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## **Age-dependent differences in the perception and production of phonological contrasts in varieties of German**

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## Motivation and Aims

- Are there any sound changes in progress in regional varieties of German under the influence of the standard variety?
- Do these changes take place both in production and perception?
- Are phonological contrasts perceived to a greater extent in prosodically strong context (i.e. sentence or lexical stress)?

## Object of study

- phonological opposition: intervocalic voicing contrast and vowel length contrast in East Franconian, Saxon und Bavarian



## Production und perception: Where and when does sound change occur?

### *Lindblom (1995)*

- speaker produces speech along a **hyper/hypoarticulation** continuum, depending on the listeners' needs
- modifications (changes) in production are intended

### *Ohala (1993)*

- misperception: Listener compensates insufficiently for coarticulation
- ↓
- changes in production occur **by accident**

- **temporary *Mismatch* in production and perception → *Realignment***

sound change frequently occurs in prosodically weak (i.e.. unaccented) words (Beckman et al. 1992), since in these contexts

- the magnitude of coarticulation is greater
- the listener focuses more on the *WHAT-IS-SAID* than on the *HOW-IS-IT-SAID* (due to the large amount of information)

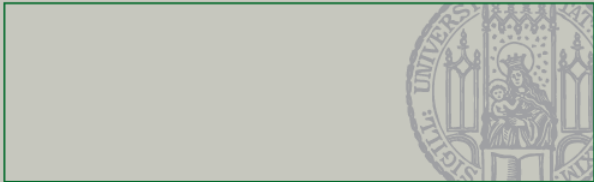


## Phonological voicing contrast in Standard German

- voiced/voiceless, lenis/fortis, etc. (cf. Braun, 1988)
- /ba:dən/ ('to bath') vs. /ba:tən/ (1 pl. 'requested'), /laɪdən/ ('to suffer') vs. /laɪtən/ ('to lead'), /mi:dən/ (1 pl. 'avoided') vs. /mi:tən/ ('to rent'), /bo:dən/ ('ground') vs. /bo:tən/ (1 pl. offered)
- Hierarchy of acoustic cues that are perceptually relevant (Kohler, 1979)
  - Aspiration (in particular in initial position)
  - Vowel : stop duration ratio  
(in particular in intervocalic position and velar release)
 

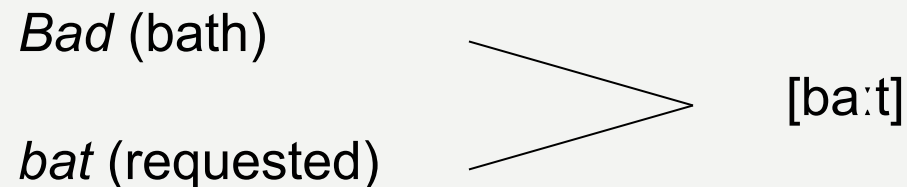
lenis

fortis
  - Formant transitions
  - phonetic voicing



## Neutralization of the phonemic voicing contrast

- in syllable **final** position in Standard German, e.g.



- incomplete neutralization of the final voicing contrast both in production (Port & O'Dell, 1985) and perception (Kleber et al., 2010)
- fine phonetic differences such as e.g. longer vowel durations before underlying voiced stops in words like *Bad* vs. *bat* (Port & O'Dell, 1985)
- in syllable **initial**, i.e. prevocalic and/or **intervocalic** position in various German dialects



## Central German Lenition

Lenition of voiceless obstruents in pre-vocalic and / or in intervocalic position (e.g. East Franconian, Saxon)

## Central Bavarian Lenition

Before voiced obstruents vowels are always long, before voiceless obstruents vowels are always short!



Quelle: [http://www.ids-mannheim.de/prag/AusVar/Deutsch\\_heute/Dialektgebiete.jpg](http://www.ids-mannheim.de/prag/AusVar/Deutsch_heute/Dialektgebiete.jpg)



## Sound change

- Lenition: frequent sound change
  - ↳ possible reasons may be internal factors (Labov, 1994) such as synchronous variability (Kohler, 1984)
- *Dialect levelling*: evidence that speakers of younger generations produce less dialect features and tend to a more standard-like pronunciation as opposed to older speakers of the same speaker community (Lameli, 2004; Wagener, 2002)
  - ↳ external factors (Labov, 1994) such as e.g. the prestige of a dialect may cause a sound change in the opposite direction (Torgersen & Kerswill, 2004)



## Research questions

1. Are phonological contrasts only incompletely neutralized in 'neutralizing' varieties of German?
2. Is there an increase in maintaining Standard German contrasts in younger generations of Upper German neutralizing dialects?



## Method

- apparent-time analysis
- phonetic Corpora: read speech, minimal pairs  
/laɪd(ə)n/ – /laɪt(ə)n/, /mi:d(ə)n/ – /mi:t(ə)n/, /ba:d(ə)n/ – /ba:t(ə)n/, etc.
- 79 speakers grouped according to region and age group

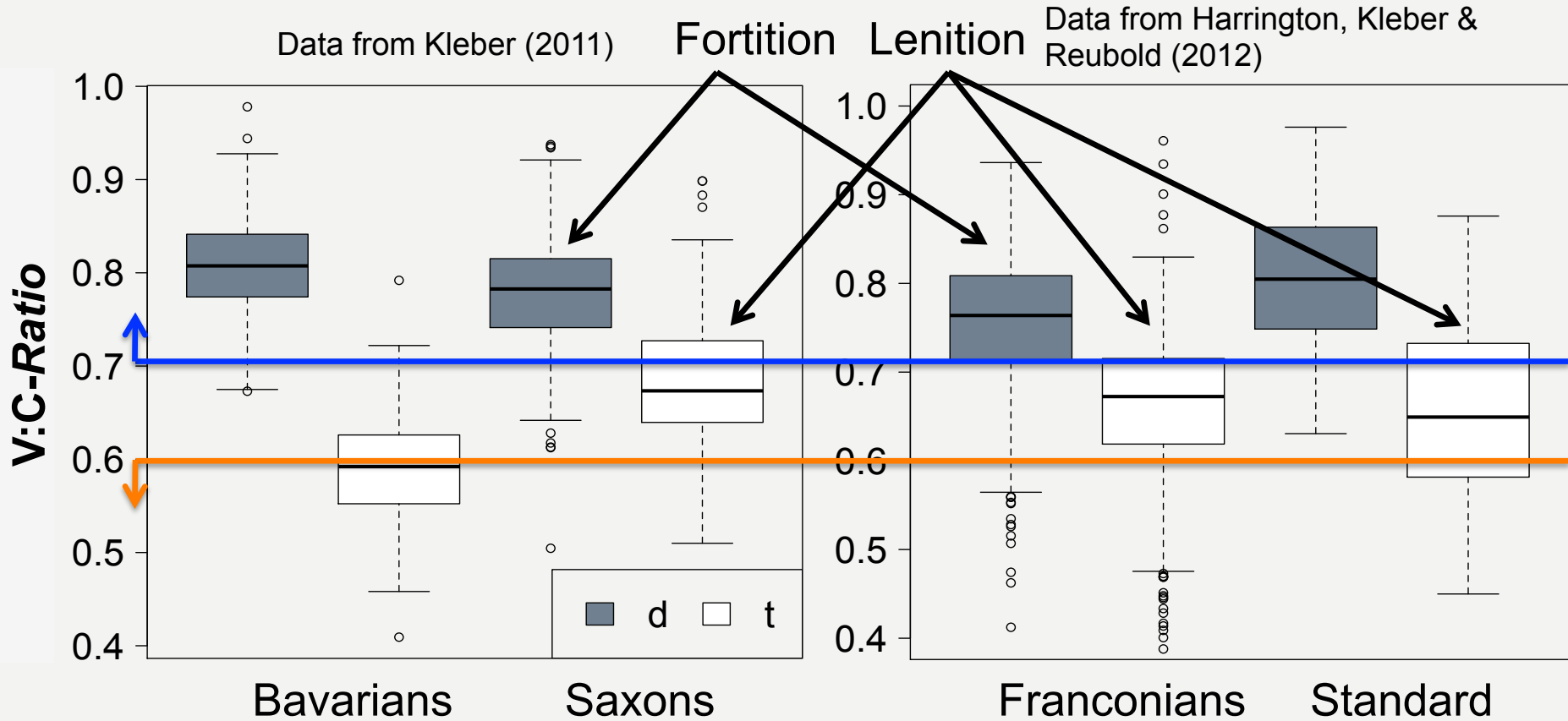
	Franconian	Bavarian	Saxon	Standard
Older (> 50)	16	8	13	5
Younger (< 50)	16	12	9	

