



# Map Use in Williams Syndrome: Patterns of Sparing and Vulnerability In Spatial Cognition

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## Background

- Individuals with Williams Syndrome (WS) share a unique cognitive profile that includes severely impaired visuospatial abilities paired with intact language and communication.<sup>1</sup>
- The etiology of WS can be traced to a spontaneous deletion of approximately 28 genes on chromosome 7q11.23.<sup>2</sup> The disorder affects one in 10,000 births.<sup>2</sup>
- Previous work indicates that individuals with WS have a strong understanding of symbolic representations,<sup>3</sup> which could implicate successful map use, but a weak understanding of spatial relationships,<sup>2</sup> which could result in poor navigation.
- This paradox leads us to question how individuals with WS might draw on various spatial features, such as Euclidean geometry, in maps to navigate real-world environments.

## Research Questions

1. Will WS participants succeed on a map-reading task, as indicated by above-chance performance?
  - a. Will WS participants perform above chance at Target A, showing that they understand the correspondence between spatial information presented symbolically in a map and the matching real-world array?
  - b. Will WS participants perform above chance at Target B, showing the ability to use the spatial information as a relational cue?
2. Will WS participants perform worse in certain conditions than other conditions, exposing specific areas of vulnerability?

## Participants

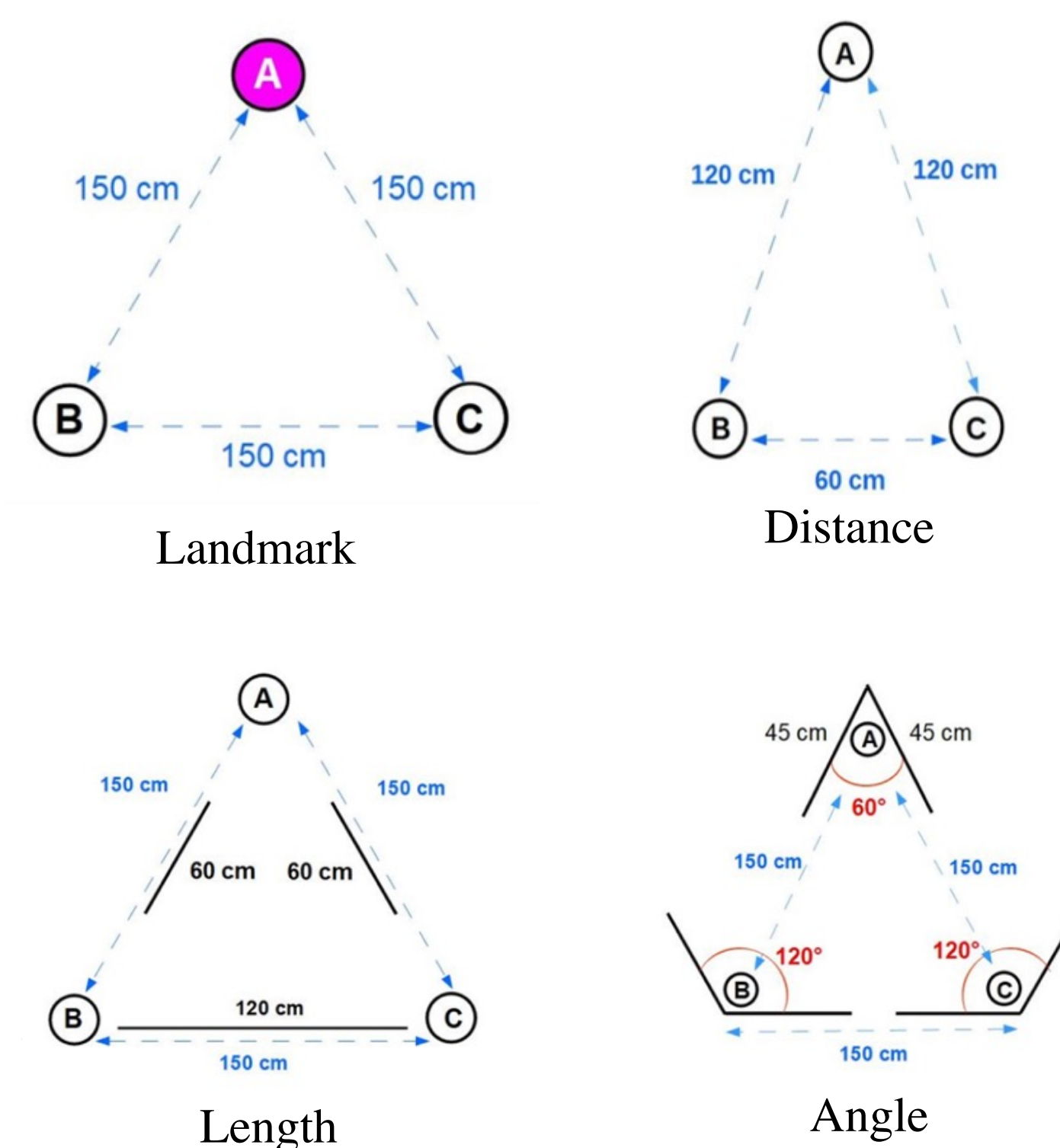
- N = 77
- WS = 26 children and adults (13 female; mean age = 22 years; 2 months, range = 6;6 – 41;9)
- TD = 51 children (24 female; mean age = 7;11, range = 3;8 – 13;0).
- All participants were from Italy.

