Acquisition of Syntax summary
Points of interest not covered in class (for reasons of time) are in gray.

1. Overview of language acquisition

**Production**

- Babbling: 6-12 months (roughly)
- 1-word: 1 yr - 1.5 years
- 2-word: 1.5 years - 2 years*
- telegraphic: 2 years - 2.5
- approaching adult-like: 2.5-

*vocabulary spurt! 5-9 new words a day until 6 years old! An average American high school senior has been estimated to know about 45,000 words.1

-->There is no 3-word stage!

**Perception/comprehension always ahead of production.**

- For example, detectable sensitivity to words and word boundaries from about 10 months. First words appear 1-2 months later.
- Detectable sensitivity to functional categories in 10-11 month-olds, missing from production in the second year (work of LouAnn Gerken). For example:

**Critical period:** Natural language acquisition process turns off...

2. Do parents teach children how to speak? — the central puzzle of language acquisition

- **The puzzle:** How does the child learn language so quickly, given the complexity of the system and the limited and faulty input.
- Language surrounding the child is error-full, not designed to accommodate the needs of a language learner: no word boundaries, no morpheme boundaries, no trees...

**Answers**

- Deliberate instruction (behaviorism): rewards and punishments?

---

1 Take such numbers with a grain of salt, since the figure includes many morphologically complex words, and does not include many morphologically complex words that the average high-school senior easily composes.

2 To my shock and horror, I realize that I did not mention in class Chomsky's cute term for this issue: "Plato's Problem", i.e. how we as humans know so much on the basis of so little information from the outside world. Every time I have taught 24.900 in the past, I have not neglected this term, and it has always been a final exam question too! Shame on me... but to reward those of you who are reading this footnote, it might be on this year's final exam nonetheless.

---

Yes! — a behaviorist view: "In teaching the young child to talk, the formal specifications upon which reinforcement is contingent are at first greatly relaxed. Any response which vaguely resembles the standard behavior of the community is reinforced. When these begin to appear frequently, a closer approximation is insisted upon. In this manner very complex verbal forms may be reached."

- B.F. Skinner (1957) *Verbal Behavior*, pp. 30-31

No! — Chomsky's famous reply: "It is simply not true that children can learn language only through 'meticulous care' on the part of adults who shape their verbal repertoire through careful differential reinforcement, though it may be that such care is often the custom in academic families. It is a common observation that a young child of immigrant parents may learn a second language in the streets, from other children, with amazing rapidity, and that his speech may be completely fluent and correct to the last allophone, while the subtleties that become second nature to the child may elude his parents despite high motivation and continued practice."

- N. Chomsky, 1957 review of Skinner's *Verbal Behavior*

- Implicit instruction -- motherese?

Children whose mothers use Motherese more consistently don't pass through the milestones of language development any faster (Newport, et al, 1977).

- Societies differ in use of Motherese.
- Warlpiri (central Australia): don't talk to someone who can't talk back.

Recall our discussion of fuckin' inflexion: those rules are not explicitly taught by loving parents intent on making sure their children don't say *Massachu-fuckin'-setts* instead of the wonderfully correct *Massa-fuckin'-chusetts!*

- **Acquisition = Universal Grammar (UG) + Experience**

Just as some languages don't occur, some errors are not made by children.

Actually, experience may be overrated as well. Google for discussions of spontaneous sign-language creation by children raised without adult sign speakers (so-called 'home sign'), and the story of Nicaraguan Sign language.

- Of course social interaction plays some role in language acquisition. Severe deprivation during the critical period impairs language acquisition.

- **Perception and comprehension always away ahead of production.**

For example, detectable sensitivity to words and word boundaries appears about 10 months — but the first produced words appear 1-2 months later.

Detectable sensitivity to functional categories at 10-11 months — but missing from production in the second year.


© Copley Publishing Group. All rights reserved. This content is excluded from our Creative Commons license. For more information, see [http://ocw.mit.edu/fairuse](http://ocw.mit.edu/fairuse).
3. Phonetics

- Discussed earlier in the course. Infants discriminate the sounds of speech categorically, in an adult-like manner, even when the distinctions lie at arbitrary points along an acoustic continuum.
- Distinctions not used in the target language are lost (more accurately: suppressed in some fashion) during the first year of life. See below.