- data analysis:
  - Measurement of vowel (V) and closure duration (C)
  - $V/(V+C) = V:C\text{-Ratio}$



# Do Saxon and Franconian speakers neutralize the intervocalic voicing contrast completely?

**No!**

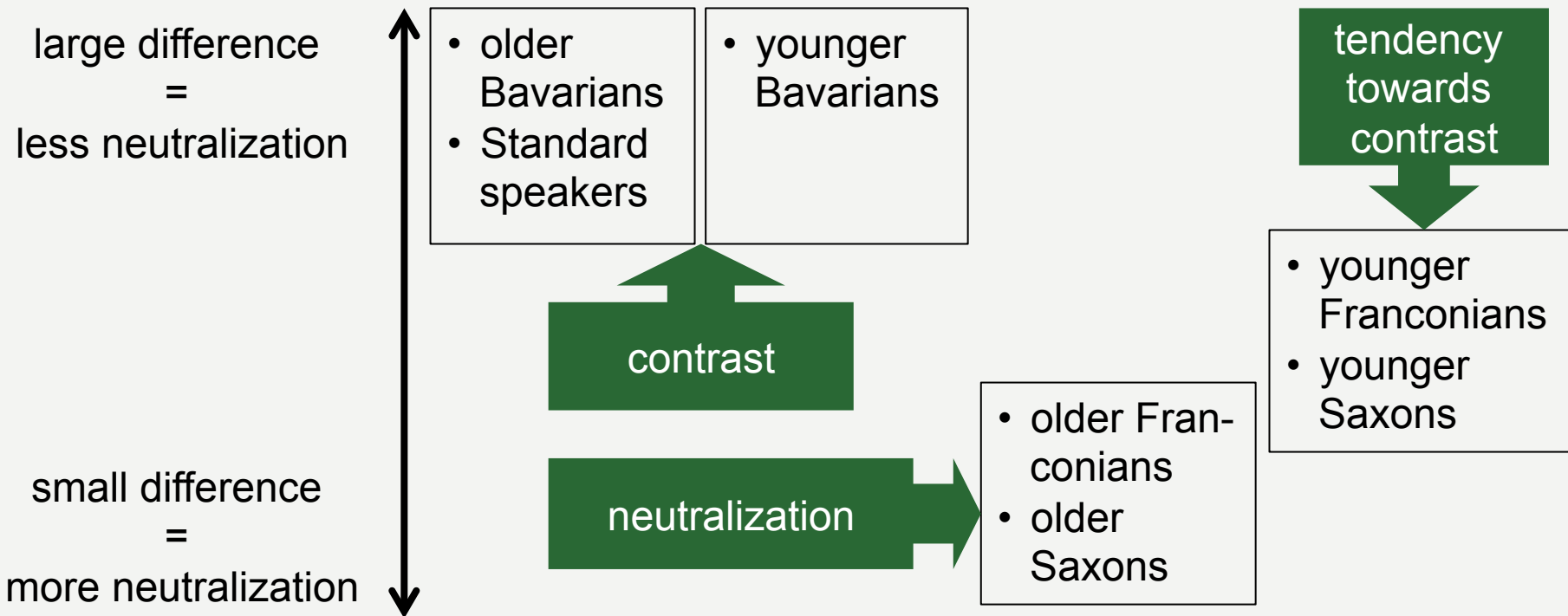


V:C-Ratios in Kohler & Kühnzel (1978): long vowel + lenis, long vowel + fortis

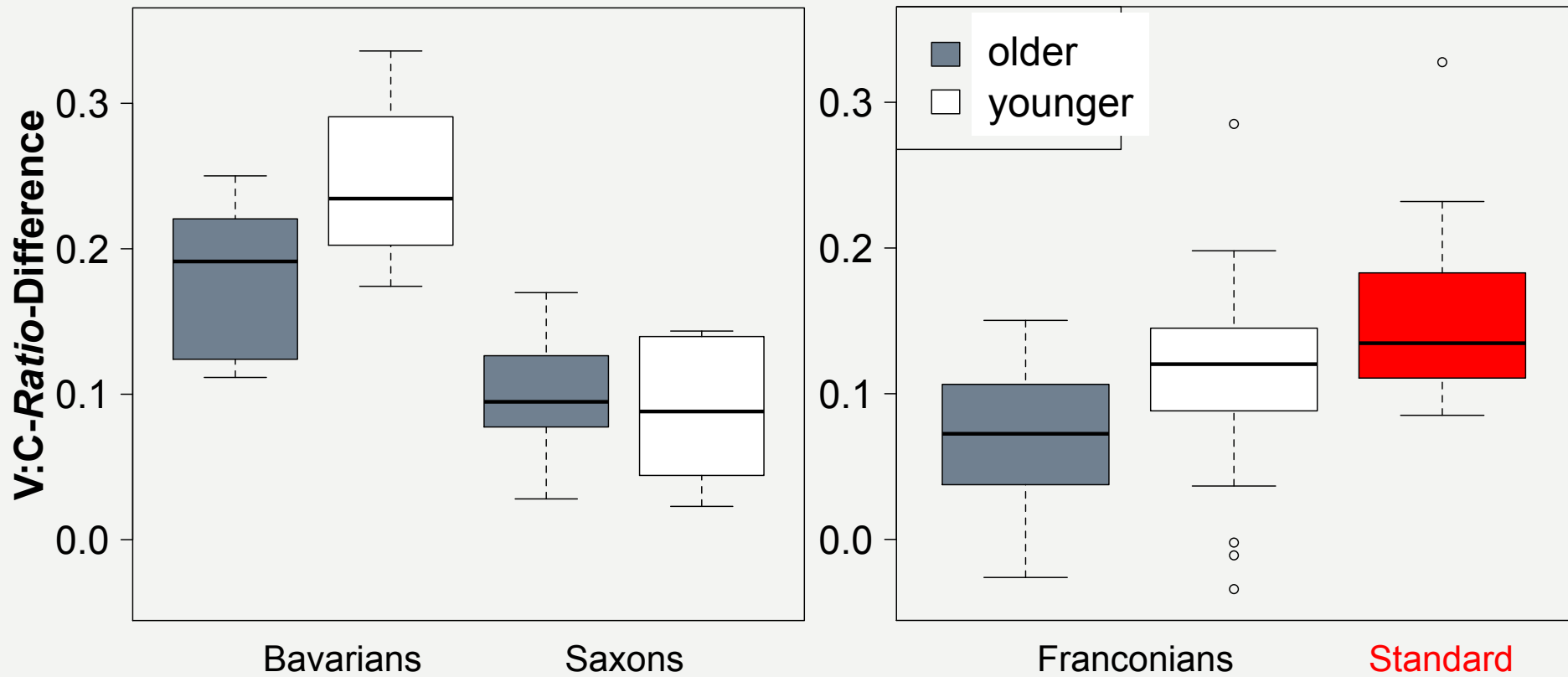


## Neutralization degree

difference between mean V:C-Ratios of all /d/ and of all /t/ tokens per speaker

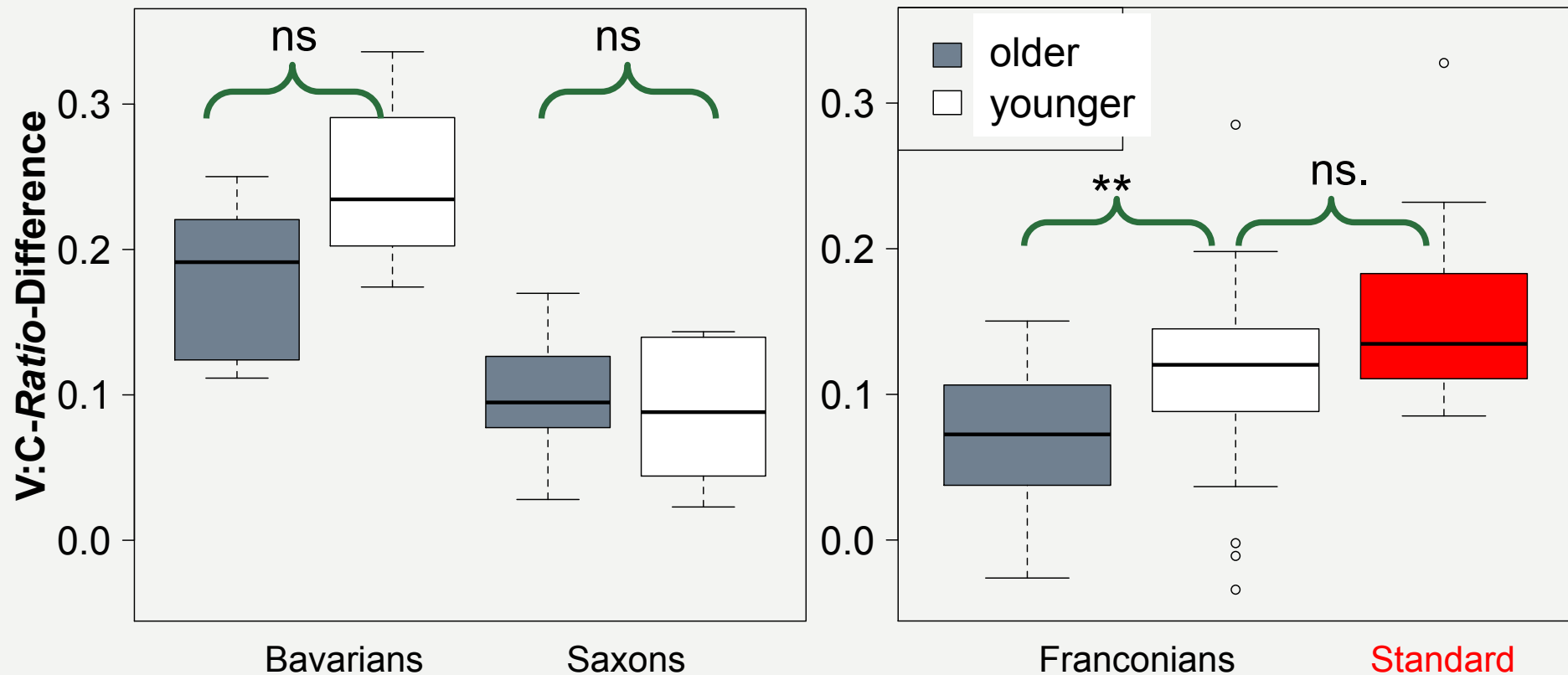


**Do Franconian and Saxon speakers neutralize the voicing contrast to a greater extent?**  
**Yes!