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The forensic implications of comparing soft, neutral and loud speech: A quantitative analysis of inter- vs intra- speaker vowel acoustics.

Massimiliano Canzi
<*massimiliano.canzi@postgrad.manchester.ac.uk*>
The University of Manchester


@MC_anzi


mcanz/mfil

In forensic phonetics

Phoneticians rely on acoustics among other things.

Acoustics measurements are not always reliable..

Many factors can play a role in how much we should trust acoustics.
e.g. recording quality, background noise, Sound Pressure Level (**SPL**)

Past studies

Focused on very few vowels at a time (e.g. Elliot 2000)

Methods

8 participants (5 males)
controlled for
Age, social background, regional accent

Word list of 56 items
Controlled for
Vowel phonemes, vowel position, Vowel length & surrounding phonological context

Each word was read three times for a total of 156 words.

The total amount of words was read three times, in ***soft, neutral and loud speech***

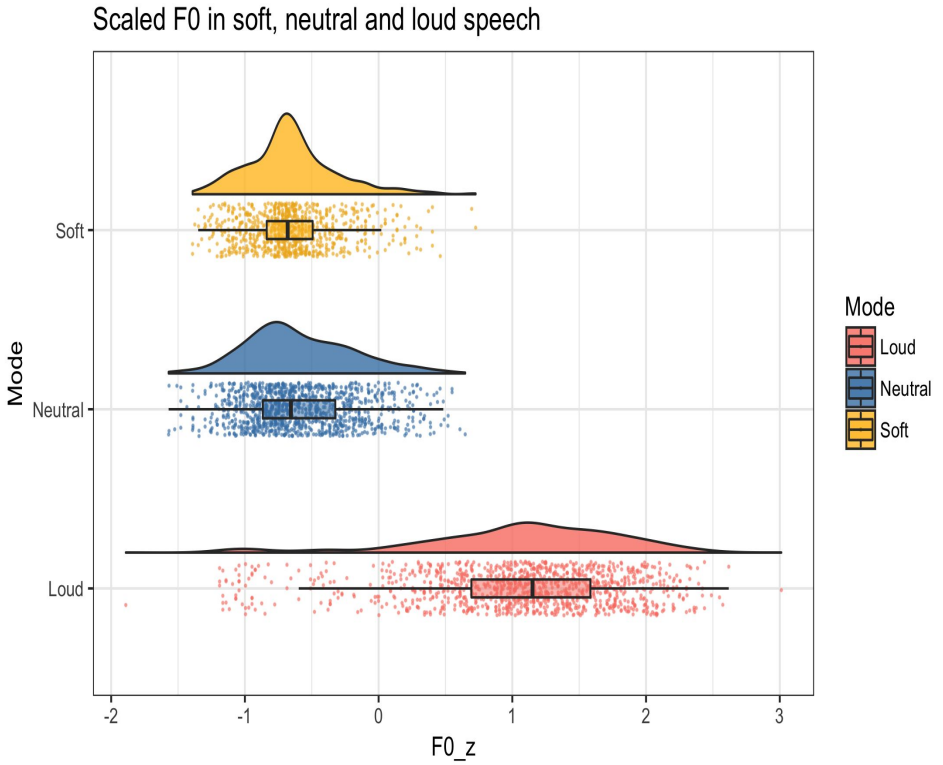
lmer test *(Kutnetsova et al, 2015)*

soft & loud speech are described as ***volitional increase / decrease of perceived speech loudness.***

Scaled F0

Significant increase between neutral and loud speech only.

