# Spatial Framing Effects and Sex Differences in Object Location Memory


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## Abstract


The current experiment investigated if sex differences in object location memory partially depend on the way the spatial task is framed: egocentric frame (observer-to-object spatial relations) or allocentric frame (object-to-object spatial relations). Participants explored a virtual maze while learning the location of six common objects within the maze. Participants recalled object location by placing objects within a top-down view of the maze and by pointing to objects from different locations within the maze. Contrary to our predictions, neither sex nor task framing significantly affected object location memory. Data collection is ongoing. Follow-up experiments will test more powerful manipulations of spatial framing.


## Background

- Men and women use different spatial encoding strategies. Men primarily use **allocentric encoding** [representing objects in terms of other objects], while women primarily use **egocentric encoding** [representing objects in terms of oneself] (Nowak, Murali, & Driscroll, 2015; Madson & Trafimow, 2001).
- Many spatial ability measures favor the allocentric encoding strategy, which might create a bias in measuring males' versus females' abilities.
- Women performed significantly worse on a perspective-taking task when encouraged to think in terms of spatial perspective-taking; however, sex differences disappeared when they were encouraged to think in terms of social perspective-taking (Tarampi, Heydari, & Hegarty, 2016).

## Research Question and Hypotheses

**Research Question:**

- Do sex differences for object location memory depend on the way the memory tasks are framed?

**Hypotheses:**

- Main effect of sex: Males will have better object location memory than females.
- Interaction: Males will have better object location memory than females in the allocentric condition, but not in the egocentric condition.
- Higher self-reported spatial skills will predict better memory for object location memory.

## Sample

- N = 89 (32 males; 55 females; 2 not reported)
- $M_{age}$ = 19.18, *SD* = 0.97, age range = 18-22 years)
- 62% first year students

## Method

**1.Training Phase**

Teach participants to:

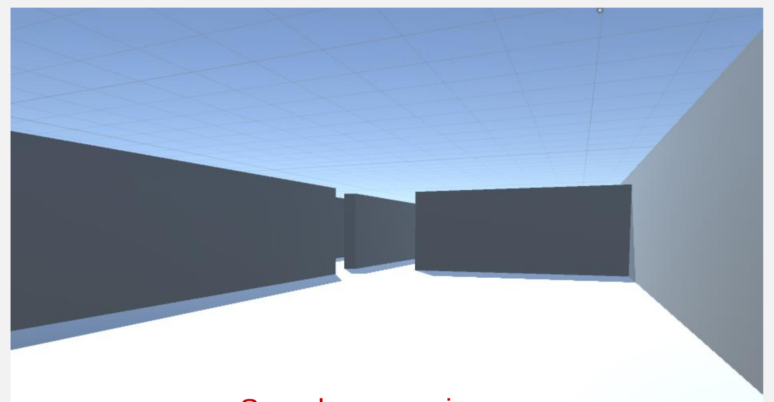
- Look around in VR
- Use remote controls to move
- Navigate in VR

**2. Learning Phase**

- 5 minute free exploration in maze
- Learn maze layout
- Learn location of 6 objects

**3. Questionnaires**

- Demographics
- Video game and VR experience
- Way Finding Strategy Scale
- Santa Barbara Sense of Direction

