Acquisition of Syntax summary

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

1. Overview of language acquisition

Production

- **Babblin**g: 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 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...

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

- **The puzzle:**[2] 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 accomodate the needs of a language learner: no word boundaries, no morpheme boundaries, no trees ...

Answers

- Deliberate instruction (behaviorism): rewards and punishments?

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'* infixation: 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'-chuseтts*!

- **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.

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[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 coins and comprehends on the fly. The main point is that the average senior knows lots and lots of words.

[2] To my shock and horror, I realize that I did not mention in class Chomsky's cute term for ths 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.

3. Phonetics

- Discussed earlier in the course. Infants discriminate the sounds of speech categorially, 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.

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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

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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.

  Conclusion: 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/%7Epetitto/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.

child	adult	comment	meaning
mitaŋ	mikan	adult [k]->child [t]	'orange'
potetto	poketto		'pocket'
neto	neko		'cat'
tama	tama	adult [t] stays [t]	'ball'
terebi	terebi		'TV'
tobɯ	tobɯ		'fly'
matʃi	matʃi	**t→tʃ /__i**	'city'
tsɯta	tsɯta	**t→ts/__ɯ**	'ivy'

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

ati	aki	'fall'
tɯma	kɯma	'bear'

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* → [dɪdɪ], *water* →[wɑwɑ]. The syllable count of the word is preserved, with a morphological process known in the adult grammar (reduplication) used to create the second syllable.

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5. **Lexicon**

Discerning word-boundaries:

Kids already know more than they say. Work of (the late) Peter Jucszyk and others:

- In 11-month old, selective looking reveals preference for pauses that coincide with word boundaries over pauses inserted between syllables of words.
- In 9-month old, no preference.

So what happens between 9 and 11? A **bootstrapping problem**.
How do you segment speech into words if you don't know the words?
No magic bullet, it seems!

two possibilities:

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 *matematricien*. So the information, if relevant to guessing word boundaries, is perceived... [Mehler et al -- this is a sucking/habituation 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*: [*tibej*] (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.

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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 Saffran *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.

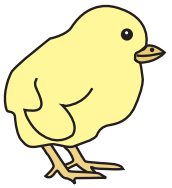
This time, however, the nonsense words in the first presentation were not randomly chosen sequences of syllables, but conformed to simple rules, or templates. One group of infants, for example, heard a string of nonsense words in which the second two syllables were identical (*ga ti ti*, *li na na*).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

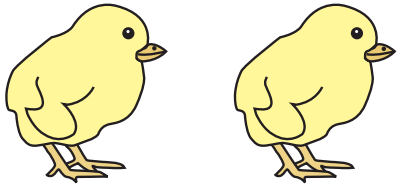
On the other hand...

- 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 [-əz]? Answer: quite early for [-s] (*cats*), and [-z] (*dogs*), but quite late for the [-əz] 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*:



This is a Wug.



Now there is another one.
There are two of them.
There are two _____.

Image by MIT OpenCourseWare.

	% correct pre-school answers	*% correct first- grade answers*
glasses	75	99
wugs	76	97
luns	68	92
tors	73	90
heafs	79	80
eras	58	86
tasses	28	39
gutches	28	38
kazhes	25	36
nizzes	14	33

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!

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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: +**
~~Ta~~ kanjian ta le.
(he) see he LE
'He saw him'.

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

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2. **Object *pro*-drop**

(7) **Chinese: +**
Ta kanjian ~~ta~~ le.
he see (him) LE

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

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

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

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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 intoV]**
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:

(16) **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.

Alas, we did not have time for the following discussion, but you may find the topic interesting nonetheless:

- Italian kids drop subject pronouns much more often than their English-speaking counterparts. So English pro-drop can't just be "English-speaking children speaking Italian". There must be a different factor. Possibility: **maturation**.

- **Root infinitive stage:** Speakers of many languages go through a period in which they use infinitival verbs in main clauses, and these may lack subjects,

(17) a. Michel dormir. (French: 'Michel sleep-infin,')
b. Ik ook lezen. (Dutch: 'I also read-infin.')

(18) **Optional root infinitive stage**

a. Danish
Hun sove. (Jens, 2;0)
she sleep-INFIN

b. Dutch
Earst kleine boekje lezen. (Hein, 2;6)
first little book read-INFIN
'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):

(19) **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:

(20) **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:

(21) **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.)

	+Finite	**-Finite**
Verb second	216	7
Verb final	15	44

- Some example of Andreas' finite sentences with V2:

(22) **Direct object topicalization**

a. Kahehabahn fahr ich.
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

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