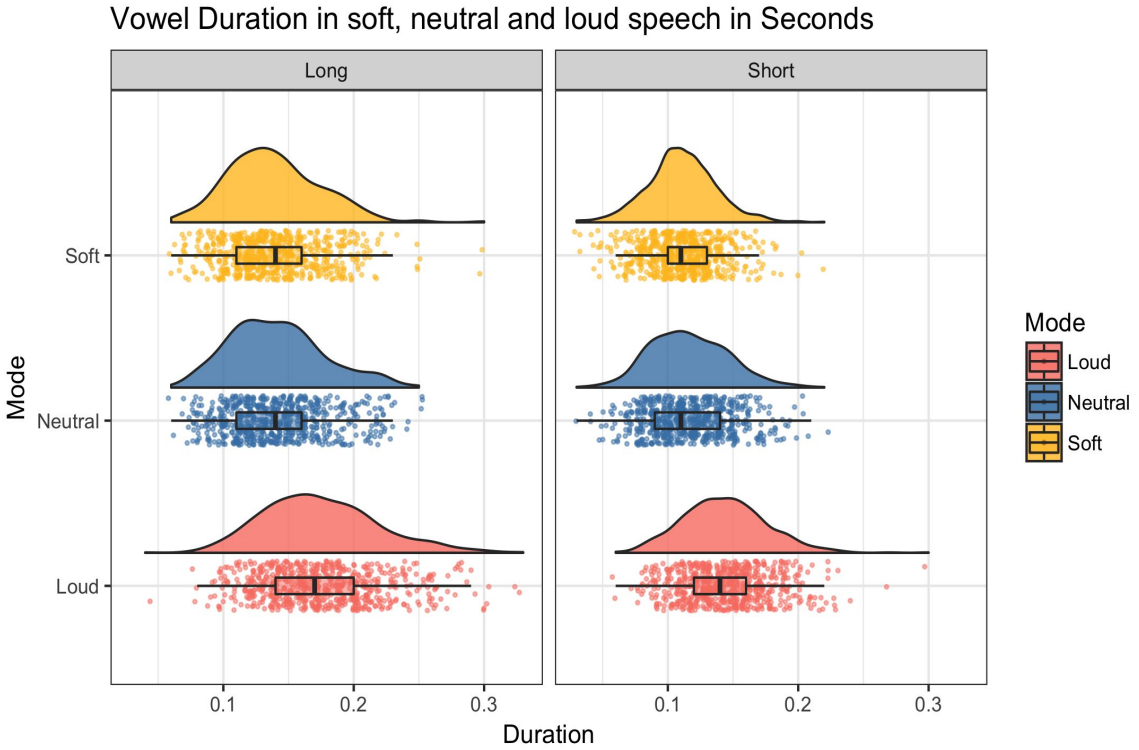
+20 Hz for F0 between neutral and loud speech **(t(7) = 7.53, p < 0.001)**



Vowel Duration

Vowel duration increases between soft and neutral and between neutral and loud speech

