Bokal sudurkarien galera Larrainen? Nasalance gailuarekin egindako azterketa

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CNRS[13] – IKER UMR5478[123], IPS-LMU[2], UPV/EHU[1], UPPA[12]

2024-06-27

Hiru bokal sudurkari(tu) iturri zubereraz (Hualde 2003: 31. or.)

Hiru bokal sudurkari(tu) iturri zubereraz (Hualde 2003: 31. or.)

/NV/ eta /VN/: *ni* [nĩ], *onki* [õŋki]

Hiru bokal sudurkari(tu) iturri zubereraz (Hualde 2003: 31. or.)

/NV/ eta /VN/: *ni* [nĩ], *onki* [õŋki]

/ñV/ eta /Vñ/: /uñue/ > [ũñũe] ‘ohore’

Hiru bokal sudurkari(tu) iturri zubereraz (Hualde 2003: 31. or.)

/NV/ eta /VN/: *ni* [nĩ], *onki* [õŋki]

/ñV/ eta /Vñ/: /uñue/ > [ũñũe] ‘ohore’

/Ṽ/: *arratu* [arat^{h}ũ] ‘arratoi’

Baina...

> Il me semble qu'a Larrau les voyelles nasales n'apparaissent que dans certains groupes de deux voyelles séparées par h. (…) Des observations plus completes et plus précises que les miennes devront etre faites pour déterminer quelle est la situation touchant les voyelles nasales a Larrau et dans l'ensemble du domaine souletin (Lafon 1957: 118. or.)

Bada bokal kontrastiboki sudurkaririk Larraineko euskaraz?

Ikerketaren diseinua

Estimuluak + SpeechRecorder + *Nasalance* gailua

Estimuluak: hitz zerrenda

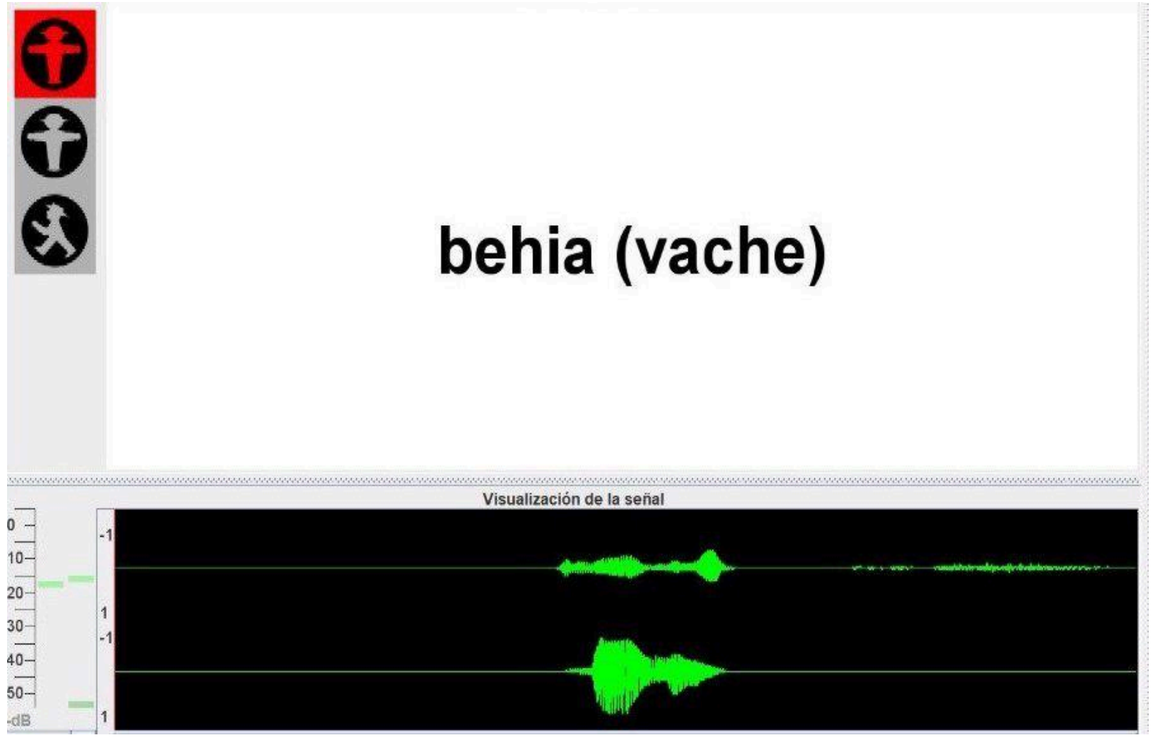
Estimuluak: hitz zerrenda

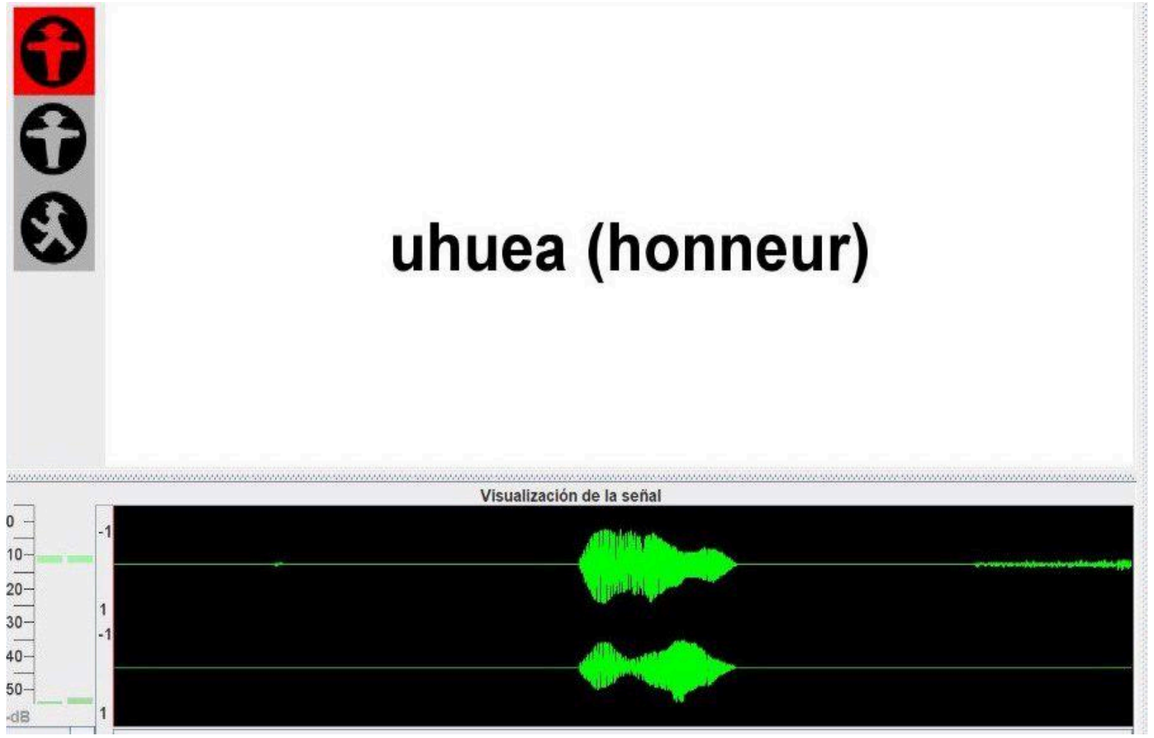
/h/	/h̃/	Nh / NVh / hVN
behi	ahate	uɲhu ‘tipula’
bihotz	ihaute	lehen
ehi ‘hatza’	ehi ‘erraz’	nihaur

