Why we should be impressed by first language acquisition

- It’s unlikely you have real memories of learning to talk
- you did not require explicit instruction to begin talking.

By age 4, children have generally mastered the full grammar of their native language, including a large grammar, in spite of the fact that they are quite bad at most other tasks
  Adults past the age of about 15 are mostly incapable of duplicating this feat, in spite of the fact that they are generally quite good at other tasks

- Language acquisition is different from other general learning processes
  - no explicit instruction.

When adults try to correct children’s errors, the children don't seem to care:
  e.g. “other one spoon”

- No negative evidence:
  - what sentences are in their language? - they can hear what adults say,
  - but they have no evidence clearly telling what sentences are not in their language.

- Possible sentences of a language are infinite, so it can't be that children simply repeat only those sentences that they actually hear.
- Rather, they produce and understand novel sentences on the basis of the grammar that they construct.

Chomsky’s argument from the “poverty of the stimulus”:
Without any head start, the problem of correctly deducing the structure and rules of a grammar on the basis of a finite sample like the one children are exposed to is probably impossible. Rather, it seems that they must have some idea of what they are looking for from birth.

- Next time: support for UG + learning-details-from-experience

The Critical Period

Children learn languages much more easily than adults.

- This difference is generally attributed to the **critical period**:
  - if you don't learn a particular language as a child, you'll never learn it as easily/well

- Ignoring a certain range of individual variation, experiments suggest that:
  - learning before the age of 7 yields perfect command;
  - learning between the ages of 8 and 15 yields progressively less perfect command;
learning at a greater age includes no advantage for relative youth.

Several case studies: in situations of extreme family dysfunction or misfortune, a child might be kept from social and linguistic interaction until a more advanced age. Language ability can be permanently impaired as a result.

- **Chelsea** – misdiagnosed as severely mentally retarded and/or emotionally disturbed. In fact she was profoundly deaf. Not exposed to language until age 31 (deafness discovered, hearing near-normal with hearing aids). Learned about 2000 words, no syntax.

  The boat sits water on. The girl is cone the ice cream shopping buying the man.

- **Genie** - isolated until the age of 13 1/2, achieved telegraphic speech (strings of words with an elementary syntax, without the full grammatical apparatus of inflection and function words).

  Mike paint. Applesauce buy store. Neal come happy; Neal not come sad.

  Genie have Momma have baby grow up. I like elephant eat peanut.

- **Isabelle** - isolated until the age of 6 1/2, and within a year and a half had mastered complex grammar, producing sentences like the following:

  Why does the paste come out if one upsets the jar?

  Do you go to Miss Mason's school at the university?

  The difference in their ages is believed to be the crucial factor in their very different outcomes.

- The critical period resembles other aspects of maturation in humans and animals:
  - in ducklings: ability to identify and follow the mother
  - in kittens: ability to perceive visual images
  - in sparrows: ability to learn the father's songs

  **Maintaining the neural circuits** that allow acquisition of these skills is costly to the organism.

  => evolution favors losing this allocation of resources when learning has (normally) occurred. There is no species-wide need to maintain the costly flexibility throughout the lifespan.

  Other factors: the course of language acquisition corresponds well to the general rate of metabolic activity in the brain, which peaks at the age of 4 and declines through adolescence.

  Hard to say: does this increased activity permit language learning? Or is it caused by it?

**Other views:** “better learning” period rather than “critical” one

**Stages of language learning**

In nearly all cases, children's language development follows a predictable sequence. There is a great deal of variation in the age at which children reach a given milestone.

Each child's development is usually characterized by gradual acquisition of particular abilities:

  e.g. "correct" use of English verbal inflection will emerge over a period of a year or more

On the production side, one way to name the stages is as follows, focusing primarily on the unfolding of lexical and syntactic knowledge: The notation X;Y means X years and Y months of age.