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## Methods

### Experimental Conditions



### Procedure

1. The experimenter showed a map to the child, pointing to the star while saying, "Look, there's a map with boxes drawn on it, and only inside one of them is a little star. Can you turn around and put this toy in one of the boxes behind you. Pick the box that is represented with the star on the map!"
2. The maps were presented with either a 90- or 270-degree rotation, so the participant had to mentally rotate the map to match the environment.
3. Each participant was given two trials at the unique cylinder (Target A) and two trials at one of the nonunique cylinders (Target B).
4. While one experimenter changed the array of the room for each condition, another experimenter conducted a left/right assessment.

## Results

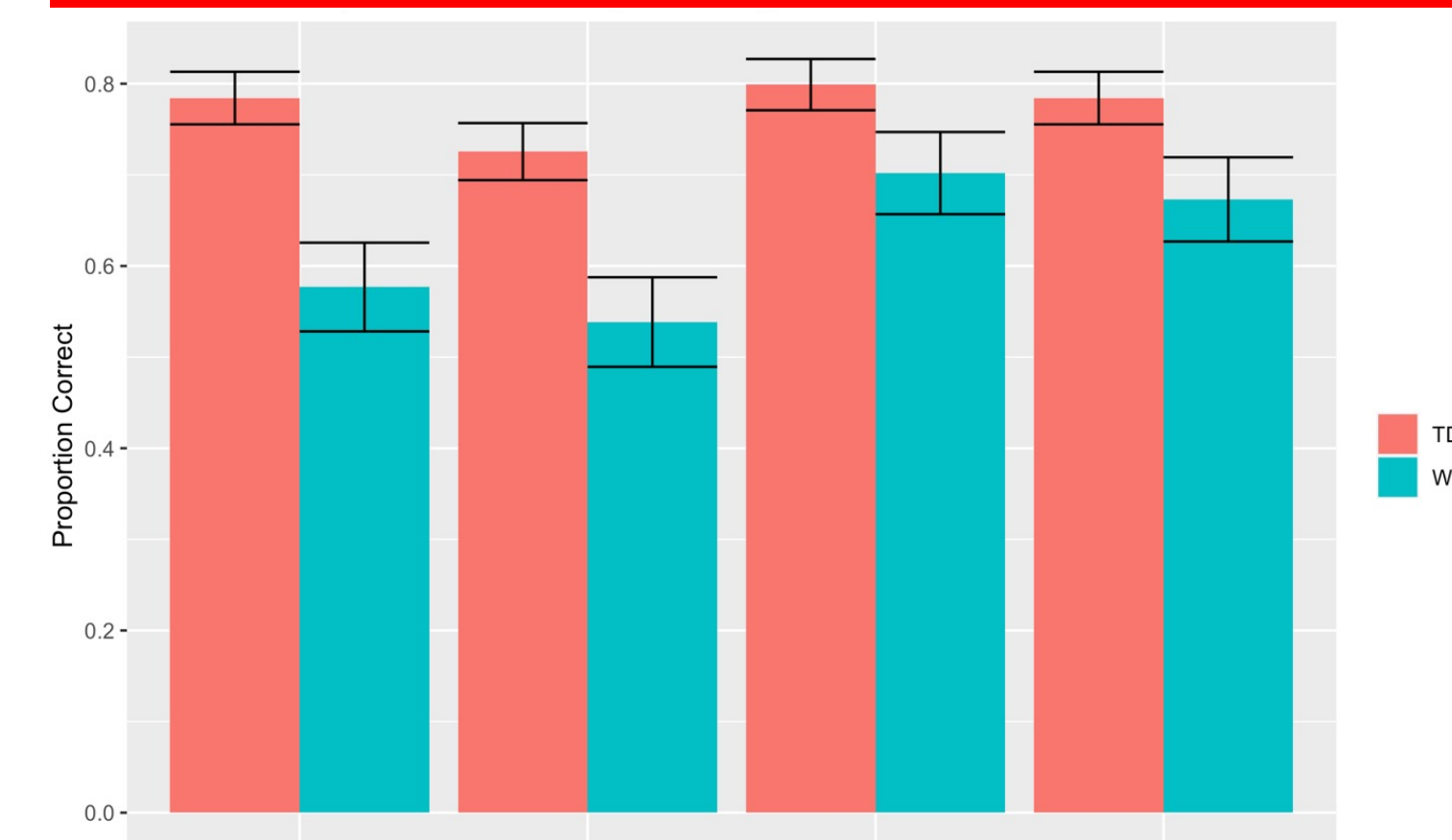


Figure 1. Mean performance by condition and population type.