Estimuluak: hitz zerrenda

/ṽ/	/v/
pelegri	ikusi
buttu	kutxi
arrazu	ahatiak

SpeechRecorder: hitzak erakusteko

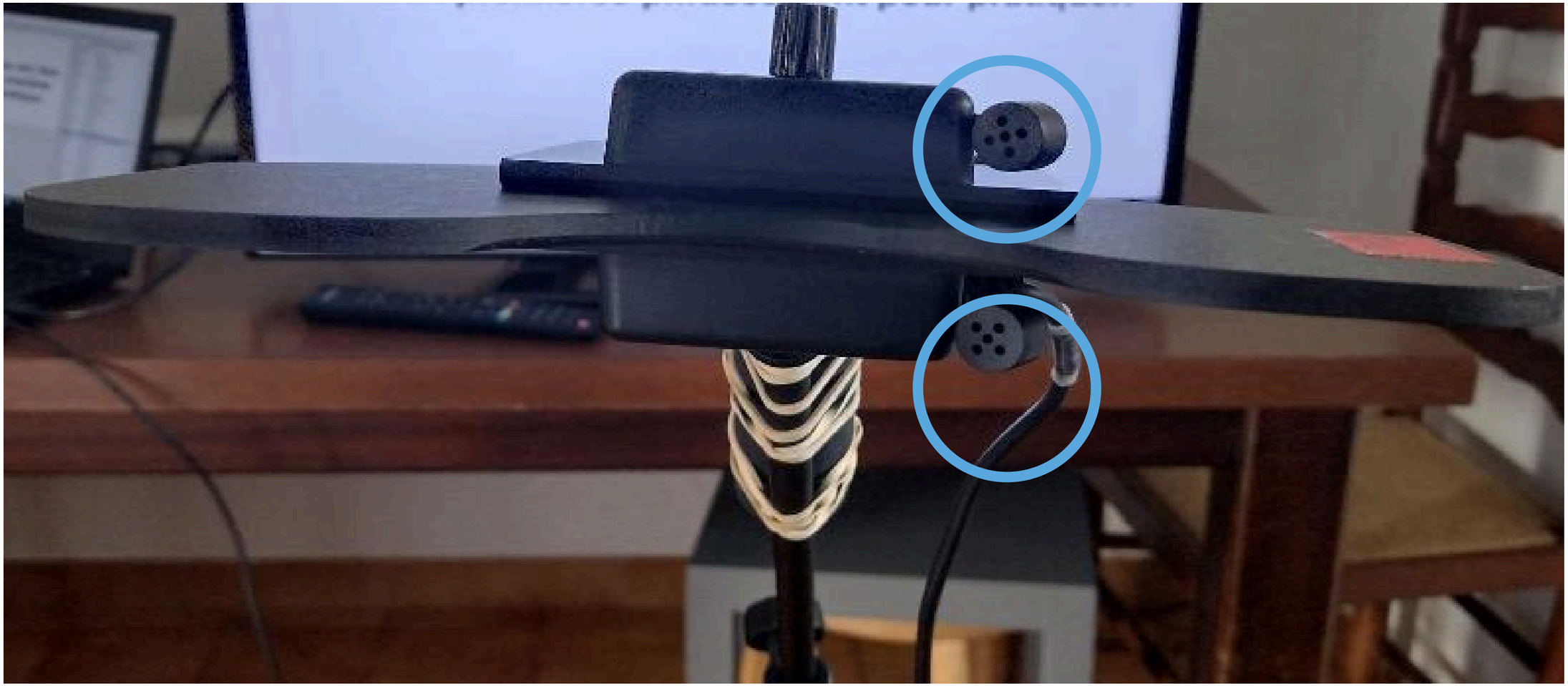




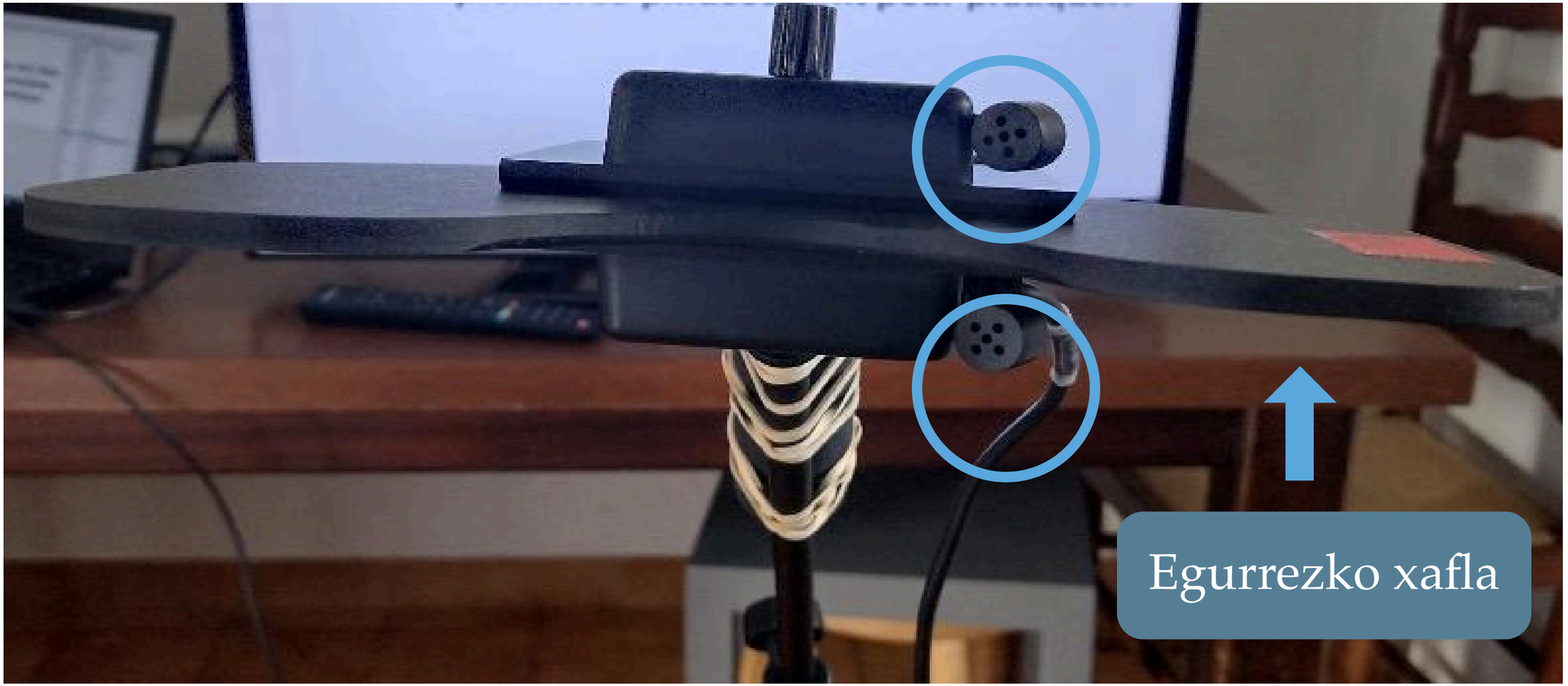
Nasalance gailua

Nasalance gailua

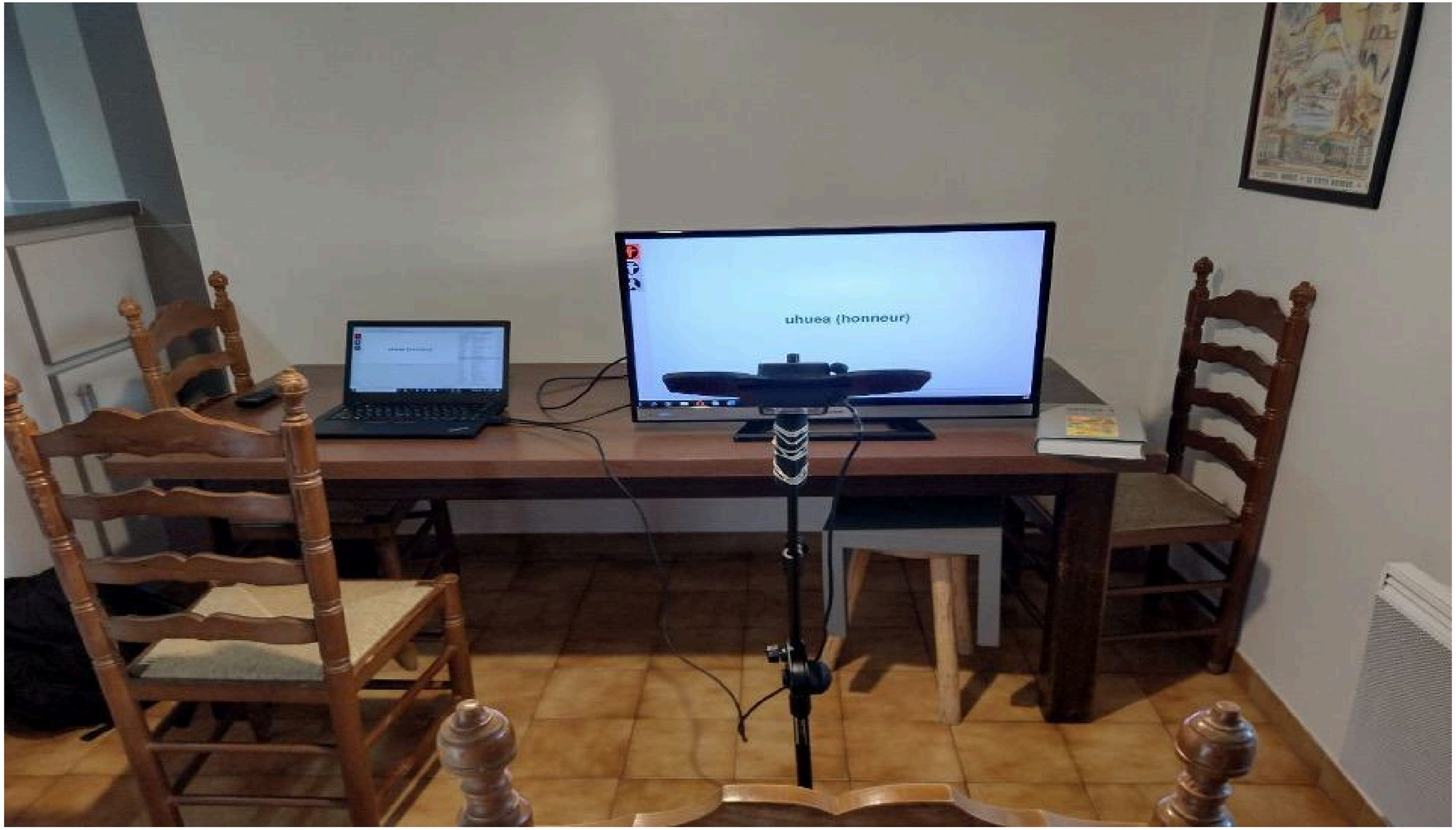
Nasalance gailua



Nasalance gailua



Laboratorioa



Parte hartzaileak

11 larraindar (4 andrazko)

Parte hartzaileak

11 larraindar (4 andrazko)

