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Investigating inter-speaker convergence through phonetic microvariation in paired data

GULP Lablunch

3rd October 2019

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Université de Poitiers

"Des savoirs & des talents"

FoReLLIS EA 3816

TALK OUTLINE

- The project
- The quest for a convergence measuring method
- First attempt at GAMMs
- What's next?

I – The project

PhD project: context, theoretical background and method

I – PROJECT : CONTEXT & BACKGROUND

PhD project (2017-2020):

- ***De la convergence interlocuteur au changement phonétique :*** *accommodation linguistique et changement phonétique de l'anglais parlé à Glasgow*

- Jointly supervised by Sylvie Hanote (Poitiers) and Jane Stuart-Smith (Glasgow)

- Funded by the French Ministry for Higher Education, Research and Innovation

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ET DE L'INNOVATION

Université de Poitiers

- How do we look at sound change in progress?

- We traditionally use aggregates for each speaker, and compare speakers according to their age/gender/etc.

- How do we look at sound change in progress?
- We traditionally use aggregates for each speaker, and compare speakers according to their age/gender/etc.
- **True story**: each speaker's phonetic production is actually quite variable (Cukor-Avila & Bailey 2013).
- Can this constant microvariation relate to sound change?

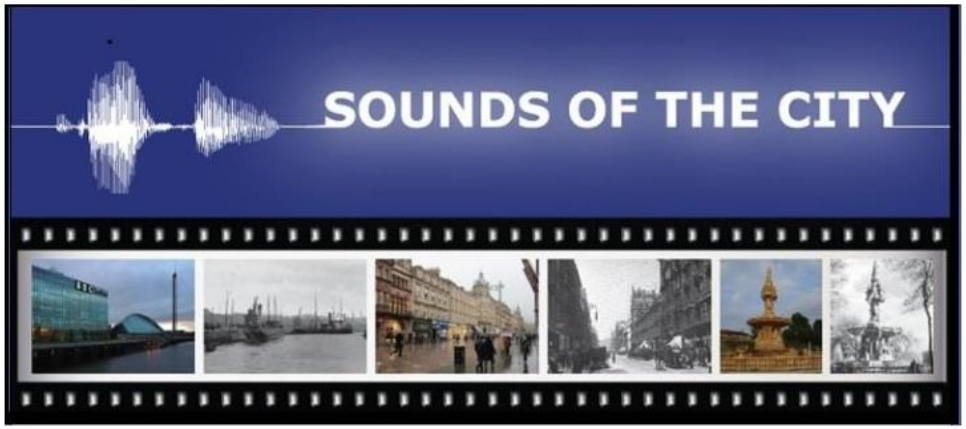
- Short-term inter-speaker accommodation (Giles & Smith 1979) is thought to be the starting point of long-term community-level sound change (Trudgill 1986).

- We know about short-term (Pardo 2013) and medium-term (Sonderegger 2012) speech accommodation.

Main research questions:

- Which **patterns of speech accommodation** can be identified/distinguished in spontaneous speech?
- How does accommodation within speakers in the **short term** relate to sound change in the **long term**?
- How is phonetic convergence constrained by **linguistic**, **social** and **situational** factors?

I – PROJECT : METHOD



Fine phonetic variation and sound change: A real-time study of Glaswegian

http://soundsofthecity.arts.gla.ac.uk/

Oct 2011-Sept 2014

The Leverhulme Trust

Decade of Recording	Old 67-90 (Decade of Birth)	Middle-aged 40-55 (Decade of Birth)	Young 10-17 (Decade of Birth)
1970s	4 f, 6 m (1890s)	7 f, 7 m (1920s)	4 f, 8 m (1960s)
1980s	6 f, 6 m (1900s)	4 f, 12 m (1930s)	2 f, 5 m (1970s)
1990s	6 f, 6 m (1910s)	6 f, 6 m (1940s)	6 f, 6 m (1980s)
2000s	6 f, 6 m (1920s)	6 f, 5 m (1950s)	6 f, 6 m (1990s)

Table 1: Real- and apparent-time structure of the main Glasgow corpus; an additional 6 speakers born in the 1890s and recorded in 1916/17 are also available. Recordings are predominantly of unprepared spontaneous speech from sociolinguistic surveys, oral histories and broadcast media.

Three variables of interest:

Variable	Type of variable	Consciousness
Vowel quality (F1 & F2)	Segmental	Above
Vowel length (SVLR)	Segmental	Below
Speech rate	Suprasegmental	Above

- F1, F2 and vowel length extracted with LaBB-CAT/ISCAN for all lexically stressed tokens

Three variables of interest:

- Variation monitored for each speaker within conversation to measure short-term accommodation
- 'Traditional' lmer modelling used across the whole corpus to account for broader real and apparent time variation
- Trajectories, rate and speed of variation within minutes will be compared to change over time

Three variables of interest:

- Variation monitored for each speaker within conversation to measure short-term accommodation … ***But how?***

II – How did people look at convergence?

