Psychology of Language

4 Learning words

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

Emma Wing
Drop-in hours:
By appointment

Road map

- Assignment #1 posted, due September 22 at midnight
- Quiz #2 available until tonight at midnight (unlimited attempts for quizzes!!)
- Review from **3 Syllables and prosody**
- Unit 1: Development of Language

  4 Learning words

Review: 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.

Review from 3 Prosody & syllables

- 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?

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

Unit 1:
Development of Language

Learning words: Building the mental lexicon

Ascent of Babel, Chapter 4 pp. 32-41

Learning words

- Learning objectives
  - Name 2+ word-learning milestones
  - Describe 2+ lexical learning principles
    - Mutual exclusivity assumption
    - Whole object assumption
    - Shape bias
    - Extendability
  - Describe 2+ ways we can study word learning
  - Define syntactic bootstrapping
  - Name 2+ ways statistical learning aids in word learning

Milestones toward word learning

- Place the learning milestones in order and guess the age
  - ??????: Begins to babble: to produce the same syllables over and over, then later, strings of different syllables
  - ??????: Can discriminate between speech sounds that are not phonemic in their language
  - ??????: Beginning of the one-word stage
  - ??????: Cannot distinguish between speech sounds that are not phonemic in their language
  - ??????: Can recognize caregiver's language as compared to other languages
  - ??????: Segment individual words from a string of speech and recognize them later

Milestones toward word learning

- Place the learning milestones in order and guess the age
  - **4 days**: Can recognize caregiver's language as compared to other languages
  - **Before 10 months**: Can discriminate between speech sounds that are not phonemic in their language
  - **After 10 months**: Cannot distinguish between speech sounds that are not phonemic in their language
  - **Around 6 months**: Begins to babble: to produce the same syllables over and over, then later, strings of different syllables
  - **Around 9 months**: Segment individual words from a string of speech and recognize them later
  - **12-18 months**: Beginning of the one-word stage

Challenges for word learning

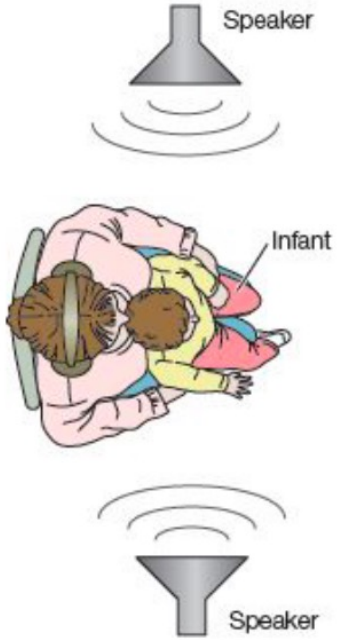
- What are some challenges that children face in learning words?
  - *Example: They have to learn the boundaries of words*
  - They have to determine what the right meanings are to map to words (referential ambiguity)
  - They have to figure out that words refer to parts of things, whole things, groups of things, properties for things, actions, emotions, and even
  - Caregivers don't always talk about what the child is attending to
  - The same object can look quite different in many instances (e.g., what exactly is a *mug* versus a *cup*?)

motherese

Speech segmentation

bidakupadotigolabubidaku

- Kids keep track of transitional probabilities between syllables
  - Transitional probabilities: likelihood that a syllable will be followed by another syllable
  - 8-month-olds could distinguish between part-words and words
  - **Statistical learning**



Experimenters create an artificial "language" of four "words":
bidaku, golabu, padoti, dutaba

Familiarization phase

Infant hears each "word" repeated 45 times in random order, in an unbroken 2-minute synthesized speech stream:
bidaku-golabu-dutaba-golabu-padoti-bidaku-dutaba-padoti-golabu-dutaba-padoti-dutaba-golabu-bidaku-dutaba-bidaku-padoti-bidaku-padoti-golabu etc.

Test phase

Loudspeakers present infant either a "real" word:
bidaku, golabu
or a sequence of syllables with parts of two words:
dakugo, buduta

Results

Mean looking times for 8-month-olds	
"Real" words	6.77 seconds
Part-words	7.60 seconds

Figure 4.2 In this study, Saffran and colleagues prepared stimuli that amount to a miniature artificial language of four "words," each word consisting of three consonant-vowel syllables. Infants then heard an uninterrupted, 2-minute stream of random combinations of the four words. The researchers noted how much attention the babies paid to the four "words" from the familiarization phase and compared it with the attention the babies paid to three-syllable sequences that also occurred in the speech but that straddled "word" boundaries (part-words). (Adapted from Saffran et al., 1996, *Science* 274, 1926.)