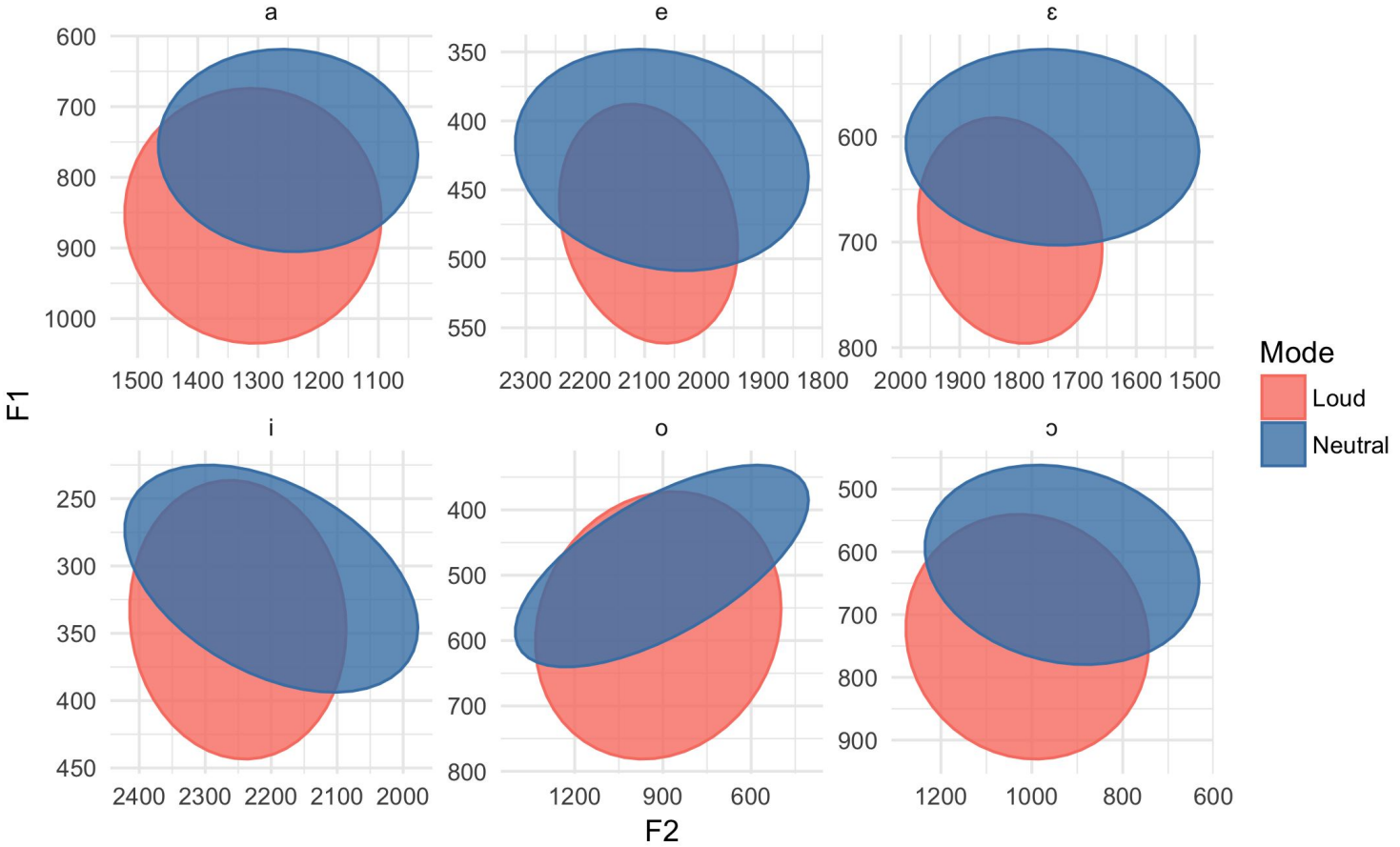
Phonological length doesn't play a role.



Significant increase for vowel duration between neutral and loud speech

(t(7) = 8.41, p < 0.0001)