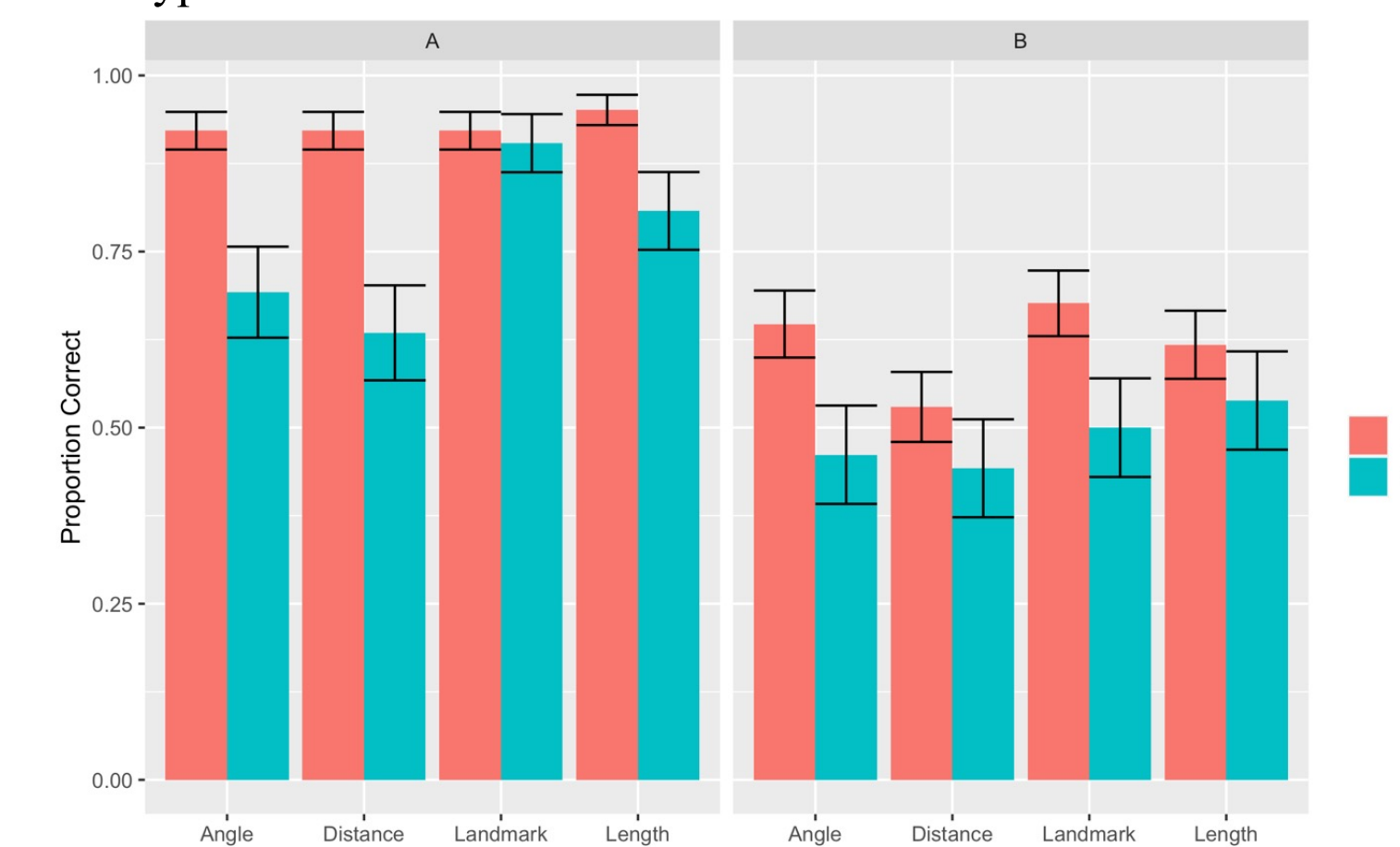


Figure 2. Performance at Target A (left) and B (right) in each condition by population.