So much methodz

- **Euclidian distances** (Babel 2009, Ruch 2015)

II – ON HOW TO MEASURE CONVERGENCE

- Euclidian distances (Babel 2009, Ruch 2015)

- **Discriminant analysis** (Delvaux & Soquet 2007)

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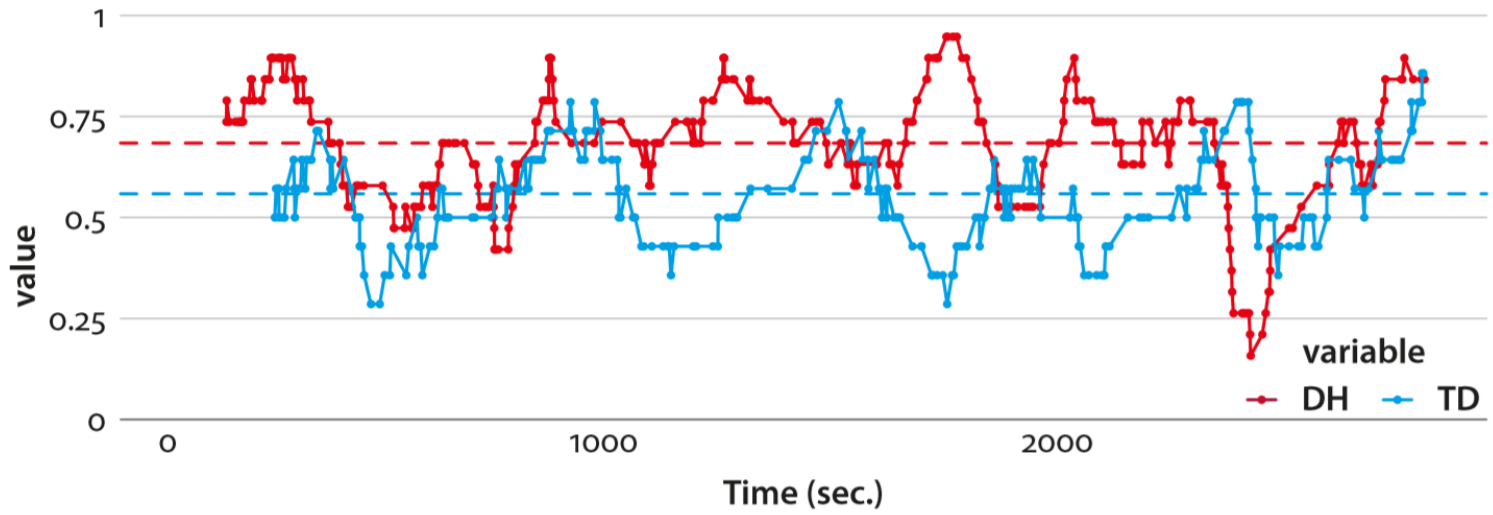
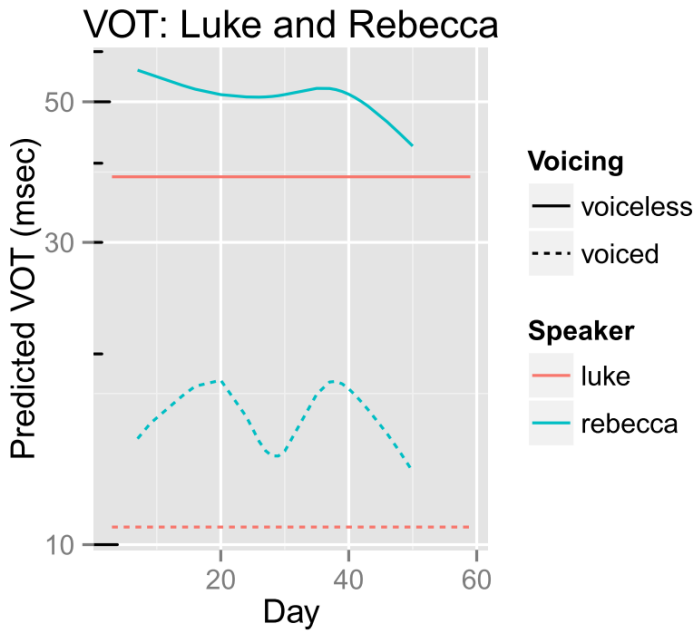
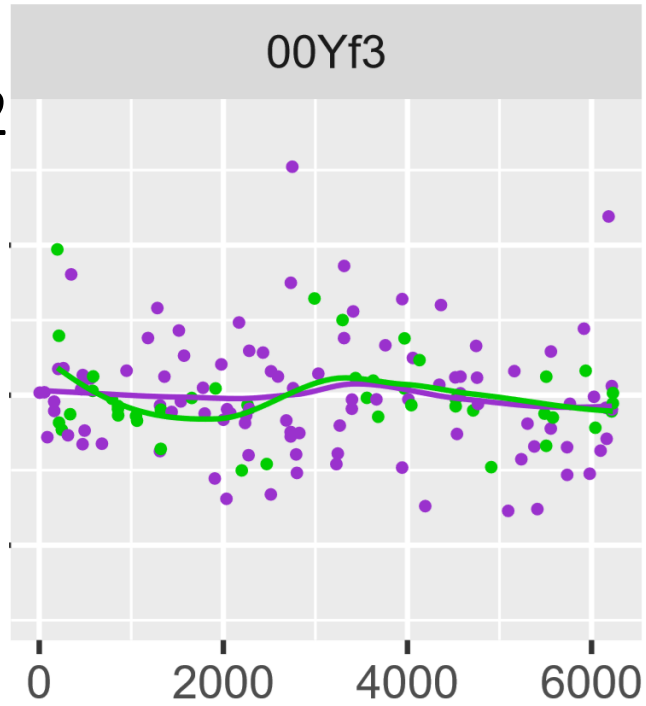
- Discriminant analysis (Delvaux & Soquet 2007)
- **Moving averages** (Tamminga *et al.* 2016)