10/11k 60-77 urte artean
34 urteko andrazko bat

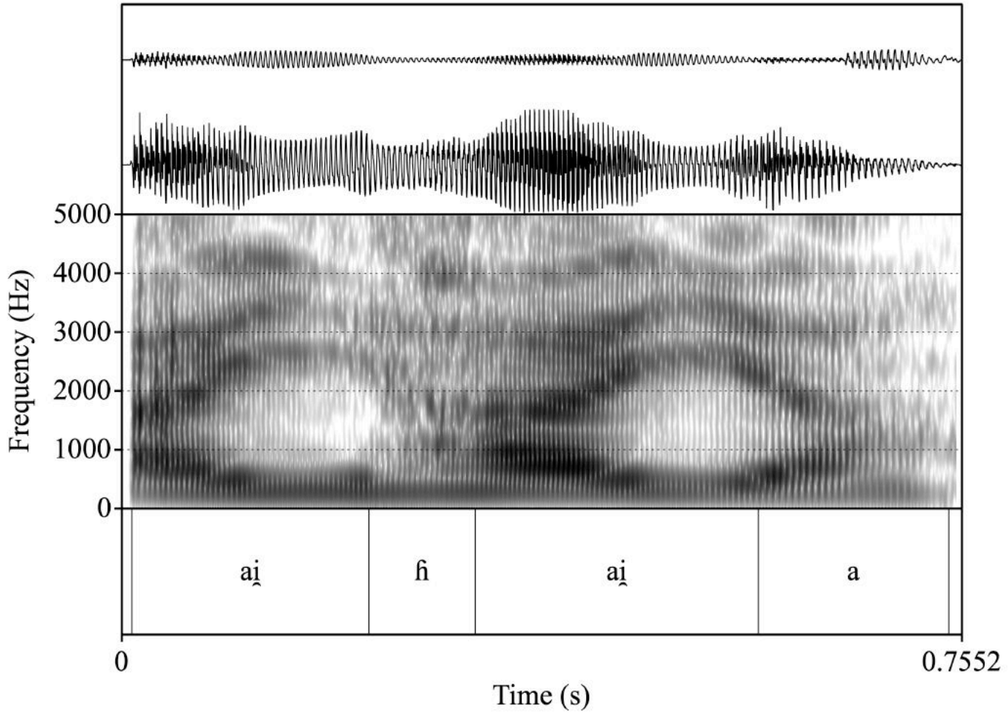
Parte hartzaileak

11 larraindar (4 andrazko)

10/11k 60-77 urte artean
34 urteko andrazko bat

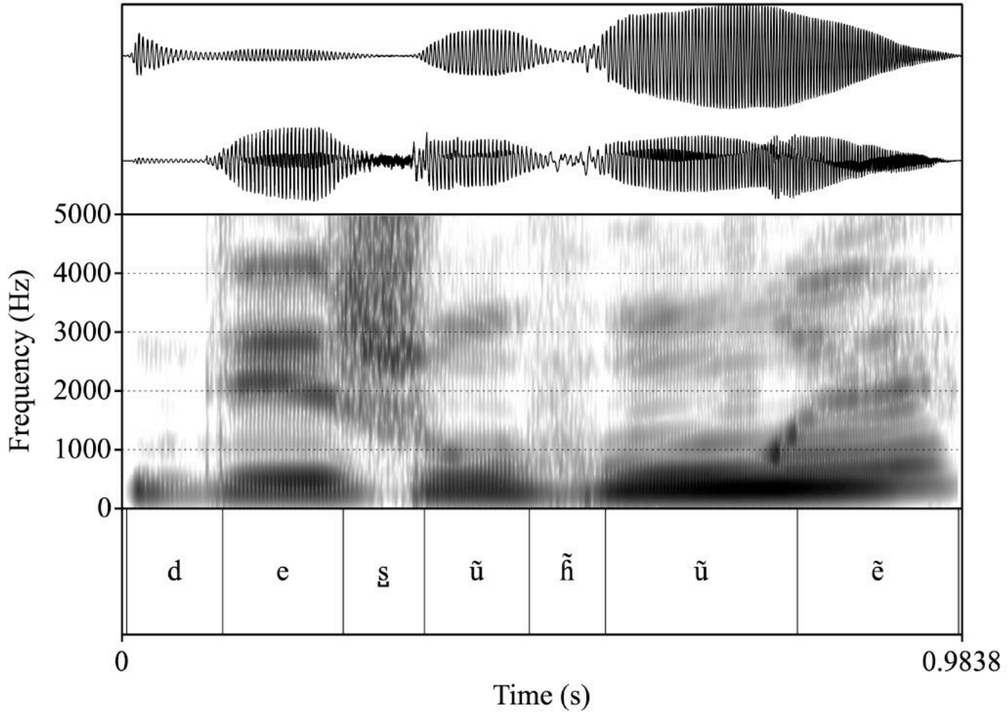
L1 Larraineko euskara
Frantsesa 5 urtetan eskolan

Grabazioak



0:00 / 0:00

aihaia ‘afaria’

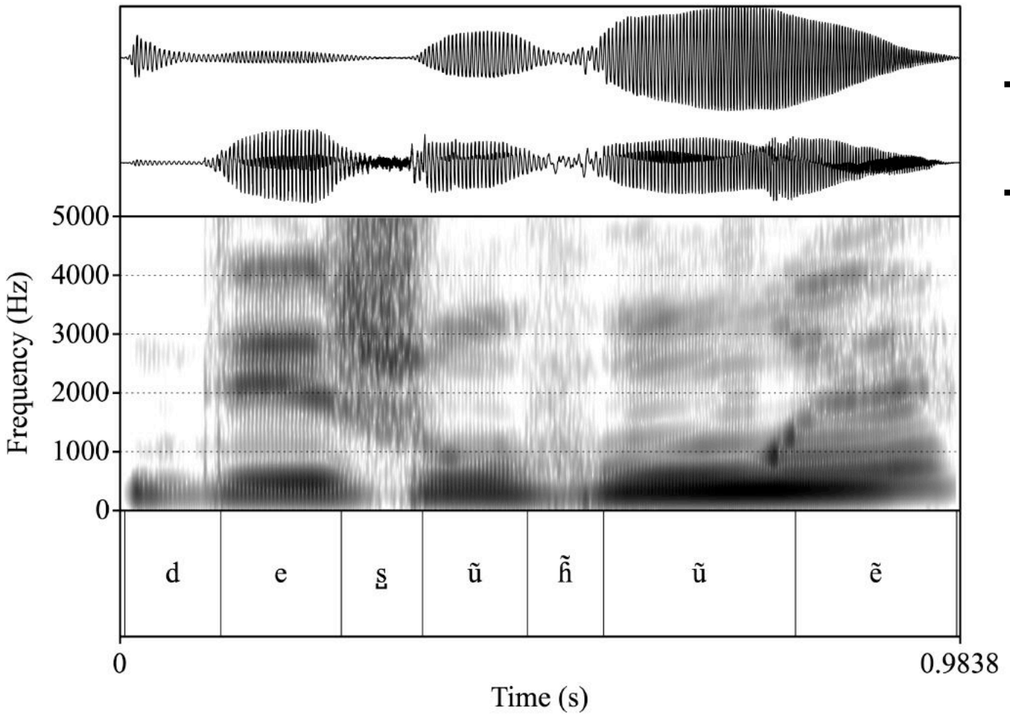


0:00 / 0:00

desuhue ‘desohore’