More statistical learning

- Referential ambiguity
  - What is the relevant referent to map to the word?
  - Extremely prevalent
- How do kids solve it?
  a) Statistical information helps kids extract common features from the environment
  b) Syntactic cues help narrow down the search

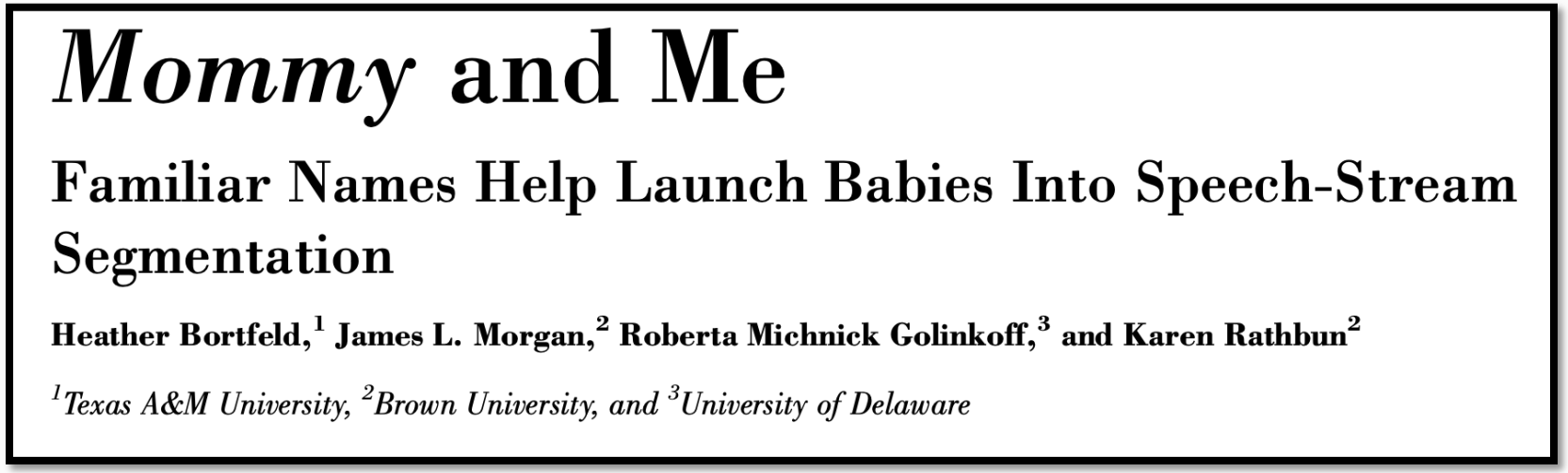
Statistical and Syntactic Information Facilitate Verb Learning by Resolving Ambiguity in Different Ways

Zhang, Y. [1], Wang, J. [2], Li, P. [2] & Yu, C. [3]
1 Max Planck Institute for Psycholinguistics
2 The Hong Kong Polytechnic University
3 University of Texas at Austin

Successful learning of meanings requires children to solve two challenges upon hearing an unfamiliar word: 1)to determine what concept is referred to in speech(referential ambiguity) as there are usually many candidate referents present and only one of them is to which the speaker intends to refer at the moment; 2)to find the right label as many words can be used to refer to the same referent(semantic ambiguity). Using the well-established Human Simulation Paradigm, we designed four experiments to quantify the degrees to which the two types of ambiguities exist in naturalistic parent-child toy play and to examine how statistical and syntactic cues independently and jointly facilitate verb learning. We found that 1)referential and semantic ambiguities are prevalent in the real-world learning environment; 2)statistical information allows learners to resolve referential ambiguity by extracting common event features embedded across multiple trials and eventually converging on the correct referent unit; 3)syntactic cues allows learners to quickly narrow down their search space by filtering out verbs (with or without similar meanings) that do not fit the given syntactic frame, resolving both referential and semantic ambiguities. Both sources of information mutually support verb learning and allow for complex bootstrapping operations in child language development.