- Euclidian distances (Babel 2009, Ruch 2015)
- Discriminant analysis (Delvaux & Soquet 2007)
- Moving averages (Tamminga *et al.*
- **GAMMs** (Sonderegger *et al.* 2017, Solanki 2017)



- Euclidian distances (Babel 2009, Ruch 2015)
- Discriminant analysis (Delvaux & Soquet 2007)
- Moving averages (Tamminga *et al*. 2016)
- GAMMs (Sonderegger *et al.* 2 Solanki 2017)
- **Residuals linear plotting** (Alexander 2018, Chevalier 2018)



- Back to GAMMs!
- Allows a dynamic perspective into time as a factor (unlike ED and DA)
- Allows controlling for factors in the modelling (unlike ED, DA and MA)
- Allows to measure the difference between smooths (unlike everything else?)

III – Applying GAMMs

And getting colourful plots

- Corpus used: all peer-to-peer conversations in the corpus, i.e. 19 pairs or 38 speakers

	90	00
M	4 F + 4 M	6 F + 4 M
Y	4 F + 4 M	6 F + 6 M

- Speech rate deviation, vowel duration for all monophthongs, vowel quality for *FLEECE*, *BOOT*, *COT*

- Basic model run using the ***mgcv*** package in R (v3.6.1):

  bam(dependent variable ~ fixed or random effects

  + s(time, by = speaker)

- Plotting using ***itsadug***

- Basic model run using the ***mgcv*** package in R (v3.6.1):

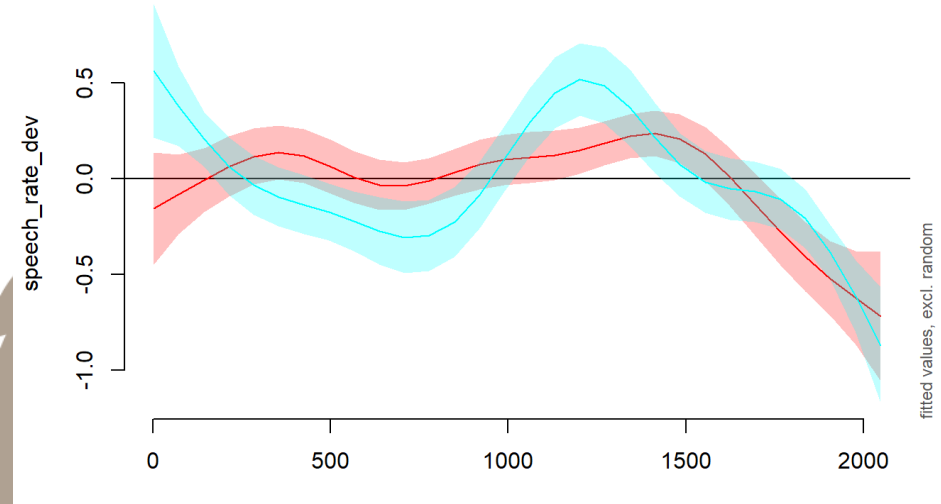
  bam(dependent variable ~ fixed or random effects

  + s(time, by = speaker)