**





## Do younger Franconians and younger Saxons tend to maintain the contrast to a greater extent than older speakers of these varieties?






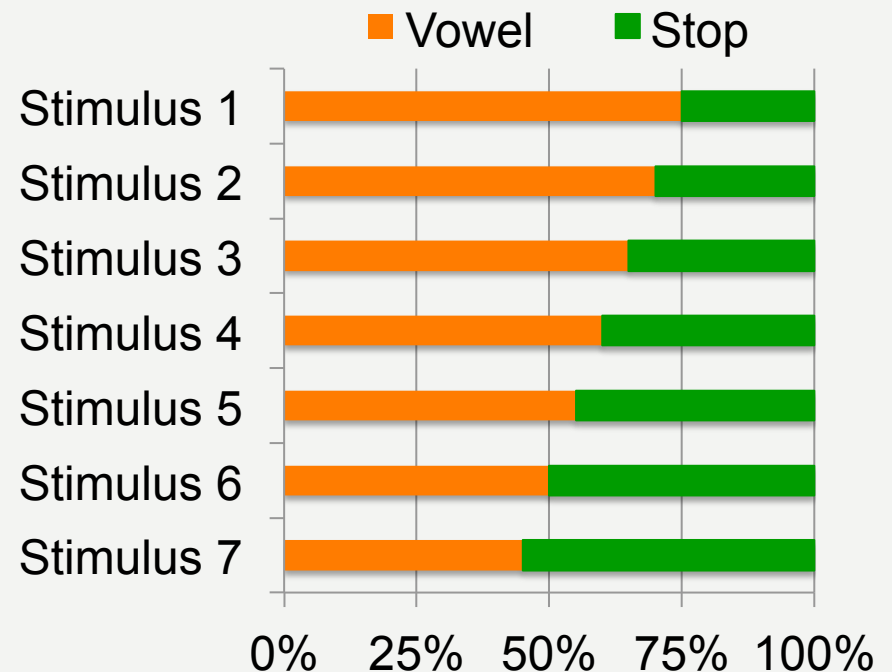
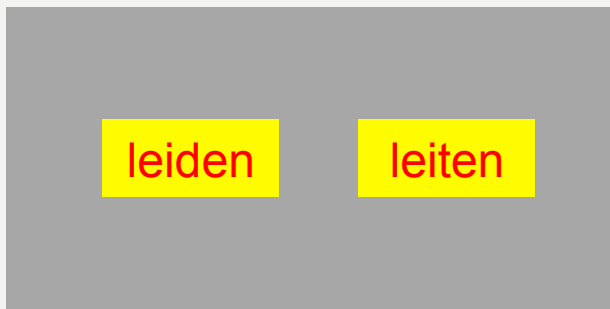
## Summary of production results

- ✓ Neither East Franconian nor Saxon speakers neutralize the voicing contrast, but they maintain it only incompletely as opposed to Standard and Bavarian speakers.
- ✓ Older East Franconian speakers tend to neutralize the contrast to a greater extent than younger East Franconian speakers!
- ✗ No difference in the degree of neutralization between older and younger Saxons.

