# Vowels of Taa (West !Xoon)
## and their acoustic properties

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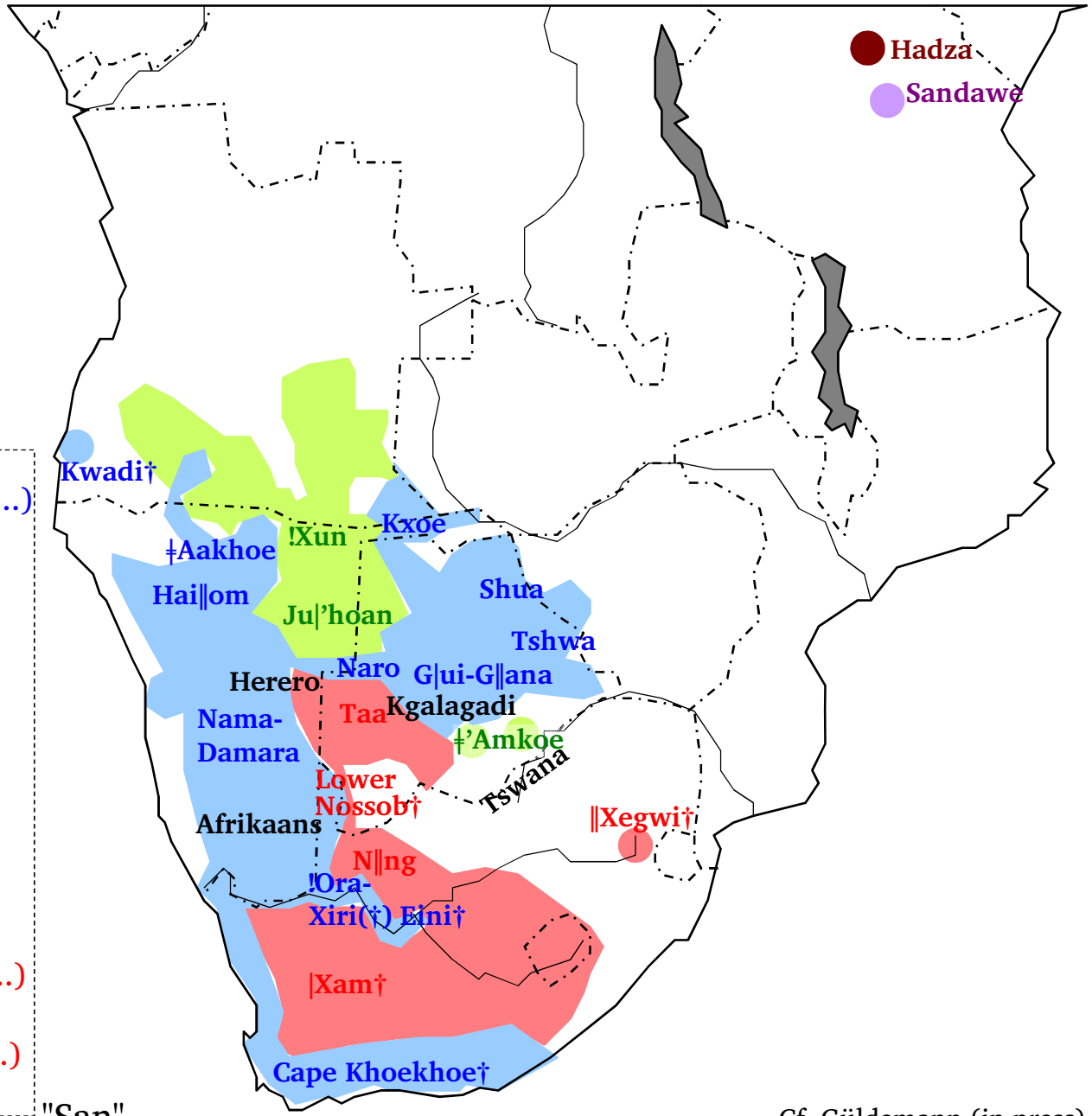
1. Introduction
2. Research questions
3. Procedure
4. Examples
5. First results

# *Introduction: Taa*

**"Khoisan"**

1. Hadza (isolate)
2. Sandawe (isolate)
3. Khoe-Kwadi
   - Kwadi†
   - Cape Khoekhoe†
   - !Ora-Xiri(†)
   - Eini†
   - Namibian Standard Khoekhoe (Nama-Damara, Hai‖om, ǂAakhoe)
   - Shua (Cara, Deti†, |Xaise, Danisi ...)
   - Tshwa (Kua ...)
   - Kxoe (Khwe, ‖Ani ...; Ts'ixa ?)
   - G‖ana (incl. G|ui)
   - Naro (Naro, Ts'ao ...)
4. Kx'a
   - (NW) !Xun
   - Ju|'hoan (incl. ǂX'ao-‖'aen)
   - ǂ'Amkoe (ǂHoan/N!aqriaxe, Sasi)
5. Tuu
   - Taa (West !Xoon, East !Xoon, ...)
   - Lower Nossob† (|'Auni, |Haasi, ...)
   - N‖ng (N|uu = ǂKhomani, ...)
   - |Xam† (Strandberg, Achterveld, ...)
   - ‖Xegwi†

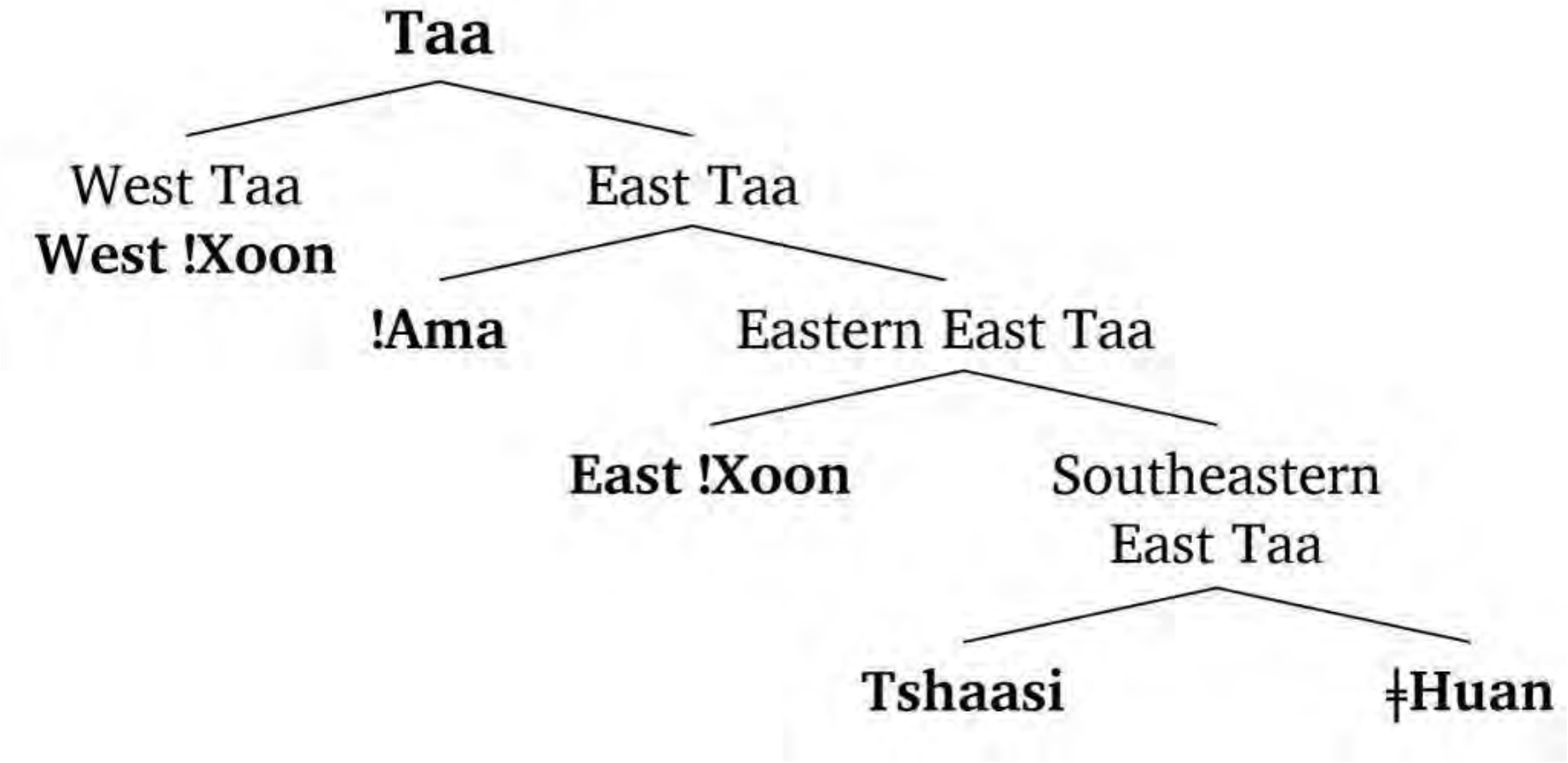
"San"




Cf. Güldemann (in press).

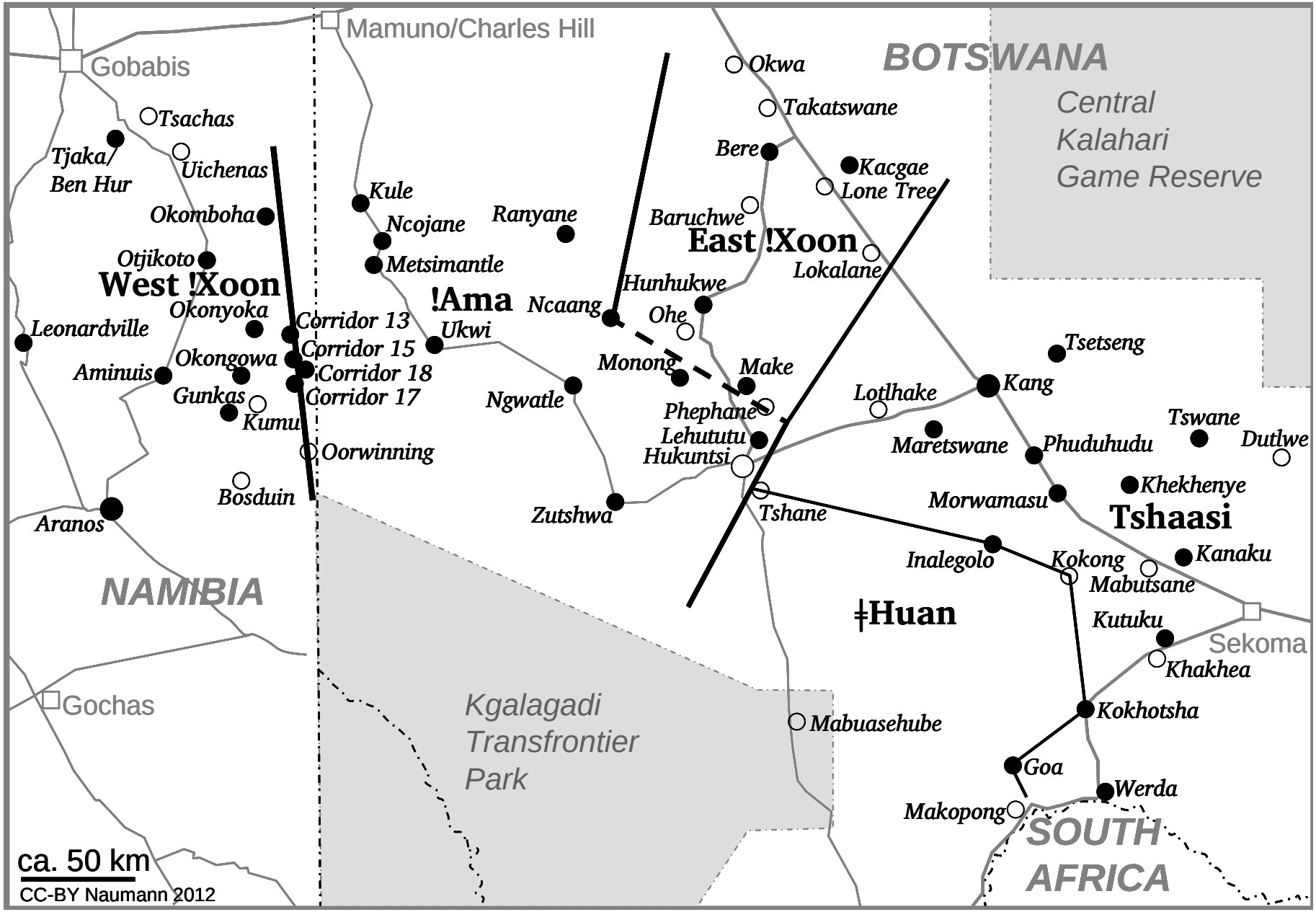
## *Introduction: Taa*

Taa dialects



# *Introduction: Taa*

Taa dialects



# *Introduction: Taa vowels*

| | Front | | Back | | | *Restrictions* |
|---|---|---|---|---|---|---|
| | Close | Mid | Open | Mid | Close | |
| modal, oral | i | e | a | o | u | |
| nasal | ĩ <in> | | ã <an> | | ũ <un> | *$V_2$ only* |
| pharyngealised | | | aˤ <aq> | oˤ <oq> | uˤ <uq> | *$V_1$ only* |
| tense ~ glottalised | | | aˀ <a'> | oˀ <o'> | uˀ <u'> | *$V_1$ only* |
| breathy | | | a̤ <ah> | o̤ <oh> | ṳ <uh> | *$V_1$ only* |
| strident | | | a͈ <aqh> | o͈ <oqh> | u͈ <uqh> | *$V_1$ only* |

(various combinations in diphtongs, including non-modal vowels in V1 and nasal vowels in V2, e.g. /u+i/, /u+ĩ/, /ṳ+i/, /ṳ+ĩ/, /o+e/, /o+a/, /o+ã/, /o̤+ã/, ...)

