Sociophonetics and Prosody

Dafydd Gibbon

Bielefeld University, Jinan University

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Selected Approaches to Sociophonetics

1) Background: Labov's Sociophonetics

2) The Sociolinguistic Survey Method: OSCAR
   - Case 1: Intonation and the prosody of impoliteness
   - Case 2: Perception judgment of Mandarin Tones

3) The Dialectometric Method
   - Kru languages

4) Prosodic Analysis of Discourse
   - Case 1: Prosodic Framing
   - Case 2: AM vs. FM Spectra
   - Case 3: Accent Constraints
   - Case 4: Long FM contours
   - Case 5: Emotive FM contours

Sociophonetics: several approaches

1. Methodologies:
   - Interpretative methods:
     - ethnomethodology
     - conversation analysis
     - discourse analysis
   - Correlationist (statistical) methods:
     - initiated by Labov
     - applied by Trudgill and many others
2. Scenarios (observational and experimental designs)
   - Natural and spontaneous speech corpora
   - Surveys:
     - prompted real-world elicitation (Labov)
     - online perception and description (OSCAR)

Labov's 'Correlationist' Approach: Selected Aspects

Labov's Surveys

1. Dimension 1: *phonetic variables*

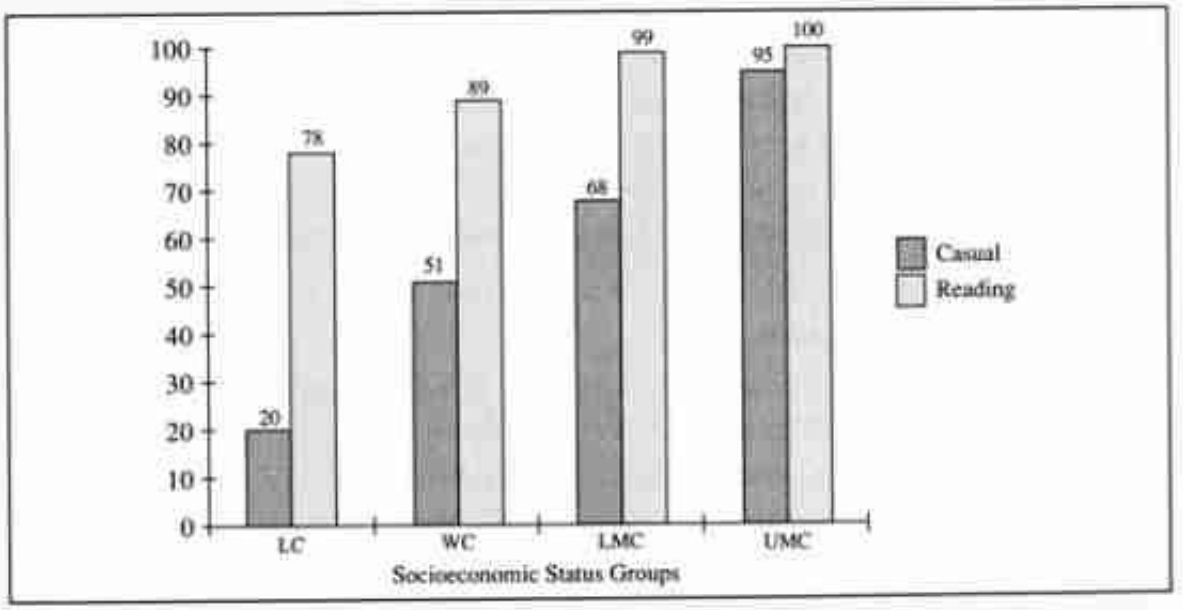
   for example:

   th [θ], *ng* [ŋ], *r* [r]

2. Dimension 2: *context style variable*
   - casual speech
   - careful speech
   - reading style
   - word lists
   - minimal pairs
3. Dimension 2: *socioeconomic variable*
   - lower class
   - working class
   - lower middle class
   - upper middle class

Labov's Surveys

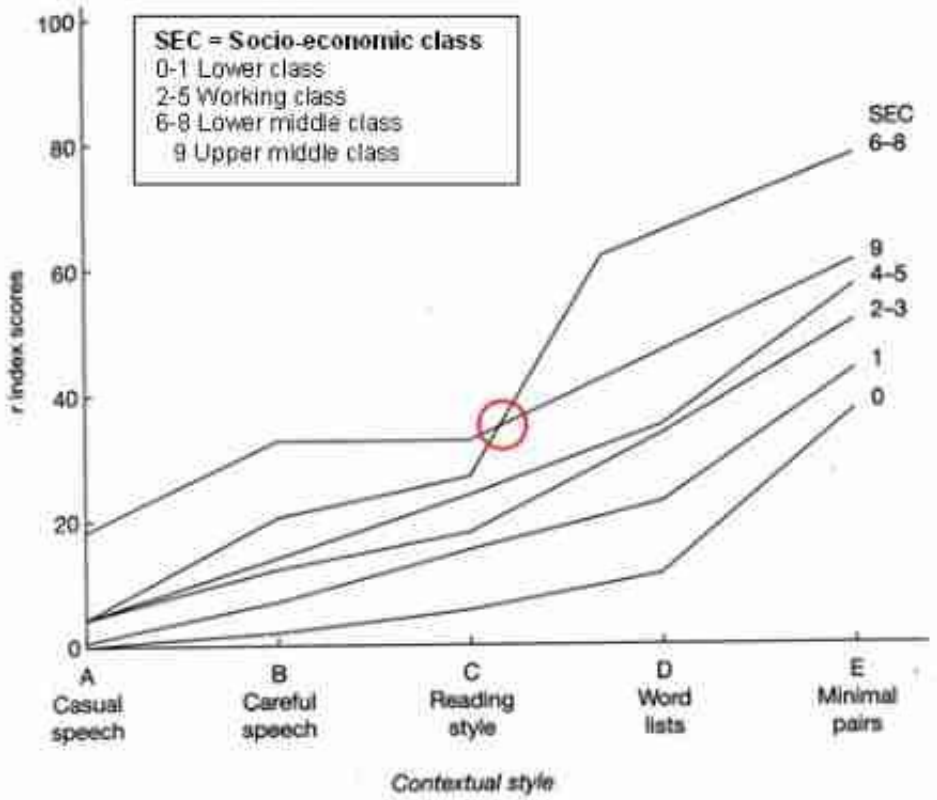
Percent of *-ing* Suffix Pronounced as /ɪŋ/ by Four Socioeconomic Groups in New York City



(Source: Finegan, 2004: 394)

Labov's Surveys

Labov's Surveys



Social and stylistic stratification for the variable (r) in New York City according to Labov (1966)

(Source: Llamas/Mullany/Stockwell, 2007: 55)

An Online Sociolinguistic Survey Method: OSCAR

(Online Survey Collation and Reporting)

Different approach: Online Opinion Survey

Task of assigning pitch descriptors to tones

- metalinguistic documentation of perception
  - cf. judgment paradigm of auditory phonetics and phonology
- sociophonetics, ‘folk linguistic’ opinions

There are many formats for opinion surveys

- open interview
- closed set (standard: Likert scale)
  - for this test:
    - audio input, Likert format response to a statement:
      - strongly agree
      - agree
      - don’t care
      - disagree
      - strongly disagree

Dr. Rensis Likert
1903-1981

Likert scale 1932
(Ph.D. thesis)

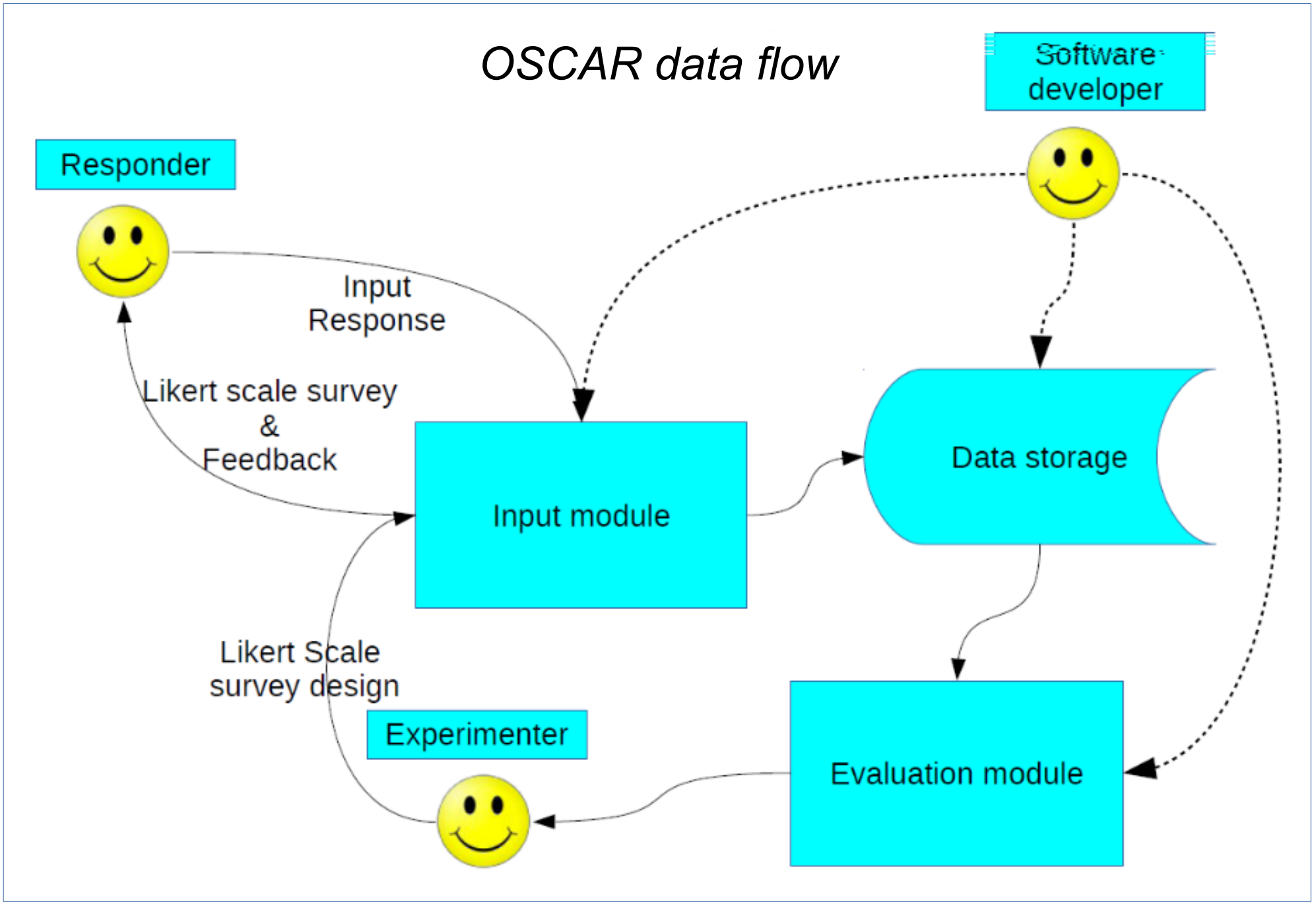
Descriptor assignment

Task of assigning pitch descriptors to tones

- metalinguistic documentation of perception
  - cf. judgment paradigm of auditory phonetics and phonology
- sociophonetics, ‘folk linguistic’ opinions

Custom online tool OSCAR

- “Online Survey Collation And Reporting”
- input:
  - responder metadata: age group, sex, L1, regional variety
  - single-page Likert format survey form
    - list of tones + pitch descriptor choices
- output:
  - for responders: notification of (in-)completeness of responses
  - for experimenter: automatic evaluation


OSCAR data flow
Software developer
Responder
Input
Response
Likert scale survey
&
Feedback
Input module
Data storage
Likert Scale
survey design
Experimenter
Evaluation module

Acknowledgment for the following section to:

Li Peng. 2018. An Analysis of Impolite Speech Acts in Donald Trump's Speeches with Special Reference to Prosodic Components. M.A. Thesis, Jinan University, Guangzhou.

Prosody and Impoliteness

1. Aim
   - Examining impolite speech acts through impoliteness strategies:
   - previous approaches
     - films, tv series, reality shows, debate
   - here: public speech
2. Focus on the role of linguistic text
   - lexical aspects
   - semantic aspects
   - prosodic aspects often missed out
   - here: both ‘textual’ and prosodic aspects
3. Method
   - previous approches
     - mainly qualitative
   - here: qualitative and quantitative

Prosody and Impoliteness

Therefore, new questions are asked:

1) What are the strategies commonly employed by Donald Trump?

2) What role does prosody play in the comprehension of impolite speech acts?

3) What are respondents' perceptions of Donald Trump's speeches?

Qualitative approaches often said to be 'merely opinion'

Novel twist: validation of 'opinion' by 'opinion survey'

(consensus theory of truth!):

Novel twist:

online questionnaire with sounds and descriptors to characterise the sounds

Methodology and Data

A combined research approach:

- Typical 5-point Likert scale
- Novel twist: an online questionnaire with sounds/ various attributes

Procedure:

- Data collection:
  - Prompts:

    1)Downloading Donald Trump's presidential election speeches from Youku (> 7 hours)

    2)Repeated listening, transcribing, and then cutting out the impolite clips

    3)Extracting 42 clips concerning impoliteness within impoliteness model

    4)Converting 42 video clips into audio clips (WAV) by Total Video Converter

    5)Choosing 10 audio clips concerning marked prosody to design a questionnaire
  - Survey:
    - Using OSCAR to distribute, collect and report on the online audio survey results (http://wwwhomes.uni-bielefeld.de/gibbon/OSCAR_al02/)

Prosodic Aspects of Impoliteness

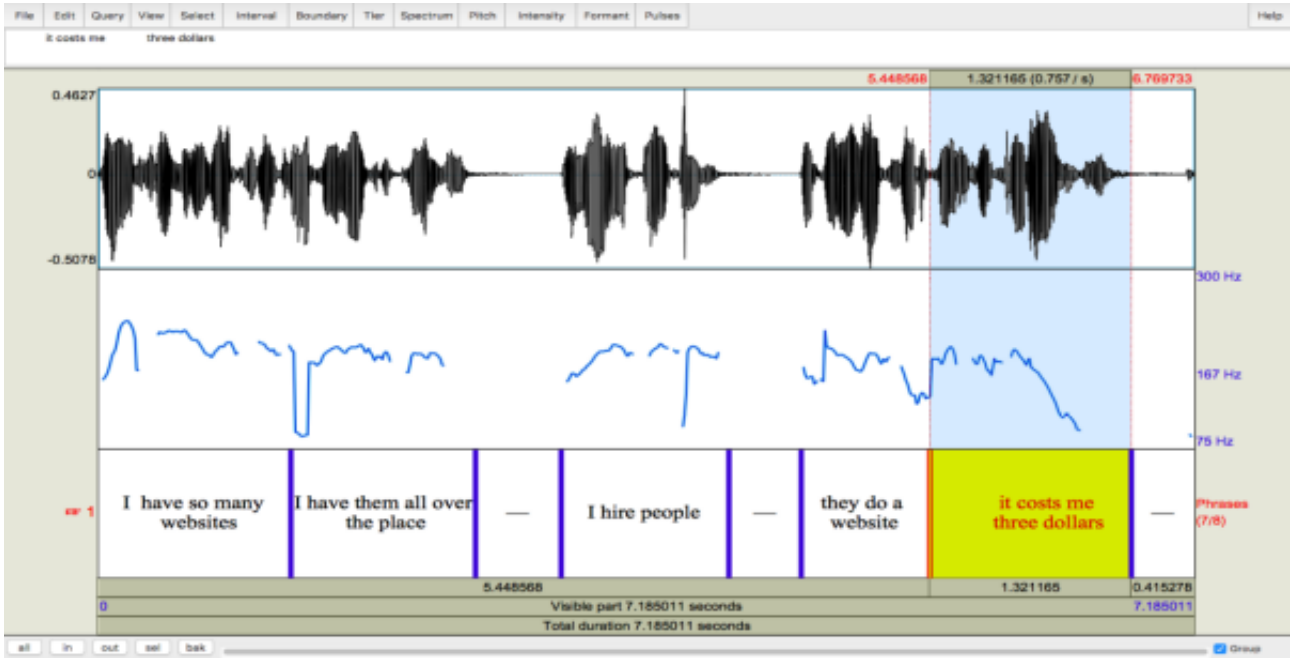
Prosodically Impolite Speech Acts

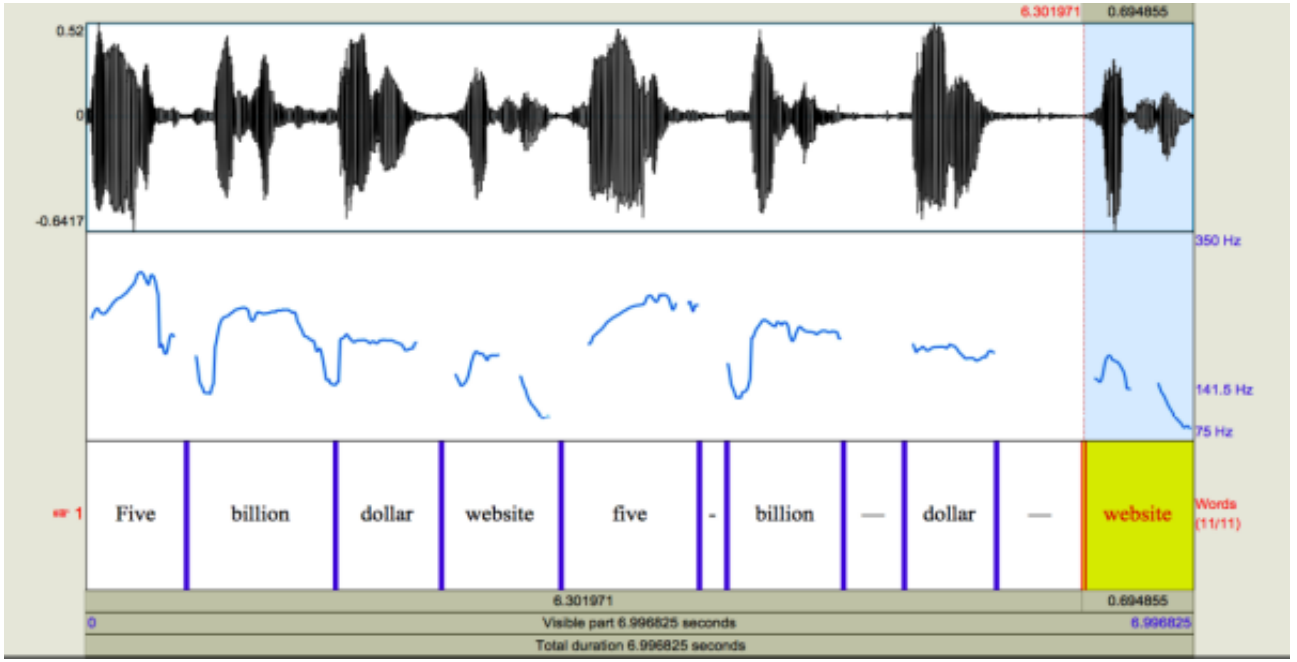
- Pause
- Stress
- Down-stepping Intonation
- Tempo of Speed
- Prosodic Mimicry

Down-stepping Intonation and Impolite Speech Acts

> “Five billion dollar website, I have so many websites, I have them all over the place. I hire people, they do a website, it costs me 3 dollars. Five billion dollar website.” (New York)

Prosodic Aspects of Impoliteness





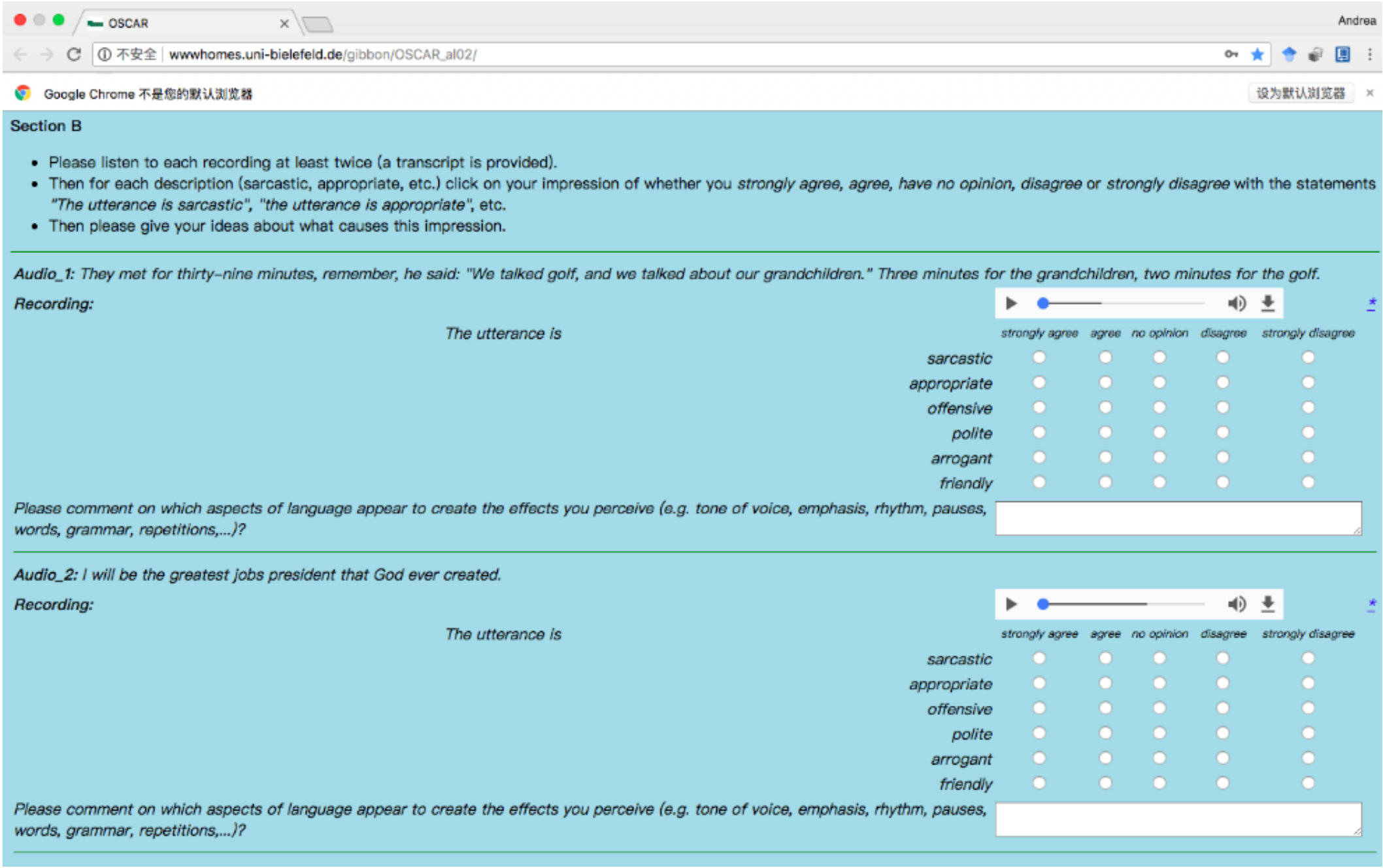
Audio_5:

Five billion dollar website
I have so many websites, I have them all over the place.

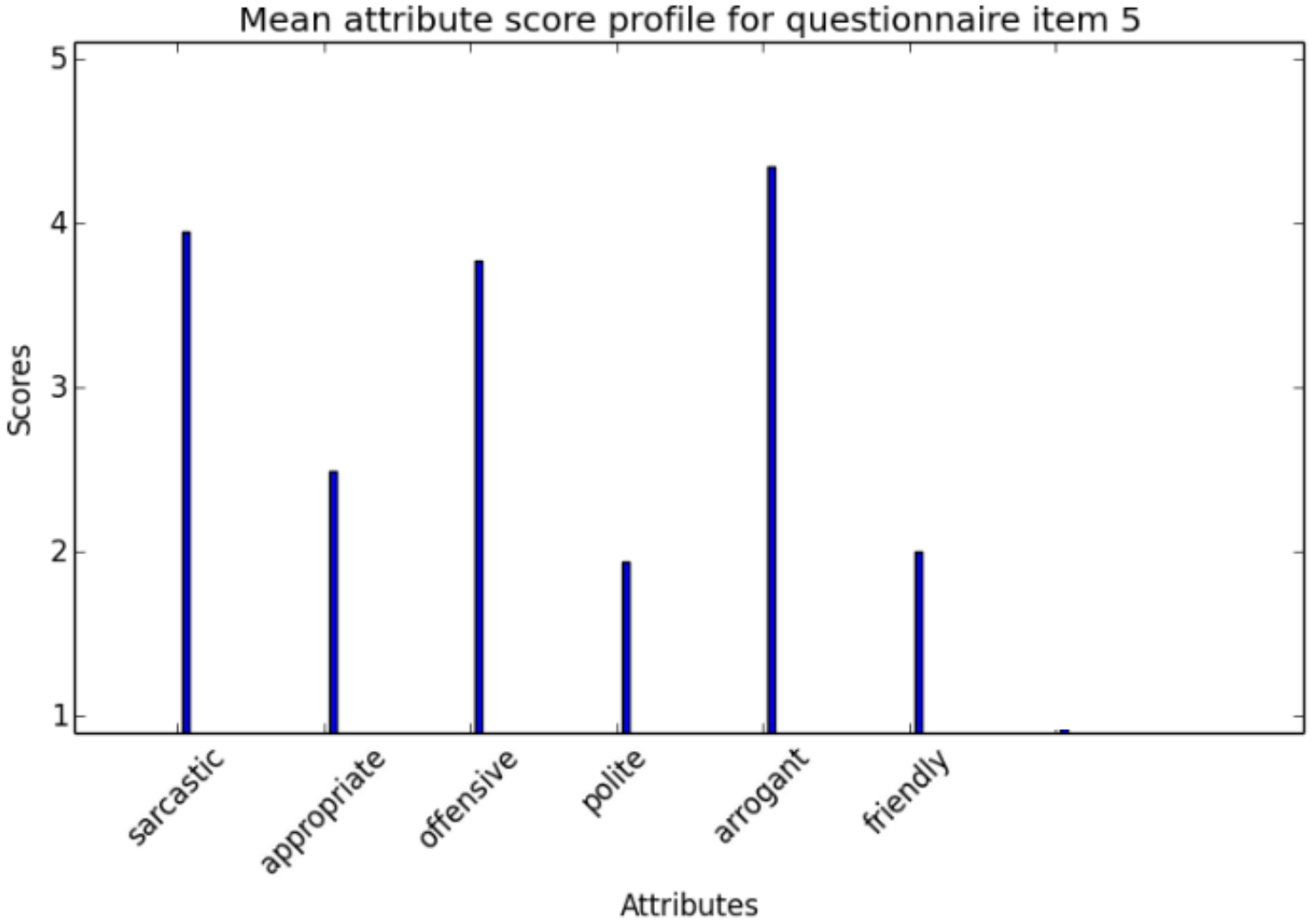
I hire people, they do a website, it costs me 3 dollars.

