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Studying French mapping of syntax to prosody in natural speech



Fabián Santiago, Camille Dutrey & Martine Adda-Decker

{fabian.santiago-vargas, madda}@univ-paris3.fr, {madda, camille.dutrey}@limsi.fr

Background

- Standard definition of the **French Accentual Phrase**: any lexical word and all dependent words at its left side [3, 5, 7].
- In general, a **rising pitch movement (H*)** marks its right edge [3, 5, 7].
- Factors contributing to the AP's formation [6, 8, 2]:
 - # of syllables (3/4 on average)
 - Articulation rate
 - Rhythm (balance of APs in terms of # of syllables)

Goals

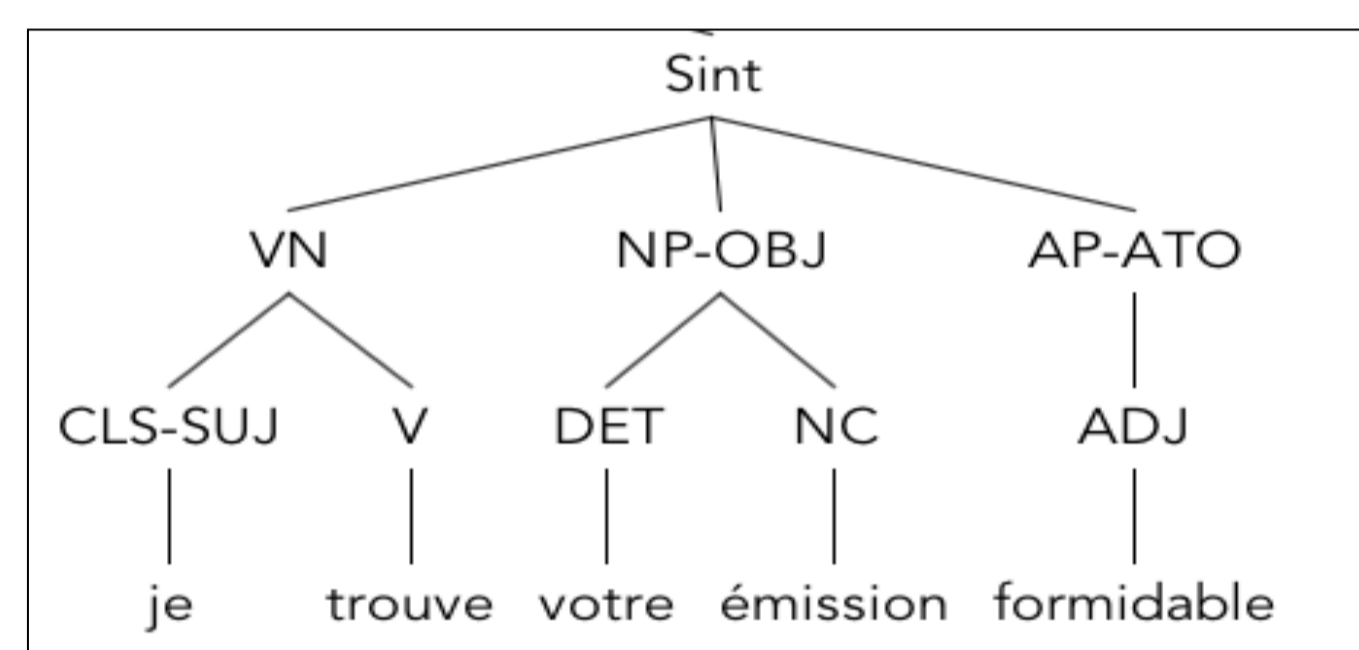
- Studying the syntax to prosody mapping to analyze the formation of APs in French by using large corpora & semi-automatic analysis
- Analyzing whether syntactic information is a good predictor of the AP's formation
- Analyzing the contribution of:
 - Constituent length (# of syllables / phrase)
 - Constituent type
 - Temporal cues

Corpus

- Subset of French ETAPE corpus [4]
 - ✓ 25 speakers
 - ✓ 1.5 hours
 - ✓ 16,377 words

Grammatical Annotations

- French Spoken Treebank [1]
 - ✓ 25 POS labels
 - ✓ 12 Constituent labels
 - ✓ Several Function labels



Grammatical labels of the clause 'I found your podcast great'

