



## Females' superiority in item memory, but not source memory for neutral and emotional Chinese words

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### ABSTRACT

Although studies have shown females' superiority in episodic memory, it is unclear whether such superiority is modulated by emotionality of stimuli. Furthermore, episodic memory consists of two elements – item memory and source memory. It is unclear whether females have advantages in both elements. This study examined gender differences in item memory and source memory for neutral and emotional words. The major findings are that females were superior to males in item memory for neutral and emotional words but did not differ from males in source memory. Additionally, it is enhancement of recollection rather than familiarity, that contributed to females' superiority in recognition. The above findings highlight the need to differentiate elements of episodic memory in examining gender differences. Possible mechanisms underlying the above findings (e.g., gender differences in verbal strategies) were discussed.

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### 1. Introduction

Despite Maccoby and Jacklin's (1974) rejection of the hypothesis of gender differences in learning and memory, gender differences has increasingly attracted attention from psychologists over the past years. Particularly, gender differences in episodic memory has been the focus of many studies, which demonstrate that females outperform males in memory for words, pictures of objects, faces, and activities (Bengner et al., 2006; Herlitz, Nilsson, & Bäckman, 1997; Horgan, Mast, Hall, & Carter, 2004; Krueger & Salthouse, 2010; Lewin & Herlitz, 2002) and that males have better performance than females with regard to visuo-spatial memory (Lejbak, Crossley, & Vrbancic, 2011; Lewin, Wolgers, & Herlitz, 2001). Additionally, studies have shown females' superiority in memory for both positive and negative events (e.g., Canli, Desmond, Zhao, & Gabrieli, 2002; Fujita, Diener, & Sandvick, 1991; Kaushanskaya, Marian, & Yoo, 2011; Seidlitz & Diener, 1998; but see Dewhurst, Anderson, & Lauren, in press).

Episodic memory consists of item memory and source memory (Slotnick, Moo, Segal, & Hart, 2003). Item memory refers to recognition or recall of previously presented information itself, whereas source memory refers to recollection or recall of the context under which an item or fact is acquired (Johnson, Hashtroudi, & Lindsay, 1993). Behavioral and neuropsychological studies have provided evidence supporting the dissociation of item memory and source

memory (e.g., Glisky, Polster, & Routhieaux, 1995). However, the majority of prior research has only focused on gender difference in item memory, and it remains unclear whether females will also have superior source memory.

Recognition memory relies on two distinct memory processes: recollection and familiarity (Yonelinas, 2002). Recollection refers to conscious recollection of encoding details, whereas familiarity refers to recollection-free feeling of familiarity (Wixted, 2009). These two subprocesses of recognition can be probed by the “remember/know” paradigm (Tulving, 1985). There has been evidence supporting the dissociation of recollection and familiarity (e.g., Duarte, Ranganath, Winward, Hayward, & Knight, 2004). However, it is not known whether females' superiority in recognition is due to enhancement of recollection or of familiarity. Larson, Lövdén, and Nilsson (2003) found that, whether odors or sentences were used as the learning stimuli, recollection (i.e., recognition of some specific contextual recollection from the learning phase such as an association, image, or some other more personal experience) was higher among females than males. However, familiarity-based recognition (i.e., recognition in the absence of any specific contextual recollection from the learning phase) was equally large across sex for both types of information.

The above finding indicates that it is enhancement of recollection that contributes to enhancement of general recognition for females.

This study investigated whether females outperform males in terms of item memory and source memory for both neutral and emotional words. The memory-testing paradigm used in this study

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is similar to that used in previous studies (e.g., Siedlecki, Salthouse, & Berish, 2005). Based on prior studies (e.g., Canli et al., 2002; Lewin & Herlitz, 2002; Lewin et al., 2001; Seidlitz & Diener, 1998), we hypothesized that females would have better performance in item memory for both neutral and emotional words. Considering the dissociation of recollection and familiarity as the two processes underlying recognition (e.g., Larsson et al., 2003), we hypothesized that females' superiority in recognition would result from the enhancement of recollection rather than familiarity. Finally, given the dissociation of item memory and source memory (e.g., Slotnick et al., 2003), we hypothesized that females' superiority in item memory may not extend to source memory.

