

Phonetic variation in French conversational speech

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What is phonetic variation?

- Naturally-occurring language is inevitably variable
 - E.g.
 - The same word or sound may be pronounced differently by different speakers, or even the same speaker
 - The same meaning may be encoded in different sentence forms

Why studying phonetic variation?

- Variation in language production used to be considered as noise in the signal
 - Needs to be filtered for better signal recognition
- However, the value of phonetic variation has been recognized in the research on
 - Sociolinguistics: group and individual indexing
 - Language production

Phonetic correlates of variation

- Studies of phonetic variation often examine
 - Duration
 - Short vs. long
 - Vowel production
 - Centralized vs. peripheral
 - Segment deletion
 - Deleted vs. non-deleted

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- Duration

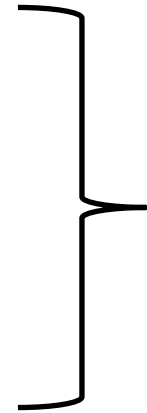
- Short vs. long

- Vowel production

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Reduction

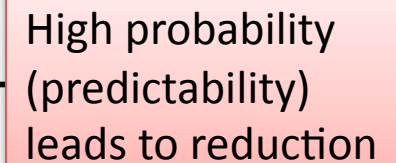
Vs.

Hyperarticulation

Findings of phonetic variation

- Main variation patterns

Factor	Finding
Word category	Function words are more reduced than content words
Word frequency	High-frequency words are more reduced
Syntactic/contextual/phonotactic likelihood	High-probability (predictability) items are more reduced
Repetition	Repeated words are reduced
Prosody	Utterance-final words are hyperarticulated; Stressed words are hyperarticulated.
Interlocutor and environment	Hyperarticulation when facing non-native or indept addressees or in noisy environment



High probability (predictability) leads to reduction

Explaining variation

Listener-oriented

- Response to different models of listener's needs
- Result of ease or difficulty of comprehension (modeled by the speaker)
- Examples
 - Foreigner- and child-directed speech
 - Speech under noise
 - Shortening and reduction in
 - High-frequency or high-predictability forms
 - Repeated items

Talker-oriented

- Result of ease or difficulty of production
- Examples
 - Shortening and reduction in
 - High-frequency or high-predictability forms
 - Repeated items

Many properties have the same predictions for comprehension and production...

Questions (I)

- How to tease apart listener-oriented and speaker-oriented forces in shaping phonetic variation?
 - Examine properties that generate **different** predictions for comprehension and production
 - E.g. phonological neighborhood density (PND)

We will come back to PND later.

Questions (II)

- In the talker-oriented account, why should high probability/predictability lead to reduction?
 - “articulatory routinization” (Bybee, 2001)
 - But homophones (e.g. *time* and *thyme*) are reduced to different degrees (Gahl 2008)
 - “synchronous planning and articulation” (Bell *et al.*, 2011)
 - High-probability words are **easier to retrieve**, and therefore executed faster in order to keep the synchrony
 - But why is synchrony important? Is synchrony only about duration? What about vowel quality? How does synchrony interact with other aspects of the language?

A more general problem

- Current literature on phonetic variation is mostly based on the study of English
- Phonetic variation patterns may be language-specific
 - Due to the interaction of language structure and language processing/production

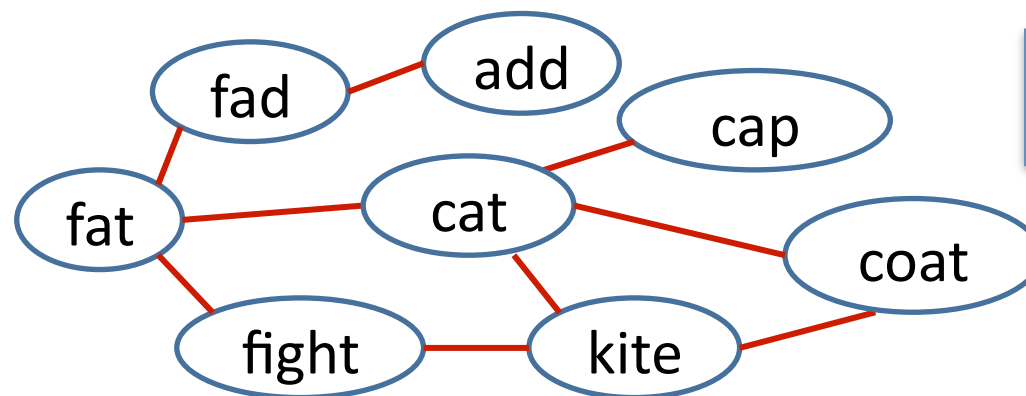
Cross-linguistic evidence is vital for establishing a general account of phonetic variation.

What we are trying to do

- Exploring phonetic variation in French
 - Compare with English results
- Why French?
 - Similar to English in many aspects
 - But also different in morphological structure, speech rhythm, prosody, etc.

A preliminary study

- The phonological neighborhood density (PND) project
 - PND is a lexical property which refers to the number of phonological neighbors of each word
 - One-phoneme difference rule (Luce & Pisoni 1998, etc)



Additional factors:
neighbor freq.

