Children's use of prosody to compute syntactic structure on-line

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ENS
ÉCOLE NORMALE
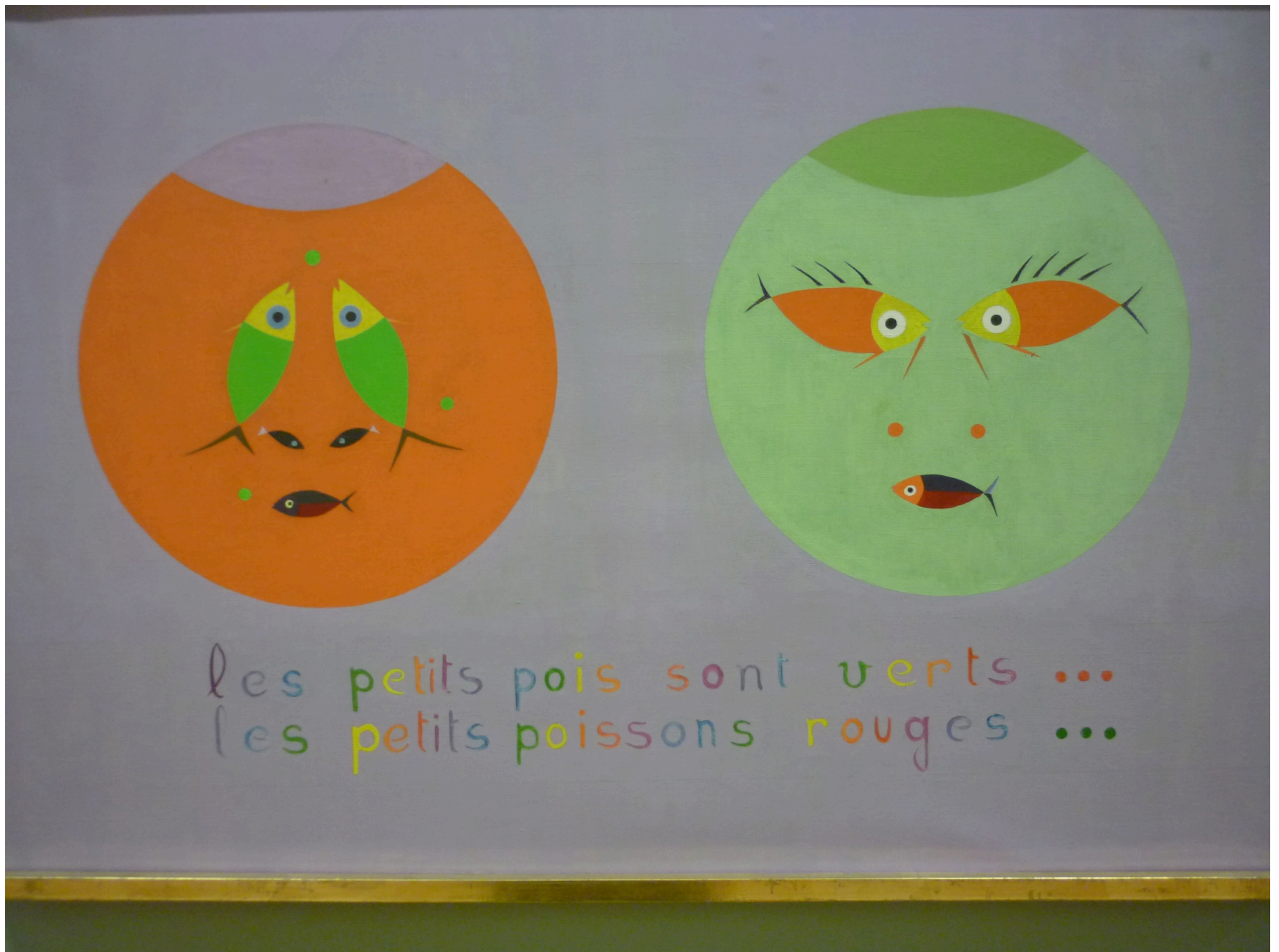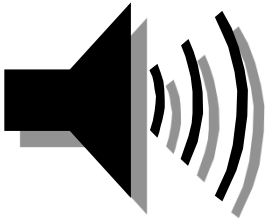### SUPÉRIEURE