<table>
<thead>
<tr>
<th>Stage</th>
<th>Typical age</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>
Babbling 0;6 - 0;8 repetitive CV patterns
One-word 0;9 - 1;6 single open-class words or word stems
Two-word 1;6 - 2;0 "mini-sentences" with simple semantic relations
Early multiword 2;0 - 2;6 "telegraphic" sentence structures of lexical rather than functional or grammatical morphemes
Later multiword 2;6 on grammatical or functional structures emerge

Parts of language (e.g., complex morphology, certain sounds at times) are not mastered so early, but in general the fundamentals of the grammar are present by around age four.

From 4-7 months: "vocal play", manipulating pitch (to produce "squeals" and "growls"), loudness (producing "yells"), and also manipulating tract closures to produce friction noises, nasal murmurs, "raspberries" and "snorts".

At about 7 months, "canonical babbling" appears: extended sounds that are chopped up rhythmically into syllable-like sequences (consonant plus vowel, or CV).

- The range of sounds produced are heard as stop-like and glide-like.
- Fricatives, affricates, and liquids are more rare; clusters of consonants are even rarer.
- Vowels tend to be low and open, at least in the beginning.

Repeated sequences ([bababa] or [nanana]); also "variegated" sequences (C-like articulations are varied). The variegated sequences are initially rare and become more common later on.

Vocal play & babbling: more often in interactions with caregivers, but also alone.

- deaf children babble a bit: babbling is instinctual.
- deaf children raised with signing parents "babble" with their hands -- trying out various movements as they learn the specific handshapes etc. of the ambient sign language: babbling is influenced by experience of speech around the baby

No other animal does anything like babbling.

Maybe: vocal play and babbling have the function of "practicing" speech-like gestures

**Phonological development**

Development of phonological abilities begins very early:
- Newborns can distinguish speech from non-speech,
- Newborns also distinguish speech sounds (e.g. [t] vs. [d] or [t] vs. [k]);
- Infants at about 2 months distinguish speech in their native language from other languages.

Early linguistic interaction is important in establishing and consolidating these early abilities.

In production

- Babbling is the first step.
- Simplification of syllable structure:
  - first syllables typically consonant+vowel, or CV.
  - this is the only syllable type found in all languages

Maybe: all languages have it because it's the easiest one to learn and to produce.

[kæ] "cat"  [bi] "beat"  [so] "soap"
Rule for getting child’s form from adult form: "Delete coda consonants."

- Also very common: simplification of consonant clusters to a single consonant:
  
<table>
<thead>
<tr>
<th>Word</th>
<th>Pronunciation</th>
</tr>
</thead>
<tbody>
<tr>
<td>clothes</td>
<td>[koz]</td>
</tr>
<tr>
<td>blanket</td>
<td>[bæk]</td>
</tr>
<tr>
<td>bump</td>
<td>[bæp]</td>
</tr>
<tr>
<td>truck</td>
<td>[tæk]</td>
</tr>
<tr>
<td>necklace</td>
<td>[nek]</td>
</tr>
<tr>
<td>school</td>
<td>[kul]</td>
</tr>
<tr>
<td>stripe</td>
<td>[tayp]</td>
</tr>
</tbody>
</table>
  
  *Note: ay=one V (diphthong)*

  Principle: "Reduce clusters to one consonant."

  Specific Rule 1: delete other consonants till only one is left. Which one survives? Often: stop (so that a liquid, nasal, or fricative is deleted). Stops are the easiest to produce and the most common in the world's languages.

Related reduction is found in words such as **bankie** for "blanket."

Specific Rule 2: instead of the cluster, put a new C that combines features of the adult C

<table>
<thead>
<tr>
<th>Word</th>
<th>Pronunciation</th>
</tr>
</thead>
<tbody>
<tr>
<td>spin</td>
<td>[fin]</td>
</tr>
<tr>
<td>water</td>
<td>[wat]</td>
</tr>
<tr>
<td>chicken</td>
<td>[chik]</td>
</tr>
</tbody>
</table>

- Deletion of unstressed syllables

  Typically, only the stressed syllable survives in the child's early utterances. This syllable might be subject to other processes, such as cluster simplification.