→ **Do listeners of these varieties perceive the fortis/lenis contrast to a different extent?**

## Perception test

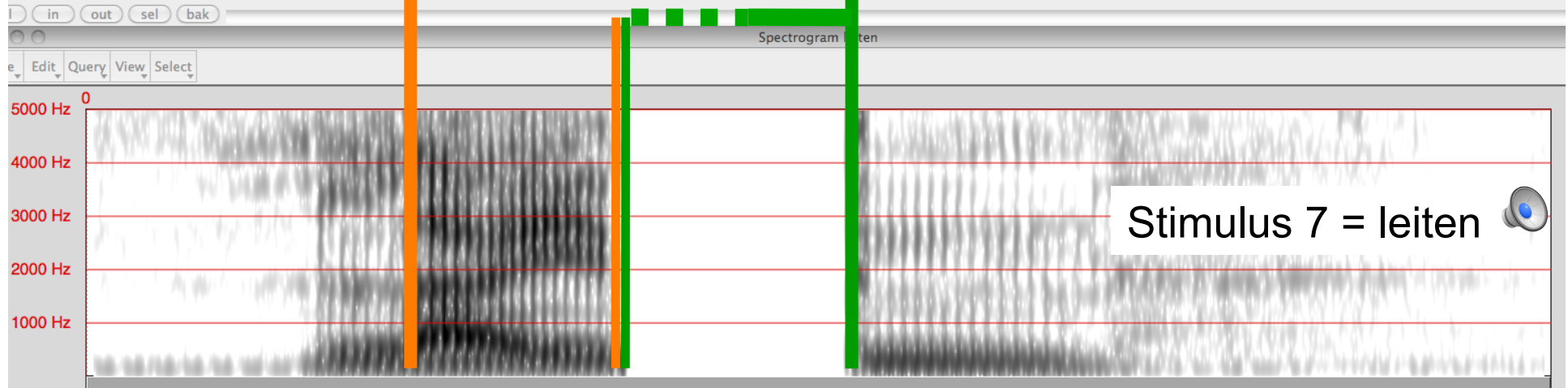
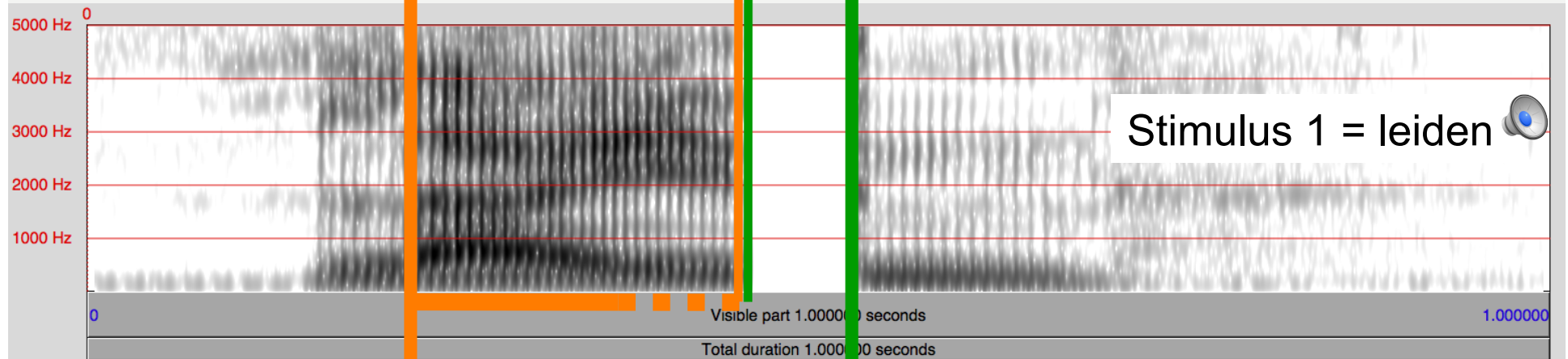
- synthesis of V:C duration continuum from  /laɪdn/ – /laɪtn/
- *Two-alternative forced-choice (2AFC)* identification test in *praat*



## Participants

- the same 32 Franconian plus 20 Standard German speakers
- 20 Bavarians (10 older, 10 younger) und 16 Saxons (6 older, 10 younger)

