The mapping problem

The gavagai problem
(Quine, 1968)

Upon hearing “gavagai” in the presence of a rabbit on a field, what could a linguist traveling in a distant land conclude?
That *gavagai* means:
- Rabbit
- Furry thing
- Big ears
- Let’s go hunting
- Dinner!
- There will be a storm tonight

Agenda

- The mapping problem
- GQ 4.1 group discussion
- Constraints on word learning
  - 0.1 Whole object
  - 0.2 Taxonomic
  - 0.3 Mutual exclusivity
  - 0.4 Fast mapping
  - 0.5 Syntax

The gavagai problem
(Quine, 1968)

How do children cope? What kinds of errors make? What strategies do they seem to employ?
The language learner faces a great many challenges in learning a word’s meaning. Children often overgeneralize or overextend the meaning of a word. A famous case in the literature is a child who learned the word for "moon" and then applied it to cakes, round marks, postmarks, and the letter "O". What is the child doing in these cases? What might the specific overgeneralizations that a child uses reveal about his or her strategy for word learning? How might such a strategy be efficient in terms of word learning?

Group leaders: Ally, Thomas, Jun, Paul, Becca, Sam, Ryan, Daniel, Stephen

The mapping problem

Errors

- Overextensions: moon applies to any round object
- Underextensions: puppy means only the child’s puppy

Questions

What do these errors reveal about strategies employed by children?

Assumptions

1. Whole object assumption – word labels refer to whole over parts
2. Taxonomic assumption – word labels extended to kinds rather than those that are thematic related
3. Mutual exclusivity – one word label per object

Whole object assumption

Whole object

Children (and adults) immediately take a new word to refer to the whole object, rather than a part or a property of that object.

Figure 1. An example of an object trial and a substance trial in Experiment 1 (filled circles indicate metal, open circles indicate plastic, filled squares indicate Dippity-do, and open squares indicate lumpy Nives).

(Soja, Carey, & Spelke, 1991)
Taxonomic assumption

Children assume that a word label should be extended to an object of the same kind (rather than one with a similar role). Markman & Hitchinson (1984) tested how children use taxonomic vs. thematic relations with and without word labels.

Taxonomic assumption

‘Find another one’  Thematic associate  Taxonomic associate

‘This is a fep. Find another fep.’  Thematic associate  Taxonomic associate
Mutual exclusivity assumption

**Mutual exclusivity**
Children assume that one word cannot refer to two different kinds of things.
Where is the dax?

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Fast mapping

**Fast mapping**
Associating a word with its referent after a single exposure: single trial learning, typically framed in terms of a deductive hypothesis about what word is likely to mean, given what learner already knows.

- Children show incredible fast-mapping abilities from age 2 on
- But can animals also show fast-mapping like behavior?

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Fast mapping

Rico, the border collie

http://www.hulu.com/watch/87813
## Differences

<table>
<thead>
<tr>
<th>Rico</th>
<th>A child</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Rico is likely exceptional</td>
<td>1. Nearly all children learn words</td>
</tr>
<tr>
<td>2. Vocabulary limited even by age 9</td>
<td>2. At 9, children know 10s of thousands of words</td>
</tr>
<tr>
<td>3. Complexity limited</td>
<td>3. Complexity unbounded</td>
</tr>
</tbody>
</table>

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**Fast mapping**

**Fast mapping specific to words?**

- Adults and Children (3–4 yrs) given 10 objects to play with as part of a game.
- Names were casually introduced in two conditions and a control:
  - **Name** “Let’s use the koba to measure which is longer. We can put the koba away now.”
  - **Description** “We can use the thing my uncle gave me to measure which is longer. We can put the thing my uncle gave me away now.”
  - **Control** “The sticker goes here …” (Placing sticker on an object.)

- Retention high for both name and description, but did not extend to control.

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**Word learning**

**Vocabulary explosion**

- 10 – 15 mo  First words
- 16 – 18 mo  Approx 8 – 12 words per month
- > 18 mo  Approx 10 words per day

**Explosion may depend on a variety of devices:**

*The ability to learn the meaning of words depends on a number of capacities, some of which are specific to language and unique to humans, others of which are potentially shared with other species. (Bloom & Markman, 1998)*

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### Fig. 1 Fast mapping is not limited to word learning

The proportion of three- and four-year-old children (open bars) and adults (filled bars) who, after a one-month-delay, recalled the object to which the novel word referred (Koba), the object that had the property of being given to the experimenter by her uncle (Uncle), and the object that had a sticker affixed to it (Sticker). There was no difference in performance between children and adults in both the ‘Koba’ and ‘Uncle’ conditions, suggesting that there is no critical period for word learning. In addition, there was no difference in performance between these two conditions, suggesting that fast mapping is not restricted to language learning. Finally, both age groups did worse in the ‘Sticker’ condition. This was especially so for the children, who were not better than chance.


**Linguistic capacities**

Use knowledge of syntax to determine the basic ontological categories of words

(1) This is …
   - a. Stella
     - a name
   - b. a doll
     - a kind

(2) a. Do you know what a sib is? In this picture, you can see a sib.
   - Count noun syntax
   b. Have you seen sibbing? In this picture, you can see sibbing.
   - Verb syntax

**Sensitivity**

**Open questions**

1. How might children become sensitive to these cues?
2. When might we expect that these cues become active in development?
3. What would we learn about these sorts of mechanisms if dogs like Rico could use syntactic cues in fast mapping? Is it likely that they can?