Wednesday, 2nd October 2013

11h ~ 11:30h
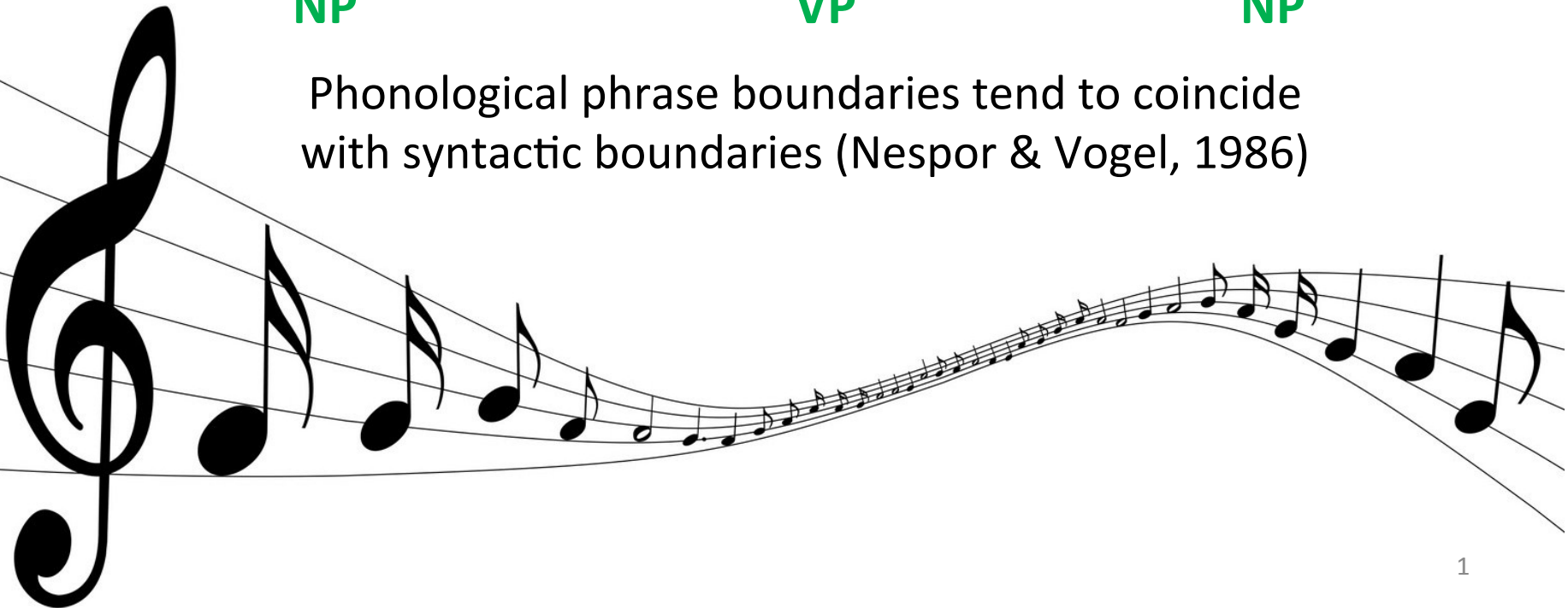
Yves Laloy - Les petits poissons rouges...les petits pois sont verts - 1960

Prosody

[The boy]   [[is eating] [an apple]]
      NP   **VP**   **NP**

Phonological phrase boundaries tend to coincide
with syntactic boundaries (Nespor & Vogel, 1986)

Prosody – Syntax

In adults : exploit phonological phrase boundaries online
to resolve syntactic ambiguities

(Millotte et al., 2007;2008; Snedeker & Yuan, 2008; Kjelgaard & Speer, 1999; Schafer, 1997)

In children: Several studies have found no effect of prosody on children's
interpretation of structurally ambiguous sentences

(Halbert et al., 1995; Snedeker & Trueswell, 2001; Vogel & Raimy, 2002; Choi & Mazuka, 2003).

