

# Memory for face locations: Emotional processing alters spatial abilities

Gerianne M. Alexander\*

*Department of Psychology, Texas A&M University, TAMU-4235, College Station, TX 77843, USA*

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## Abstract

The present study was designed to delineate further the female advantage in location memory by testing memory for faces that varied in their emotional expressions. A female advantage in face location was found, consistent with the implicit assumption that a female advantage in location memory is not dependent on the nature of the stimulus. However, exposure to threatening facial expressions abolished (in the instance of mental rotation) or reversed (in the instance of location memory) the characteristic sex differences in task performance. In both males and females, a brief exposure to sad facial expressions impaired subsequent performance on a targeting task. These findings suggest that sex differences in male and female spatial ability are not fixed or absolute but may be influenced by a sex-dimorphic affective system that is responsive to the immediate demands of a social context.

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## 1. Introduction

Although the cross-species distribution of sex differences in spatial ability can be better explained by other models (e.g., Gaulin & FitzGerald, 1986, 1989; Jacobs, Gaulin, Sherry & Hoffman, 1990; Sherry & Hampson, 1997), the division-of-foraging-labor model (Eals & Silverman, 1994; Silverman & Eals, 1992) can explain a female advantage on object-location

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\* Tel.: +1 979 845 2567; fax: +1 979 845 4727.

*E-mail address:* gma@psyc.tamu.edu.

memory in humans. On this latter view, differential selection pressures arising from hunting versus gathering activities put a premium on different spatial competencies in ancestral men and women. Accordingly, the cognitive demands of hunting favored male spatial abilities that enhanced the capture of animals, whereas the cognitive demands of gathering plant food favored female abilities to identify the shape and color of edible plants and to locate them by remembering their proximity to landmarks (e.g., a particular tree or rock). Consistent with this formulation, a present-day male advantage is reliably documented on a variety of spatial tasks that appear to support successful hunting, including spatial navigation (Moffat, Hampson, & Hatzipantelis, 1998), mental rotation (Linn & Petersen, 1974), and the accurate aiming of projectiles (Watson & Kimura, 1991). Furthermore, in tasks developed specifically to test the evolutionary hypothesis of a female advantage for spatial location memory, women outperform men in their memory for object locations in a visual spatial array (Eals & Silverman, 1994; Silverman & Eals, 1992).

Although the activities of gathering or hunting are thought to result in divergent selection on women's and men's spatial abilities, an implicit assumption of the methods that have been used to test the theory is that the nature of the stimulus is not strongly relevant to demonstrating a sex difference in task performance. Consistent with this possibility, men's greater efficiency at mental rotation has been demonstrated in tasks using real or schematic representations of three-dimensional objects (Robert & Chevrier, 2003) and schematic representations of 2-dimensional objects (Collins & Kimura, 1997). Similarly, women show an advantage in memory for the spatial location of common household objects (e.g., Eals & Silverman, 1994), as well as abstract shapes (McGivern et al., 1998).

Whereas the male advantage in many spatial tasks has been reliably documented (Linn & Petersen, 1974; Voyer, Voyer, & Bryden, 1995), less is known about the female advantage in spatial location memory. A goal of the present research was to test the hypothesis that the female advantage in location memory may generalize to a variety of stimuli by testing memory for face locations. Faces were selected as visual stimuli because, like abstract objects, faces are less compatible with verbal strategies that may afford a greater female advantage in location memory tasks (Chipman & Kimura, 1998; Galea & Kimura, 1993). The hypothesis that sex-typical spatial abilities may be evolved cognitive adaptations to foraging roles (Silverman & Eals, 1992) also implies that the female advantage in location memory does not generalize to other 'male-typical' spatial abilities (McBurney, Gaulin, Devineni, & Adams, 1997). For these reasons, in the present study, women and men completed a novel face location task and, for comparison, three spatial tasks that, in previous research, have shown a reliable male performance advantage.

## 2. Experimental methods

### 2.1. *The face location memory task*

A novel spatial memory task was constructed similar to the Silverman and Eals Location Memory task (Eals & Silverman, 1994; Silverman & Eals, 1992), which shows a female ad-

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