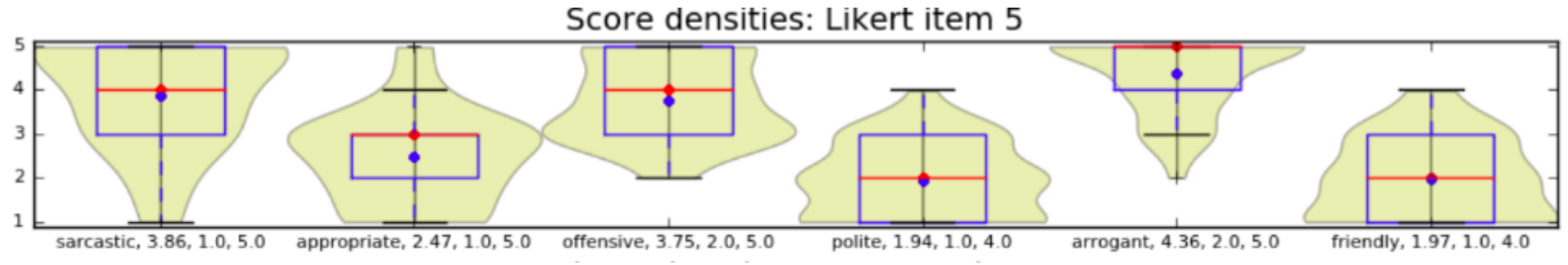
Five billion dollar website.
(Context: Donald Trump is talking about Obama's health care website. Bloomberg Government estimated that Obama's healthcare government cost less than 2.1 billion dollars.

Prosodic Aspects of Impoliteness

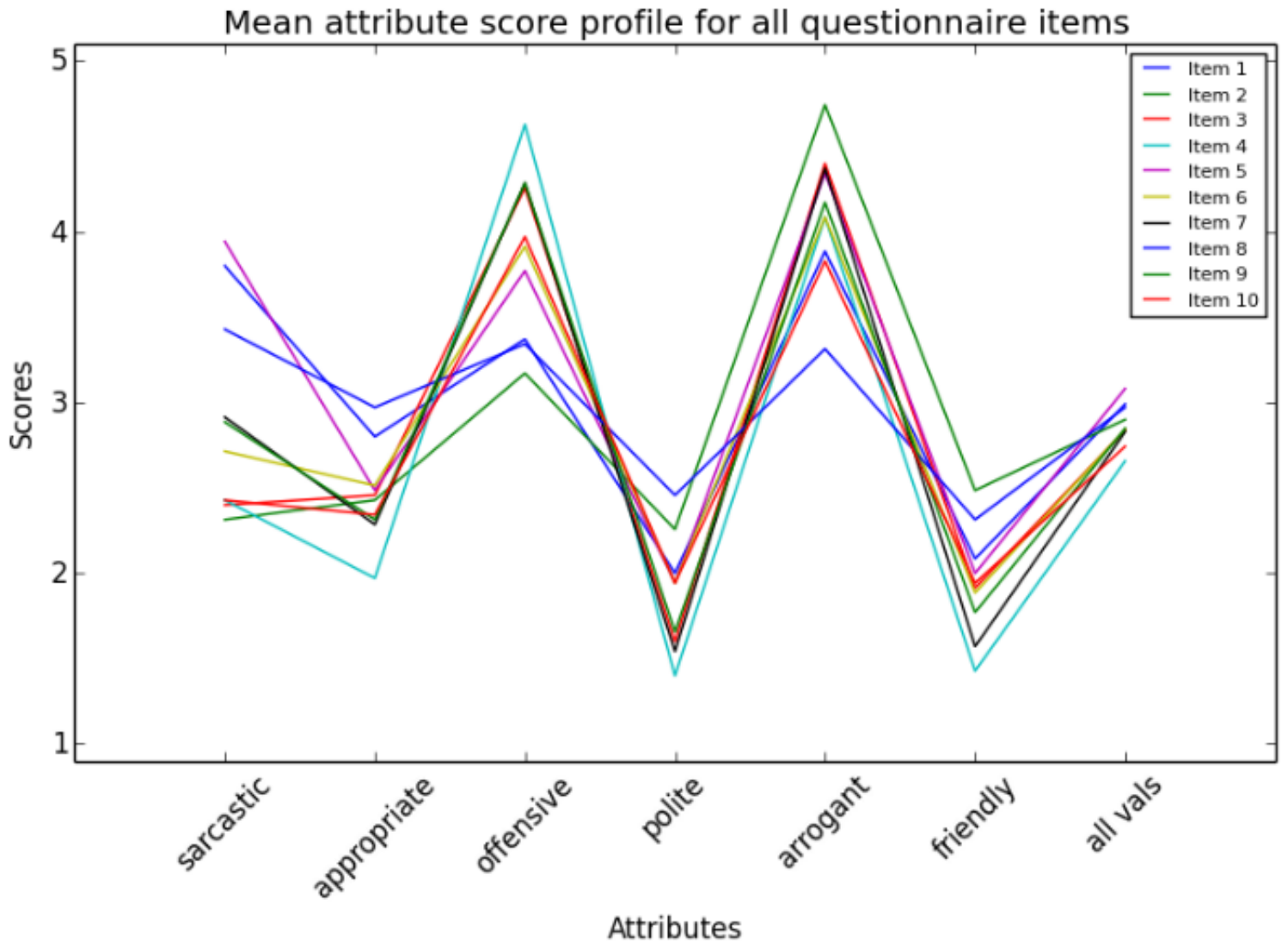


Prosodic Aspects of Impoliteness





Prosodic Aspects of Impoliteness



Prosodic Aspects of Impoliteness

Gender	F=3.113	p≤0.1†	p=0.0778
Language	**F=3.199**	**p≤0.001*** **	**p=0.000**
Language Variety	F=1.554	p≤0.1†	p=0.091
Party	**F=9.447**	**p≤0.001*** **	**p=3.355e-06**
Descriptor	**F=298.688**	**p≤0.001*** **	**p=3.081e-243**
Prompts	F=1.751	p≤0.1†	p=0.073

Acknowledgment for the following section to:

Gibbon, Dafydd and Huangmei Liu. 2018. Variability in Mandarin Tone Perception. *Proceedings of Speech Prosody 2018, Poznań, Poland* [In the ISCA Proceedings Archive]

GOALS

Test of new method

- multidialectal comparison
- contrast with previous bidialectal and bilingual comparisons
- exploratory rather than confirmatory

Sociophonetic focus

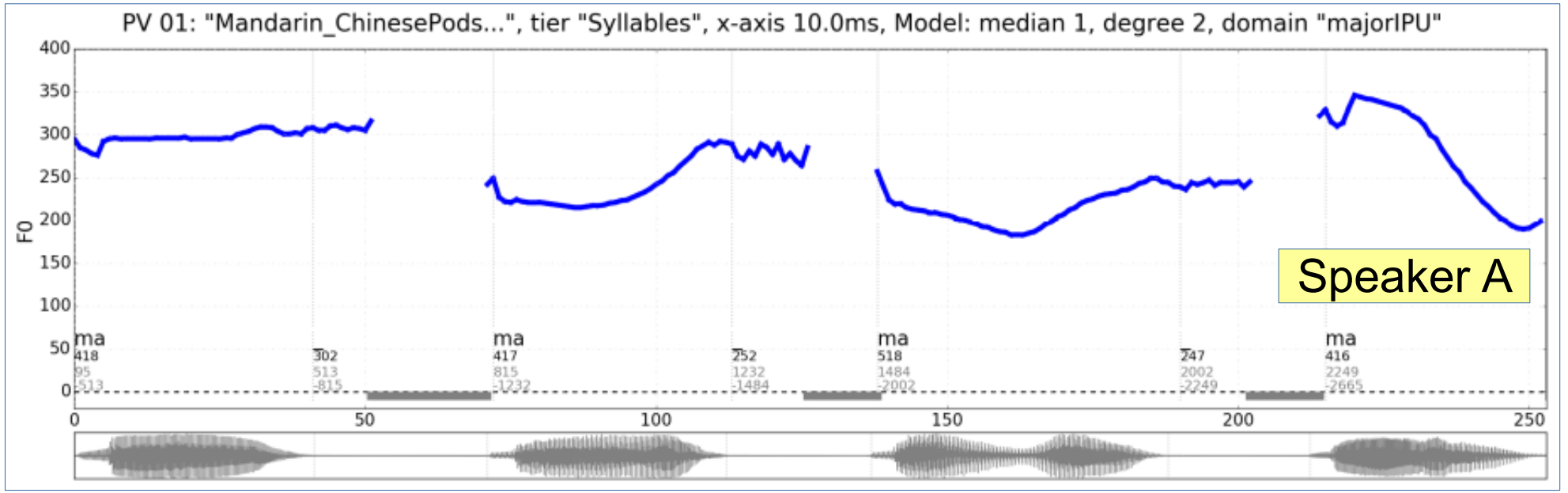
- assignment of descriptors of perceived pitch
  - to standard Mandarin (Pǔtōnghuà) tones
  - by native speaker responders from different regions
- comparison of height and contour descriptors
- focus on inter-rater variability
  - contrast with inter-rater reliability
- preparation for a large-scale multidialectal study
- longer-term goal of relating pitch descriptor assignments
  - to self-ascribed regional dialects
  - to linguistic dialect classification

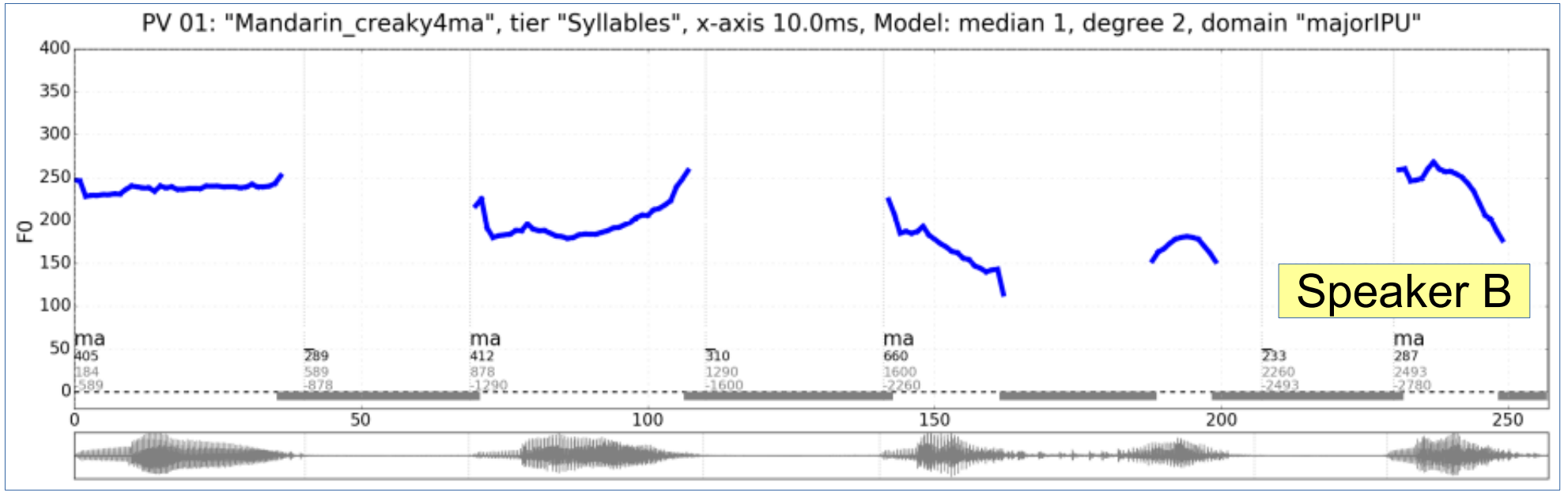
TASK

Stimuli

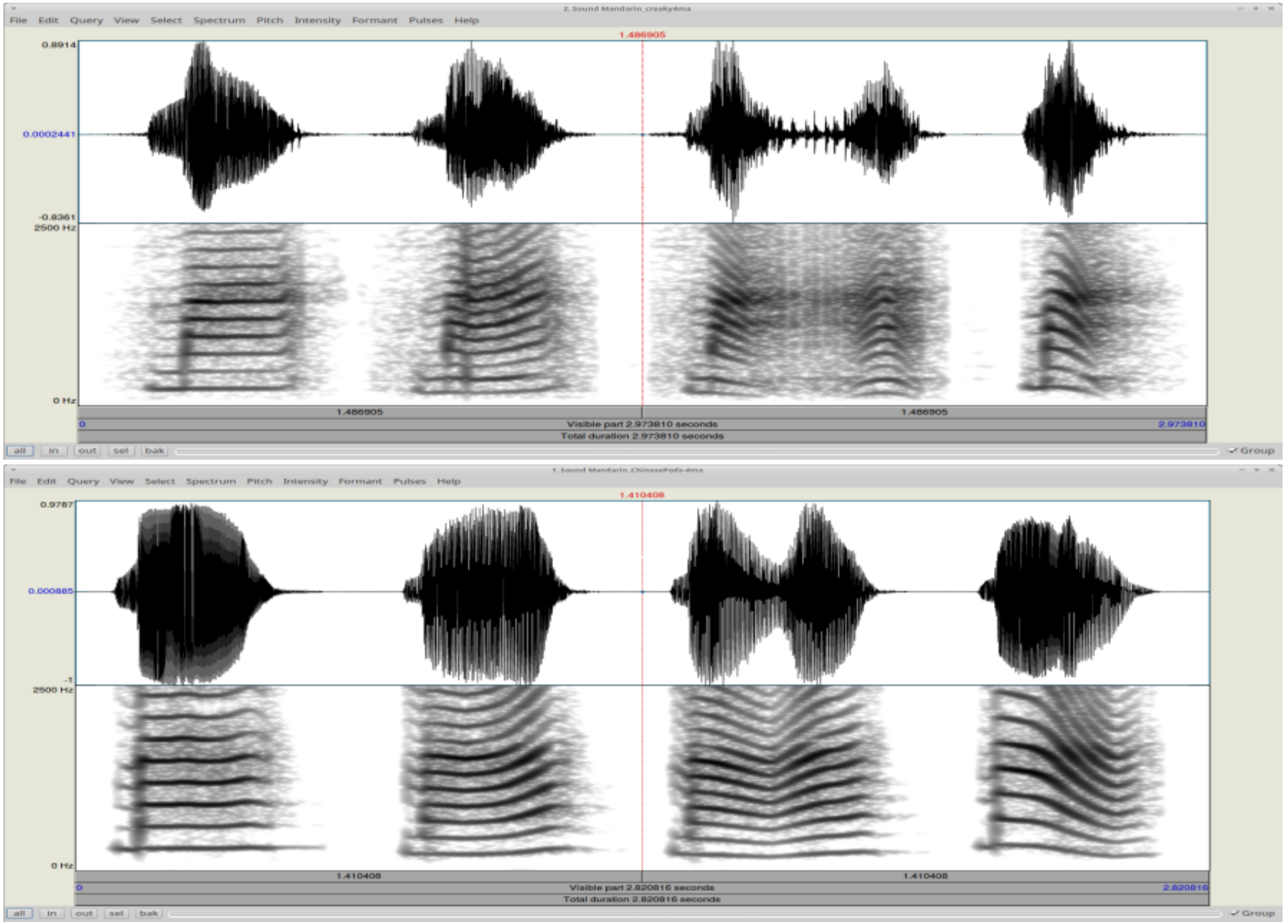
- 16 tone items:
  - 4 tones
  - 2 tokens each
  - 2 female speakers, standard Beijing Mandarin
- for all responders:
  - same randomised token order
  - no adjacent repetitions

Mandarin lexical tones





Variability in Mandarin Tone Perception



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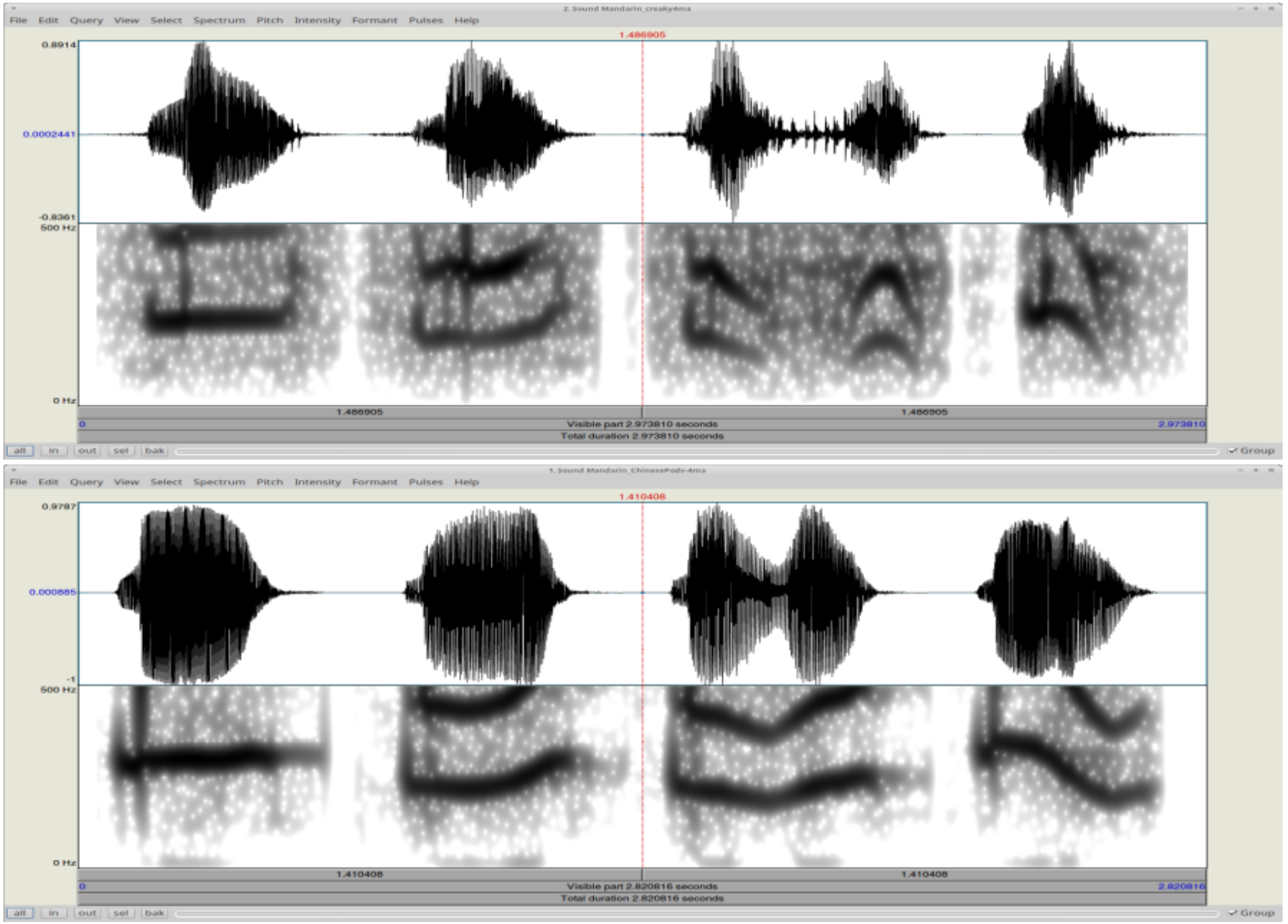

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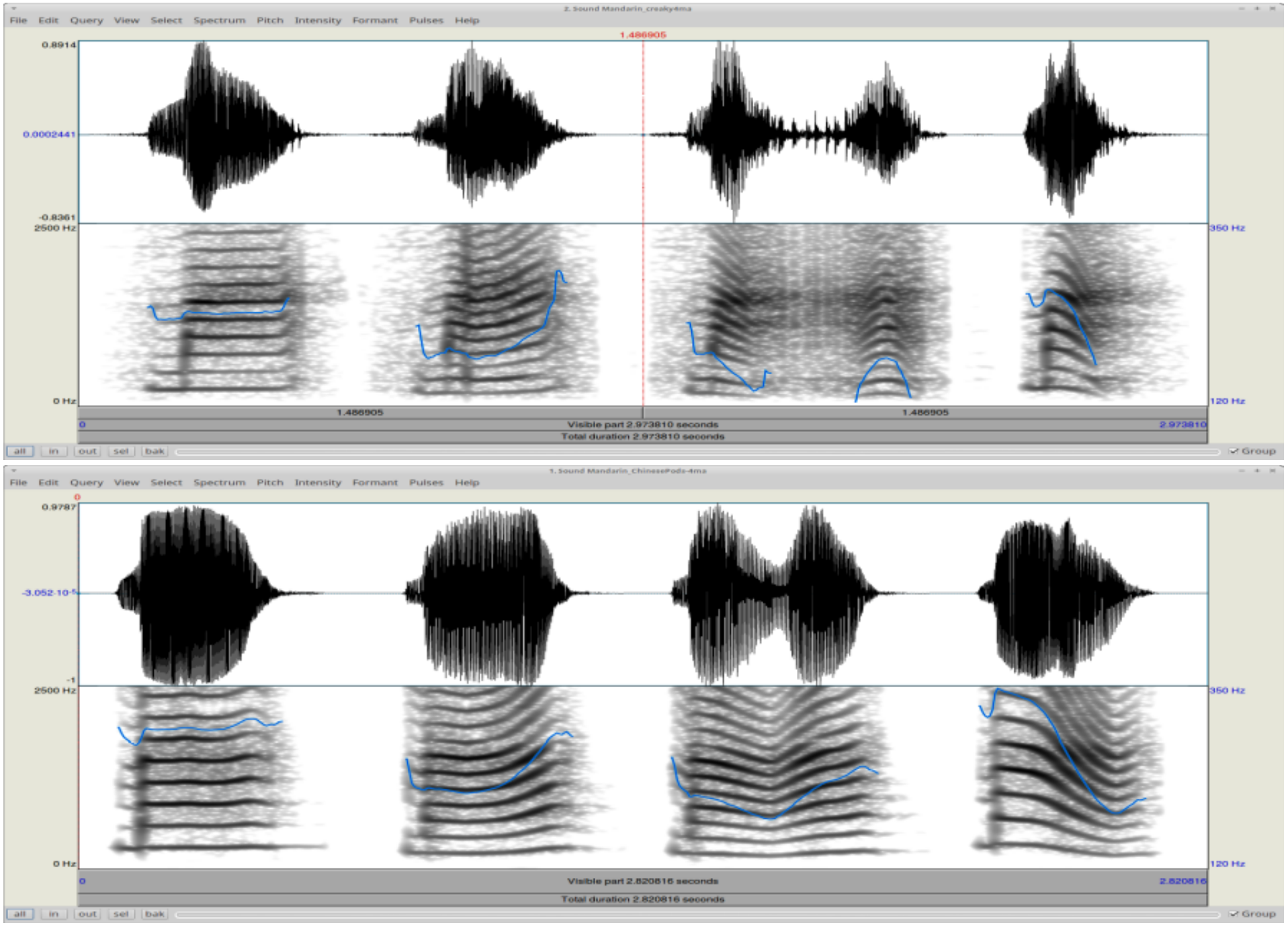