Speech segmentation

- Speech segmentation
  - Children also use familiar words (their names, the name used for their caregivers) to segment speech
    - As early as 6 months
    - Learn (previously unfamiliar) words following familiar names



***Mommy* and Me**

Familiar Names Help Launch Babies Into Speech-Stream Segmentation

Heather Bortfeld,[1] James L. Morgan,[2] Roberta Michnick Golinkoff,[3] and Karen Rathbun[2]

[1]Texas A&M University, [2]Brown University, and [3]University of Delaware

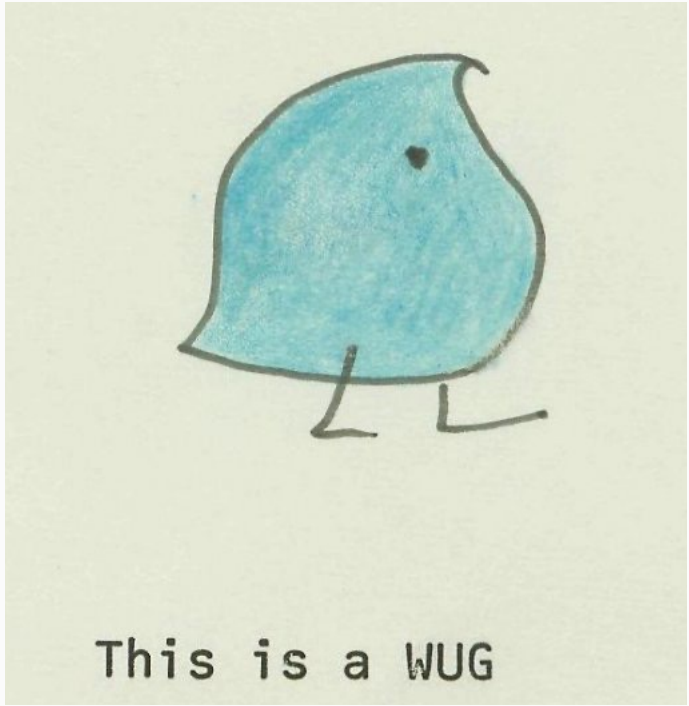
Bortfeld et al. (2005)

Lexical learning principles

- Assumptions children make that help lexical learning
  - Whole object
  - Mutual exclusivity
  - Shape bias
  - Extendability
    - Overextension
    - Underextension

Lexical learning principles

1. **Whole object**: a word refers to the whole object rather than a part of it



Markman (1991)

Lexical learning principles

2. **Mutual exclusivity**: everything has only one name

- What group is this a potential problem for?
  - Bilinguals!
  - Young bilingual children use mutual exclusivity, but older bilinguals suspend the assumption

- Whole object and mutual exclusivity work together
  - If the child has already learned the word for an object, they will assume future words applied to that object refer to parts of the object

Markman and Wachtel (1988); Golinkoff, Mervis, & Hirsch Pasek (1994), Markman (1994)

