Designing a Task to Measure the Impact of Spatial Layouts on Categorization Learning

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Introduction

- Spatial reference frames help structure both spatial and nonspatial knowledge [1,2].
- Humans naturally use familiar spatial structures such as rows, grids, and axes to process both spatial and nonspatial information [3].
- Computational mechanisms explaining how space aligns information for cognitive processing remain unclear.

Aims & Hypotheses

Aim: To design an experimental task that measures the connection between spatial layouts, memory, and categorization learning.

H1: Spatial memory influences categorization performance. H2: Participants will perform better when categorization aligns with a clear spatial structure, compared to more complex spatial arrangements.

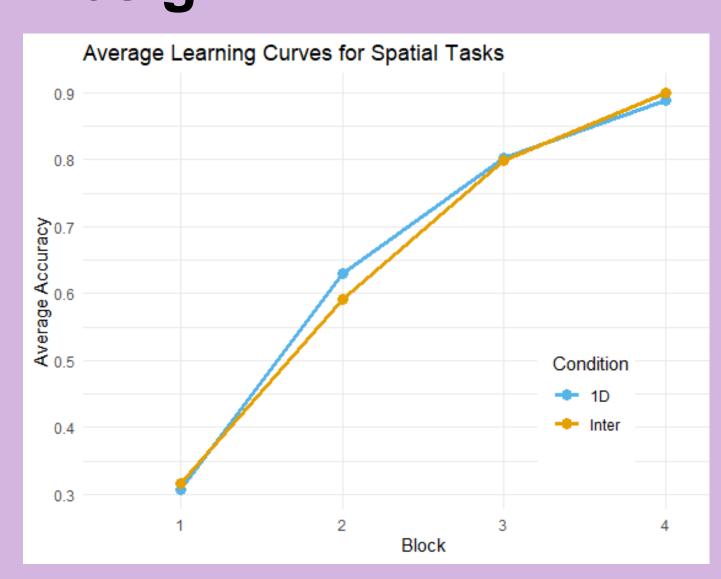
Results

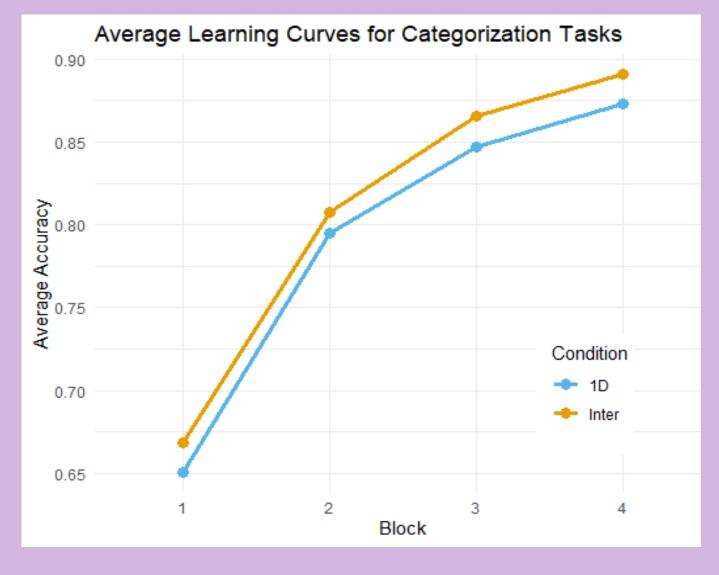
Design 1:

First approach task sequence Average Learning Curves for Categorization Tasks



Design 2:





Discussion

- We observe that participants learn across blocks in both the object-location association (spatial) and categorization tasks
- We have yet to see the inter-task effect of clear spatial patterns (1D) aiding in categorization performance vs more complex layouts (2D, Interdigitation)

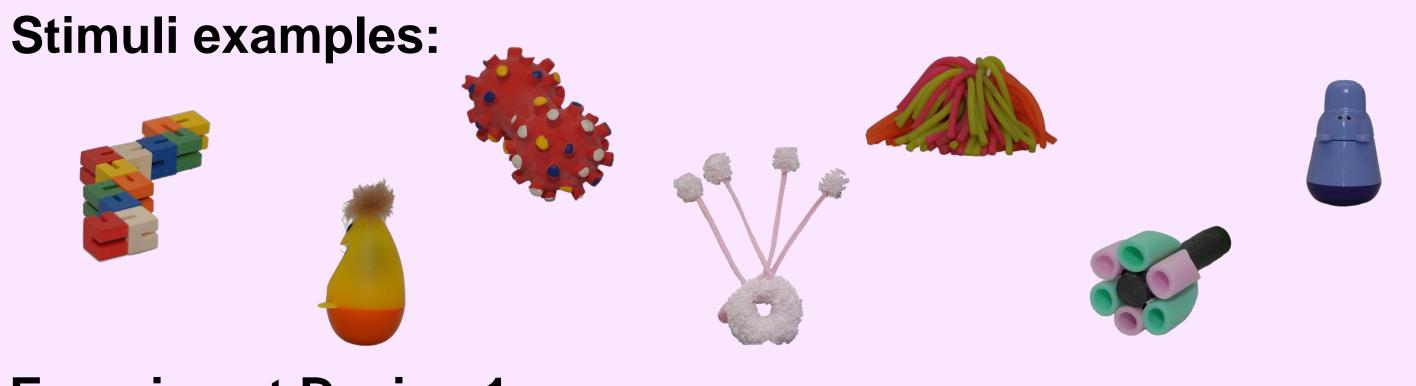
Next steps:

- Improve Task Design
- Computational Modeling: Neural network models will be used to simulate learning processes

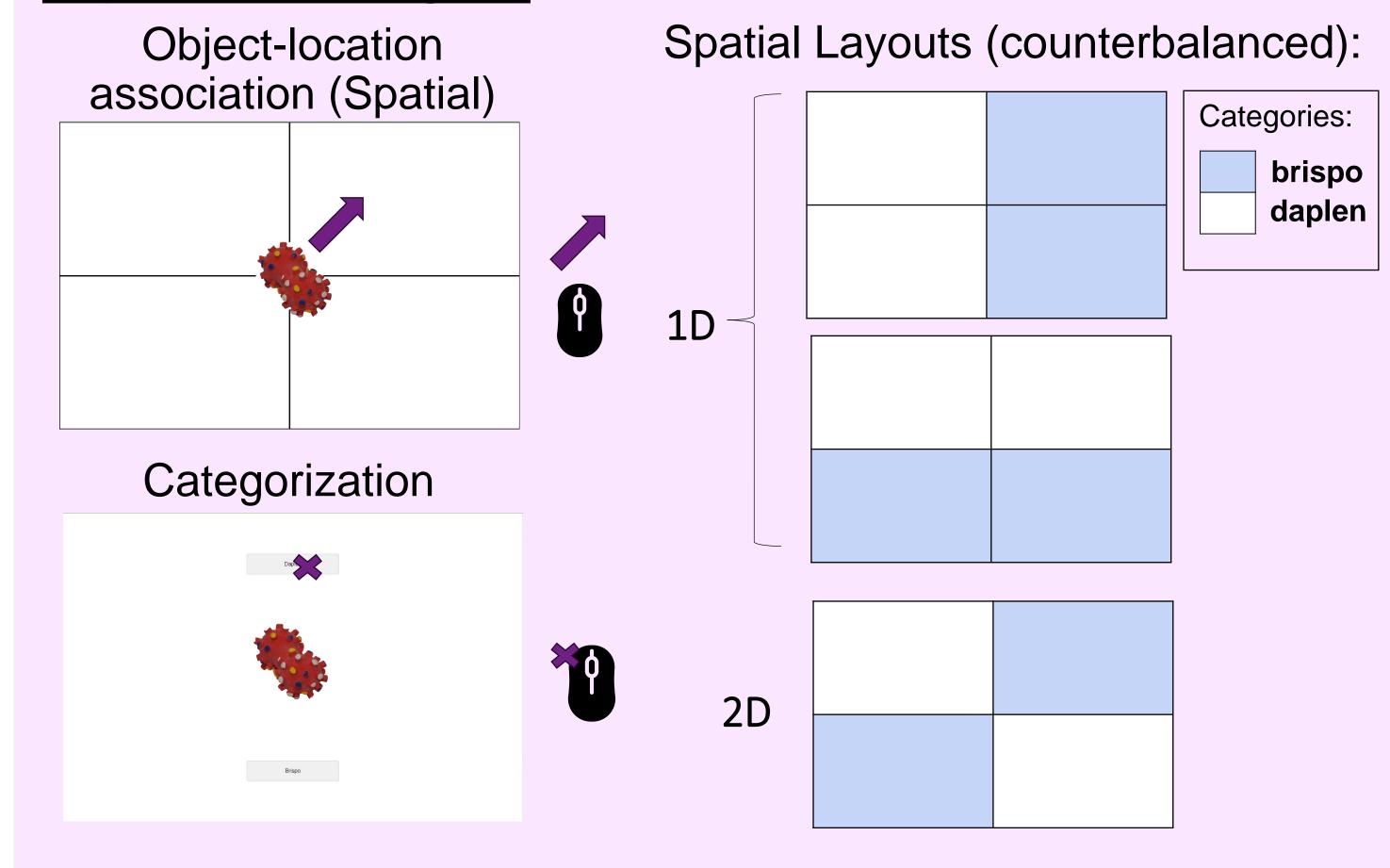
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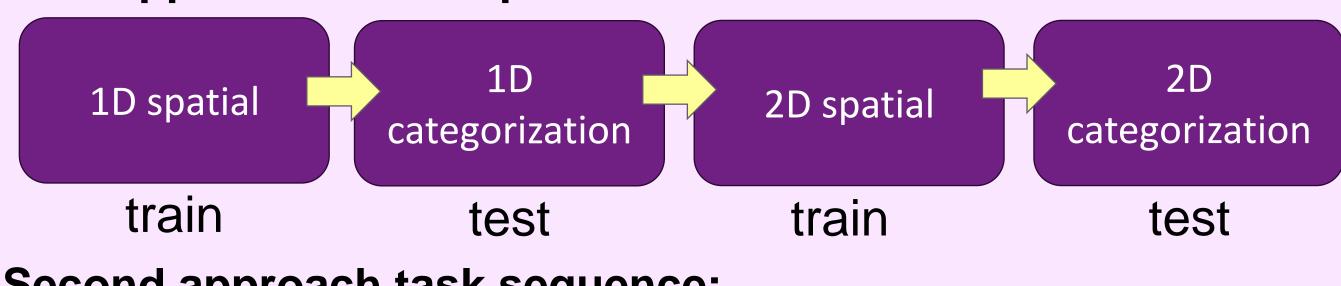
Paradigm