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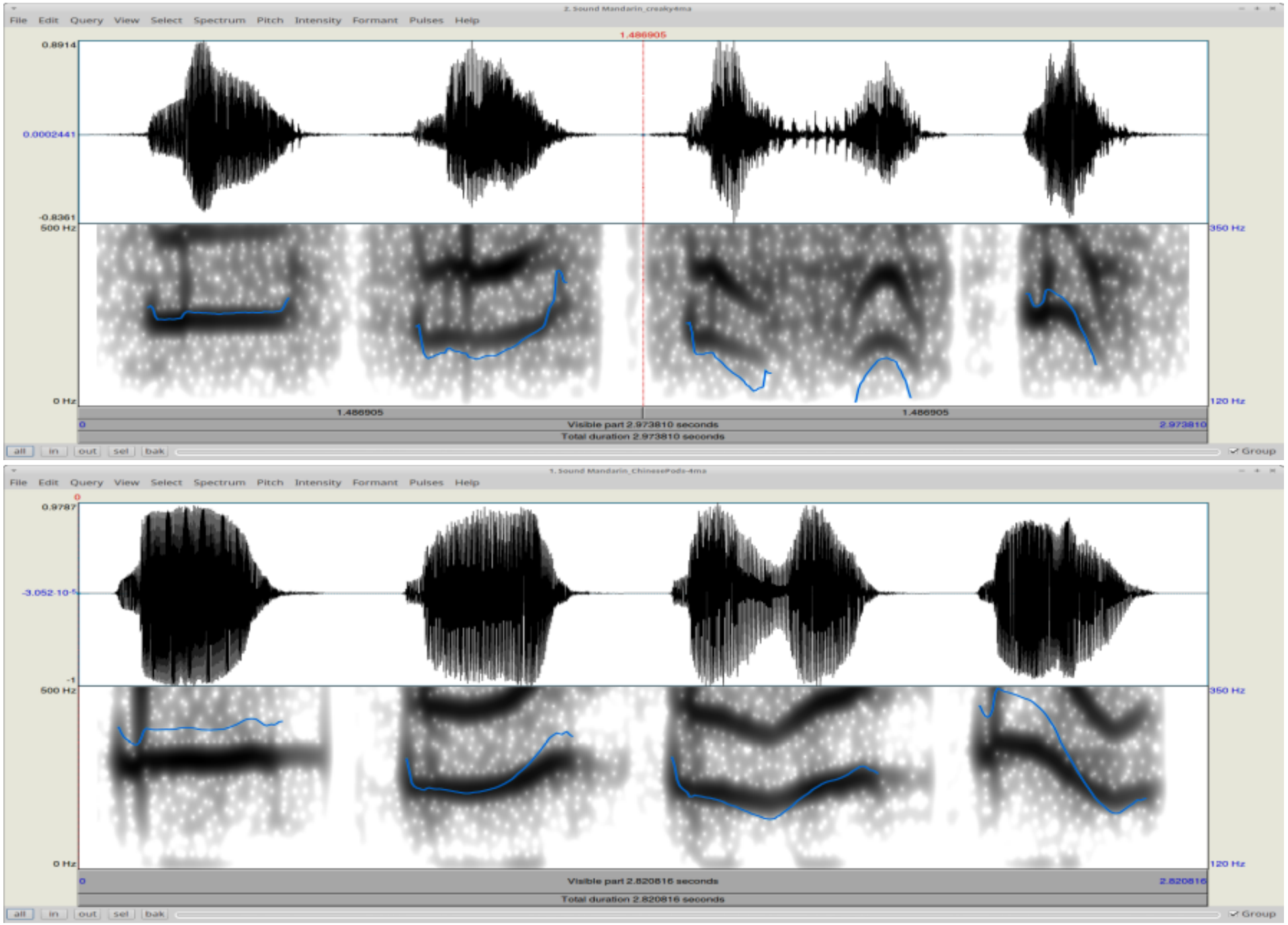

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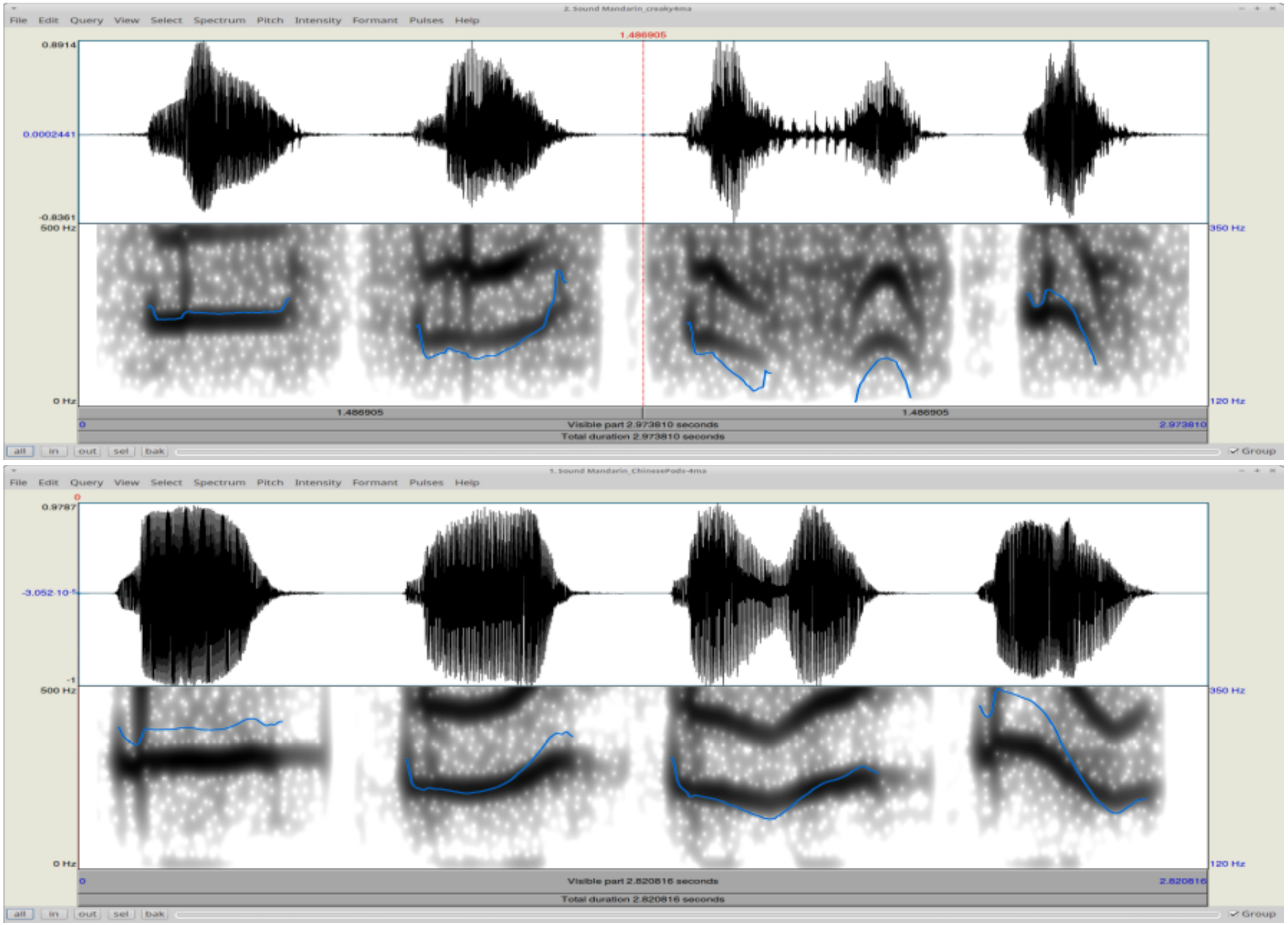

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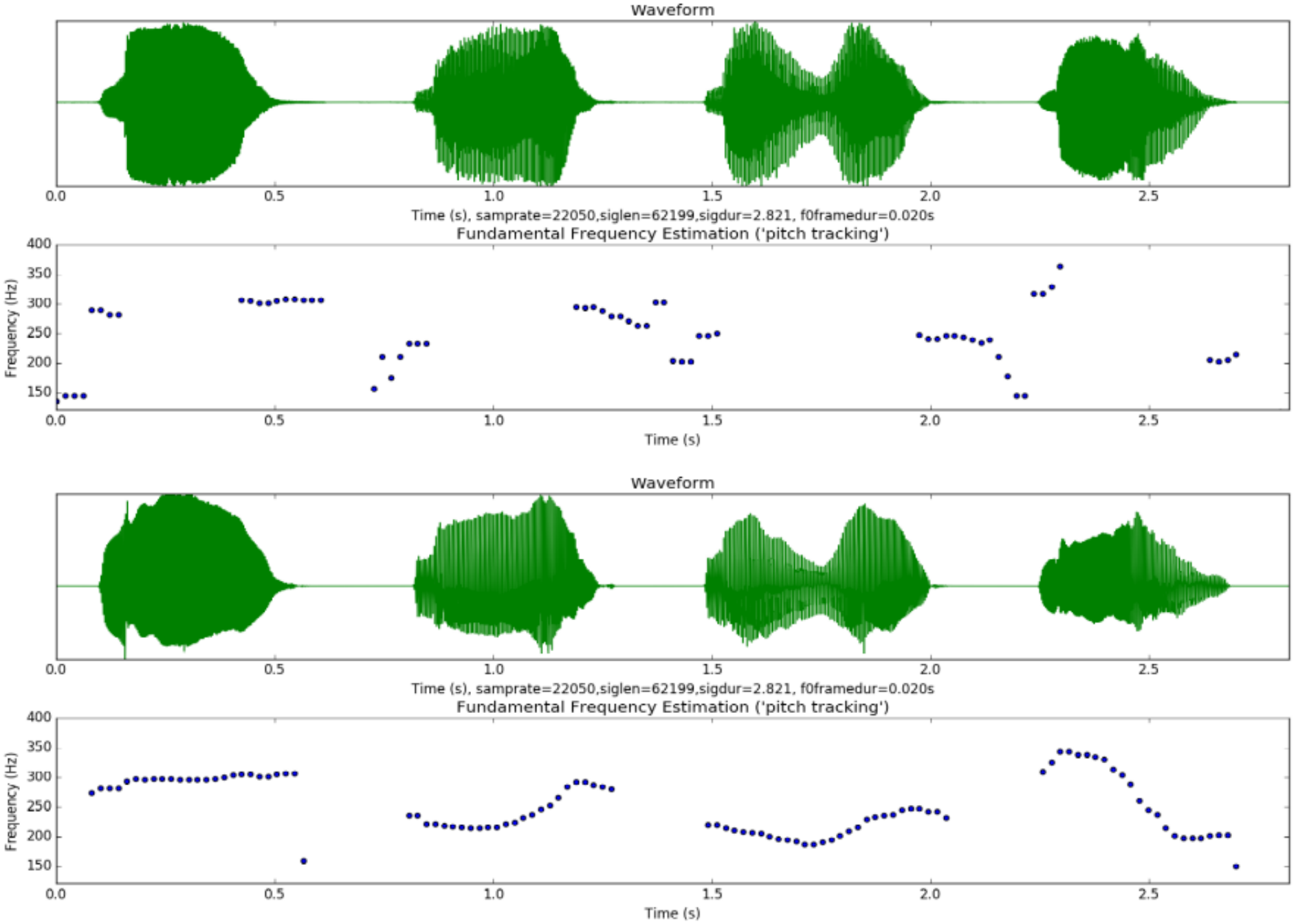
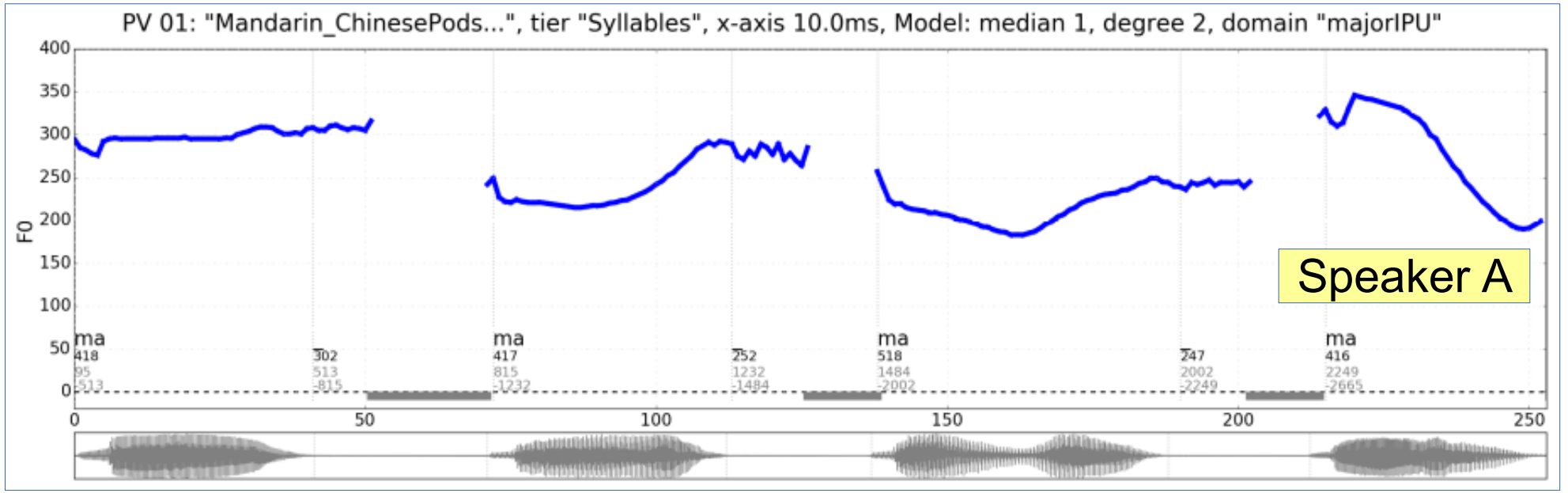
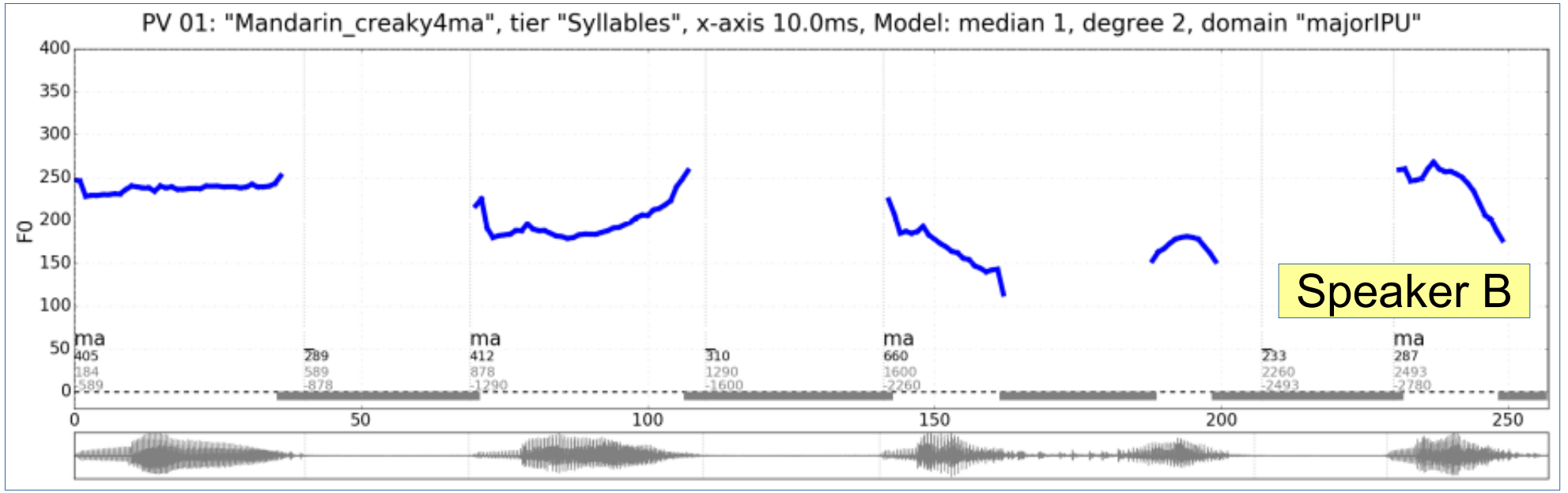


Mandarin lexical tones

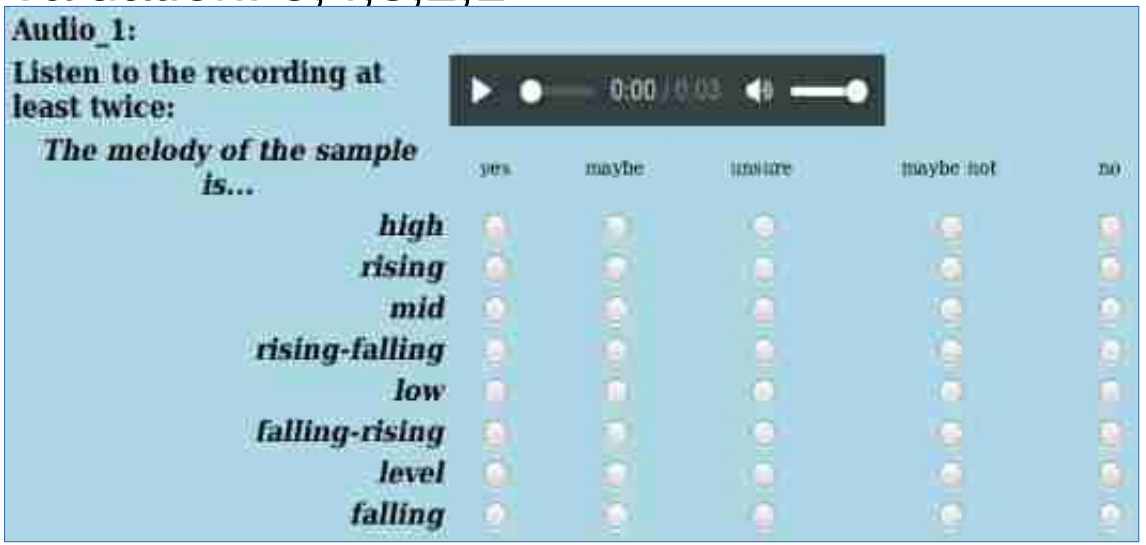




INPUT TASKS

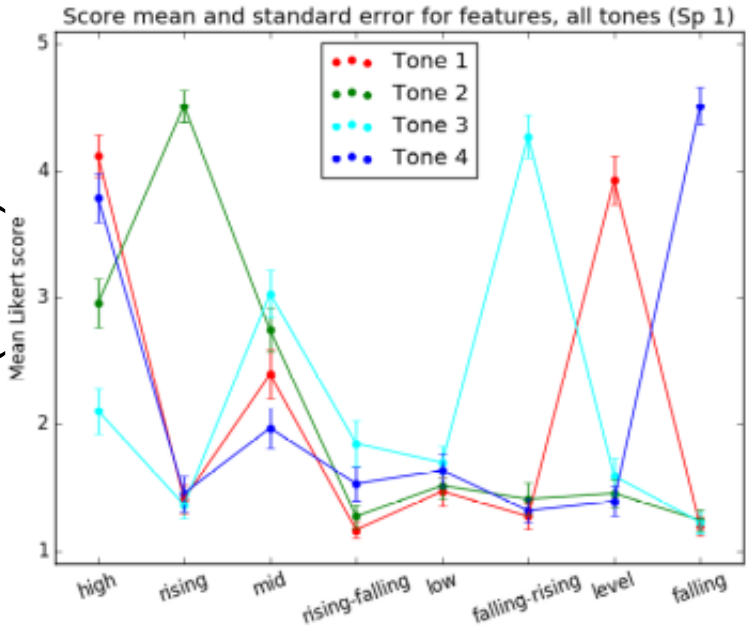
Descriptors:

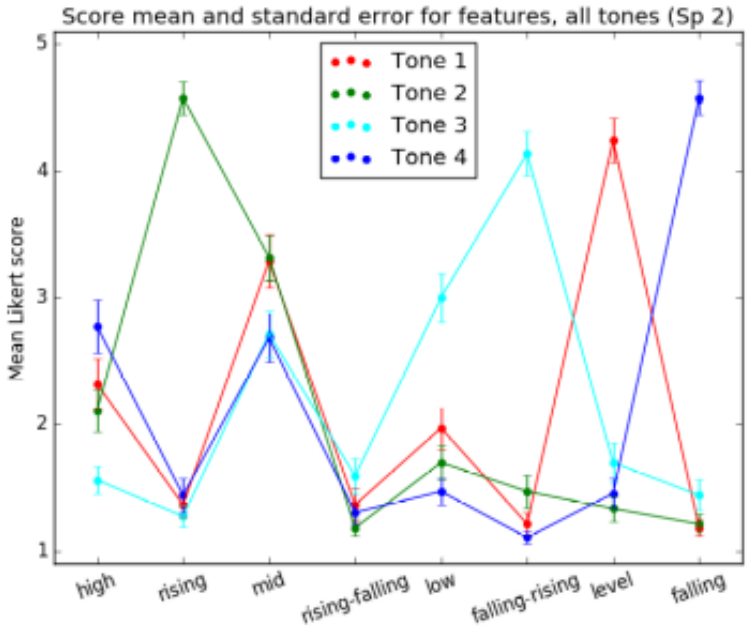
- 8 pitch descriptors
  - contours: *level*, *rise*, *fall-rise*, *rise-fall* (distractor), *fall*
  - heights: *high*, *mid*, *low*
- 5-point Likert format input scale
  - yes, maybe, not sure, maybe not, no
- coded for evaluation: 5,4,3,2,1



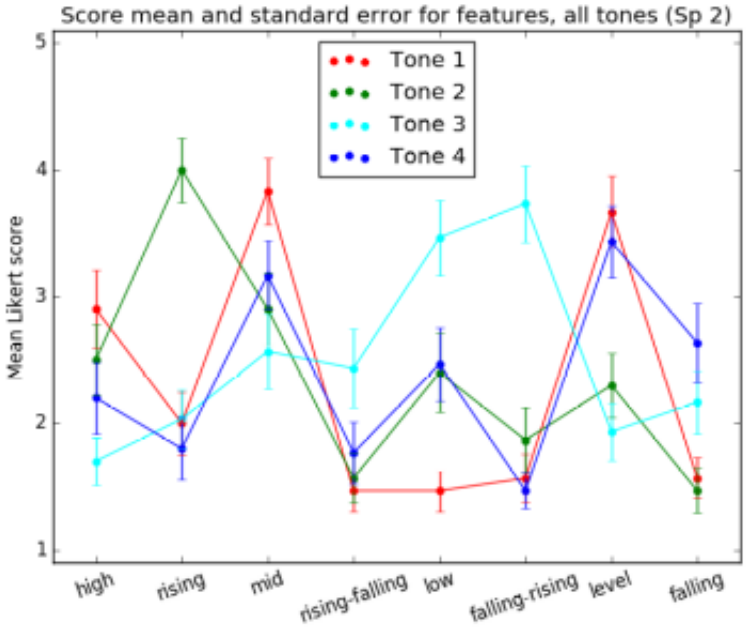
Variability in Mandarin Tone Perception

Mandarin responders (n=33)





German (&c.) responders (n=15)

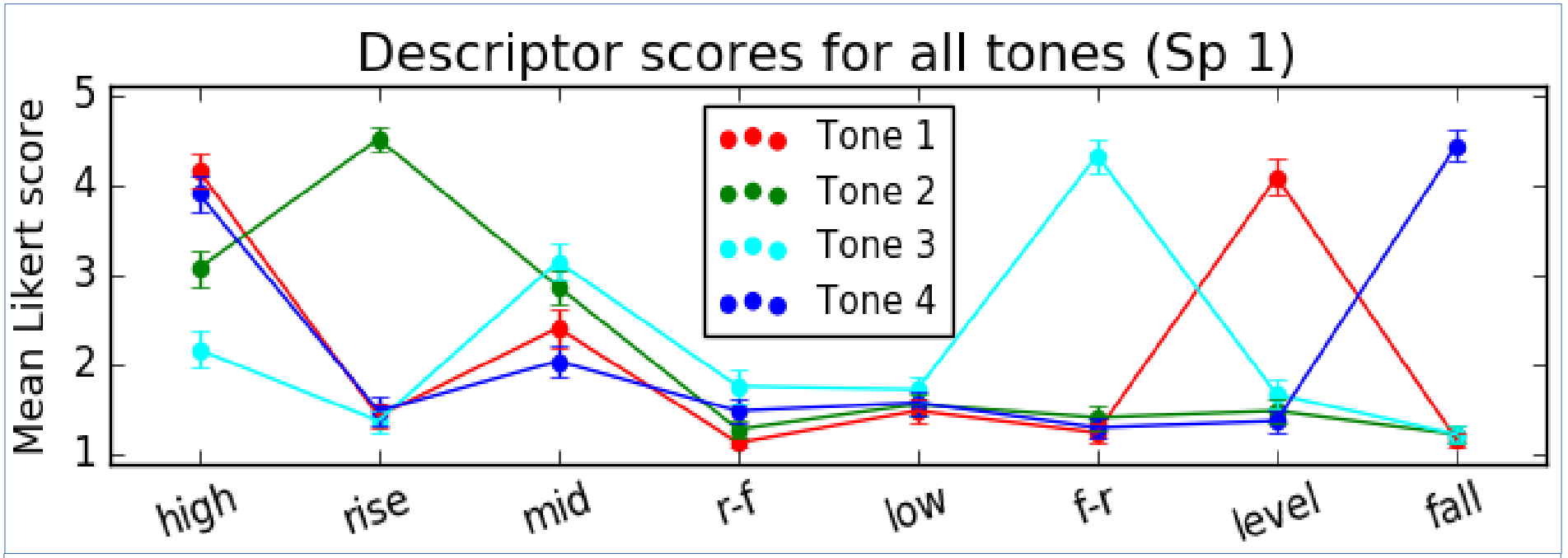


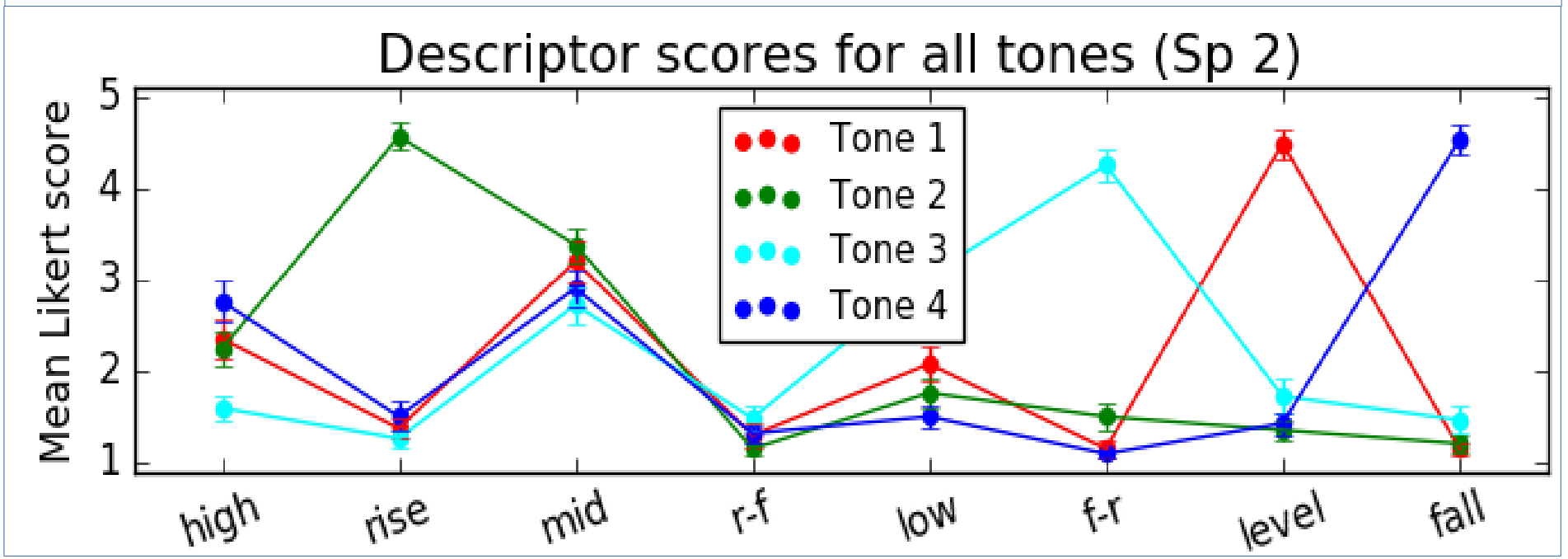
Descriptor results

- Inter-speaker variability
  - *mid* varies for tones, not so much for speakers
- low varies strongly
  - for Speaker B
  - not for Speaker A
- *high* score
  - stronger for Speaker A
  - not for Speaker B

→ overall higher pitch for Speaker A than for Speaker B?

