# 24.904
# Language Acquisition

## Class 5:  Word Segmentation, continued

# Last time

- Tools in infants' segmentation toolkit:
  - Distributional information (transitional probabilites)
  - Knowledge about prosodic structure
  - one constrains the other

# Today

- more on the relevance of prosody

- other helpful elements

# Shukla et al. 2011

- Can infants extract a statistically defined, novel auditory word form from running speech and simultaneously map it onto a visual referent?

- How, if at all, does this process interact with structural properties such as prosodic constituency?

# Shukla et al. 2011

- Familiarization with two utterance-types, as the target object moved along the table, of the form **xAByz**, where AB is the target nonce word, whereas the syllables x, y, and z vary.

**ʒə-muː-raː]-lei-sə…ʒə-muː-raː]-ni-sə**

**vs.**

**ʒə-muː-]raː-lei-sə…ʒə-muː]-raː-ni-sə**

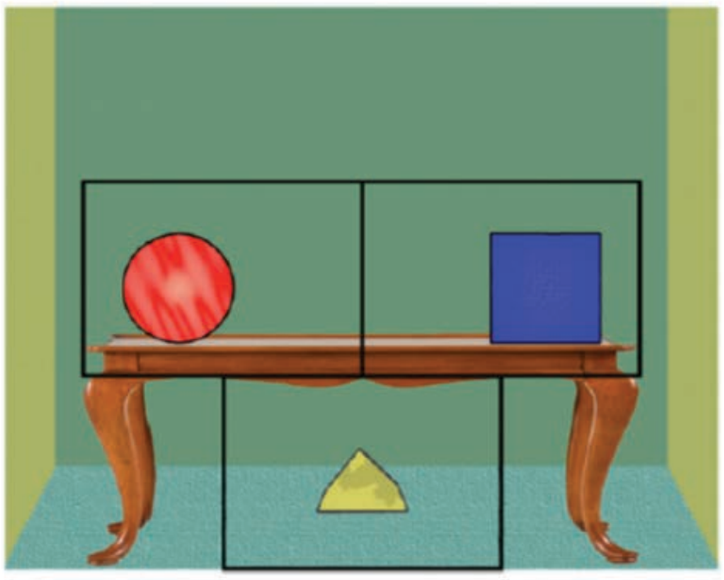

Fig. 1. Screen shot from the experiment, showing the setup of the objects. The three observation windows are overlaid as black outline rectangles.