*Lexical stems in native vocabulary:*

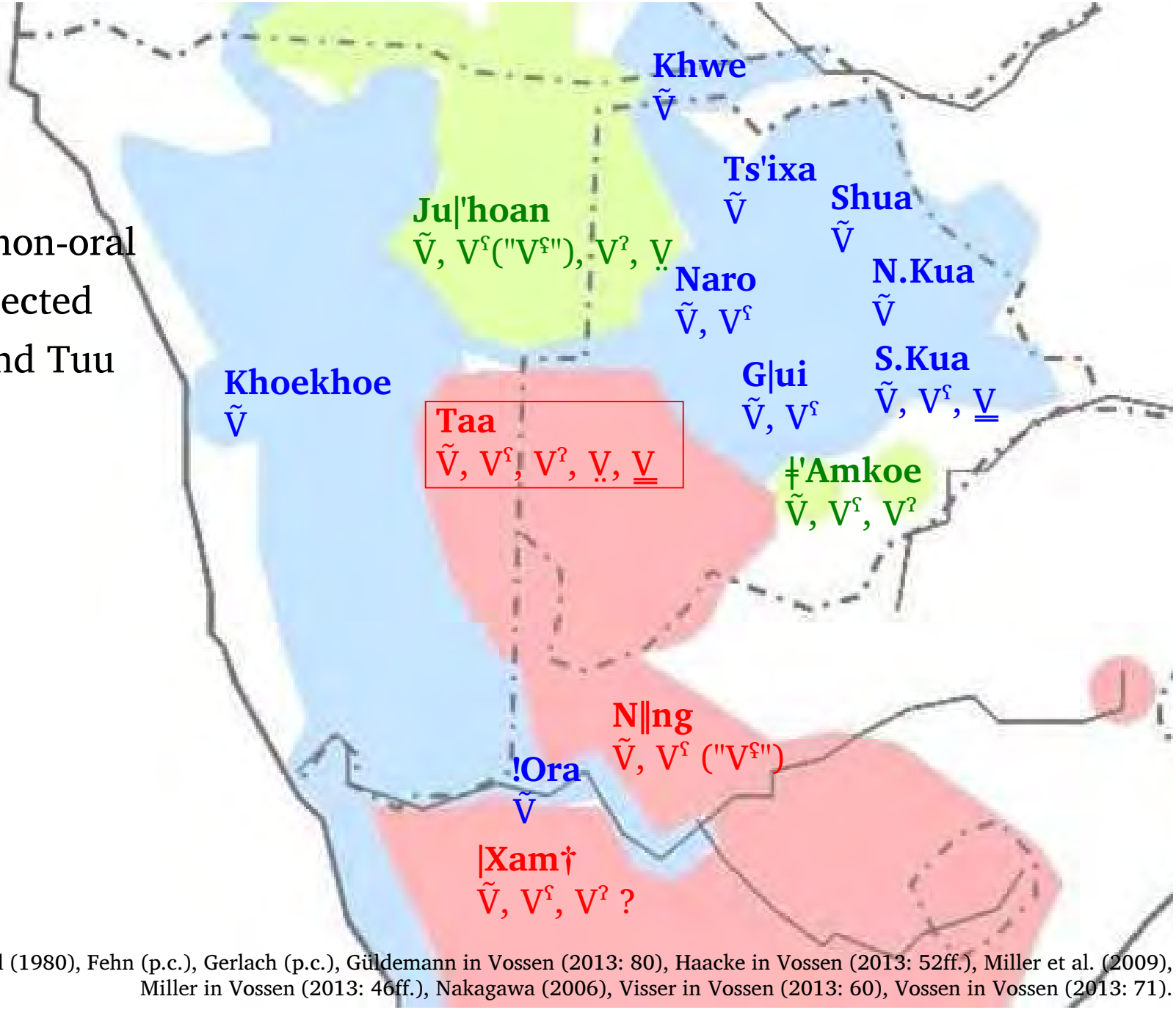
*$C(C)V_1CV_2$*
*$C(C)V_1N$*
*$C(C)V_1V_2$*



Boden et al. (2008)

# Introduction: Taa vowels

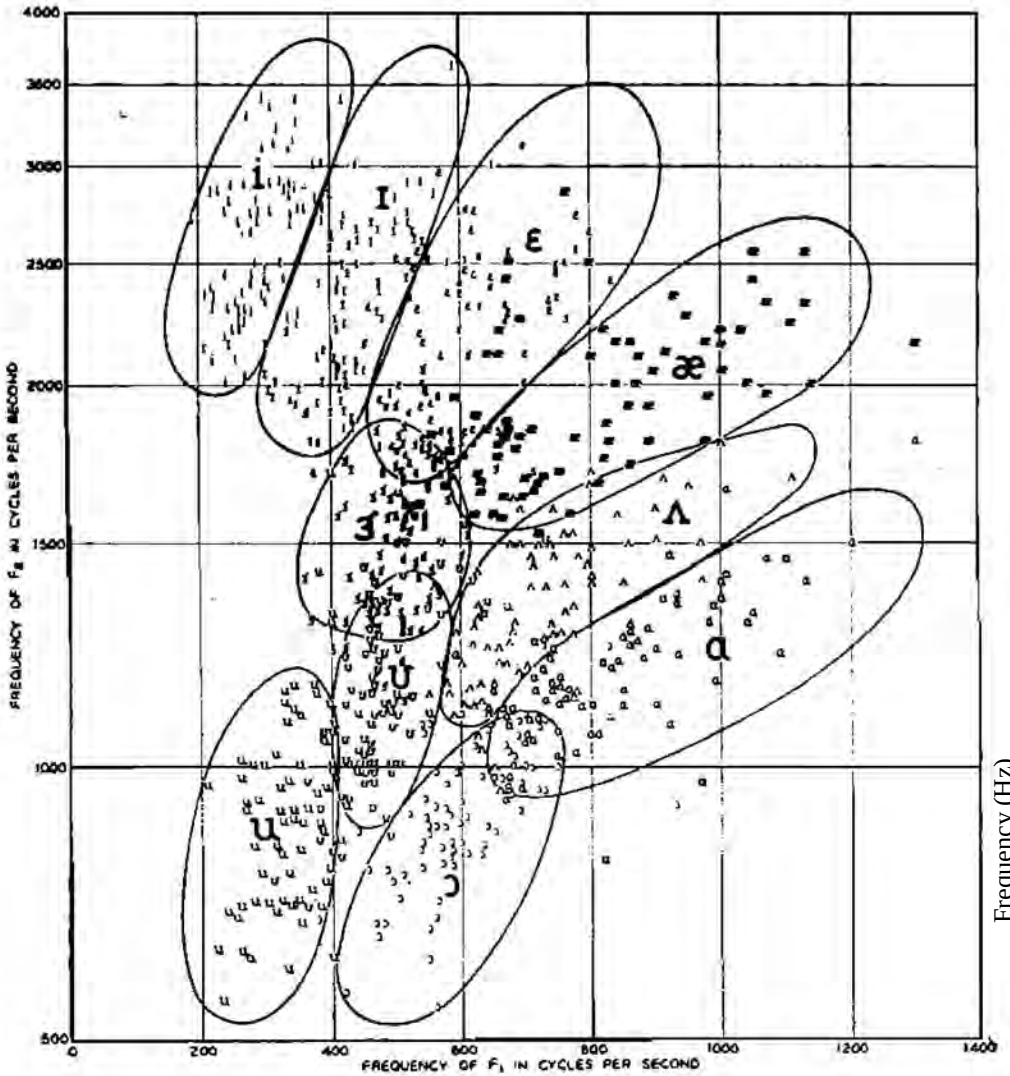
Non-modal/non-oral vowels in selected Khoe, Kx'a and Tuu languages



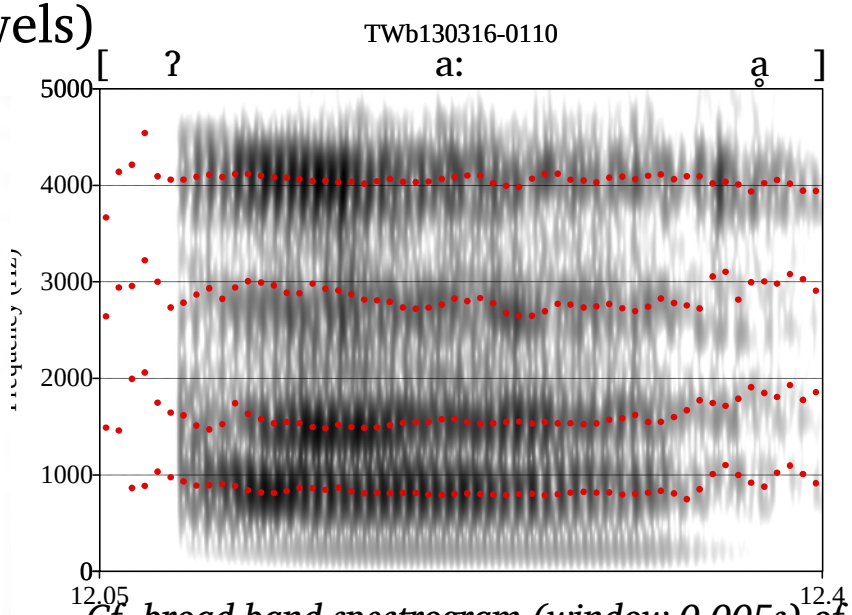

Traill (1980), Fehn (p.c.), Gerlach (p.c.), Güldemann in Vossen (2013: 80), Haacke in Vossen (2013: 52ff.), Miller et al. (2009), Miller in Vossen (2013: 46ff.), Nakagawa (2006), Visser in Vossen (2013: 60), Vossen in Vossen (2013: 71).

# Research questions

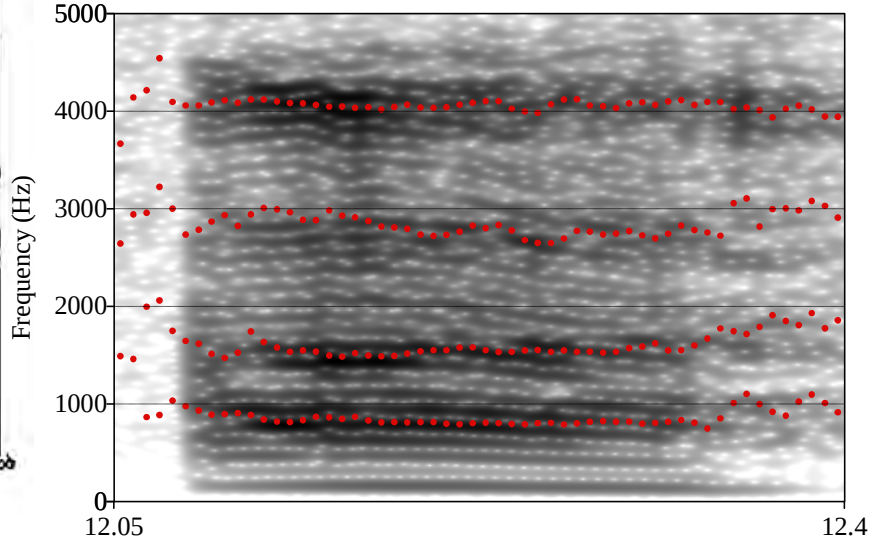
## 1. Distinct acoustic properties (plotting vowels)




