Psychology of Language

3 Syllables and prosody

Fall 2023
Tues/Thur 5:00-6:15pm

Emma Wing
Drop-in hours:
By appointment

Road map

- Review from **2 Speech perception**
  - **And last few slides from that lecture**
- Unit 1: Development of Language

  3 Syllables and prosody

Review from 2 Speech perception

- In groups:
  - Remind each other about at least one part of the discussion on acquisition of language
  - Define phoneme
  - Name the three dimensions on which consonants vary
    - What differs between [p] and [t]?
    - What differs between [t] and [d]?
    - What differs from [ʃ] (”sh”) to [ʧ] (“ch”)?
  - Name at least one challenge for babies when learning phonemes
  - Why do we say that phonemes are abstract mental categories?

Unit 1:
Development of Language

Syllables & prosody: Learning patterns of sounds

Ascent of Babel, Chapter 2 (and optional readings)

3 Syllables & prosody

- How do babies learn the legal and illegal orderings of sounds in their language?
- Learning objectives
  - Describe what a phonotactic constraint is and name one
  - Describe what a syllable is
  - Describe what prosody is
  - Describe a piece of evidence that suggests when babies start learning prosody, and another that suggests when babies start learning syllable information
  - Describe evidence that suggests bilingual babies can distinguish between rules of the two languages they are learning

Sound patterns in languages

- Even if we cannot understand the words, how is it that we can know what a particular language sounds like?

  Note: you must have at least heard the language before to do this!

  1. It's **phonetic inventory** (from last time)
  2. It's **Phonotactic constraints**: the way syllables can and can't be created in a language
  3. It's **Phonological rules**: mental representations of rules to avoid violating phonotactic constraints

Phonological rules

- A rule in English: Can you figure out the rule for plural nouns?

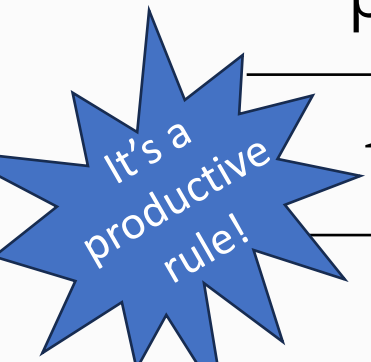
?		?		?	
cat	myth	mom	car	church	bush
plant	mop	puppy	lid	kiss	garage
fluff	plate	beginning	hole	waltz	cause

Phonological rules

- A rule in English: Can you figure out the rule for plural nouns?

Voicing Assimilation

-voicing		+voicing		homorganic (same sound)	
cat	myth	mom	car	church	bush
plant	mop	puppy	lid	kiss	garage
fluff	plate	beginning	hole	waltz	cause
blick		*mung*		*dax*	



Phonological rules

- Another rule in English: past tense
  - Travel → trave**led** [d]
  - Miss → miss**ed** [t]
  - Chat → chatt**ed** [ɪd]

- Can you think of any in another language you speak?

Phonological rules

- In order to learn the patterns for plurals and past tense in English, a child needs to have categories for voicing (voiced and voiceless).
- One more rule: Flapping [ɾ]
  - writing, riding, fatter, city, *captain, *baton, potato
  - Rule: between two vowels and **at the onset of an unstressed syllable**