Variability in Mandarin Tone Perception





Descriptor results

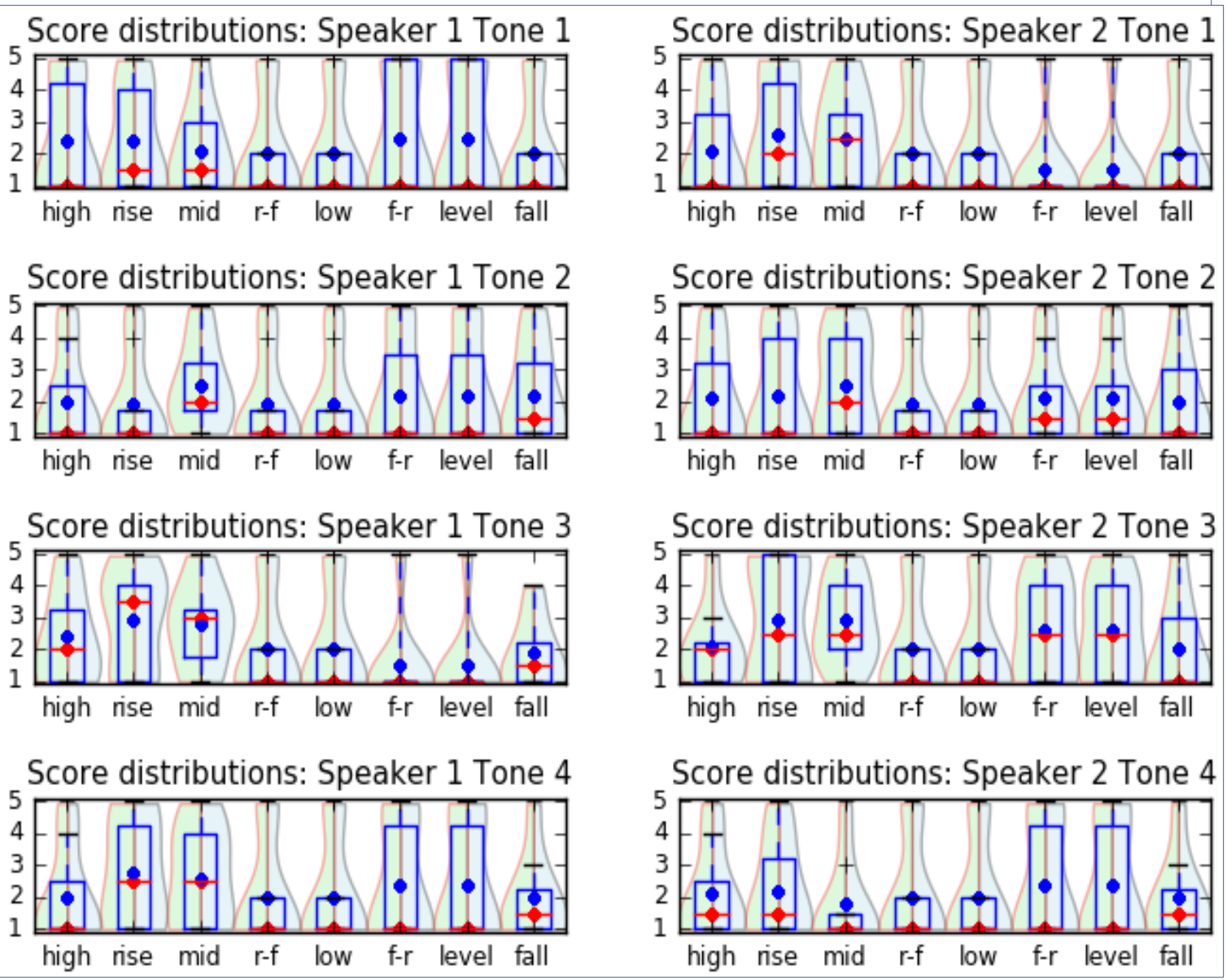
1. Contour descriptors:
   - ‘canonical tone descriptors’:
     - high skewed distribution for high scores
     - cf. Mandarin tones:
       - Tone 1: *level*, Tone 2: *rise*, Tone 3: *fall-rise*, Tone 4: *fall*
       - Neutral tone not included
       - Distractor tone rise-fall: low
2. Height descriptors
   - ‘non-canonical’
     - high, mid, low
     - low scores:
       - skewed distributions
       - bimodal distributions
       - broad distributions

SpA	high	rise	mid	r-f	low	f-r	level	fall
T1	4.12	1.41	2.39	1.17	1.47	1.27	3.92	1.20
T2	2.95	4.52	2.74	1.27	1.52	1.41	1.45	1.24
T3	2.11	1.36	3.03	1.85	1.70	4.27	1.59	1.23
T4	3.79	1.45	1.97	1.53	1.64	1.32	1.39	4.52
SpB	**high**	**rise**	**mid**	**r-f**	**low**	**f-r**	**level**	**fall**
T1	2.32	1.36	3.29	1.36	1.97	1.21	4.24	1.18
T2	2.11	4.58	3.32	1.18	1.70	1.47	1.33	1.21
T3	1.56	1.27	2.71	1.59	3.00	4.14	1.70	1.44
T4	2.77	1.44	2.68	1.30	1.47	1.11	1.45	4.58

Descriptor results

Kernel density plots

(violin plots)



Descriptor results

1. Inter-speaker variability:
   - some inter-speaker variability
     - pitch height descriptor *mid* varies for tones but not so much for speakers
     - *low* varies strongly for Speaker B but not for Speaker A
     - higher score of *high* for Speaker A: overall higher pitch
2. MANOVA
   - fixed factors: tone type, pitch descriptor, dialect, speaker, with interactions
   - significant effects: dialect region, pitch descriptor
   - strong interactions
     - tone + descriptor, speaker + descriptor
     - dialect + tone + shape (multiinteraction)

Descriptor results: MANOVA

Fixed factors:

- tone type, pitch descriptor, dialect , speaker, with interactions

Significant effects:

- dialect region, pitch descriptor

Strong interactions:

- tone + descriptor, speaker + descriptor
- multiinteraction: dialect + tone + shape

Factors	Df	Sum Sq	Mean Sq	F	p
dial	16	480	30	12.966	<0.001
descr.	1	123	123.19	53.252	<0.001
tone:descr.	1	130	130.39	56.365	<0.001
sp.:descr	1	38	38.26	16.54	<.0001
dial:tone:descr	16	89	5.58	2.413	<0.01

Hierarchical Clustering

Method:

- a distance matrix is maintained at each iteration; the *d*[*i*,*j*] entry corresponds to the distance between cluster and components (here: Pearson distance)
- distance matrix updated to reflect distance of the newly formed cluster with remaining clusters
- classifiers:
  - Nearest Point Algorithm.
  - Farthest Point Algorithm (Voor Hees Algorithm)
  - Unweighted Pair Group Method with Averaging
  - Weighted Pair Group Method with Averaging
  - Unweighted Pair Group Method with Centroid Averaging (Median)
  - Weighted Pair Group Method with Centroid Averaging (Median)
  - Ward variance minimization (incremental)

https://docs.scipy.org/doc/scipy/reference/generated/scipy.cluster.hierarchy.linkage.html

HIERARCHICAL CLUSTERING

Pearson Distance classification, 7 clustering algorithms

→ Ward incremental variance minimisation

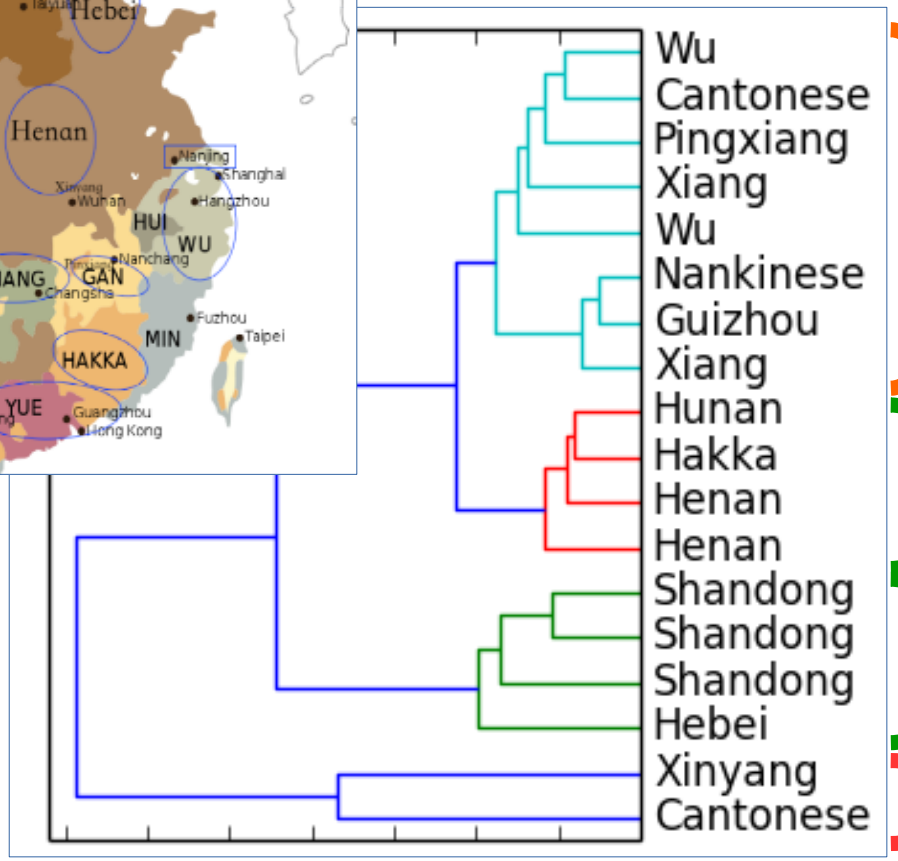
Comparison with geographical location

- Shandong+Hebei:
  - geographically close, N. Mandarin
- Hunan, Hakka, Henan:
  - geographically close, historically related
- others:
  - prosodic typology partly plausible, geography and history less so

Noise due small data set with large number of classes

- inaccuracies and normative element in self-ascription
- language graduates, strong influence of standard Mandarin

HIERARCHICAL CLUSTERING



Geographically and/or historically distant pairs:

WU-Cantonese, Nankinese-Guizhou, Henan-Hebei-Wu, Henan-Hebei, Xiang-Wu, Xinyang-Cantonese

Xiang, Wu, Pingxiang, Cantonese: *typol. rel.: 5-9 tones, 2 registers*

geog. close, hist. related

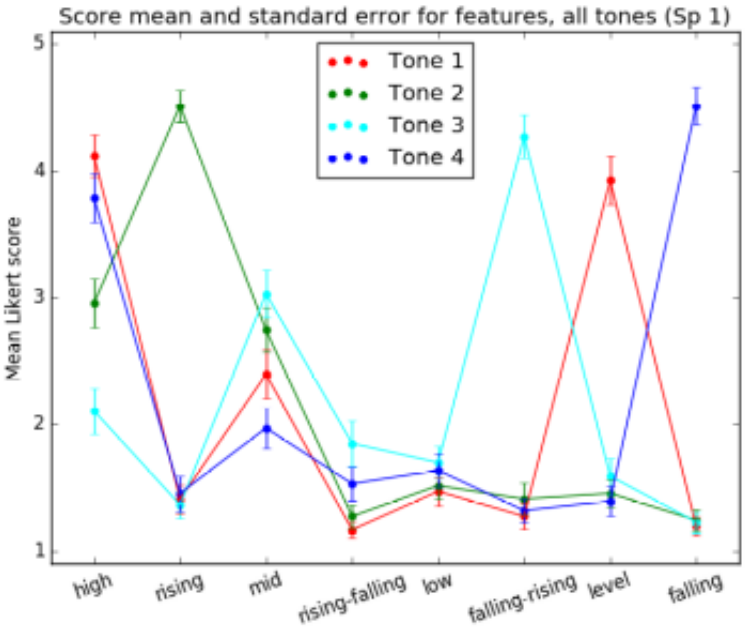
geog. close, N. Mandarin

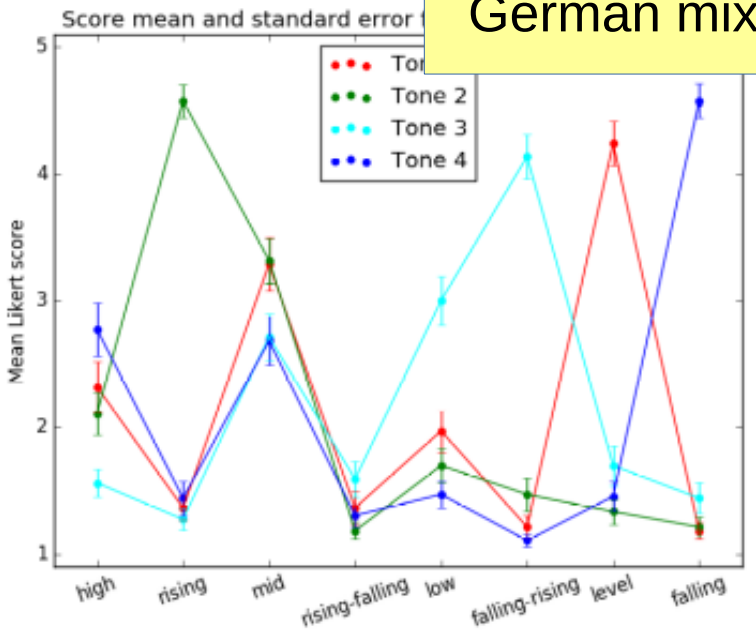
implausible

Variability in Mandarin Tone Perception

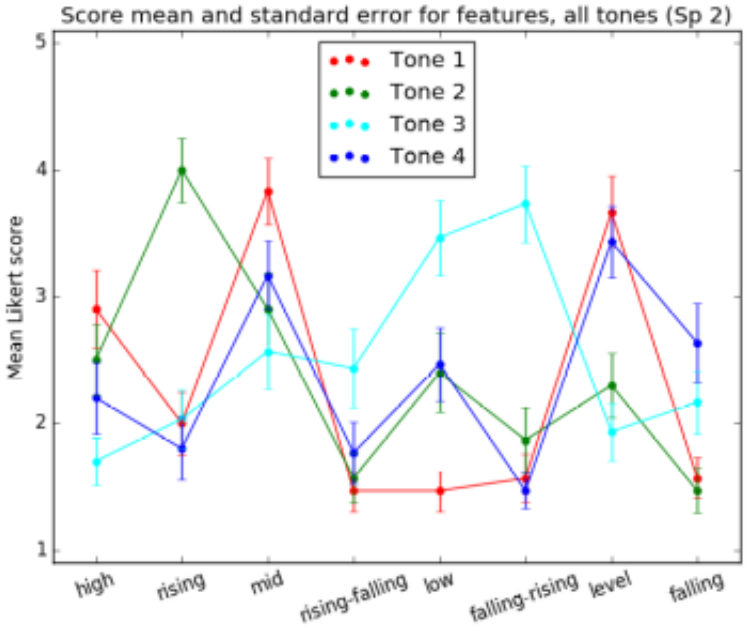
Mandarin
vs.
German mixed

Mandarin responders





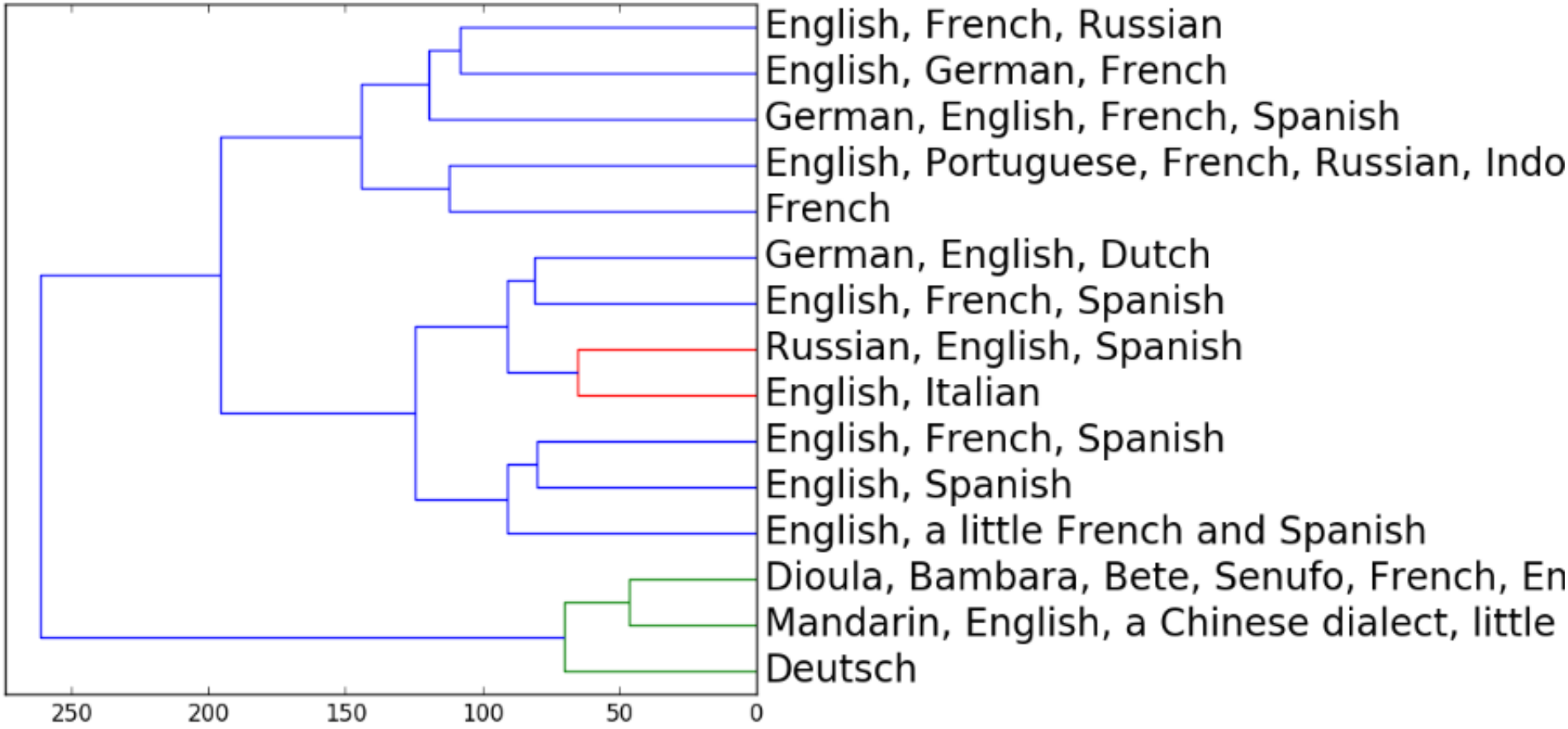
German (&c.) responders



HIERARCHICAL CLUSTERING

An experiment with an *ad hoc* group of German linguistics students, plus guests.

Check the clusters – do any seem particularly interesting?



Conclusions on tone descriptor assignment

Main descriptive outcomes

- expected: contour unlike height descriptors
  - canonical descriptors more consistent: categorial perception
- significant effects
  - dialect, descriptor; interactions for tone + descriptor, speaker + descriptor, dialect + tone + descriptor

Classification

- partly plausible classification results
- despite small dataset – but more data needed

Main strategic outcome

- the novel method is fit for purpose for planning
  - a larger dialect survey
  - more complex contextual data: tone sandhi, accent, intonation
  - more systematic dialect classification for self-ascription
  - more speakers, gender balance, socio-economic information

The Dialectometric Method

Gibbon, Dafydd. 2018. Legacy Language Atlas Data Mining: Mapping Kru Languages. LREC 2016.

Internet: http://wwwhomes.uni-bielefeld.de/gibbon/DistGraph

Language Documentation: Cooperation with Different Methods

Linguistic Fieldwork

- interviews, questionnaires,
- structured elicitation, experiments

Language Description

- phonetics, phonology, morphology lexicon, syntax, discourse
- semantics, pragmatics
- typology, history

Language Documentation

- standard formats
- storage and search
- multimedia document production

Computational Methods

- **computational linguistics**
  - production, perception, learning models
  - dialectometry, stylometry
- **speech and language technologies**

ARCHIVE

Recordings
Transcriptions
Annotations
Phonetics, Phonology
Lexicon
Grammar
Discourse description

Sociolinguistic descripton
Language Atlas

The Dialectometric Method

- **Case Study**

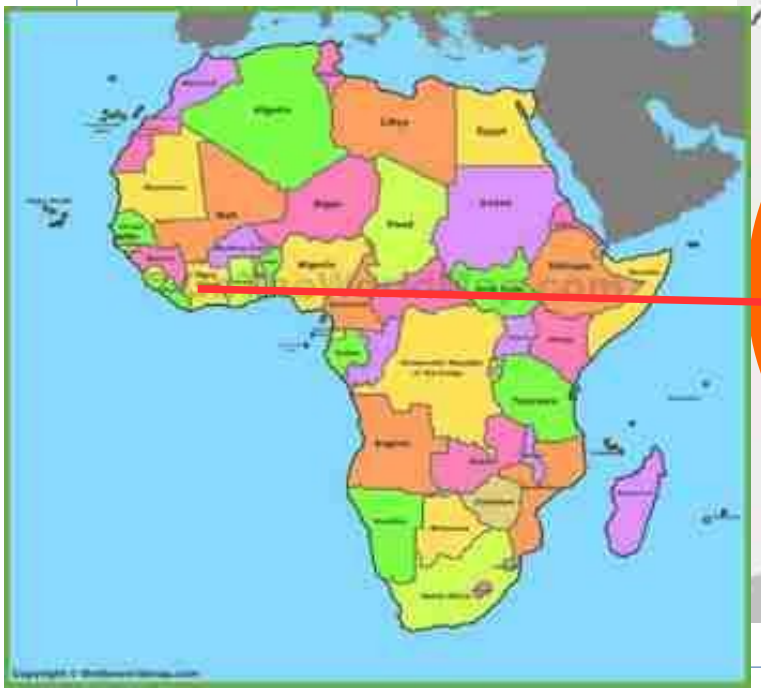
  Kru languages

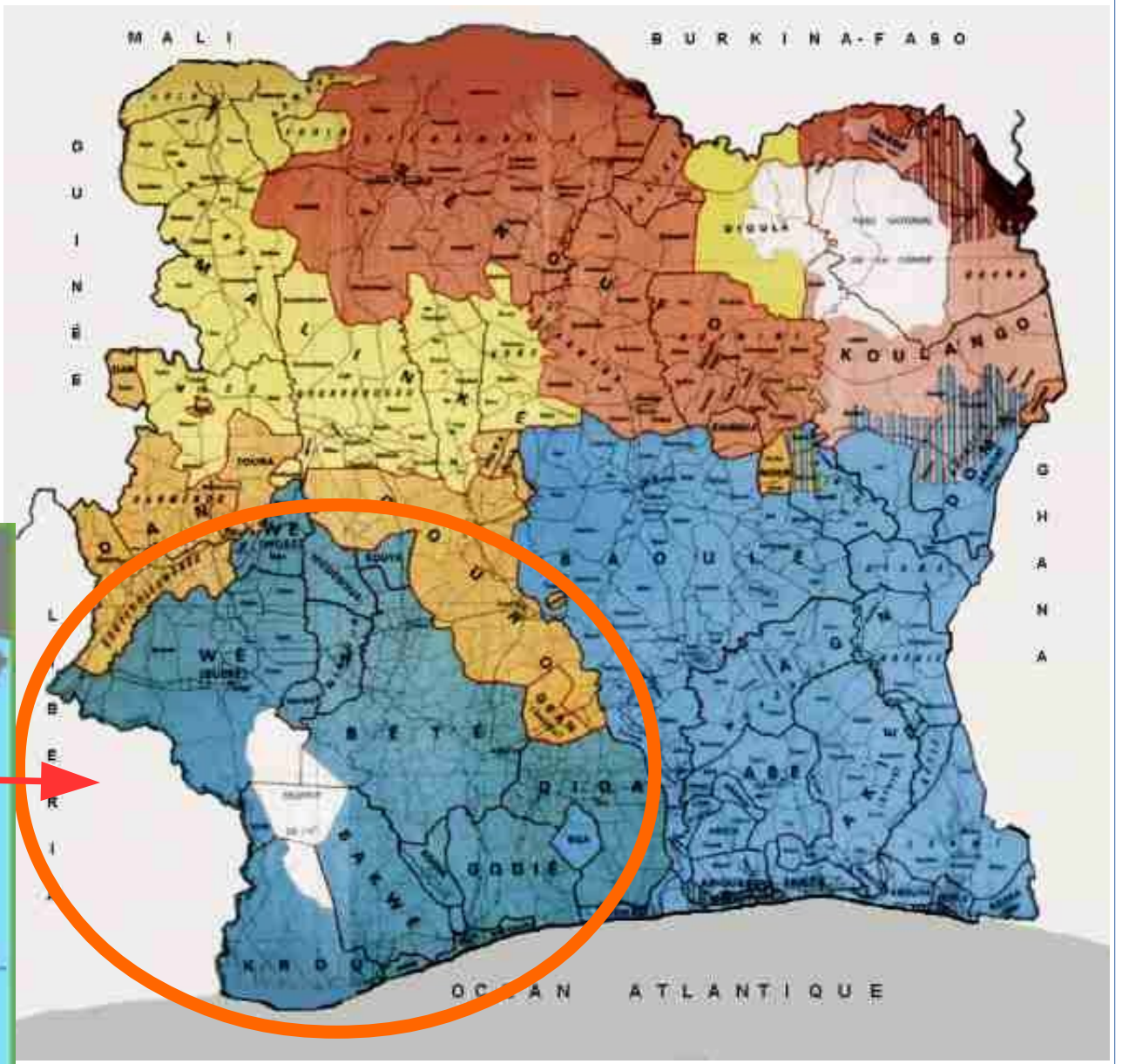
  Niger-Congo (1538)

  Atlantic-Congo (1441)

  Volta-Congo (1367)

  - Kru (3)





The Dialectometric Method

Language typology:

- classification of languages according to their linguistic similarities and differences

- **Case study:**
  - Legacy data from language atlas of Ivory Coast languages
  - Kru languages of Ivory Coast
  - Comparison of consonant inventories for similarities and differences

    Notes:
    - The comparison of vocabulary similarities and differences is more common
    - However, consonant inventories are more stable

Niger-Congo (1537)
- Atlantic-Congo (1440)
  - Volta-Congo (1367)
    - Kru (39)
      - Aizi (3)
      - Eastern (11)
        - Bakwe (2)
        - Bete (5)
        - Dida (3)
        - Kwadia (1)
        - Kuwaa (1)
      - Seme (1)
      - Western (23)
        - Bassa (3)
        - Grebo (9)
        - Klao (2)
        - Wee

The Dialectometric Method

Language typology:

- classification of languages according to their linguistic similarities and differences

- **Case study:**
  - Legacy data fro
    of Ivory Coast la
  - Kru languages c
  - Comparison of c
    inventories for s
    differences

    Notes:
    - The comparison of vocabulary similarities and differences is more common
    - However, consonant inventories are more stable

Case study of consonants

Also applicable to prosody, e.g. tones, pitch accents, ...