<table>
<thead>
<tr>
<th>Word</th>
<th>Pronunciation</th>
</tr>
</thead>
<tbody>
<tr>
<td>bottle</td>
<td>[bæ]</td>
</tr>
<tr>
<td>baby</td>
<td>[be]</td>
</tr>
<tr>
<td>daddy</td>
<td>[dæ]</td>
</tr>
<tr>
<td>water</td>
<td>[wot]</td>
</tr>
<tr>
<td>chicken</td>
<td>[chik]</td>
</tr>
<tr>
<td>window</td>
<td>[win]</td>
</tr>
</tbody>
</table>

  This is common in many adult languages: e.g., English **Sue** from Susan, **vet** for veteran, etc. Also, common in historical change. (recall our discussion of processes like syncope and apocope in the lecture on language change.)

Sometimes, at a later stage, one unstressed syllable can also be preserved. This structure is called a trochee, or a trochaic foot: stressed+unstressed syllable pair, a fundamental element in the prosody of many languages, including English.

<table>
<thead>
<tr>
<th>Word</th>
<th>Pronunciation</th>
</tr>
</thead>
<tbody>
<tr>
<td>banana</td>
<td>[nma]</td>
</tr>
<tr>
<td>granola</td>
<td>[owa]</td>
</tr>
<tr>
<td>potato</td>
<td>[dedo]</td>
</tr>
<tr>
<td>belly button</td>
<td>[beba]</td>
</tr>
<tr>
<td>Eleanor</td>
<td>[ano]</td>
</tr>
</tbody>
</table>

Also common in adult speech: e.g., **Alex** for Alexander and **Becca** for Rebecca.

Prosodic patterns – trochees, also the overall intonation of a phrase: acquired early.

Pre-speech infants can distinguish the basic intonation patterns of their parents' language from that of other languages.

Reduplication

If more than one syllable is present in the child’s utterance, preference for repeated syllables;

In adult language, this is called reduplication (often serves a grammatical function).

E.g., Samoan plural: **alofa** = “to love-singular” **alolofa** = “to love-plural”

Why do children do it?

Avoidance of too-complex articulations (or mental representations for those articulations)

Reduplication can be full, in which case the two syllables are identical:
It can also be **partial**, with the two syllables are partly distinct, but either Cs or Vs identical.

**Consonant harmony**, i.e. modifying consonants so that they're the same place of articulation, stems from the same source as reduplication. It’s especially interesting since it's practically unknown as a phenomenon in adult language.

The end result of consonant harmony is similar to that of partial reduplication; the distinction is an artificial one, since what really matters is the output the child can produce.

**Substitution**

Until children learn to pronounce all the phonemes in adult language, there are many substitutions of sounds based on what the child is able to say at a particular point in time. These are quite varied, but some patterns are relatively common:

- **Stops for fricatives** or affricates: [tʰ] "ship"  [bɾ] "bus"  [tʃ] "sing"  [pə] "pencil"
- **Glides for the liquids** /l, r/ or other Cs: [w] "look"  [ʃ] "Andrea"  [tw] "truck"  [y] "light"
- **Front for back Cs**, i.e. alveolar for palatal/velar: [dɑn] "gone"  [tʰ] "chip"  [dzdz] "Christmas"

These patterns are found in children learning any language: e.g. Finnish (Vihman & Velleman 2000).

**Exercise: classify these modifications according to those illustrated for English**

**The one-word (holophrastic) stage**

At about **10 months**, infants start to utter recognizable words. Mostly used in **naming**:

- duck while hitting a toy duck off the edge of the **tup**
- sweep while sweeping with a broom

Young children often use words in ways that are too narrow or too broad:

- bottle only for plastic bottles  teddy only for a particular bear
- dog for dogs, lambs, cats, & cows  kick for kicking, pushing & wing-flapping.

