Children's Causal Inferences about Enabling Conditions in the Physical and Psychological Domains

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Background

Reasoning about enabling conditions is distinct from reasoning about generative causality

While there has been lots of research examining how adults reason about enabling conditions (e.g., Cheng & Novick, 1991; Goldvarg & Johnson-Laird, 2001), almost all research on children has focused on generative and inhibitory causality

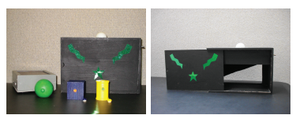
Can young children reason about enabling condition relations? Is this reasoning domain general or domain specific? What affects children's reasoning abilities?

One indirect investigation has been by Lillard (1993, 2001), who demonstrated that 4-year-olds often fail to recognize the enabling condition relation between pretending and knowledge. Children develop this understanding between ages 4-8 (Richert & Lillard, 2002).

In the physical domain, children appear to recognize a particular enabling condition relation: between batteries and electronic toys working. Informally, we performed a CHILDES analysis on five children's transcripts and found that all of them talked about batteries being necessary for toys to work before the age of five.

Objectives

Experiments 1 and 2 examined enabling conditions in physical causality. We presented children with objects that had a causal property as well as an internal enabling component. A "recharger" allowed the inside to be switched to its enabling state (note: the recharger" was never referred to as such in front of the children).



Experiment 3 used a modified version of Lillard's (1993) Moe task to examine enabling condition reasoning in the psychological domain.

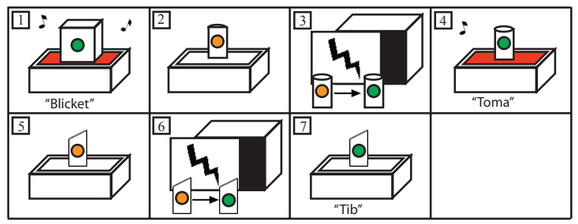
Experiment 1

Does the ability to reason about enabling conditions in physical causality develop between the ages of four and six?

Methods

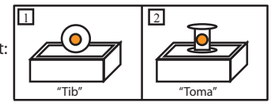
Participants: 26 four-year-olds and 24 six-year-olds

Familiarization

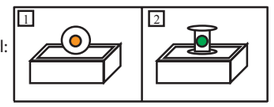


Test Phase

Experiment:



Control:

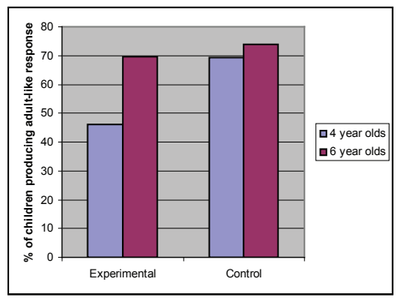


Data were coded on two dimensions: adult-like response and which object the child recharged first.

Adult-like response = child recharged the "toma" and placed it on the detector prior to recharging the "tib"

"Recharged first" data allows for comparison with chance levels of performance.

Results



Effect of age on experimental tasks: $\chi 2$ (1, N = 49) = 2/71, p = .086

Effect of age on control tasks: $\chi 2$ (1, N=49) = .131, p = .483

Difference from chance of six-year-olds on experimental tasks: binomial test, p = .093

Difference from chance of four-year-olds on experimental tasks: binomial test, p = .85

Experiment 2

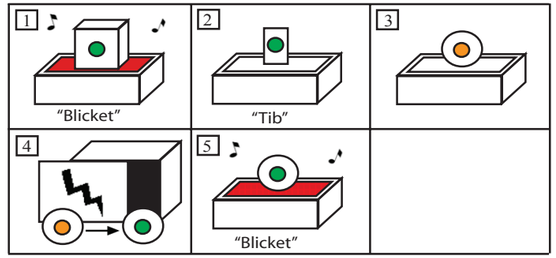
Can the performance of four-year-olds be improved by presenting enabling conditions in the context of batteries, a concept with which they are already familiar?

Methods

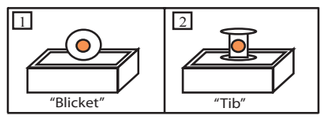
Participants: 48 four-year-olds
Two conditions: "insides" vs. "batteries"

In battery condition, internal components of the blocks were called "batteries".

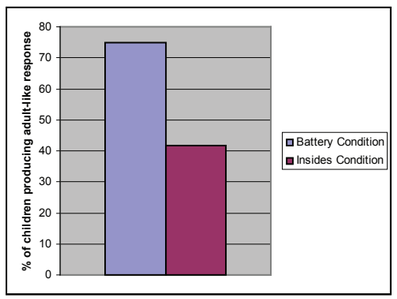
Familiarization



Test Phase



Results



Difference between conditions: $\chi 2$(1, N = 48) = 5.49, p < .05

Difference from chance in the battery condition: binomial test, p < .01

Difference from chance in the insides condition: binomial test, *ns.*

Experiment 3

Will the beneficial effect of batteries on four-year-olds' reasoning extend to the psychological domain?

Methods

Participants: 48 four-year-olds
Two conditions: batteries vs pictures

"Moe is from the Land of the Trolls. He knows about bunnies but not about kangaroos. When Moe hops, he looks like a bunny and a kangaroo."
"Is Moe pretending to be a kangaroo?"

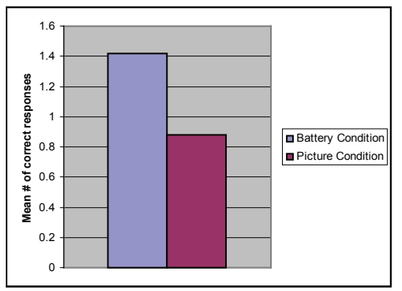
Battery Condition

In this condition, Moe's knowledge of bunnies was represented as a battery that was "plugged" into Moe.

Picture Condition

In this condition, Moe stood next to a picture of a bunny to represent his knowledge of them.

Results



Difference between conditions: t(46) = -2.11, p < .05

Difference from chance in the battery condition: t(23) = 2.63, p < .05

Difference from chance in the picture condition: t(23) = -0.62, *ns.*

Discussion

In general, six-year-olds are better able than four-year-olds to reason about enabling conditions in the physical domain.

These data suggest that children have sophisticated causal inference abilities early in development, but their knowledge about types of causal inference might not be in place until after the preschool years.

Four-year-olds' performance, however, improves when the enabling condition is represented as a battery. Children are able to use their specific knowledge of batteries to reason about enabling condition relations in the physical domain.

The beneficial effect of batteries applies to both physical and psychological causality. When psychological events were presented as batteries, children were more likely to understand an enabling condition relation in that domain (specifically between knowledge and pretending).

This suggests the possibility that children's developing understanding of the relation between knowledge and pretending reflects an underlying development of their knowledge of enabling condition relations. More research is necessary to consider this possibility.

References

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