Nasalance proportzioaren azterketa

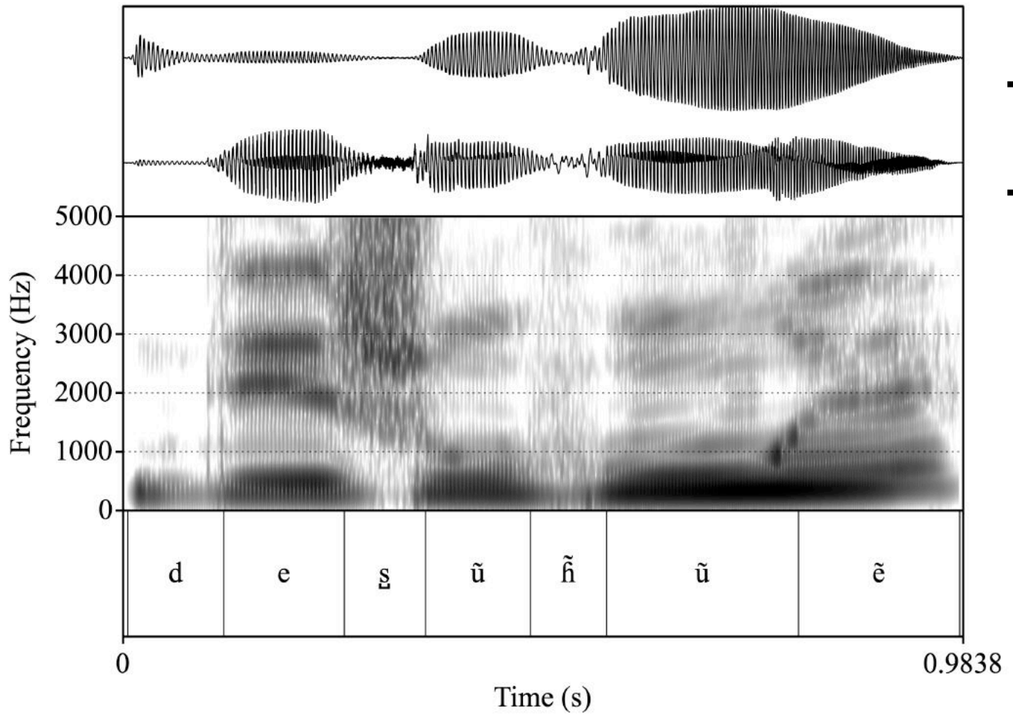
Nasalance proportzioa



→ → Anplitudea → $A_n(dB)$

→ $A_o(dB)$

Nasalance proportzioa

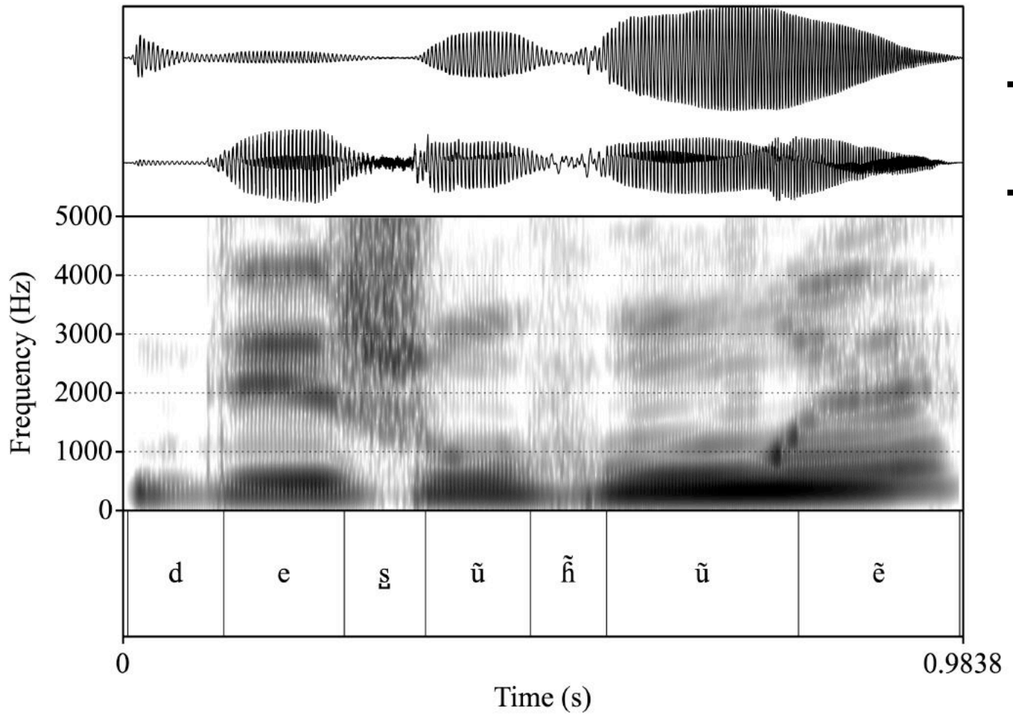


→ → *Anplitudea* → $A_n(dB)$ → $A_o(dB)$

↓ ↓

$$Pa = 10^{\frac{dB}{20}}$$

Nasalance proportzioa



Anplitudea

