First Language Acquisition

– attack imitation/correction and stats theories
  • Brown findings, fast mapping, goldilocks
  • constraints on learning: word meaning, null subjects
  • crazy rules and chain shifts
  • abilities in womb
  • invariant stages
  • loss of abilities at 12 months
  • regularisation stage
Today’s topics

• What does acquiring a language involve?
  – Plato’s Problem
• How can we investigate child language given all the inherent difficulties?
  – sucking, head turn, eye tracking…
• What have these methods shown us about child language?
  – stages of learning, fast mapping, craziness…
• What do these findings entail for our understanding of language and the mind?
  – innate knowledge, hypothesis formation…

What does acquiring a language involve?

• How do children manage to learn a language, given such limited and faulty input?

  – The Imitation Hypothesis:
  • Children mimic the speech of their parents and/or peers. If they are successful, they are reinforced; if they err, they are corrected. Once they have mastered certain forms, they generalize what they have learned to create new utterances, extending what they know by analogy.
Problems with the Imitation Hypothesis

2. We know many things that we were never taught.
   • word meanings, Principle C...

3. What children are exposed to is deficient and faulty.
   - The Gavagai problem
   - Background noise
   - Quayle/Bush speech
   - Parents’ priorities (Roger Brown)
     • Child: Momma isn’t a boy, he’s a girl.
     • Mother: That’s right.
     • Child: And Walt Disney comes on Tuesday.
     • Mother: No, he does not.
Problems with the Imitation Hypothesis

2. We know many things that we were never taught.
3. What children are exposed to is deficient and faulty.
4. What children are taught they often ignore.

Child: Want other one spoon, Daddy.
Father: You mean you want the other spoon.
Child: Yes, I want other one spoon, please, Daddy.
Father: Can you say “the other spoon”?
Child: Other…one…spoon.
Father: Say “other”.
Child: Other.
Father: “Spoon”.
Child: Spoon.
Father: “Other…Spoon.”
Child: Other…spoon. Now give me other one spoon?

2. We know many things that we were never taught.
3. What children are exposed to is deficient and faulty.
4. What children are taught they often ignore.
5. Children in all cultures acquire language in the same way:

<table>
<thead>
<tr>
<th>Age</th>
<th>Stage</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-7 months</td>
<td>babbling (including deaf children)</td>
</tr>
<tr>
<td>12-18 months</td>
<td>one word stage</td>
</tr>
<tr>
<td>18 months</td>
<td>2+ word stage; 50 word vocabulary</td>
</tr>
<tr>
<td>2-3 years</td>
<td>fluent sentences</td>
</tr>
<tr>
<td>7 years</td>
<td>ability to acquire language begins to decline</td>
</tr>
</tbody>
</table>
Problems with the Imitation Hypothesis

2. We know many things that we were never taught.
3. What children are exposed to is deficient and faulty.
4. What children are taught they often ignore.
5. Children in all cultures acquire language in the same way.
6. Children create original combinations.

\[\text{goed} = \text{went} \]
\[\text{allgone outside} = \text{I just came in} \]
\[\text{more page} = \text{read me more stories}\]

Plato’s Problem

- How do children manage to learn a language, given such limited and faulty input?

- 1. The Imitation Hypothesis
- 2. We have a genetic endowment that gives us a head start on learning languages.

- NB no priors, no learning!
• What evidence do we have for UG other than the arguments already adduced?
  – If there is an innate linguistic component, it should have an identifiable place in brain.
    • Damage to this area should impair language, while other intelligence remains. DYSPHASIAS
    • Damage to all but this area should produce general retardation while leaving language intact. TURNER’S AND WILLIAMS SYNDROMES
  – Conversely, if language is part of general intelligence, language and other aspects of intelligence should be affected equally in all cases.