*Vowels of American English (Peterson & Barney 1952)*



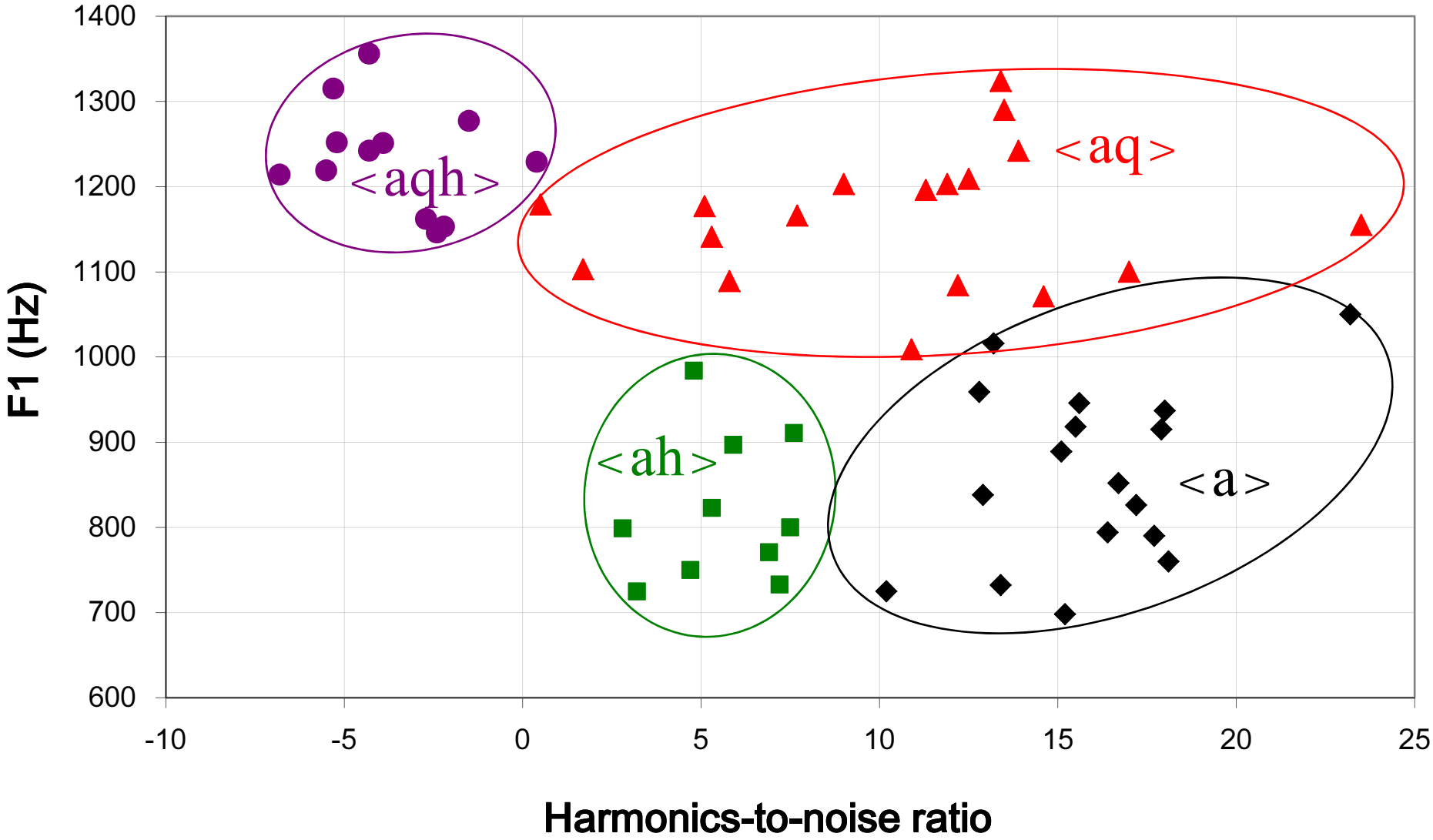

*Cf. broad band spectrogram (window 0.005s) of Taa /ʔaa/ "you" for one male speaker.*




*Cf. narrow band spectrogram (window 0.02s).*

## Research questions

1. Distinct acoustic properties (plotting vowels)




*Plot of F1 vs. harmonics-to-noise ratio of four phonation types for one female speaker of West !Xoon (Boden et al. 2008)*

## Research questions

2. Simple underlying contrast /a, aˤ, aˀ, a̤, a̲/ vs. /u, uˤ, uˀ, ṳ, u̲/ in V1?
(Nakagawa 2010 for G|ui)

> > /u/ vs. /o/ in V1 in Taa?

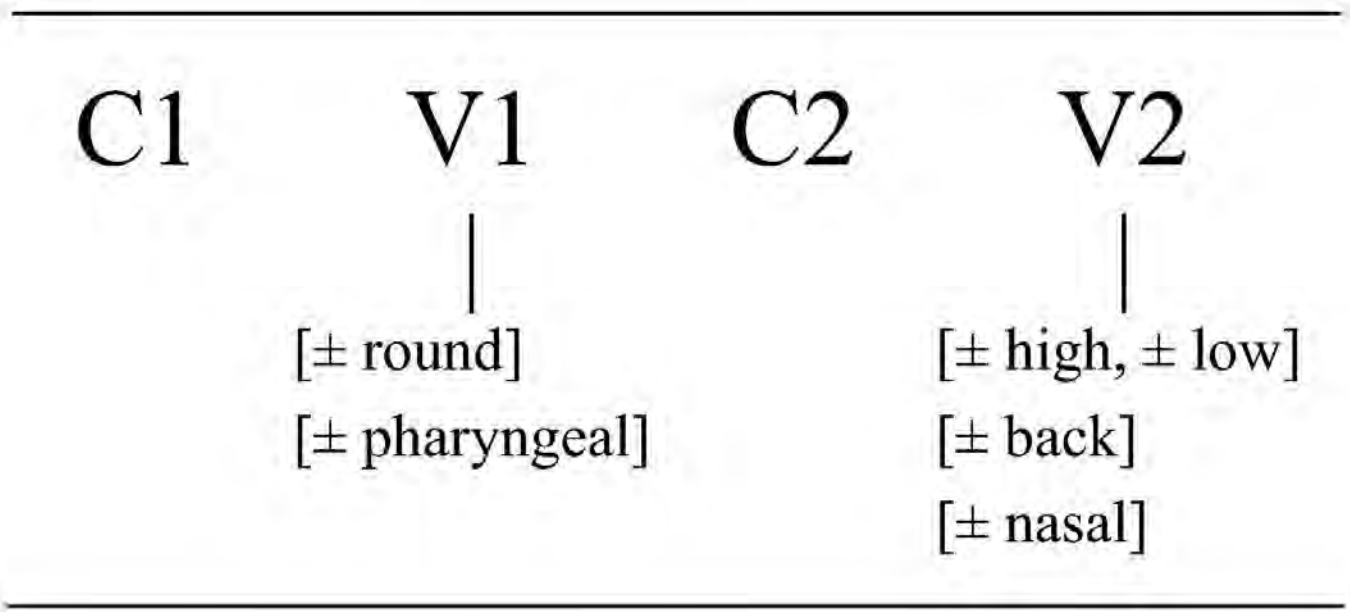



Figure 1 Distribution of relevant features in the disyllabic roots in G|ui

*Nakagawa (2010: 31)*

## Research questions

3. More research questions

- allophones & allophonic variation
- phonological representation of [i:], [e:], etc.
  (/a+i/ ~ /i+i/ ?, /a+e/ ~ /e+e/ ?, etc.)
- consistent representation of [u] vs. [o] (e.g., for q_, !_ )
- further phonotactic restrictions (e.g., in diphtongs)

>> phonological questions for a concise description of West !Xoon

# Procedure

Background

- phonological analysis
  - structuralist linguistics: through **minimal pairs** (*tea* vs. *pea*, contrast in identical environments ) > sound categories (phonemes) by function (differentiation of meaning)
  - (acoustic / articulatory data secondary)

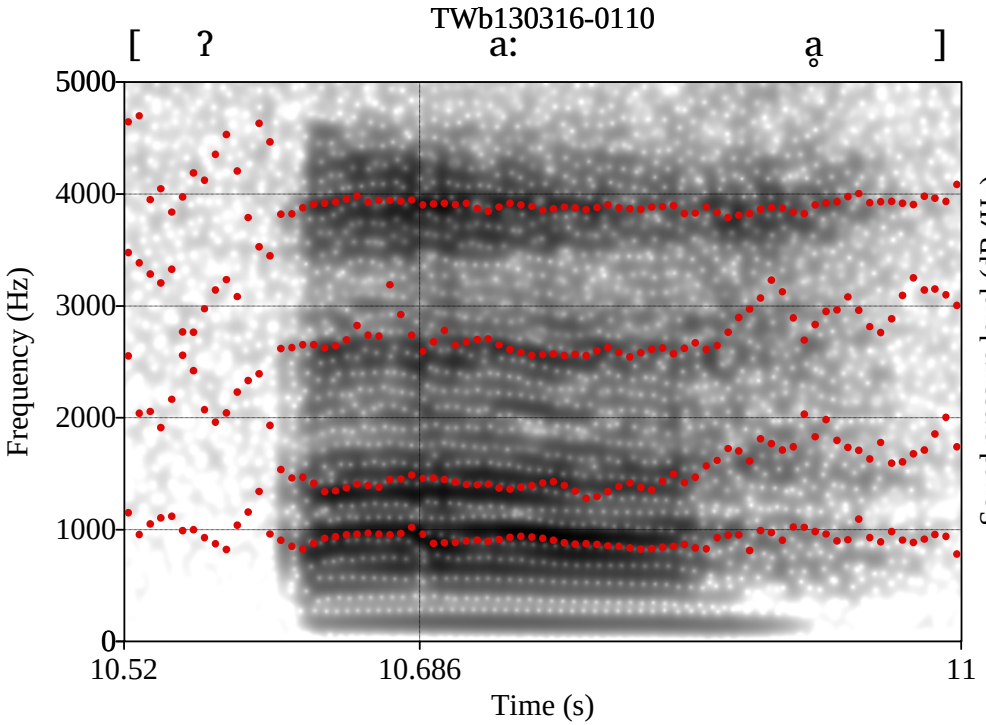
- here: (hybrid categorical) usage-based approach (Pierrehumbert 2001, 2003, 2006)
  - phonemes = sound categories with frequency distributions on the phonetic level to one abstract unit on the discrete phonological level
  - > primary phonetic properties, secondary usage in sound systems
  - equivalent to **contrast in analogous environments** ("no plausible statement of environmental conditioning") (cf. Burquest 2006: 35)
  - distinct (non-overlapping) distributions (clusters) for comparable environments, e.g., F1 + F2 values for vowels #{t/th/d/s/z/l}__{t/th/d/s/z/l}#

# Procedure

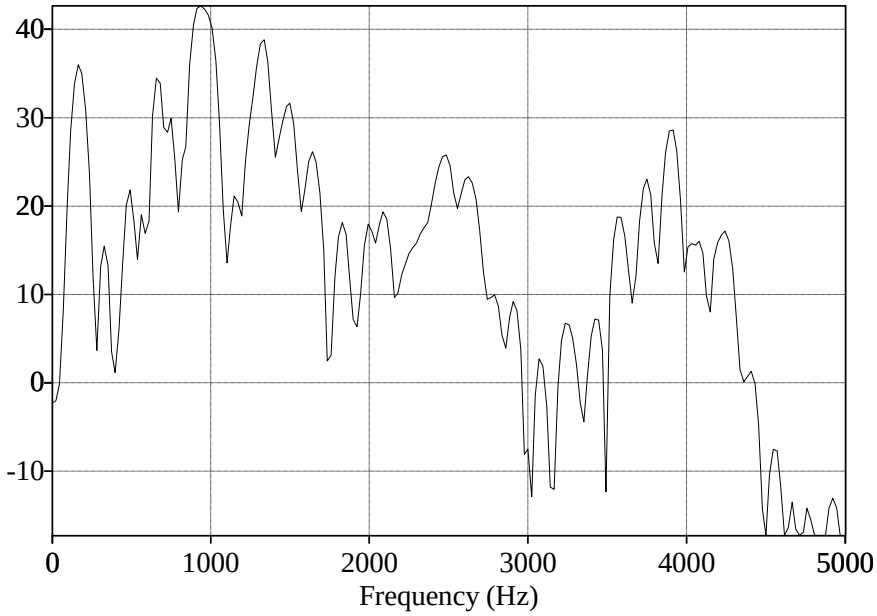
- March 2013: elicitation of words (in isolation)
- one female and two male speakers
- ca. 1500 ~ 750 vowels
- different contexts:
  - $C_1$_C(V) ($C_1$ = anterior egressive or ʔ)
  - $C_1$ _ _ [CVV]
  - |_C(V), |_ _
  - !_C(V), !_ _
  - Q_C(V), Q_ _ (Q - uvular egressive)
  - CVC_
- annotation/labelling in PRAAT
- script-run measurements
  - duration
  - F1, F2, F3 (at 1/8, 2/8 ... 7/8)
  - shimmer, jitter, harmonics-to-noise ratio
  - H1, H2, "A1"
  - centre of gravity
  - extraction of long-term average spectra ("LTAS", 1-1 and bandwidth = mean F0)

# Examples

## Modal vowel /a/ (/ʔaa/ "you.SG", anaphoric pronoun)




*Narrow band spectrogram (window 0.015s) of Taa /ʔaa/ "you" for one male speaker.*