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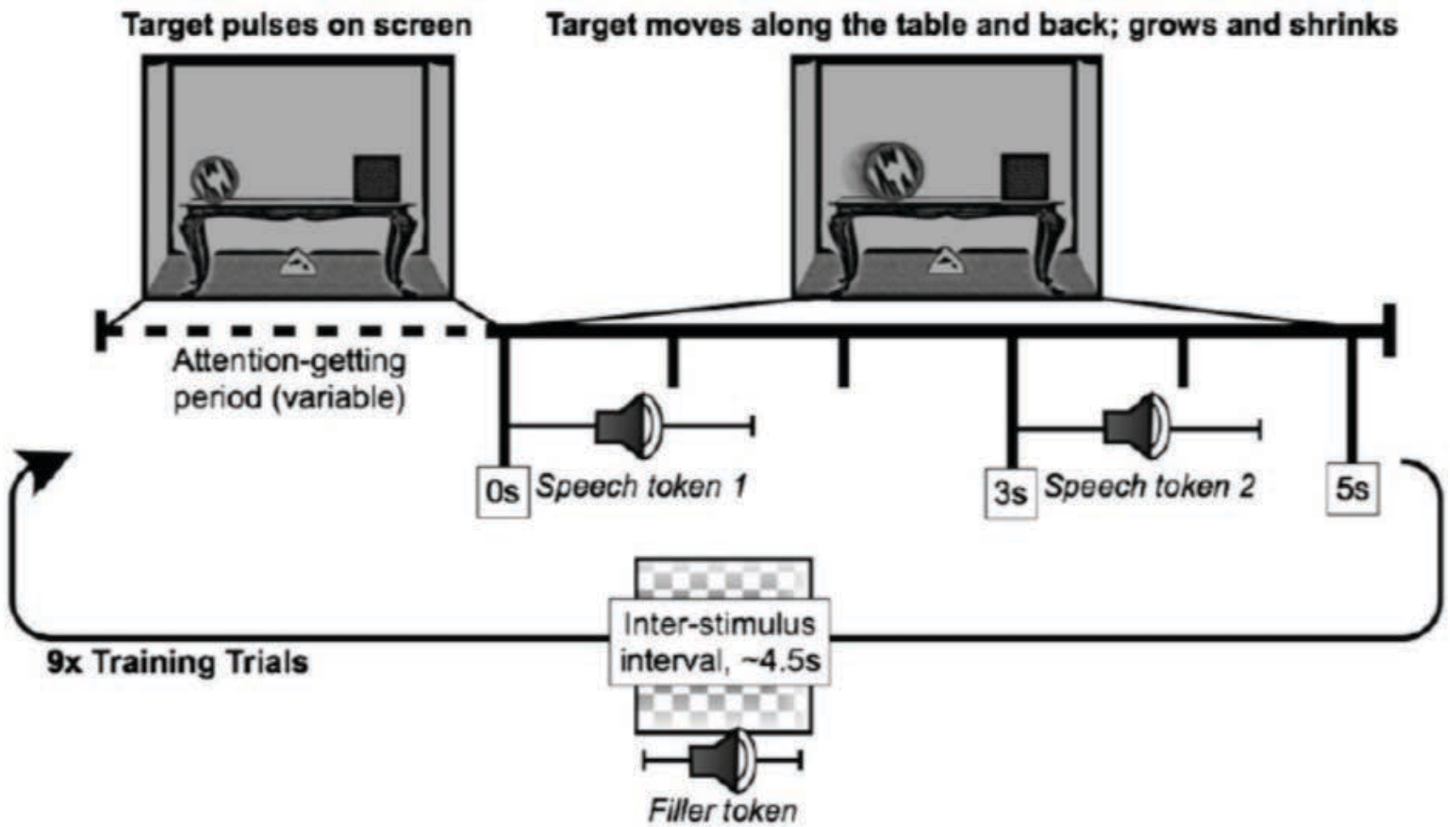
# Shukla et al. 2011

- Familiarization with utterances of the form **xAByz** as the target object moved along the table, where **AB** is the target nonce word, whereas the syllables **x**, **y**, and **z** vary.

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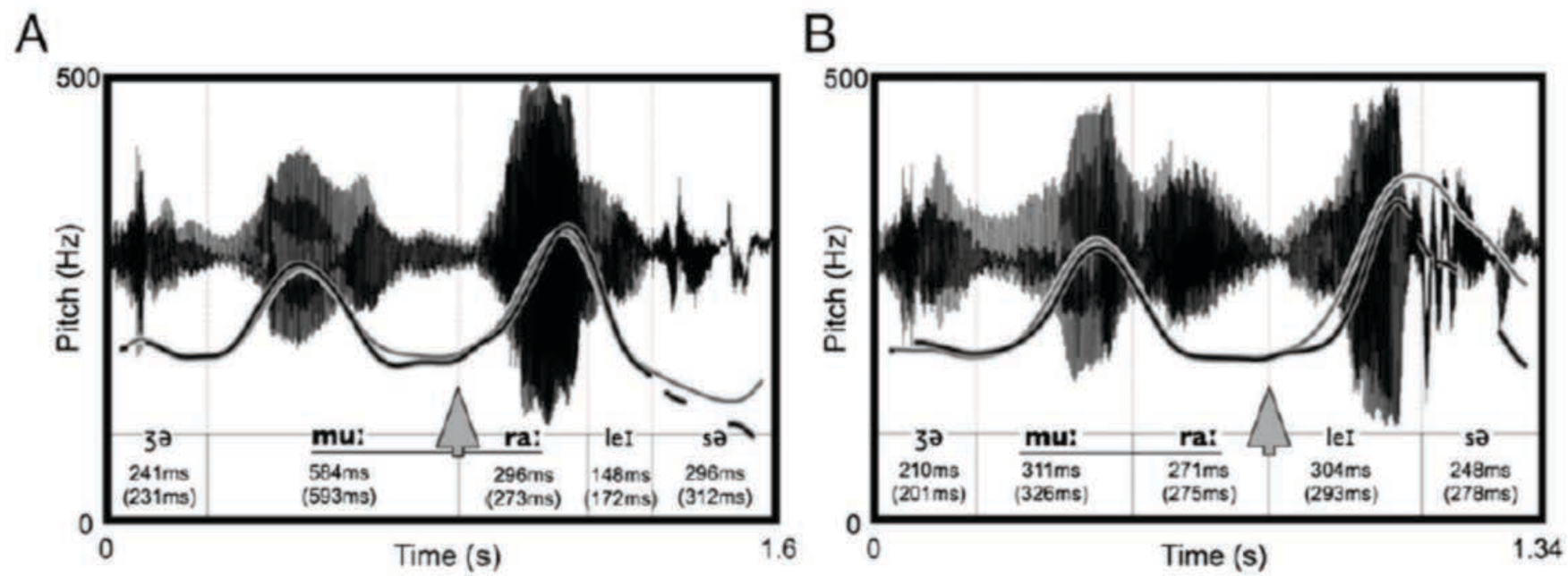
# Shukla et al. 2011