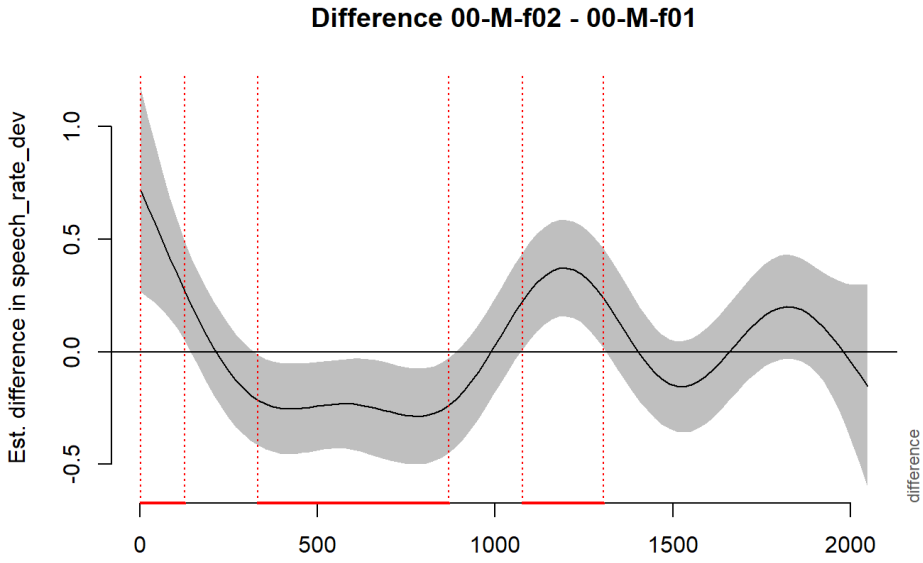
- Plotting using ***itsadug***

example for speech rate deviation, pair 00Mf1

plot_smooth



plot_diff



1) Speech rate (deviation in syll/sec)

- *bam(speech_rate_dev ~*
  s(phone_begin, by = speaker_name), data = pair)

- A ***lot*** of wigglyness within speakers

- **All** pairs have periods of significant difference between speakers

2) Vowel duration (in ms, log)

- *bam(phone_logdurms ~ phone_label + follseg + nsyl + speech_rate_dev + logfreq + s(phone_begin, by = speaker_name), data = pair)*

- There is variation within speakers but not as spiky as in speech rate

- **Most** pairs have periods of significant difference between speakers (13 pairs out of 19)

3) F1 and F2 (one model per formant per vowel per pair; formant values have been Lobanov-normalized)

- *bam(F2.normr ~ Preceding.POA + Following.POA + Target.duration.ms +*
  s(phone_begin, by = speaker_name), data = pairvowel)

- There is some variation within speakers but very smooth

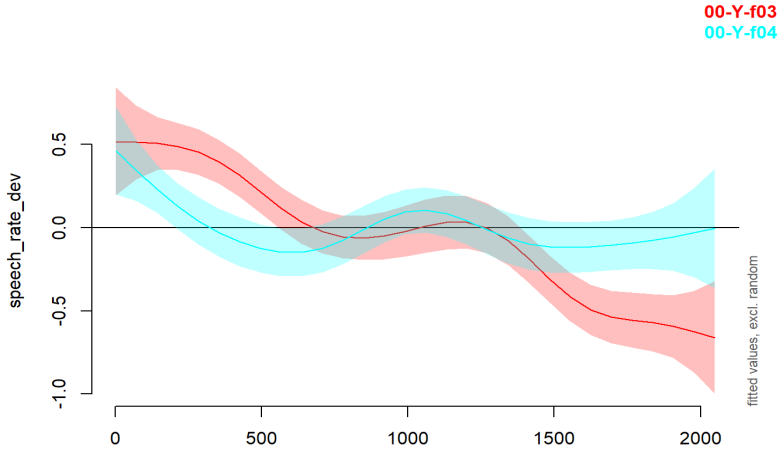
- Models were only run for 3 pairs (=18 models!): no consistence in significant difference periods in formant values within pairs

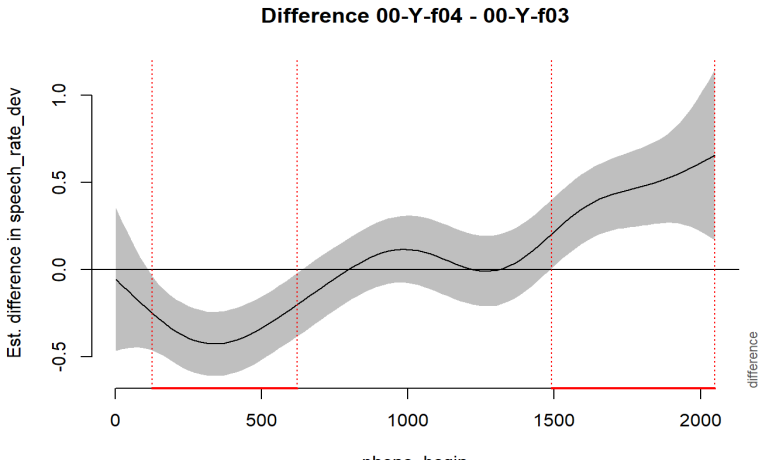
Focus on three pairs:

- **00Yf3**: overlapping periods of significant difference between speakers in speech rate and vowel duration
- **90Ym1**: non-matching periods of significant difference between speakers in speech rate and vowel duration
- **00Mf2**: no difference between speakers in vowel duration but periods of significant difference in speech rate

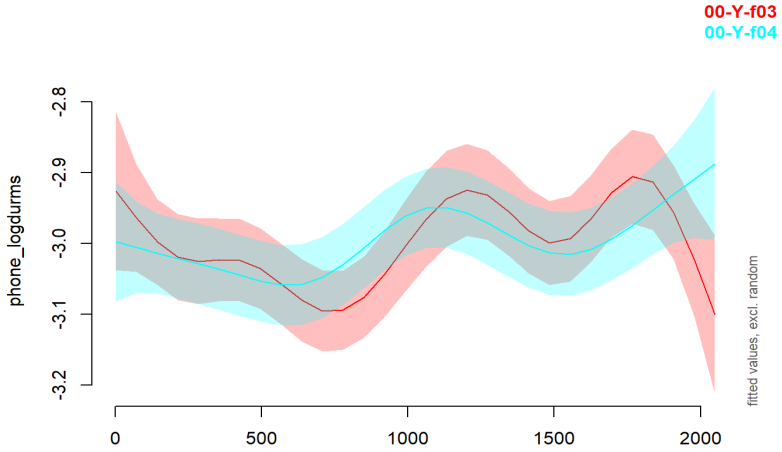
➢ Interaction 00Yf3 (overlapping divergence periods)

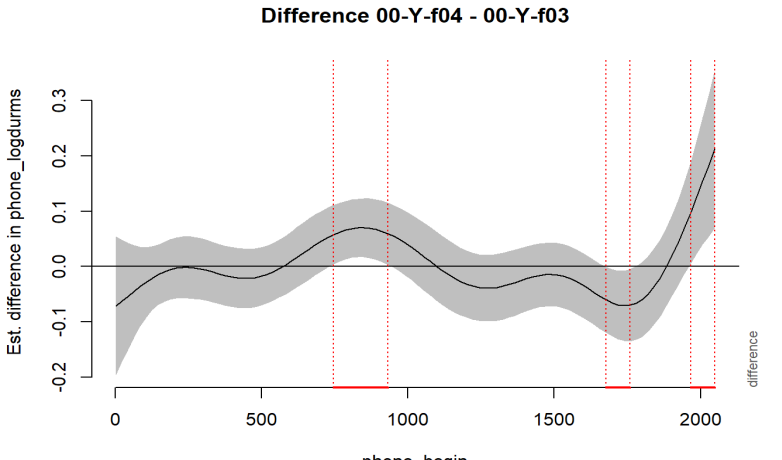
Speech rate variation





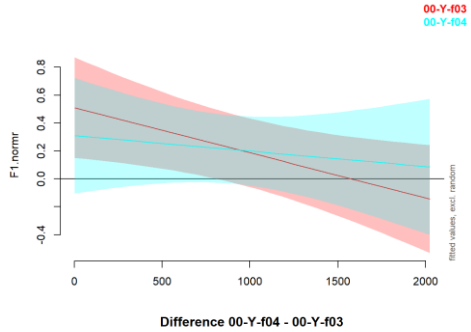
Vowel length variation

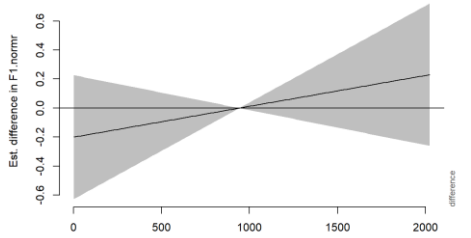


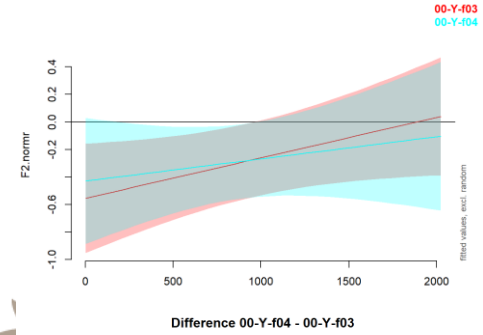


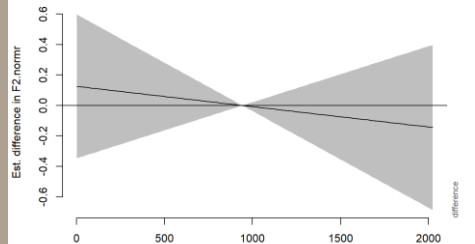
III – APPLYING GAMMS

FLEECE (F1 and F2)