Vowel Closure

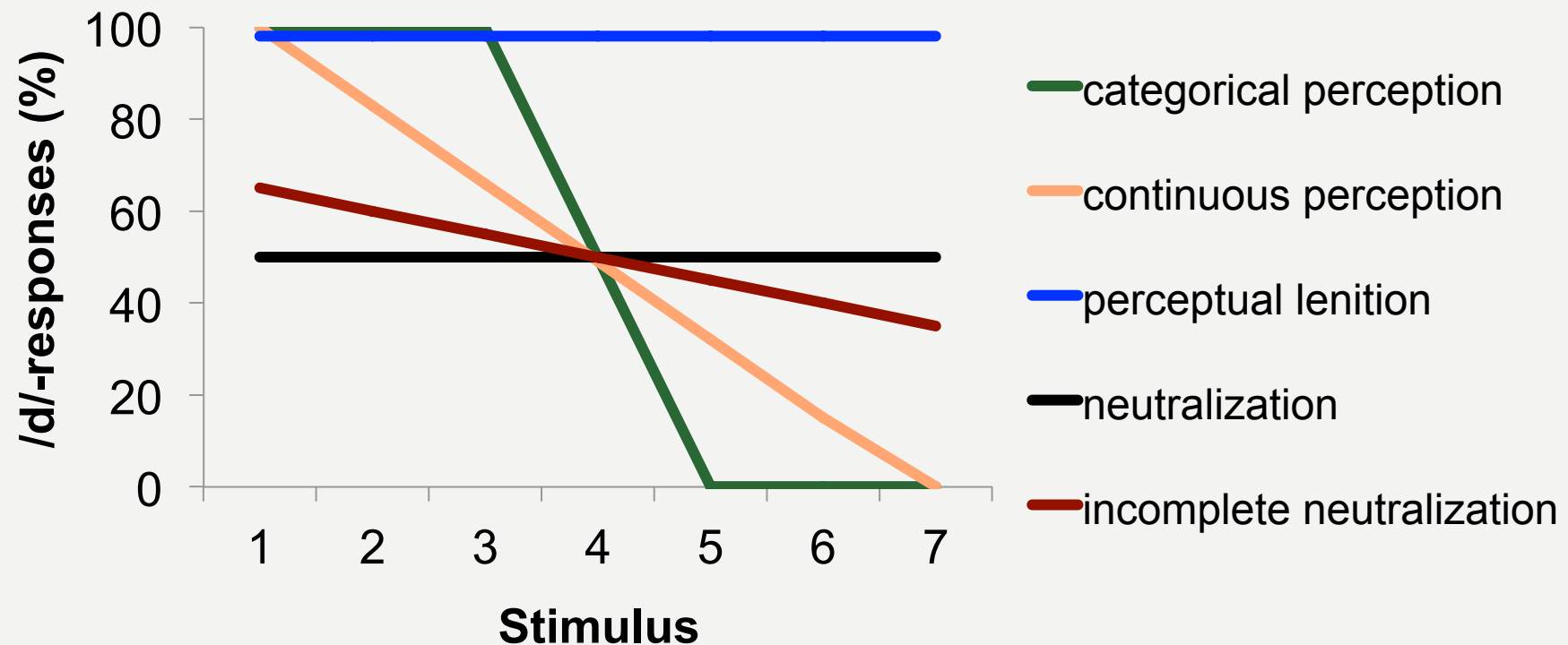






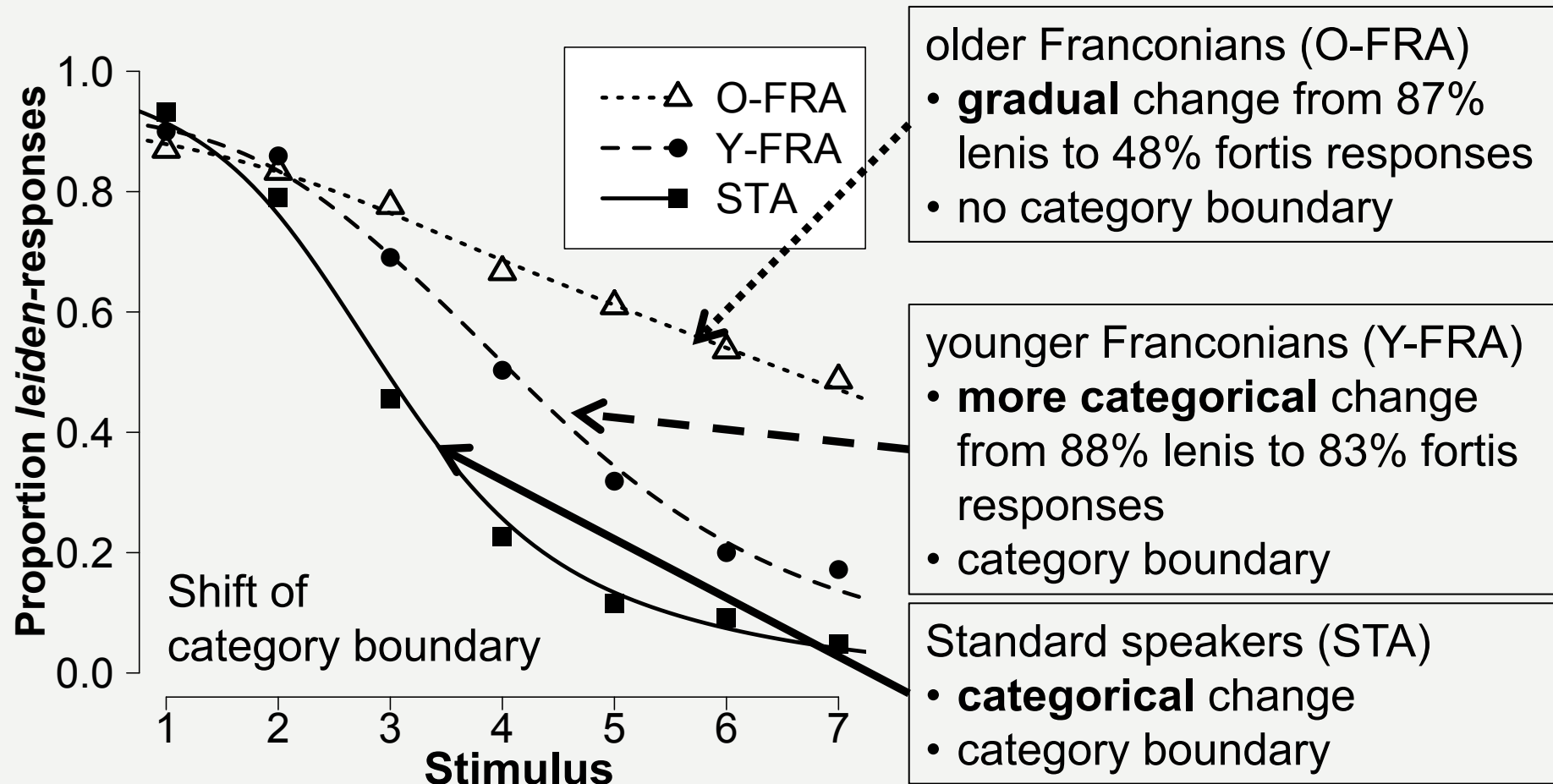
## Perception, sound change and the categorical perception paradigm

- perceptual subdivision of acoustic continuum in distinct categories





## Do younger Franconians perceive the lenis/fortis-contrast more categorical than older Franconians?



## Do Saxon listeners differentiate between *leenis* and *fortis*?

### 2. Is the contrast perceived to a greater extent in prosodically strong words?

A: Was hat Maria gesagt?

*What did Maria say?*

B: Maria hat **LEITEN** gesagt.

*Maria has said **LEITEN**.*

→ less neutralization

A: Wer hat leiden gesagt?

*Who has said *leiden**

B: **MARIA** hat *leiden* gesagt.