These **underextensions** and **overextensions** develop and change over time.

Overextension in production is likely a **compensation for limited vocabulary**, in addition to misunderstanding the reference of a word. - partly that’s why it’s so common.

**Perception vs. production**

Infants show (e.g., by gaze direction) understanding some words at the age of 4-9 months, often even before babbling begins.

**Perception vs. production in vocabulary development**

[**wawa**] "water"  [**baba**] "bottle"  [**mama**] "mommy"  [**kiki**] "kitten"  [**baba**] "Patrick"
Benedict (1979): mothers kept records of words children produced, & words they gave evidence of understanding.

Results: when producing 10 words, understanding about 60 words; an average gap of five months between understanding 50 words & producing 50 words.

Both maternal diaries & checklists: underestimate # of words children know something about a overestimate # of words with adult-like meanings.

E.g., a child may "know" the word doggie, but may also think that it applies to any four-legged creature, including cows.

Difference between perception and production, e.g. ‘fis’ phenomenon

**Combining words: the emergence of syntax**

During the second year, word combinations begin to appear.

Novel combinations as early as 14 months.

At 18 months, 11% of parents say child is often combining words; 46% say sometimes.
By 25 months, 80% often, and almost all children are sometimes combining words.

**Early multi-unit utterances**

Early multiple-unit utterances may be concatenations of individual naming actions that might just as well have occurred alone:  

- &rightarrow;  
  - mommy & hat  
  - shirt & wet  

Combinations tend to occur in an order that is appropriate for the language being learned:


This stage might better be termed the two-morpheme stage

Some combinations with certain closed-class morphemes begin to occur:  

- my turn  
- in there

These closed-class words have semantic content (similar to open-class)

Purely grammatical morphemes (verbal inflections & auxiliaries, determiners, complementizers, etc.) are typically absent.

At around a year and a half, children exposed to all languages produce two-unit sentences.

<table>
<thead>
<tr>
<th>Language</th>
<th>Original</th>
<th>Repeated</th>
</tr>
</thead>
<tbody>
<tr>
<td>German</td>
<td>buch da&quot;book there&quot;</td>
<td>bitte apfel &quot;please apple&quot; wo ball?&quot;where ball?&quot;</td>
</tr>
<tr>
<td>Russian</td>
<td>baba kreslo&quot;grandma armchair&quot;</td>
<td>daj chasy&quot;give watch&quot; vady net&quot;water not-there&quot;</td>
</tr>
<tr>
<td>Finnish</td>
<td>ei susi &quot;not wolf&quot;</td>
<td>torni iso &quot;tower big&quot; missd pallo? &quot;where ball?&quot;</td>
</tr>
</tbody>
</table>
| Samoan   | fia moe "want eat" | mai pepe "give doll" tapale "oe "hit you"

Developing grammars overwhelmingly follow the correct word order for the ambient language.

In early multi-word stage, children asked to repeat sentences may leave out the function words:

<table>
<thead>
<tr>
<th>Original</th>
<th>Repeated</th>
<th>(child)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I can see a cow</td>
<td>See cow</td>
<td>Eve, 25 months</td>
</tr>
<tr>
<td>The doggy will bite</td>
<td>Doggy bite</td>
<td>Adam, 28 months</td>
</tr>
<tr>
<td>Where does Daddy go?</td>
<td>Daddy go?</td>
<td>Daniel, 23 months</td>
</tr>
</tbody>
</table>
The same pattern can be seen in their own **spontaneous utterances**:

- **Baby doll ride truck**  
  Baby, 22 months
- **Want lady get chocolate**  
  Daniel, 23 months

The pattern of leaving out most grammatical/functional morphemes is called **telegraphic**.