- **2 between-subjects conditions:**
  - AB either was within a phonological phrase (one pitch accent; [ʒə-**muː-raː**]-[lei-sə]) or straddled two phonological phrases ([ʒə-**muː][-raː**-lei-sə])

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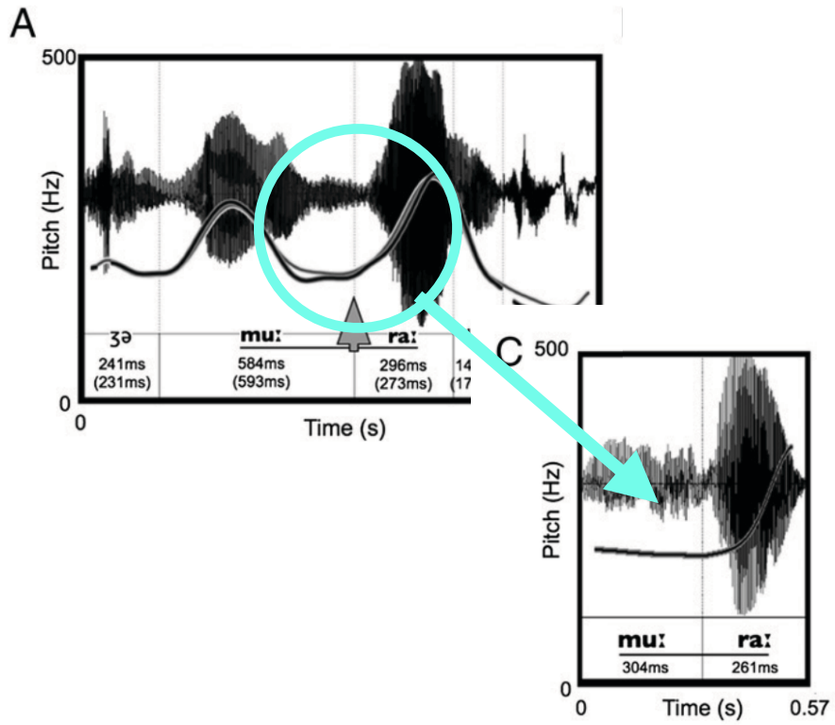
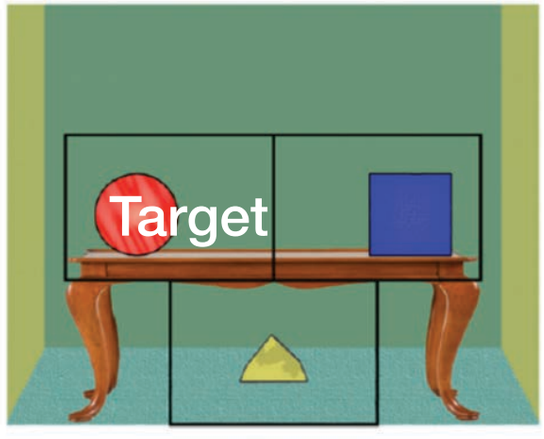
# Shukla et al. 2011

- Test
  - **AB** (mu:ra, the statistical "word") vs. **By** (ra:lei, the part-word)
    - NB: prosodically the test word had the same intonation-patterns as the boundary-straddling sequence
  - Measure: looks to target (the object that moved in fam)

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# Shukla et al. 2011

- Results:
  - more looks to target upon word vs. part-word…
  - …but *only* for the prosodically-aligned group!