F1-F2 vowel plots
Male speakers



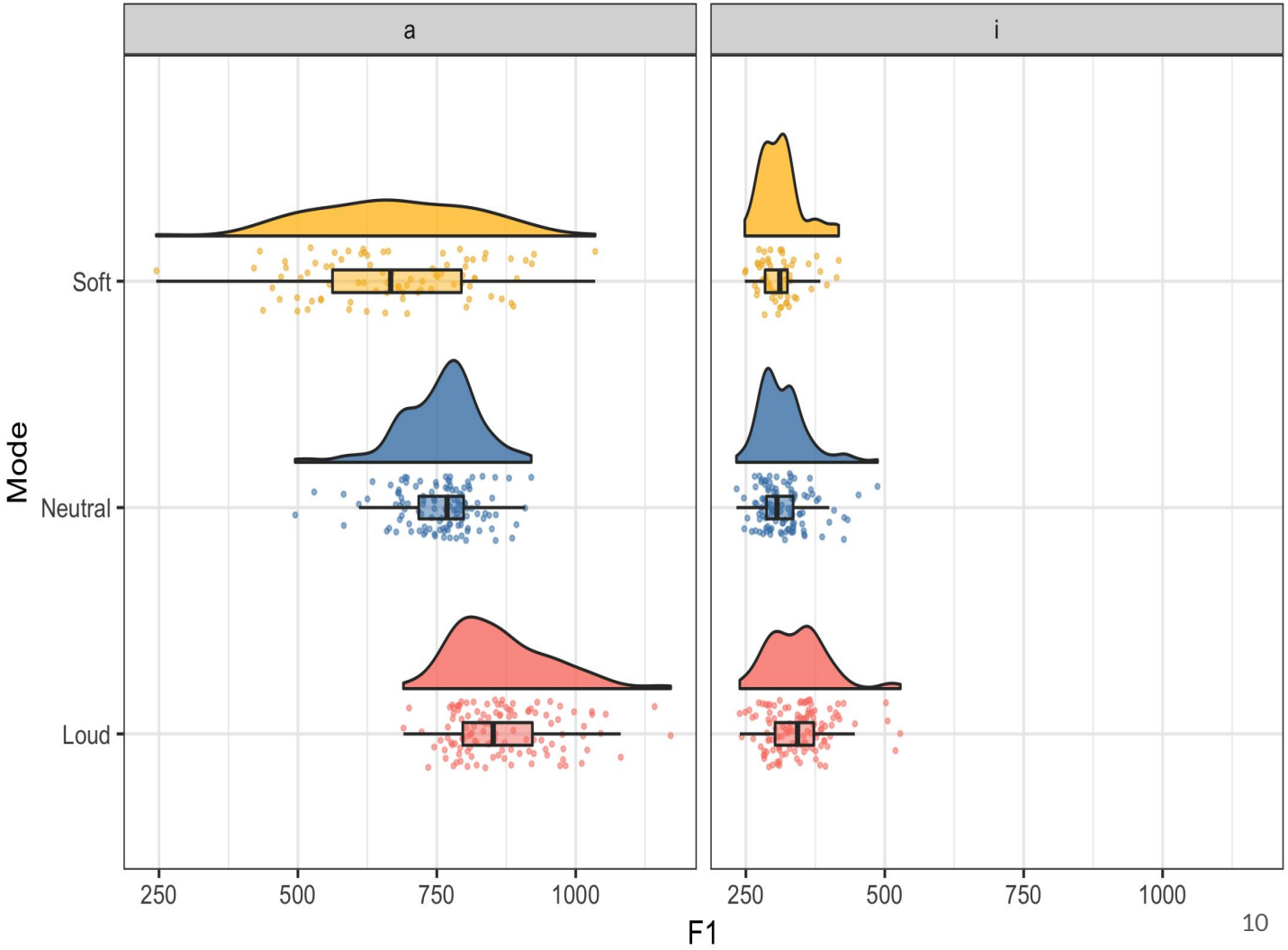
+89 Hz for F1

+/- 40 Hz
Speaker slope

between neutral
and loud speech
($t(7) = 7.77$, $p < 0.001$)