One way to think about these utterances: longer, more adult structure is chopped down to its essential elements (mostly lexical words), with the adult order maintained. (Roger Brown.1973. *A First Language: The Early Stages* p.205; Steven Pinker.1994. *The Language Instinct* p.273)

It seems, the child is partly **modeling the adult grammar**, but is not yet able to "fill in all the slots" in potential sentences.

**Grammatical elements and corresponding structures**

At about the age of 2, children gradually begin to use **grammatical elements**. 

**English**: finite auxiliaries (*is, was*) verbal tense and agreement affixes (*-ed, -s*)  
nominative pronouns (*I, she*) complementizers (*that, where*) determiners (*the, a*).

E.g., the boy Adam **progressed in one year from two- or three- word sentences to complex structures, though still with some errors** (Brown 1973, Pinker 1994).

As grammar becomes more complex, the **elements of the sentence develop internal complexity**.

- **Big doggie**  
  NP = Adj N
- **Give doggie paper**  
  S = V N N
- **Give big doggie paper**  
  S = V NP N

Such **hierarchical structure** is, of course, a fundamental property of adult language.

**Perception vs. production again**

Children who regularly omit grammatical elements **expect them from adults**: their sentence comprehension suffers if the grammatical elements are missing or absent.

**Grammar understanding** is also in advance of grammar use (= production).

**Morphological acquisition**

Children seem to learn categories of morphemes in a **consistent order**, (minor variations in order; great variation in rate) (Brown 1973).

The last item is acquired, on average, at about 3 years.

- **present progressive**: (*is) playing, (*was) singing** (19-28 mos.)
- **prepositions**: *in, on* (27-30)
- **regular noun plural**: *toys, cats, dishes* (24-33)
- **irregular past tense**: *came, fell, saw* (25-46)
- **possessive noun**: *doggie's* (26-40)
- **uncontractible copula**: *here I am, who is it* (27-39)
- **articles**: *a, the* (28-46)
- **regular past tense**: *played, washed, wanted* (26-48)
Possible influences on ease of acquisition:

- **Contribution to overall meaning** (past tense vs. third person)
- **Frequency of irregularity** (past tense verb vs. plural noun)
- **Variation in pronunciation** (cf. allomorphy of plural and past tense)
- **Identifiability of a morpheme** (contracted vs. uncontracted verbs)
- **Complexity of meaning** (just past tense vs. third person + singular + present tense)

Many morphemes were not studied: irregular plurals (*feet*), inflected adjectives (*bigger, biggest*), & pronouns (*I, we, he, she, they*).

Ignores some subtleties: e.g., allomorph of plural in *dishes* [əz] learned later than in *cats & dogs*.

**Progress backwards**

Morphological inflections: **regular** and **irregular** or **exceptional**:

- *walk/walked*  
- *open/opened*  
- *want/wanted*  
- *go/went*  
- *throw/threw*  
- *hold/held*

In the earlier stages all such words normally used in the root form:

- *walk*  
- *open*  
- *want*  
- *go*  
- *throw*  
- *hold*

As inflections first start being added, both **regular and irregular patterns** are found.

- *walked*  
- *opened*  
- *wanted*  
- *went*  
- *threw*  
- *held*

At a later point, it is common for children to **overgeneralize the regular case**:

Verbs: *goed threwed holded eated maked finded hitted falled doed speaked breaked goed runned*

Nouns: *foots tooths childs mans mouses peoples*

At this stage, the child's speech may actually become **less correct**.

Over-regularization, like most other aspects of child speech, is typically **resistant to correction**:

E.g., *holded the baby rabbits*.

Eventually, children resume (& refine) the use of irregular forms as they hear them more. If an irregular form is **not heard frequently**, some children may never abandon the regular form: once enough children do this, the **irregular form will drop out of the language**.

E.g., The Shakespearean example of *holp* for *helped*, discussed previously.

Abandonment of irregular forms is driven mostly by the **regularizing tendency in child language acquisition**.