$$\rightarrow A_n(dB)$$

$$\rightarrow A_o(dB)$$

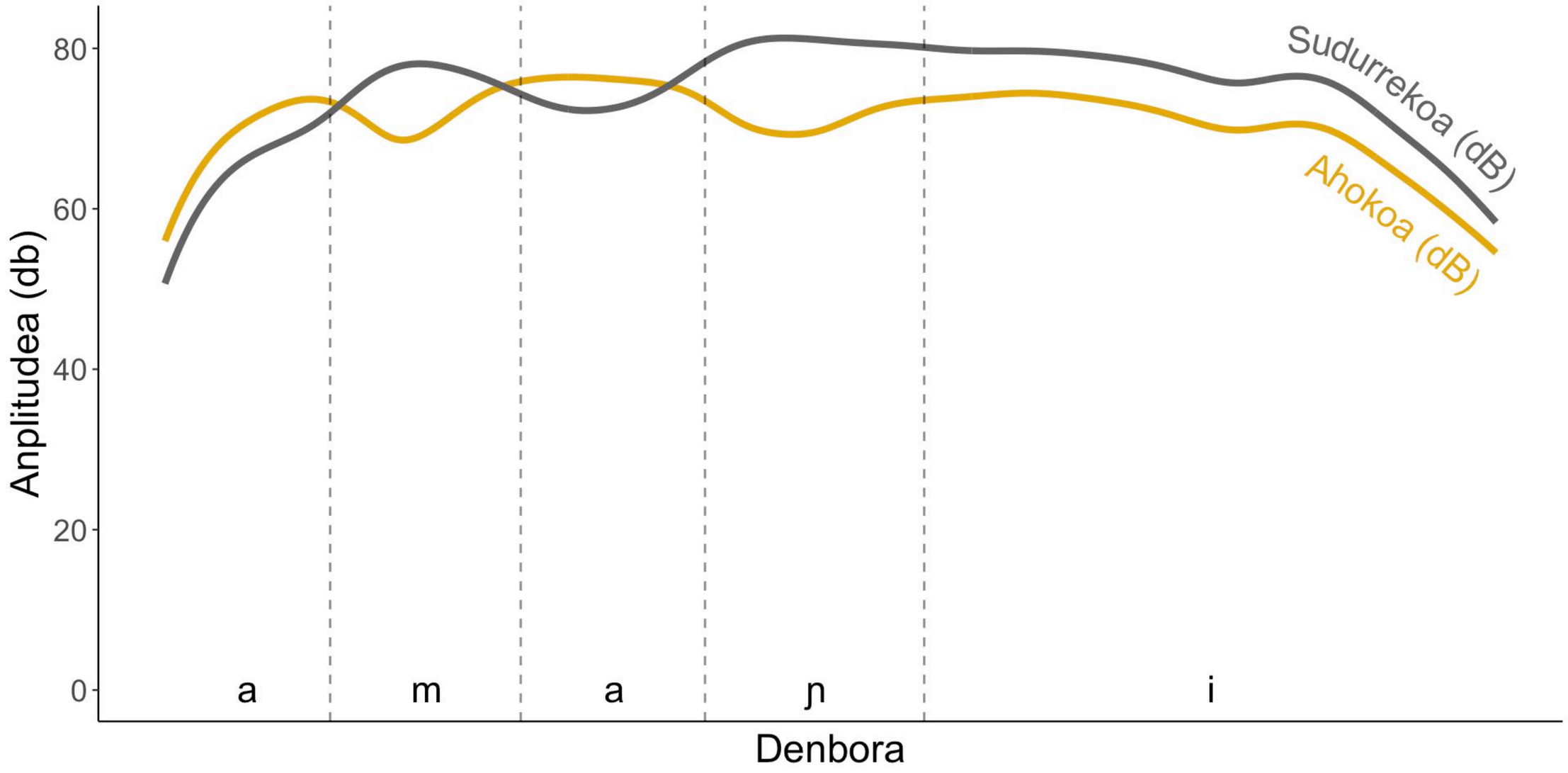
$$\downarrow\downarrow$$

$$Pa = 10^{\frac{dB}{20}}$$

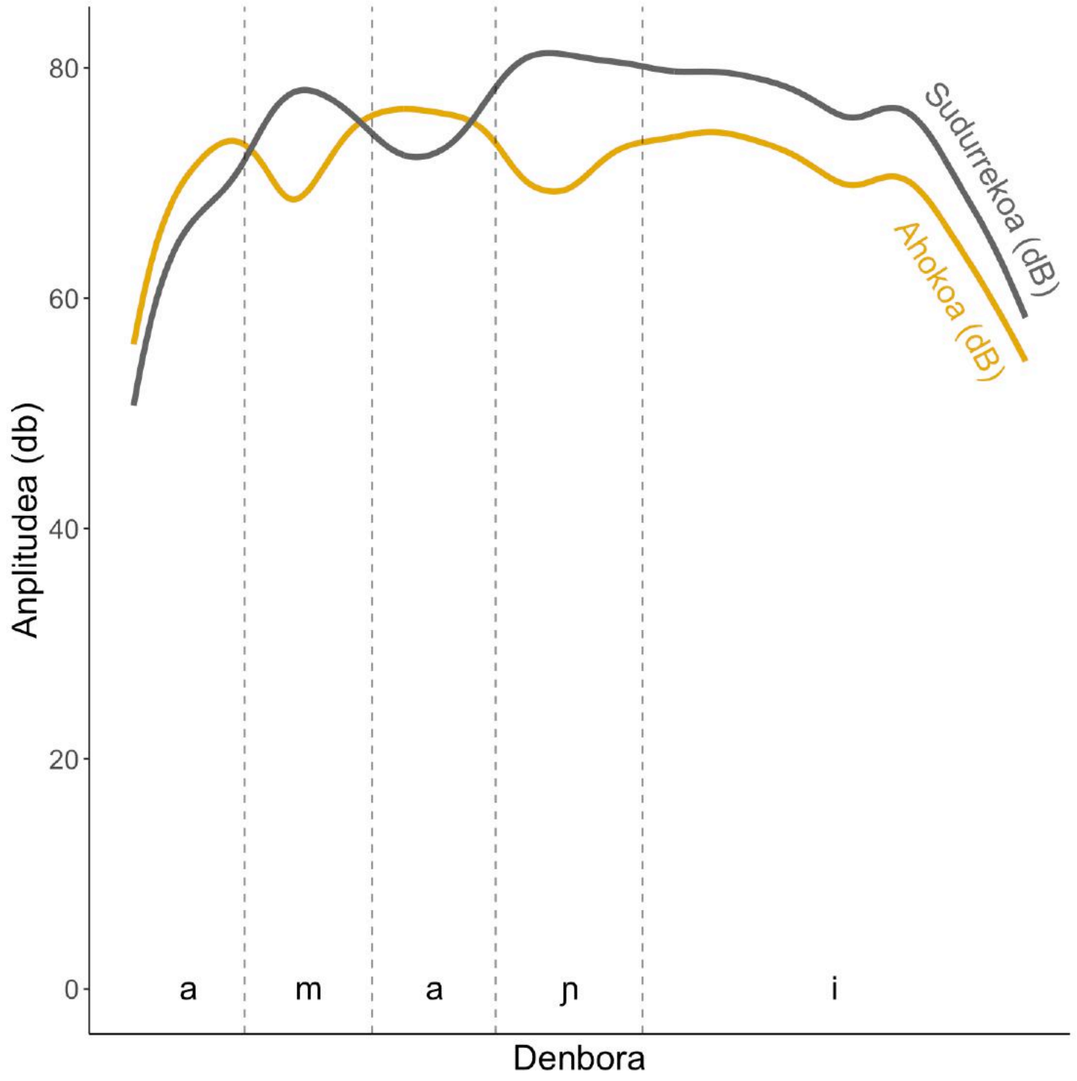
$$\downarrow\downarrow$$

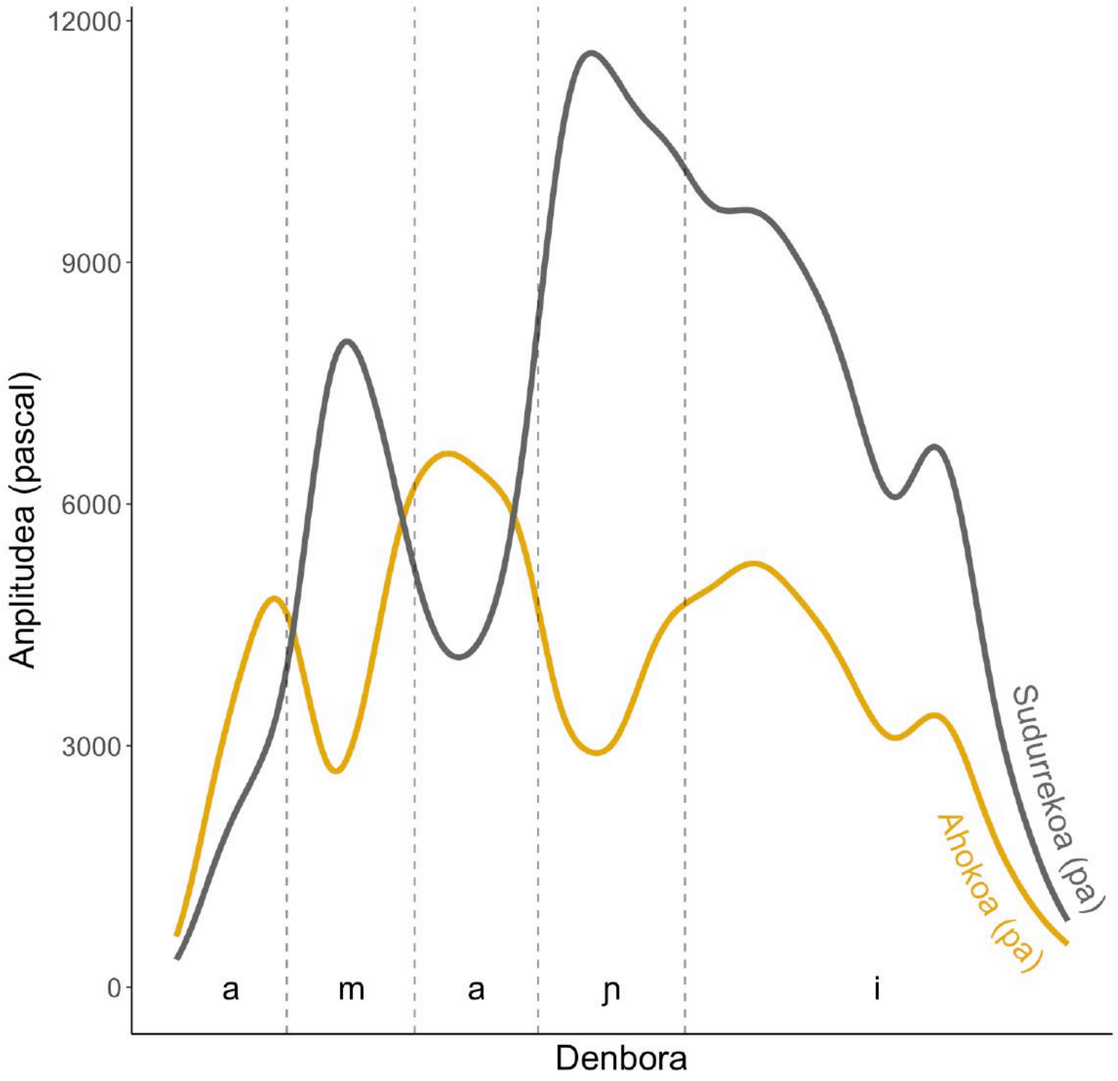
$$\frac{A_n}{A_n + A_o}$$

Nasalance proportzioa