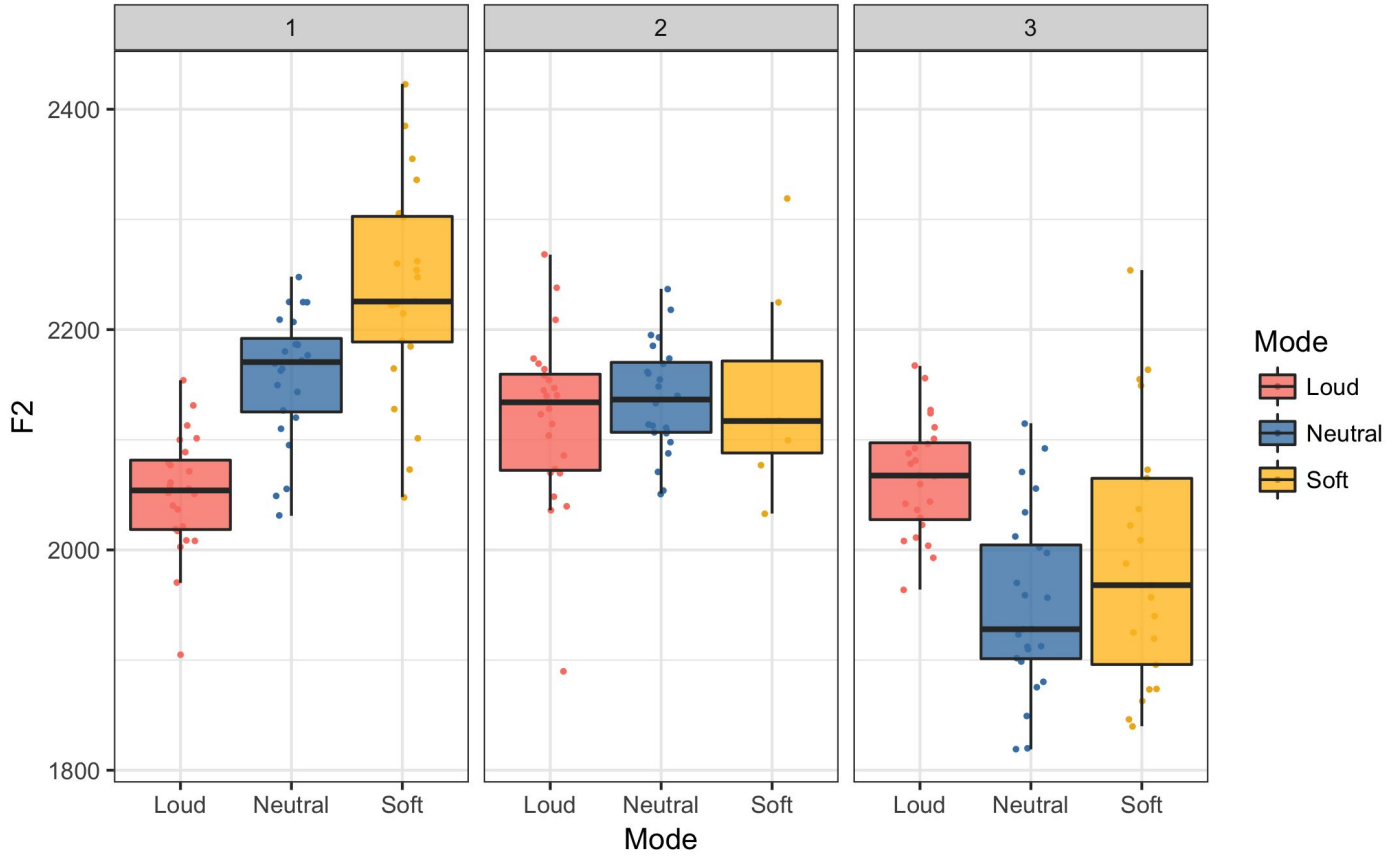
F1 never decreases

But it can increase at