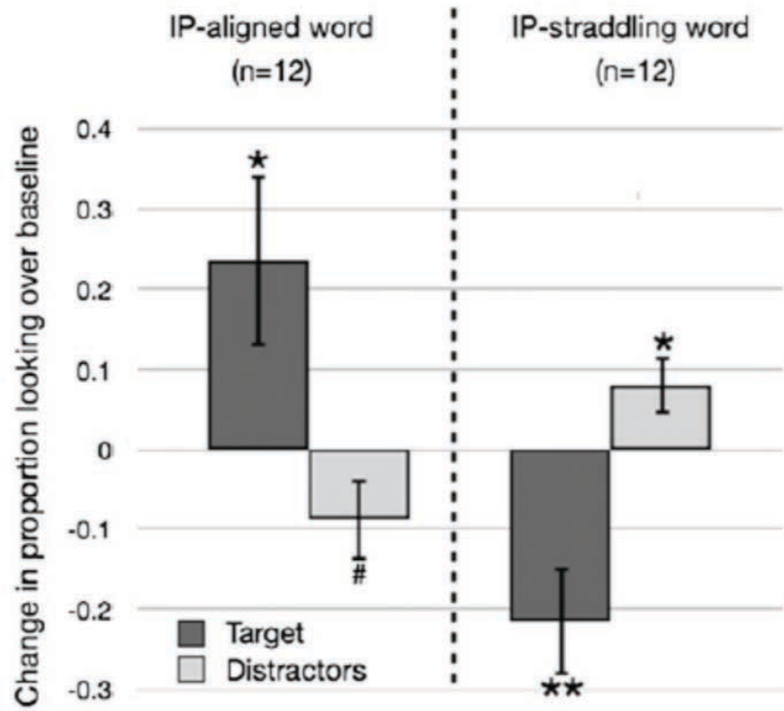


**Fig. 5.** Change in proportion of looking over baseline (±SEM) to the target and distracter objects upon hearing the nonce word in the two prosodic conditions ($n = 12$ each). Positive values indicate an increase in proportion of looking over baseline. $^{**}P < 0.01$; $^{*}P < 0.05$; $^{\#}P = 0.1$.

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# Shukla et al. 2011

- Infants in the prosodic-phrase-internal word group associated the high-TP test word to the target object, but infants in the prosodic-phrase-straddling group did not

  - even though the test items were more *perceptually* similar to the boundary-straddling sequence

# Shukla et al. 2011

- "Our findings lend support to arguments that prosodic cues, which signal constituent edges, are critical for acquiring word forms and grammatical patterns in infants and adults."

- “Cognitive capacities of infants are appropriately constrained… language acquisition is most rapid when the structure of the linguistic input is well matched to these constraints."

- "Prosodically organized input may be an essential feature for optimal word learning."

# “Function words”

- the, a(n), some, my…
- be, have, to…
- that, if, for…

# Characteristics

- Small in number, but each with very high frequency
  - In contrast, “content” words are large in number, each with low frequency
- Phonologically and prosodically reduced
  - fewer syllables per word
  - fewer consonants per syllable
  - weak prosody (e.g. short duration, weak pitch)

# Shi and Lepage 2008

- 8-month-olds use familiar function words to segment adjacent lexical words.

# Shi and Lepage 2008

- **Familiarization:** “novel” content words preceded by (i) a high-frequency functional morpheme or (ii) a low-frequency functional morpheme or (iii) a nonsense morpheme with the shape/prosody of functors