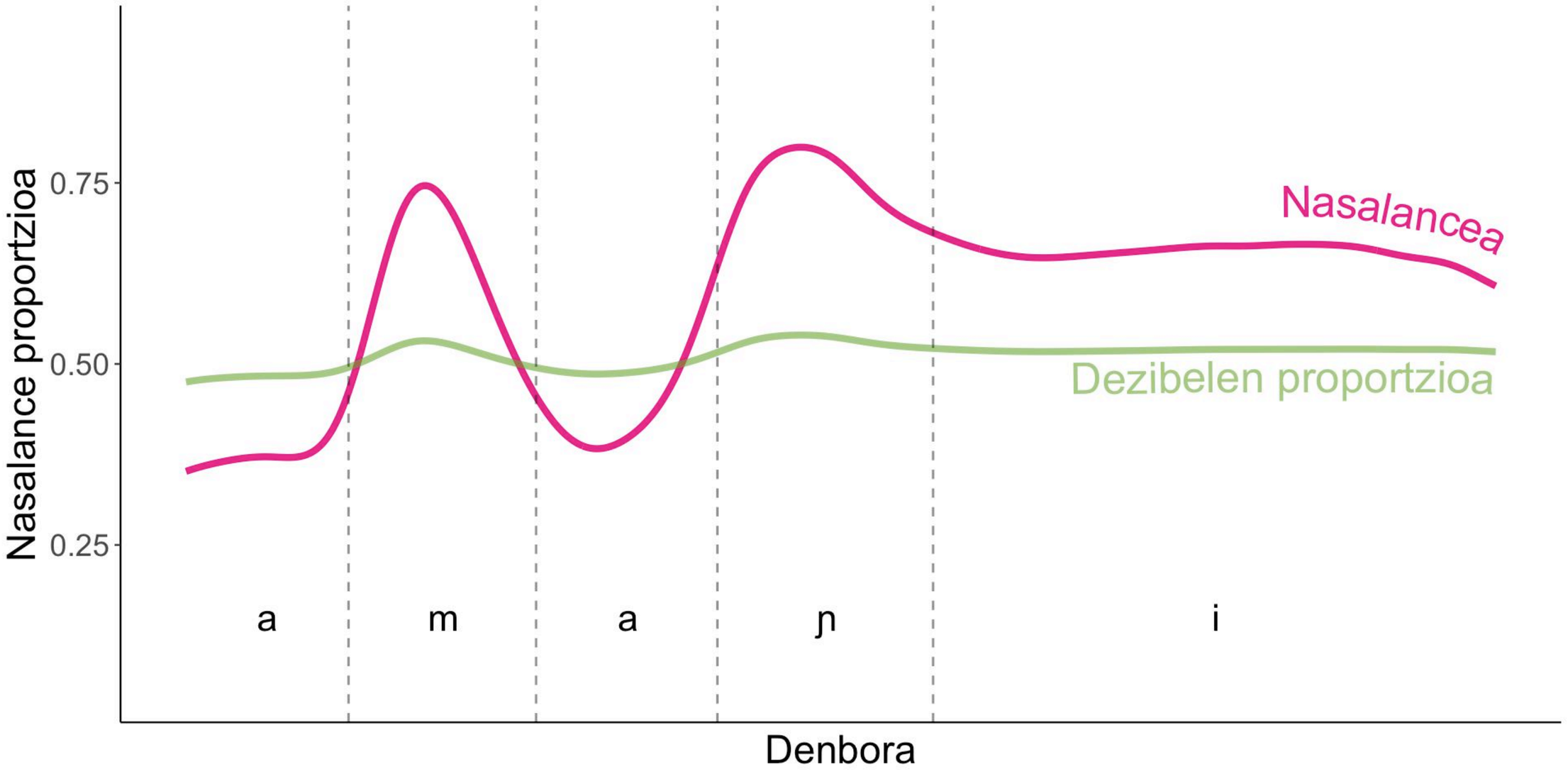


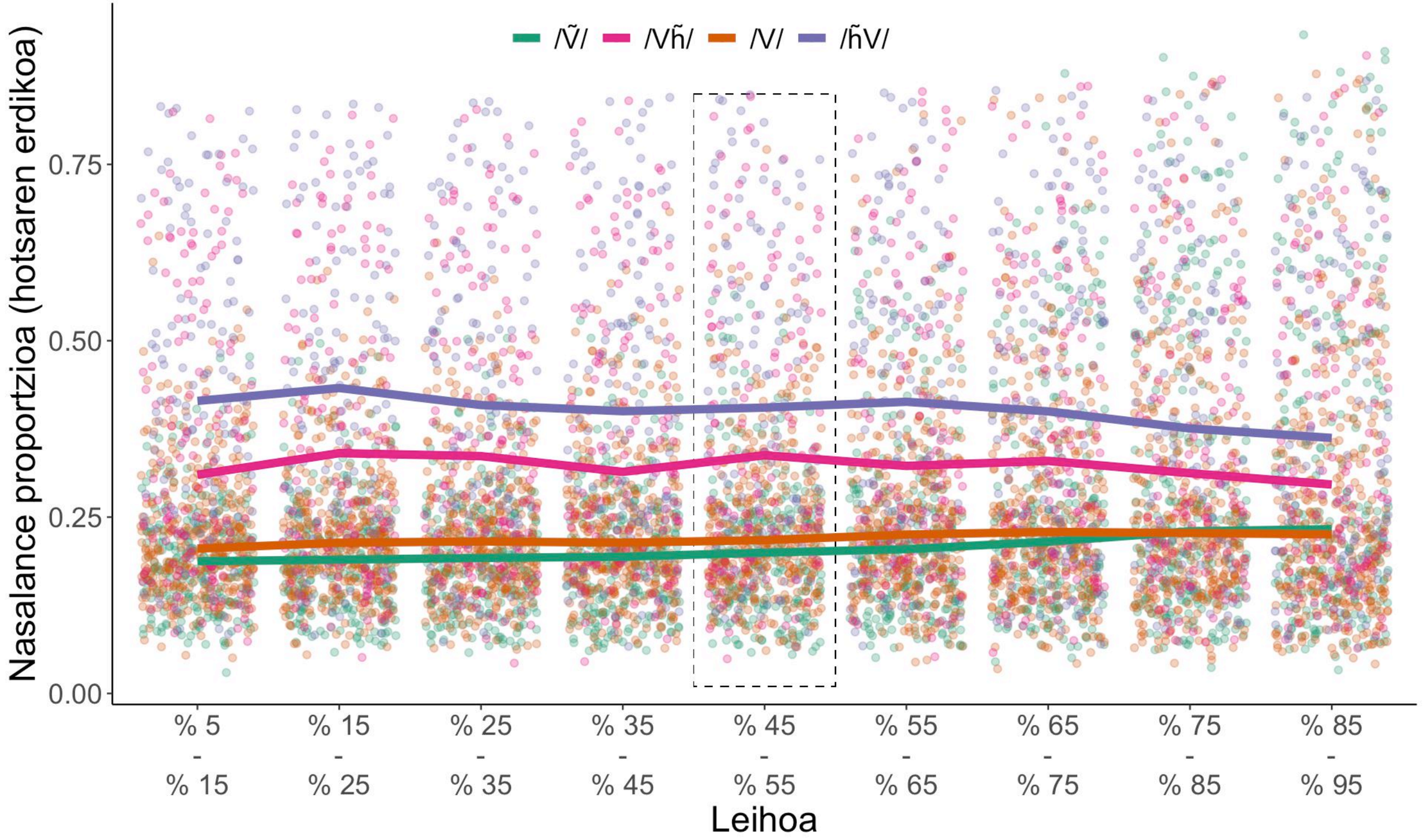
Nasalance proportzioa





Nasalance proportzioa




/Ṽ/
/Vñ/
/V/
/ñV/
Nasalance proportzioa (hotsaren erdikoa)
0.00
0.25
0.50
0.75
% 5 - % 15
% 15 - % 25
% 25 - % 35
% 35 - % 45
% 45 - % 55
% 55 - % 65
% 65 - % 75
% 75 - % 85
% 85 - % 95
Leihoa