Methods

Linguistic Information Extraction

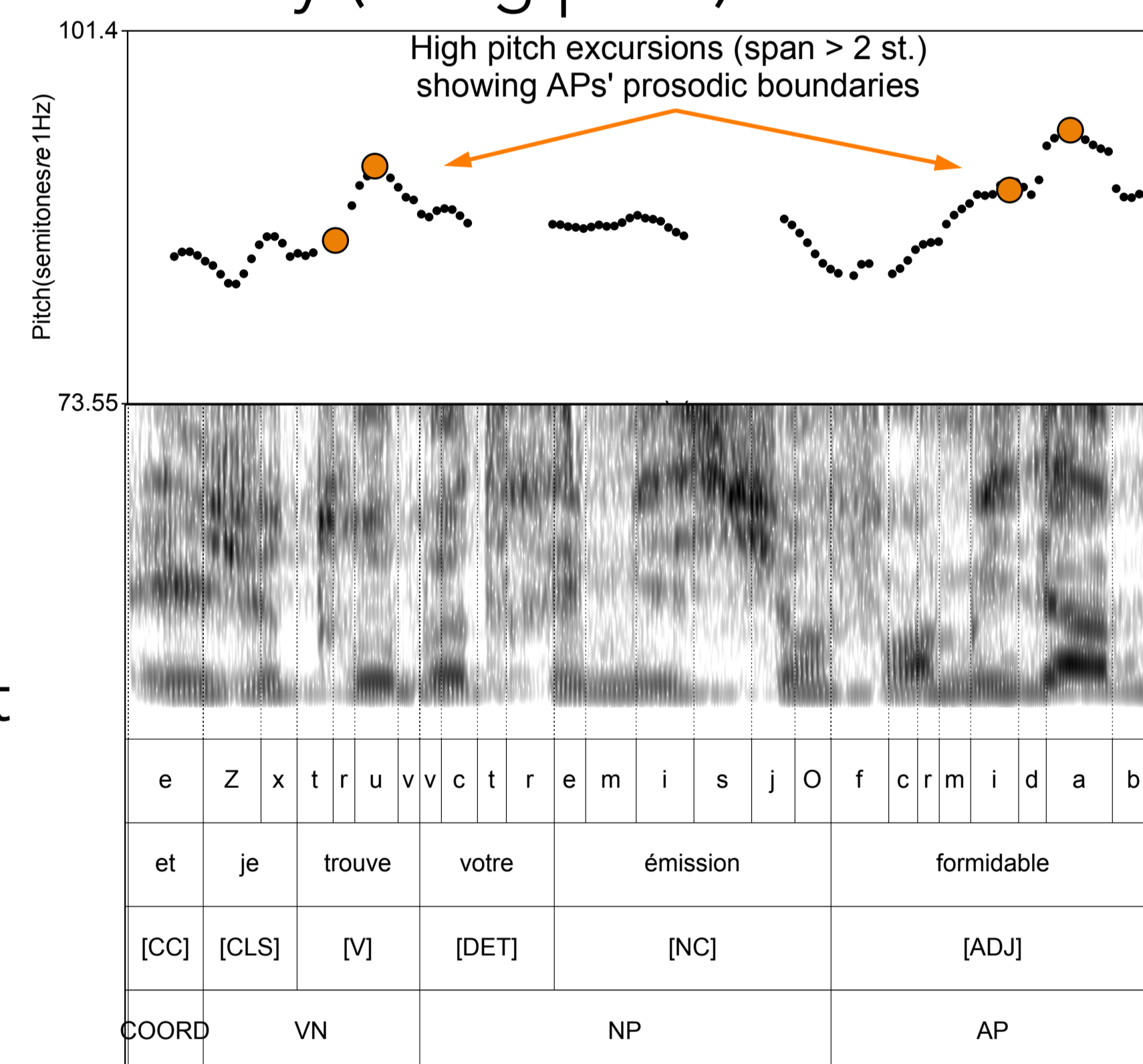
- Focus on the most frequent constituents observed in the corpus:
 - ✓ Noun Phrases (NP)
 - ✓ Verbal Nuclei (VN)
 - ✓ Adjectival Phrases (AdjP)
- Automatic alignment to the signal as Praats' TextGrids

Prosodic Analysis

- Rising pitch: an AP was marked if its rightmost syllable carries a rising movement > 2 st
- Normalization of constituent durations: duration of constituent / number of phones