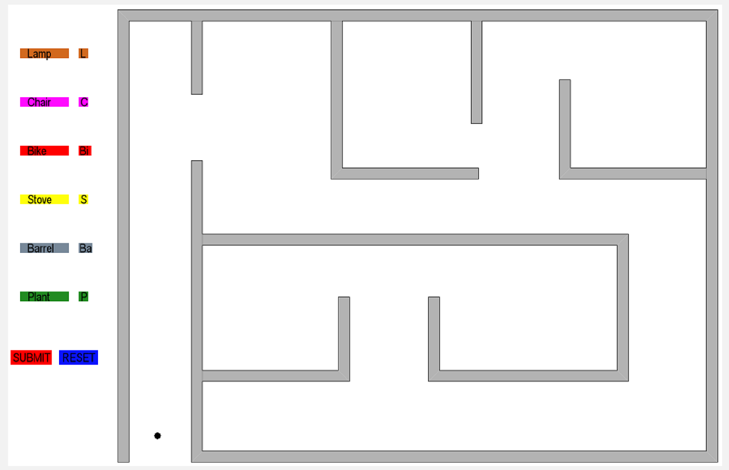


Sample maze view

### Allocentric Condition

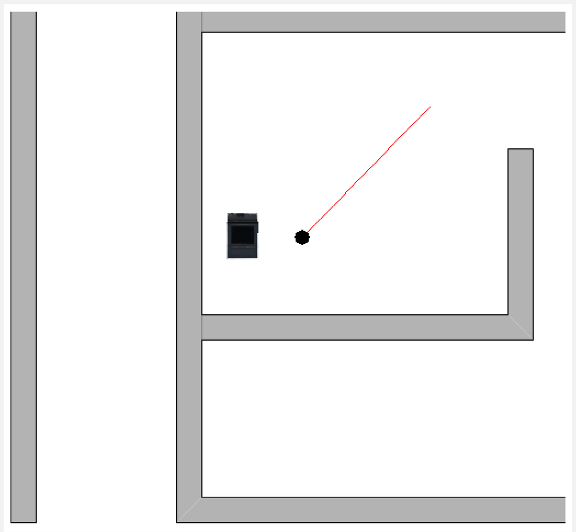
**Map Placement Task**

The dot represents the starting location. Drag and drop the objects to where you think they were in the maze.



**Angular Pointing Task**

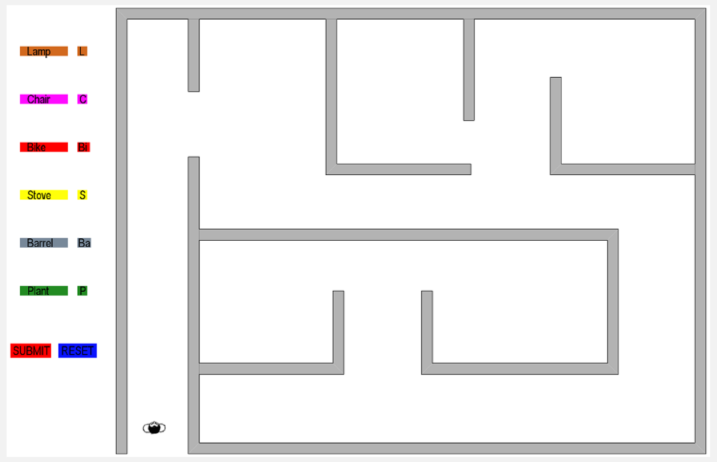
Look at the dot next to the (1st object name). Draw an arrow to the (2nd object name) relative to the dot.



### Egocentric Condition

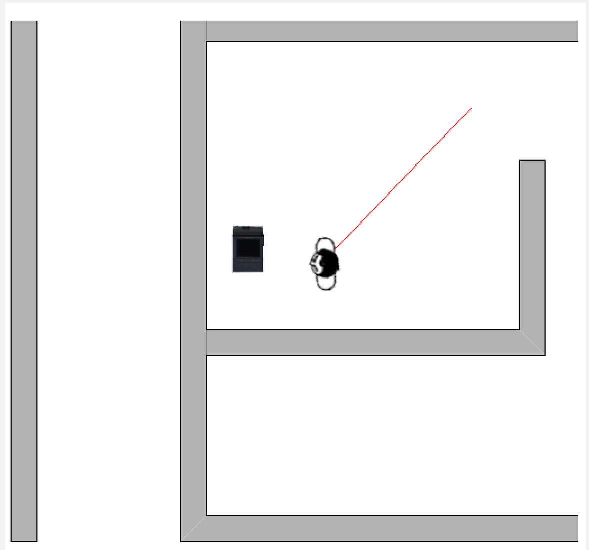
**Map Placement Task**

Imagine you are the person standing at the starting location. Drag and drop the objects to where you think they were in the maze.