**MARIA** *has said *leiden*.*

→ more neutralization

1. Do Saxon listeners differentiate between lenis und fortis?
2. **Effect of sentence stress on contrast perception**


**Method**

- the same stimuli embedded in two versions of a carrier phrase

Version 1 

Pitch accent on Stimulus

*Maria hat **STIMULUS** gesagt*

Version 2 

Pitch accent on Maria

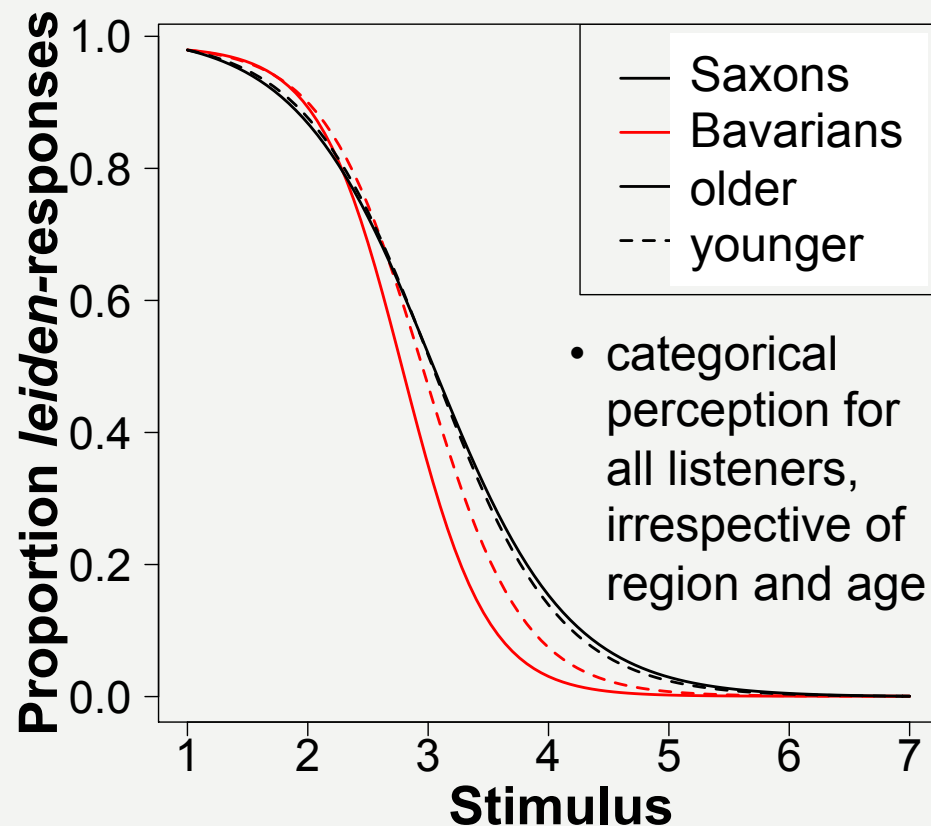
***MARIA** hat Stimulus gesagt.*

- *Two-alternative forced-choice* Identification test: *leiden* or *leiten*
  - 20 Bavarians (10 older, 10 younger) and 16 Saxons (6 older, 10 younger)
- \* Manipulation and resynthesis in *praat*: flat *f0* and less intensity on stimulus as well as *f0*-maximum on *Maria*, greater intensity and lengthened second syllable of *Maria*.



# 1. Do Bavarians perceive a greater (more categorical) contrast between lenis and fortis stops than Saxons?

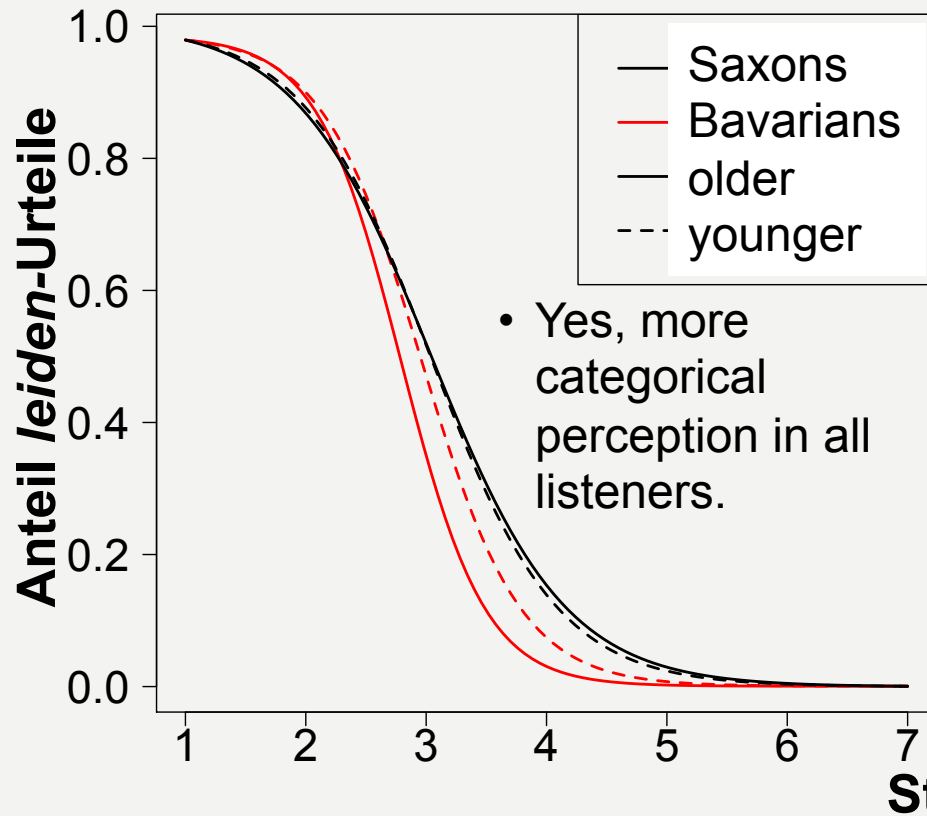
*Maria hat **STIMULUS** gesagt*



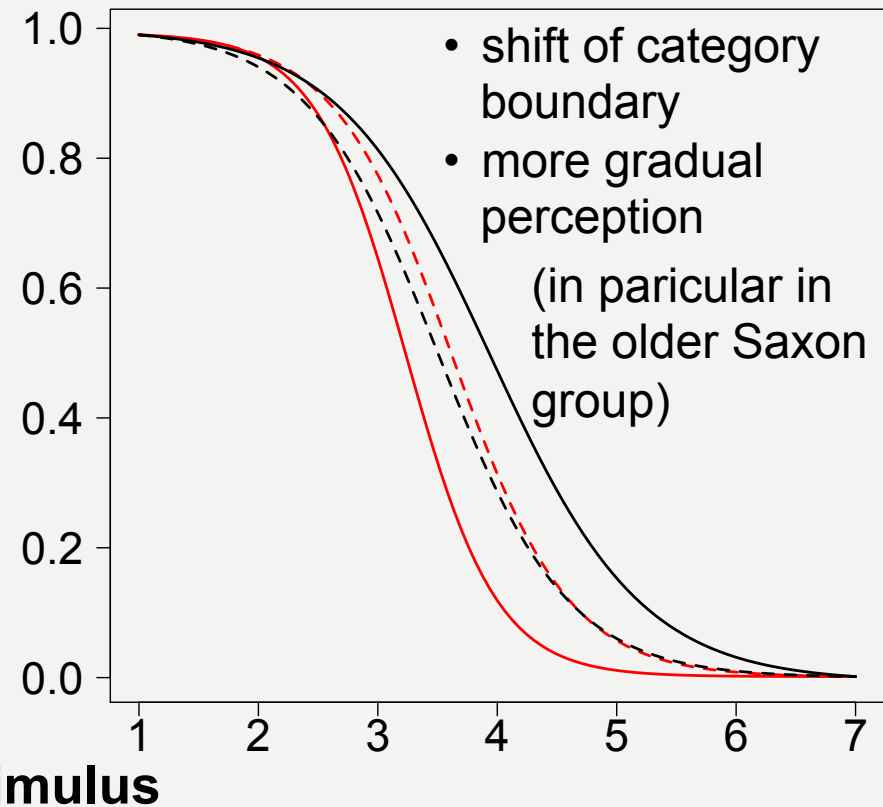


## 2. Is the contrast perceived more clearly (i.e. more categorical) in prosodically strong as opposed to prosodically weak words?

*Maria hat **STIMULUS** gesagt*



***MARIA** hat Stimulus gesagt*





## Summary of perception results

- ✓ Older East Franconians perceive the voicing contrast to a lesser extent than younger East Franconians!
- ✗ Older and younger Saxons show a categorical perception pattern despite their greater tendency to neutralize the voicing contrast in production
- ✗ good labelling performance in prosodic weak contexts, but
  - ✓ shift of category boundary in prosodically weak contexts, i.e. enhancement of the acoustic cue *V:C-ratio* in order to perceive the contrast
  - ✓ more gradual perception



Corpus analysis II

# VOWEL LENGTH CONTRAST





Do Bavarians maintain the intervocalic voicing contrast to a greater extent than Saxons because of the Central Bavarian Lenition?