Niger-Congo (1537)
- Atlantic-Congo (1440)
  - Volta-Congo (1367)
    - Kru (39)
      - Aizi (3)
      - Seme (1)
      - Western (23)
        - Bassa (3)
        - Grebo (9)
        - Klao (2)
        - Wee

The Dialectometric Method: Legacy Data

Language atlas

Marchese, Lynell. 1984. *Atlas linguistique kru*. Agence de coopération culturelle et technique, Université d'Abidjan, 3ème éd.

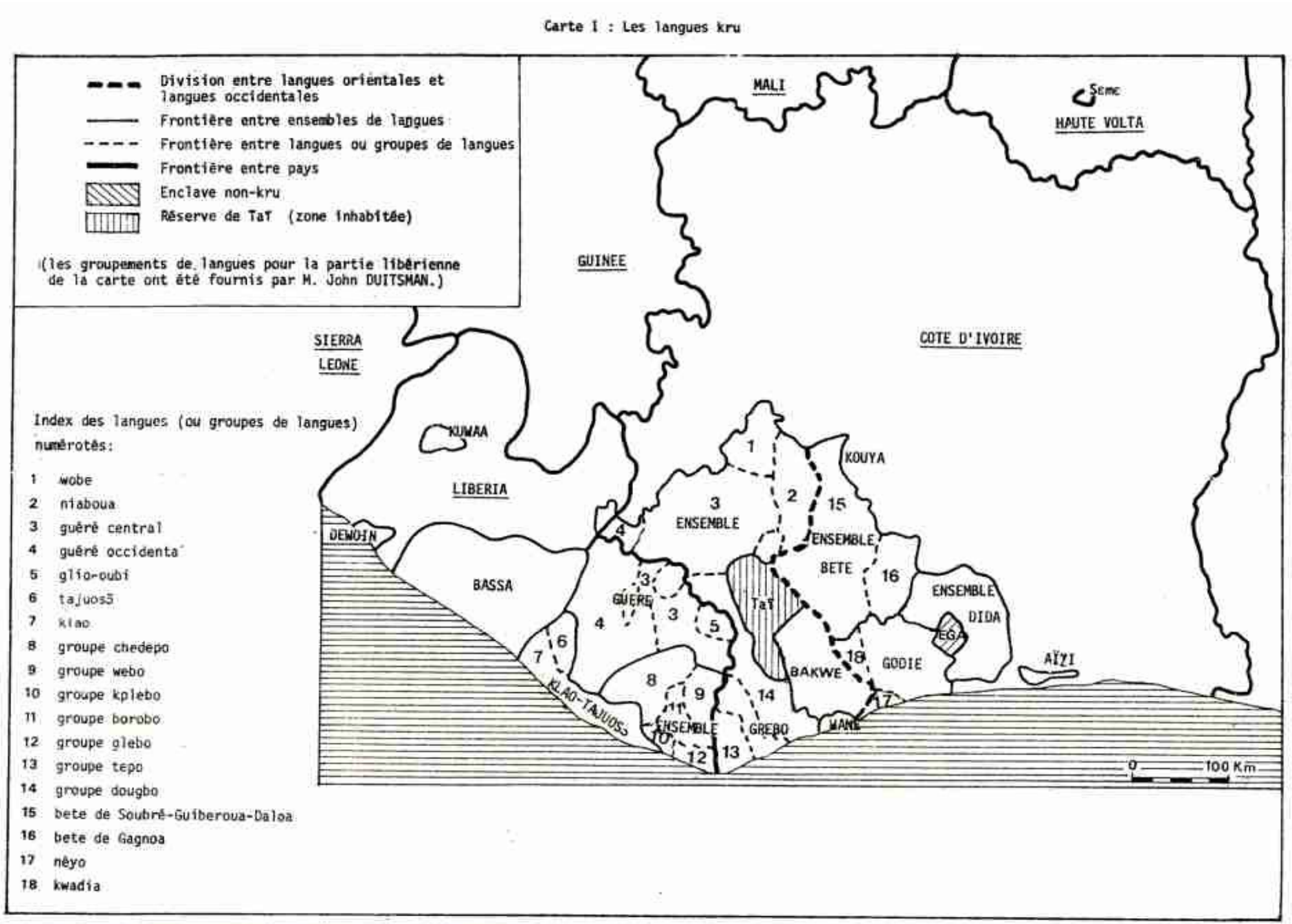
Contents: language sketch tables & maps for 19 languages

Selection: consonant inventories for 19 languages, 44 different consonants

Why consonants, not lexical items?

- Lexical items are highly heterogeneous, easily borrowed
- Consonant systems are relatively stable, slow changing
- Consonant change laws are well-established for many language families (cf. Grimm's Law, Verner's Law, High German Sound Shift)

The Dialectometric Method



The Dialectometric Method

Godié de Dakpadou et Lagako (Marchese, 1975)	Koyo (Kokora, 1976, p. 23)
p t c k kp kw b d ɟ g gb gw f s v z ɓ l j ɣ w m n ɲ ŋ ŋw	p t c k kp C^w C^j b d ɟ g gb f s v z ɓ l j $ɣ^{(2)}$ w m n ɲ ŋ
Dida de Lozoua (Gratrix)	**dida-f (vata) (Siméon, Dugas, Kaye, Koopman, 1981)**
p t c k kp kw b d ɟ g gb gw f s v z ɓ l j ɣ w m n ɲ ŋ ŋw	p t c k kp kw b d ɟ g gb gw f s v z m n ɲ ŋ $ŋm^{(3)}$ ɓ l j ɣ w

The Dialectometric Method: Classification

Input:

- Data table
  - in CSV (Character Separated Value) format
- Table rows:
  - languages
- Table columns:
  - consonants

Data type:

- consonant phoneme inventories of Kru languages
- conspicuous properties:
  - labiovelar consonants

    kp, gb, Nw

```
Bete;p;t;c;k;kp;kw;_;b;d;C;_;g;gb;_;f;s;_;v;z;_;_;_;B;_;l;j;x;w;m;n;J;N;Nw;_;_;_;_;_;_;_;_;_;_
Godie;p;t;c;k;kp;kw;_;b;d;C;_;g;gb;gw;f;s;_;v;z;_;_;_;B;_;l;j;x;w;m;n;J;N;Nw;_;_;_;_;_;_;_;_;_
Koyo;p;t;c;k;kp;kw;kj;b;d;C;_;g;gb;_;f;s;_;v;z;_;_;_;B;_;l;j;x;w;m;n;J;N;_;_;_;_;_;_;_;_;_;_
Neyo;p;t;c;k;kp;kw;_;b;d;C;_;g;gb;_;f;s;_;v;z;_;_;_;B;_;l;j;x;w;m;n;J;N;_;_;_;_;_;_;_;_;_;_
DidaDeLozoua;p;t;c;k;kp;kw;_;b;d;C;_;g;gb;gw;f;s;_;v;z;_;_;_;B;_;l;j;x;w;m;n;J;N;Nw;_;_;_;_;_;_;_;_;_
DidaF;p;t;c;k;kp;kw;_;b;d;C;_;g;gb;gw;f;s;_;v;z;_;_;_;B;_;l;j;x;w;m;n;J;N;_;Nm;_;_;_;_;_;_;_;_;_
Wobe;p;t;c;k;kp;kw;_;b;d;C;_;_;gb;_;f;s;_;_;_;_;_;_;_;_;_;_;w;m;n;J;_;Nw;Nm;km;_;_;_;_;_;_;_;_
Guere;p;t;c;k;kp;kw;_;b;d;C;_;g;gb;gw;f;s;_;v;z;_;_;_;B;D;l;j;_;w;m;n;J;_;Nw;Nm;km;_;_;_;_;_;_;_;_
Krahn;p;t;c;k;_;kw;_;b;d;C;_;_;gb;_;f;s;_;_;_;_;_;_;_;_;l;_;_;w;m;n;J;_;_;_;_;_;_;_;_;_;_;_;_
Cedepo;p;t;c;k;kp;kw;_;b;d;C;_;_;gb;_;f;s;_;_;_;_;h;_;_;_;l;_;_;_;m;n;J;_;_;Nm;_;_;_;_;_;_;_;_;_
Klao;p;t;c;k;kp;kw;_;b;d;C;_;_;gb;_;f;s;_;_;_;_;_;_;_;_;l;j;_;w;m;n;J;_;_;Nm;_;_;_;_;_;_;_;_;_
Niaboua;p;t;c;k;kp;kw;_;b;d;C;_;g;gb;gw;f;s;_;v;z;_;_;_;B;_;l;j;_;w;m;n;J;_;_;_;_;_;_;_;_;_;_;_
Dewoin;p;t;_;k;kp;kw;_;b;d;C;_;g;gb;gw;f;s;_;v;z;_;_;_;B;_;l;j;_;w;m;n;J;N;_;_;_;_;_;_;_;_;_;_
Bassa;p;t;c;k;kp;_;_;b;d;C;dj;g;gb;_;f;s;_;v;z;_;h;hw;B;_;l;_;_;w;m;n;J;_;Nw;_;_;_;_;_;_;_;_;_
Grebo;p;t;c;k;kp;_;_;b;d;C;_;g;gb;_;f;s;_;_;_;_;h;hw;_;_;l;j;_;w;m;n;J;N;Nw;Nm;_;_;hm;hn;hl;_;_;_;_
Tepo;p;t;c;k;_;kw;_;b;d;C;_;g;gb;_;f;s;_;_;_;_;h;_;_;_;l;j;_;w;m;n;J;N;_;Nm;_;_;_;_;_;_;_;_;_
KuwaaLiberia;p;t;_;k;kp;kw;_;b;d;C;_;_;_;_;f;s;_;_;_;_;_;_;_;_;l;j;x;w;m;n;J;N;_;_;_;_;_;_;_;mb;nd;nC;Ng;Nmgb
SemeHauteVolta;p;t;c;k;kp;_;_;b;d;C;_;g;gb;_;f;s;S;v;_;_;h;_;_;_;l;j;_;w;m;n;J;_;_;_;_;gm;_;_;_;_;_;_;_;_
AiziCdI;p;t;c;k;kp;_;_;b;d;C;_;g;gb;_;f;s;S;v;z;Z;_;_;_;_;l;j;_;w;m;n;J;N;_;_;_;_;_;_;_;_;_;_;_
```

The Dialectometric Method: Classification

Input:

- Data table
  - in CSV (Character Separated Value) format
- Table rows:
  - languages
- Table columns:
  - consonants

Data type:

- consonant phoneme inventories of Kru languages
- conspicuous properties:
  - labiovelar consonants

    kp, gb, Nw

Bete	p	t	c	k	kp	kw	_	b	d	C	_	g	gb	_	f	s	_	v	z	_	_	_	B	_	l	j	x	w	m	n	J	N	Nw	_	_	_	_	_	_	_	_	_	_	_
Godie	p	t	c	k	kp	kw	_	b	d	C	_	g	gb	gw	f	s	_	v	z	_	_	_	B	_	l	j	x	w	m	n	J	N	Nw	_	_	_	_	_	_	_	_	_	_	_
Koyo	p	t	c	k	kp	kw	kj	b	d	C	_	g	gb	_	f	s	_	v	z	_	_	_	B	_	l	j	x	w	m	n	J	N	_	_	_	_	_	_	_	_	_	_	_	_
Neyo	p	t	c	k	kp	kw	_	b	d	C	_	g	gb	_	f	s	_	v	z	_	_	_	B	_	l	j	x	w	m	n	J	N	_	_	_	_	_	_	_	_	_	_	_	_
DidaDeLozoua	p	t	c	k	kp	kw	_	b	d	C	_	g	gb	gw	f	s	_	v	z	_	_	_	B	_	l	j	x	w	m	n	J	N	Nw	_	_	_	_	_	_	_	_	_	_	_
DidaF	p	t	c	k	kp	kw	_	b	d	C	_	g	gb	gw	f	s	_	v	z	_	_	_	B	_	l	j	x	w	m	n	J	N	_	Nm	_	_	_	_	_	_	_	_	_	_
Wobe	p	t	c	k	kp	kw	_	b	d	C	_	_	gb	_	f	s	_	_	_	_	_	_	_	_	_		_	w	m	n	J	_	Nw	Nm	km	_	_	_	_	_	_	_	_	_
Guere	p	t	c	k	kp	kw	_	b	d	C	_	g	gb	gw	f	s	_	v	z	_	_	_	B	D	l	j	_	w	m	n	J	_	Nw	Nm	km	_	_	_	_	_	_	_	_	_
Krahn	p	t	c	k	_	kw	_	b	d	C	_	_	gb	_	f	s	_	_	_	_	_	_	_	_	l	_	_	w	m	n	J	_	_	_	_	_	_	_	_	_	_	_	_	_
Cedepo	p	t	c	k	kp	kw	_	b	d	C	_	_	gb	_	f	s	_	_	_	_	h	_	_	_	l	_	_	_	m	n	J	_	_	Nm	_	_	_	_	_	_	_	_	_	_
Klao	p	t	c	k	kp	kw	_	b	d	C	_	_	gb	_	f	s	_	_	_	_	_	_	_	_	l	j	_	w	m	n	J	_	_	Nm	_	_	_	_	_	_	_	_	_	_
Niaboua	p	t	c	k	kp	kw	_	b	d	C	_	g	gb	gw	f	s	_	v	z	_	_	_	B	_	l	j	_	w	m	n	J	_	_	_	_	_	_	_	_	_	_	_	_	_
Dewoin	p	t	_	k	kp	kw	_	b	d	C	_	g	gb	gw	f	s	_	v	z	_	_	_	B	_	l	j	_	w	m	n	J	N	_	_	_	_	_	_	_	_	_	_	_	_
Bassa	p	t	c	k	kp	_	_	b	d	C	dj	g	gb	_	f	s	_	v	z	_	h	hw	B	_	l	_	_	w	m	n	J	_	Nw	_	_	_	_	_	_	_	_	_	_	_
Grebo	p	t	c	k	kp	_	_	b	d	C	_	g	gb	_	f	s	_	_	_	_	h	hw	_	_	l	j	_	w	m	n	J	N	Nw	Nm	_	_	hm	hn	hl	_	_	_	_	_
Tepo	p	t	c	k	_	kw	_	b	d	C	_	g	gb	_	f	s	_	_	_	_	h	_	_	_	l	j	_	w	m	n	J	N	_	Nm	_	_	_	_	_	_	_	_	_	_
KuwaaLiberia	p	t	_	k	kp	kw	_	b	d	C	_	_	_	_	f	s	_	_	_	_	_	_	_	_	l	j	x	w	m	n	J	N	_	_	_	_	_	_	_	mb	nd	nC	Ng	Nmgb
SemeHauteVolta	p	t	c	k	kp	_	_	b	d	C	_	g	gb	_	f	s	S	v	_	_	h	_	_	_	l	j	_	w	m	n	J	_	_	_	_	gm	_	_	_	_	_	_	_	_
AiziCdI	p	t	c	k	kp	_	_	b	d	C	_	g	gb	_	f	s	S	v	z	Z	_	_	_	_	l	j	_	w	m	n	J	N	_	_	_	_	_	_	_	_	_	_	_	_

The Dialectometric Method: Classification

Input:

- 19 ordered consonant sets x 44 features (consonants)

Outputs:

- pairwise difference matrix (Hamming distance)
- feature ranking list (variance)
- distance distribution histogram
- table of average distance/isolation
- table of specific pairwise differences

Implementation

Internet server:

- HTML → CGI → HTML+graphics
- Linux, Windows (public & localhost)
- Python 2.7
  - Graphics
    - GraphViz neato engine (line drawings)
    - SciPy + MatPlotLib (dendrogram)

Internet client:

- (almost) any browser
- resource demo:
  - localhost on laptop

The Dialectometric Method: Differences as Distances

Count the pairwise distances between each row and each other row.

- 'Hamming Edit Distance':
  - For each column, if they are different, the values is 1, otherwise 0
  - Add the differences

An example comparing English words:

s t r i p

s p r a t

Same or different?

0 1 0 1 1 = 3

Create a 'distance table' for all language pairs

The Dialectometric Method: Differences as Distances

Bete	0	1	2	1	1	3	10	6	9	11	8	4	4	7	11	8	12	9	6
Godie	1	0	3	2	0	2	11	5	10	12	9	3	3	8	12	9	13	10	7
Koyo	2	3	0	1	3	3	12	8	9	11	8	4	4	9	13	8	12	9	6
Neyo	1	2	1	0	2	2	11	7	8	10	7	3	3	8	12	7	11	8	5
DidaDeLozoua	1	0	3	2	0	2	11	5	10	12	9	3	3	8	12	9	13	10	7
DidaF	3	2	3	2	2	0	11	5	10	10	7	3	3	10	12	7	13	10	7
Wobe	10	11	12	11	11	11	0	8	6	6	4	10	12	12	11	8	14	11	12
Guere	6	5	8	7	5	5	8	0	11	11	8	4	6	9	13	10	18	11	10
Krahn	9	10	9	8	10	10	6	11	0	4	3	7	9	10	12	5	11	8	9
Cedepo	11	12	11	10	12	10	6	11	4	0	3	9	11	10	10	5	13	8	11
Klao	8	9	8	7	9	7	4	8	3	3	0	6	8	11	9	4	10	7	8
Niaboua	4	3	4	3	3	3	10	4	7	9	6	0	2	7	13	8	14	7	6
Dewoin	4	3	4	3	3	3	12	6	9	11	8	2	0	9	13	8	12	9	6
Bassa	7	8	9	8	8	10	12	9	10	10	11	7	9	0	10	11	19	8	9
Grebo	11	12	13	12	12	12	11	13	12	10	9	13	13	10	0	7	17	10	11
Tepo	8	9	8	7	9	7	8	10	5	5	4	8	8	11	7	0	12	7	8
KuwaaLiberia	12	13	12	11	13	13	14	18	11	13	10	14	12	19	17	12	0	15	14
SemeHauteVolta	9	10	9	8	10	10	11	11	8	8	7	7	9	8	10	7	15	0	5
AiziCdI	6	7	6	5	7	7	12	10	9	11	8	6	6	9	11	8	14	5	0

The Dialectometric Method

IO parameters

Input table CSV separator:

semicolon

Graphics format:

GIF bitmap graphics (smallest files)

IMPLEMENTATION

Output type:

- *parametrised LED graph*
  (properties of same attributes in same field position)
- *parametrised SIRD graph*
  (use only if properties in different fields are different, i.e. sets)
- *CSV HTML XML formatted input data*
- *CSV HTML XML output of LED distance matrix*
- *CSV HTML XML output of LED distance triples*

Graph parameters

Graph engines (from AT&T GraphViz package):

- *neato spring model*
- *dot undirected graph model*
- *twopi centred circle model*
- *circo circle model*

Numerical parameters:

0 ... 6 *range of distances to be processed (check distance matrix for full data range)*

6 *random seed for neato spring model (trial and error)*

minimal scaling

90 *% graph width (percent of window)*

```
<i>Language Atlas mining:</i><br>Consonant sets of Kru
languages.<br>Data source: Marchese, Lynell. 1984. <i>Atlas
Linguistique des Langues Kru.</i> 3&egrave;me
```

title, comment, etc. (HTML formatting permitted)

```
Bete;p;t;c;k;kp;kw;_;b;d;C;_;g;gb;_;f;s;_;v;z;_;_;_;B;_;l;j;x;w;m;n;J;N;Nw;_;_;_;_;_;_;_;_;_;_
Godie;p;t;c;k;kp;kw;_;b;d;C;_;g;gb;gw;f;s;_;v;z;_;_;_;B;_;l;j;x;w;m;n;J;N;Nw;_;_;_;_;_;_;_;_;_;_
Koyo;p;t;c;k;kp;kw;kj;b;d;C;_;g;gb;_;f;s;_;v;z;_;_;_;B;_;l;j;x;w;m;n;J;N;_;_;_;_;_;_;_;_;_;_;_
Neyo;p;t;c;k;kp;kw;_;b;d;C;_;g;gb;_;f;s;_;v;z;_;_;_;B;_;l;j;x;w;m;n;J;N;_;_;_;_;_;_;_;_;_;_;_
DidaDeLozoua;p;t;c;k;kp;kw;_;b;d;C;_;g;gb;gw;f;s;_;v;z;_;_;_;B;_;l;j;x;w;m;n;J;N;Nw;_;_;_;_;_;_;_;_;_;_;_
DidaF;p;t;c;k;kp;kw;_;b;d;C;_;g;gb;gw;f;s;_;v;z;_;_;_;B;_;l;j;x;w;m;n;J;N;_;Nm;_;_;_;_;_;_;_;_;_;_
Wobe;p;t;c;k;kp;kw;_;b;d;C;_;_;gb;_;f;s;_;_;_;_;_;_;_;_;_;_;_;w;m;n;J;_;Nw;Nm;km;_;_;_;_;_;_;_;_;_
Guere;p;t;c;k;kp;kw;_;b;d;C;_;g;gb;gw;f;s;_;v;z;_;_;_;B;D;l;j;_;w;m;n;J;_;Nw;Nm;km;_;_;_;_;_;_;_;_;_
Krahn;p;t;c;k;_;kw;_;b;d;C;_;_;gb;_;f;s;_;_;_;_;_;_;_;_;_;l;_;_;w;m;n;J;_;_;_;_;_;_;_;_;_;_;_;_;_
Cedepo;p;t;c;k;kp;kw;_;b;d;C;_;_;gb;_;f;s;_;_;_;_;_;h;_;_;_;l;_;_;_;m;n;J;_;_;Nm;_;_;_;_;_;_;_;_;_;_
Klao;p;t;c;k;kp;kw;_;b;d;C;_;_;gb;_;f;s;_;_;_;_;_;_;_;_;_;l;j;_;w;m;n;J;_;_;Nm;_;_;_;_;_;_;_;_;_;_
Niaboua;p;t;c;k;kp;kw;_;b;d;C;_;g;gb;gw;f;s;_;v;z;_;_;_;B;_;l;j;_;w;m;n;J;_;_;_;_;_;_;_;_;_;_;_;_;_
Dewoin;p;t;_;k;kp;kw;_;b;d;C;_;g;gb;gw;f;s;_;v;z;_;_;_;B;_;l;j;_;w;m;n;J;N;_;_;_;_;_;_;_;_;_;_;_
Bassa;p;t;c;k;kp;_;_;b;d;C;dj;g;gb;_;f;s;_;v;z;_;h;hw;B;_;l;_;_;w;m;n;J;_;Nw;_;_;_;_;_;_;_;_;_;_
Grebo;p;t;c;k;kp;_;_;b;d;C;_;g;gb;_;f;s;_;_;_;_;h;hw;_;_;l;j;_;w;m;n;J;N;Nw;Nm;_;_;hm;hn;hl;_;_;_;_;_
Tepo;p;t;c;k;_;kw;_;b;d;C;_;g;gb;_;f;s;_;_;_;_;h;_;_;_;l;j;_;w;m;n;J;N;_;Nm;_;_;_;_;_;_;_;_;_;_
KuwaaLiberia;p;t;_;k;kp;kw;_;b;d;C;_;_;_;_;_;f;s;_;_;_;_;_;_;_;_;l;j;x;w;m;n;J;N;_;_;_;_;_;_;_;mb;nd;nC;Ng;Nmgb
SemeHauteVolta;p;t;c;k;kp;_;_;b;d;C;_;g;gb;_;f;s;S;v;_;_;h;_;_;_;l;j;_;w;m;n;J;_;_;_;_;gm;_;_;_;_;_;_;_;_
AiziCdI;p;t;c;k;kp;_;_;b;d;C;_;g;gb;_;f;s;S;v;z;Z;_;_;_;_;l;j;_;w;m;n;J;N;_;_;_;_;_;_;_;_;_;_;_;_;_
```

