

Original Article

Sex differences in search and gathering skills

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Abstract

The hunter–gatherer theory of sex differences states that female cognition has evolutionarily adapted to gathering and male cognition to hunting. Existing studies corroborate that men excel in hunting-related skills, but there is only indirect support for women excelling in gathering tasks. This study tested if women would outperform men in laboratory-based computer tests of search and gathering skills. In Experiment 1, men found target objects faster and made fewer mistakes than women in a classic visual search study. In Experiment 2, participants gathered items (fruits or letters presented on screen), and again, men performed significantly better. In Experiment 3, participants' incidental learning of object locations in a search experiment was studied, but no statistically significant sex differences were observed. These findings found the opposite of what was expected based on the hypothesis that female cognition has adapted to gathering. Alternative interpretations of the role of object location memory, female gathering roles and the division of labor between the sexes are discussed.

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Cognitive scientists have discovered that men and women perform with different speed and with different levels of accuracy in a variety of experimental paradigms (for an extensive review, see Halpern, 2000). An important part of the continuing research into cognitive sex differences is not only to identify performance differences, but also to develop theories that can explain broad patterns in the available data. In this respect, evolutionary psychologists have contributed a great deal by explaining cognitive sex differences as a function of evolutionary adaptation (for an elaborate review, see Geary, 2009). The current paper explores and tests the hypothesis that women are evolutionarily adapted to be good at gathering tasks, as originally proposed by Silverman and Eals (1992) and subsequently in a number of papers by the same group (Eals & Silverman, 1994; Silverman et al., 2000; Silverman, Choi, & Peters, 2007).

Silverman and Eals (1992) discovered that women have a better memory for object location than men, especially under incidental learning conditions. In their experiments, participants studied drawings of objects for a short time and were later shown drawings in which some objects had changed locations. Women outperformed men in identifying the locations of moved objects. Further, it was found that women

outperformed men in remembering the locations of objects they saw in a waiting room (without knowing that they had to remember them later). This finding has been replicated multiple times and confirmed meta-analytically (Voyer, Postma, Brake, & Imperato-McGinley, 2007). The finding contrasts with the many studies showing that men are better at tasks involving spatial cognition (Gaulin & Fitzgerald, 1986).

Silverman and Eals (ibidem) argued that the superior female performance in object location memory tasks reflects an evolutionary adaptation that supports women in gathering behavior. The idea that remembering locations can help gathering is based on the assumption that gatherers return to previously observed items of interest (e.g., food); hence, better object location memory should make one a better gatherer. At the time of their proposal, it was already well established that men outperformed women in a number of spatial abilities and that men's spatial skills might reflect a cognitive adaptation to hunting (Eals & Silverman, 1994; Gaulin & Fitzgerald, 1986; Tooby & DeVore, 1987). The finding that women outperformed men in a spatial skill showed that the distribution of spatial skills was not as simple as thought until then, and the new theory of Silverman and Eals offered an explanation.

The problem with the hypothesized link between object location memory and gathering is that this link is indirect (for an in-depth criticism, see Newcombe, 2010). While object

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location memory might occasionally help gathering, it is not a necessity for being a good gatherer. After all, gathering can take place in novel and rapidly changing environments. In contrast to object location memory, a logical necessity for good gathering is the capacity to search and find target objects amongst irrelevant objects. Therefore, if female cognition is optimized for gathering, it is reasonable to expect that women should be better than men in searching and finding objects, an advantage that might be related to sex differences in the visual-attention system.