- In order to learn this rule, you have to know something about syllables

Phonotactic constraints

Syllables

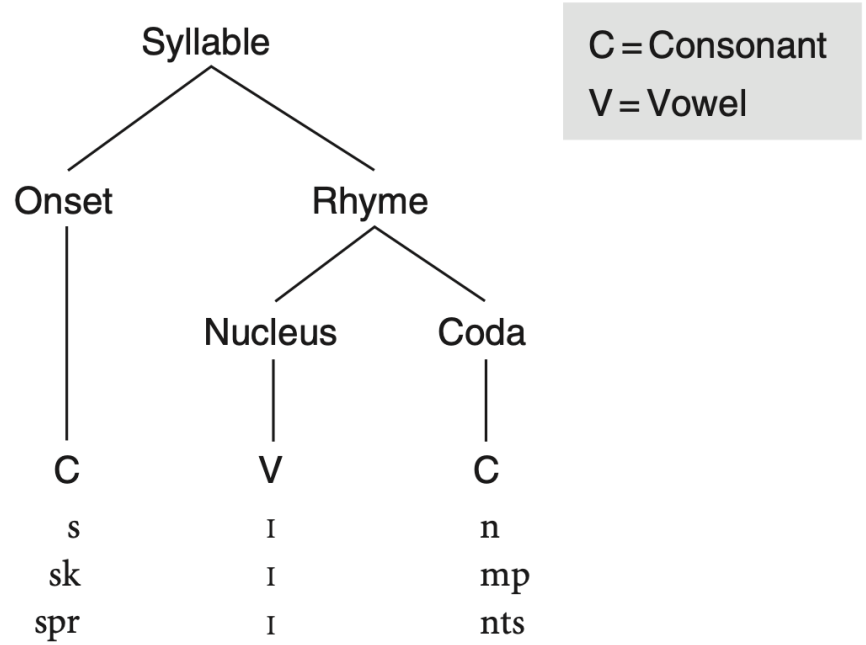


Figure 2.3 Schematic diagram of the structure of a syllable, and examples of three monosyllabic words with different onsets and codas: *sin*, *skimp*, and *sprints*. The number of consonants permitted in onset and coda position is controlled by phonotactic constraints.

Phonotactic constraints

Legal positions and strings of sounds varies across languages

- P and k + some consonants → not at the start of a word in English
  - pterodactyl, pneumonia, knife
  - apt, acknowledge
- S+consonant → not at at the start of a word in Spanish
  - *Spanish, Espańol
- Borrowed words and learning a second language
  - Japanese syllable-final phonotactic constraints differ from English
    - Beer → birru
    - Bus → basu

Prosodic rules

- Apply to suprasegmentals: units that span more than one segment
- In English, different syllables have main stress in words (they are more prosodically prominent)
  - They have a higher pitch or are elongated: *elephant*
  - Stress can distinguish word meanings:
    1. Emily made progress. (noun)
    2. Emily and her partner can progress to the next level. (verb)
  - Entire sentences have patterns of intonation
    3. Marta charged her computer. (typical declarative; falling intonation & final word prominence)
    4. Marta charged her computer. (new information is Marta)
    5. Marta charged her computer? (rising intonation)
  - Prosody can show where groups of words should be grouped syntactically
    3. They invited Sue, and Jim and Amanda got rejected.
    4. They invited Sue and Jim, and Amanda got rejected.

Prosody and rhythm

Stopped here Sept. 5

- Phonological component includes **prosody**
  - Prosody: the rhythm and intonation of speech
    - E.g., insertion of pauses in sentences, grouping of words into rhythmic phrases
- General rhythmic tendencies of languages
  - Stress-timed (e.g., English, Dutch)
  - Syllable-timed (e.g., Spanish, French, Italian)
  - Mora-timed (e.g., Japanese)

When do we start learning all this?

- Adults have tacit knowledge of these rules
- How and when do babies learn these rules?

Group activity!

“Articles” are on HuskyCT: Read and discuss

1. What was the research question?
2. Who were the subjects and how old were they?
3. Describe the methods in your own words
4. What were the findings?
5. What can we conclude from this?
6. Questions you have or interesting things to share?

Study 1

1. What was the research question?
2. Who were the subjects and how old were they?
3. Describe the methods in your own words
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ELSEVIER

Cognition

Volume 29, Issue 2, July 1988, Pages 143-178

COGNITION

A precursor of language acquisition in young infants ☆

Jacques Mehler, Peter Jusczyk, Ghislaine Lambertz, Nilofar Halsted, Josiane Bertoncini, Claudine Amiel-Tison

https://doi.org/10.1016/0010-0277(88)90035-2

Abstract

Four-day-old French and 2-month-old American infants distinguish utterances in their native languages from those of another language. In contrast, neither group gave evidence of distinguishing utterances from two foreign languages. A series of control experiments confirmed that the ability to distinguish utterances from two different languages appears to depend upon some familiarity with at least one of the two languages. Finally, two experiments with low-pass-filtered versions of the samples replicated the main findings of discrimination of the native language utterances. These latter results suggest that the basis for classifying utterances from the native language may be provided by prosodic cues.

