- **Child language acquisition**
- **Acquisition of phonology**

Background reading:

- *CL* Ch 9, chapter intro
- *CL* Ch 9, §1, "The study of language acquisition"
- *CL* Ch 9, §2, "Phonological development"

1. Linguistics as natural science

- Scientific investigation:
  - Observe **data** (phenomena in the natural world)
  - Build a **model** to describe, understand the data
  - **Test** the model:
    - What predictions does it make?
    - What happens when we test those predictions against new data?
      → Is the model supported?
      → Or does it need to be changed?

1. Linguistics as natural science

In linguistics:

- **Data** = human language behavior
  - **Naturalistic** — observe what naturally occurs
    - How people speak and understand
    - The environments where segments occur
    - (etc.)
  - **Experimental** — create situations, collect responses
    - Ask speakers for grammaticality judgments
    - Lab experiments (production, perception)
    - (etc.)

1. Linguistics as natural science

- We want to build a model of both
  - the **mental grammar** of the speakers of a certain language, specifically
  - the **range of possibilities** of human mental grammars, in general
- Our current model includes
  - sound **properties** (building blocks of segments)
  - **phonemes** (stored in memory; mental)
  - **allophones** (pronounced; physical)
  - **rules** to produce allophones in specific contexts

1. Linguistics as natural science

- Some things linguists hope to achieve by doing research on child language:
    - Can **applying our model** of mental grammar help us **explain** what happens during children's acquisition of their native language(s)?
    - Can **data** from children's developing language systems help us **test our model** of mental grammar?

2. Where child language acquisition fits in

- **A key idea:** "Learning" a native language is not the same as learning to do math or ride a bike
  - This is why the term **acquisition**, not "learning," is typically used for this process
- Children acquire their native language relatively **easily** and **quickly** (compared to adult language learning)
- Children do **not** acquire language by having their parents explicitly "teach" it to them
  - More about this in a later class

2. Where child language acquisition fits in

- In our model of human language, we propose:

  Children acquire language through contact between

  - the **language data** in the environment
  - the (universal) language acquisition mechanism of the **mental grammar**

2. Where child language acquisition fits in

- **Adults** can speak and understand their native language(s) because they have a **lexicon** and **mental grammar** of that language
    - How do these two pieces of the system relate to predictable and unpredictable information?

2. Where child language acquisition fits in

- **Adults** can speak and understand their native language(s) because they have a **lexicon** and **mental grammar** of that language

  - **lexicon** — where sounds, meaning, and other unpredictable information are stored for each word (or morpheme; more on this in *CL* Ch 4)

  - **mental grammar** — rules and principles that handle predictable / systematic patterns, including phonology

2. Where child language acquisition fits in

- **Adults** can speak and understand their native language(s) because they have a **lexicon** and **mental grammar** of that language
- How would a child acquiring a native language (first language; L1) get to this **target** adult state?
  - **lexicon** *(unpredictable info)*:
  - **mental grammar** *(rules for predictable info)*:

2. Where child language acquisition fits in

- **Adults** can speak and understand their native language(s) because they have a **lexicon** and **mental grammar** of that language
- How would a child acquiring a native language (first language; L1) get to this **target** adult state?
  - **lexicon**: unpredictable information must be learned and stored
  - **mental grammar**: How does this develop?
    - Any (normally developing) infant has the potential to develop the mental grammar of any language

2. Where child language acquisition fits in

- Proposal:
  - Infants all start out with their mental grammar at the same (**universal**) original/default settings: "Universal Grammar" (**UG**)
  - When infants are exposed to language data, they will begin to develop the mental grammar needed to produce and comprehend a **particular** adult language (the **target** language)

In this model, we can analyze each stage of a child's developing mental grammar with the same tools we use for adult languages

2. Where child language acquisition fits in

- A child in the process of acquiring a language goes through different **stages** of development
  - These stages reflect **intermediate mental grammars** on the way to the adult grammar
- A child often shows **variable** behavior
  - A rule may be applied only some of the time
  - Multiple versions of a rule may be in use
- But we can still find a great deal of **systematicity** in children's language behavior

2. Where child language acquisition fits in

- We can consider data about the **stages** children typically go through in developing their phonological system
  - Does our **model** of mental grammar help us understand this **data**?
  - Does this **data** help us test predictions and evaluate our **model** of the mental grammar?