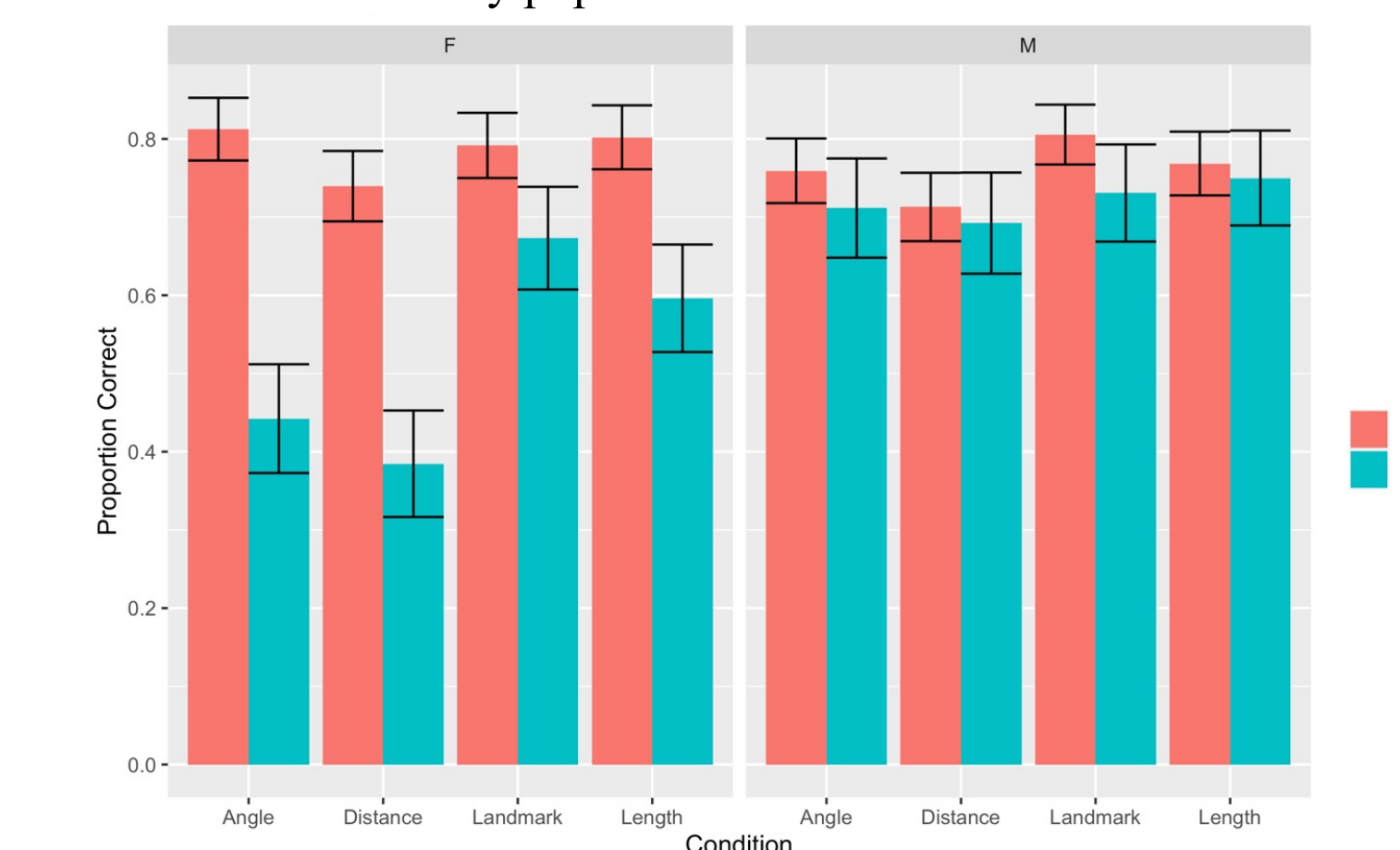


Figure 3. Performance by sex and condition.

## Discussion

- WS participants successfully used maps with symbolic geometry to navigate, scoring above chance in each condition.
- In the Landmark condition, WS participants performed at the same level as TD participants, providing further evidence for intact object recognition within this population.<sup>3</sup>
- In each of the geometric conditions, WS participants performed significantly above chance, but significantly below the TD controls, which reinforces the previously established deficit in spatial processing.<sup>2</sup>
- Interestingly, the WS performance profile is similar to that of the TD participants, indicating that the foundational understanding of core geometry is preserved.
- Both WS and TD participants performed worse when asked to use the spatial information presented in the map as a relational cue compared to a direct cue.
- There was an effect of sex in the WS sample, but not the TD sample, with WS males significantly outperforming WS females. The finding is novel and requires further research.

## References

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