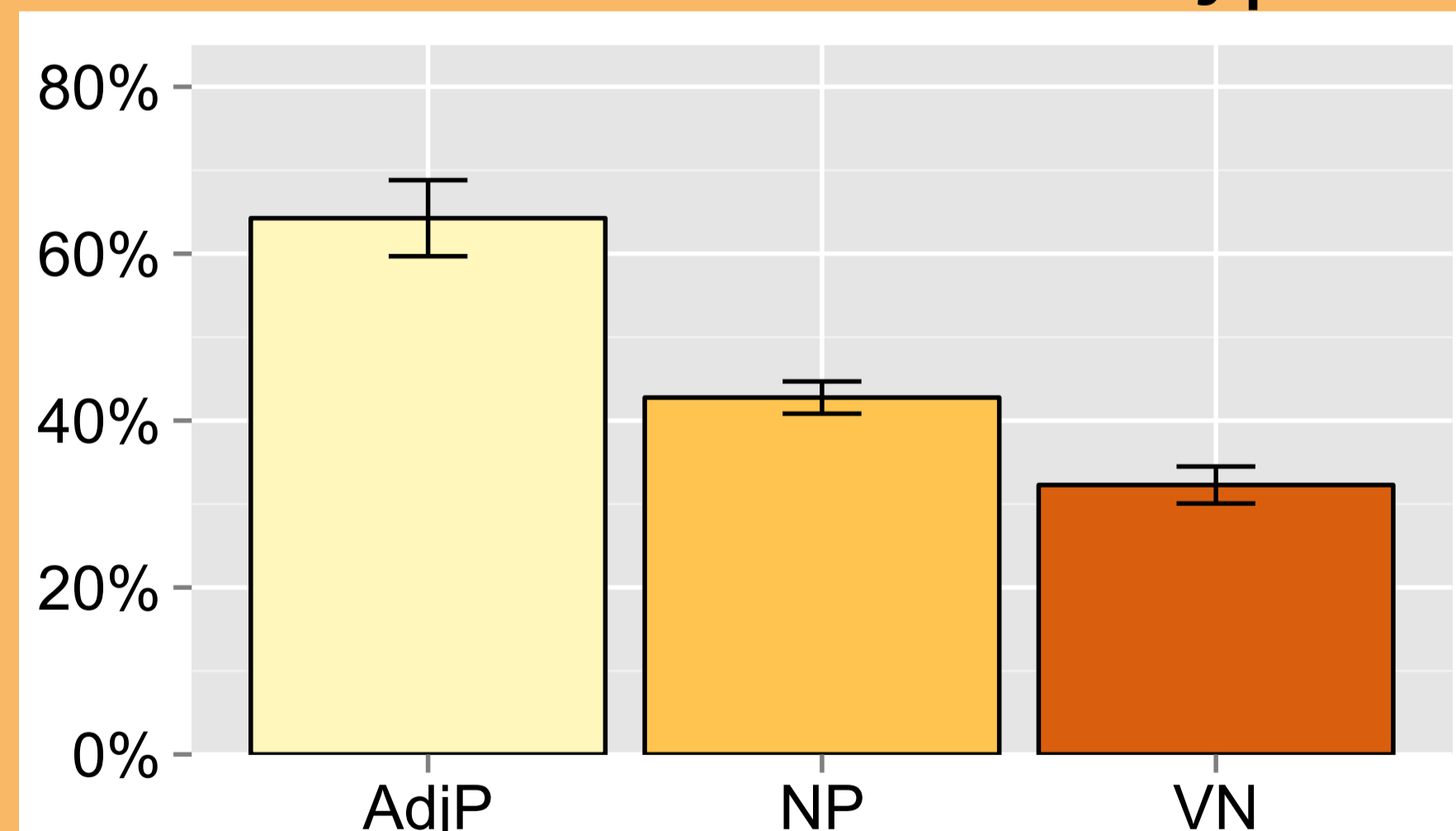
Mapping

- Predictions: Any lexical word and its function word(s) at the left side (in non-final positions) calls for a final prosodic boundary (rising pitch)



