Longer Childhood, Bigger Brain, Smarter Animal
It Takes a Village to Raise a Quokka
Human Brain
Development of Connections (Synapses)

Adapted from P. Huttenlocher et. al. (1979-1997)
How Children Learn

- Like Scientists
- Analyzing Statistics
- Doing Experiments
The Blicket Detector

Some blocks are blickets. Blickets make the blicket detector light up and play music.
24-Month-Old Statistics

RED WORKS 4/6 TIMES

BLUE WORKS 4/12 TIMES
Which objects are blickets?

Is D a blicket? Is E a blicket? Is F a blicket?
What if you also saw these events?
“Or” Training

“And” Training

Test
Imitation, statistics and pedagogy

Buchsbaum, Gopnik, Griffiths & Shafto, 2009
Current Study - Overview

• What parts of causal action sequences do children choose to imitate?

• Do they imitate different portions of sequences when given different statistical evidence about their effectiveness?
Experiment 1

- Children 3-5 years old (median 4.3 years)
- Two musical toys
- 6 possible actions on each toy
- Combinations of 3 actions are demonstrated
  - Some cause the toy to play music, some don’t
- Which of the actions will children imitate?
## Evidence Patterns

<table>
<thead>
<tr>
<th>“ABC” Condition</th>
<th>“BC” Condition</th>
<th>“C” Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABC+</td>
<td>ABC+</td>
<td>ABC+</td>
</tr>
<tr>
<td>DEC</td>
<td>ADC</td>
<td>ADC+</td>
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<tr>
<td>ABC+</td>
<td>DBC+</td>
<td>DBC+</td>
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<tr>
<td>EDC</td>
<td>AEC</td>
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<tr>
<td>ABC+</td>
<td>EBC+</td>
<td>EBC+</td>
</tr>
</tbody>
</table>
Le Gare: Play as Experiment
**EXPERIMENT 1**

“ALL BEADS” OR “SOME BEADS”

**Glued pair**

Separable pair

*Demonstration phase*

*(All pairs activated the toy)*

**Free play**

*(60 seconds)*

**EXPERIMENT 2**

“ALL BEADS” OR “SOME BEADS”

**Glued pair**

Cook, Goodman and Schulz, 2011
Children’s Exploratory Play

Do children recognize when evidence is confounded?

Do children play more when evidence is confounded?

Schulz & Bonawitz, 2007
Novel Toy

• Four interesting properties

Bonawitz, Shafto, Gweon, Katz, Chang, & Schulz, 2009
Understanding Other Minds: Repacholi and Gopnik
Understanding other minds;

- Statistics - Kushnir, Wellman & Xu
Imagination: Imaginary Companions
Marjorie Taylor: Imaginary Companions and the Children Who Create Them
Monkey’s Birthday

• Two within-subject phases
  – Counterfactual phase
  – Pretense phase
• 52 preschool age children
  – 26 four year olds
  – 26 three year olds
• “Birthday machine” for Monkey’s birthday
Counterfactual Phase

• Introduced to “birthday machine” and two objects
  – Plays happy birthday when “zando” is on top
  – Does nothing when “not a zando” is on top
• Asked counterfactuals
  – “if this one was not a zando what would happen if we put it on the machine?”
  – “if this one was a zando, what would happen if we put it on the machine?”
Counterfactuals
Pretense Phase

- Confederate needs to borrow real machine and objects
- Introduce box + two wood blocks for pretend
- How do we pretend to make the machine go?
  - What do we pretend when we put each block on the machine?
  - Reverse roles of blocks and repeat
Pretense
It Takes a Village
Collaborators and Support

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- Noah Goodman
- Caren Walker
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- Sophie Bridgers

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