varying rates



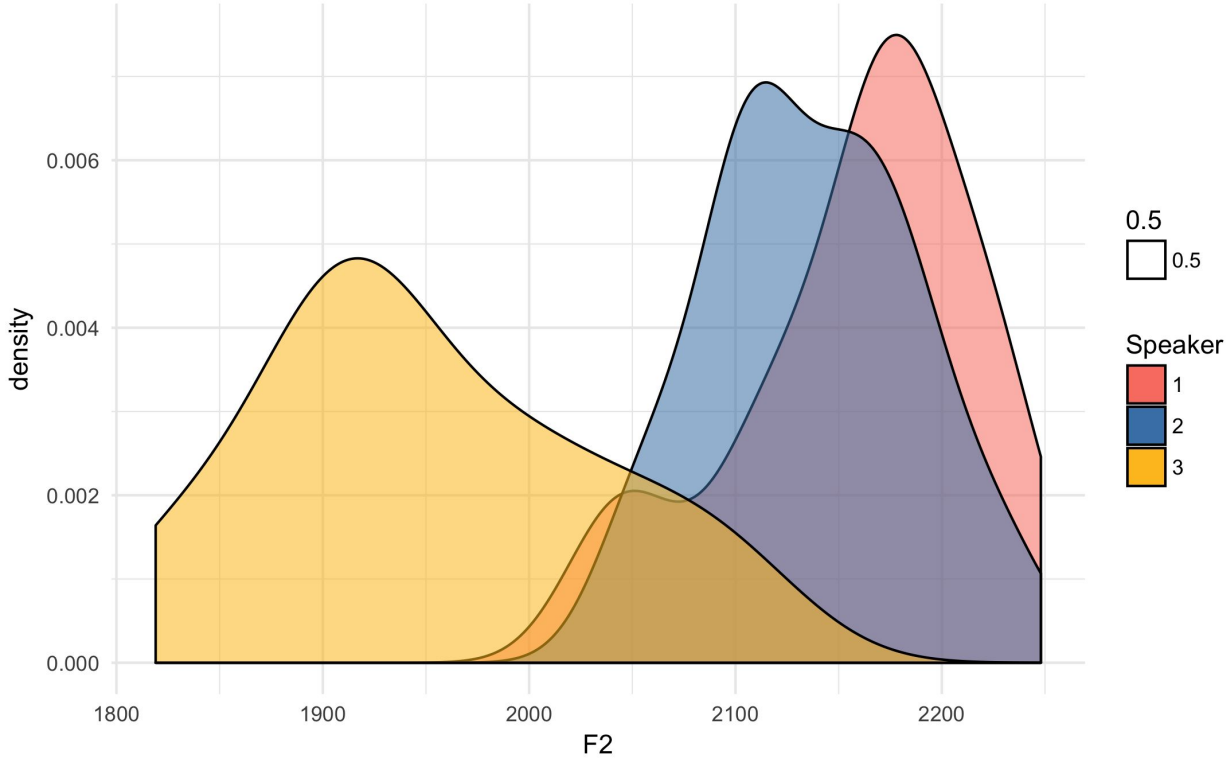
F2, on the other hand..