Study 1: Mehler et al. 1988

1. What was the research question?
   - When can babies begin to distinguish between sounds in two different languages? Does it take a long time to become familiar with a particular language? How old were the subjects?
2. Who were the subjects and how old were they?
   - 4-day-old French infants and 2-month-old American infants.
3. Describe the methods in your own words.
   - They played French and Russian to infants and measured sucking rate to determine preference for a language.
4. What were the findings?
   - Infants sucked at significantly higher rates while listening to French than while listening to Russian.
   - Infants whose caregivers spoke neither Russian nor French behaved liked French-learning infants who listened to Russian.
5. What can we conclude from this?
   - Familiarity with a language is important in order to distinguish between two languages.
6. Questions you have or interesting things to share?

Study 2

1. What was the research question?
2. Who were the subjects and how old were they?
3. Describe the methods in your own words
4. What were the findings?
5. What can we conclude from this?
6. Questions you have or interesting things to share?

ELSEVIER

Infant Behavior and Development

Volume 17, Issue 2, April–June 1994, Pages 159-164

Fetal reactions to recurrent maternal speech ☆

Anthony J. DeCasper, Jean-Pierre Lecanuet, Marie-Claire Busnel, Carolyn Granier-Deferre, Roselyne Maugeais

https://doi.org/10.1016/0163-6383(94)90051-5

Abstract

Pregnant women recited a short child's rhyme, “the target”, aloud each day between the thirty third and thirty seventh weeks of their fetuses' gestation. Then their fetuses were stimulated with tape recordings of the target and a control rhyme. The target elicited a decrease in fetal heartrate whereas the control did not. Thus, fetuses' exposure to specific speech sounds can affect their subsequent reactions to those sounds. More generally, the result suggests that third trimester fetuses become familiar with recurrent, maternal speech sounds.

Study 2: De Casper et al. 1994

1. What was the research question?
   - Is postnatal perception of speech sounds influenced by prenatal experience?
2. Who were the subjects and how old were they?
   - Prenatal fetuses two weeks before they were due.
3. Describe the methods in your own words.
   - Mothers recited one of two rhymes every day for the four weeks leading up to the experiment. Infants' heart rate was recorded at test, when rhymes were played for the fetuses.
4. What were the findings?
   - Fetal heart rates decreased when listening to the rhyme the mother had recited.
5. What can we conclude from this?
   - Fetuses have access to some information, namely prosody and rhyme, in utero. We start to learn about language even before we're born, and we can distinguish between different sequences of rhymes.
6. Questions you have or interesting things to share?

Study 3

1. What was the research question?
2. Who were the subjects and how old were they?
3. Describe the methods in your own words
4. What were the findings?
5. What can we conclude from this?
6. Questions you have or interesting things to share?

ELSEVIER

Infant Behavior and Development

Volume 4, March 1981, Pages 247-260

Syllables as units in infant speech perception *

Josiane Bertoncini, Jacques Mehler

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The aim of the research we have carried out is to assess the role of the syllable in the processing of speech in the very young infant. We used three kinds of stimuli: syllabic, non-syllabic and syllabic-synthetic sequences. These were presented to infants who were less than 2 months old in an habituation-dishabituation paradigm. Results indicate that the syllable-like stimuli are discriminated better than the non-syllable-like stimuli even though the physical change from the habituation to the dishabituation stimuli was always the same. We interpret our results as favoring a view according to which the syllable is the natural unit of speech segmentation and processing.