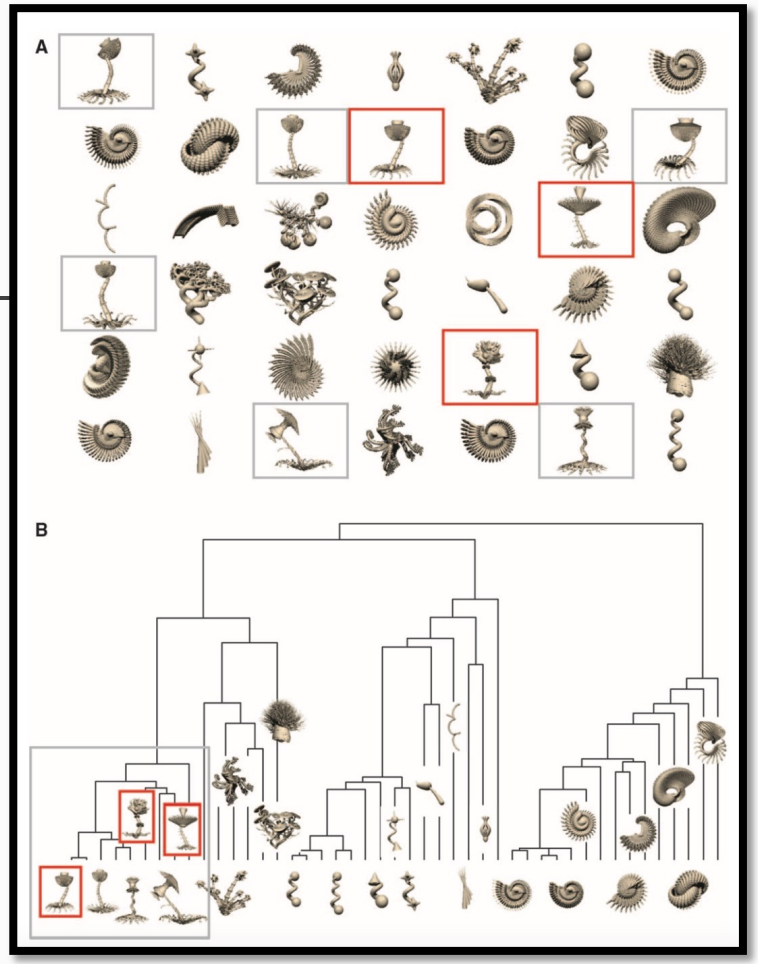
Lexical learning principles

3. Shape bias

Investigating the shape bias in typically developing children and children with autism spectrum disorders

Emily R. Potrzeba[1,2], Deborah Fein[1] and Letitia Naigles[1]*

[1] Department of Psychology, University of Connecticut, Storrs, CT, USA, [2] Department of Allied Health Sciences, University of North Carolina, Chapel Hill, NC, USA



Tenenbaum et al. (2011)

- **Participants**: TD (typically developing): 18-23 months; ASD (autism spectrum disorder): 24-42 mos old
  - Groups were matched on language and cognitive levels using standardized test measures
- **Method**: intermodal preferential looking: children view side-by-side videos and hear a linguistic stimulus that matches only one of the videos.
- **Results**: TD group showed shape bias from the first visit; ASD group did not show a consistent shape bias, but a lot of variation

Lexical learning principles

4. **Extendability** (aka taxonomic assumption): individual words refer to categories of similar things. Labels for items shift category assumptions.
   - overextension and underextension

Mason (25 mos)

Mason: duck! (pointing to an image of hummingbird)
Emma: That's a hummingbird.
Mason: humming duck!

Jack (35 mos)

Mother: what are these?
Jack: uh worms.
Mother: they look like worms. They're seahorses.
Jack: worms seahorse.
Mother: seahorses.
Jack: seahorses worm.

Lexical learning principles

4. **Extendability** (aka taxonomic assumption): individual words refer to categories of similar things. Labels for items shift category assumptions.
   - overextension and underextension

Daria (24 mos)

Mother: What's that? (pointing to a picture of a bug)

Daria: a fruit snack!

Underextension (less common)

A child calls their cat "kitty" but does not extend to other cats

Bilingual lexical acquisition

Bilingual vocabularies

- Smaller vocabularies in each language than a monolingual has!
- What's going on?

- Not a deficit: total number of words across both lexicons is greater than a single lexicon of English!
- What can we infer from this?
  - Could be because they receive less input for each word
  - Could be because of early mutual exclusivity assumption
  - Other reasons?

Nouns and verbs

- These lexical learning principles have been about learning nouns.
  - There is a noun bias!
    - **Noun bias:** children are more likely to map novel words onto novel objects than onto novel actions
- But what about learning words from other categories, like verbs?

Syntactic bootstrapping

- Verbs can label ongoing activity rather than stationary objects
  - The same object can be seen twice
  - Objects can often be manipulated or interacted with

- *Moak* (novel verb)
  - What does it mean?

    1. The cat is moaking the mouse.
    2. The mouse is moaking from the cat.

- To learn a new verb, a child must pay attention to its syntactic context

Gleitman (2000)