Experiment Design 1:



First approach task sequence:

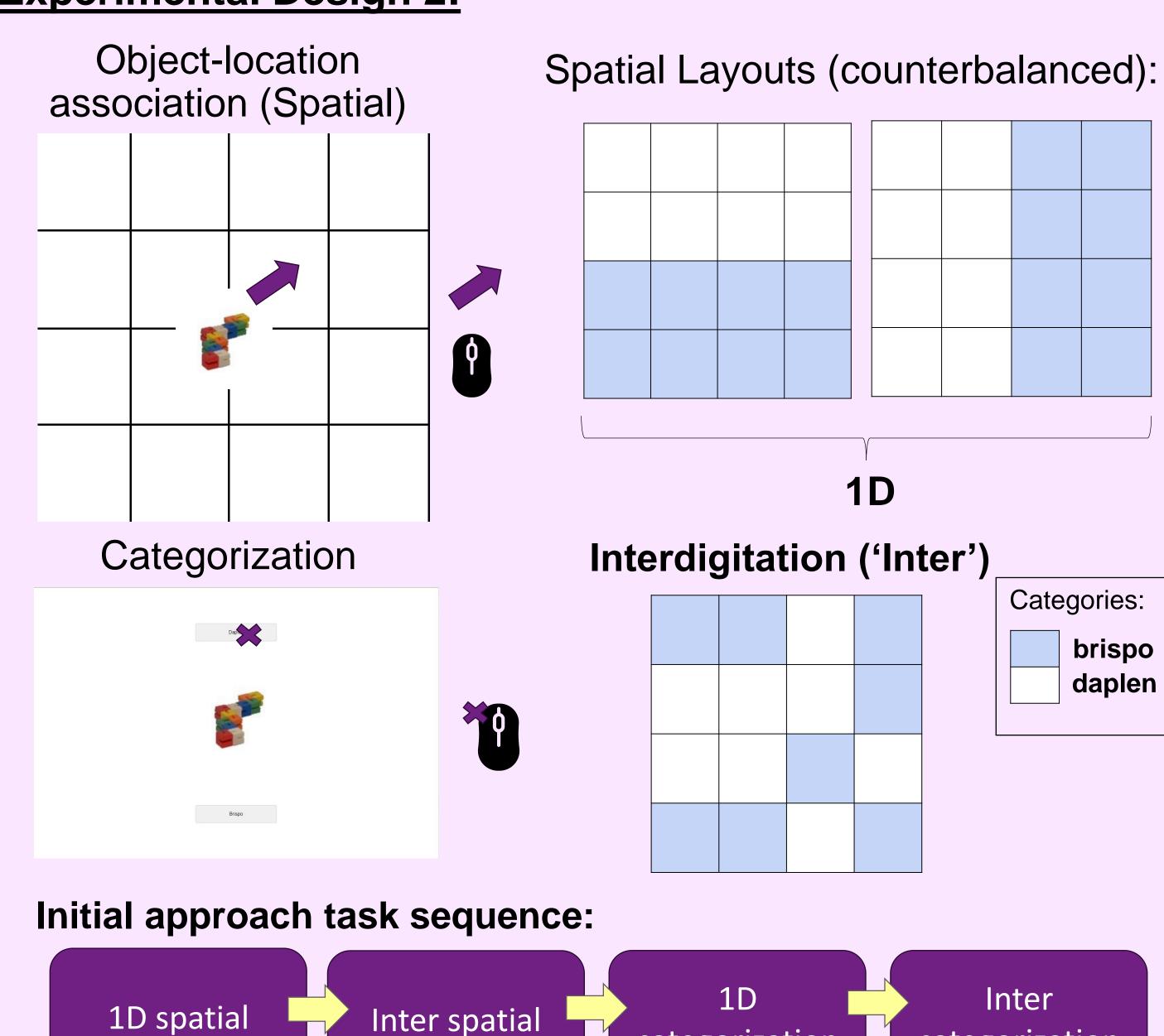


Second approach task sequence:



Experimental Design 2:

train



Metrics (both designs): Accuracy, Response time (RT)

train

References

categorization

test

categorization

test

- [1] Gärdenfors, P. (2000). Conceptual spaces: The geometry of thought. MIT Press.
- [2] Gattis, M. (Ed.). (2001). Spatial schemas and abstract thought. MIT Press.
- [3] Shah, P. (Ed.). (2005). The Cambridge handbook of visuospatial thinking (1. publ). Cambridge University Press.