[ba:dən] or [batən]

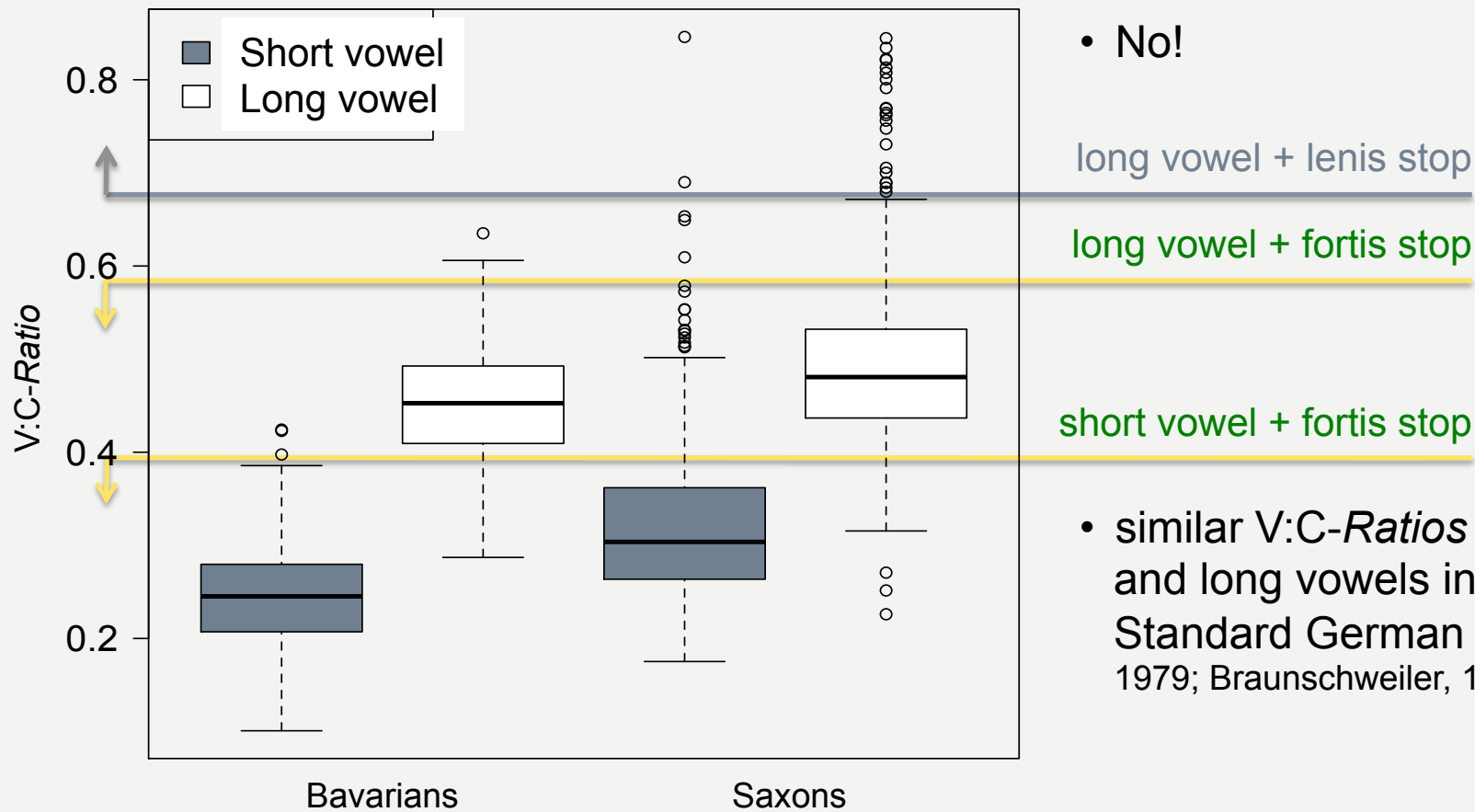
Do Bavarians neutralize the Standard German vowel length contrast in vowels preceding fortis stops?

### Phonemic vowel length contrast in Standard German

- short/long, lax/tense, etc. (cf. Mooshammer, 1998)
- test words: *bieten* – *bitten* ('to offer' – 'to request'), *beten* – *betten* ('to pray' – 'to bed'), *Hüte* – *Hütte* ('hats' – 'hut'), *Höhle* – *Hölle* ('cave' – 'hell')
- acoustic cues: vowel duration, vowel quality



## Do Bavarians neutralize the Standard German vowel length contrast?



• No!

long vowel + lenis stop

long vowel + fortis stop

short vowel + fortis stop

• similar V:C-Ratios in short and long vowels in Standard German (Kohler, 1979; Braunschweiler, 1997)

## Vowel length in German varieties: Expectations

### Bavarians (BAV)

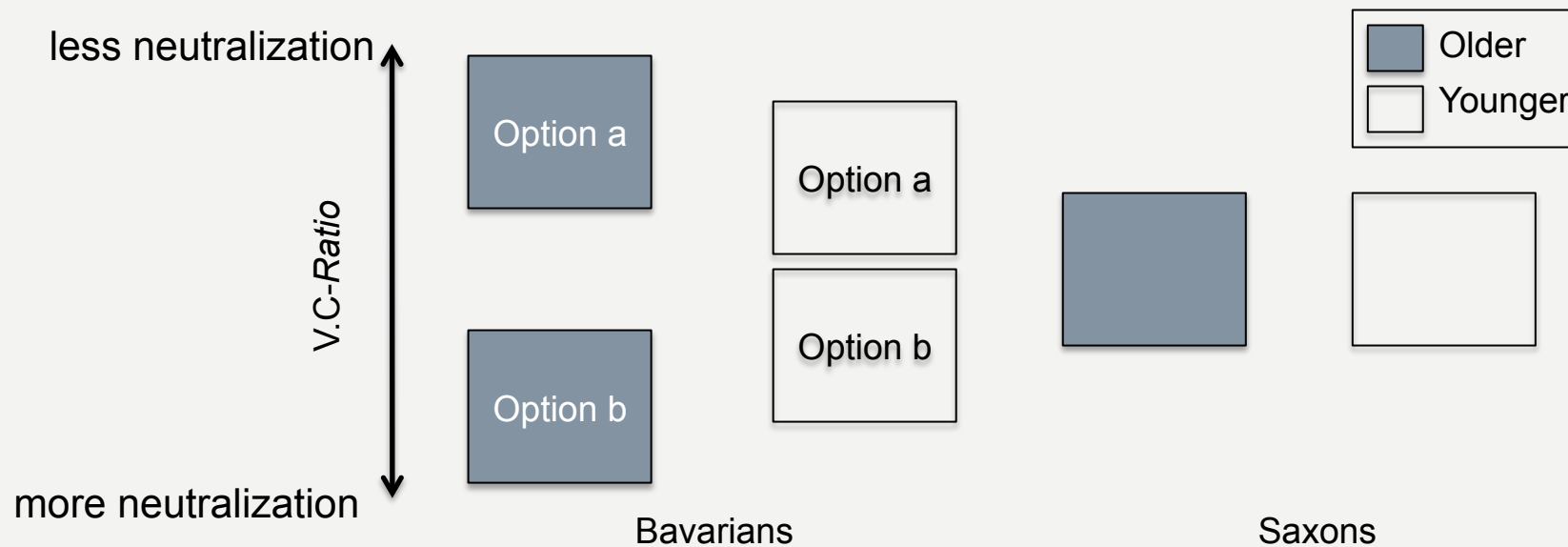
Central Bavarian Lenition

- STA /be:tən/ > BAV [be:dən] or [bɛtən]
- STA /bɛtən/ > BAV [bɛtən]