The Dialectometric Method: Classification

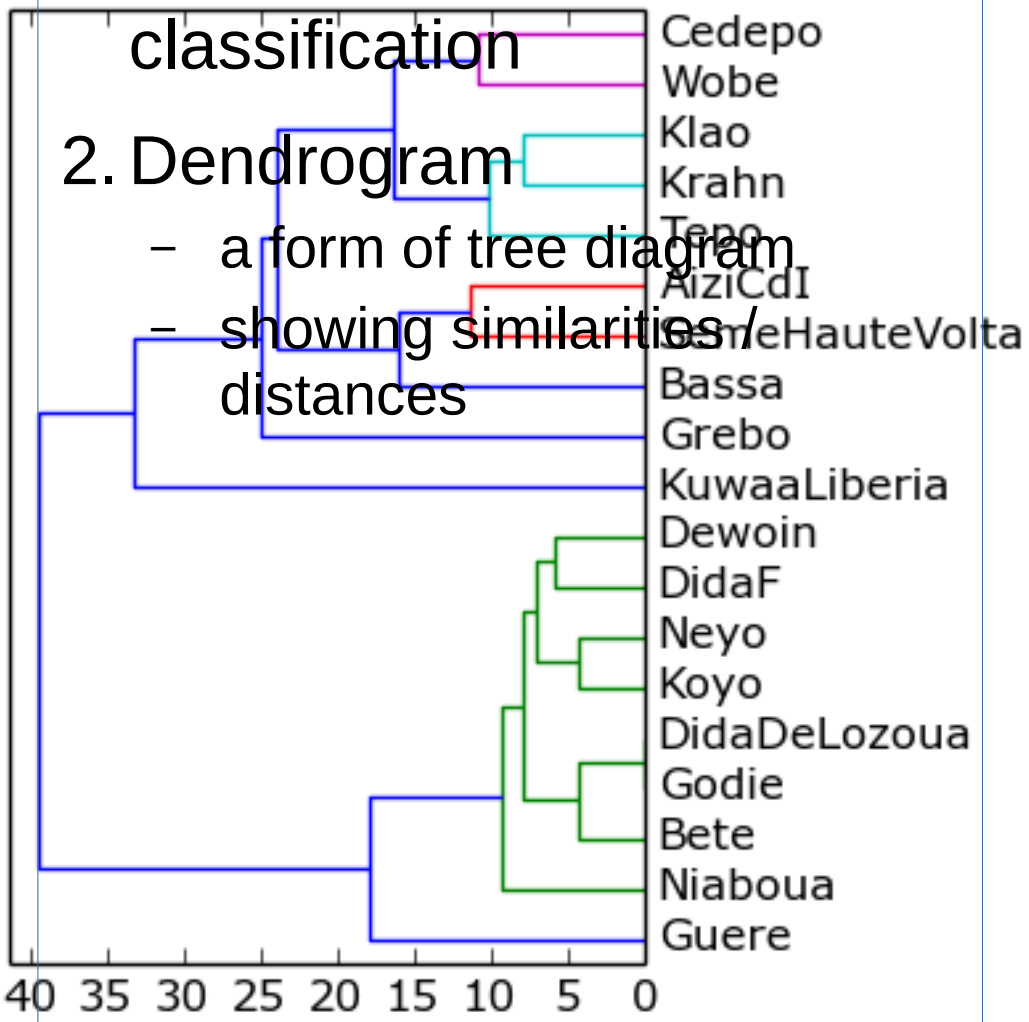
Distance (Difference) Map
(force/spring map)

DIMENSION REDUCTION
CLASSIFICATION
VISUALISATION

Typological Similarity Dendrogram
(hierarchical clustering)

The Dialectometric Method: Classification

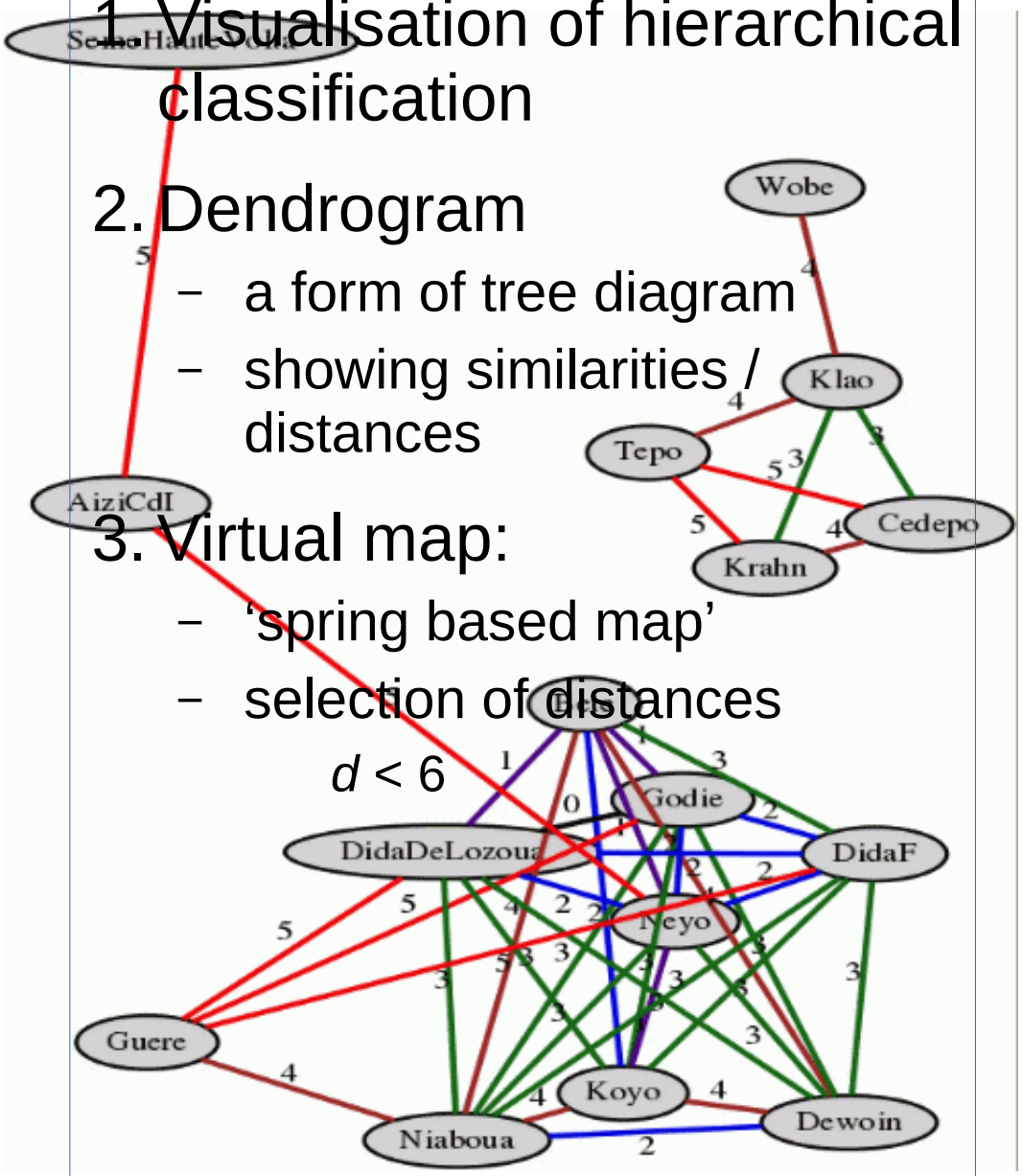
1. Visualisation of hierarchical classification
2. Dendrogram
   - a form of tree diagram
   - showing similarities / distances



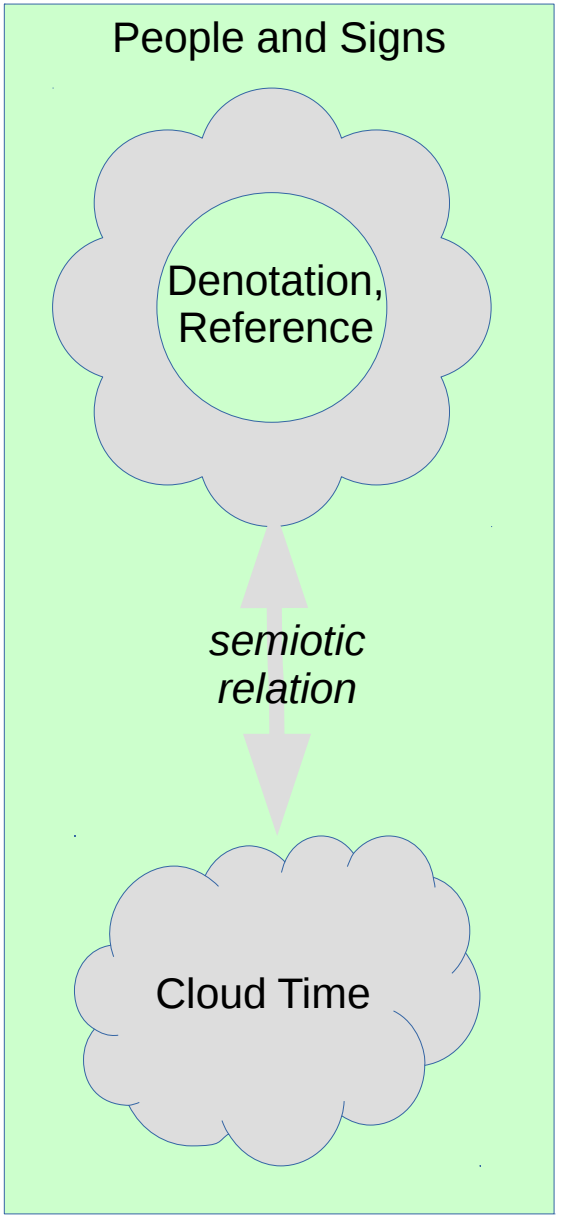
The Dialectometric Method: Classification

1. Visualisation of hierarchical classification
2. Dendrogram
   - a form of tree diagram
   - showing similarities / distances
3. Virtual map:
   - 'spring based map'
   - selection of distances

     $d < 6$



Rank-Interpretation Model of Language



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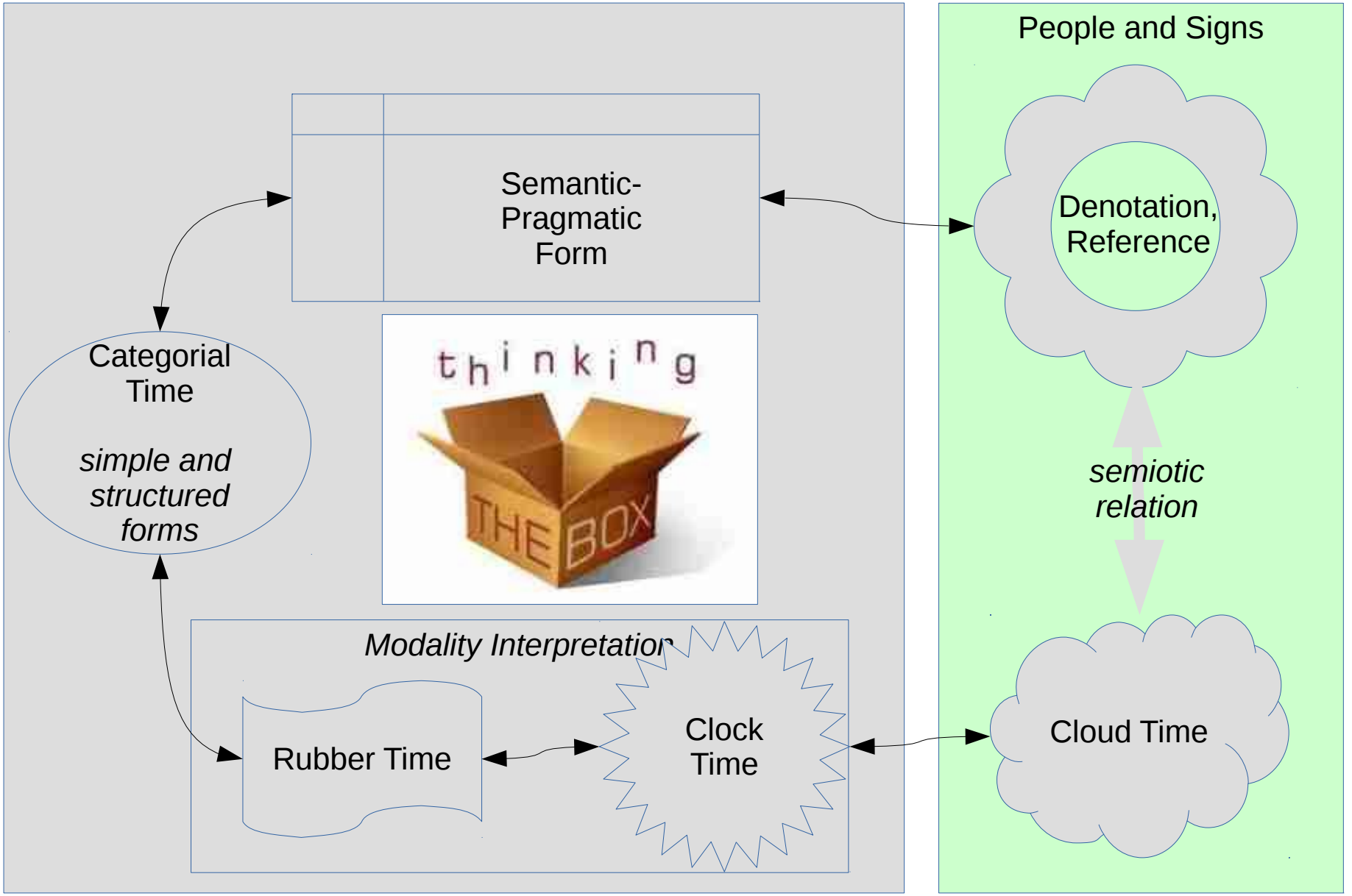
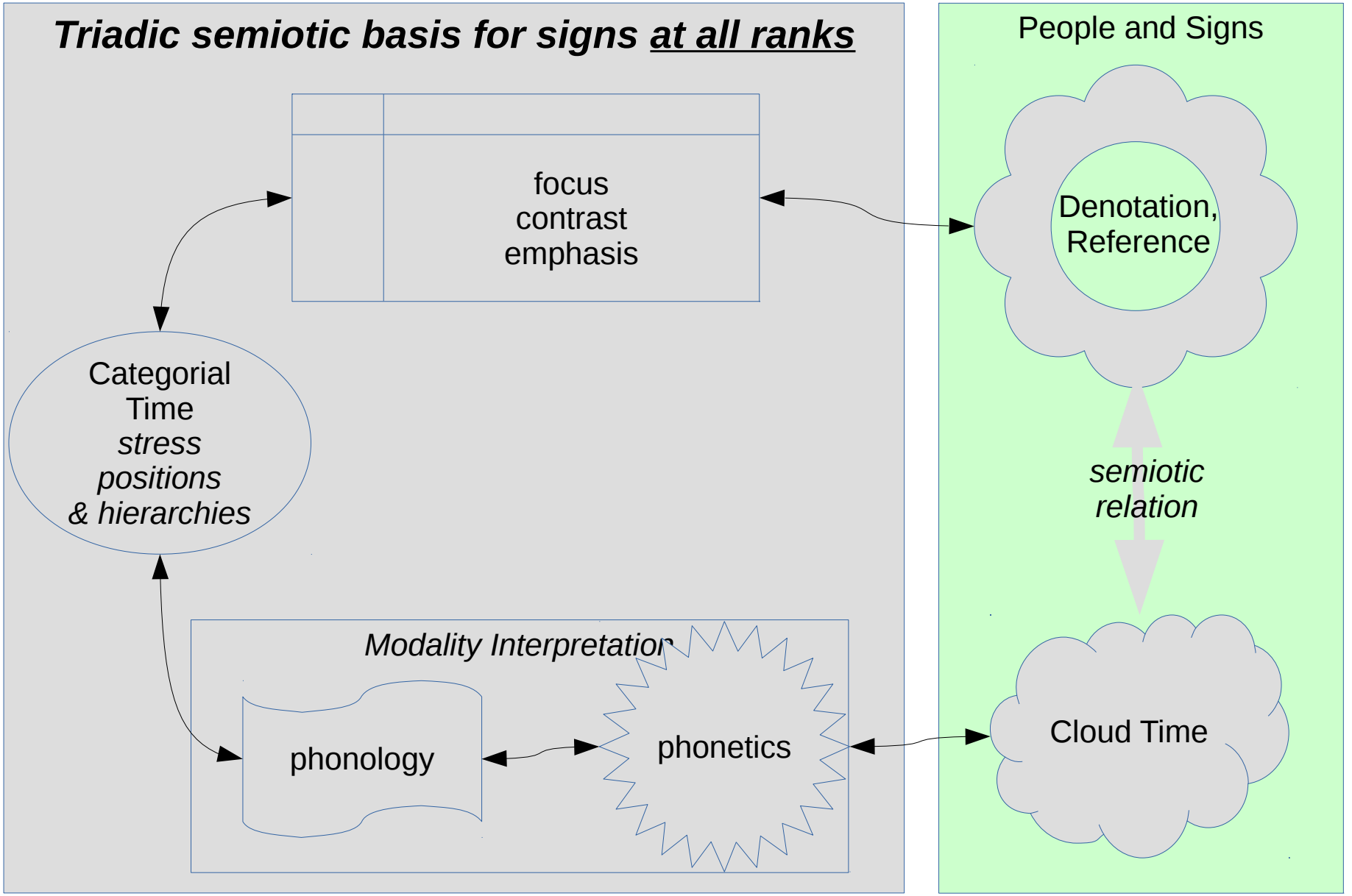


Rank-Interpretation Model of Language



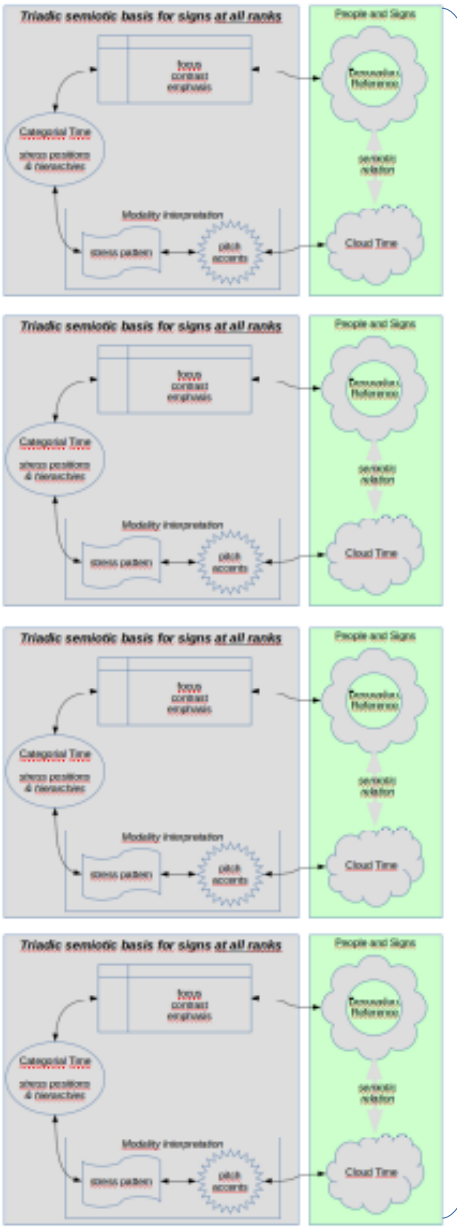
Rank-Interpretation Model of Language

Discourse: Monologue, Dialogue

Utterance: turn, IPU, ...

Sentence, phrase, clause

Word: simple, inflected, compound, derived

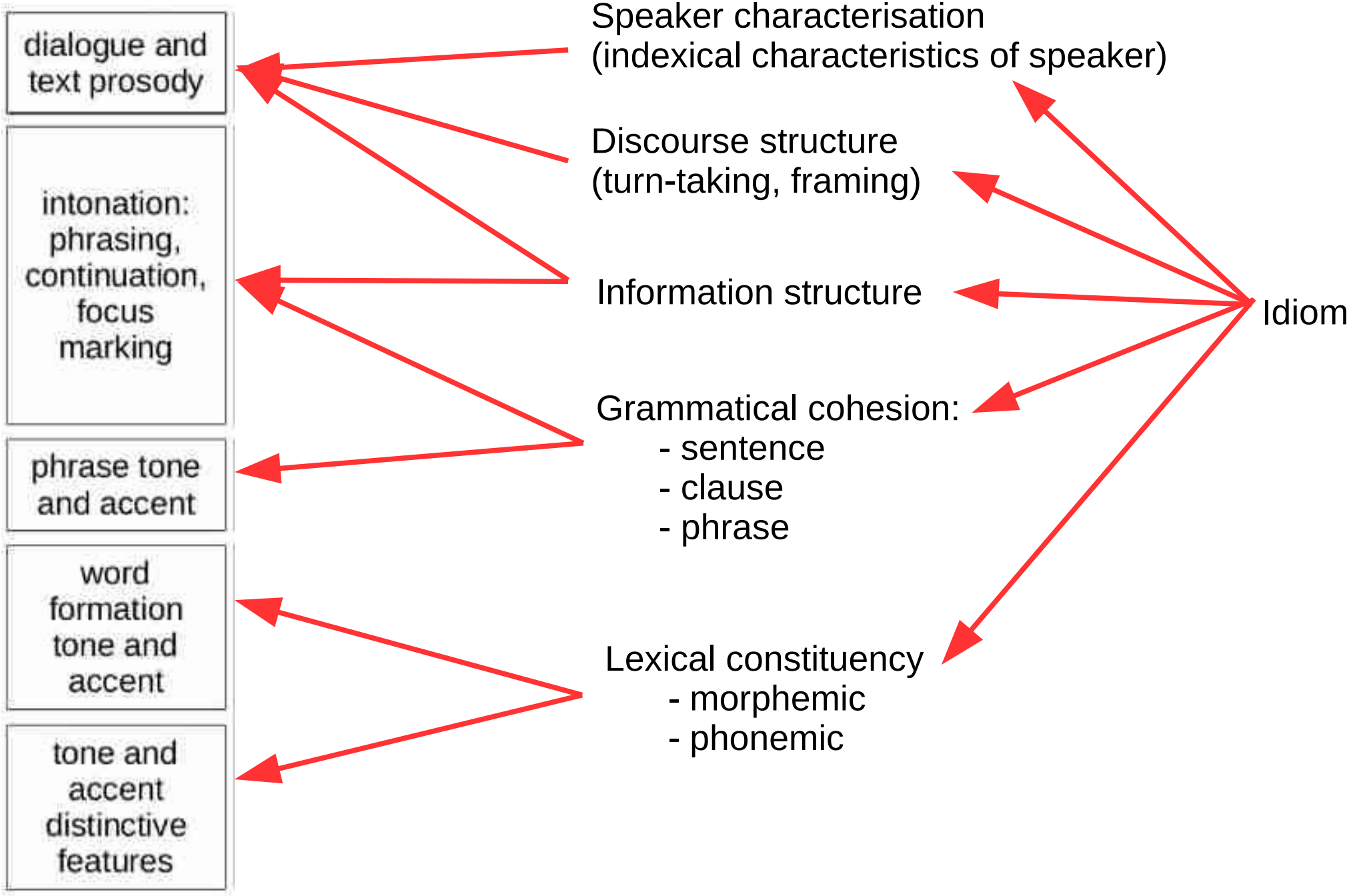


Rank

Interpretation

Architecture

The Rank Interpretation Architecture - Prosody



Discourse functions

- discourse framing
  - “call contours”
  - strategic use of hesitation phenomena, vocalisations
- turn-taking continuity
  - start with high pitch
  - end with low pitch
- dialogue act and speech act marking marking
  - adjacency pair marking

    e.g. question-answer pattern

Hirschberg & Pierrehumbert 1983

"semantico-pragmatic effects":

- structure:
  - discourse segmentation, topic structure
  - parallelism between mentioned items
  - subordination relationships between propositions salient in the discourse
  - topic shift, digression, interruption
  - turn-taking
- semantics:
  - disambiguation of ambiguous utteranaces (MW: scope)
  - appropriate choice of referent (reference resolution)
  - distinction between 'given' and 'new' information (information status: given/new, topic/comment, focus/presupposition)
  - conceptual contrast
  - indirect speech acts (MW: other speech acts, too)

"The central thesis of this work is that there are many ways in which intonation helps to structure discourse."

Discourse structure marking

- **linguistic** structure (phrasing, framing)
  - pitch register, pitch range
- **intentional** structure (purposes, speech acts)
  - pitch accent contour type
  - boundary tone type
- **attitudinal** state (objects, properties, relations, and discourse intentions that are most salient at any given point)
  - accent placement, focus, contrast, emphasis
  - given/new, theme/rheme

Grosz, B. J. and C. L. Sidner. 1986. Attention, intentions and the structure of discourse. BBN report.