Results, Analysis and Discussion

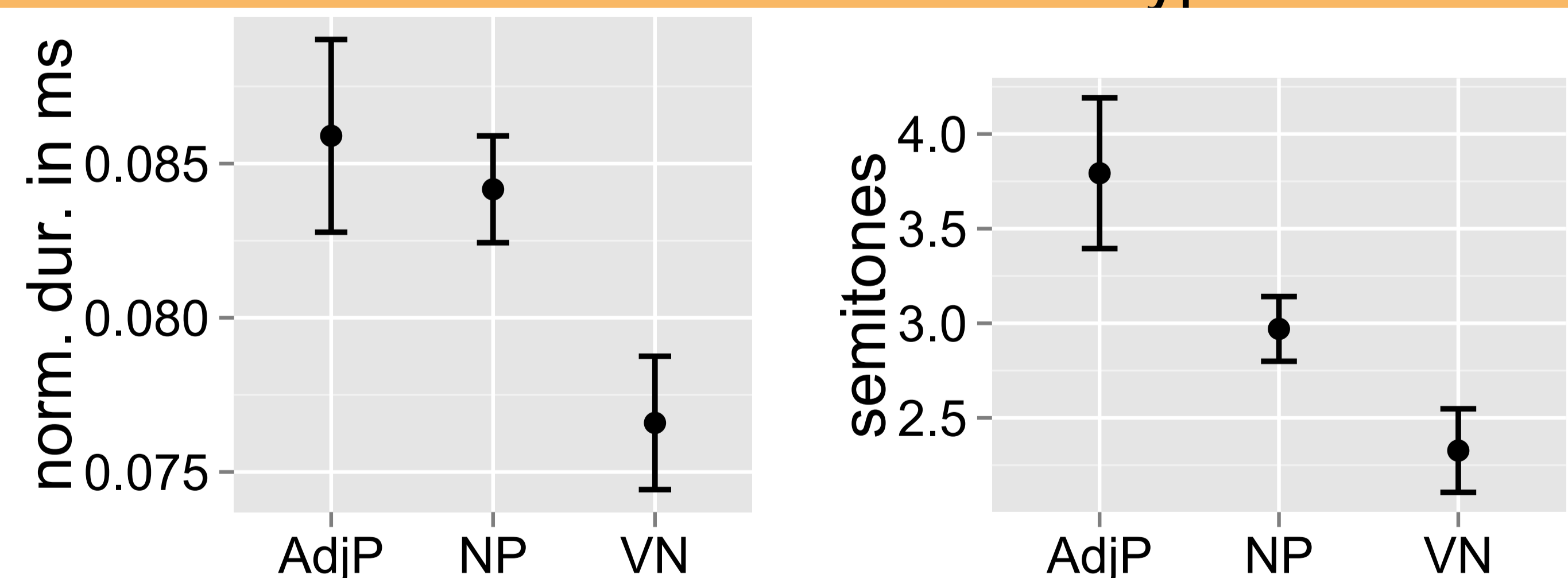
Successful predictions across the 3 constituent types



General observations

- Identification of 4,415 potential APs:
 - ✓ 2,528 Noun Phrases
 - ✓ 1,713 Verbal Nuclei
 - ✓ 428 Adjectival Phrases
- 43% success rate: relatively weak match of syntactic and prosodic information
- The syntactic-prosodic mapping predictions are less accurate with VN

Durations & f0 delta values across the 3 constituent types



Possible Explanations

- 40% -> monosyllabic constituents -> too small for an AP
- Prosodic patterns in VN constituents:
 - ✓ Rising pitch movements are less frequent than in the rest of the categories
 - ✓ Durations are shorter

Conclusion

- ✓ Best match for AdjP: Adj. tend to follow NP
- ✓ Worst match for VN: (i) Tend to precede NP & (ii) short durations
- ✓ Future: consider phrase merging (NP+AP, VP+AP...) & length conditions

References

[1] Abeillé A. & Crabbé B. (2013), Vers un treebank du français parlé. In *Proceedings of TALN*, 2013, pp. 174–187. [2] Delais-Roussarie, E. (2000), Vers une nouvelle approche de la structure prosodique, *Langue Française* 126, 92-112. [3] Di Cristo A. (1998), Intonation in French, in Hirst D. & Di Cristo A. (eds), *Intonation Systems: A survey of twenty Languages*. Cambridge: Cambridge University Press, pp. 195–218. [4] Gravier G., Adda G., Paulsson, N. Carré, M., Giraudel A. & Galibert O. (2012), The ETAPE corpus for the evaluation of speech-based TV content processing in the french language, in *Proceedings of LREC*, 2012, pp. 114–118. [5] Jun, S.-A. & Fougeron C. (2002), The Realizations of the Accentual Phrase in French Intonation, *Probus* 14, pp. 147–172. [6] Martin, P. (1987). Prosodic and rhythmic structure in French. *Linguistics* 5(5), pp. 925-949. [7] Post B. (2000), *Tonal and phrasal structures in French intonation*. The Hague: Holland Academic Graphics. [8] Post B. (2011), The multi-faceted relation between phrasing and intonation in French. In Gabriel C. & Li. Conxita (eds), *Intonational Phrasing at Interfaces: Cross-Linguistic and Bilingual Studies in Romance and Germanic*, Amsterdam: John Benjamins, 2011, pp. 43–74.