### Saxons (SAX)

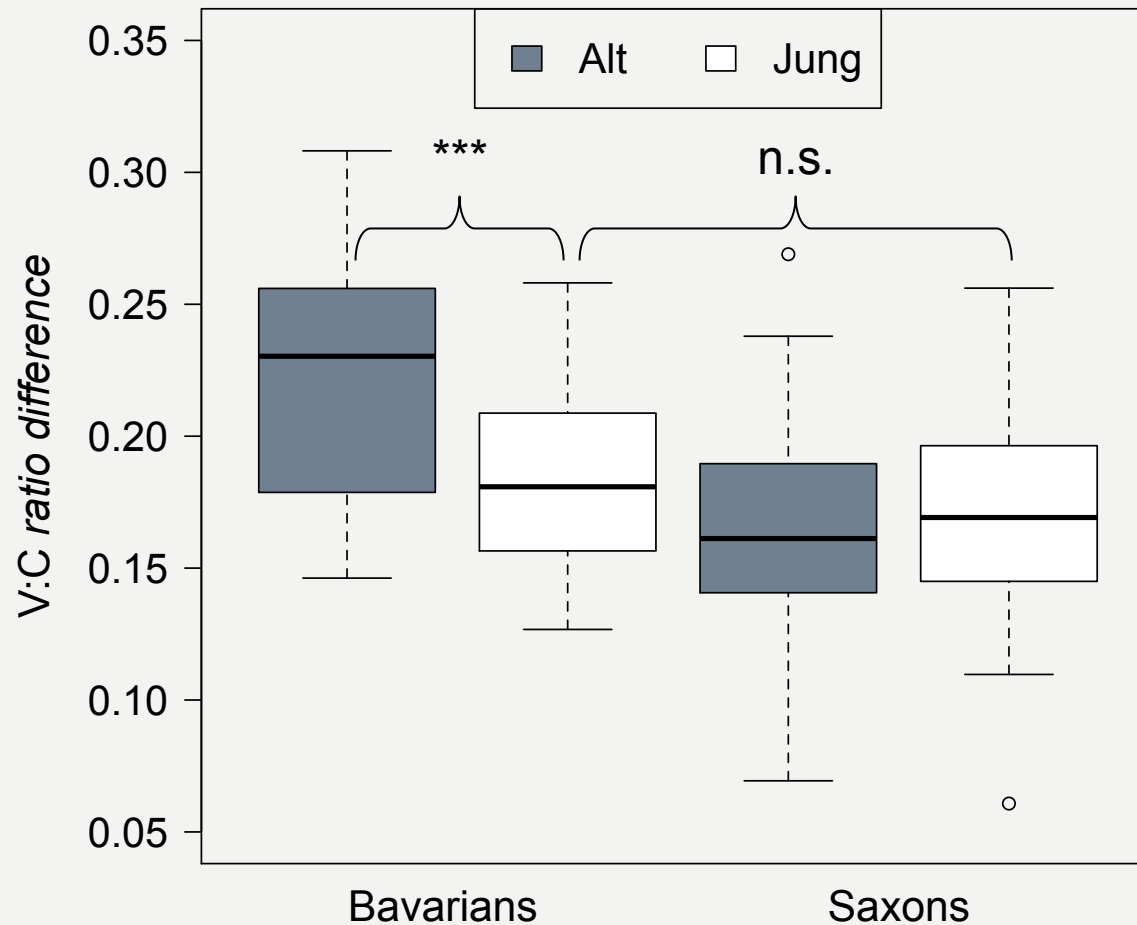
Vowel length contrast + lenition

- STA /be:tən/ > SAX [be:dən]
- STA /bɛtən/ > SAX [bɛdən]



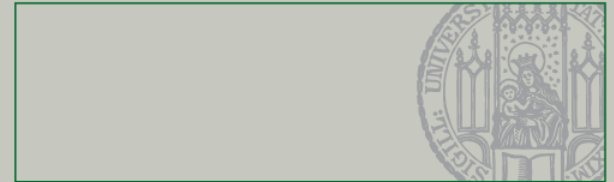


## Results



Dialect: \*\*\*  
Age: n.s.  
Dialect x Age: \*\*

- ✓ dialect dependent greater contrast in the Bavarian productions
- ✓ but only in tokens produced by older Bavarians
- ✓ younger Bavarians do not differ in their V:C ratios from those of the Saxons



## Summary of main results

- 1) the degree of contrast neutralization was smaller for young East Franconians and greater for young Bavarians compared to older speakers of those speech communities...

... but the young East Franconians' degree of maintaining the voicing contrast was not yet as marked as in the productions of Standard German speakers

→ **Two sound changes in progress**



## Summary of main results (cont.)

### 2) (*Mis-*)*Match* between perception and production:

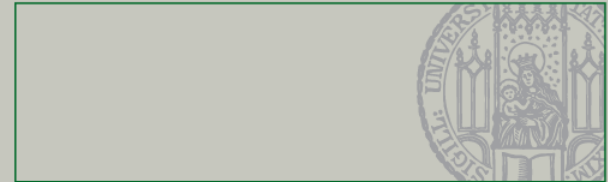
#### – East Franconian → *Match*

younger East Franconian listeners differentiate perceptually between intervocalic /t, d/, but not older East Franconians

#### – Saxons → *Mismatch*

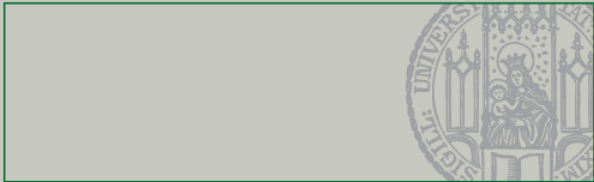
younger and older Saxon listeners differentiate between intervocalic /t, d/ in perception, despite the fact that both age groups tend to neutralize the voicing contrast in production

greater effect of accentuation in perception found for older Saxons as opposed to older Bavarians



## Two sound changes in progress

- East Franconian
  - development of an intervocalic voicing contrast – presumably under the influence of the standard language
  - phonologization of the acoustic cue V:C ratio which is used in Standard German
- Bavarian
  - gradually decreasing contrast maintenance
  - development of a one-contrast system ('complementary length' → Bannert, 1976) towards a two contrast system, in which vowel length and voicing (or consonant length for that matter) can be freely combined (with some restrictions)



## Discussion

- Saxon
  - Production: contrast maintenance, but tendency towards neutralization
  - Perception: categorical
  - ➔ sound change in progress more advanced in perception?
  - ➔ greater shift of older Saxons' category boundaries: perceptual categories not yet as stable as they are for Bavarians?





## Discussion

- consistent with an exemplar model in which phonological categories are associated probabilistically with the speech signal
  - Neutralization is not categorical
  - sound change in progress results in a gradual enhancement of the contrast by which phonological contrasts are evolving in regional varieties that are not yet as marked as they are other German phonological systems that already have these phonemic oppositions



## Conclusion

- Important to analyse the relation between the production and the perception during a sound change in progress
- Does sound changes in perception (*misperception* → Ohala, 1993 or as in our case a „better / improved“ perception through contact of varieties?) lead those in production
- Is an early stage of a sound change in progress characterized by a *mismatch* between production and perception and is a late stage or a sound change that is near to completion marked by a *realignment* of perzeption and produktion?



**Thank you!**