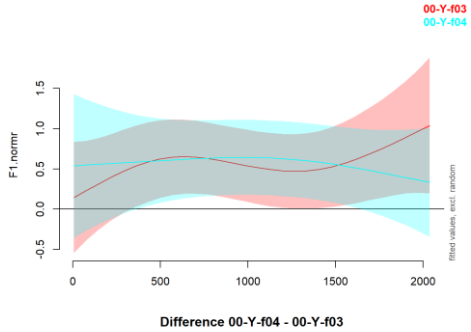


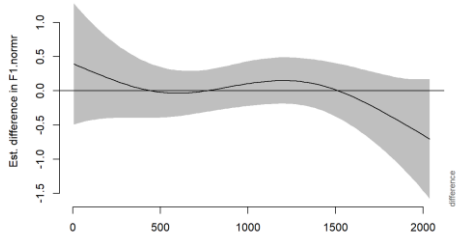


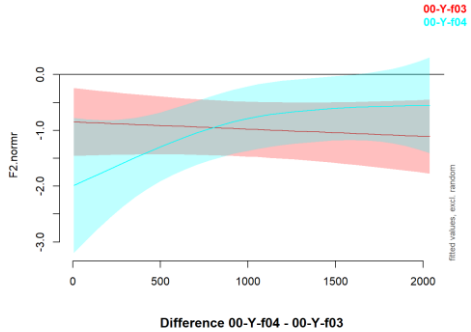


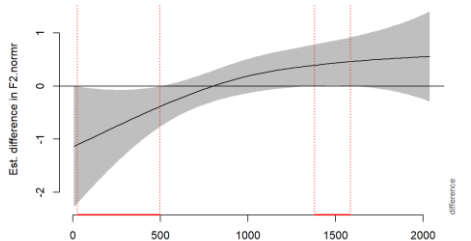


BOOT (F1 and F2)

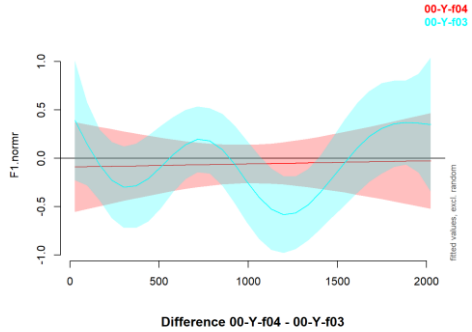


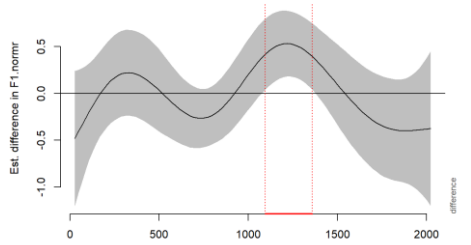


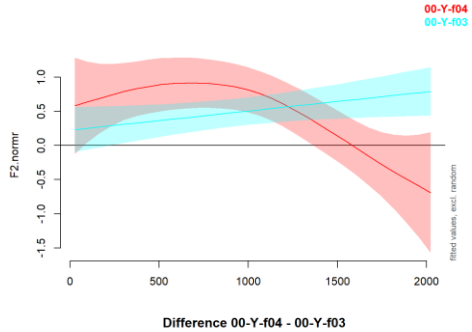


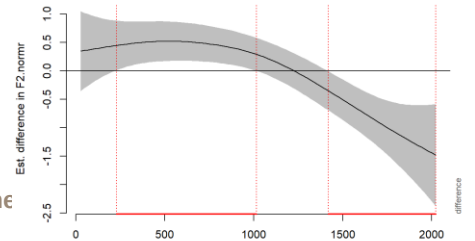


COT (F1 and F2)









