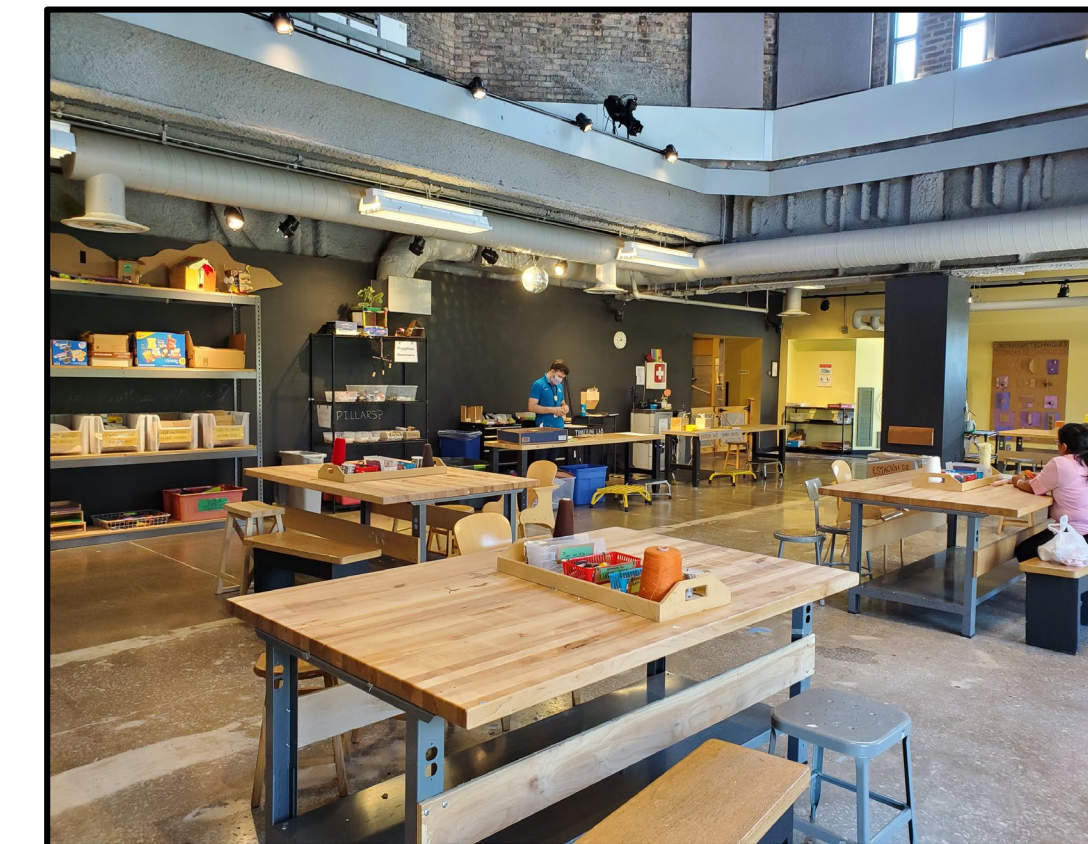


## Introduction

- Tinkering activities designed for parents and children can foster spatial thinking, which benefits spatial skill development (Ramey et al., 2020).
- During tinkering activities, families may be challenged to use tool and materials to solve open-ended problems (Bevan, 2017).
- The problems specified by different tinkering challenges can highlight intrinsic or extrinsic spatial information (Chatterjee, 2008; Mix et al., 2018).
- Research Question:** How does the spatial information highlighted by a tinkering challenge affect the quality of families' spatial thinking?

## Participants & Procedures

- 74 children ( $M = 7.12, SD = 1.44$ ) and their parents were video recorded in Tinkering Lab at Chicago Children's Museum.
- Families participated in one of two tinkering challenges that highlighted different types of spatial information.
- To measure spatial thinking, video recordings were coded for types and quantity of families' spatial conversations (Cannon et al., 2007; Ramey & Uttal, 2017).



## Tinkering Lab Challenges

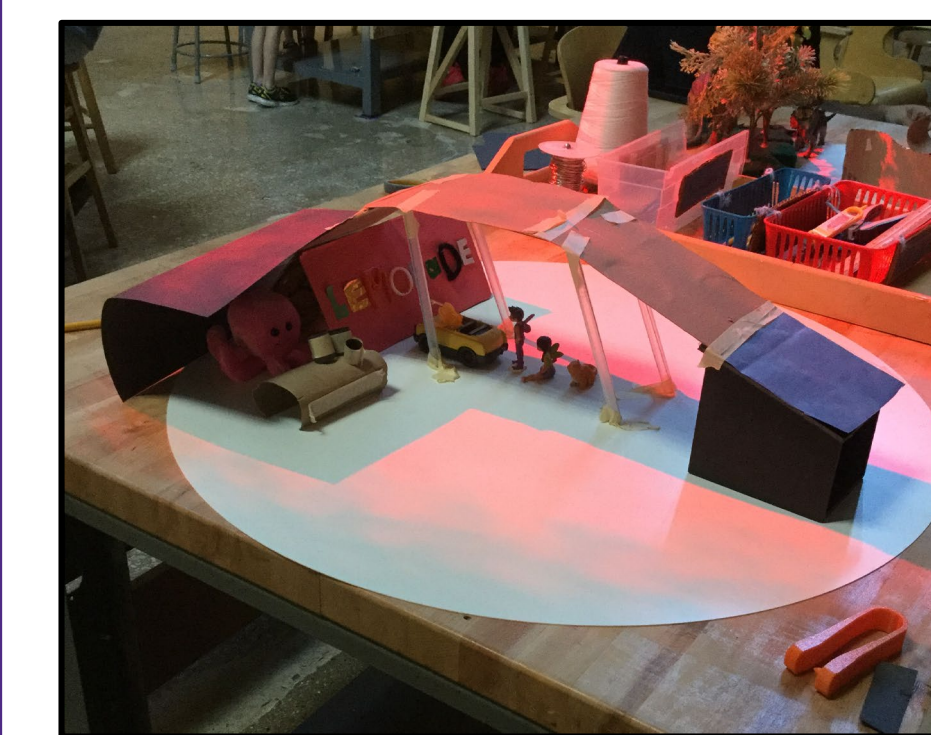
### Party Hat Challenge (n = 25)

