormones are hypothesized to influence the sex differences (Baron-Cohen, 2003; Hampson, 1990; Kimura, 1992; McGee, 1979). While on the nurture side, socialization and early life experience such as sex-typed play (Denier & Serbin, 1983; Serbin & Connor, 1979), spatial activities (Baenninger & Newcombe, 1989, 1995; Olson & Eliot, 1986), outdoor games involving balls (Bjorklund & Brown, 1998), motivation, self-concept, efficacy, and control have been proposed as explanations for the gender differences (Eccles, 1987).

Many studies revealed that experience has a clear effect on spatial abilities. On the one hand, numerous *training studies* (e.g., Alington, Leaf, & Monaghan, 1992; Connor, Serbin, & Schackman, 1977; Kyllonen, Lohmans, & Snow, 1984; McGee, 1979; Platt & Cohen, 1981; Richardson, 1994) have shown that spatial-test performance can be improved through practice. On the other hand, an improvement of spatial-test performance can also be induced by a training of geometrical skills (Kirby & Boulter, 1999). Furthermore, schooling has a large effect on spatial abilities. For instance, the number of mathematics courses taken is related to spatial-test performance (Burnett & Lane, 1980; Casey, Colon, & Goris, 1992). An investigation using the summer vs. school year design has shown that for kindergarten and first-grade children, growth in spatial ability is more rapid during the school year than during the summer (Baenninger & Newcombe, 1995).

Lately, the study of the role of training and experience for individual differences in spatial-test performance has been expanded to computer-related experiences including computer-games (McClurg & Chaillé, 1987; Subrahmanyam & Greenfield, 1994). Playing the computer-game 'Blockout', for example, which requires mental-rotation of geometric figures (De Lisi & Cammarano, 1996) and playing the computer game 'Tetris', which requires rapid rotation and placement of seven differently-shaped blocks, improved spatial-test performance (Ogakaki & Frensch, 1994).

Many computer applications (e.g., computer-aided design and drawing) and video games (such as Tetris) require spatial processes such as mental rotation and spatial visualization. In research conducted by Norman (1994), the spatial skill level was found to be the most significant predictor of success in the ability to interact with, and take advantage of the computer interface in performing database manipulation.

Technology usage, however, has been masculinized through computer-games and images in the media (Ware & Stuck, 1985). Computers are seen to be 'boys' toys and males indicate that they play computer-games more frequently than females (Alington et al., 1992; Goldstein, 1994; Peters, Chisholm, & Laeng, 1995). Females, on the other hand, seem to have higher levels of computer anxiety (Brosnan & Davidson, 1994). In a cross-cultural study (Sorby, Leopold, & Górska, 1999),