*Spectral slice from 10.686 s +/- 20ms (= 1/4 of vowel length).*



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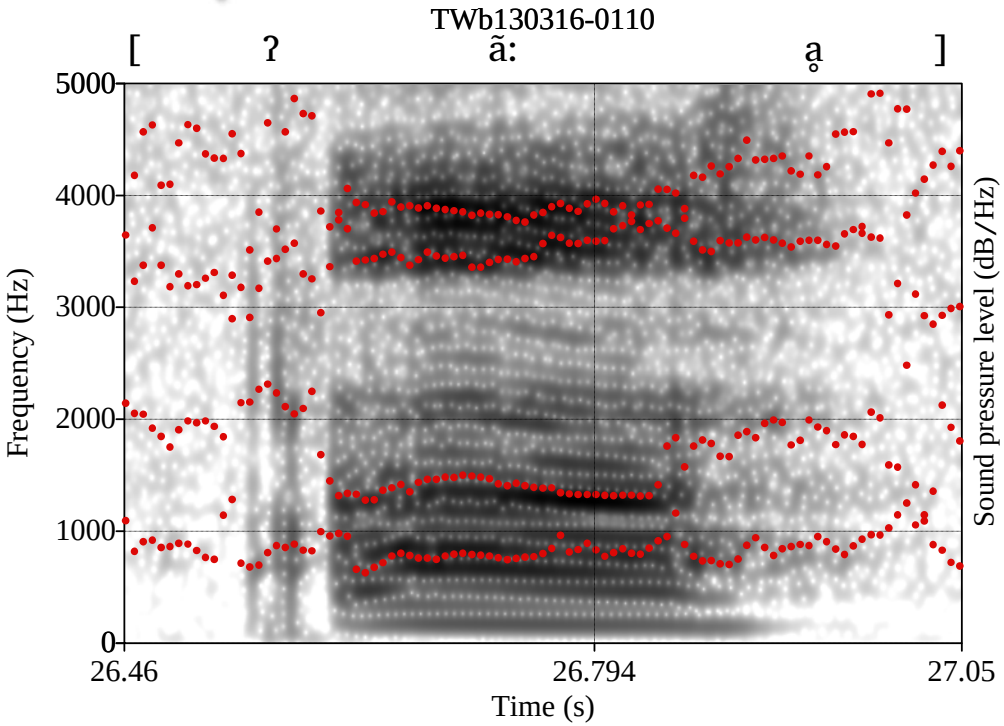
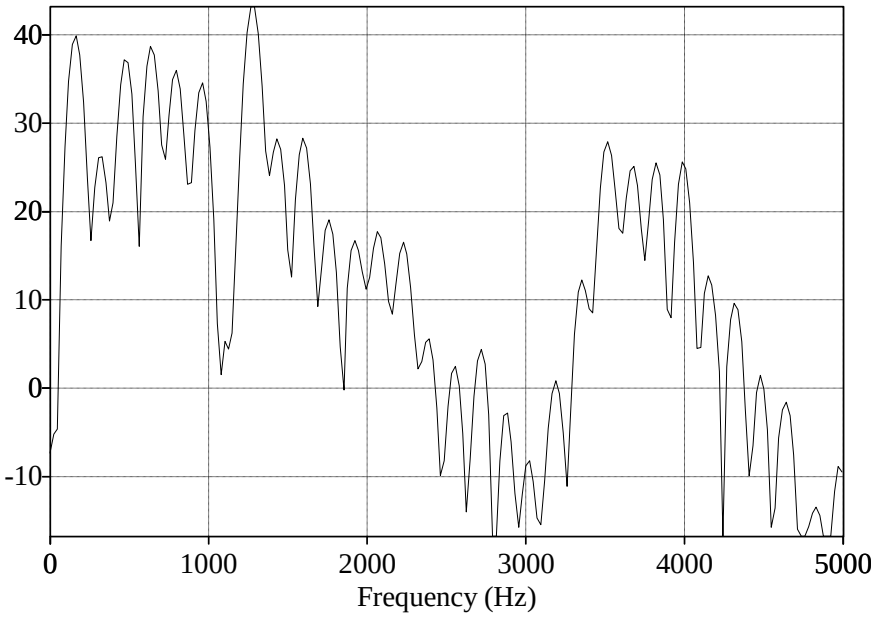
# Examples

## Nasal vowel /ã/ (/ʔaã/ "it", anaphoric pronoun, agreement class 2i)




*Narrow band spectrogram (window 0.015s) of Taa /ʔaã/ "it" for one male speaker.*




*Spectral slice from 26.794 s +/- 20ms.*



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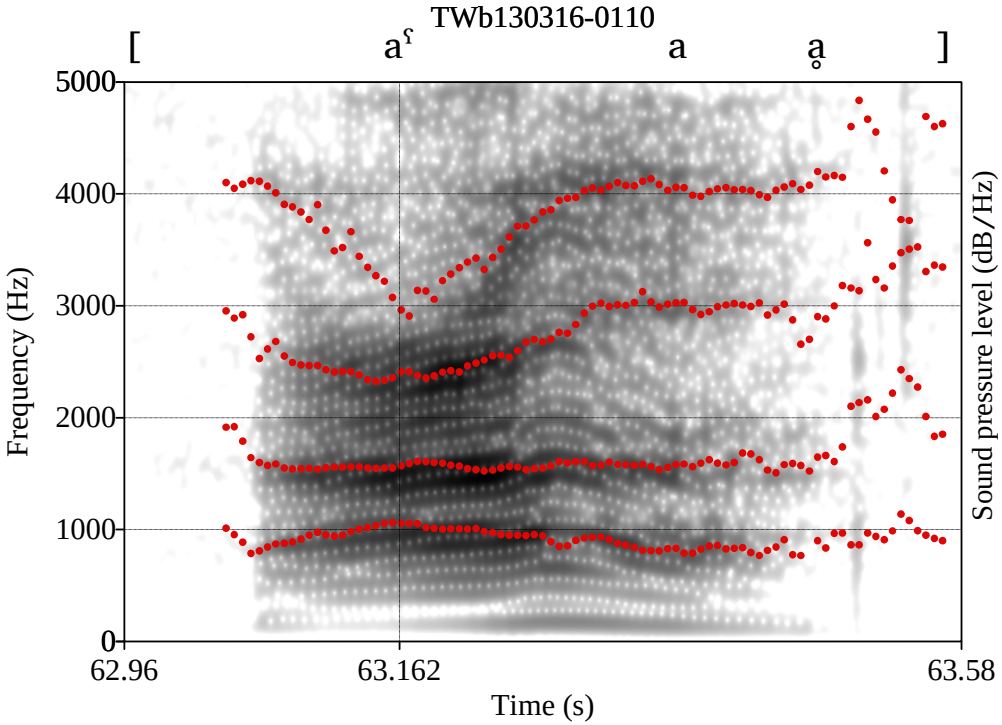
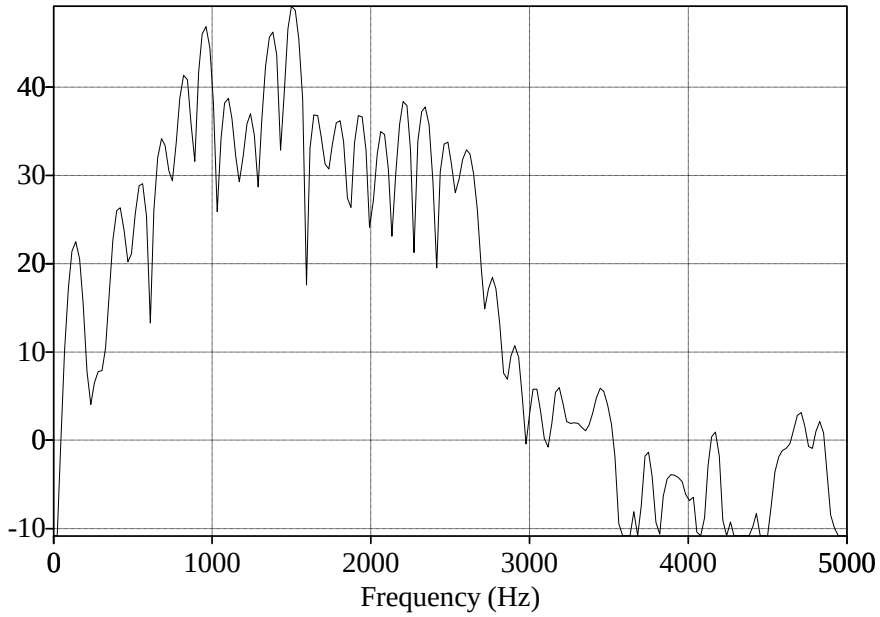
# Examples

## Pharyngealised vowel /aˤ/ (/aˤa/ "father")




*Narrow band spectrogram (window 0.015s) of Taa /aˤa/ "father" for one male speaker.*




*Spectral slice from 63.162 s +/- 20ms (= 1/4 of vowel length).*



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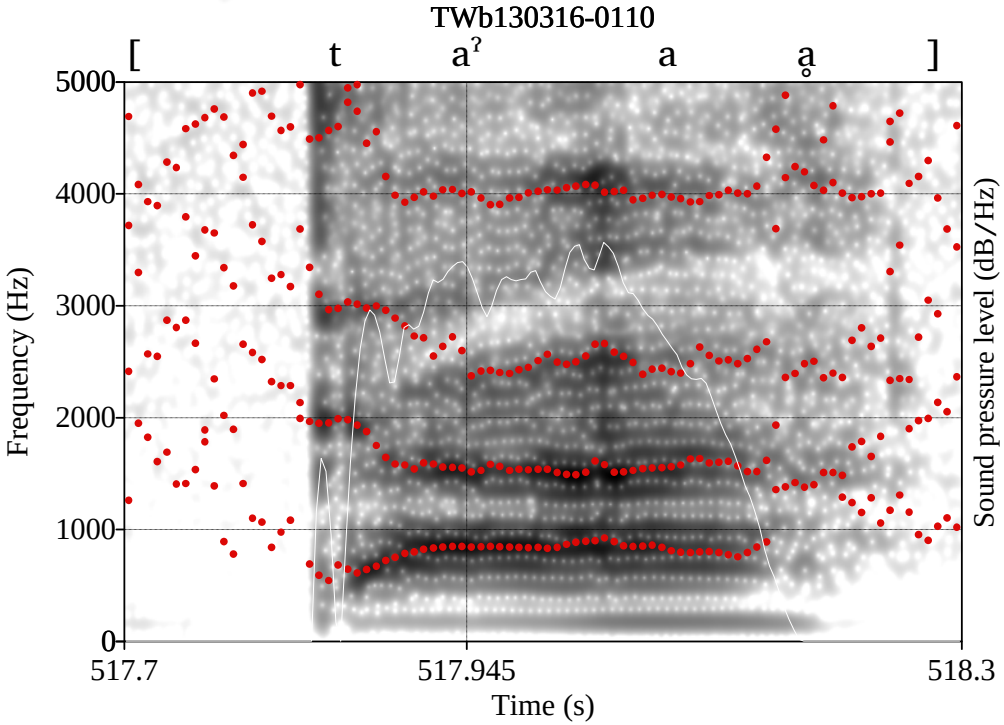
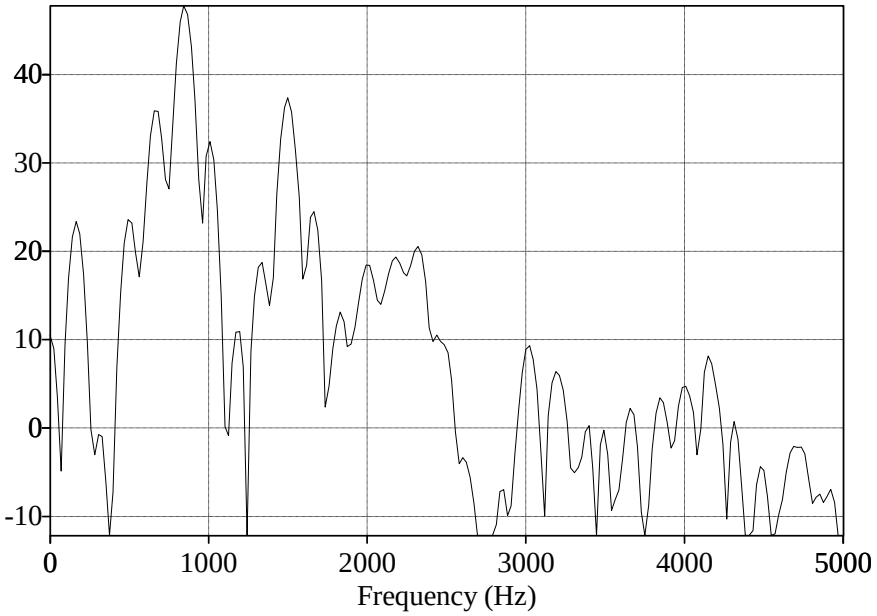
# Examples

## Glottalised vowel /aˀ/ (/taˀa/ "you here")




*Narrow band spectrogram (window 0.015s) of Taa /taˀa/ "you here" for one male speaker. Formant contours in red, intensity contour in white.*




*Spectral slice from 517.945 s +/- 20ms (= 1/4 of vowel length).*



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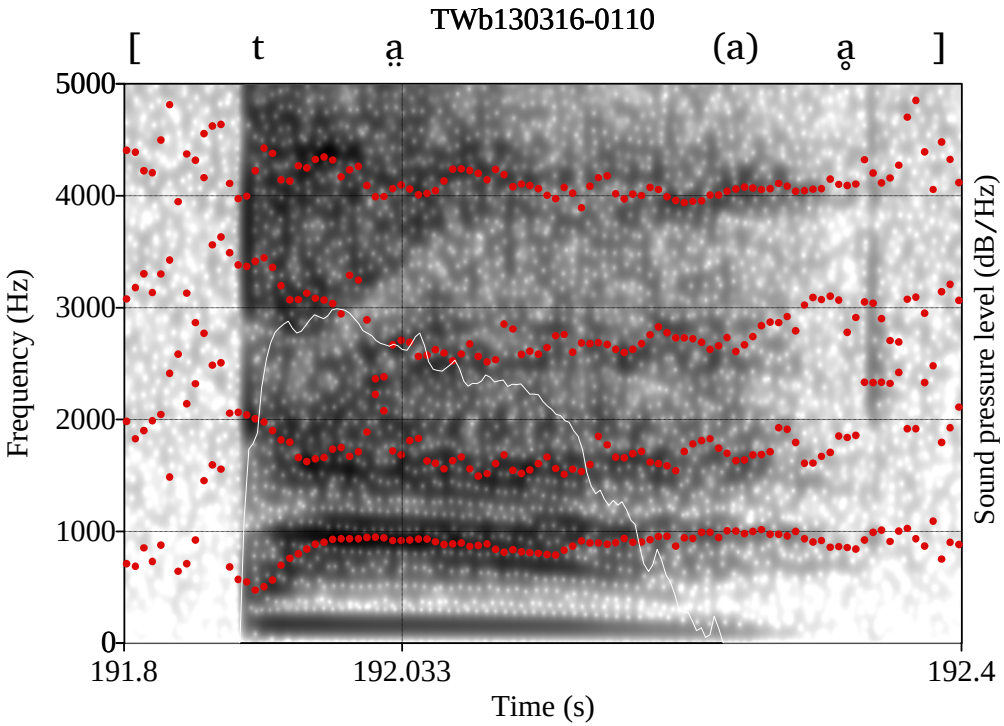
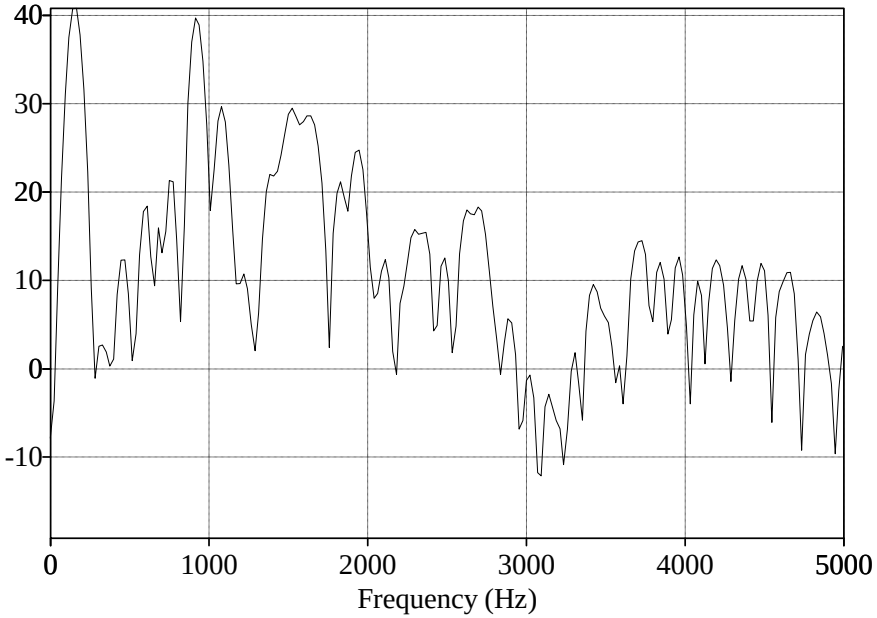
# Examples