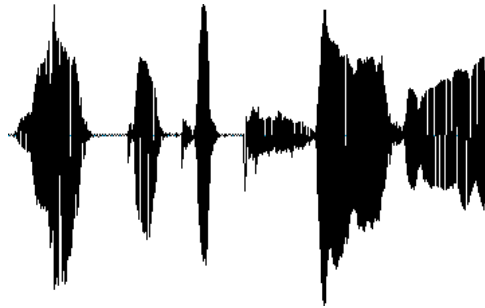only Snedeker & Yuan 2008 found one (weak effect, perseveration)

Our goal:

To test whether children could use prosody online to constrain syntactic analysis.
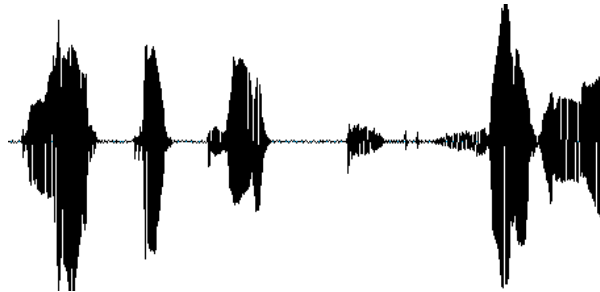
Stimuli

« [ferme] (noun/verb) »

Local ambiguities

Noun

Verb

[La petite$_A$ ferme$_N$] lui plait beaucoup
The small farm pleases him a lot

[La petite$_N$] [ferme$_V$] [le coffre à jouets]
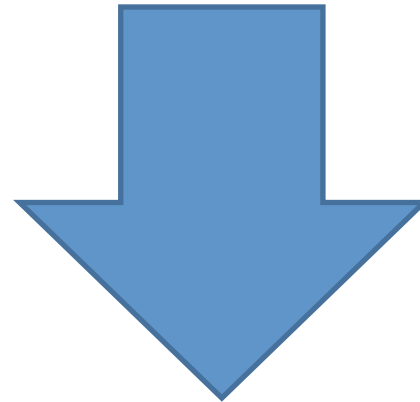*The little girl closes the toy box*

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Two experiments:

Experiment 1:
Oral completion task

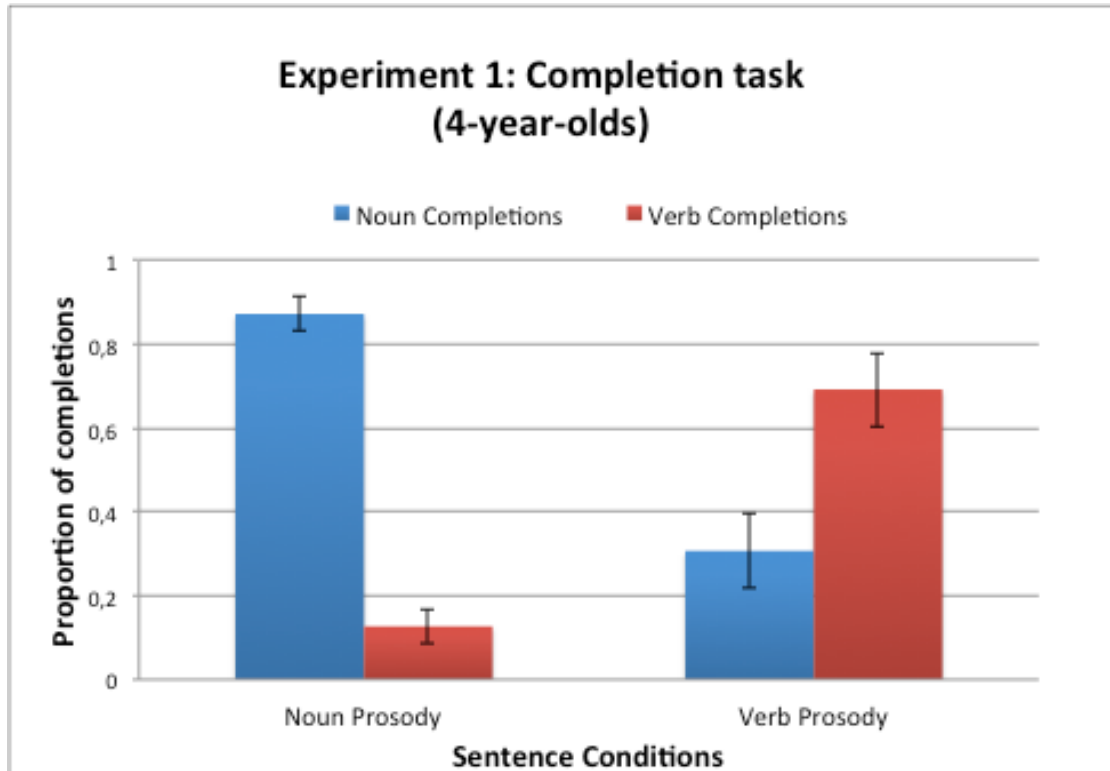[La petite ferme]... vs. [La petite] [ferme] ...