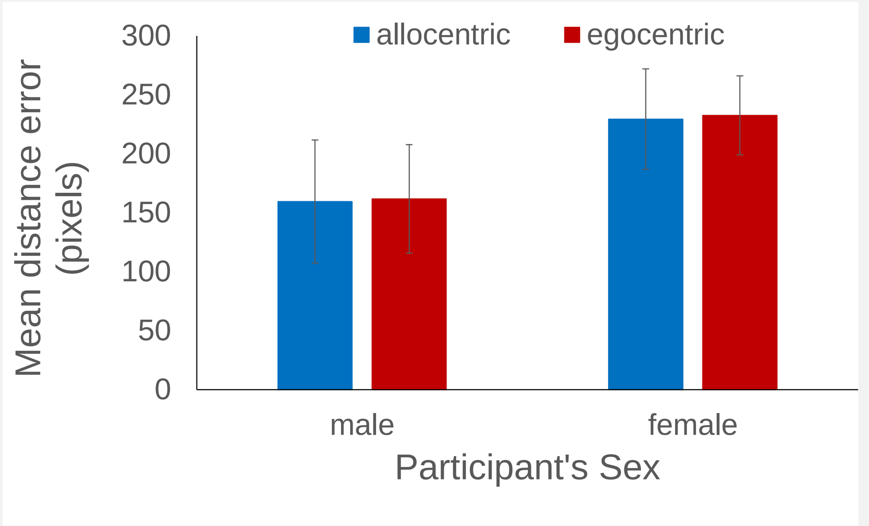
**Angular Pointing Task**

Imagine you are the person standing next to the (1st object name). Draw an arrow to the (2nd object name) relative to yourself.



## Results

**Object Placement Task**

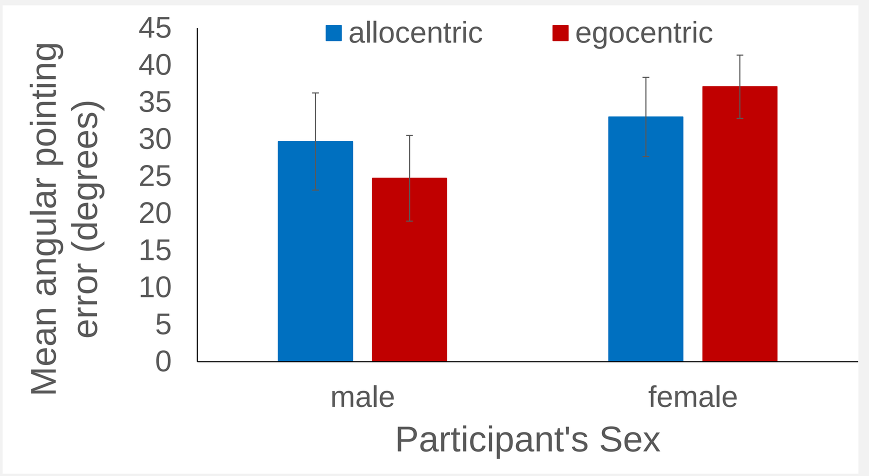



Task Frame:
*F* (1, 83) = 0.004, *p* = .951

Sex:
*F*(1,83) = 2.54, *p* = .115

Task Frame x Sex
*F*(1,83) = 0.00, *p* = .991

**Angular Pointing Task**




Task Frame:
*F* (1, 83) = 0.005, *p* = .944

Sex:
*F*(1,83) = 1.97, *p* = .164

Task Frame x Sex
*F*(1,83) = 0.65, *p* = .423

**Questionnaires**

- Stronger sense of direction correlated with lower distance error ($r$ = -.44, $p$ < .001) and lower angular error ($r$ = -.40, $p$ < .001).
- There was no significant relationship between route strategy and distance error ($r$ = -.05, $p$ = .62) or angular error ($r$ = .06, $p$ = .56).

## Conclusions & Discussion

- Sex and task framing did not affect memory for object location.
- Higher self-reported spatial skills, but not spatial strategy, predicted better memory for object location.
- Currently have an uneven sample of males and females.
- Further validation of the map placement task is needed. It currently cannot distinguish errors that occur within rooms versus between rooms in the maze, even if absolute errors are similar.
- In the current experiment, participants encoded information in a 3D virtual environment but were tested in a 2D computer environment. Future research should test participants in a 3D space.

## References


- Madson, L., & Trafimow, D. (2001). Gender comparisons in the private, collective, and allocentric selves. *The Journal of Social Psychology, 141*(4), 551-559.
- Nowak, N. T., Murali, N., & Driscoll, I. (2015). Factors related to sex differences in navigating a computerized maze. *Journal of Environmental Psychology, 43*, 136-144.
- Tarampi, M. R., Heydari, N., & Hegarty, M. (2016). A tale of two types of perspective taking: sex differences in spatial ability. *Psychological Science, 27*(11), 1507-1516.