Causal Knowledge as a Guide to Question Asking in Childhood

Amberley R. Stein[1], Elizabeth Lapidow[2], Giovanni Thomas[1], & Caren M. Walker[1]

[1] University of California, San Diego; [2] University of Waterloo

The Early Learning & Cognition Lab

PREREGISTERED

2023 CogSci Conference Proceedings

Question:

Can 5- and 7-year-olds draw on their knowledge of real-world ***causal relationships*** to identify relevant questions?

Background:

*In question asking, learners need to identify which of **numerous possible queries** will be helpful to their information search.*

- By age 5, children can identify more effective questions when gathering information about an explicitly presented space of possibilities. (Ruggeri, Sim, & Xu, 2017)
- However, when question evaluation requires drawing on their abstract, real-world conceptual knowledge, older children (~7yrs) struggle. (Davidson, 1991; Jirout & Klahr, 2020)
- Young children are adept causal reasoners (Gopnik & Schulz, 2007), and readily utilize their abstract causal knowledge to guide inference. (Magid, Sheskin, & Schulz, 2015)

Can young children draw on their abstract, conceptual knowledge of real-world causal relationships to guide their question asking?

Method:

Ppts heard **one of two stories** about an event with an unknown cause.

The stories included **details suggesting traits** of the true cause.

Story 1: *Kitchen*

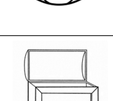
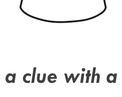
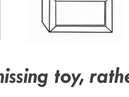
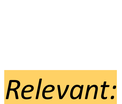


Story 2: *Garden*



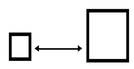
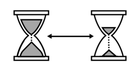
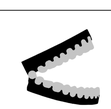
In **three trials,** children made forced-choices between two questions to ask about possible causes. Both questions targeted similar information, but one was **causally related** to one of the three story details.

Story 1: *Kitchen*

"For each pet, we can ask..."	*Relevant:*	*Irrelevant:*	*Clue from Story:*
Ability: *"...can it **climb** or can it **make noise**?"*			*"There was a mess on top of the fridge."*
Appearance: *"...what color **eyes** does it have or what color **fur** does it have?"*			*"There was black fur all around."*
Preference*: *"...what does it like to **play with** or what does it like to **eat**?"*			*"There were the rattle, the ball, and the chips, but the cookies were missing."*

**Note: Half of participants saw a clue with a missing toy, rather than a missing food item.*

Story 2: *Garden*

"For each pet, we can ask..."	*Relevant:*	*Irrelevant:*	*Clue from Story:*
Ability: *"... how **big** is it, or how **fast** is it?"*			*"The pet got in by fitting through a crack in the fence."*
Appearance: *"...what color **eyes** does it have or what color **fur** does it have?"*			*"There was black fur all around."*
Preference*: *"...what does it like to **chew on** or what does it like to **sleep on**?"*			*"There was the basket of hay, sticks, and cucumbers, but the tomatoes were full of holes."*

**Note: Half of participants saw a clue with a nest in the sticks or hay, rather holes in vegetables.*

Results:

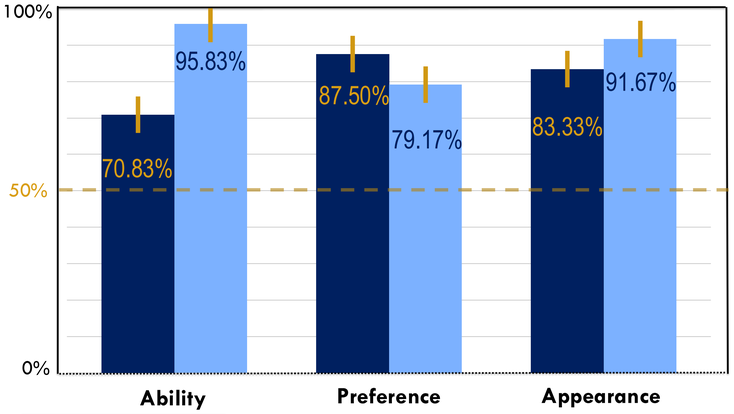
($N = 96$, 48 per age group)

Overall, children overwhelmingly chose questions that targeted relevant causal relationships, with differences by age.

- The overall proportion of relevant questions chosen (72.92%) was significantly greater than chance ($p < 0.001$; 95% CI = [68.03, 78.43], *two-tailed binomial*).
- Performance differed significantly between age groups (Wald, $z = -2.33$, $p = 0.02$) and between Story 1 and Story 2 ($p < 0.001$).

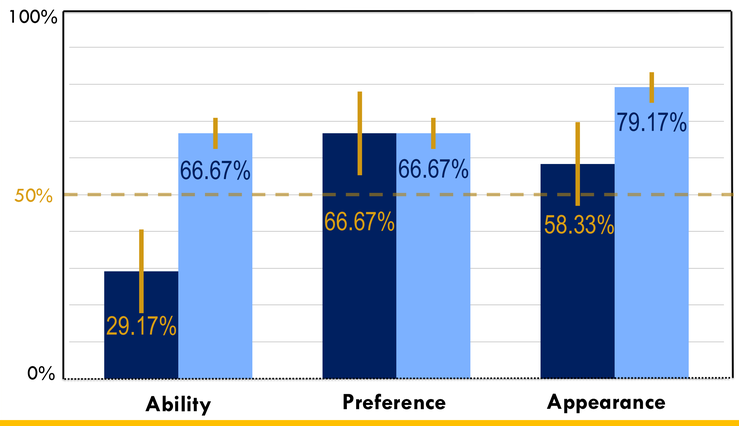
Percentage of Causally Relevant Questions *(by age, story, and trial type)*

Story 1: *Kitchen*



Story 2: *Garden*

Note: Error bars represent standard error.



Conclusion:

Children readily leverage conceptual, real-world, ***causal knowledge*** to evaluate and select relevant questions. A follow-up study is currently underway to test whether causal inference provides similar guidance during ***question generation***.

Thanks to Jacob's Foundation and NSF Career Award (SBE #2047581) to C.M.Walker, NDSEG Fellowship to E.Lapidow, the ELC Lab, and families!

Correspondence to amstein@ucsd.edu