Study 3: Bertoncini & Mehler, 1981

1. What was the research question?
   - Are 2-month-old infants sensitive to legal and illegal syllable structure?
2. Who were the subjects and how old were they?
   - 2-month-old infants (or younger)
3. Describe the methods in your own words.
   - Infants were tested with non-nutritive sucking and researchers recorder infant behavior when the stimulus changed (e.g., from *tap* to *pat* or *tsp* to *pst*) to determine whether the infants noticed the change.
4. What were the findings?
   - Infants were more likely to notice when a legal syllable's (CVC) phonemes changed order.
5. What can we conclude from this?
   - Infants are able to distinguish between different syllables that are allowed in language but struggle to do this with syllables that are not allowed (and don't conform to our definition of syllable!).
6. Questions you have or interesting things to share?

Study 4

1. What was the research question?
2. Who were the subjects and how old were they?
3. Describe the methods in your own words.
4. What were the findings?
5. What can we conclude from this?
6. Questions you have or interesting things to share?

Rhythmic distance between languages affects the development of speech perception in bilingual infants

Megha Sundara, Adrienne Scutellaro [1]

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https://doi.org/10.1016/j.wocn.2010.08.006

Abstract

The time course and trajectory of development of phonetic perception in Spanish–Catalan bilingual and monolingual infants is different (Bosch & Sebastián-Gallés (2003a), Bosch & Sebastián-Gallés (2003b), Bosch & Sebastián-Gallés (2005); Sebastián-Gallés & Bosch, 2009). Bosch and Sebastián-Gallés argue that, at least initially, bilingual infants track statistical regularities across the two languages, leading to their temporary inability to discriminate acoustically similar phonetic categories. In this paper, we test bilingual Spanish–English 4- and 8-month-olds' discrimination of vowels. Results indicate that, when the two languages being learned are rhythmically dissimilar, bilingual infants are able to discriminate acoustically similar vowel contrasts that are phonemic in one, but not the other language, at an earlier age. These results substantiate a mechanism of language tagging or sorting; such a mechanism is likely to help bilingual infants calculate statistics separately for the two languages.

Study 4: Sundary & Scutellaro 1981

1. What was the research question?
   - Can bilingual infants distinguish between phonemes that are contrastive in one language but not in another when those two languages are rhythmically dissimilar?
   - Do infants tag different languages or do they initially learn statistics from both as though they were a single language?
2. Who were the subjects and how old were they?
   - 4- and 8-month-old infants learning English only or learning both English and Spanish
3. Describe the methods in your own words.
   - Tokens of /e/ and /ɛ/ were played to infants in a visual habituation procedure.
4. What were the findings?
   - Both age groups and language groups could distinguish between them.
5. What can we conclude from this?
   - When the two languages are rhythmically dissimilar, bilingual infants can distinguish between contrastive phonemes even when they haven't had input in that language.
     Infants may to tag languages to learn them separately from a very young age when those languages are rhythmically dissimilar.
6. Questions you have or interesting things to share?

Main findings of studies 1-4

- **Study 1:** Familiarity with a language is important in order to distinguish between two languages.
- **Study 2:** Fetuses have access to some information, namely prosody and rhyme, in utero. We start to learn about language even before we're born, and we can distinguish between different sequences of rhymes.
- **Study 3:** Infants are able to distinguish between different syllables that are allowed in language but struggle to do this with syllables that are not allowed.
- **Study 4:** When the two languages are rhythmically dissimilar, bilingual infants can distinguish between contrastive phonemes even when they haven't had input in that language. Infants may to tag languages to learn them separately from a very young age when those languages are rhythmically dissimilar.

Final points

- What does this mean for babies born deaf?

Review

- What is a phonotactic constraint?
  - Name a phonotactic constraint we learned about today
- Define syllable
- Define prosody
- What is one piece of evidence that babies start learning about speech sounds in the womb?
- What is language tagging and what is one piece of evidence that suggests bilinguals may do this?

Key concepts

- ✓Phonotactic constraint
- ✓Phonological rules
- ✓Prosody
- ✓Syllable
- ✓Speech-tagging
- ✓Experimental evidence of when babies start to learn about prosody and syllables

Next…

- Knowing prosody may allow infants to distinguish where syllables start and end, which helps them segment speech
- Speech segmentation is necessary in order to start mapping words to their meanings