How do young children learn to name objects? (given the indeterminacy problem…?)

Children must be biased learners.
They must know something about how nouns map onto categories.

Names for things
Novel Noun Generalization Task
(e.g., Landau, Smith & Jones, 88; Soja, Carey & Spelke, 92; Samuelson & Smith, 99)

Children seem to honor a distinction between solid objects and non-solid substances

The Phenomenon

- Biases that constrain word learning
- Abstract, apply to things never seen before
- Divide the world into two ontological categories

Emerge with development
The nativist idea:

Guides
chair  milk  sand
castle  egg

An opposing idea from the connectionist perspective:

castle  egg  milk  sand

An opposing idea:

generalize
chair  milk  sand
castle  egg

castle  egg  milk  sand

Step 1.

Child learns the names of individual objects (slowly, effortfully).
Same name goes with same shape in the input.
Attention to shape is rewarded.
Step 2.

Balls are round.
Cups are cup-shaped.

1\textsuperscript{st} order generalization: Child forms individual lexical categories organized by object shape.

Step 3.

Balls are round.
Cups are cup-shaped.

2\textsuperscript{nd} order generalization: Child develops a \textit{general} tendency to attend to object shape when extending an object name to new instances.

That is… a \textit{“shape bias”}.

Step 4.

\textit{In consequence}...

Child shows an increase in rate of new object name acquisitions.

- Are the words children know really organized this way?
  – Yes!
- Is that organization enough to create biases?
  – Yes!
  – I’ll show you in a computational model.
- Well, ok, but can your model make any novel predictions?
  – Yes!
Are the words children know really organized this way? (Samuelson & Smith, 1999)

- examined the similarity structure of 300 early nouns
- for each noun:
  - Are the items in this category solid or non-solid?
  - Are the items in this category alike in shape?
  - Are the items in this category alike in material?
  - Are the items in this category alike in color?

Samuelson & Smith, 1999

- Are the words children know really organized this way?
  - Yes!
- Is that organization enough to create biases?

Experiment 1 - Networks
Training

Testing

Results

• Are the words children know really organized this way?
  – Yes!
• Is that organization enough to create biases?
  – Yes!
• How about novel predictions?
A new prediction: the ontology bias

names do not refer to categories that violate ontological boundaries

Experiment 2 - Networks

Does the network believe that names will not violate the boundary between solid and non-solid?

Experiment 2 - Ontology violating

Experiment 3

- given a \textbf{solid} object, will children refuse to generalize its name to an object of the same shape if it is \textbf{not solid}?
- given a \textbf{non-solid} substance, will children refuse to generalize its name to a material match that is \textbf{solid}?
Stimuli - in the networks

Stimuli - ontology violating shape matches

Stimuli - ontology violating material matches

Experiment 3 - Children

Design

Subjects: 24 children, 30-36 months old
Solid vs. Non-solid exemplar between subjects
Ontology Maintaining vs. Ontology Violating within subject
Each child had 12 trials
**Conclusions**

- Early words present an organized structure
- Enough to create a shape bias for solids and a material bias for nonsolids
- Enough to create an “ontology:” *a belief in solid objects and nonsolid substances as different kinds*
- In two kinds of statistical learners: *networks and children*

**Other predictions of the model**

- Early material bias for some kinds of shapes
- Similarities and differences in noun generalizations by Japanese- vs. English-speakers.
- Similarities and differences in noun generalizations by Spanish- vs. English-speakers