Do rhythm measures separate languages or speakers?

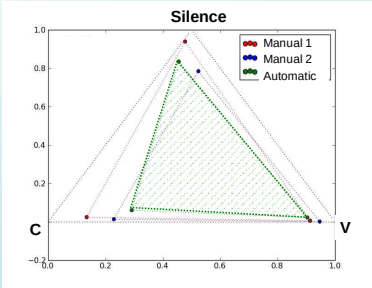
Anastassia Loukina[1], Greg Kochanski[1], Elinor Keane[1], Burton Rosner[1], Chilin Shih[2]
[1]Oxford University Phonetics Laboratory, UK
[2]EALC/Linguistics, University of Illinois, Urbana-Champaign, USA

Data

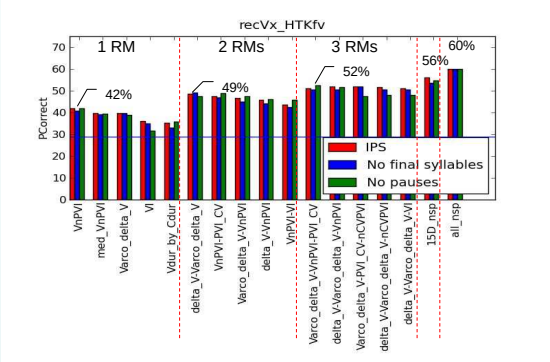
- **5 languages**: British English (Southern England), Modern Greek (Athens), Russian (Moscow/St. Petersburg), French (Paris), Taiwanese Mandarin (Taipei)
- **45 short texts** in each language (extracts from "Harry Potter", Aesop's fables, Cinderella)
- **50 speakers**: 20-28 years old. All non-English speakers lived outside their home country <4 years.
- **Total size of the corpus: 2265 texts**

Automatic segmentation

- Language independent
- A specialized speech recognition system, based on the HTK toolkit using acoustic description vector
- Produces sequence of C, V and S
- In the training data, all vowels and sonorants were mapped into V and all other phonemes into C

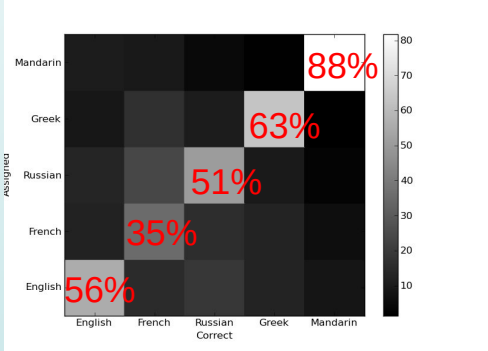


Separating languages



- **45** classifiers based on single RM
- **315** classifiers based on pairs of RM
- **1365** classifiers based on three measures
- **3** classifiers based on 15 RM
- **1** classifier based on 45 RM

- 45D classifier
- Chance=29%
- %Correct=60%
- K*=0.44



*K=(%correct-chance)/(perfection-chance)

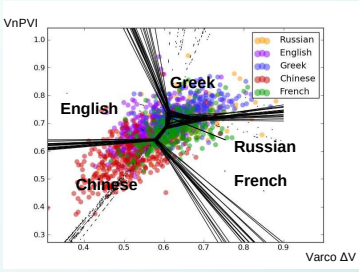
Conclusions

- Rhythm is a multidimensional phenomenon
- Substantial variation within languages makes it impossible to reliably separate languages based on the rhythm of a single paragraph
- The differences between speakers of the same language can be more consistent than the differences between different languages

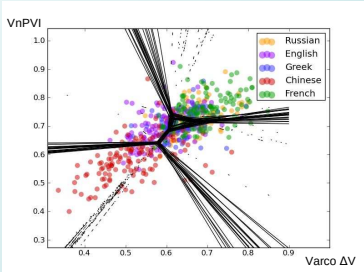
Classifier

- 12 splits into training set/test set
- 20 classifiers for each split
- **Data from one speaker always in the same set**

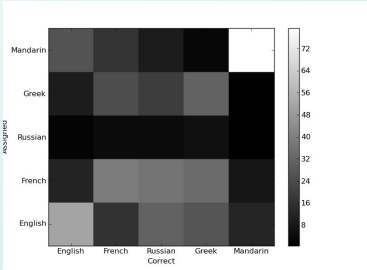
All classifiers for one training set



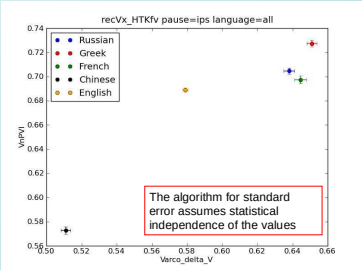
All classifiers for one test set



Confusion matrix: 47% correct



Mean values and standard errors

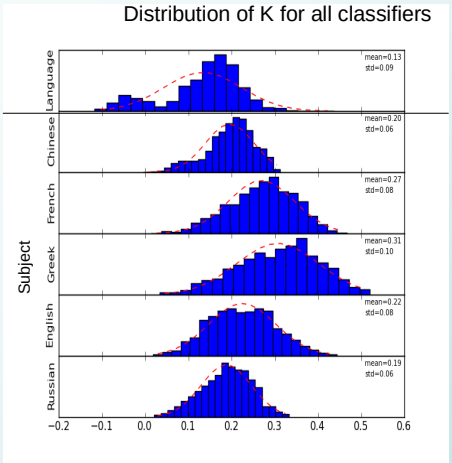


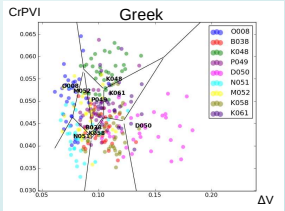
Varco ΔV- VnPVI

Separating people

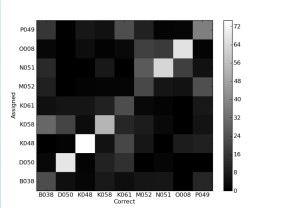
How well can a linear classifier identify the speaker of an utterance?

Distribution of K for all classifiers





Chance=12%, Correct=47%, K=0.40



Maximum % correct achieved for each language*

Language	Russian	English	Greek	French	Chinese
Chance	10%	9%	12%	11%	10%
Max %	40%	49%	58%	53%	38%

*For 1D, 2D and 3D classifiers

How do ΔV vs. CrPVI separate speakers in other languages?

French: 38% (11%), K=0.30
English: 31% (9%), K=0.24
Chinese: 30% (10%), K=0.22
Russian: 27% (10%), K=0.19

And how do they separate languages?

27%= chance, K=0

Rhythm measures

Global	Local	CV based
%V	CrPVI	PVI-CV
ΔV	VnPVI	VI
ΔC	CnPVI	YARD
Vdur/Cdur	med CrPVI	nCVPVI
VarcoΔV	med VnPVI	
VarcoΔC		

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Acknowledgements

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