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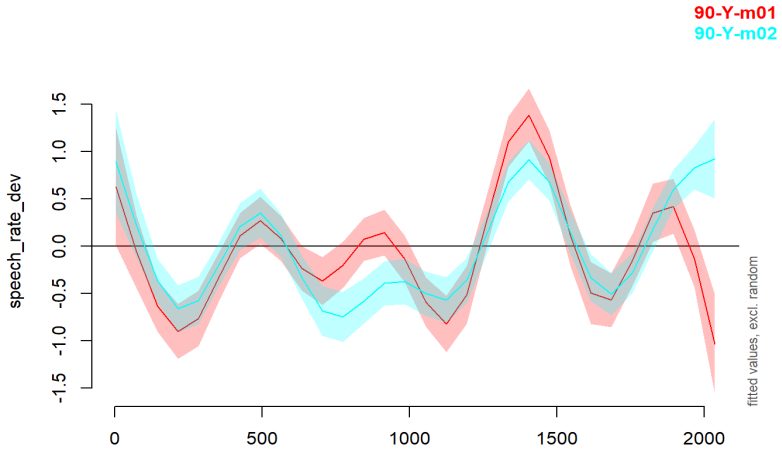
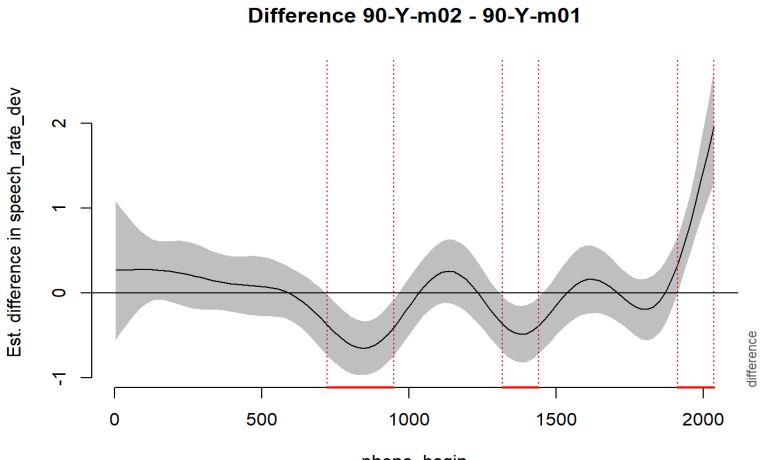
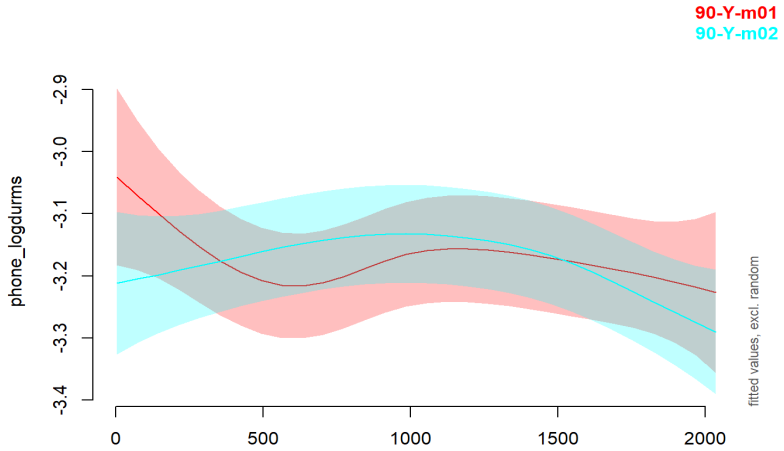
➢ Interaction 90Ym1 (non-matching divergence periods)