Effects of neighborhood density

- Phonological neighbors
 - Both compete with and bring more activation to the target word
 - Either **impede** or **facilitate** the processing of the target word
- Therefore
 - High PND → **hard** to perceive but **easy** to produce
 - How does PND affect phonetic variation?

perception

production

Predictions

- Talker-oriented Results based on English found support for shortening and reduction in high-PND words.
 - High-density words are easy to produce → shortening and reduction
- Listener-oriented
 - High-density words are hard to perceive → lengthening and vowel dispersion

Current study

- Conversational French corpus
- Aspects of production
 - Word duration
- Preview of results
 - High-PND words have **longer durations** than low-PND words
 - → opposite of the English results

Corpus

- The CID corpus
 - 16 speakers, one-to-one conversations
 - 8 hours
- Target words
 - Monosyllabic
 - Monomorphemic
 - Content words
- Dataset
 - 5412 tokens of target words

Modeling

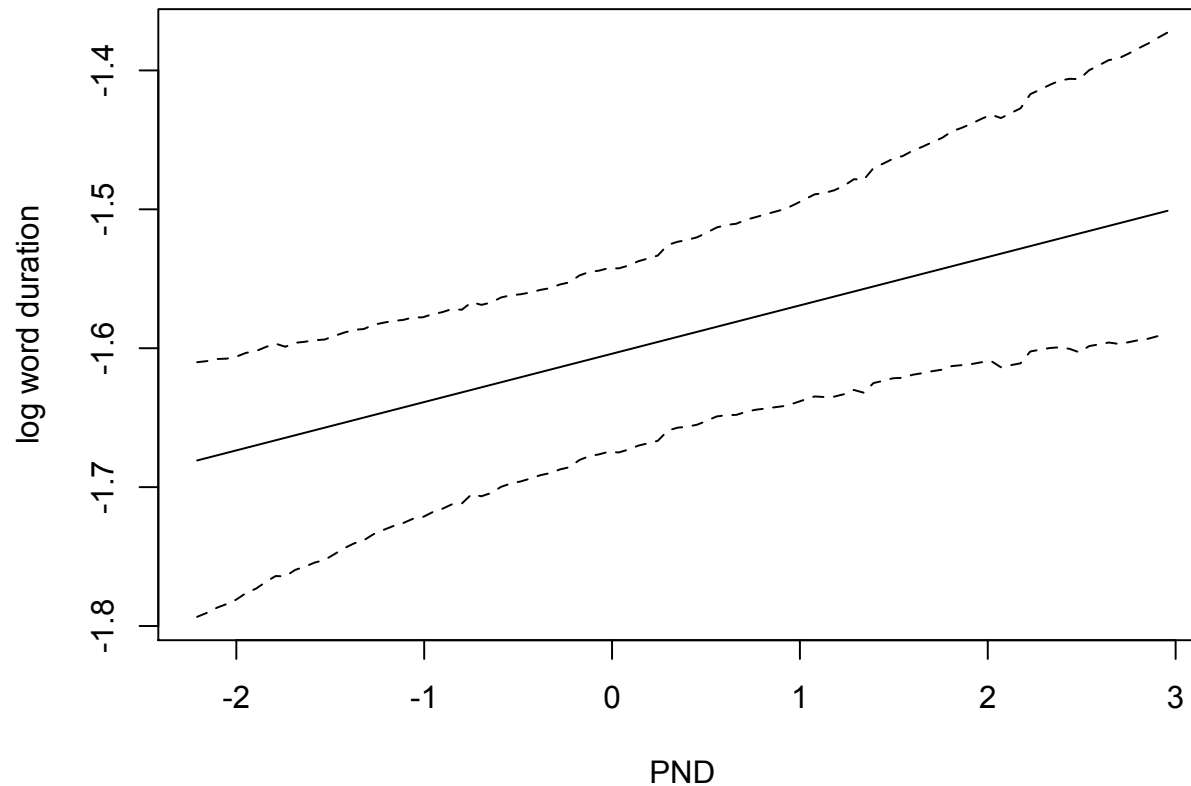
- Mixed-effects regression models
 - Outcome variable: (log) word duration
 - Random effects: word and speaker
 - Fixed effects
 - PND
 - Neighbor frequency
 - Other control factors (frequency, predictability, word length, speech rate, speaker sex, etc.)

Results

- Significant positive effect of PND

$$-\beta = 0.034, t = 2.12, p_{MCMC} = .03$$

Neighbor frequency is not significant.



Revisiting predictions

- Talker-oriented Results based on English found support for shortening and reduction in high-PND words.
 - High-density words are easy to produce → shortening and reduction
- Listener-oriented Results based on French found support for longer duration in high-PND words.
 - High-density words are hard to perceive → lengthening and vowel dispersion

Discussion

- How to explain the differences between English and French?
 - French speakers are more accommodating?
 - Maybe the predictions do **NOT** hold for French?

Revisiting predictions for French

- Talker-oriented

? High-density words are easy to produce →
shortening and reduction

- Listener-oriented

Results based on French found support for
longer duration in high-PND words.

✓ – High-density words are hard to perceive →
lengthening and vowel dispersion

Dufour &
Frauenfelder
(2010)

Discussion

- How to explain the differences between English and French?
 - French speakers are more accommodating?
 - Maybe the predictions do **NOT** hold for French?
 - Maybe high-PND → difficulty of production?
 - Pattern found in Spanish. Morphological structure?
 - Maybe easy to produce → longer duration?
 - Planning-articulation synchrony not as important in French?

Future work

- Examine effects of PND on
 - French lexical retrieval and vowel production
- Systematic examination of the effects of probability (predictability) in French
- Phonetic variation phenomena in other languages
 - Propose a general theory of phonetic variation - its underlying mechanisms and language specificity

End

- This project is supported by the Brain & Language Research Institute (BLRI) in Aix-en-Provence, France.
- We thank the audience at the BLRI and LPL research meetings for comments and suggestions.

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High probability
(predictability)
leads to reduction