- Note: The stages described here (especially the representative ages given) are average or general patterns; individual children may be somewhat different

3. Early stages of phonological development

- *Data:* **Distinguishing** different speech sounds
  - 6-8 months: Infants can distinguish among almost all of the sound categories used in the world's languages
  - 10-12 months: Infants now have difficulty distinguishing sound categories that are **not contrastive** in their target language

- *Analysis:* What does this change suggest about the child's mental grammar?

3. Early stages of phonological development

- *Data:* **Distinguishing** different speech sounds
  - 10-12 months: Infants now have difficulty distinguishing sound categories that are **not contrastive** in their target language

- *Analysis:* This developmental change is evidence for the beginning of a **language-specific phonological grammar**
  - Children at this stage are developing an inventory of contrastive sounds (**phonemes**)

3. Early stages of phonological development

- *Data:* **Babbling** — approximately 6 to 12 months
  - In babbling, an infant makes syllable-like noises that don't mean anything (they are not words)
  - This seems to be a kind of practice with articulation (and perception?) before the child's production of words begins

3. Early stages of phonological development

- *Data:* **Babbling** — approximately 6 to 12 months
  - The **most frequent consonants** used in babbling are very **consistent** even for babies acquiring different languages

Table 9.1 from *CL*, p 353 | What generalizations can we make?

Cross-linguistic similarities in babbling

Frequently found	*Infrequently found*
p b m **t d n** k g s h ***w j***	f v θ ð ʃ ʒ ʧ ʤ *l r* ŋ

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p b m **t d n** k g s h ***w j***	f v θ ð ʃ ʒ ʧ ʤ *l r* ŋ

- Labials are common
- Oral and nasal **stops** are common, except [ŋ]
- Fricatives are rare, except [s, h]
- *Liquids* are rare but ***glides*** are common

3. Early stages of phonological development

- *Data:* **Babbling** — approximately 6 to 12 months
  - The **most frequent consonants** used in babbling are very **consistent** across languages
  - The most frequent consonants used are also frequent sounds in **adult** languages
- *Analysis:* How can we explain these connections?

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  - The **most frequent consonants** used in babbling are very **consistent** across languages
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- *Analysis:* How can we explain these connections?
  - Maybe these consonants are typically early and common because **UG prefers them**
  - But maybe it is because of **articulation and perception** factors that do *not* depend on UG
  - Or **both!** | This is an area of current research

3. Early stages of phonological development

- *Data:* **Early word production** — Individual children develop differently, but some **general patterns** can be observed:
  - **Vowels** develop before consonants
  - **Stops** are usually the earliest consonants
  - **Labial** is usually the first place of articulation (note: sighted children only!)
  - New phoneme categories are often distinguished in **word-initial position** first
- *Advanced research question:*
  What factors might lead to these patterns?

4. Later stages of child phonology

- Young children's word pronunciations often lack the full set of sounds found in the adult language
- But in many cases, children are able to **distinguish between phonemes they hear** even before they can produce the difference themselves
  - How do we know this?
  - What are the implications for the child's **mental grammar**?

4. Later stages of child phonology

- *Data:* We often find that **comprehension** is more adult-like than **production**
  - Example: A child pronounces both *mouse* and *mouth* as [maws], but can point to the correct pictures in a comprehension experiment

- *Analysis:* What are the **implications** of this pattern for the child's developing mental grammar?

4. Later stages of child phonology

- *Data:* A child pronounces both *mouse* and *mouth* as [maws], but can point to the correct pictures in a comprehension experiment
- *Analysis:* What are the **implications** of this pattern?
  - How is each of these words represented in the child's **mental lexicon**?
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    - 
  - How can we explain the child's **pronunciation**?

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- *Analysis:* What are the **implications** of this pattern?
  - How is each of these words represented in the child's **mental lexicon**?
    -  /maws/
    -  /mawθ/
  - How can we explain the child's **pronunciation** in the case of  [maws] ?