## Breathy vowel /a̤/ (/ta̤a/ "to refuse")




*Narrow band spectrogram (window 0.015s) of Taa /ta̤a/ "to refuse" for one male speaker. Formant contours in red, intensity contour in white.*




*Spectral slice from 192.033 s +/- 20ms (= 1/4 of vowel length).*



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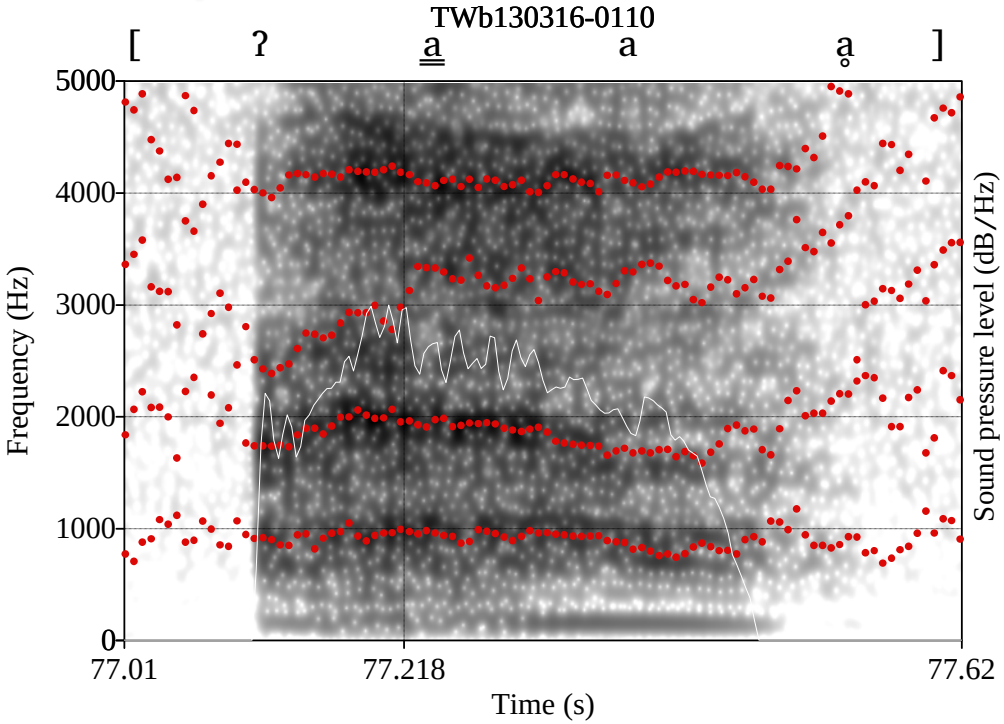
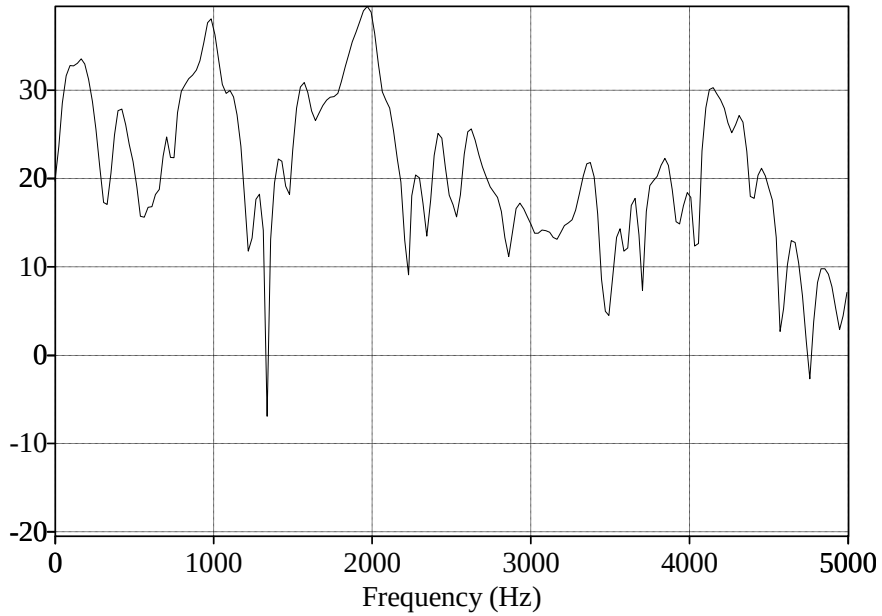
# Examples

## Strident vowel /a͡/ (/a͡a/ "porridge")




*Narrow band spectrogram (window 0.015s) of Taa /a͡a/ "porridge" for one male speaker. Formant contours in red, intensity contour in white.*




*Spectral slice from 77.218 s +/- 20ms (= 1/4 of vowel length).*



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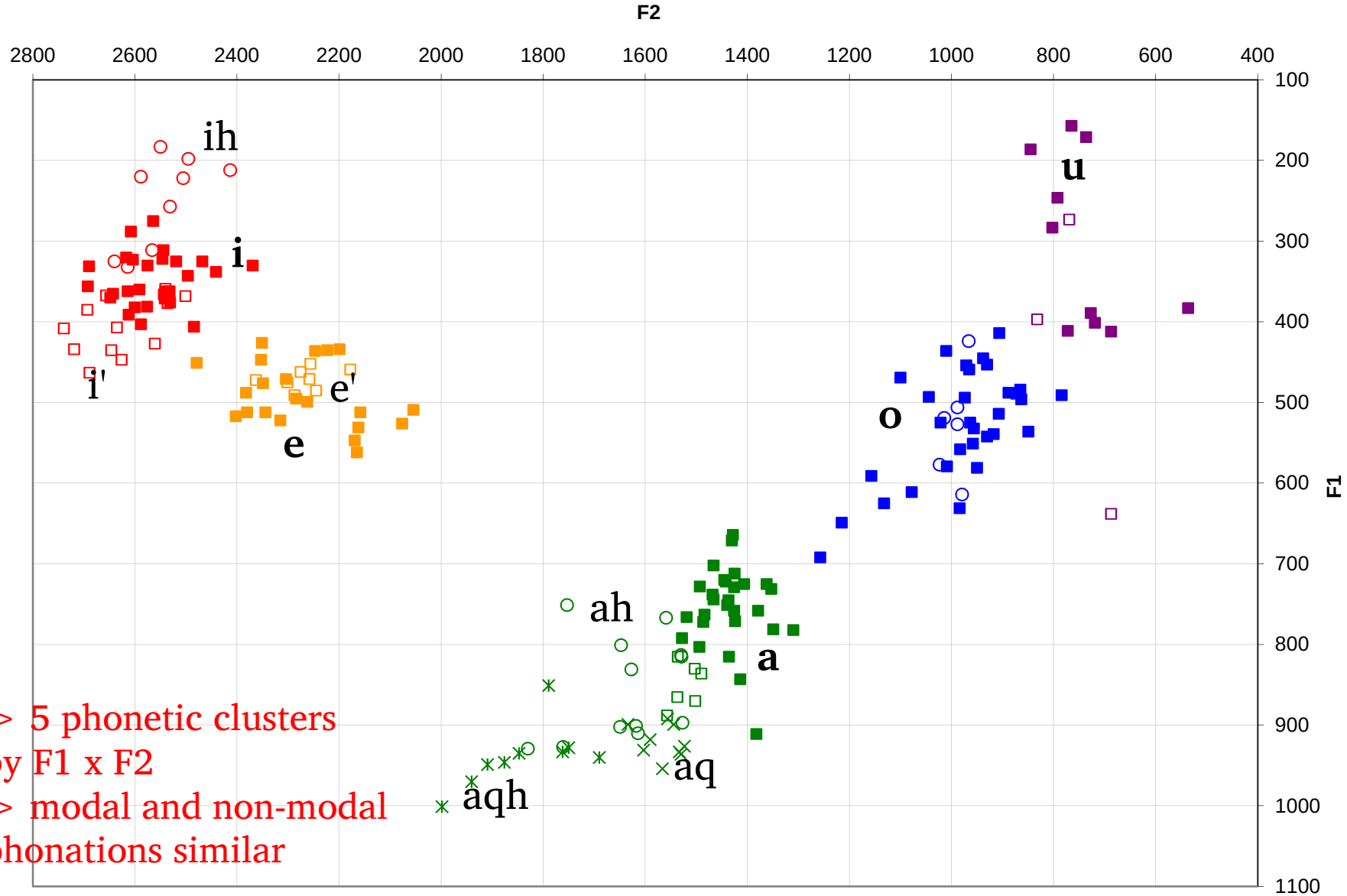
# First results: Phonetic properties




> 5 phonetic clusters by F1 x F2
> modal and non-modal phonations similar

*Vowels in C_ _ context (with formant quality of V1 = V2): F1 vs. F2 for male speaker 278-FT*



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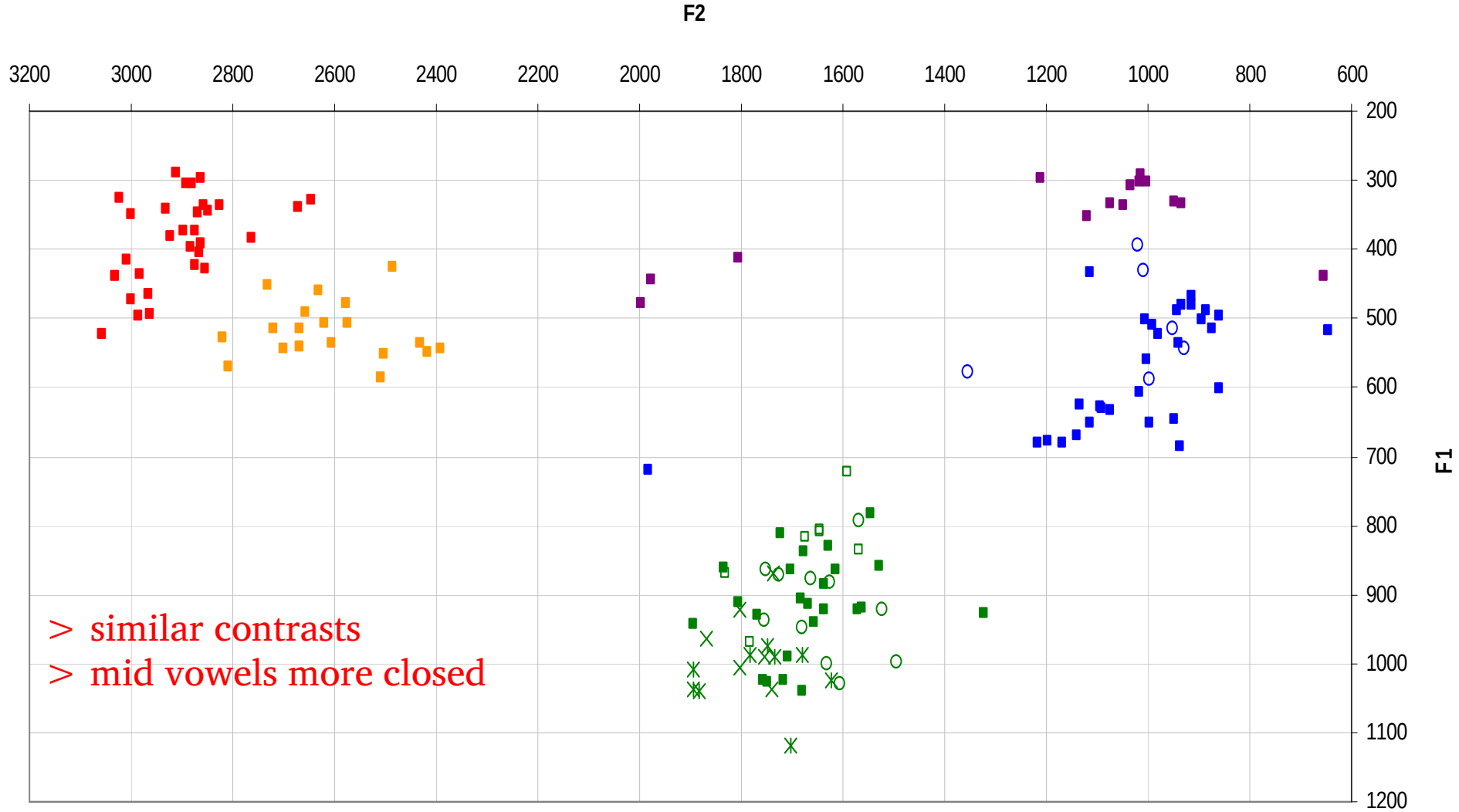
# First results: Phonetic properties