Example for /e/

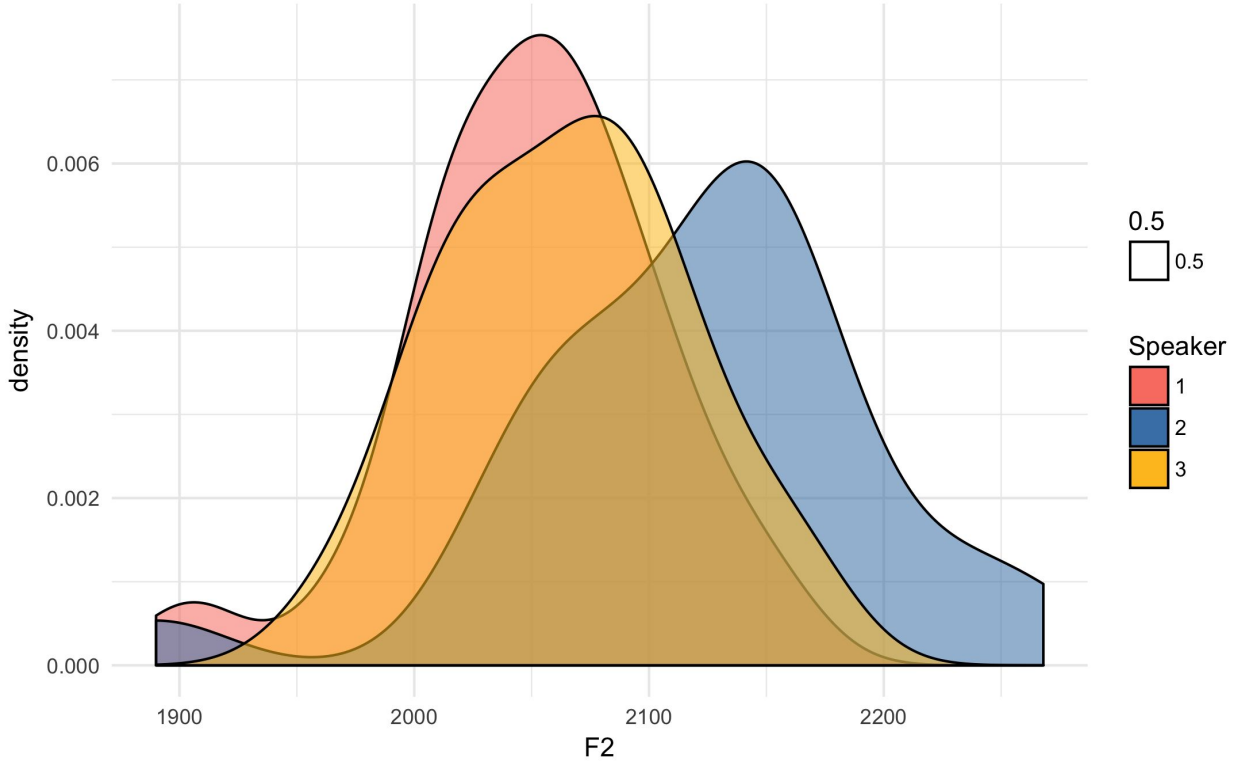


F2 significantly changes between neutral and loud speech across all vowels and speakers **(t(7) = 3.46, p < 0.01)**

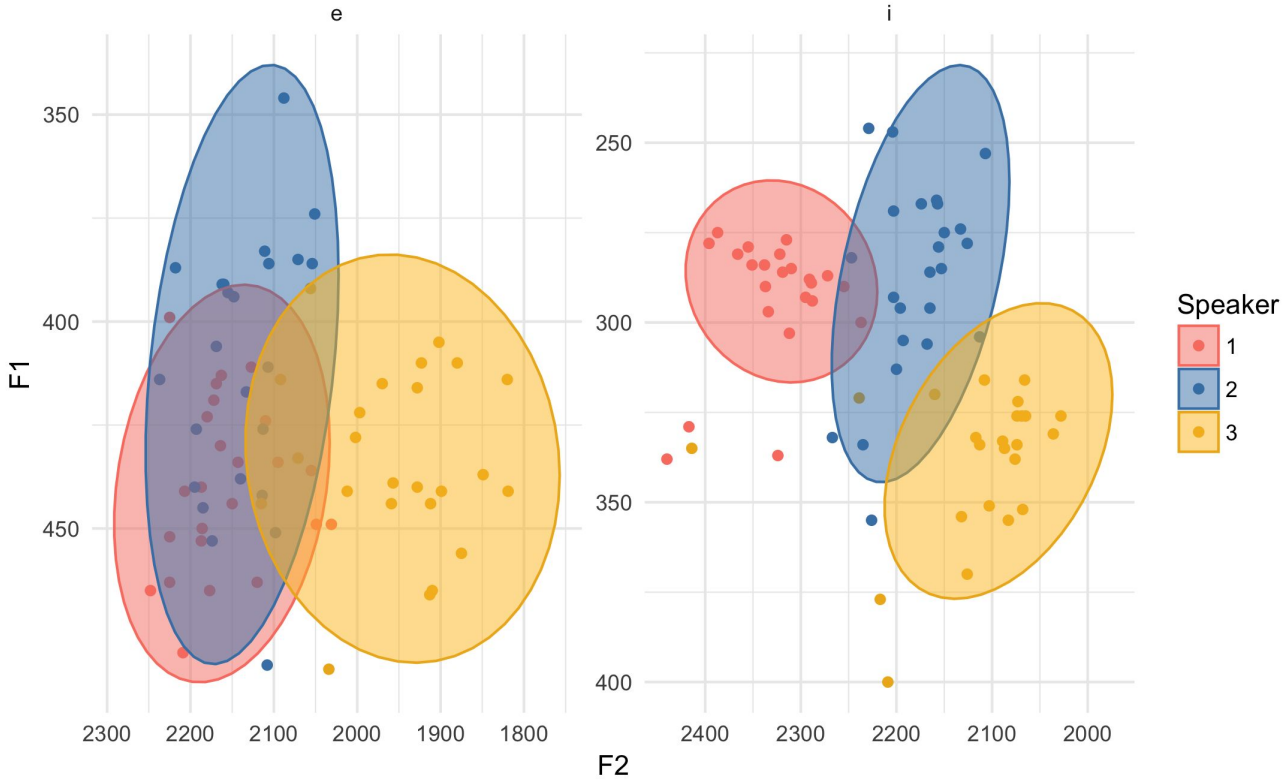
What this means is that..



