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THE IMPORTANCE OF STABILITY IN CHILDREN'S AND ADULTS' BLOCK-BUILDING

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Introduction

Adults and children show notable selectivity in their block-building[1,2]

- They build using a small number of specific states and full paths
- Build paths frequently exhibit a layer-by-layer approach
- Layer-by-layer strategy may reflect the goal of building stable intermediate structures

What is the role of stability in building?

- Adults and children are sensitive to the stability of objects and structures[3,4]
- Are more stable structures easier to build than less stable ones? How does stability affect building?
- Does information-seeking while building, as measured by eye gaze,[5,6] vary over structural stability?

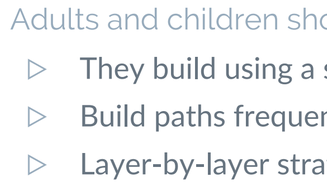
Methods

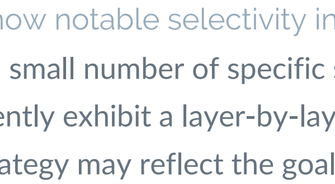
Participants

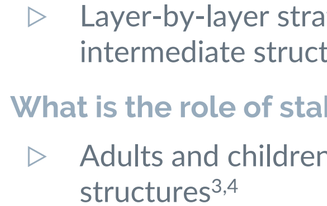
- 23 adults
- 12 children ages 4-8 (M = 7;0, 9 males)

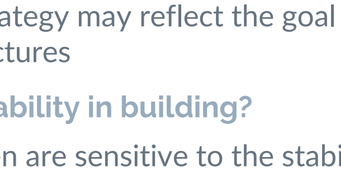
Materials

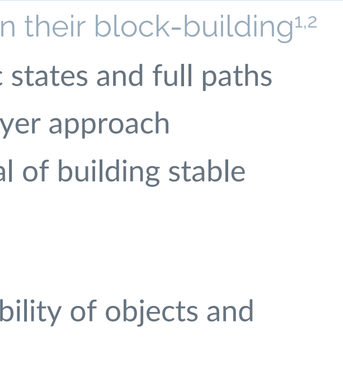
- 4 models consisting of 6 Duplo blocks
  - Strong support (highly stable) and Weak support (less stable)
- Building recorded by overhead camera
- Eye movements recorded with Tobii Pro Glasses 2









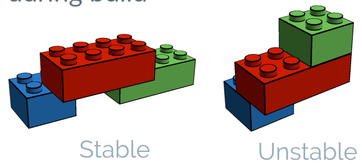


Construction path analysis

- Overhead videos: Adults: 90, Children: 45
- Followed procedures from Cortesa et al.[1,2]
  - Metrics: State Accuracy, Excess Steps, Action Duration
  - New metric: Stability of states produced during build

Eye-tracking analysis

- Recordings: Adults: 90, Children: 43
- Three AOIs: Blocks, Copy, Model
  - Number of visits and total looking time



Stable State | Unstable State

Results

Highly stable (Strong support) structures are easier to build than less stable (Weak support) structures

Final copy accuracy

- Adults: 99%
- Children: 73%
  - Strong support models: 87%
  - Weak support models: 59%

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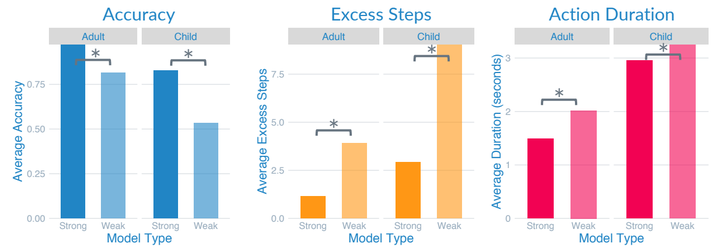


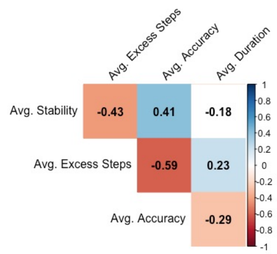
Selectivity of paths

- Both adults and children built only a small proportion of possible correct states
  - For adults, more variable paths for weak support models

Model	# of possible correct states	Attested correct states: Adults		Attested correct states: Children	
		N	Proportion	N	Proportion
1 (Strong)	80	12	0.15	25	0.31
2 (Weak)	62	23	0.37	17	0.27
3 (Strong)	89	9	0.10	19	0.21
4 (Weak)	50	19	0.38	18	0.36

Stability & path metrics

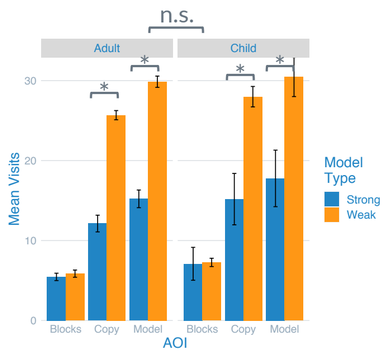
- Paths for strong support models had fewer unstable states than paths for weak support models
- **Paths with more stable states had fewer excess steps, higher accuracy** – suggesting an advantage for building stable structures



Highly stable (Strong support) structures elicit different eye gaze patterns than less stable (Weak support) structures, suggesting different information-seeking strategies for both adult and child builders

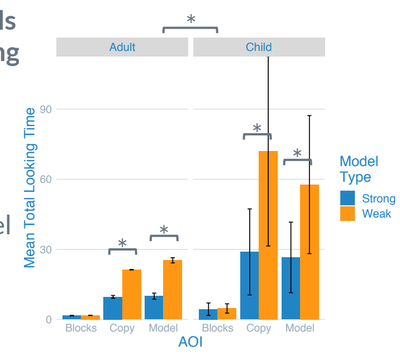
Visits to Copy, Model, & Blocks Areas

- **Eye gaze patterns were nearly identical for adults and children**, with most looks to Copy and Model areas (consistent with Ballard *et al.*[3,4])
- **Strong support models elicited fewer looks** to the Copy and Model areas for adults and children



Total looking time per AOI

- **Strong support models elicited shorter looking times** than weak support models for both adults and children
- Looking time to Model and Copy areas was **greater for children than for adults**
  - Interaction of age & model type



Eye-tracking & path metrics

- More excess steps and longer action durations positively correlated with most eye-tracking measures; higher accuracy negatively correlated with all but one eye-tracking measure

Conclusions

Adult and child builders seek to create stable structures

- Manipulating stability has downstream effects on building & information-gathering behavior: accuracy, number of steps, gaze patterns, looking time

Adults and children were remarkably similar in their information-seeking (looking) behavior

- Striking similarity in number of looks to Copy, Model and Blocks
  - Visual information gathered in similar ways by both adults and children
- Clear effects of stability (Strong vs. Weak support) for both age groups
  - Sensitivity to stability emerges early in development

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