How can we investigate child language given all the inherent difficulties?
Wug tests

- wug video from Crain lab

Techniques with pre-linguistic infants

- “In preverbal infants, inferences about categorization have relied on methods based on habituation, conjugate reinforcement, and operant conditioning.”
  - heart rate (pre-natal)
  - Multiple Exemplar Habituation/Preferential Looking
  - Conjugate Reinforcement
    - High Amplitude (Non-Nutritive) Sucking
    - Foot Kicking
  - Operant Conditioning
    - Conditioned Head Turn (Kuhl 1979, 1983)
  - 2-alternative anticipatory eye movement response
## Effects of prenatal exposure

- Method: measurement of heart rate
- Prenatal exposure: mother’s voice (filtered sound)
- Recognition of a prose passage before birth (DeCasper et al. 1994)
- Recognition of the native language (after birth (Mehler et al. 1986))

### High-Amplitude Sucking (HAS)

- [Jusczyk sucking video]
Conditioned Head Turn

- Infant (≥ 0;6) hears constant background stimulus, e.g. [ba], and target, e.g. [pa]
- Conditioned to turn head only to target set, not background set (correct response reinforced by flashing lights, drumming bears)

Conditioned Head Turn

- one such test:
  - [ta] : [tʰa]
  - [tha] : [dʰa]
**Color vs. shape**

*Two-alternative forced choice: McMurray and Aslin 2004*

**Experiment:** Compare the relative weighting of shape and color in forming visual categories.
- Infants trained on either red squares (which emerged on the left of the occluder) or yellow crosses (which emerged on the right).
- Then tested on red crosses and yellow squares.
- Previous studies: color primacy.

**Results:**
- All 5 babies who both generalized and learned (and did not show a directional bias) showed a preference for color higher than expected by chance.
- They treated red crosses as if they came from the same category as red squares and yellow squares as if they came from the same category as yellow crosses.
- Cf. Baldwin 1989 on form vs color

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**What have these methods shown us about child language?**
Generalisation by Infants

- **Marcus et al 1999**
  - **Question**
    - Do infants extract linguistic generalisations, and in what form?
  - **Method**
    - 16 infants randomly assigned to one of two groups, each familiarized with 2-minute speech sample
      - ABA group: 3 reps of each of 16 3-word sentences from ABA grammar (ga ti ga, li na li, etc.)
      - ABB group: same with ABB grammar (ga ti ti, etc.)
    - After habituation, testing on sentences of 3 novel nonce words
      - Test sentences varied as to whether they were consistent or inconsistent with the grammar of the habituation sentences.
      - Because none of the test words appeared in the habituation phase, infants could not distinguish the test sentences based on transitional probabilities, and because the test sentences were the same length and were generated by a computer, the infant could not distinguish them based on statistical properties such as number of syllables or prosody.
  - **Results**
    - The infants attend longer to sentences with unfamiliar structures.
  - **Conclusions**
    - “Results suggest that infants can represent, extract, and generalize abstract algebraic rules.”

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Null Subjects

- **Rate of acquisition**
  - > 90% of sentences in adult input contain overt subject
  - Anglophone children don’t master overt sentential subject requirement until as late as 36 months (Valian 1991)
  - Compare to acquisition of finite verb placement (before negation and adverbs) in French by 1;6
- **Subtleties**
  - 2-year-olds imitating sentences omitted subjects NPs 19%, object NPs 1% (Gerken 1991)
  - Children omit 1st and 2nd persons more frequently than 3rd person arguments (Clancy 1993)
  - Children don’t omit:
    - subjects in questions with a fronted wh-element (Valian 1990)
    - subjects in subordinate clauses (Valian 1991)
Double-WH constructions

• CRAIN VIDEO: What do you think what’s in here?

Acquisition of word meaning

• Typical stages
• Indeterminacy $\Rightarrow$ error typology
• Priors
**Stages of lexical development**

- Onset around nine months (comprehension) or 12 months (production)
- 14,000 words around the age of six (approximately 10 words per day after the age of two)
- Between six and 17: approximately 3,000 words per year; 50,000 words at the age of 17
- NB saltatory inference of meaning ("fast mapping", Carey & Bartlett 1978)

**Acquisition of lexical meaning**

- How do children learn what a word refers to?
  - Quine’s gavagai problem ("underdetermination"; subcase of Plato’s Problem)
  - Cognitive biases
Semantic errors

- Overextensions (see next slide)
  - A word is used for something that has a similar shape, color, or function as the original referent
    - daddy = all adult males
    - ball for moon, dog for bear, donkey, wolf, etc.
  - Barrett 1978 (?1996): 7-33% of words
  - Occurs late in the development of a word (Dromi 1987)
  - Based on appearance and shape more often than on function
    - car for a sled
- Underextensions (see next slide)
  - A word is used for only a subset of what the word refers to
    - shoes for the child’s own shoes but not for someone else’s shoes
  - more common early on (Golinkoff et al. 1994)
- Naming errors most common when children are in 50-150 word stage (Gershkoff-Stowe 2001)