# Shi and Lepage 2008

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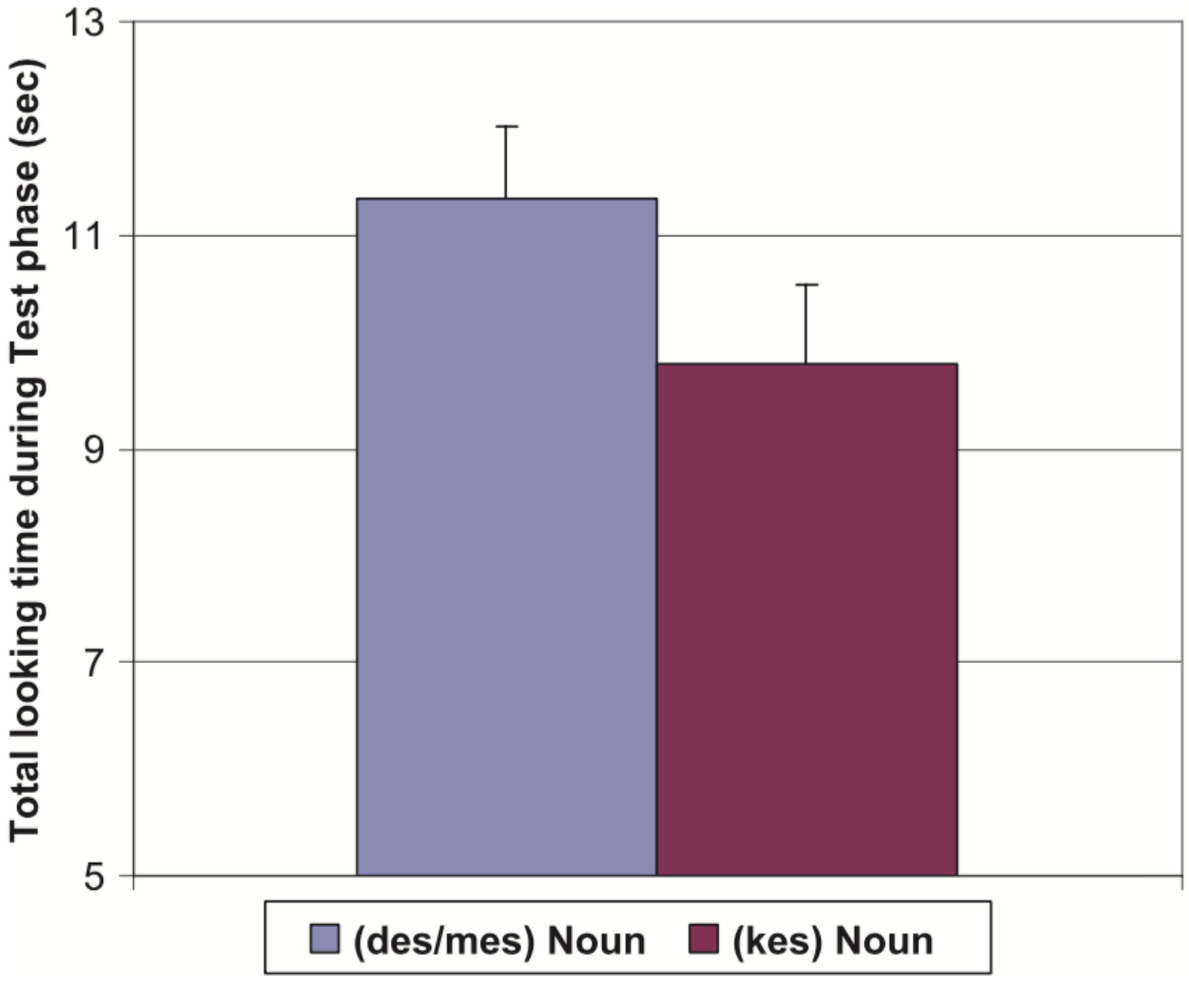
- **Test:** content words presented in isolation

# Shi and Lepage 2008

- **Familiarization**: “novel” content words preceded by (i) a high-frequency functional morpheme or (ii) a low-frequency functional morpheme or (iii) a nonsense morpheme with the shape/prosody of functors
  - *des preuves, des sangles*, *mes preuves, mes sangles* (between)
  - *kes preuves, kes sangles*
- **Test:** content words presented in isolation
  - *preuves, sangles*

# Shi and Lepage 2008




**32 infants**
**16 per group**

**Figure 1** *Total looking time during the Test phase (with SE). Eight-month-old infants listened significantly longer to the isolated productions of the noun that had been previously familiarized with a frequent functor* des *or* mes*, than to the isolated noun previously familiarized with the nonsense functor* kes.



Fig ure from R. Shi and M. LePage, "The effect of functional morphemes on word segmentation in preverbal infants" Developmental Science 11:3 (2008), pp 407– 413. © 2008 The Authors. Journal compilation © 2008 Blackwell Publishing Ltd
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# frequency matters?

