# Prof. Rex Li's Writings

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**Title:** Gopnik's Blicket Machine: What's It About?

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**Summary/ Abstract:** Gopnik had developed a blicket machine to study infant thinking. See what she did and discovered.

**Prof. Li's Ideas 958 (26/1/2022)** **Revised (5/2/2022)**

# Gopnik's Blicket Machine: What's It About?

## (A) Background

Gopnik studied philosophy and psychology. She wrote even on Hume's induction problem, seeing Hume's connection with eastern philosophy (?). She got the inspiration from a MIT cognitive scientist Nancy Soya (1987) and created the Blicket Machine to study causality in children, starting in 1990s. (https://www.wordsense.eu/blicket/)

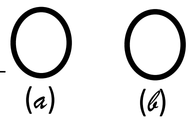
## (B) Research 1: 2003

Objective: Study children's understanding of causal power.

Pre-task: Learn the names of blicket (age 2,3,4)

Task 1: (categorization) —— which is blicket

Task 2: (induction) ——




Children to predict whether (a) or (b) can set off machine, property of object —— color, shape.

Task 3: (association) object —associate→ light up?

Object —cause→ to light up?

Findings:

(1) Use causal power to determine name

(2) Use name to produce causal power.

(3) Children don't category by association.

(4) Perceptual features confuse with causal power.

(5) These studies demonstrate that even very young children will easily and swiftly learn about a new causal power of an object and spontaneously use that information in classifying and naming the object. (quote from paper abstract)

R: Problem in research 1: How to distinguish association from cause? What is causality and association in Gopnik's definition?

## (C) Research 2: 2010

Background Issue: causality or association

Previous research suggests that children can infer causal relations from patterns of events. However, what appear to be cases of causal inference may simply reduce to children recognizing relevant associations among events, and responding based on those associations. (quote from paper abstract)

Experiment 1: Blicket detector

Experiment 2: Use abject and machine activation to make causal inference.

Findings:

(1) Associative models made no prediction or wrong prediction

(2) Causal inference by Bayesian structure learning. (not recognizing association)

Experiment 3: Probability on ambiguous data.

3-year-old ×

4-year-old ✓ causal inference

## (D) R: Implication and Significance

(1) Causality and association are complicated issues, traceable to Aristotle (4 causes) and Hume (induction bias). By 19th century, British psychologists, notably Berkeley and Bain, studied association. In early 20th century, Palvov discovered association and conditioning in dogs.

(2) It appears Gopnik had a pragmatic definition of association and causality (when something works in an *a* → *b* pattern, it is causal). She seems to discover that young children have associative thinking but grow into causality thinking.

(3) Her contribution is to discover child thinking in probability terms, in complex daily events, i.e. Bayesian structural learning and network.

Below are information from *The Philosophical Baby*

## (E) The Novel Blicket Machine

R: The advantage is that it can yield reliable pure experimental results not confounded / imputed by former experience.

> puters? One thing we could do is actually to introduce three- and four-year-olds to new causal events and see if they could use that knowledge to make predictions, design new interventions, and consider new possibilities. That way we could know for sure that the children were drawing these conclusions based just on the causal information we gave them—the new map—and nothing else.

(p. 43)

## (F) Children's Ability to Name and Categorize

See idea 956. Young children can name, categorize, see causality / association.

## (G) 4-year-old Counterfactual Thinking

Thinking in if-then mode.

> One of the first four-year-olds we tested immediately came up with a counterfactual any philosopher would be proud of. "But s'pose," he said excitedly, "you didn't put on the blicket that time, s'pose you only put on that one (pointing to the nonblicket) then it wouldn't have gone."

(p. 44)

> They can use the new causal information to draw the right kinds of conclusions, including counterfactual conclusions. They can imagine what will happen if you take the blicket off the machine or what might have happened if you had taken it off before.

(p. 45)

## (H) Pushing Button vs Talking to Machine

Laura Schuz and Gopnik asked children which will move the machine; push a button on the machine or talk and ask machine to move. Their experiment and conclusion:

> At first, every single one of the children said that the switch could make the machine go, but simply talking to it couldn't. These children have learned that machines work differently than people do.
>
> But then, if we actually demonstrate that talking to the machine causes it to light up, children change their minds. If you ask them to make the machine stop they very politely say, "Machine, please stop," instead of reaching for the switch. And if you ask the children to predict what will make a new machine go, they are much more willing to entertain the "talk to it" possibility than they were before, though they still think the switch is a better bet. Giving the children new causal knowledge changed the way they thought about possibilities, and changed the kinds of actions they would take. Children could imagine a listening machine that had seemed downright impossible before.

(p. 45)

R: In today's AI-speech-controlled machine, "talking to" works very well and children are accustomed to it. They had good discoveries: young children will take in new information and <u>update</u> their causal network; the network keeps growing.

## (I) Autism Children on Blicket Machine

p. 60 They don't seem to bother with causality. They are more visual and don't "think" causally in language (?)

## (J) Probabilistic Thinking in Babies

By showing children with blickets of different probability, Gopnik concluded that children have probability thinking like adults / students. In 2001, she had three experiments (two reported in book).

p. 84 1) Is it a blicket? —— one and two condition

p. 86 2) How to stop it? —— one and two condition

> We can even show that these young children are unconsciously calculating probabilities. We showed the children one block that made the detector go two out of six times and another that made it go two out of four times. Four-year-olds, who can't yet do simple addition, said that the second block had more of an effect on the detector than the first one. And in other experiments we showed that they used even more sophisticated Bayesian reasoning to calculate the probability of causes and effects.

(p. 85)

Babies Want to Effect Change

p. 87 See experiment of mobile tied to leg. Babies want to produce effect.

## (K) The Gear Toy Experiment

p. 88-89 Figuring out which causes what.

## (L) "Why didn't it Work" Explanation

> In another experiment Christine Legare took our blicket detector and added in a small twist. One group of preschool children saw that blocks made the box go. But another group saw that three blocks worked, but then saw that one block didn't work. Christine asked the children, "Why did that happen?" and then she let them play with the box. Children gave a bunch of interesting explanations: "You put it in the wrong place!" or "The battery's dead!" or "It just looks like a blicket, it isn't one really." The children who saw the puzzling event played with the box much longer than the children who saw the regular box. And they played in a way that reflected their explanations—the kids who said the last block wasn't really a blicket carefully made a pile of the good blickets and segregated them from the defective one.

(p. 90)

R: It appears children gave many explanations and dwell on puzzles.