4. Phonology

Child's tasks:
- determine the phonemic inventory (underlying segments) of the language
- build the phonological part of the lexicon (underlying representations)
- determine the rule system that relates underlying representations to surface forms

Determining phonemic inventory

**Production:**
- 4-5 months, some speech sounds.
- 6-7 months - "canonical babbling" begins.

**Babbling** initially contains a wide repertory of speech sounds, and finally zeroes in on the speech sounds of the target language.

- Around 8-10 months, adults can recognize the target language of a babbling child (French, Cantonese, Arabic). By 6 months, Chinese children's babbling contains more tonal variation than the babbling of an American child.
- Deaf children babble vocally as well, though naturally there's no gradual approximation to a target language.
- Also: gestures analogous to babbling are noted in deaf children learning ASL.

Concluding: inner biological clock governs onset of babbling; this clock is unaware of child's deafness.

- Just as spoken language babbling shows properties of the language being acquired, so does sign language babbling.
- Laura Pettito's work: Hearing children who are acquiring sign (deaf parents) babble manually. You can see the video clip from class, along with a fuller description of this work, at [http://petitto.gallaudet.edu/~7Epettito/archive/nature.html](http://petitto.gallaudet.edu/~7Epettito/archive/nature.html). The other materials on Pettito's website are worth reading as well.

- Children with tracheostomy surgery that eliminates vocal production do not hear themselves babble. When the tracheostomy hole is closed, there are some delays in speech, but they quickly jump to age-appropriate behavior, skipping various stages.

**Conclusion:** Babbling is linguistic (not motoric) — but it is not "practice" essential for language acquisition. It is a by-product of the process of language acquisition, not an essential building block.

**Perception:** During first year, child stops discriminating certain distinctions that are non-phonemic in his/her target language. This parallels the refinement of sounds produced in babbling that approximates the target language.

- **First words/Production:** Not all contrasts made, much individual variation in order with which contrasts appear in production (e.g. alveolar/velar then labial).

For example, a typical development of contrasts:
- stage 1: p t k
- stage 2: p t k
- stage 3: voicing
- stage 4: nasal

**Perception/knowledge lags behind production:**
- Children know the contrasts that they do not produce/
- Also, numerous observations that children do not recognize words produced with the very phonetic changes they put in them. A child who says *sip* for *ship* will not identify a *sip* as something you sail in.
Underlying representations/rule system

(1) A Japanese child’s phonology
Age 3;2: substitutes [t] for [k] — but phonological rules that apply to adult [t] only apply to those [t]'s that really are [t]'s for the adult.

<table>
<thead>
<tr>
<th>child</th>
<th>adult</th>
<th>comment</th>
<th>meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>mitaŋ</td>
<td>mikan</td>
<td>adult [k]—&gt;child [t]</td>
<td>'orange'</td>
</tr>
<tr>
<td>potetto</td>
<td>poketto</td>
<td></td>
<td>'pocket'</td>
</tr>
<tr>
<td>neto</td>
<td>neko</td>
<td></td>
<td>'cat'</td>
</tr>
<tr>
<td>tama</td>
<td>tama</td>
<td>adult [t] stays [t]</td>
<td>'ball'</td>
</tr>
<tr>
<td>terebi</td>
<td>terebi</td>
<td></td>
<td>'TV'</td>
</tr>
<tr>
<td>tobu</td>
<td>tobu</td>
<td></td>
<td>'fly'</td>
</tr>
<tr>
<td>matʃi</td>
<td>matʃi</td>
<td>t→tf/ __i</td>
<td>'city'</td>
</tr>
<tr>
<td>tsuta</td>
<td>tsuta</td>
<td>t→ts/ __u</td>
<td>'ivy'</td>
</tr>
</tbody>
</table>

These rules do not apply to child's [t] that corresponds to adult [k]:

<table>
<thead>
<tr>
<th>ati</th>
<th>aki</th>
<th>'fall'</th>
</tr>
</thead>
<tbody>
<tr>
<td>tuma</td>
<td>kuma</td>
<td>'bear'</td>
</tr>
</tbody>
</table>

But production differences are systematic and linguistic:

For example, common to use only initial onset and rhyme of adult production. This creates syllable simplification in monosyllabic words: (bɛd → bɛ). But this simplified syllable is copied (reduplication) in production of a disyllabic word: chicken → [dɪd], water → [wɔwɔ]. The syllable count of the word is preserved, with a morphological process known in the adult grammar (reduplication) used to create the second syllable.