4. Later stages of child phonology

- If a child has an adult-like phonemic form, but produces a non-adult-like phonetic form…
  - Phonemic form:  /mawθ/
  - Phonetic form: [maws]

4. Later stages of child phonology

- If a child has an adult-like phonemic form, but produces a non-adult-like phonetic form…
  - Phonemic form:  /mawθ/
  - Phonetic form: [maws]

- The child's developing grammar must have a **phonological rule** that is not part of the adult grammar

4. Later stages of child phonology

- Writing child-specific phonological rules
  - Same as for adult phonological rules:
    - Rule format (A → B / X __ Y)
    - Use of **sound properties**
  - One difference: A child-specific rule may have **no environment** if a certain natural class changes into something else *everywhere*
    - Rule in such a case is only "A → B", no " / ..."
- *Mouth* example: A rule for /mawθ/ → [maws] ?

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- *Mouth* example: voiceless interdental → alveolar

5. Another example of a child-specific rule

- Example from A., age 1;11

(a)		(b)		(c)	
cup	[t̚ʌp]	*goat*	[d̚owt]	*dog*	[dɔt̚]
okay	[ot̚ej]	*Grampa*	[d̚æmpə]	*egg*	[ejt̚]
fork	[fɔɹt̚]	*digger*	[dɪd̚ɻ]		

- What systematic patterns can we see here?

  (Hint: Think about **phonetic properties** and **natural classes**)

- What rule(s) should we propose for A. at this stage?

5. Another example of a child-specific rule

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- What systematic patterns can we see here?
  - /k/ produced as [t] in all positions
  - /g/ produced as [d] in initial and medial positions and as [t] in final position
- General rule?

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- What systematic patterns can we see here?
  - /k/ produced as [t] in all positions
  - /g/ produced as [d] in initial and medial positions
    and as [t] in final position
- General rule? Velar stops → alveolar

  Apparently also: Voiced stops → voiceless / _#

5. Another example of a child-specific rule

- A. **consistently** applied this rule until about age 2;6
  - Then 2 wks of **variable** [t]~[k] for /k/ (likewise /g/)

    Sometimes, A. would visibly **correct** her first production: "[tʌp] … [kʌp]"
  - After that, she settled on consistent [k] and [g]
  - Only one lexical item showed confusion about which phoneme it contained: *gear* [diɹ]

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- Just for fun: A. at age 4;6, when I misheard what she said about a bad smell along the road on a hot day
  - "No, I didn't say *tar*, I said *car*! Not T-A-R. C-A-R."

6. Methods in acquisition research

- Just as with adult language data, we can classify child language data as either:
  - **Naturalistic** — observe what naturally occurs
  - **Experimental** — create situations, collect responses

- What are some of the advantages and disadvantages of each of these types of data?

6. Methods in acquisition research

- What are some of the advantages and disadvantages of each of these types of data?

Naturalistic	**Experimental**
☺ Taken from real life (is actual behavior)	× Artificial situation (does behavior change?)
× Can't control what kind of data is available	☺ Can collect particular types of data

6. Methods in acquisition research

- Methods of data collection for each type:
  - **Naturalistic** — observe what naturally occurs
    - Diary studies (write down observations)
    - Audio or video recordings (and transcripts)

6. Methods in acquisition research

- Methods of data collection for each type:
  - **Experimental** — create situations, collect responses
    - Infants react differently when they hear something familiar vs. new
      → Do two segments sound different?
    - Young children can point to pictures, answer questions (“which is a mouth?”)
    - All ages can do eye-tracking experiments
      → Which picture on a screen do they watch?

6. Methods in acquisition research

Examples of some experimental methods used in child language research

- Video
  - Infant Language Lab (1999) — Johns Hopkins
    Video is old, but shows actual infants being tested
- Research lab web sites with photos & information about the methods they use
  - Bergelson Lab — Duke U and Harvard U
  - BabyLab — U Potsdam
  - Penn Infant Language Center — U Pennsylvania