A common paradigm to study searching and finding in humans is the visual search paradigm (Egeth & Yantis, 1997; Treisman & Gelade, 1980; Wolfe, 2003). In the simplest visual search paradigms, a number of objects are displayed on a computer screen, and a participant needs to press a button if a target object is present among distracter objects and withhold a response if it is not present. The response time (a.k.a. search time) is indicative of the time it takes to analyze the search area. Apart from the basic response time and accuracy measures, psychologists have studied how these measures depend on the number of items being shown in a search array. The more items there are, the longer it typically takes to find a target object. In visual search paradigms, this increase in search time due to more items can be expressed with the slope of the regression line. The steepness of the “search slope” might indicate the effectiveness of the search strategy being used, with shallower slopes indicating higher levels of efficiency (Treisman & Gelade, 1980)¹. Altogether, the visual search paradigm is a well-tested and effective paradigm that models a psychological activity common to daily life activities. If it could be demonstrated that women excel in visual search, this would be direct evidence for the women-do-the-gathering-because-they-are-better-at-it aspect of the hunter–gatherer theory.

Given that there are many studies on visual search, it is somewhat surprising that there are no studies comparing men and women in this task; one of the aims of this study is to fill this gap in our knowledge (Experiment 1). A further aim of this study is to test whether women are better in gathering (Experiment 2) and if this could be related to the advantages in object location memory (Experiment 3).

1. Experiment 1

1.1. Methods

1.1.1. Participants

Forty neurotypical men and forty neurotypical women (18–23 years old) participated in this study. All participants had normal or corrected to normal vision.

¹ Today, researchers are more cautious in interpreting the exact meaning of the search slope (Wolfe, 1998), and therefore the role of the search slope shall not play a central role in the current paper, although it is of interest for a complete report of the data.

1.1.2. Apparatus and stimuli

The experiment was controlled by a Linux-operated PC using the PsyToolkit software to present stimuli on a 17" color monitor and record responses (Stoet, 2010a). The target stimulus was an orange letter T. Distracter stimuli were a blue T and an upside-down orange T. Targets and distracters each were 16 mm high and 15 mm wide. Masking stimuli consisted of interleaved blue and orange rectangles (12 by 12 mm).

1.1.3. Procedure

Participants were seated in a quiet and dimly lit room behind the computer screen (with around 50 cm between eyes and screen), and received written and verbal instructions from the experimenter. There were 320 trials (in four blocks of 80 trials). The set size ranged from 5 to 20 items. Half the search displays had no target stimulus.

Each trial started with a fixation point for 100 ms, followed by a 400-ms delay, followed by the search display (Fig. 1). Participants had maximally 4 s to respond. In case participants did not respond to the presence of a target stimulus, the target location would be highlighted for 2 s to point out to the participants where the target they missed was (just as a matter of feedback). In case participants responded in the absence of a target stimulus, they were informed about their erroneous response for 2 s. All trials were followed by two masks, each shown for 100 ms. The interval between a response and the next search display lasted 600 ms.

1.2. Results

First, search times were analyzed. Search times of individual participants (correct responses only) were averaged for each condition and then analyzed with a mixed-design analysis of variance (ANOVA) with the between-subject factor “sex” (female vs. male) and the within-subject factor “set size” (5–20, Fig. 2). In the following, averages±1 standard error of the mean (S.E.M.) will be reported in parentheses. The analysis shows a main effect of sex, $F(1,78)=3.81, p=.05$. There was a sex difference in response speed, with men (756 ± 16) responding 44 ms faster than women (799 ± 16). Further, there was an effect of the set size,

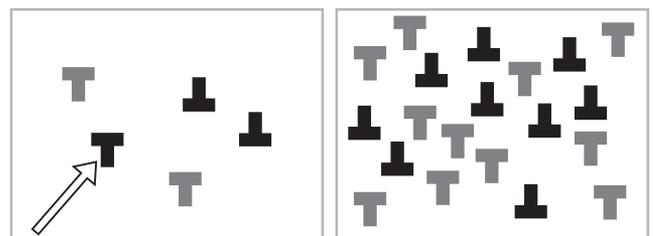


Fig. 1. Two examples of search displays. The examples are a schematic representation only. In reality, the screen was black (here white), the search target was orange (here black), and the distracter color was blue (here grey). In the example on the left, the search target is present (pointed at by arrow), but not in the example on the right. The number of items (set size) varied between 5 (example on the left) and 20 items (example on the right).

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