Overextension

<table>
<thead>
<tr>
<th>child's word</th>
<th>first referent</th>
<th>extensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>fly</td>
<td>housefly</td>
<td>specks of dirt, dust, all small insects, child’s own toes, crumbs, small toad</td>
</tr>
<tr>
<td>koko</td>
<td>rooster crowing</td>
<td>piano, phonograph, tunes played on violin, accordion, all music, merry-go-round</td>
</tr>
<tr>
<td>wau-wau</td>
<td>dog</td>
<td>toy dog, soft slippers, picture of old man in furs, all animals</td>
</tr>
</tbody>
</table>
## Underextension

<table>
<thead>
<tr>
<th>child’s word</th>
<th>first referent (no extensions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>car</td>
<td>family Pontiac</td>
</tr>
<tr>
<td>plant</td>
<td>fern in kitchen</td>
</tr>
<tr>
<td>dish</td>
<td>child’s dish</td>
</tr>
<tr>
<td>mow-mow</td>
<td>family cat</td>
</tr>
</tbody>
</table>

## Constraining the hypothesis space

- There literally is an infinity of possible inductive inferences for the child.
- Something must constrain their hypothesis space.
  - If not, the child cannot learn words for objects.
- Proposal: LAD/UG
  - “priors” in Bayesian learning
Semantic priors

- **Noun bias**
- **Mutual Exclusivity bias** (Markman 1989; cf. Clark 1987 on contrast)
  - children assume that the newly introduced word maps to an object which does not yet have a label
- **Whole Object bias**
  - children assume that the word refers to the entirety of the referred object, not its part, material, texture, or color
- **Object Category bias**
  - assume that the word is not restricted to the originally referred object, but it can be generalized to other objects of 'like kind'
- **Shape bias** (Imai, Gentner, & Uchida 1994)
  - provides children with a basis for determining what objects are 'alike' to the originally labeled object
- **Form over color bias** (Baldwin 1989)

Nouns learned before verbs

- **Why?**
  - Ns often refer to individual objects, persons, etc. ∴ their meaning is relatively easy to figure out.
  - Verbs are relational, i.e. you can’t imagine what a verb means without the verb’s arguments. Therefore, their meaning is relatively difficult to figure out.
- **This is not an input effect:**
  - Verbs are more frequent than nouns
  - Even in 'verb-friendly' languages (e.g., Korean, where verbs come at the end of utterances, and occur often in isolation) children start with nouns and not with verbs.
Mutual Exclusivity

- Anecdotal evidence: Children say things like That is not a car it is a taxi.
- show child pair of pewter tongs and call it biff, child interprets biff as tongs in general; when asked for more biffs, it picks out plastic tongs.
- If shown a pewter cup called biff, child assumes it means pewter, not cup, since it already has a word for ‘cup’. When asked for more biffs, the child chooses pewter spoon or pewter tongs.

The whole object bias

- Returning to “look at the dog”:
- Which object, exactly, are we talking about?
  - The whole dog?
  - The tail?
  - The face?
  - The front-left paw?
- Or are we talking about a property of an identifiable object?
  - For example, the color of its coat...
- The child assumes that the label refers to the whole object.
Shape bias and substance bias

- **Soja, Carey, and Spelke 1991**
  - When objects are solid (e.g., hammer, pencil), children tend to categorize them by their shape.
  - When objects are not solid (hair gel, liquids), children tend to categorize them by their substance.
  - Note: in some languages, these distinctions are expressed in the language (mass nouns vs. count nouns in English), but in other languages, these distinctions are not expressed (e.g., classifier languages, such as Japanese). However, children of both languages respond similarly, which shows that this is not a language effect, but a cognitive effect.

Form over color

- **Baldwin 1989**
  - no label condition: child shown object for picture book, asked to find another one like it
  - novel label condition: same, but puppet says “see this X? Can you find another X?”
  - 10 trials
  - 20 2 yr olds, 20 3 yr olds
What do these findings entail for our understanding of language and the mind?

- The Language Acquisition Device is constrained by a wide range of priors (syntactic, semantic, phonetic...), which restrict the sorts of linguistic hypotheses entertained by the child.
- Hypothesis formation is rapid and aggressive.
  - compatible with Bayesian but not connectionist learning models

References


References


