Modelling Children's Development of Modal Thought

Collective Undergraduate Research Experience (CURE)'s Inaugural Flash Talk

University of Toronto

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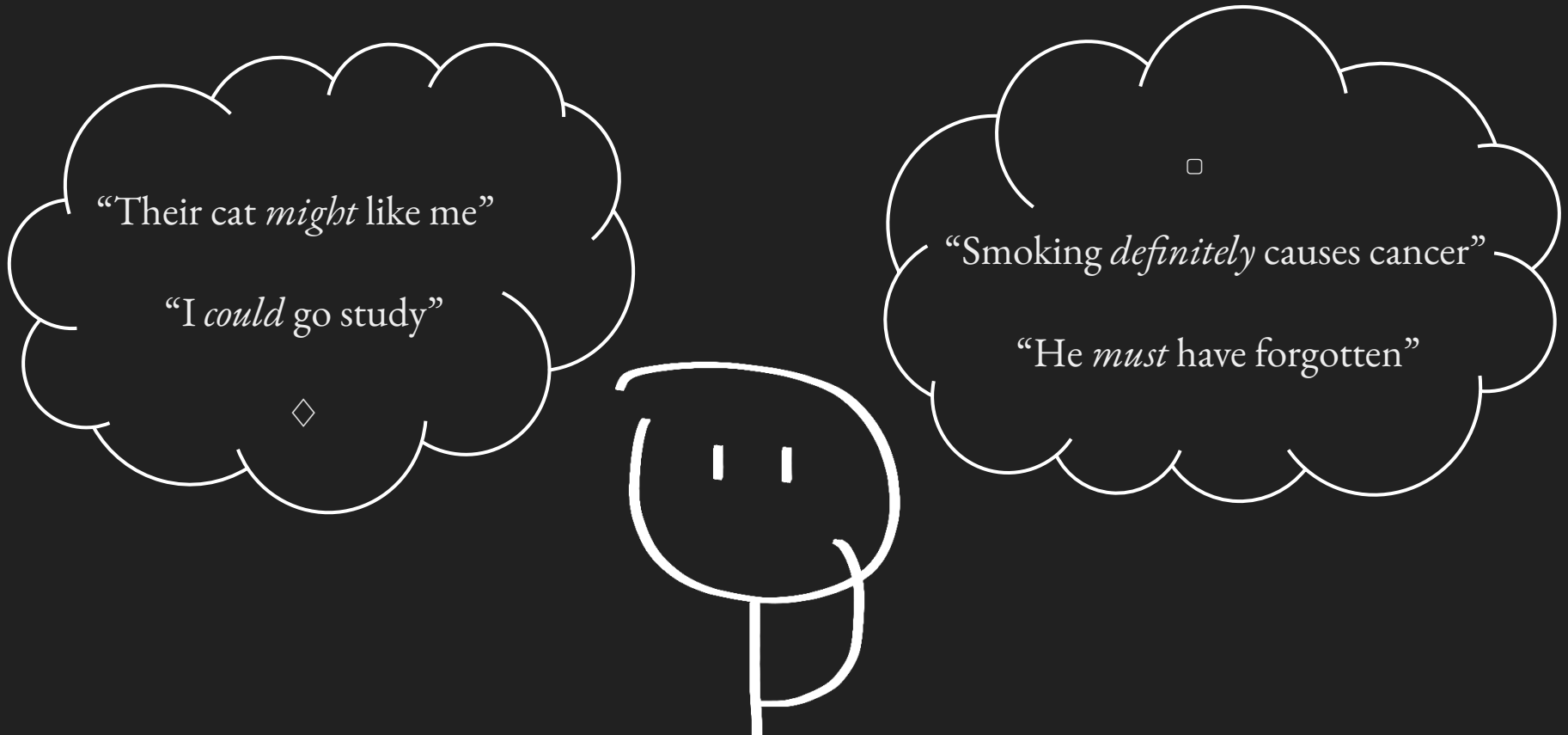
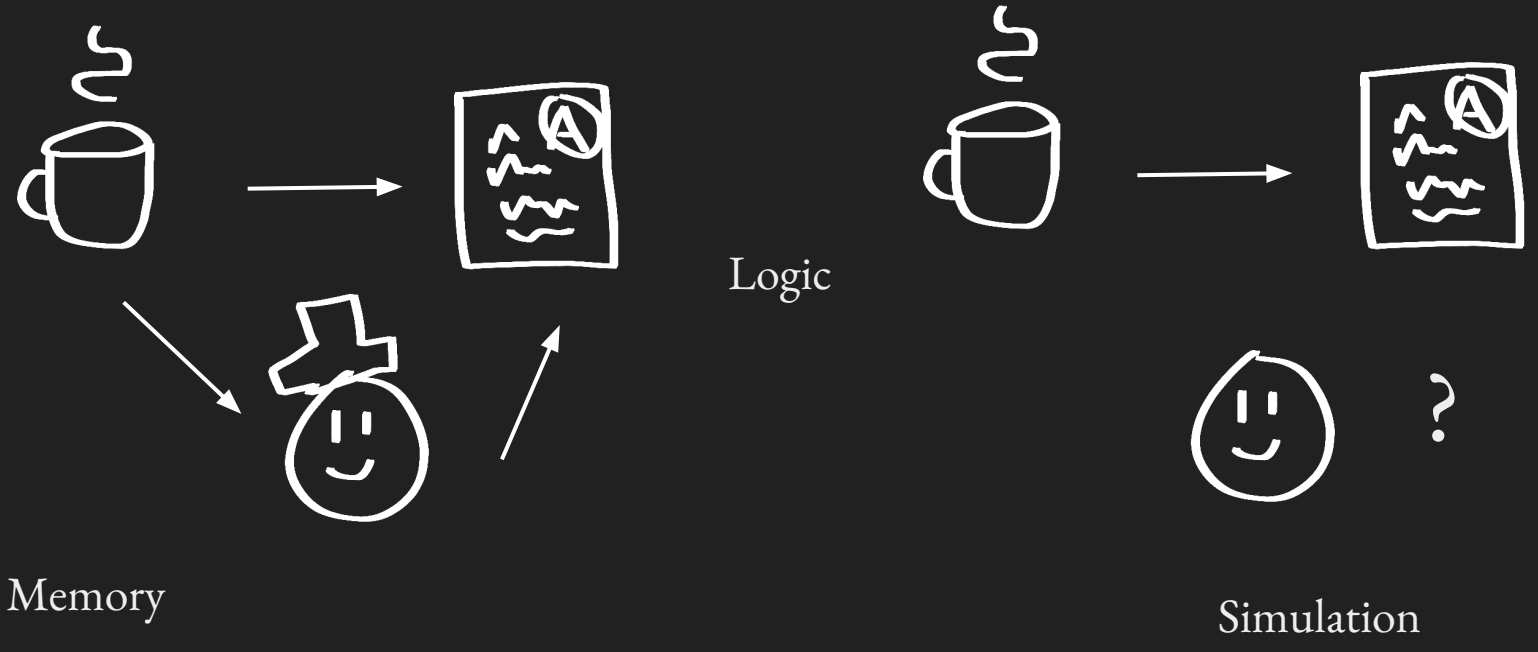
CURE Advisor