Prosodic bootstrapping:
Some common, but not universal phonological phenomena respect word boundaries.

- For example, in French, the final a of panorama is longer than the first a of matimaticien. 3-day old infants can distinguish ma-ti from panorama typique from ma-ti out of matematrixien. So the information, if relevant to guessing word boundaries, is perceived... [Mehler et al -- this is a sucking/habitation experiment]

- Also, typical stress patterns get noticed. Czech - initial / French - final / Polish - penultimate. English: 90% of nouns have stressed initial syllables. If a child anticipates this sort of regularity, it at least narrows hypotheses... In a 1993 study by Juszyk, Cutler and Redanz, 9-month old American infants listened longer to words with initial stress than to other words. No such difference among 6-month olds.

- Maybe these features are exaggerated in production by parents (motherese)?

Statistical bootstrapping
Sequences of syllables that overlap word boundaries are often less likely than sequences of syllables within words, simply because it's words that are being learned.

- pretty baby: [rɪˈbi] (pret-ty ba-by) less common because it's not a word. If kids are sensitive to these probabilities, they can form hypotheses about word/non-word on the basis of these probabilities.

- Computer corpus analysis does fairly well (emphasize "fairly") finding word boundaries this way. Do babies do this too? Perhaps.

6. Morphology

Child's tasks:
- determine the morphemes/words of the language
- determine the rules that combine morphemes into words

Example:
learn that walked contains two morphemes

On the one hand...
- Some evidence that language acquisition device is "pretuned" to pick up morphological patterns.

Those of you who read the paper by Safran, Aslin & Newport on statistical learning by infants (one of the choices for the first paper) might be interested in a follow-up by Marcus et al (1999) in Science:

In a clever twist on the Safran et al. experiment, Gary Marcus of NYU and three colleagues did a similar experiment with 7-month old (actually, slightly younger) infants. (Science, January 1, 1999). Once again, a two-minute stream of synthesized speech was played to the infants. Once again, the speech stream was composed of three-syllable nonsense words, made from synthesized speech, with no cues identifying the word boundaries. Once again, the
children were played different recordings in a later presentation which they could control by
gazing at or looking away from a blinking light.

This time, however, the nonsense words in the first presentation were not randomly chosen
sequences of syllables, but conformed to simple rules, or templates. One group of infants, for
example, heard a string of nonsense words in which the second two syllables were identical (ga
ti ti, li na na). Another group heard words in which the first and third syllables were identical
(ti ga ti, na li na).

The key recording in the second presentation did not consist this time of the same words
rearranged, but consisted of entirely new words that followed the same rule as the first set of
words. Could infants distinguish new words that followed the rule from new words that did
not? Strikingly, they could. The infants preferred novel second presentations over familiar
second presentations. But "familiar" here meant -- not containing the same "words" -- but
containing new words that followed the old rule. In their words: "Infants [can] extract abstract
algebra-like rules that represent relationships between placeholders (variables), such as "the
first item X is the same as the third item Y," or more generally, that "item I is the same as item
J...In addition to having the capacity to represent such rules, our results appear to show that
infants have the ability to extract those rules rapidly from small amounts of input and to
genralize those rules to novel instances."

On the other hand...

• Morphological rule learning across the entire language takes a while longer.
  It's still miraculously fast, but far from instantaneous!