## Same procedure for a second speaker




*Vowels in C_ _ context (with formant quality of V1 = V2): F1 vs. F2 for female speaker 276-JT*

# First results: Phonetic properties

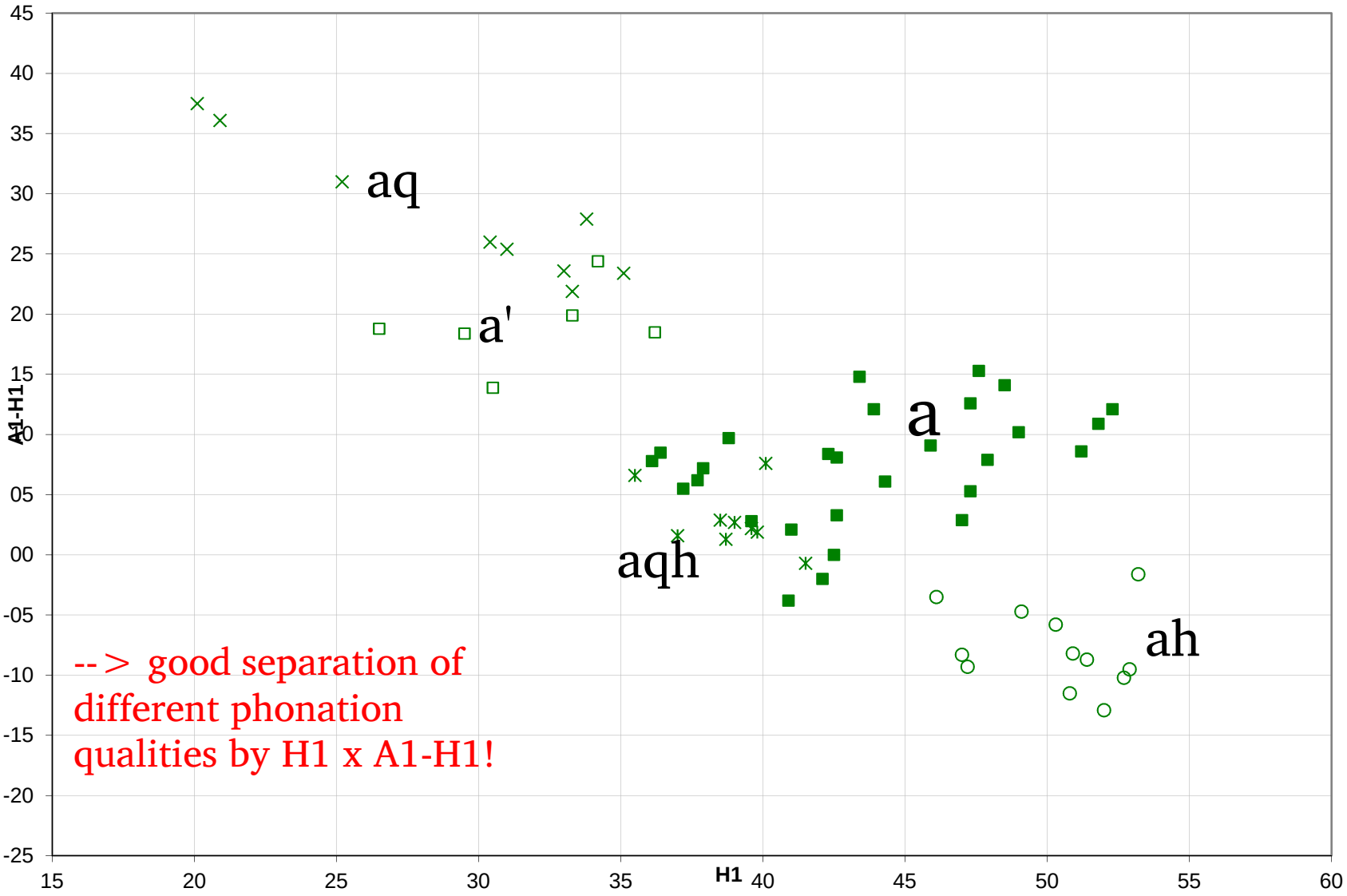
> [i:], [e:], [a:], [o:], [u:], [ i̪:], ... in the context of C_ _#

- complementary distribution (front vowel) monophtongs – diphtongs:

| | after coronal egressives, dental and palatal clicks (e.g., *t_, s_, |_, ǂ_, ...*) | after uvular egressives, bilabial, alveolar and lateral clicks (e.g., *q_, χ_, ʘ_, !_, ǁ_, ...*) |
|---|---|---|
| [i:] | ✓ | – |
| [ai] | – | ✓ |
| [e:] | ✓ | – |
| [ae] | – | ✓ |
| aber: | | |
| [a:] | ✓ | ✓ |
| [o:] | ✓ | ✓ |
| [ao] | ✓ | ✓ ? |
| [u:] | ✓ | ✓ |
| [au] | ✓ | ✓ |

--> [i:], [ i̪:], [i':], [e:], [e':]
analysable as
/ai/, /a̪/, /a'i/, /ae/, /a'e/
(previously known)

# First results: Phonetic properties



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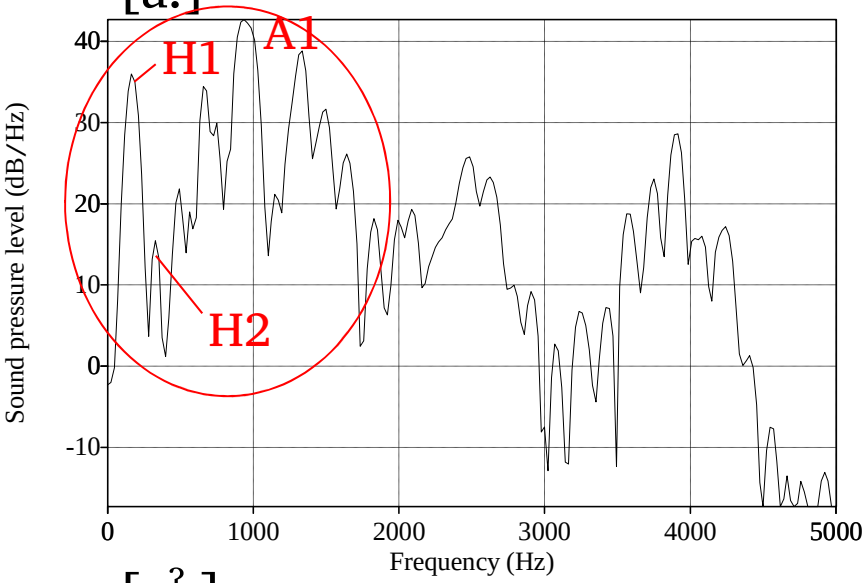
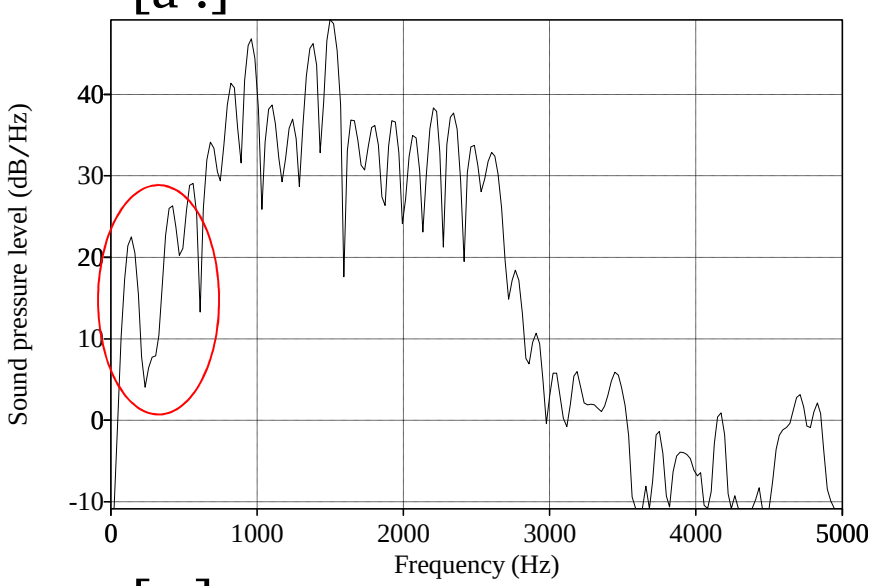
# First results: Phonetic properties

## Vgl. Spektra:

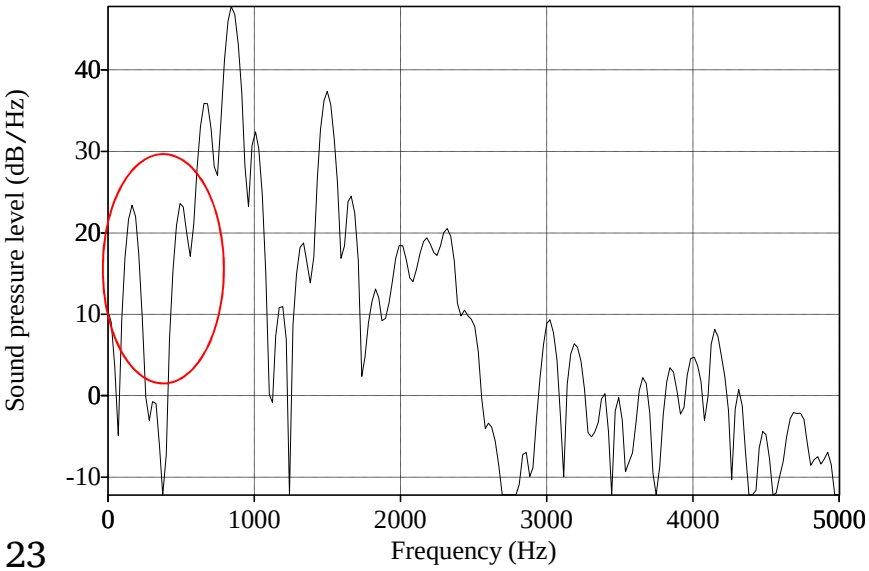
[a:]



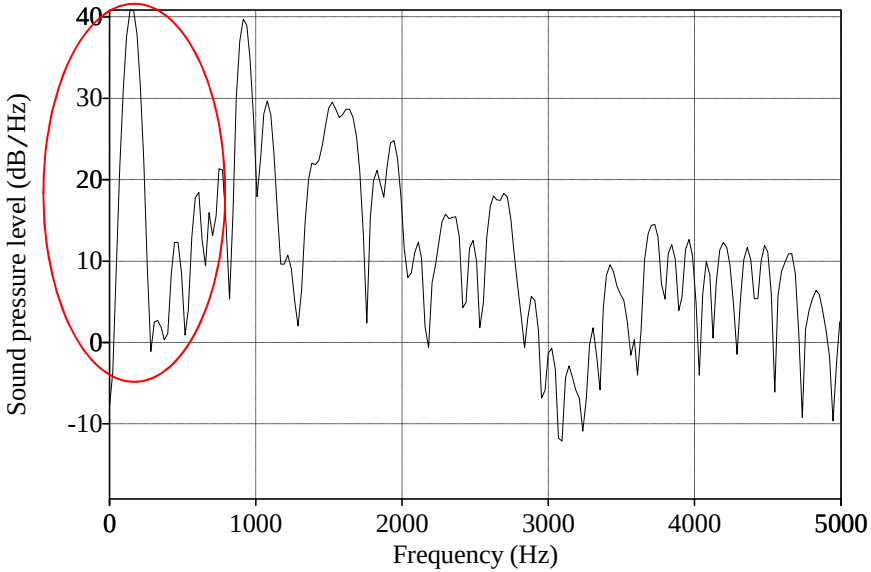

[aˤ:]




[aˀ:]

