Preschoolers compute literal and pragmatic meanings of conditionals with contextual support

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INTRODUCTION

A 4-year-old hears, "**If you eat all your broccoli, you'll get a candy.**"

Literal interpretation: Eating all the broccoli is one way to get candy, but there could be other ways too.

Pragmatic interpretation: If I don't eat all my broccoli, I won't get a candy (meaning broccoli is the only way to get candy).

We ask: Can preschoolers access both literal and pragmatic interpretations of conditionals?

BACKGROUND

What we know so far:

- School-aged children (7-12) struggle with literal interpretations of conditionals but often compute pragmatic ones (e.g., Barrouillet & Lecas, 2002; Gauffroy & Barrouillet, 2009; Klaczynski, 2006; though see Rumain et al., 1983).

Why the delay?

- Lack of abstract reasoning (e.g., Byrnes & Overton, 1986; Inhelder & Piaget, 1958; Braine & O'Brien, 1998).
- Difficulty maintaining alternatives in working memory (Barrouillet & Lecas, 1999; Gauffroy & Barrouillet, 2009; Johnson-Laird & Byrne, 1991).
- Struggles generating alternative antecedents (e.g., Cummins et al., 1991; Cummins, 1995; Markovits et al., 2016; Markovits et al., 1996; 1998; Markovits, 2000; Rumain et al., 1983).

- Most research focuses on decontextualized tasks (e.g., "if triangle, then purple"), where literal interpretations are which are more difficult due to arbitrary, abstract relations.

CURRENT STUDY

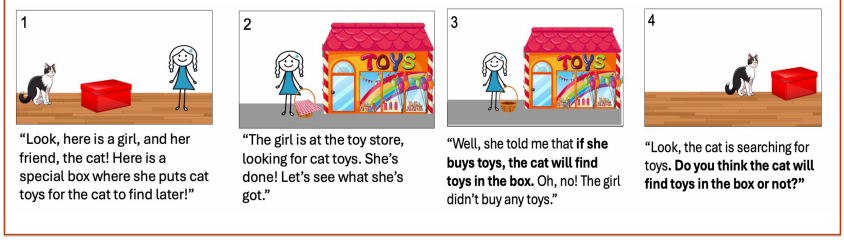
- Tests younger age group: 4-year-olds can reason about multiple possibilities and make causal, counterfactual, and disjunctive inferences (e.g., Gopnik & Tenenbaum, 2007; Nyhout & Ganea, 2019; Alderete & Xu, 2023; Leahy et al., 2022; Mody & Carey, 2016).

- Focuses on two cases where literal interpretations are felicitous and expected in conversation:
  - **Experiment 1**: Contextual alternative antecedents are available.
  - **Experiment 2:** No causal dependence (e.g., *biscuit* conditionals, "If you're hungry, there are biscuits in the cupboard").

EXPERIMENT 1

- **Participants**: 60 preschoolers (ages 4;0 to 5;11, Mage = 4;11) tested in person, 30 adults tested online.
- **Design**: Between-subjects design with two conditions:

No Alternatives



Alternatives*

*A follow-up study (N=30) with "The cat will find toys in the box *only if* the boy buys toys" confirmed that children were not simply responding based on surface cues, like the contextual availability of toys, but attended to the meaning of conditionals, as they responded 'no' when the boy did not buy any toys.

More literal responses: Alternatives > No Alternatives

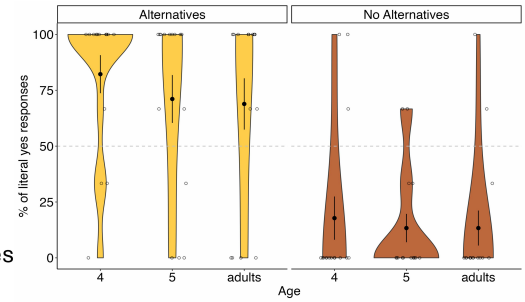


Figure: Literal "yes" responses by Alternatives Type and Age. Each dot = one participant. Dashed line=chance

EXPERIMENT 2

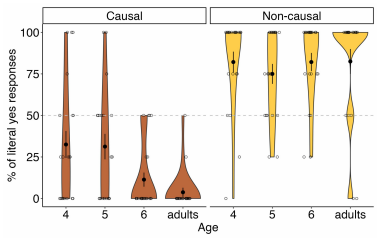
- **Participants**: 120 preschoolers (ages 4;0 to 6;11) tested in person, 40 adults tested online.
- **Design**: Between-subjects design with two conditions:

Look, here is a girl and a boy, and a box!

Causal

You know what, **if the girl bakes cookies, the boy will find cookies in the box.**

Guess what? The girl didn't bake cookies. But the boy wants cookies. **Do you think the boy will find cookies in the box or not?**



Non-Causal

You know what, **if the boy wants to read, he will find books in the box.**

Guess what? The boy doesn't want to read. But the girl wants to read. **Do you think the girl will find books in the box or not?**

More literal responses: Non-Causal > Causal

CONCLUSION

Preschoolers as young as 4 years can compute literal meanings when:

- Salient alternatives are introduced (Exp 1).
- The antecedent is not causally related to the outcome (Exp 2).

Findings suggest preschoolers have the logical ability and processing resources for conditional inferences with contextual support.