Syntactic bootstrapping

The structure of a sentence affects a child's interpretation of a novel verb

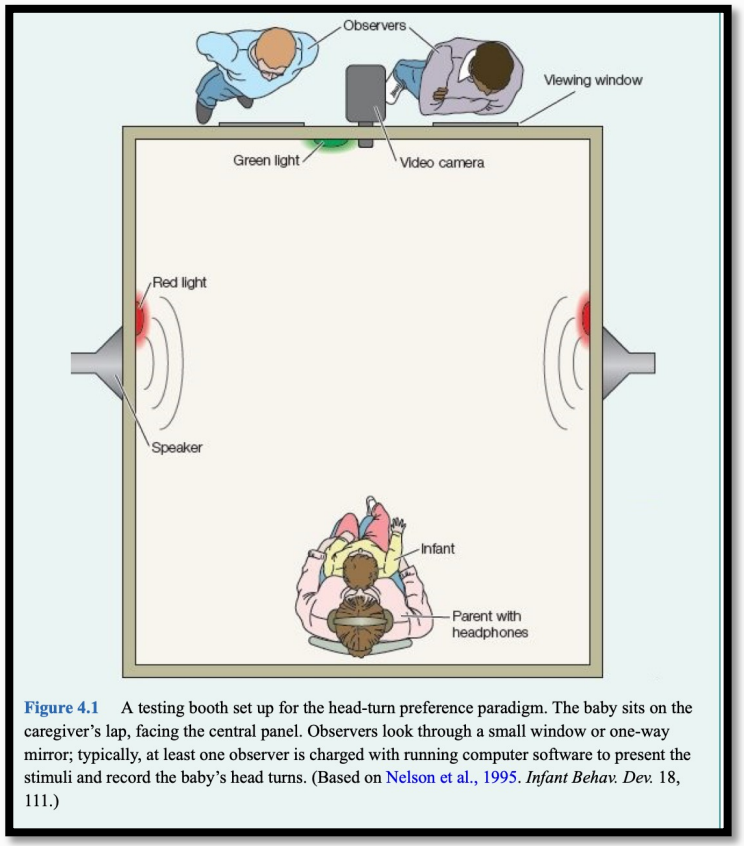


Figure 4.1 A testing booth set up for the head-turn preference paradigm. The baby sits on the caregiver's lap, facing the central panel. Observers look through a small window or one-way mirror; typically, at least one observer is charged with running computer software to present the stimuli and record the baby's head turns. (Based on Nelson et al., 1995. *Infant Behav. Dev.* 18, 111.)

A. The rabbit is gorping the duck.
B. The rabbit and the duck are gorping.

Results:

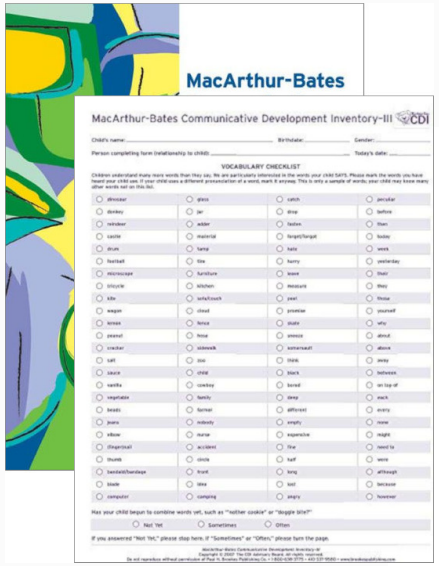
- Children who heard the transitive sentence (A) looked toward a video of the rabbit pushing the duck.
- Children who heard the intransitive sentence (B) looked at the video of the duck and the rabbit waving their arms

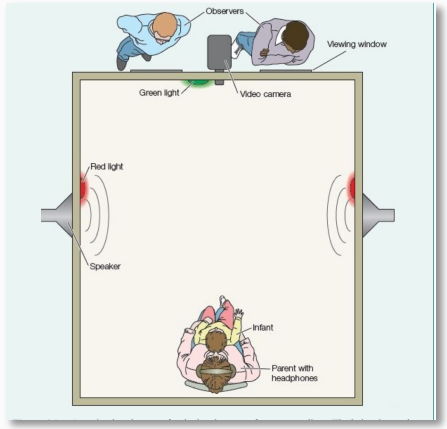
Naigles (1990)

Testing children's word learning

1. Experimental comprehension
   - **Example**: preferential looking paradigm, head-turn preference paradigm
2. Experimental production
   - **Example**: watch a novel action and elicit production of sentence
3. Parent report
   - **Example**: Communicative Development Inventory (checklists of words that parents complete)
4. Language sample analysis
   - **Example**: Recorded play session with parent and child which is then transcribed and tagged

benefits and limitations of these?





Wrapping up

- Infants are learning about prosody which helps segment syllables
- Syllables help segment speech sounds
- Speech sounds help learn phonotactic constraints
- Segmenting a handful of words (your name, “mom”, etc.) helps learn where syllables are
- Knowing about syntax helps learn word meanings

…it’s all connected!

Key concepts

- ✓Statistical learning
- ✓Lexical learning principles
  - ✓Mutual exclusivity assumption
  - ✓Whole object assumption
  - ✓Shape bias
  - ✓Extendability
- ✓Noun bias
- ✓Syntactic-bootstrapping
- ✓Methods for testing children's word learning
  - ✓Experiment; parent report; language sample

Next…

- After the one-word stage comes the two-word stage!
- How do children learn the rules of their language?