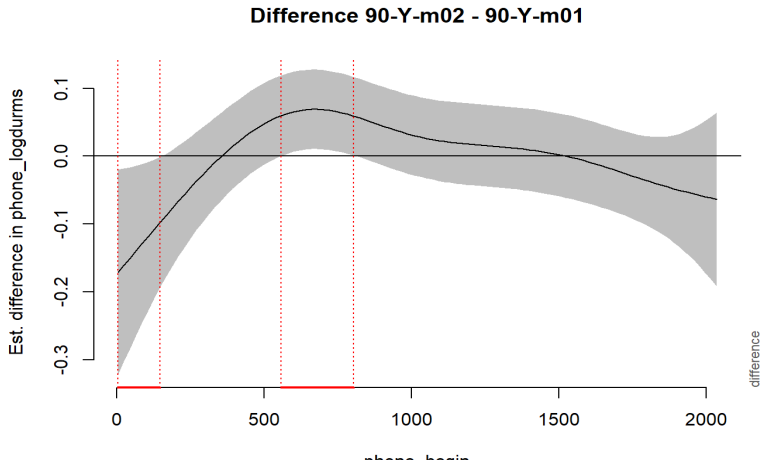
Speech rate variation





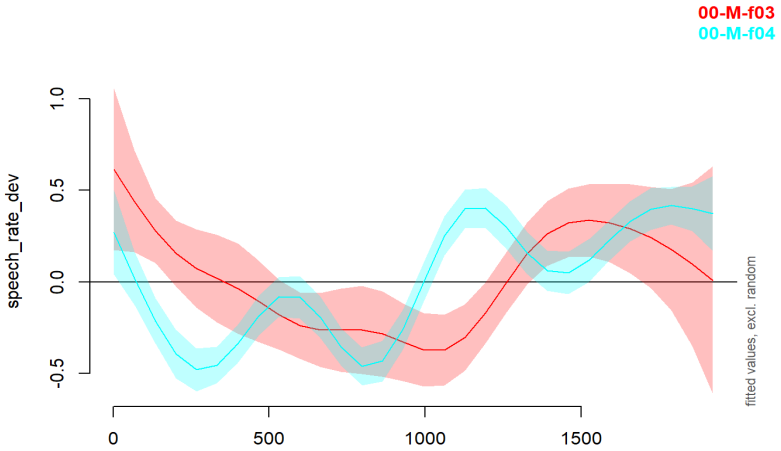
Vowel length variation

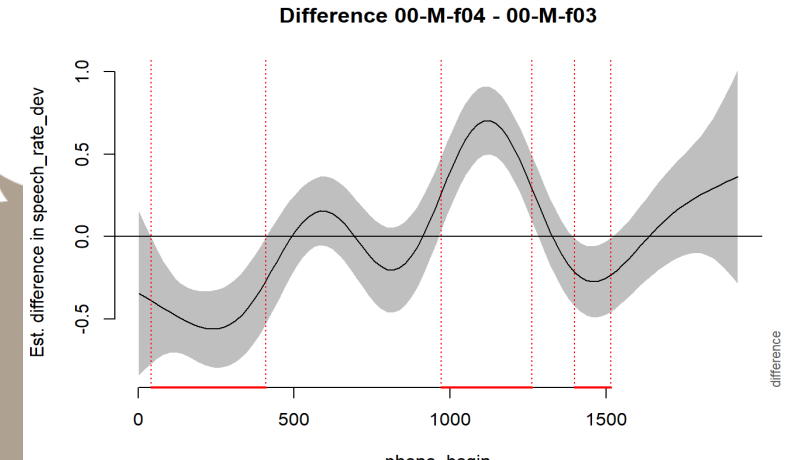




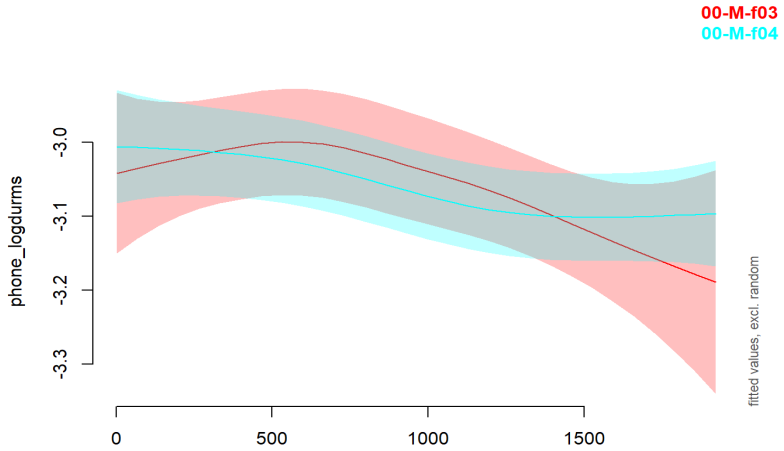
➢ Interaction 00Yf3 (differences in speech rate only)

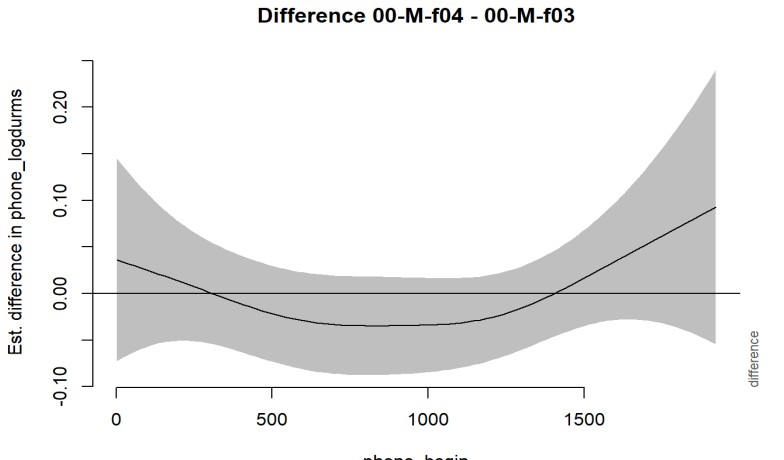
Speech rate variation





Vowel length variation





What conclusions can be drawn from this?

- Various variables vary in a more varied way than others
- Divergence/convergence between for speakers for one variable doesn't mean divergence/convergence for other variables

IV – What's next?

Help, I'm in my last year

- Take a step back and look at the whole dataset together

- Two options here:
  - Treat pairs as a random factor to compare microvariation trajectories by social factors (age, gender);
  - or actually base the analysis of convergence/divergence patterns on pairs themselves?

IV – INTO THE FUTURE

- Extracting the whole corpus with ISCAN
- Adding other types of conversations, more interesting, more relevant, more promising, more harder
- Include additional factors and information for further quantitative and qualitative analysis

IV – INTO THE FUTURE

- Write a thesis about all this

Thank you for listening!

** roars **

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