

Putting German [ʃ] and [ç] in two different boxes: native vs. L2 German speakers

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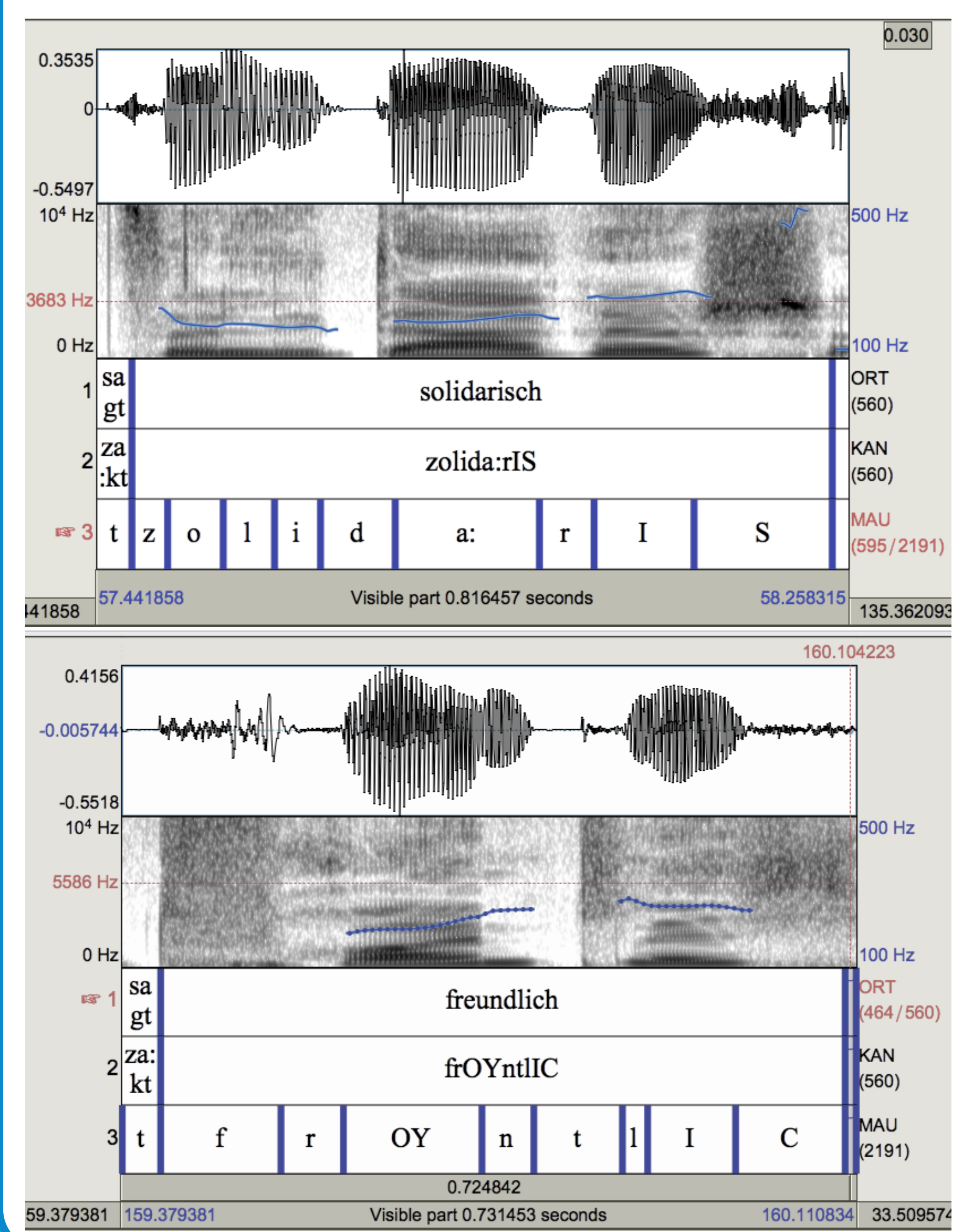
RESEARCH QUESTIONS

- Where does L1 and L2 German differ from an acoustic point of view?
- What acoustic measurements distinguish the [ʃ] et [ç] fricatives in L1 and L2 German?

SPEECH MATERIAL

- **FLACGS Corpus:**
(French Learners Audio Corpus of German Speech)
German L1 & L2, here : repeated speech
- **Selected words:**
with suffixes *-/ɪʃ/* or *-/ɪç/* : *solidarisch* [zoli'da:rɪʃ] (solidary) or *freundlich* ['frɔ̃ntliç] (friendly)
- **Nb of tokens:**
284 (of 40 speakers)