The small farm   *The little girl closes*

?

Results

Experiment 1: Completion task (4-year-olds)

■ Noun Completions ■ Verb Completions

Proportion of completions

Noun Prosody   Verb Prosody

Sentence Conditions

$F_1(1,14)=79.43$; $p < 0.001$*** ; $F_2(1,7) = 32.37$; $p < 0.001$***

Experiment 1:

16 French-speaking children
(4;3 to 5;3, M = 4;9)

8 pairs of words
(Noun/Verb)
[*ferme, porte, marche*, etc. ..]

Each child heard only one sentence from each N/V pair
(half noun, half verb; counterbalanced across participants. Total = 8)

Discussion

4-year-old children use prosodic boundaries to find syntactic boundaries and infer the syntactic category of an ambiguous word
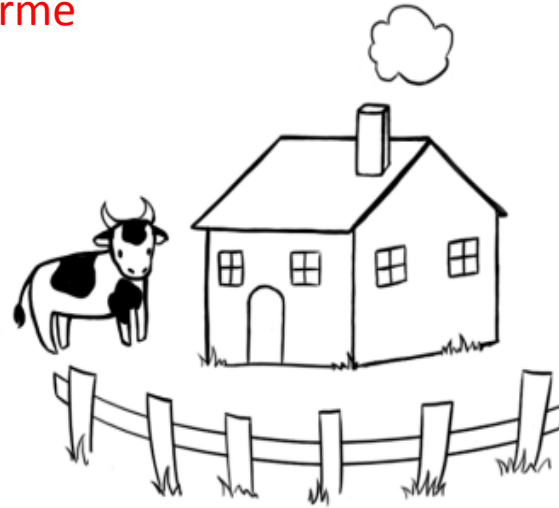
But, does prosody constrain syntactic processing **online**, or is it only used for (re)verification of an utterance?

Experiment 2: Eye-tracker

La petite ferme

Two measures:

Pointing towards the images   The time course of eye-gaze
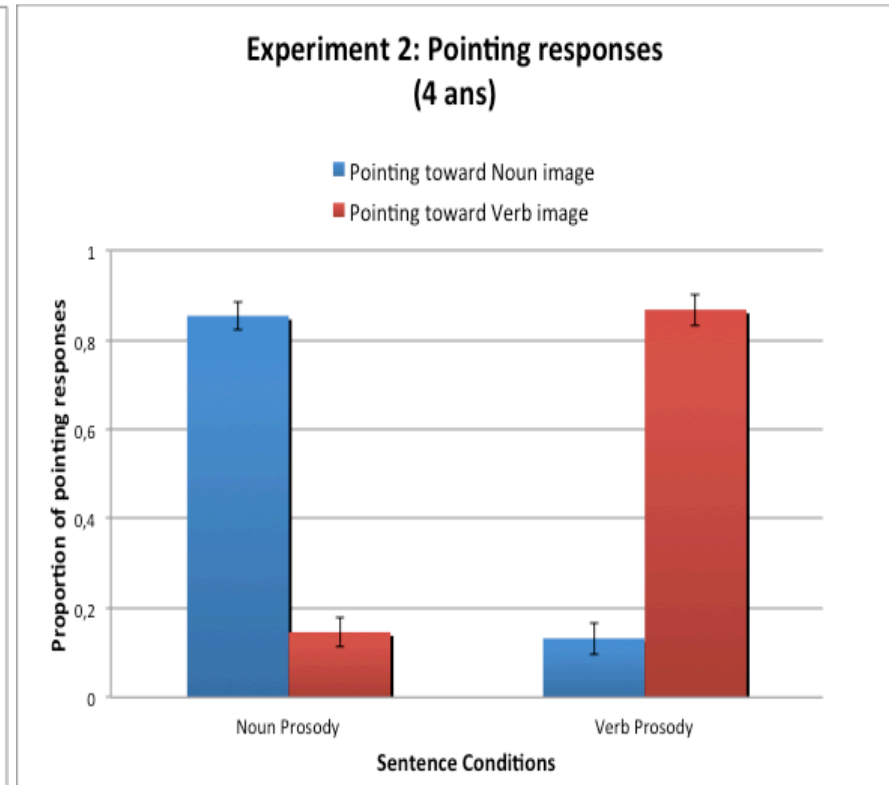
Participants:

    18: 3-year-olds   **18:   4-year-olds**

    (3;4 to 4;3, *M* = 3;7)   (4;3 to 5;10, *M* = 4;8)

Results

- Pointing task:

Experiment 2: Pointing responses (3 year-olds)

Experiment 2: Pointing responses (4 ans)
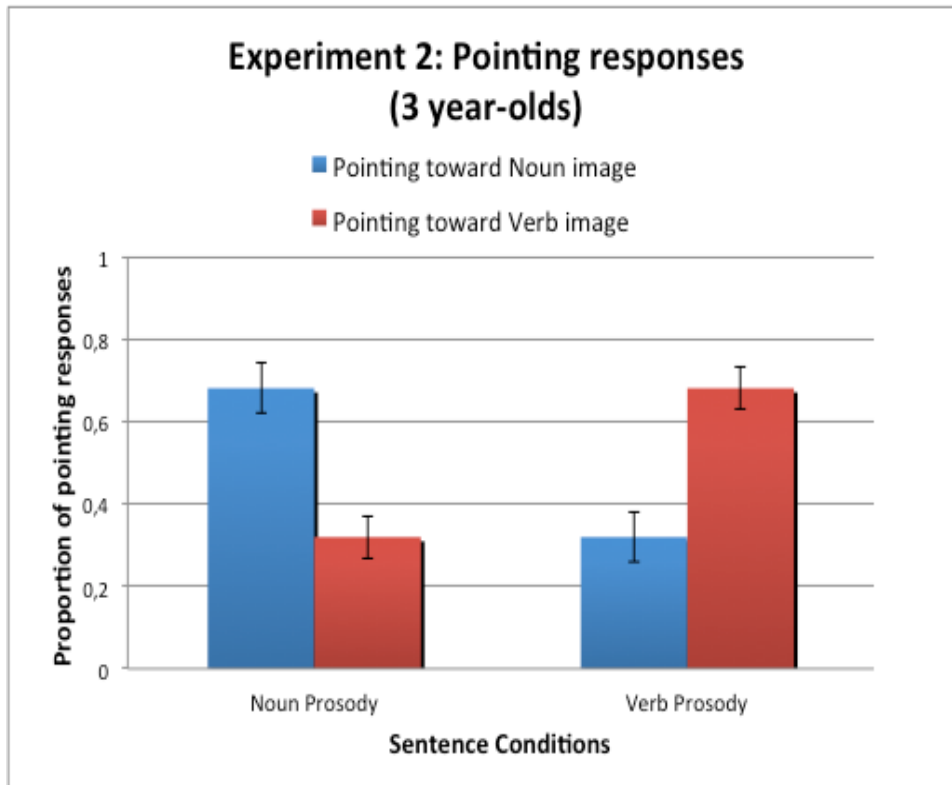
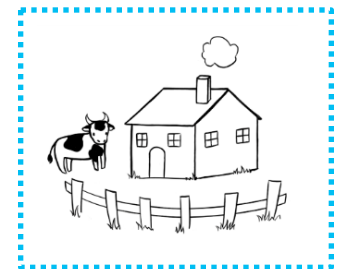$F_1(1,16)=28.64$; $p < 0.001$; $F_2(1,7) = 16.65$; $p < 0.004$ $F_1(1,16)=79.75$; $p < 0.001$; $F_2(1,7) = 14.01$; $p < 0.01$

Results

- Eye-tracker:

Proportion of looks toward the images (Noun x Verb)
during the onset of test sentences