## 2. Method

### 2.1. Participants

Fifty-two undergraduates and graduate students (28 female and 24 male, mean age = 22.27 years, SD = 1.82 years, data of the age of three undergraduate students were missing) in Beijing attended this experiment. All participants reported themselves to be non-smoking and free from any emotional disorders. Participants were monetarily compensated.

### 2.2. Stimuli

One hundred and twenty Chinese words, including 40 neutral, 40 positive and 40 negative words, were evenly divided into set 1 and set 2 such that each set consists of 20 neutral words, 20 positive words, and 20 negative words. For the 120 words, pleasantness, arousal, concreteness was rated on a 9-point Likert-type scale. The two sets of words were matched in pleasantness ( $p = .929$ ), arousal ( $p = .983$ ), concreteness ( $p = .271$ ), and word frequency ( $p = .127$ ). In each set, positive words have greater pleasantness than both neutral and negative words (both  $p < .001$ ), and neutral words have greater pleasantness than negative words ( $p < .001$ ). Both positive and negative words have greater arousal than neutral words (both  $p < .001$ ), but arousal is comparable between positive and negative words ( $p = .117$ ). In addition, in each set, the three types of words do not significantly differ in abstractness and word frequency (in set 1, for abstractness,  $p = .398$ , for word frequency,  $p = .218$ ; in set 2, for abstractness,  $p = .331$ , for word frequency,  $p = .256$ ). Descriptive data for the two sets of words are presented in Table 1.

### 2.3. Design and procedure

A mixed design was used, with emotion (negative, positive, and neutral) as the independent variable and gender as the between-subjects variable. Performance of item memory and source memory are the dependent variables.

During the learning phase, in each trial a crosshair first appeared at the center of the screen for 1 s, followed by a word in either red or blue font (Courier New, font size = 40) appearing for 2 s, against a white screen background. Participants were asked to memorize both the words and their font colors. After the learning phase participants were given 5 min to recall the words. Following the free recall, the old words and new words were mixed and randomly presented at the center of the screen in the font color of black. Participants first determined whether they "remember" a word (consciously recollect its details), "know" a word (thought it to be only familiar but could not have any recollection of its details), or thought a word was new. When they decided that they "remember" or "know" a word, they then judged the color of

**Table 1**  
Descriptive data for the two sets of neutral, positive and negative words.

| Word set | Neutral words |              |              |                | Positive words |              |              |               | Negative words |              |              |                |
|----------|---------------|--------------|--------------|----------------|----------------|--------------|--------------|---------------|----------------|--------------|--------------|----------------|
|          | p             | a            | c            | wf             | p              | a            | c            | wf            | p              | a            | c            | wf             |
| Set 1    | 5.059 (.050)  | 4.947 (.045) | 4.854 (.149) | 0.0091 (.0038) | 6.307 (.068)   | 6.016 (.083) | 4.781 (.244) | 0.0263 (.014) | 2.440 (.090)   | 5.771 (.164) | 4.495 (.182) | 0.0070 (.0020) |
| Set 2    | 5.052 (.058)  | 4.947 (.051) | 4.884 (.177) | .0087 (.0045)  | 6.418 (.066)   | 6.010 (.105) | 4.691 (.197) | .0075 (.002)  | 2.417 (.071)   | 5.786 (.133) | 4.691 (.197) | .0024 (.0004)  |

Note: p = pleasantness; a = arousal; c = concreteness; wf = word frequency. Values in the parentheses represent standard errors. The values of wf came from Dictionary of Modern Chinese (Compiled by Beijing Institute of Languages).

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