Intentional structure: prosody and speech acts

1. Grice 1975: conversational maxims
2. Austin 1962 & Searle 1969:
   - **locutionary acts**:
     - meaning: modality, mood, possibility, predicate & arguments
       - lexical morphemic tone; phrasal intonational meaning
     - metalocutionary acts
       - marking of properties of locutions (boundary tones, accents, ...)
   - **illocutionary acts**:
     - interactive creation of new bond between interlocutors
       - question, promise, command; marriage, official appointment, ...
   - **perlocutionary acts**:
     - creation of an effect by the speaker on the hearer
       - impress, disappoint, interest, excite, bore; praise, insult, ...

Discourse Prosody Case 1: Metalocutionary Framing - Calls

Intonation meaning is 'metalocutionary'

1. Paralinguistic metalocutionary channel
   - two aspects:
     - gradient constraints on pitch/intensity/tempo variation
     - affect, sentiment, attitude
   - not necessarily automatic: can be imitated
2. Linguistic metalocutionary channel
   - information marking – a rough correspondence:

Prague school	**Halliday**	**ToBI**
delimitative	- tonality	- boundary assignment
culminative	- tonicity	- tone assignment
distinctive	- tone	- tone

Metalocutionary discourse framing:

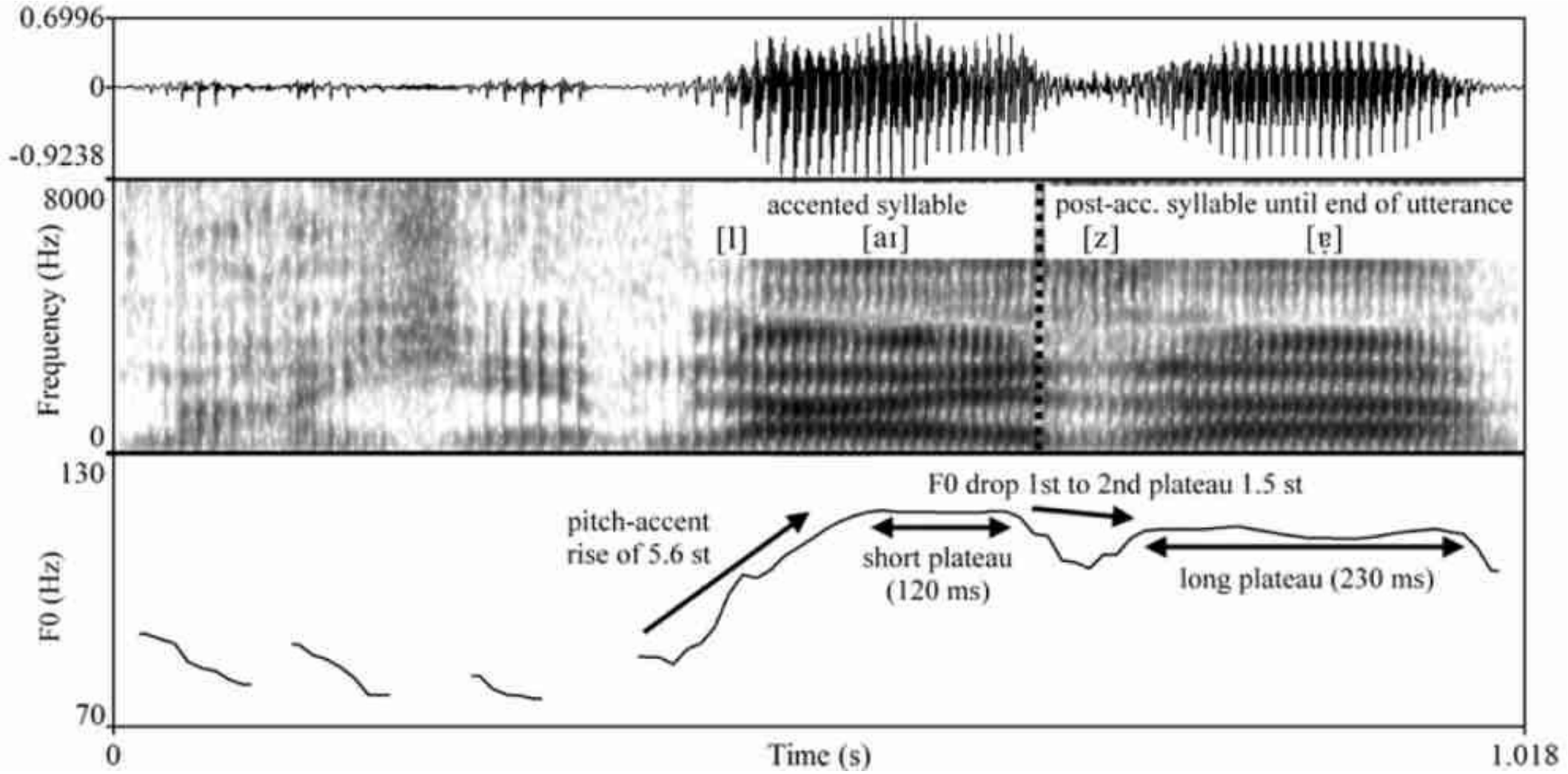
3 basic conditions on speech acts:

- Uptake condition / Channel condition
  - Normal input and output conditions obtain
- Essential condition
  - commitment
- Sincerity condition
  - truth – probability – certainty

Example – “call contours”

- Only discourse framing:
  - Start: “Jooohn-neee!”
  - End: “Byyy-eee!”
  - * Yesterday I saw Jooohn-neee in town.

Metalocutionary discourse framing: German 'call contour'



"Dann mach ich eben leiser!"

Niebuhr, O. 2013. Resistance is futile – the difference between continuation rise and falling contour in German. Interspeech.

Metalocutionary discourse framing:

dialogue and text prosody

intonation: phrasing, continuation, focus marking

phrase tone and accent

word formation tone and accent

tone and accent distinctive features

1. Discourse functions of: “call contour”:
   - Uptake condition / Channel condition
     - Normal input and output conditions obtain
       - **But: missing (English, German), disturbed (German) or closing (English, German) channel**
       - **So normal input and output conditions do NOT obtain!**

ENGLISH: ¯JOHN-NY - ¯BY-E

GERMAN: Manu¯E-LA - - - - ¯LAU-TER - - - - - ¯WIEDER-SEHEN

discourse-initial | discourse-medial | discourse-final

DISCOURSE FRAME TIMELINE →

Discourse Prosody Case 2: Discourse Rhythms

Discourse Prosody Case 2: Discourse Rhythms

AM and FM spectra:

If a spectrum can be derived from the **AM envelope**,
why not derive a spectrum from the **FM track**
and see whether they correlate?

Preliminary answer:

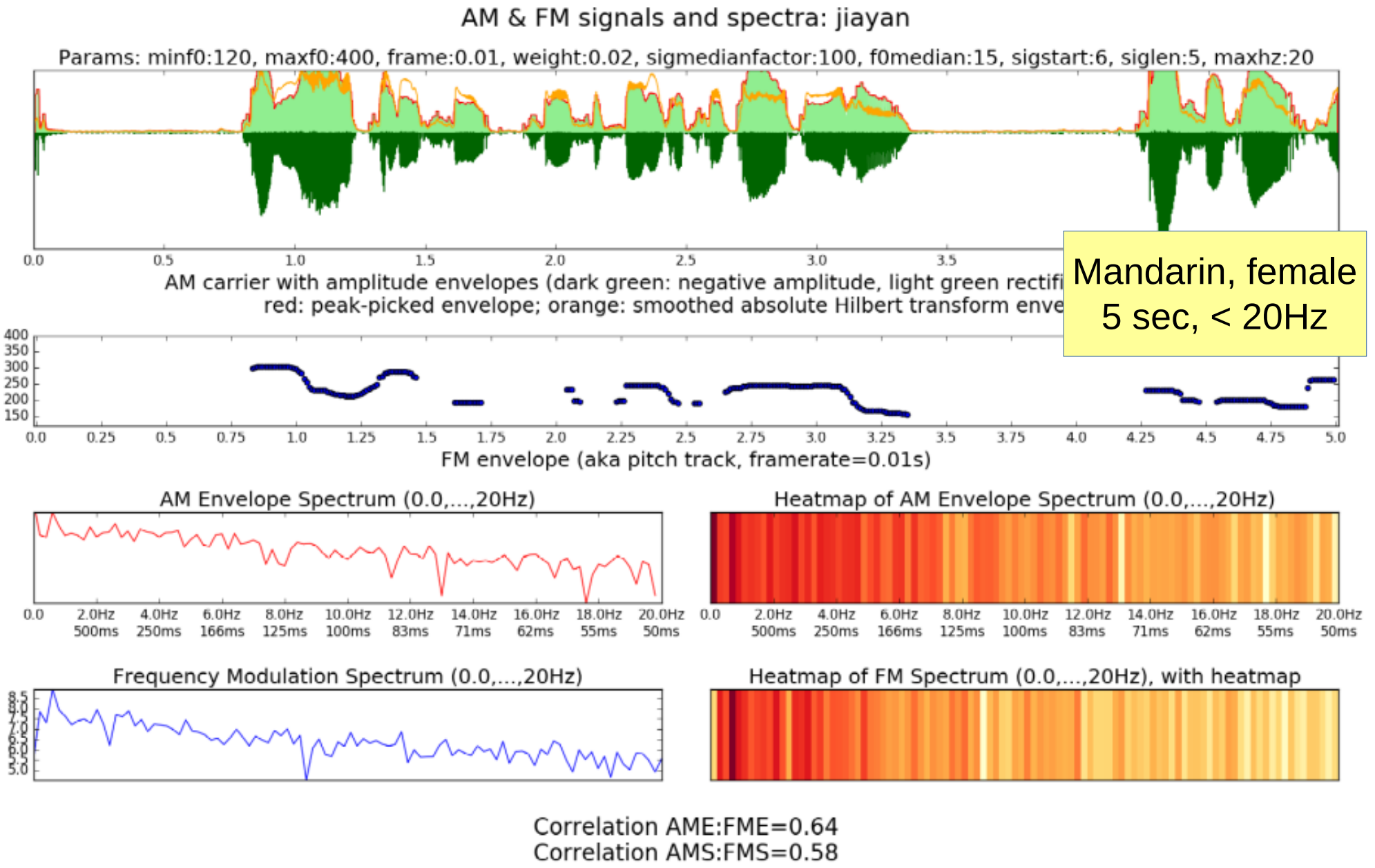
Yes, they do correlate, but not overwhelmingly strongly, and depending on which subspectra are measured.

Discourse Prosody Case 2: Discourse Rhythms

English			
A0101B	0.996	0.626	0.645
A1202B	0.993	0.597	0.368
NW048	0.95	0.561	0.549
Mandarin			
jiayan	0.994	0.694	0.632
wuxi	0.991	0.561	0.48

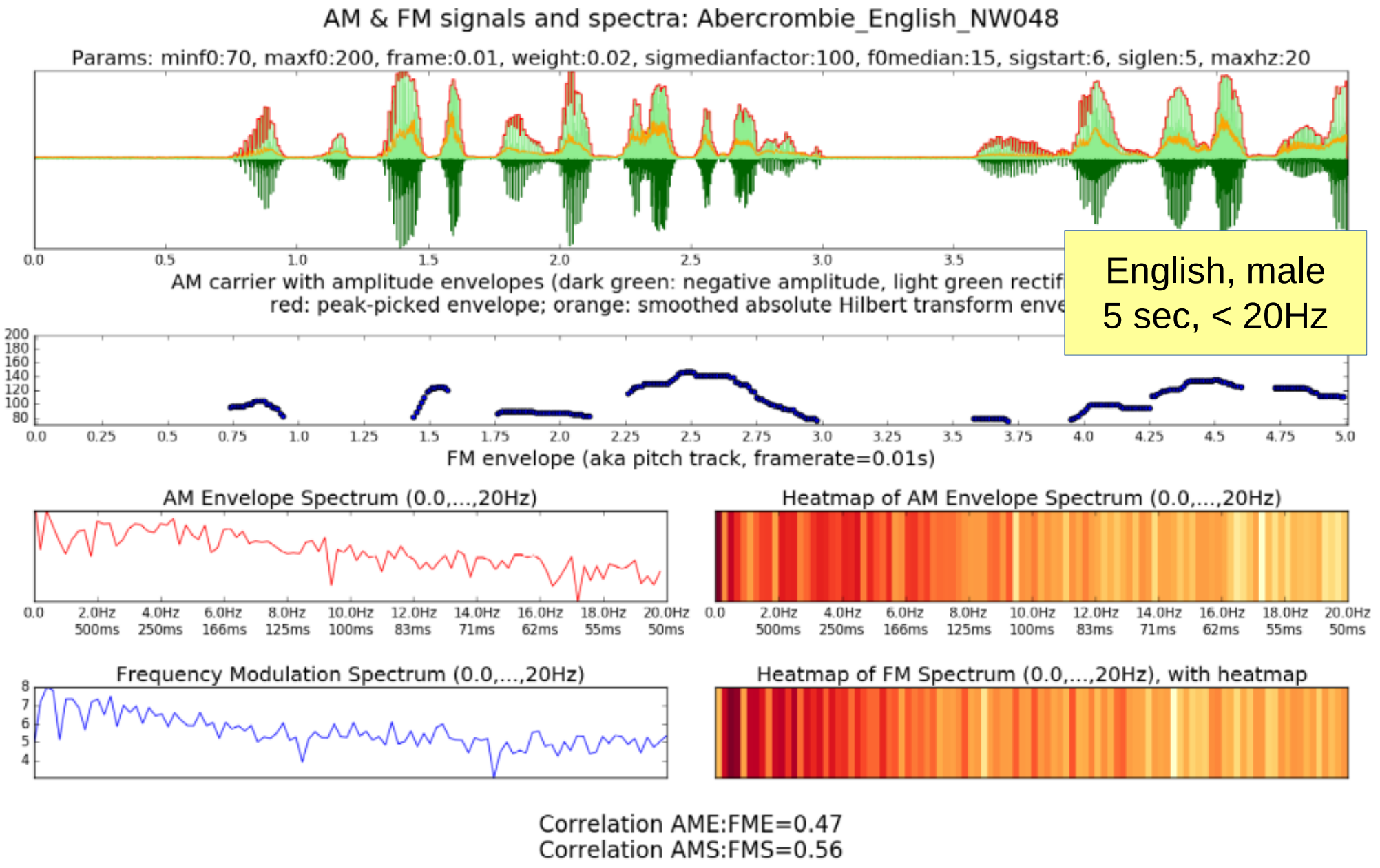
12s: full spectrum over the selected signal suspiciously strong correlations	12s: spectrum 0...20Hz (1200...50ms) more interesting weaker correlations	12s: spectrum 0...10Hz (1200...100ms) very interesting weaker correlations