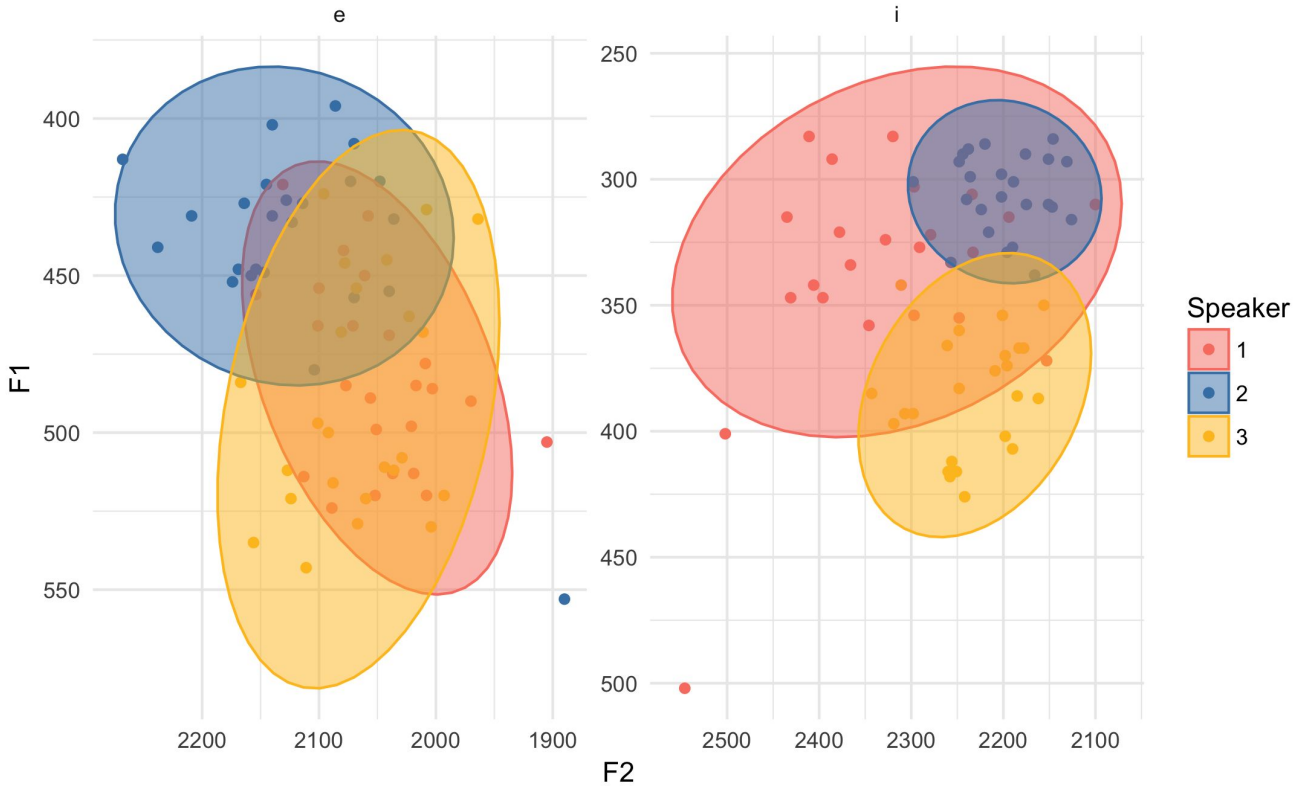
Turns into..


0.006
0.004
0.002
0.000
density
1900
2000
2100
2200
F2
0.5
0.5
Speaker
1
2
3

F1-F2 plots for /e/ and /i/ by speakers 1, 2 and 3 in **neutral** speech



F1-F2 plots for /e/ and /i/ by speakers 1, 2 and 3 in **loud** speech



Proceed carefully!

when comparing measurements.

References

Elliott, J et al. 2000. Comparing the acoustic properties of normal and shouted speech: a study in forensic phonetics. In *Proc. sst-2000: 8th int. conf. speech sci. & tech*, 154–159.

Kuznetsova, Alexandra, Per Bruun Brockhoff & Rune Haubo Bojesen Christensen. 2015. Package: lmer test. *R package version* 2.

Thanks!

@MC_anzi

mcanzi / mfil