Classic experiment: the "wug test". At what age do English-speaking children produce the correct plural endings [-s], [-z] and [-əəz]? Answer: quite early for
[-s] (cats), and [-z] (dogs), but quite late for the [-əəz] that follows sibilants
(horses, edges). Testing is done with a mixture of nouns that the children know and invented nouns like the now-famous wug:

% correct pre-school answers % correct first-grade answers

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>glasses</td>
<td>75</td>
<td>99</td>
</tr>
<tr>
<td>wugs</td>
<td>76</td>
<td>97</td>
</tr>
<tr>
<td>luns</td>
<td>68</td>
<td>92</td>
</tr>
<tr>
<td>tors</td>
<td>73</td>
<td>90</td>
</tr>
<tr>
<td>heafs</td>
<td>79</td>
<td>80</td>
</tr>
<tr>
<td>eras</td>
<td>38</td>
<td>66</td>
</tr>
<tr>
<td>tors</td>
<td>73</td>
<td>90</td>
</tr>
<tr>
<td>heafs</td>
<td>79</td>
<td>80</td>
</tr>
<tr>
<td>eras</td>
<td>38</td>
<td>66</td>
</tr>
</tbody>
</table>

Note about 2/3 of the first-graders tested failed to produce adult-like plurals for words that
end in sibilants. That is very late by the standards of language acquisition experiments!

7. Syntax

(2) What we find when we carefully study the world's languages
Languages are not all the same, but the ways in which they differ are highly
restricted. The same peculiar bits show up again and again, all over the world.

What's the same is called Universal Grammar (UG)
What's different are settings of parameters within UG.

An acquisition perspective on UG and parameter setting:
• UG reflects our genetic endowment for language
• Parameter setting reflects our linguistic experience in early childhood.

• For example, though we don't find verb-second in all the languages of the world, we
do find it popping up repeatedly — as discussed in the syntax lecture notes. On
the other hand (I am repeating myself here) there are some types of languages that are
just as easy to describe in words as the verb-second languages, which we never find:

(3) Some languages that don't exist anywhere (as far as we know):
  a. Like German, but patterns of embedded and main clause are reversed.
  b. Main verb must follow the second phrase, third phrase, etc.
  c. Not the main verb, but the direct object must follow the first phrase.

• We made a similar point in class when we discussed the relative ordering of heads of
phrases and their complements. We observed that the relative order of a head and the
element that it merges with varies systematically across languages.

We also observed that postulating a uniform "head-first/head-last" parameter across
entire languages oversimplifies the picture. Certain kinds of mixed languages do exist, but they are restricted by FOFC (the Final-over-Final Constraint). If correct, FOFC is (or is a by-product of) a principle of UG — a principle that restricts the ways in which languages vary (and restricts the "search space" for a child acquiring language).

Some other parameters (and how they are set in a few languages)
[See Baker's book for much more.]

1. Subject pro-drop

(4) **Italian:** +
   a. Io parlo italiano
      (I) speak Italian
   b. Noi parliamo italiano
      (we) speak Italian

(5) **Chinese:** +
   他看见他 LE
   (he) see him
   'He saw him'.

(6) **English:** -
   *(We) speak English.*

2. Object pro-drop

(7) **Chinese:** +
   他看见 LE
   (he) see LE
   'He saw him'.

(8) **Italian:** -
   *Gianni vede.
      Gianni (him) sees.

   (Object pronouns generally move to the left of I in Italian.)

(9) **English:** -
   *John saw him.

3. Polysynthesis

(10) **English:** [+ incorporation into N] (and A), but [- incorporation into V]
   a. I disapprove of book-burning
   b. A user-friendly computer is a distant goal.
   c. *The baby meat-ate last night.

(11) **Mohawk:** [+ incorporation into V]
    Owira'a waha'-wahrake'.
    baby meat-ate (Baker p. 91)

Mohawk:
- polysynthesis (V): +
  (*"incorporation")
  subject pro-drop: +
  object pro-drop: +

(12) a. Wa'eksohare'
    'She dishwashed'
   b. Wa'kenaktahninu'
    'I bed-bought.
   c. Wahana'tarakwetare'
    'He bread-cut.'

English:
- polysynthesis (V): —
  subject pro-drop: —
  object pro-drop: —

(13) **The verb-object constraint**
    The object of a verb must be the first noun (phrase) to combine with the verb; the subject cannot combine with the verb until after the object does.