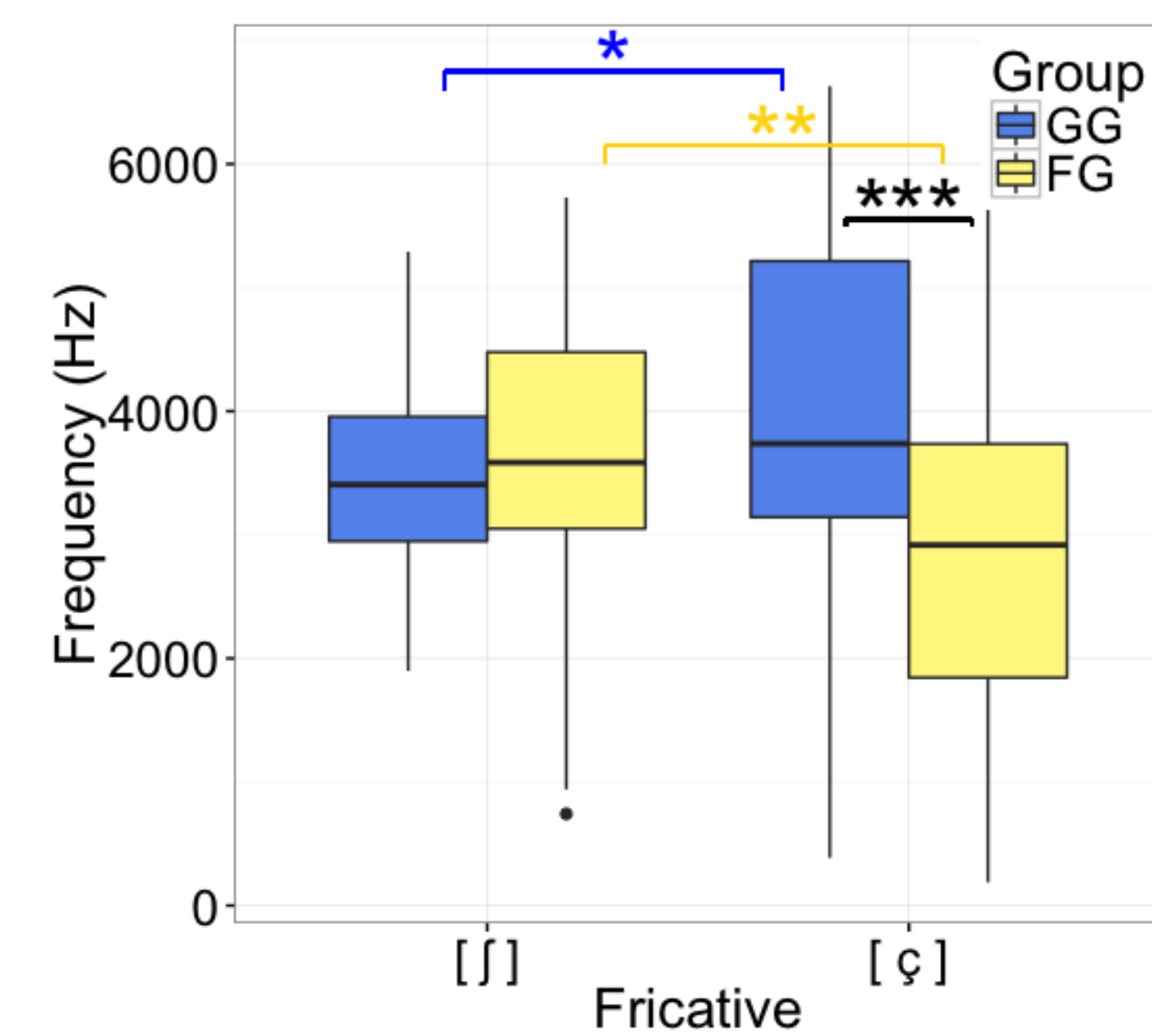
SPECTROGRAMS



INTRODUCTION

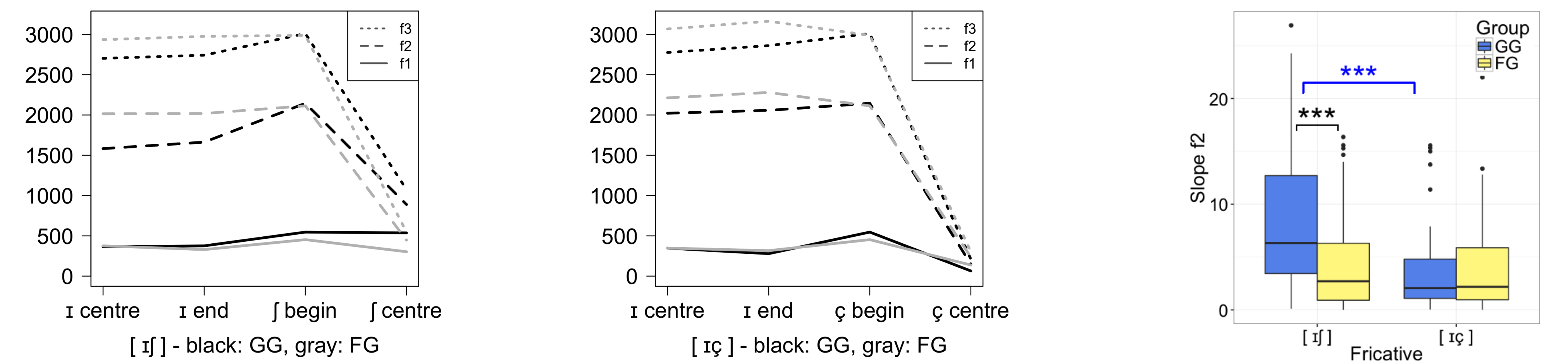
- Study on German pronunciation
- Comparison of L1 and L2 (L1 French)
- Reliable feedback \Rightarrow acoustic measurements
- Comparison of the fricatives /ʃ/ et /ç/