- **Experiment 2:** an even less frequent function word *vos (*vs. nonce functor *kos*)

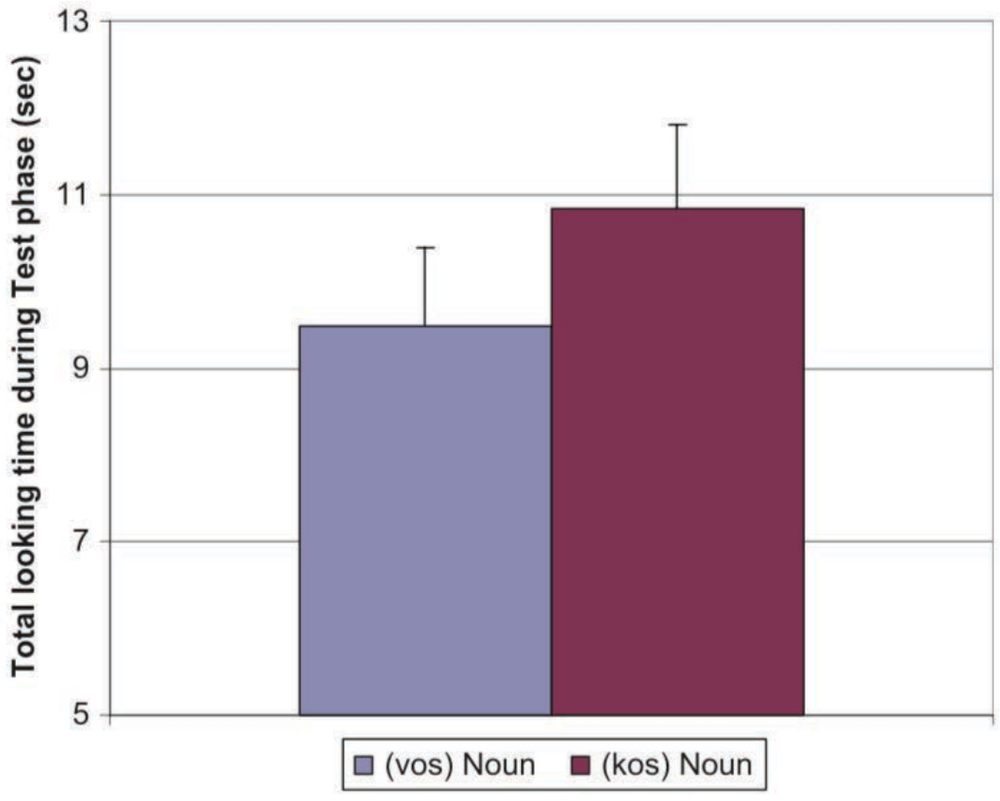


**Figure 2** *Total looking time during the Test phase (with* SE*). Eight-month-old infants' listening times to the isolated productions of the noun that had been previously familiarized with an infrequent functor* vos *and to the isolated noun previously familiarized with the nonsense functor* kos*. No significant difference was found.*

Figure from R. Shi and M. LePage, "The effect of functional morphemes on word segmentation in preverbal infants" Developmental Science 11:3 (2008), pp 19 407– 413. © 2008 The Authors. Journal compilation © 2008 Blackwell Publishing Ltd

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# why should frequency matter?

- “…this indicates that functional morphemes can indeed assist infants in the earliest step of lexical learning. Moreover, frequency was shown to be the determinant for this effect.”

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- “…this indicates that functional morphemes can indeed assist infants in the earliest step of lexical learning. Moreover, frequency was shown to be the determinant for this effect.”

- but why should the child not assume that e.g. French has a lot of *des*-initial content words?

# Function words are structure-builders

- Function words are grammatical formatives; they are essential and immutable in ways that content words aren’t

*‘Twas brillig, and the slithy toves*
*Did gyre and gimble in the wabe...’*

# Function words are structure-builders

- Function words are grammatical formatives; they are essential and immutable in ways that content words aren’t

(1) Colorless green ideas sleep furiously

(2) Colorless green idea-ed sleeper furiously

# Function words are structure-builders

- Function words are grammatical formatives; they are essential and immutable in ways that content words aren’t

(1) I went on a crazy devour. [verb —> noun]

(2) I lamped the room. [noun —> verb]

(3) Cat is barking. [predicate —> proper name]

(4) *A lot of wine is too many.

# Function words are structure-builders

- Consequences:
  - frequent
  - prosodic alignment: syntactic phrases are headed by functional elements, so they will correspond to the beginnings or ends of prosodic constituents
    - infants sensitive to this — functor at the beginning for Italian and at the end for Japanese; Gervain et al., 2008

# next class

- Bloom Ch.1
- Read one of:
  {Smith & Yu, Trueswell et al., Woodard et al., Aravind et al.}

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