(14) **...in English compounding**
    a. I disapprove of meat eating in here. (i.e. meat getting eaten)
    b. *I disapprove of baby eating in here. (i.e. babies eating dinner)

(15) **...in Mohawk "incorporation"**
    *Wahawirake' ne o'wahru.
    baby-ate the meat
    'The baby ate the meat.'
    (compare (11))

An acquisition perspective on parameter-setting

- Early production of complete sentences may show parameters set in a fashion familiar from languages other than the language that the child is in the process of acquiring.

**Example: pro-drop**
Danish, English and French are not pro-drop languages, but early sentence production appears to show selective omission of subject pronouns:
Early pro-drop
a. Danish
Se, blomster har. (Jens, 2;2)
look flowers have/has
b. English
Tickles me. (Adam, 3;6)
c. French
Mange du pain. (Grégoire, 2;1)
eat-3sg some bread

Are young English-speaking children in effect "speaking Italian" until they start regularly using subject pronouns? Much controversy ...

We also saw a video of English-speaking kids "speaking German" or "speaking Swedish" with respect to other phenomena, making the same points.

Optional root infinitive stage
a. Danish
Hun sove. (Jens, 2;0)
she sleep-INFIN
b. Dutch
Eerst kleine boekje lezen. (Hein, 2;6)
first little book read-INFIN
'I First (I/we) read little book'
c. French
Dormir petit bébé. (Daniel, 1; 11)
sleep-INFIN little baby
'Little baby is sleeping.'

English does not have a specifically infinitive suffix, but the root infinitive state is found among English-speaking children as well — showing up as missing -s on third-person present-tense verbs. This is not an inability to pronounce the -s, since plural and possessive -s is regularly present (with the caveat discussed above in connection with the wug discussion):

English root infinitives
a. Papa have it. (Eve, 1;6)
b. Cromer wear glasses. (Eve, 2;0)
c. Marie go. (Sarah, 2;3)
d. Mumma ride horsie. (Sarah, 2;6)

It has been claimed that "early pro-drop" in languages like Dutch or English is largely limited to such root infinitival clauses. Hmm... So is it pro-drop after all. And if so ...

So what about parameter setting? When does it happen?

Answer: Perhaps some syntactic parameters are set earlier than we can yet detect.

For example, German children around age 2 already know V2 — and even though they use root infinitives, they almost never apply V/2 to them.

In adult German, an infinitive verb does not move to C, but remains final in VP:

German (adult) infinitival verb does not move to C
Ich will [dieses Buch lesen]
'I want this book read-INFIN'
'I want to read this book'

Here are some examples of sentences uttered by the German speaking child Andreas (2;1). The first two examples show finite (non-infinitive) verbs, while the second two show root infinitives:
Andreas (2;1): finite and infinitive root sentence

a. Ich hab ein dossen Ball.
   I have a big ball (note: dossen for grossen)

b. Ich mach das nich.
   I do that not
   ‘I’m not doing that.’

c. Thorsten Caesar haben. (note: Caesar = a doll)
   Thorsten Caesar have-INFIN

d. Du das haben.
   you that have-INFIN

• In fact, out of 281 sentences in a corpus of Andreas’s utterances on a single day, which included 231 finite sentences and 51 sentences with root infinitives, Andreas overwhelmingly applied V2 to the finite verbs and failed to apply it to the non-finite verbs — following the adult rule in this respect. (He disobeys the adult rules of V2 7.8% of the time. Child data is always noisy.)

<table>
<thead>
<tr>
<th>+Finite</th>
<th>-Finite</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verb second</td>
<td>216</td>
</tr>
<tr>
<td>Verb final</td>
<td>15</td>
</tr>
</tbody>
</table>

• Some example of Andreas’ finite sentences with V2:

(22) Direct object topicalization

   toy-race-car drive I

b. Eine Fase hab ich.
   a vase have I

(23) Adverb topicalization

a. Da bin ich.
   there am I

b. So macht der.
   so does he
24.900 Introduction to Linguistics
Fall 2012

For information about citing these materials or our Terms of Use, visit: http://ocw.mit.edu/terms.