Looks toward the Verb image

Looks toward the Noun image

Legend:
- Verb image - Verb sentence (target)
- Verb image - Noun sentence (distractor)
- Noun image - Noun sentence (target)
- Noun image - Verb sentence (distractor)

La | Petite | Ferme — Noun Prosody
Petite | Ferme — Verb Prosody

Proportion of Looks

Time from the beginning of the sentence (ms)

$F(1,16)=11.98; p <.01$

10
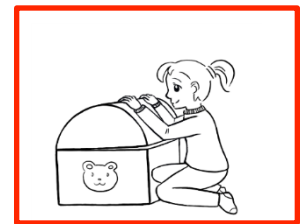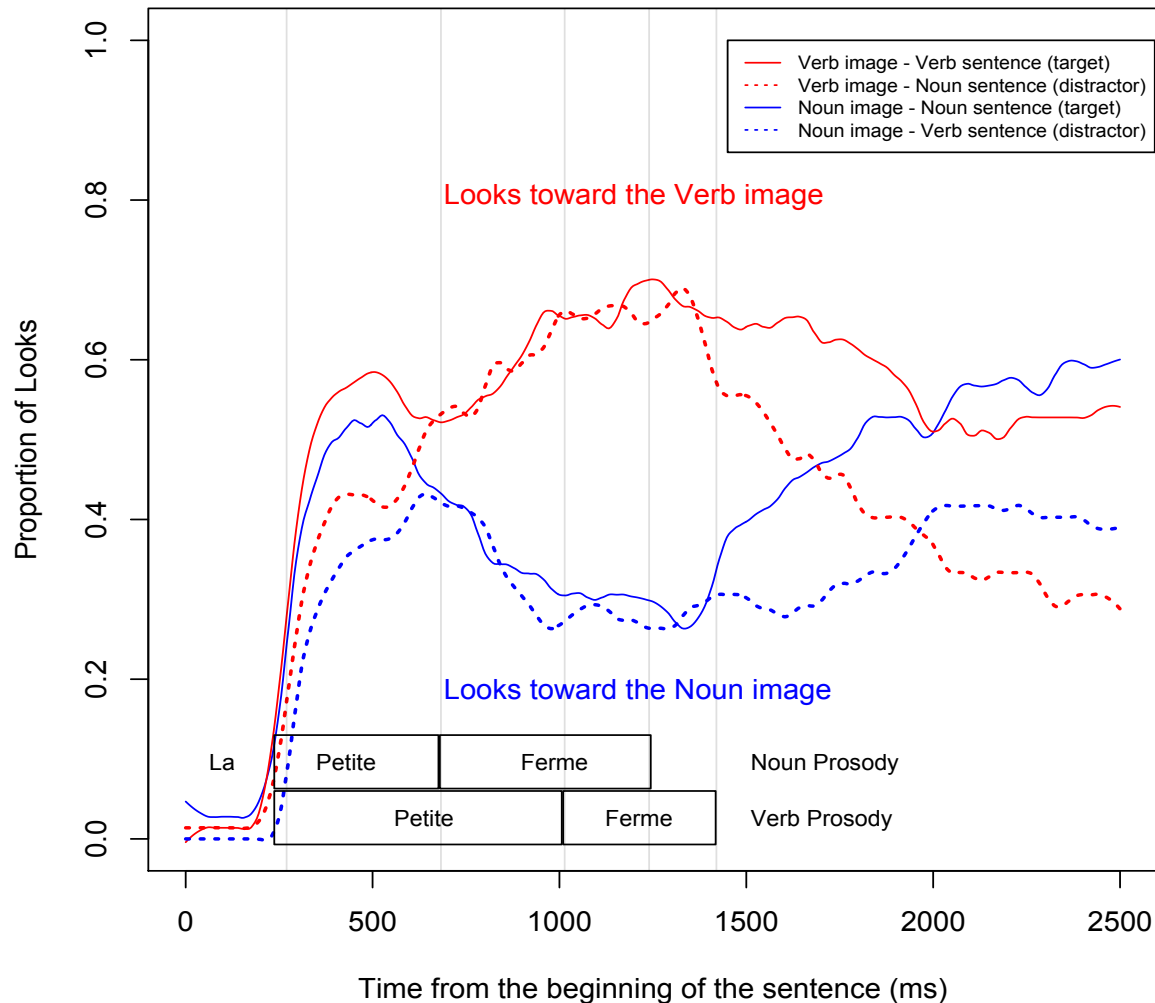
Discussion

Young children, upon hearing the first words of a sentence, exploit prosody on-line to calculate the syntactic category of a word.