Modal Thought ~ “Thinking about possibilities”



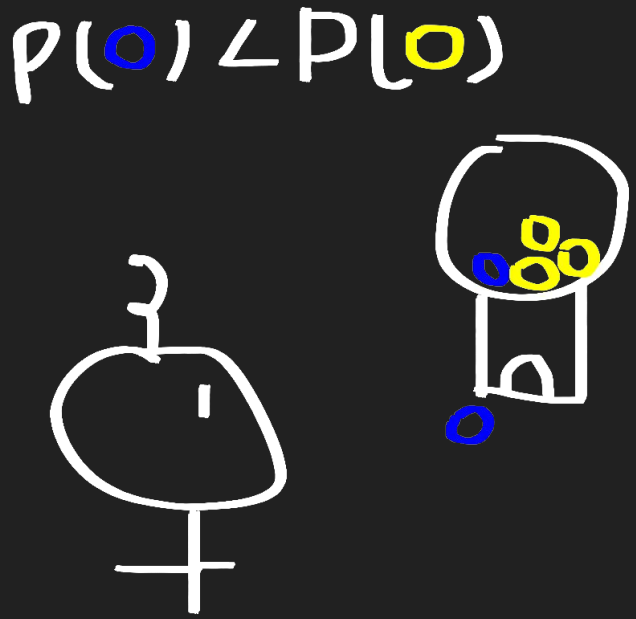
Components of Modal Thought

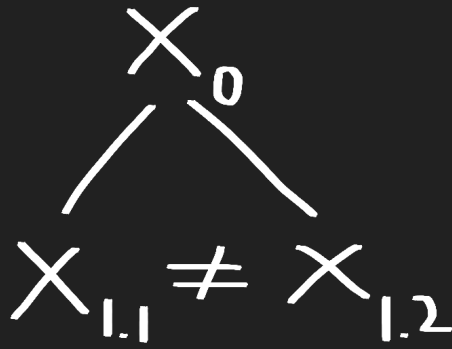


Simulation Mindset (Rafetseder et al., 2013)

Children's Milestones of Modal Thought

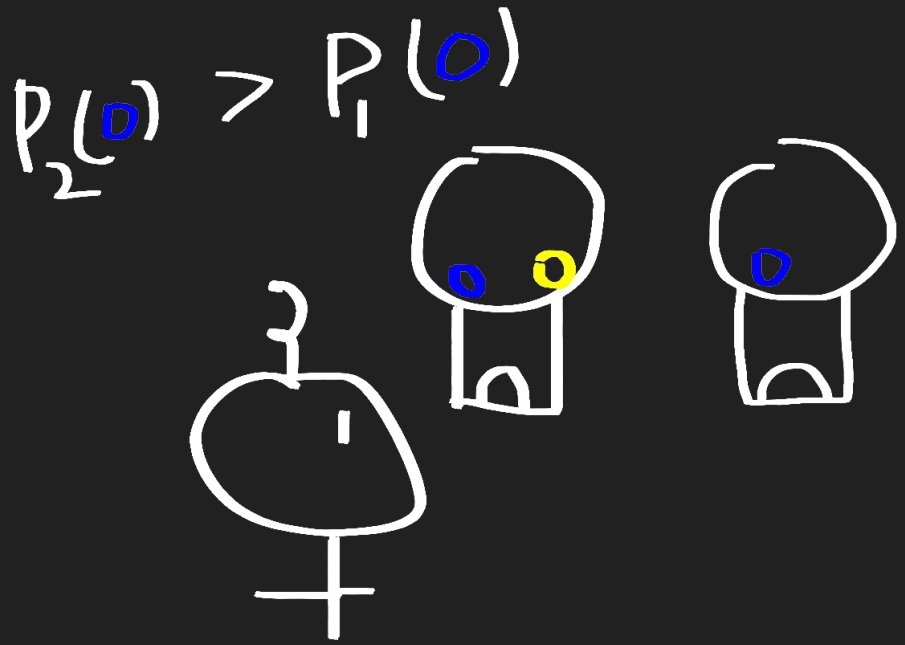
Multiple possibilities at 1 years

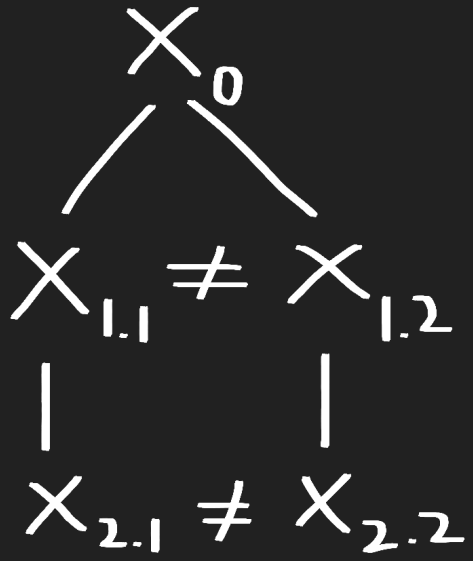




(Telegas et al., 2007)