Discourse Prosody Case 2: Discourse Rhythms



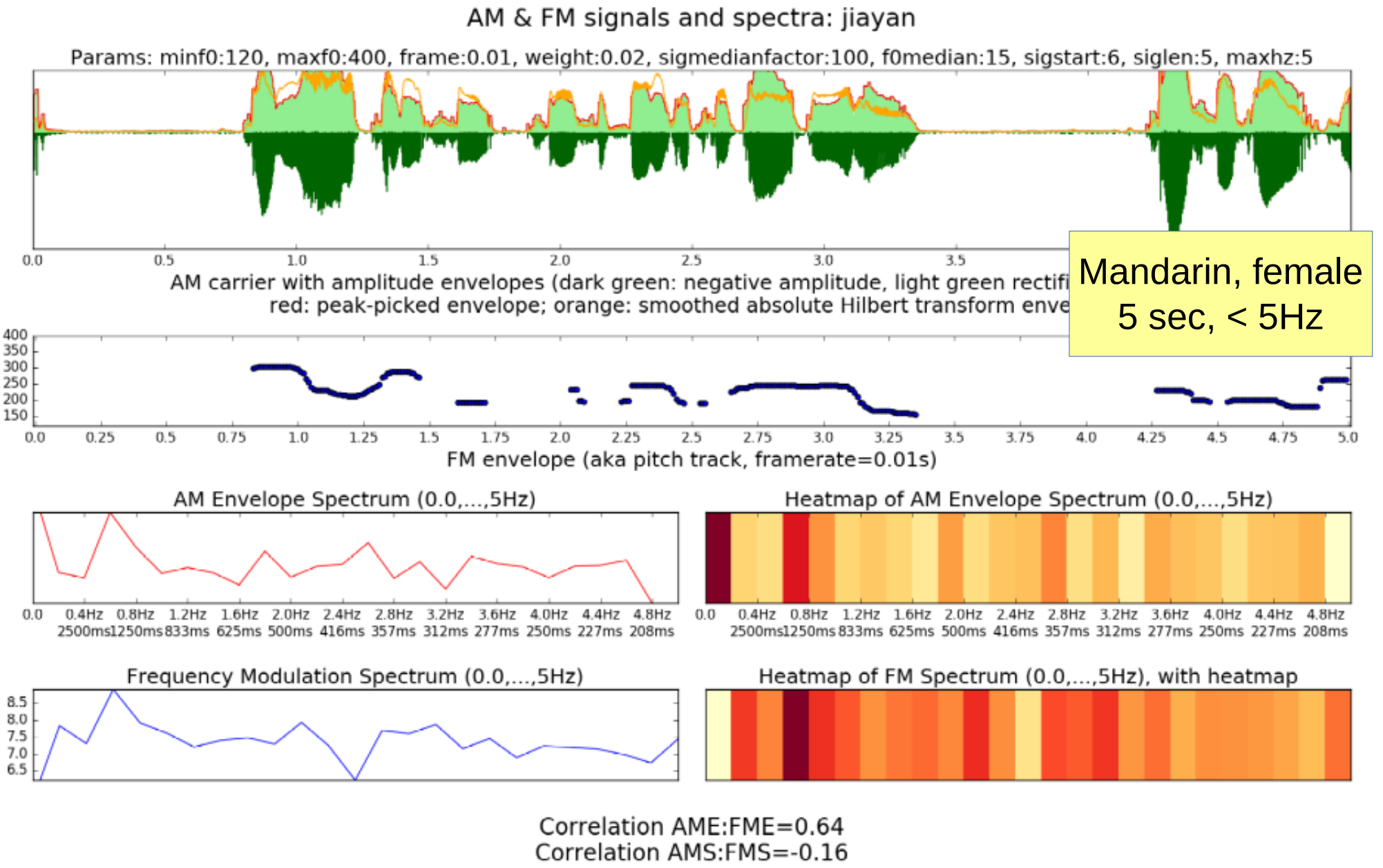
Mandarin, female
5 sec, < 20Hz

Discourse Prosody Case 2: Discourse Rhythms



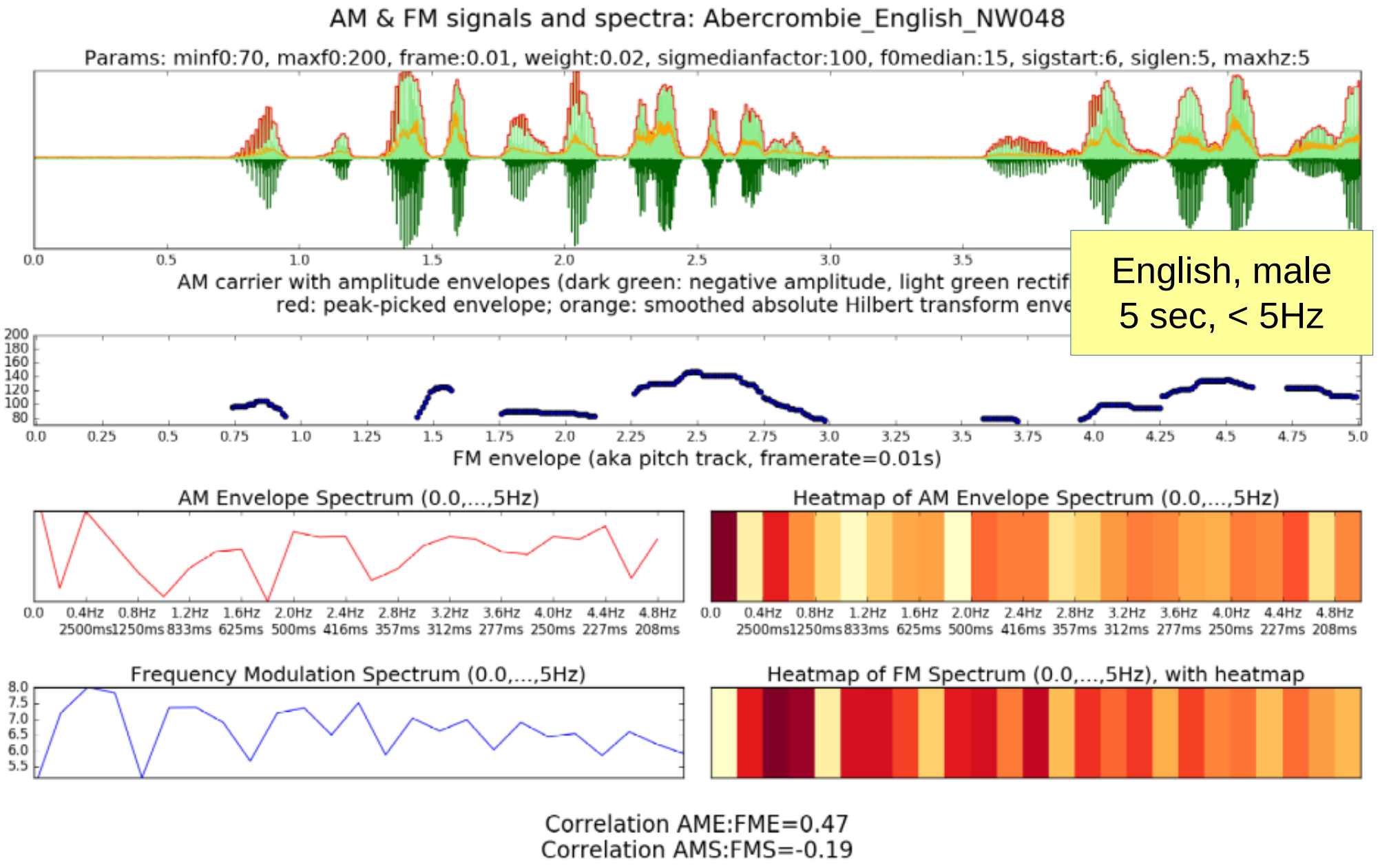
English, male
5 sec, < 20Hz

Discourse Prosody Case 2: Discourse Rhythms



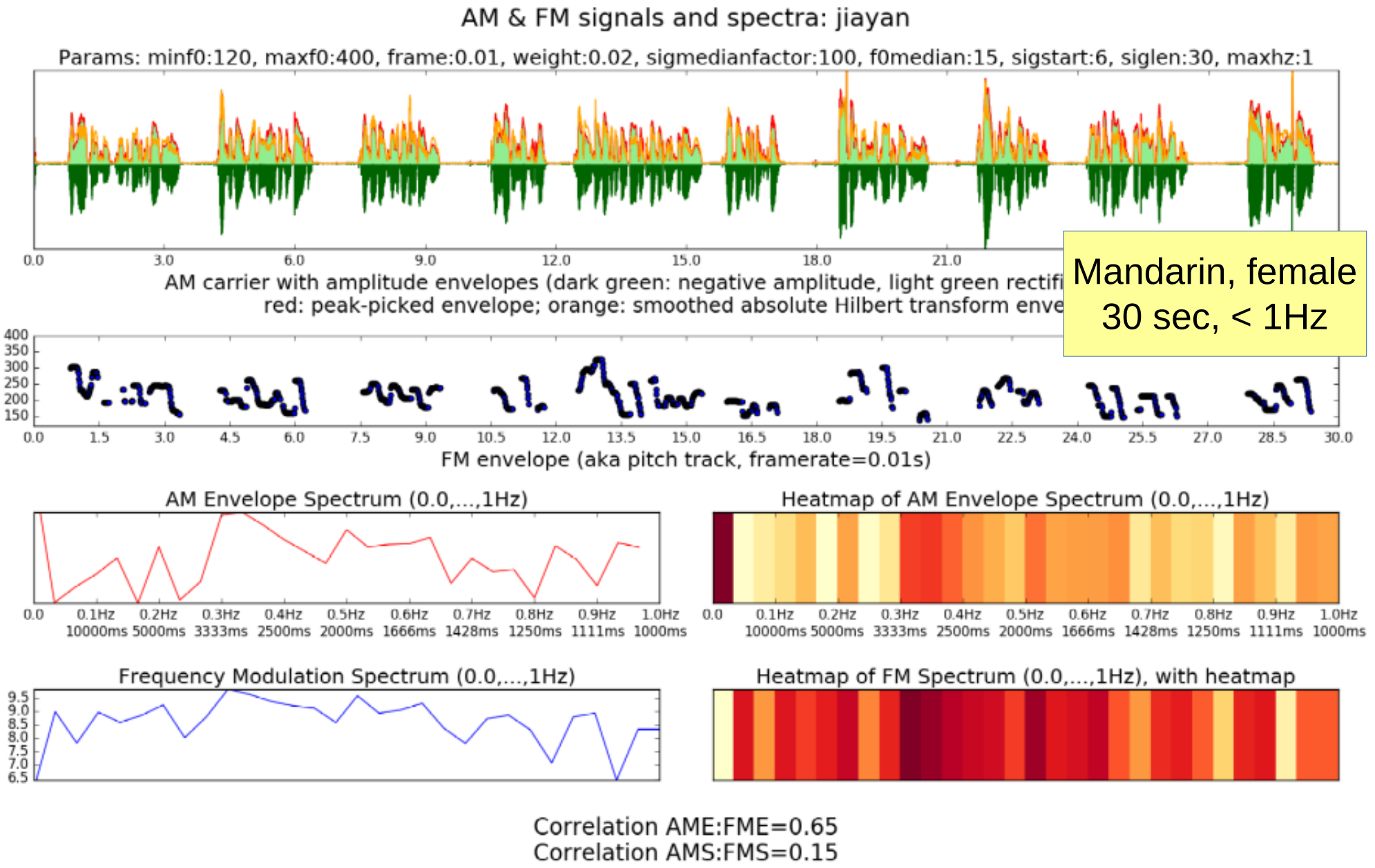
Mandarin, female
5 sec, < 5Hz

Discourse Prosody Case 2: Discourse Rhythms



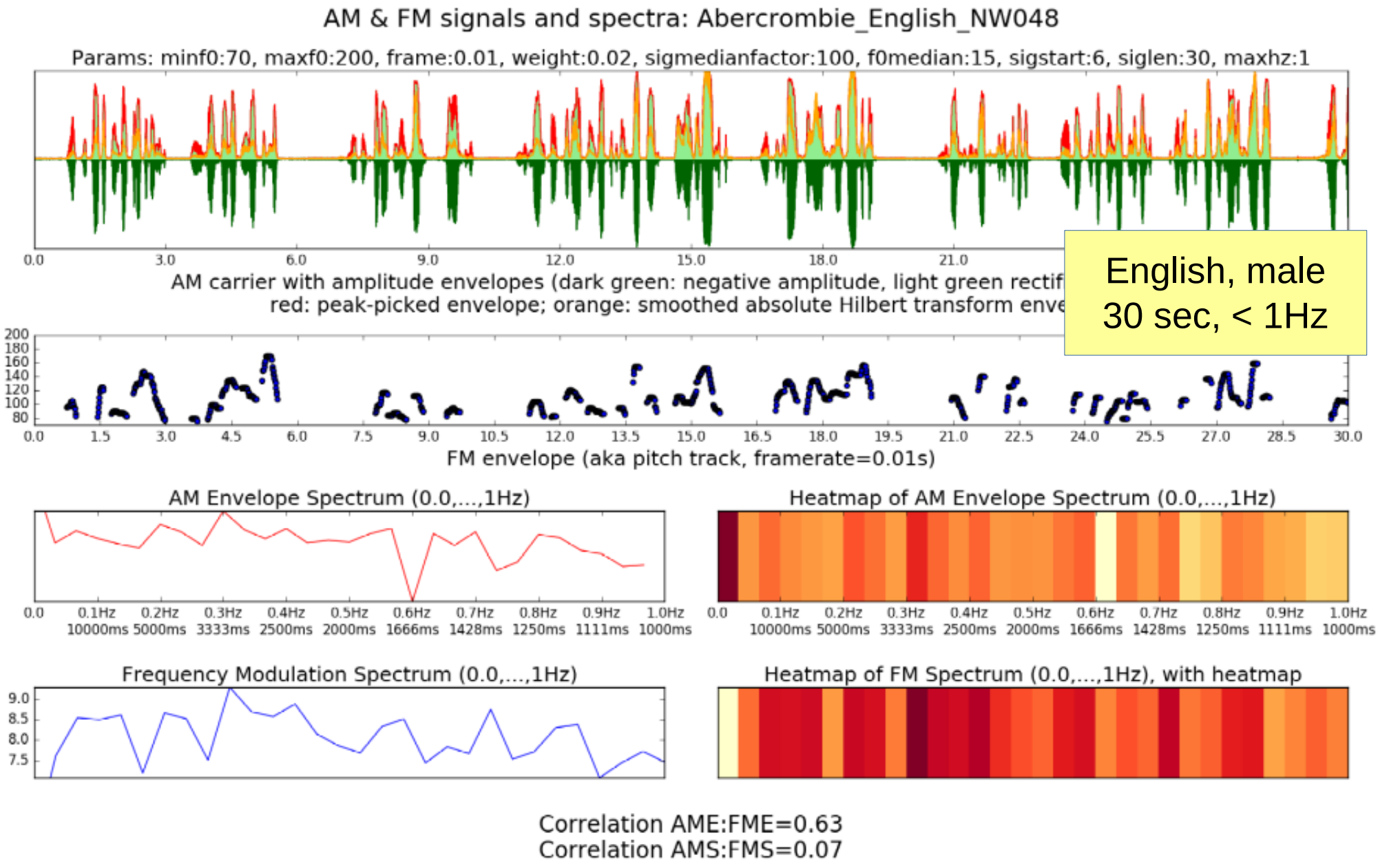
English, male
5 sec, < 5Hz

Discourse Prosody Case 2: Discourse Rhythms



Mandarin, female
30 sec, < 1Hz

Discourse Prosody Case 2: Discourse Rhythms



English, male
30 sec, < 1Hz

Discourse prosody, Case 2: Accent constraints

Constraint 1:

Pitch accents in the same sequence tend to be of the same type.

Constraint 2:

Pitch accent sequences tend to match the final phrasal accent:

- low rising types tend to be followed by a rising final accent
- high rising types tend to be followed by a rising final accent

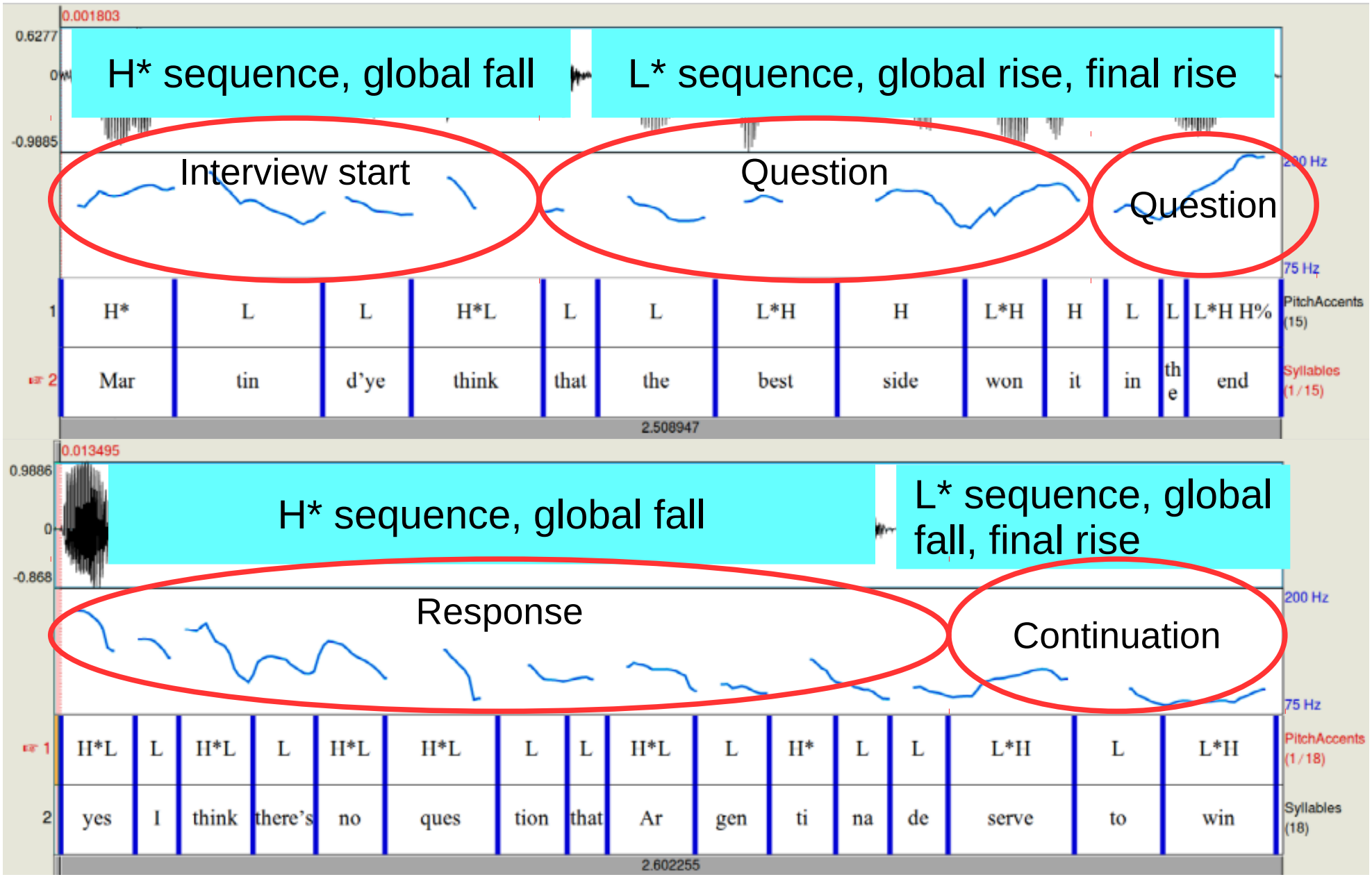
Constraint 3:

Pitch accent sequence types tend to match information structure

- low pitch accent sequences tend to be introductory or questioning
- high pitch accent sequences tend to be closing or stating

with typologically relevant constraint violations in different languages and dialects

Discourse Prosody Case 3: Accent Constraints



Discourse Prosody Case 4: Long FM Contours

Thesis: in evolution,

- **frequency modulation and rhythm came first**
  - **emotional cries**
  - **turn-taking came before grammar**

    Levinson, "Turn-taking in Human Communication – Origins and Implications for Language Processing", 2015

Note: in infant speech,

- **frequency modulation and rhythm also come first**
  - **emotional cries**

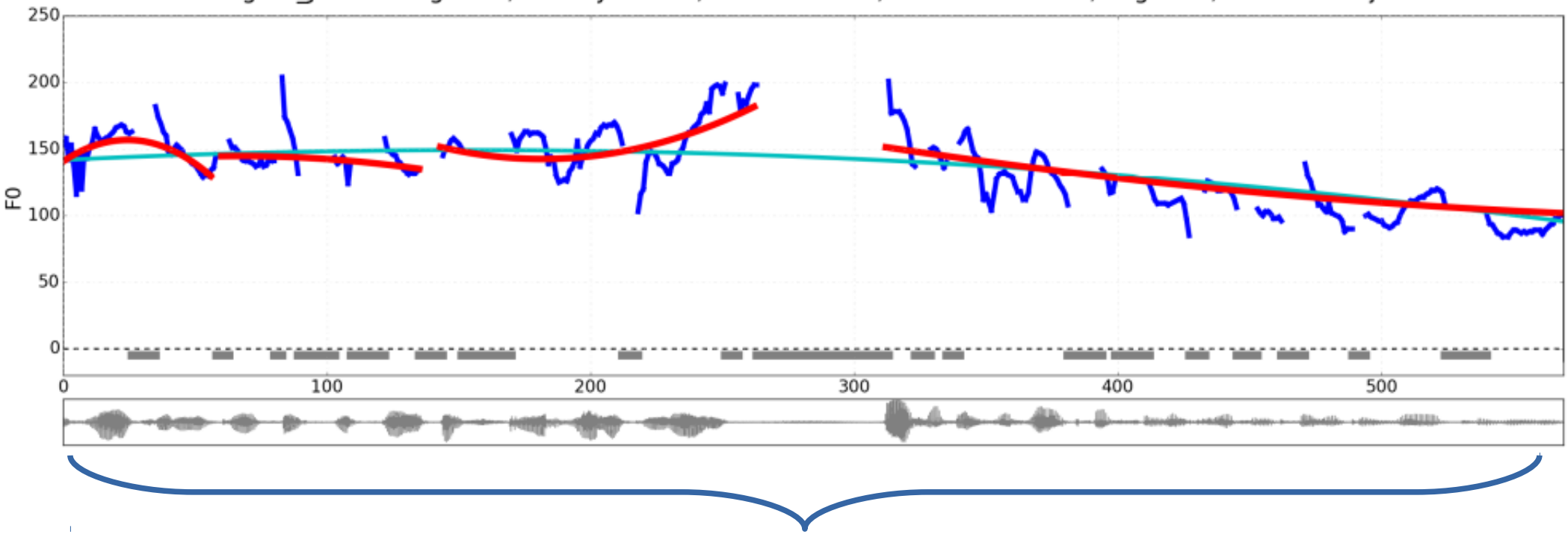
    Wermke, Sebastian-Galles
  - **turn-taking**

Check the infant 'twin-talk' videos on YouTube ☺

Discourse Prosody Case 4: Long FM Contours

Question: rising utterance contour

Answer: falling utterance contour



Question+Answer: rising-falling adjacency pair contour

syntagmatic entrainment

Discourse Prosody Case 5: Emotive FM Contours

Thesis 1:

In the evolutionary time domain, emotive modulations came before structural modulations

Thesis 2:

“Wow!” is among the first emotive utterances

Thesis 3:

Or maybe it was the wolf whistle

Thesis 4:

In any case, other primates wowed and whistled first – we continued the custom

Is this why in some societies whistling is tabooed?

Discourse Prosody Case 5: Emotive FM Contours

***Short discourse contributions*:**

Wow! Aah! Oh my!

The Wolf Whistle is not just 'cat-calling'

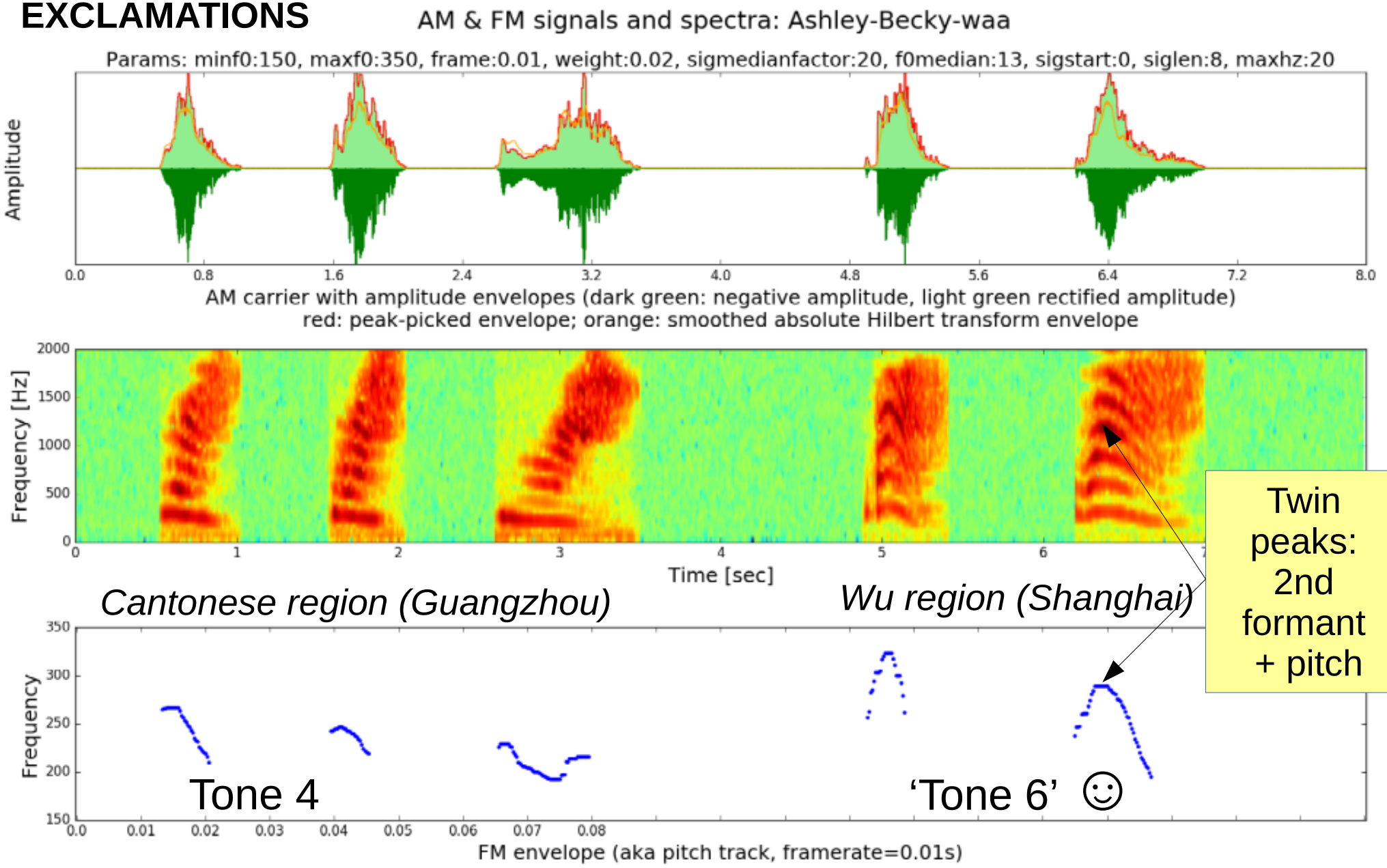
… and the Mandarin '6th tone' **[^]** ☺

Emotions. Exclamations. Teleglossia.

Discourse Prosody Case 5: Emotive FM Contours

EMOTIVE EXCLAMATIONS

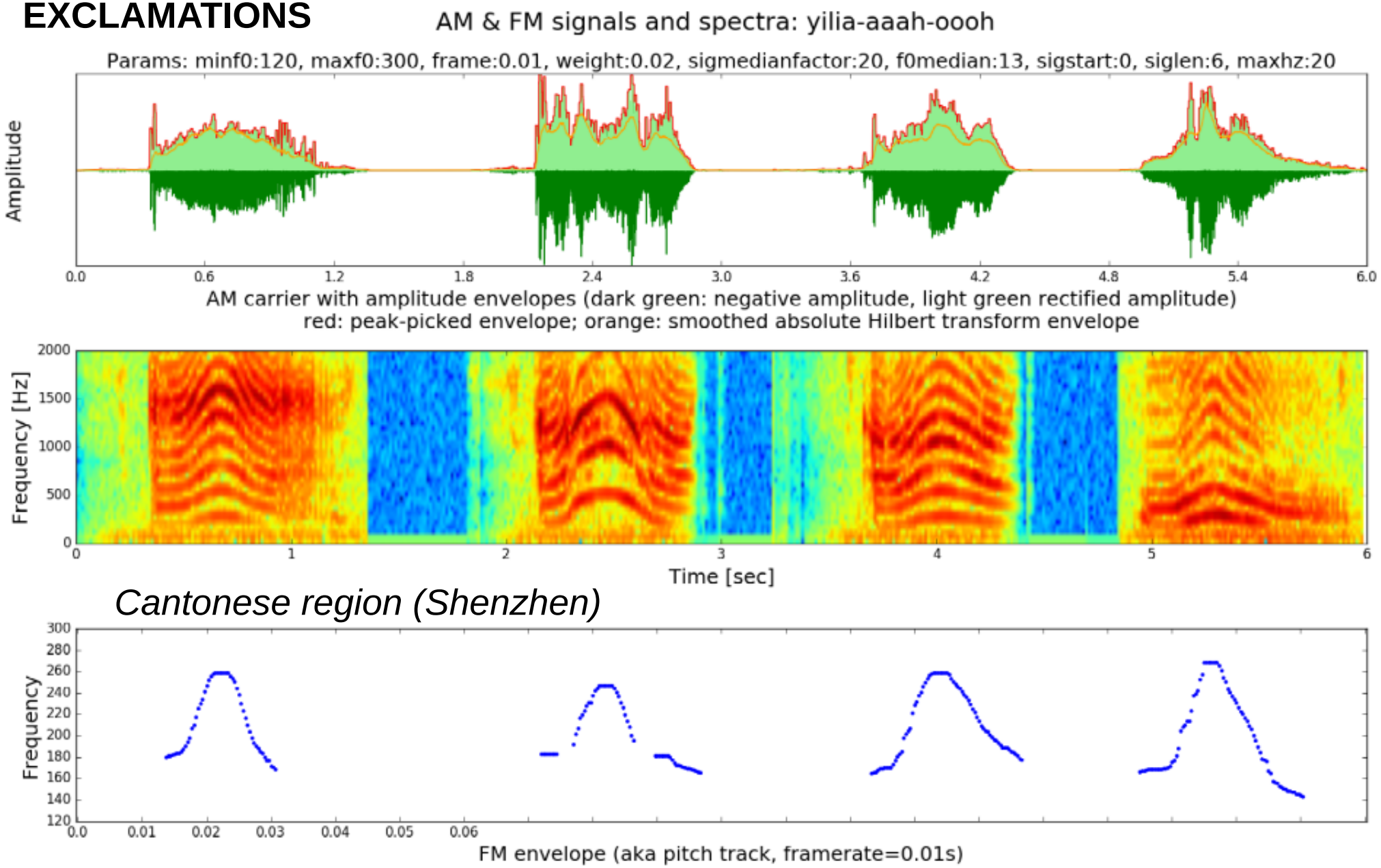
哇



Discourse Prosody Case 5: Emotive FM Contours

EMOTIVE EXCLAMATIONS

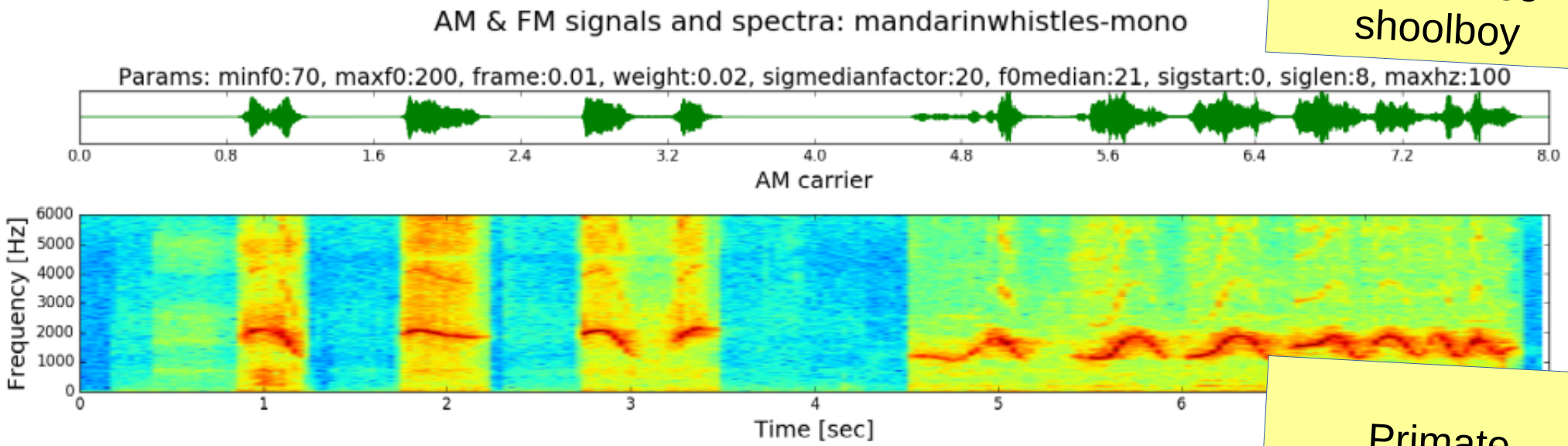
啊



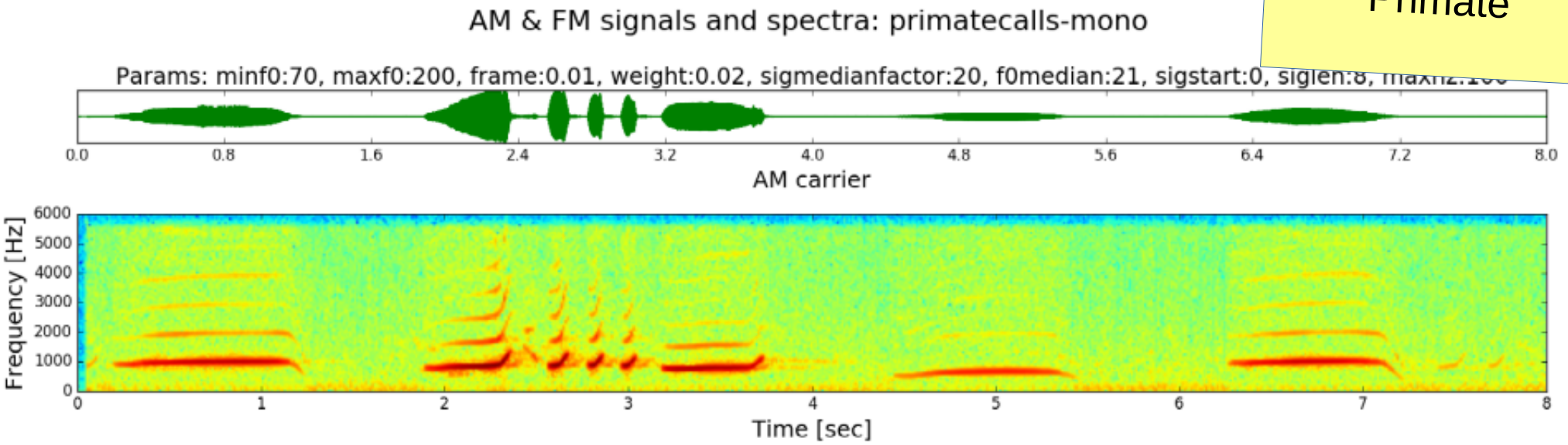
Discourse Prosody Case 5: Emotive FM Contours

TELEGLOSSIA

Street whistle Cantonese shoolboy



Primate



Discourse Prosody Case 5: Emotive FM Contours

TELEGLOSSIA

A Rising Contour: back-channel communication from the richest ex-linguist in the world

Falling, Rising-Falling and Rising F0 Contours: Intonation and Gesture

Summary:

Labov's Sociophonetics

OSCAR: Phonetic Opinion Survey:
1. The Prosody of Impoliteness
2. Description of Mandarin Tones
3. Dialectometry

Phonetic Analysis of Discourse:
Case 1: Discourse framing
Case 2: AM vs. FM Spectra
Case 3: Accent Constraints
Case 4: Long FM contours
Case 6: Emotive FM contours

Conclusion:

… thinking outside the box

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Thank you!

谢谢！