Going further…

- Prosodic cues with function words allow children to constrain the syntactic analysis of a sentence and in particular, to calculate the syntactic category of a word.

  (Homophones: fermeN/fermeV)

  This computation of the syntactic category could be done even for unknown words.

- The syntactic category of a word constrains its meaning.

  Nouns vs. Verbs: inferring the syntactic category of a novel word can be extremely helpful during early language processing (Gleitman, 1990)

- Children could exploit prosody, with function words, to categorize unknown words, and use this information to constrain the acquisition of word meanings.

- This mechanism could be active as early as 18 to 24 months.

Thank you for your attention!

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References:

Choi, Y., & Mazuka, R. (2003). Young children's use of prosody in sentence parsing. Journal of Psycholinguistic Research, 32, 197–217.

Christophe, A., Guasti, M. T., Nespor, M., & van Ooyen, B. (2003). Prosodic structure and syntactic acquisition: The case of the head-complement parameter. Developmental Science, 6, 213–222.

Christophe, A., Mehler, J., & Sebastia´n-Galle´s, N. (2001). Perception of prosodic boundary correlates by newborn infants. Infancy, 2, 385–394.

Mehler, J., Jusczyk, P. W., Lambertz, G., Halsted, N., Bertoncini, J., & Amiel-Tison, C. (1988). A precursor of language acquisition in young infants. Cognition, 29, 143–178.

Morgan, J. L. (1996). A rhythmic bias in preverbal speech segmentation. Journal of Memory and Language, 35, 666–688.

Morgan, J. L., & Saffran, J. R. (1995). Emerging integration of sequential and suprasegmental information in preverbal speech segmentation. Child Development, 66, 911–936.

Snedeker, J., & Trueswell, J. (2001). Unheeded cues: Prosody and syntactic ambiguity in mother-child communication, Paper presented at the 26th Boston University Conference on Language Development.

Gerken, L., Jusczyk, P. W., & Mandel, D. R. (1994). When prosody fails to cue syntactic structure: 9-month-olds' sensitivity to phonological versus syntactic phrases. Cognition, 51, 237 – 265.

Gleitman, L. (1990). The structural sources of verb meanings. Language Acquisition, 1, 3 – 55.

Gout, A., Christophe, A. & Morgan, J. (2004). Phonological phrase boundaries constrain lexical access: II. Infant data. *Journal of Memory and Language*, 51, 547-567.

Millotte, S., René, A., Wales, R., & Christophe, A. (2008). Phonological phrase boundaries constrain on-line syntactic analysis. Journal of Experimental Psychology: Learning, Memory, and Cognition, 34, 874-885.

Millotte, S., Wales, R., & Christophe, A. (2007). Phrasal prosody disambiguates syntax. *Language and Cognitive Processes*, 22, 898-909.

Morgan, J. L., & Demuth, K. (1996). Signal to syntax: An overview. In J. L. Morgan & K. Demuth (Eds.), Signal to syntax: Bootstrapping from speech to grammar in early acquisition

Snedeker, J., & Yuan, S. (2008). Effects of prosodical and lexical constraints on parsing in young children (and adults). *Journal of Memory and Language*, 58(2), 574-608.

Spivey, M. J., Tanenhaus, M. K., Eberhard, K. M., & Sedivy, J. C. (2002). Effects of visual context in the resolution of tempory syntatic ambiguities in spoken language comprehension. *Cognitive Psychology*, 45, 447-481.

Trueswell, J. C., Sekerina, I., Hill, N. M., & Logrip, M. L. (1999). The kindergarten-path effect: studying on-line sentence processing in young children. *Cognition*, 73, 89-134.

Peperkamp, S. Christophe, A., & Dupoux, E. (2010) Bootstrapping language acquisition: an integrative approach. ANR research proposal, 17-25.