- Instructions:** "Build a party hat that stays on your head while dancing."
- Challenge Focus:** Size & stability.
- Spatial Information:** Intrinsic.



### Safe Travels (n = 50)

- Instructions:** "Build a structure that helps a toy monster stay out of the light as they move between two locations."
- Challenge Focus:** Movement through space & cause and effect.
- Spatial Information:** Extrinsic.



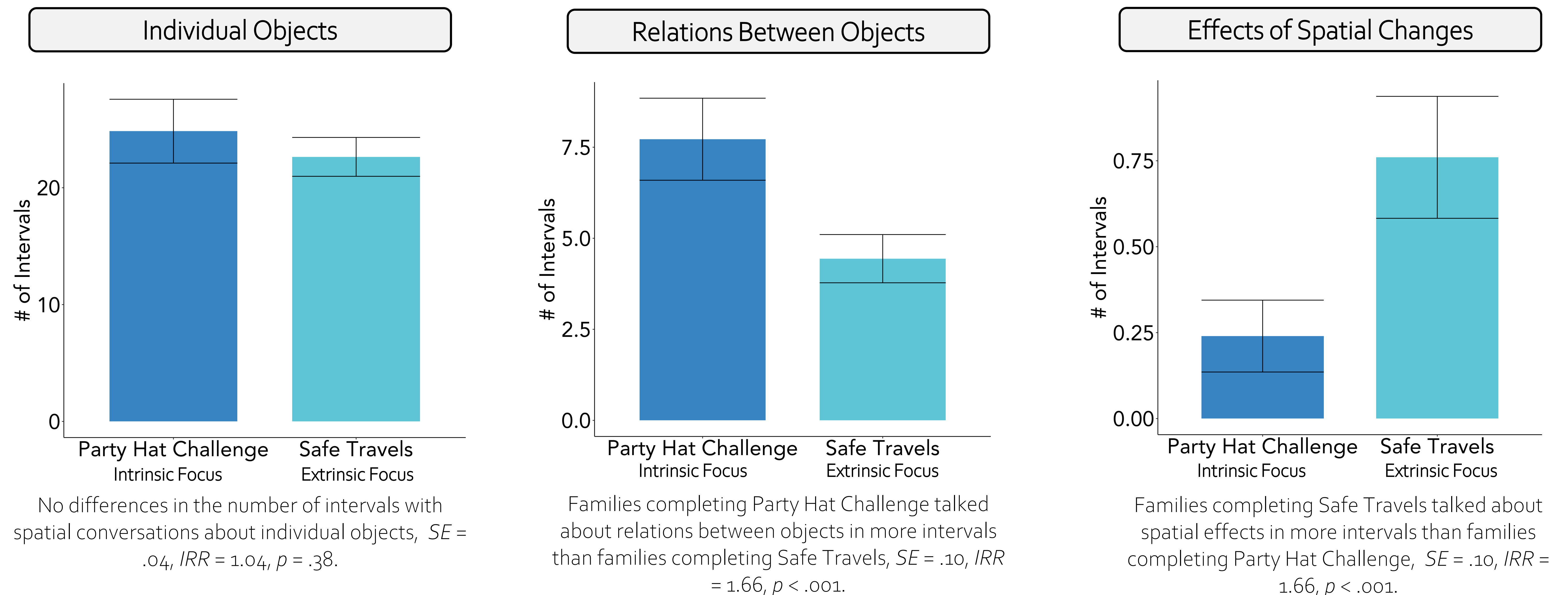
## Spatial Conversation Coding

Recordings were split into 30-second intervals that were coded for the presence of three types of spatial conversations.

Spatial Conversation Type	Definition	Examples
Spatial Characteristics of Individual Objects	Talk about the locations, size, shapes, and orientations of individual objects and tools.	"Put the tunnel over here." "Is the hat <i>big enough</i> for your head?"
Spatial Relations Between Objects	Talk about the arrangement of objects, spatial comparisons, and how objects fit together to create a whole.	"Should we put the cardboard box in the middle of the bridge or at the end?" "This piece is flat, but this piece is angled down."
Effects of Spatial Changes	Talk about how a change in one spatial characteristic of an object or creation impacts another characteristic of the creation's function.	"If we put the strap under here, the hat will stay straight up." "If we move the cardboard over here, the shadow goes over there."

## Differences in Spatial Conversations By Tinkering Challenges

- Poisson regressions were used to examine differences by challenge type in the quantity and types of families' spatial conversations during the tinkering activity while controlling for the total number of intervals in each families' recordings.



## Discussion & Implications

- Tinkering challenges that highlight intrinsic information by focusing on size and stability (e.g., hats on heads) seem to foster thinking about spatial relations.
- Tinkering challenges that highlight extrinsic information by focusing on travel through the environment might support considering spatial effects.
- These findings have implications for the ways tinkering challenges can be leveraged in playful activities to engender different types of spatial thinking.