THE INTERGENERATIONAL TRANSMISSION OF CAUSAL REASONING

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BACKGROUND & RATIONALE

- Causal reasoning allows us to explain why past events have happened, predict future events, and intervene to obtain desired outcomes (Pearl & Mackenzie, 2018)
- Causal reasoning supports many forms of expertise (e.g., medical, scientific, programming, mechanics)
- Poor causal reasoning -> beliefs in pseudoscience (Matute et al., 2011)
- Little is known about the sources of variation in the development of causal reasoning (Kuhn, 2012)
- We will investigate intergenerational transmission as a potential source of variability, similar to intergenerational transmission of math skills (Braham & Libertus, Elliott et al., 2017, Silver et al., 2024)

AIMS AND QUESTIONS

- To develop a novel battery of causal reasoning tasks relevant to children and parents, separately and together
- Are there links between causal reasoning skills in caregivers and children?
- How do caregivers talk about causal relations with their children and scaffold their understanding of cause and effect, and is the quality and quantity of caregivers' causal language use associated with children's causal reasoning skills?

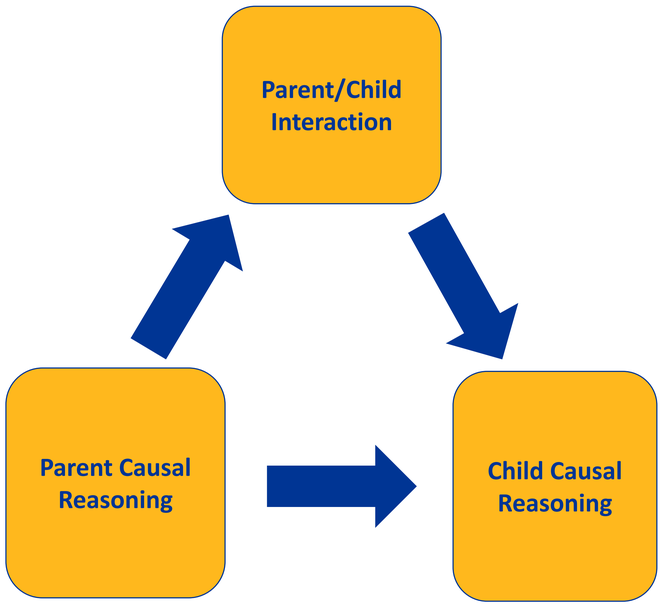
METHODS

Participants:

- 8-9-year-old children and one of their caregivers
- Recruited through Children Helping Science

Procedures:

- First Half: children and caregivers complete tasks separately
- Second Half: children and caregivers complete tasks together
- Will record conversations



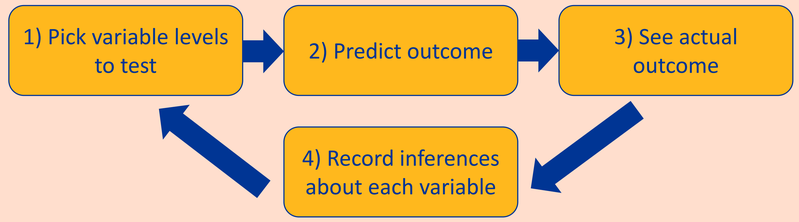
Create a Farm

- Measures **engagement and exploration** in learning cause and effect relationships
- Ps will figure out what the effects are of clicking each button
- The goal is to create a farm of their choice and learn what each button does
- Some buttons are more difficult than others (e.g., have more than one effect, have delays)
- The task will vary in difficulty for children and parents

Create a Farm Behavioral Measures of Causal Reasoning and Exploration	
Total Play Time	Time (in sec) exploring task
Engagement	Total number of interactions with inputs
Exploration Depth	Number out outputs explored such that all options were seen
Breadth	Number of different inputs used at least once (0-8)
Knowledge Test Accuracy	Proportion of correct answers

THE MULTIVARIABLE PREDICTION (MVP) TASK

- Measures **controlling for variables** in making causal decisions
- Validated in children and adults (Kuhn et al., 2008, 2009)
- We are designing new versions to be interesting and shorter



Structure of Causality in MVP



MVP Behavioral Measures of Causal Reasoning	
Prediction Error	Was their guess correct? How far off?
Magnitude of Impact	Did they notice one variable was more important than others?
Controlled Comparison	How often only changing one variable between consecutive cases
Valid Inference	Number of justified inferences
Consistency of Inferences	Do they consistently think a variable is causal or noncausal?
Level of Verbalized Inquiry Skill	**1:** no difference between theory and evidence **2:** interpret single cases, no comparisons **3:** comparisons, but not between controlled cases **4:** do controlled and uncontrolled comparisons **5:** do controlled comparisons

Parent/Child Speech Measures for Both tasks	
Causal Connectives	"because" "since"
Causal Verbs	"causes" "makes"
Causal Questions	"why" "how come"
Predictions	"if-then"
Counterfactuals	"if [subject] was different, then…"
Probability/Uncertainty	"always" "never" "sometimes"
Comparisons	"the same" "more/less than"
Amount of Interaction	How much the dyad interact
Question Responses	Are questions being answered?
Open vs Closed Ended Questions	What type of questions are being asked?
Amount of Unrelated Topics	How much the dyad discuss unrelated things

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