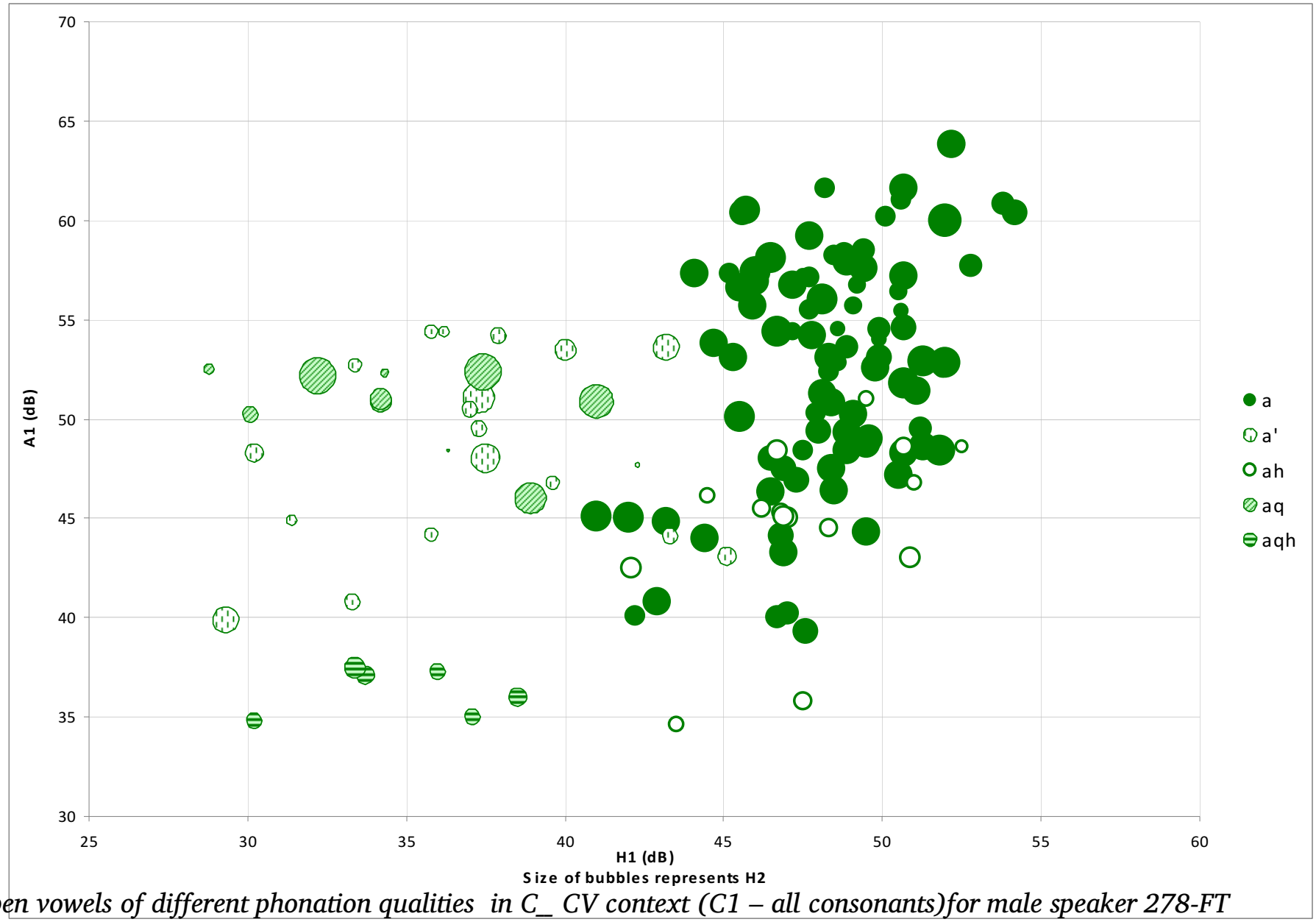



[a̰:]



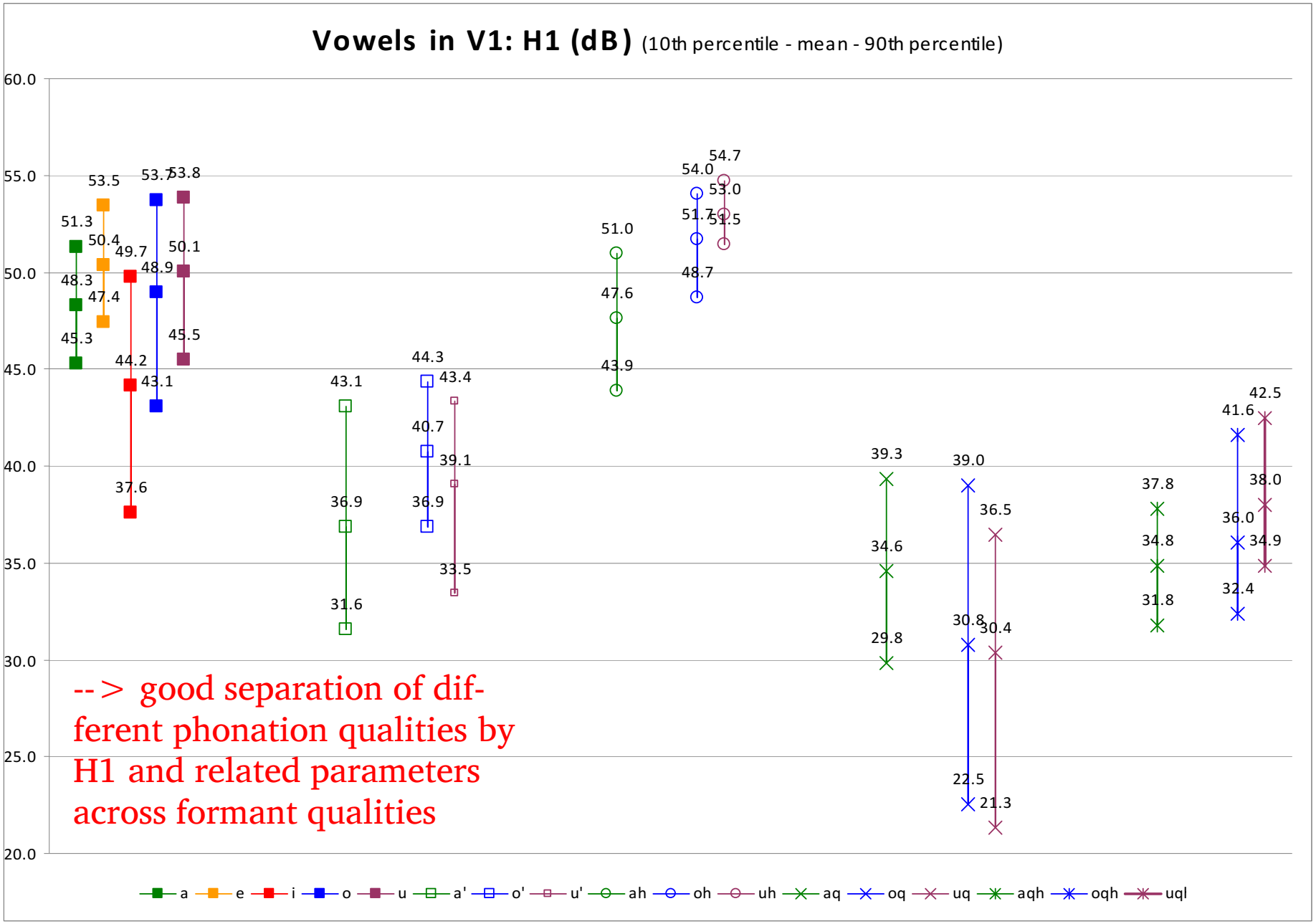
# First results: Phonetic properties

## A similar arrangement



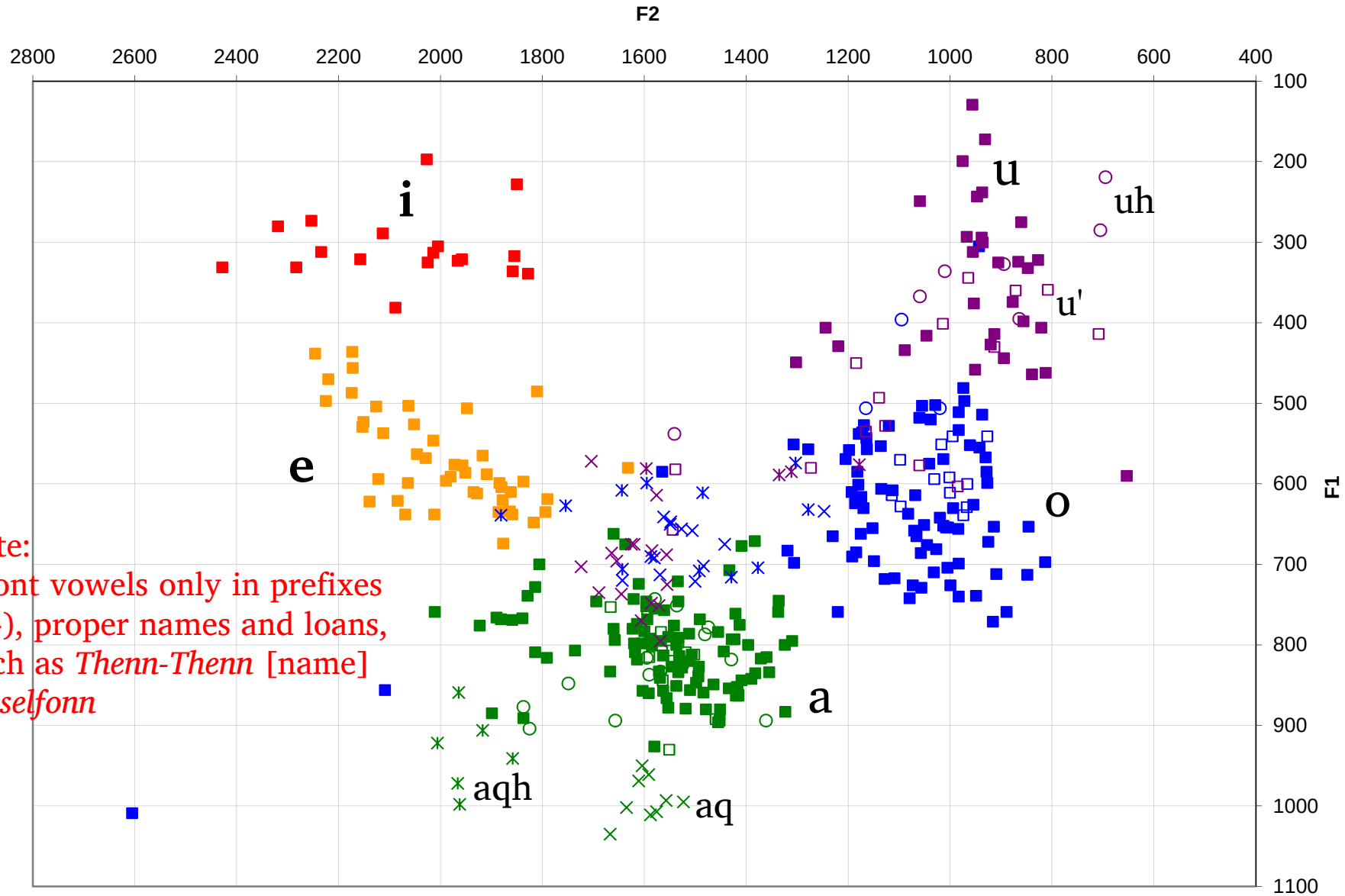

24 *Open vowels of different phonation qualities in C_ CV context (C1 – all consonants)for male speaker 278-FT*

# *First results: Phonetic properties*




25 *Vowels of different phonation qualities in C_ C(V)# contexts (C1 – all consonants) for male speaker 278-FT*

# First results: Contrast in $C_{cor}$_C(V)




note:
•front vowels only in prefixes (*si-*), proper names and loans, such as *Thenn-Thenn* [name] or *selfonn*

*Vowels in C_C(V) context (C1 = anterior egressive or glottal): F1 vs. F2 for male speaker 278-FT*



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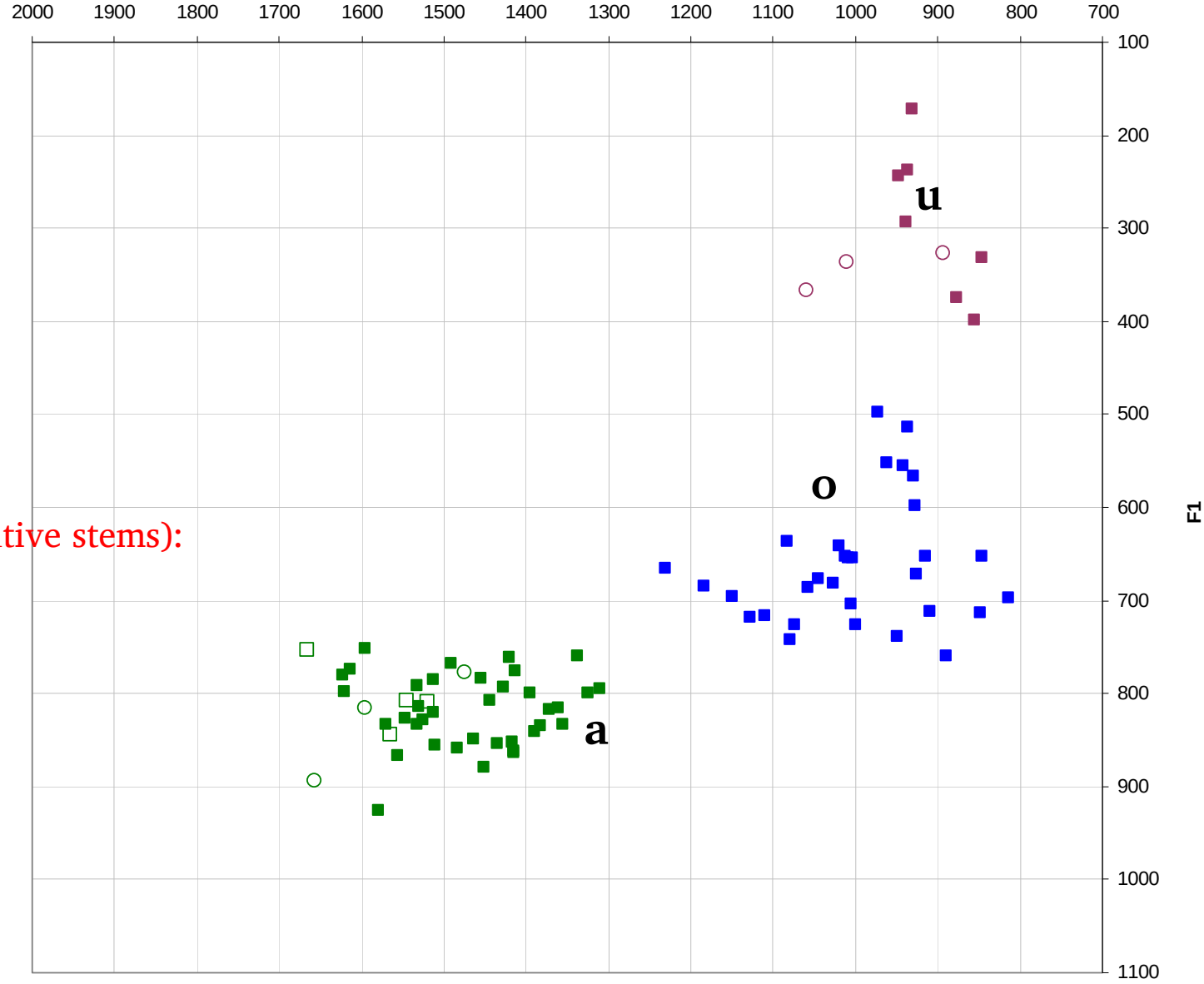
# First results: [a] : [o] : [u] ? in $C_{cor}$_C(V)