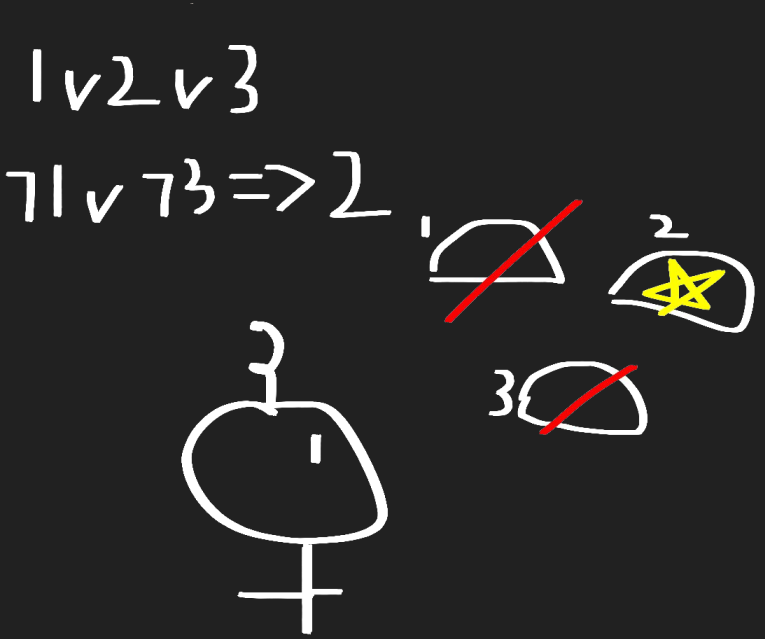
Branching possibilities at 2.5 years





(Alderate and Xu, 2023)

Logical negation at 2.5 years



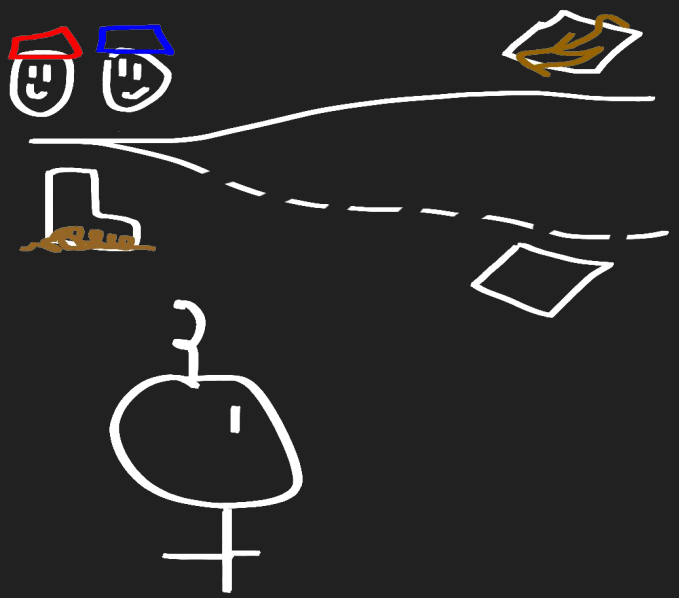
Grigoroglou et al. (2019)

Counterfactual negation at 3.5 years

Harris et al. (1996)

Complex Counterfactual Reasoning at 6-8 years

See Rafetseder et al. (2013) for ambiguous case



Nyhout et al. (2019)

Cases:

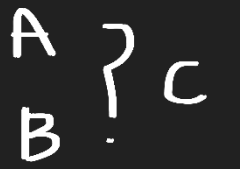
Ambiguous causes (n/a)

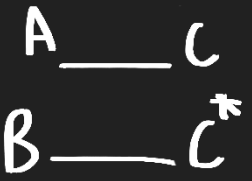
"A and B went in together"

vs.