COG & FREQUENCY BANDS



- The center of gravity (CoG) was extracted at the beginning, in the middle and the end of the fricatives.
- [ʃ] \Rightarrow no significant difference in mean (CoG) between groups.
- [ç] \Rightarrow significant differences in CoG in all three places of the fricative and the mean CoG ($p \leq 0.001$).
- FG speakers produce two different fricatives.
- Intensity of low (1kHz-3kHz, 1kHz-4kHz) and high (3kHz-6kHz, 4kHz-7kHz) frequency bands.
- GG group \Rightarrow significant intensity differences in both low as well as in the high frequency band 3kHz-6kHz ($p \leq 0.001$). \Rightarrow no significant difference for 4kHz-7kHz.
- FG group \Rightarrow significant differences in both high and low frequency bands ($p \leq 0.001$).
- Intensity of frequency bands \Rightarrow more distinctive for FG than in GG speakers.

FORMANT TRANSITION & F2 SLOPE



- GG speakers - fairly large differences in F2 - conditioned by the following fricative.
- GG group \Rightarrow both fricatives have different places of articulation.
- FG group - less variable F2 transition \Rightarrow places of art. for [ʃ] and [ç] globally less well separated.
- F2 slope (e.g. Žygis and Padgett (2010)):
$$\text{slope } F2 = \frac{F2_{VC \text{ boundary}} - F2_{V \text{ midpoint}}}{\text{duration between these two points}}$$

CLASSIFICATION OF /ʃ/ AND /ç/ USING WEKA

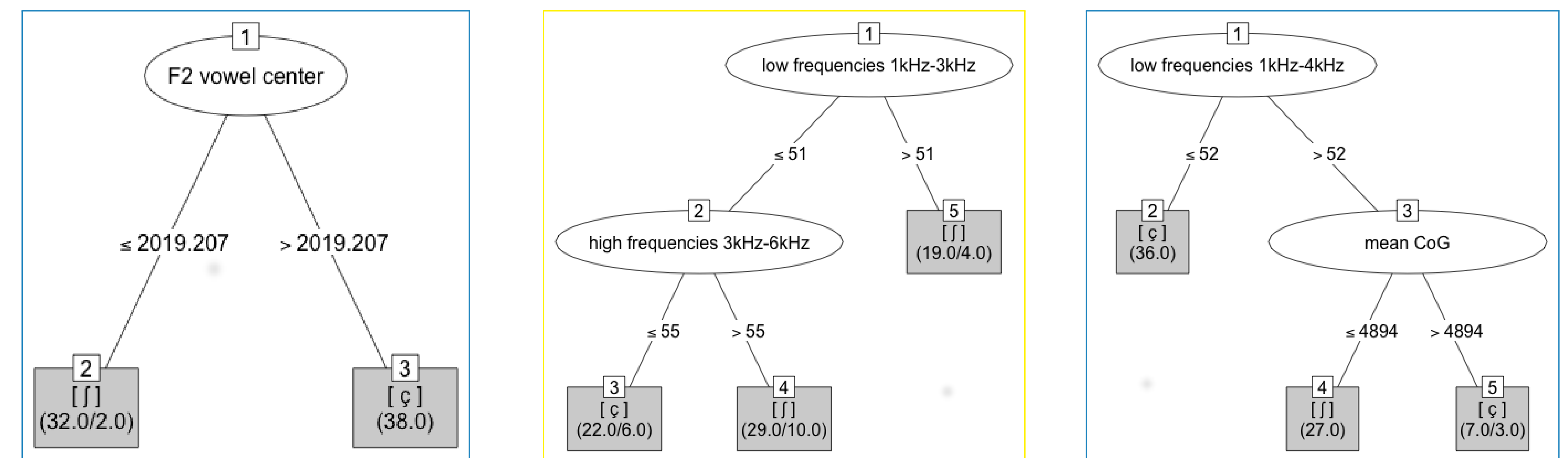


Figure 1: left: GG female (+ contextual measures), center: FG female (+ contextual measures), right: GG female (- contextual measures)

CONCLUSIONS

- Acoustic measures for [ʃ] and [ç] in a VC context.
- Results show \Rightarrow contextual measures are only solid cues in German native speech.
- Vowel quality in German L2 speech of French L1 speakers \Rightarrow does not allow a solid distinction in a VC context.
- No contextual measures in German L1 speech \Rightarrow no increased error rate regarding classification.
- Local measures only \Rightarrow Advantageous (no revision of acoustic measures and decision thresholds with respect to the preceding vowel or context VC vs. CV)