## [a] : [o] : [u] in $C_{eggr.cor}$_C# (male speaker 278-FT)

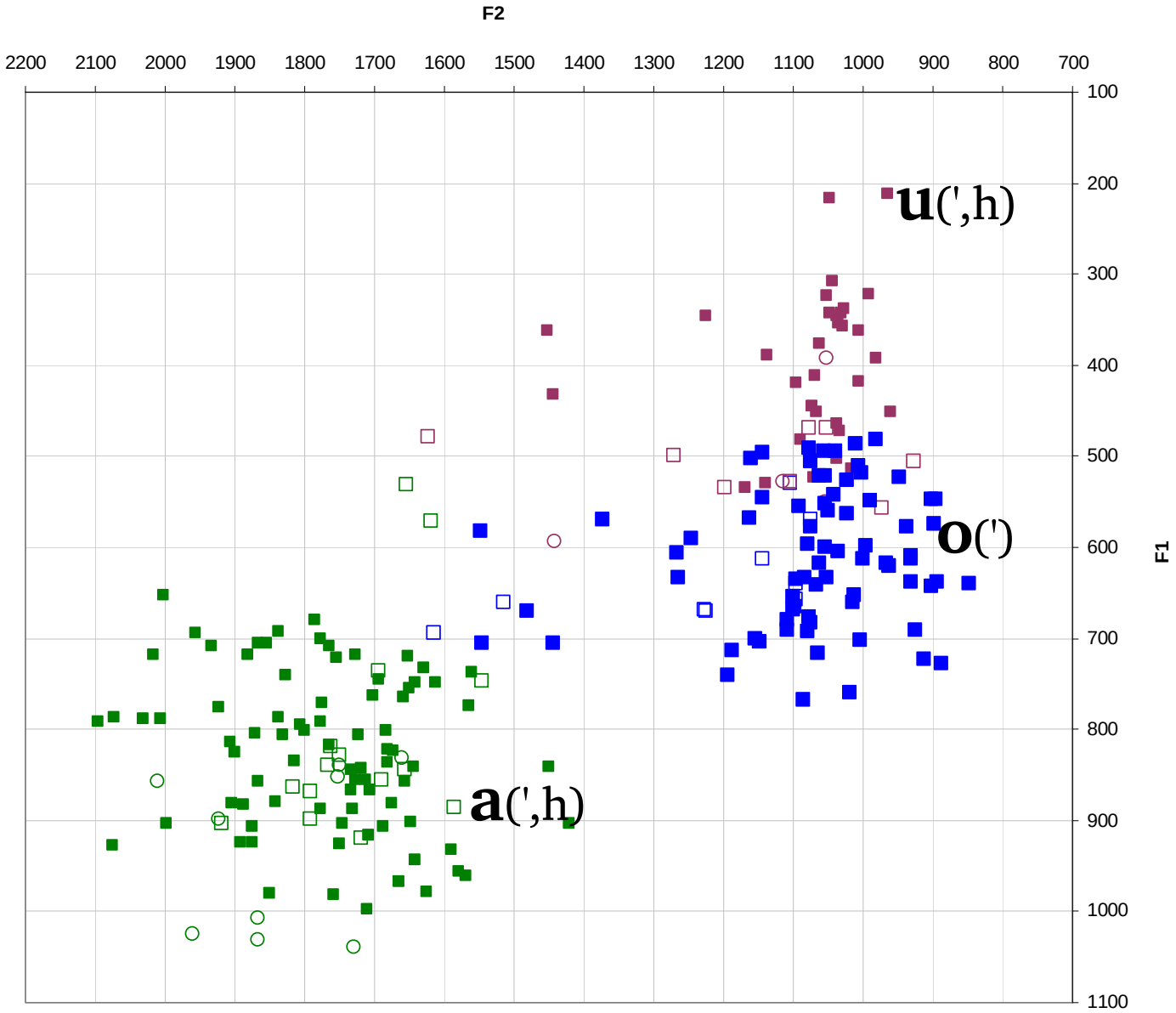



tendency (native stems):

- [o] _m
- [u] _n

## *First results: [a] : [o] : [u] ? in $C_{cor}$_C(V)*

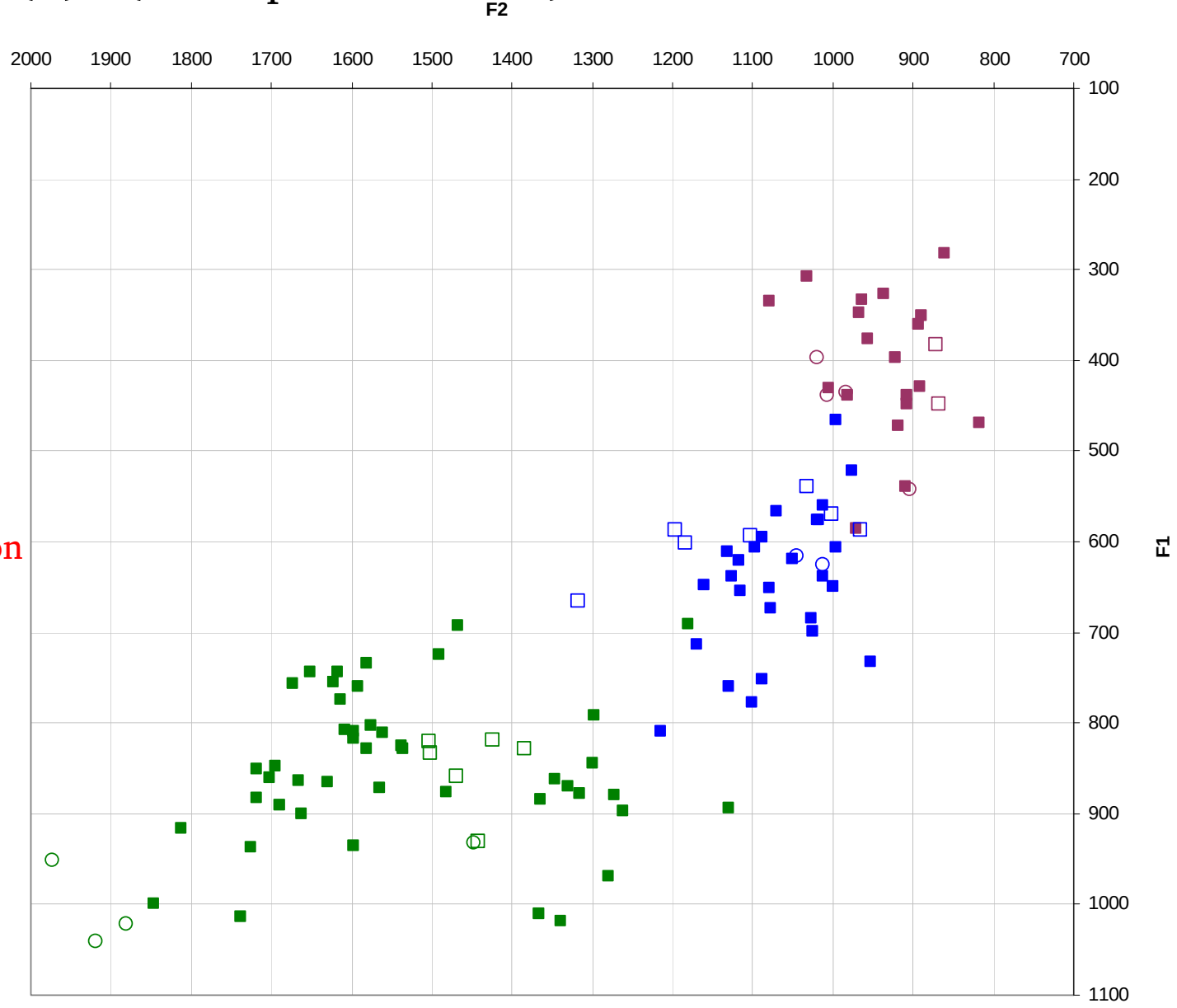
[a] : [o] : [u] in $C_{eggr.cor}$_C# (female speaker 276-JT)




> partial neutralisation
> [u] ~ [o]?

# *First results: [a] : [o] : [u] ? in $C_{cor}$_C(V)*

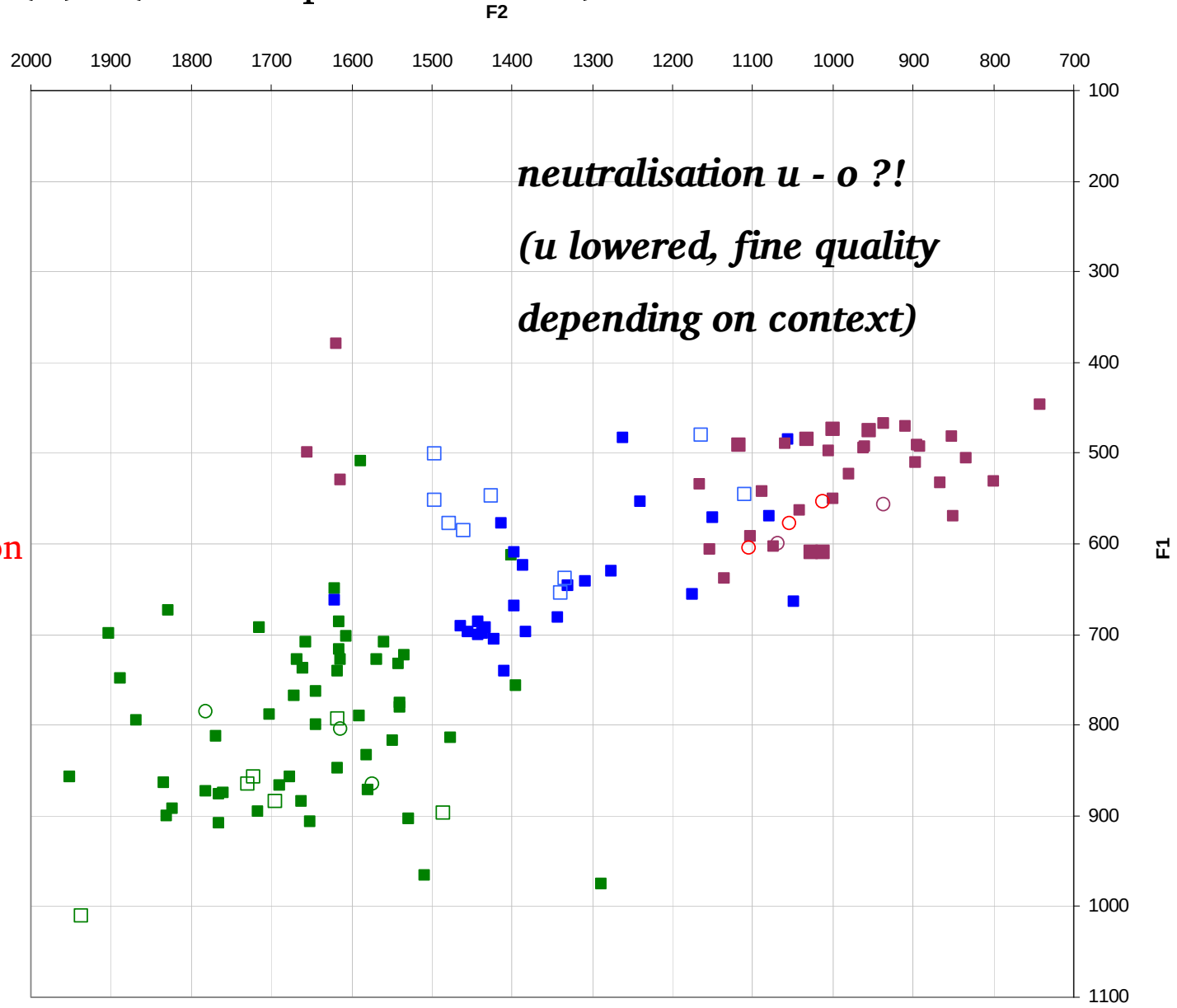
## [a] : [o] : [u] in !_C(V)# (male speaker 278-FT)




> partial neutralisation
> [u] ~ [o]?

## *First results: [a] : [o] : [u] ? in $C_{cor}$_C(V)*

[a] : [o] : [u] in !_C(V)# (female speaker 276-JT)




> partial neutralisation [u] ~ [o]!

# References

**Acknowledgements to:**

- **Annika Vosseler** (data preparation)
- **Sven Grawunder** (scripts)

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