Unrelated causes (6 <)

"A and B went in separately"





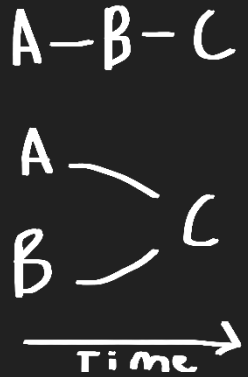
Connected causes (6 <)

"A told B to tell C"

vs.

Disconnected causes (8 <)

"A and B both told C"

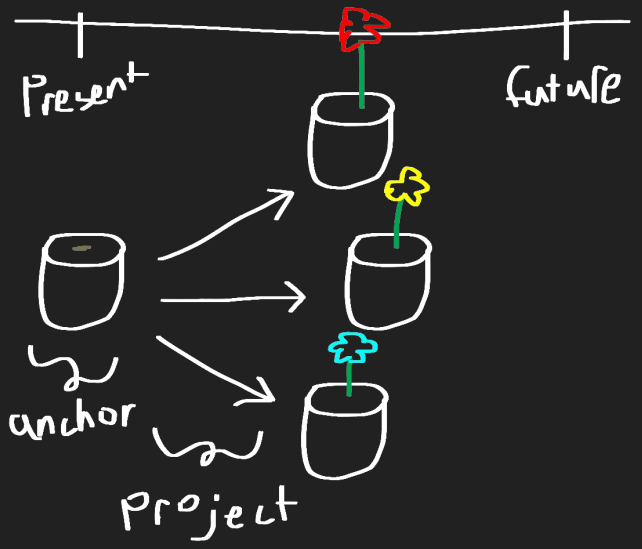


Modelling Modal Thought

Generating possibilities: a Decomposed Unified Framework

(Philips & Kratzer, 2022)

- Domain Projection
  - A cognitive function that inputs *anchors* and outputs its possibilities in the future.
  - Factuality-directed domain projection for real world thought.
  - *Inverted* domain projection outputs possible events from the anchors past.
- Anchors
  - Class of objects that represents a situation.
  - Actual anchors are based on situations in the real world.
  - Epistemic anchors are based on beliefs.



Reasoning through: Structural Causal Models

Structured in a directed acyclic graphs.

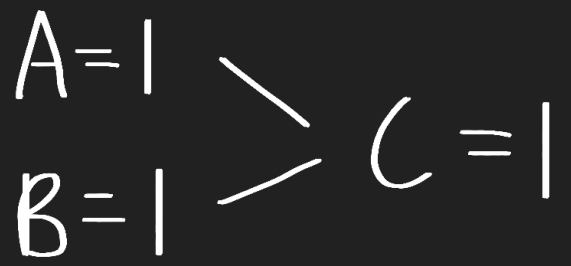
Situations are nodes and connections are causal relationships.

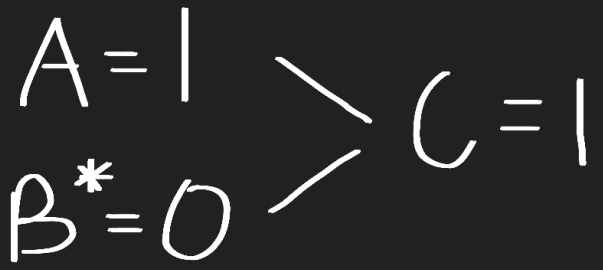
(Pearl, 2009)

- Changes from a counterfactual are followed unidirectionally (past to future)

(Hiddleston, 2009)

- Changes from a counterfactuals are followed by bidirectionally





Reference

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