Beta erregresioko eredu hierarkiko bayestarra *brms*rekin

Beta erregresioko eredu hierarkiko bayestarra *brms*rekin

$$Nasalance \sim 0 + taldea:ahoskunea + (0 + taldea:ahoskunea \mid hiztuna) + (1 \mid hitza)$$

Beta erregresioko eredu hierarkiko bayestarra *brms*rekin

$$Nasalance \sim 0 + taldea:ahoskunea + (0 + taldea:ahoskunea \mid hiztuna) + (1 \mid hitza)$$

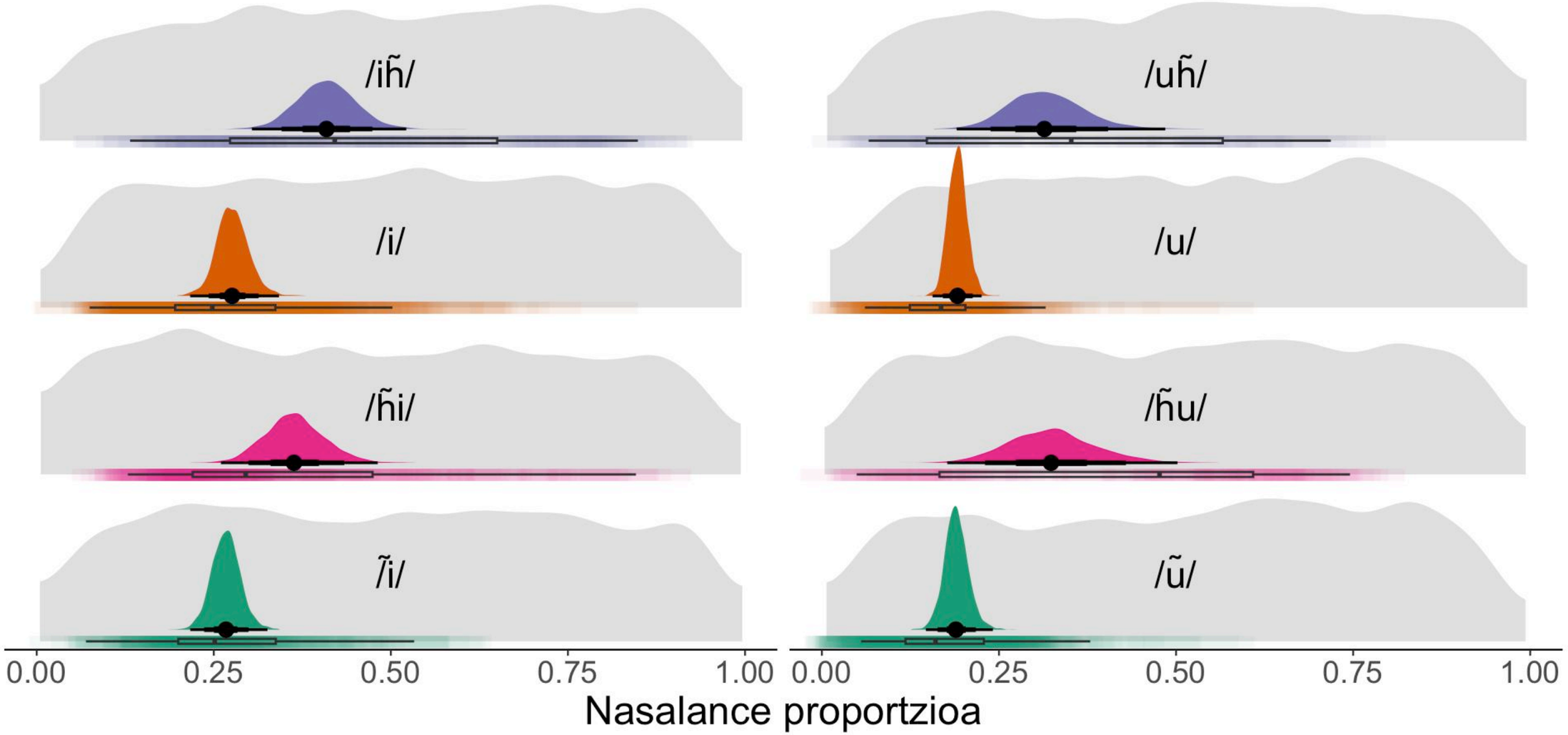
Aldez aurrekoak:

$\beta \sim Normal(0, 1.5)$

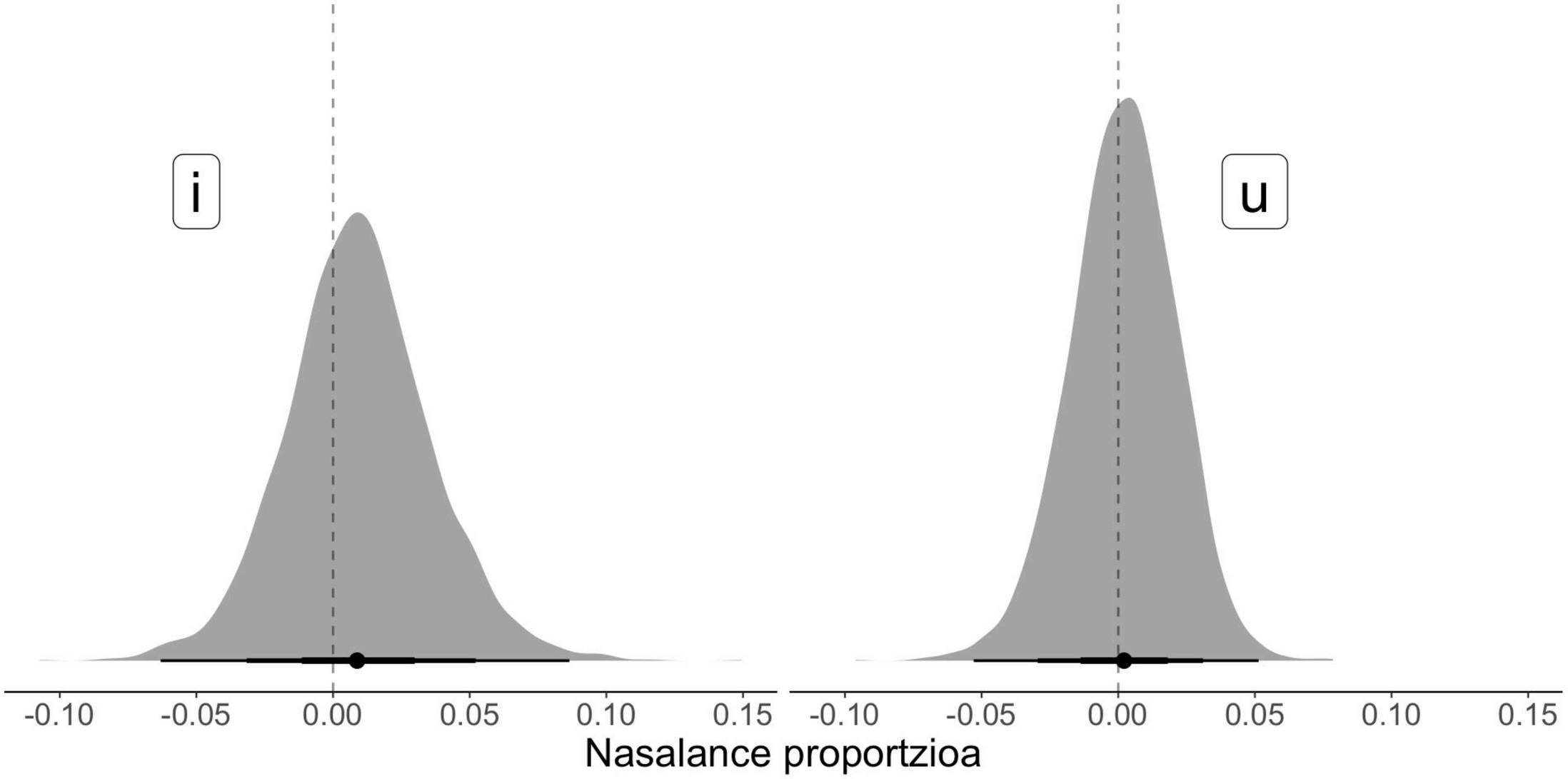
$\phi \sim Normal(0, 1.2)$

$sd \sim Gamma(0.01, 0.01)$

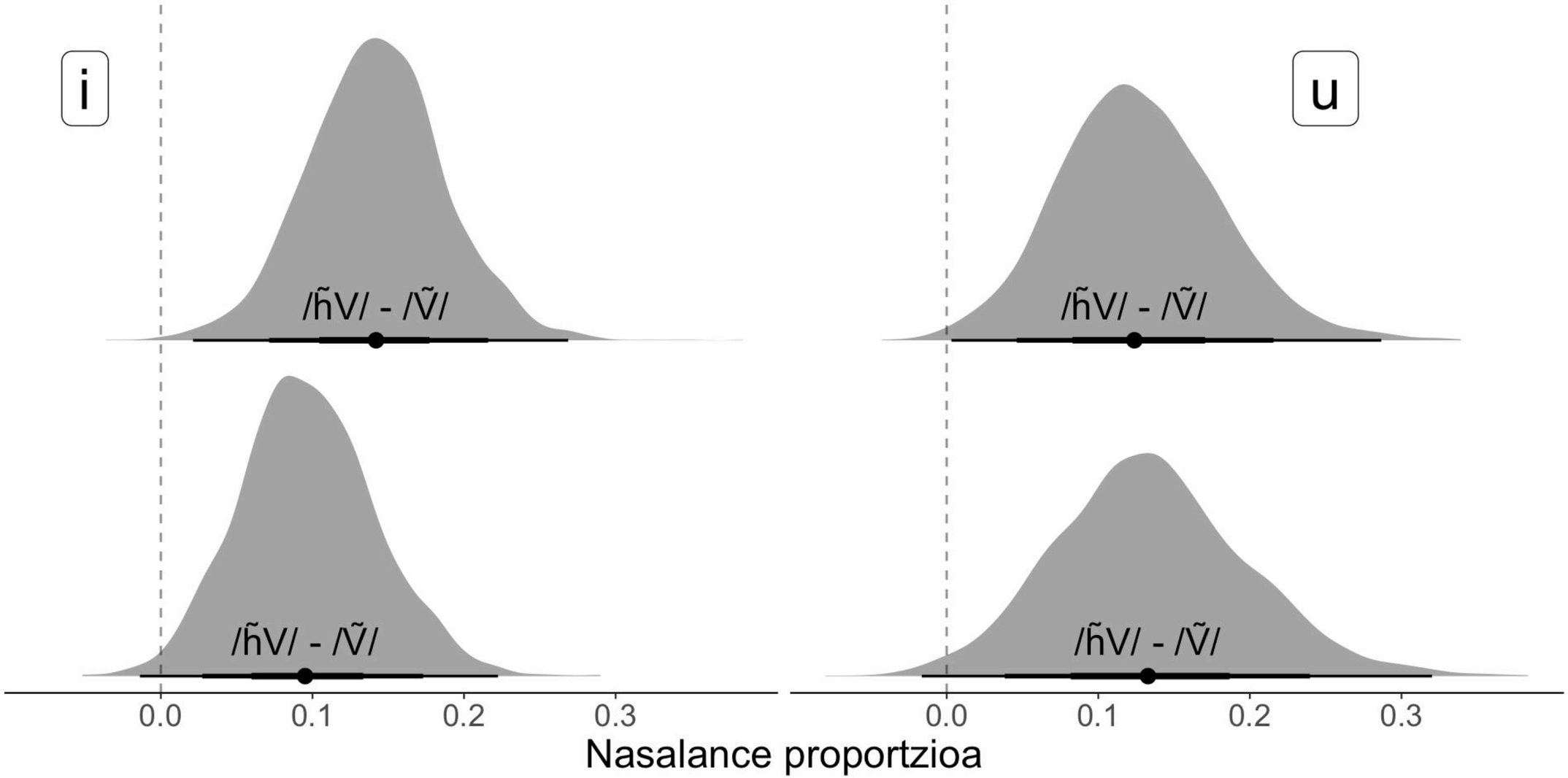
$\rho \sim LKJ(2)$

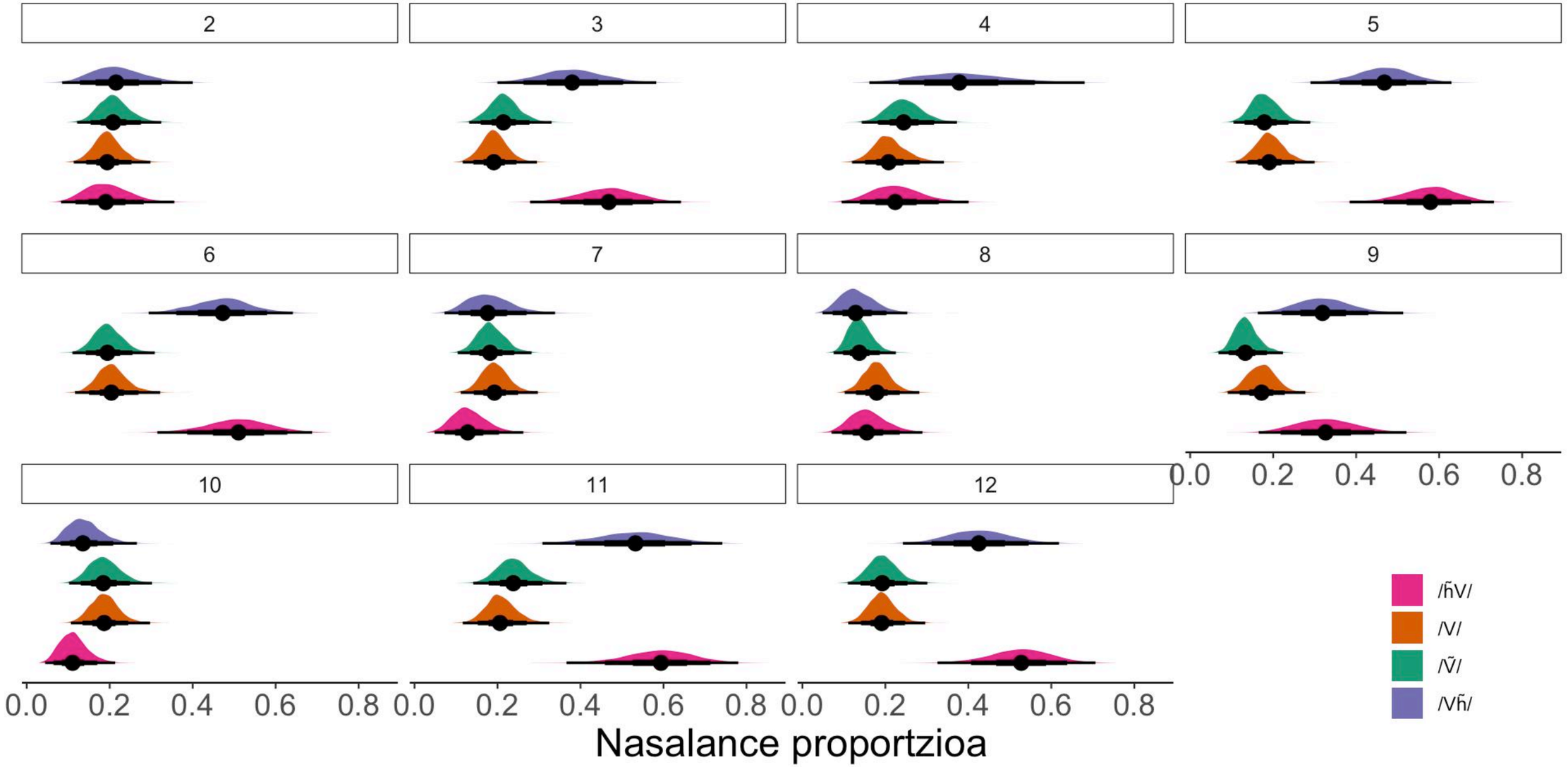

/iñ/
/i/
/ñi/
/ĩ/
/uñ/
/u/
/ñu/
/ũ/
0.00
0.25
0.50
0.75
1.00
0.00
0.25
0.50
0.75
1.00
Nasalance proportzioa

/V/ = /Ṽ/



/ṼV/ ≠ /ñV/ & /Vñ/


i
u
/ñV/ - /Ṽ/
/ñV/ - /Ṽ/
/ñV/ - /Ṽ/
/ñV/ - /Ṽ/
0.0
0.1
0.2
0.3
0.0
0.1
0.2
0.3
Nasalance proportzioa


2
3
4
5
6
7
8
9
10
11
12
0.0
0.2
0.4
0.6
0.8
/ɦV/
/V/
/Ṽ/
/Vɦ/
Nasalance proportzioa

Eztabaida

/ṽ/

Eztabaida

/ṽ/ -> /v/

Eztabaida

/ṽ/ -> /v/

/h̃/ : /h/

Eztabaida

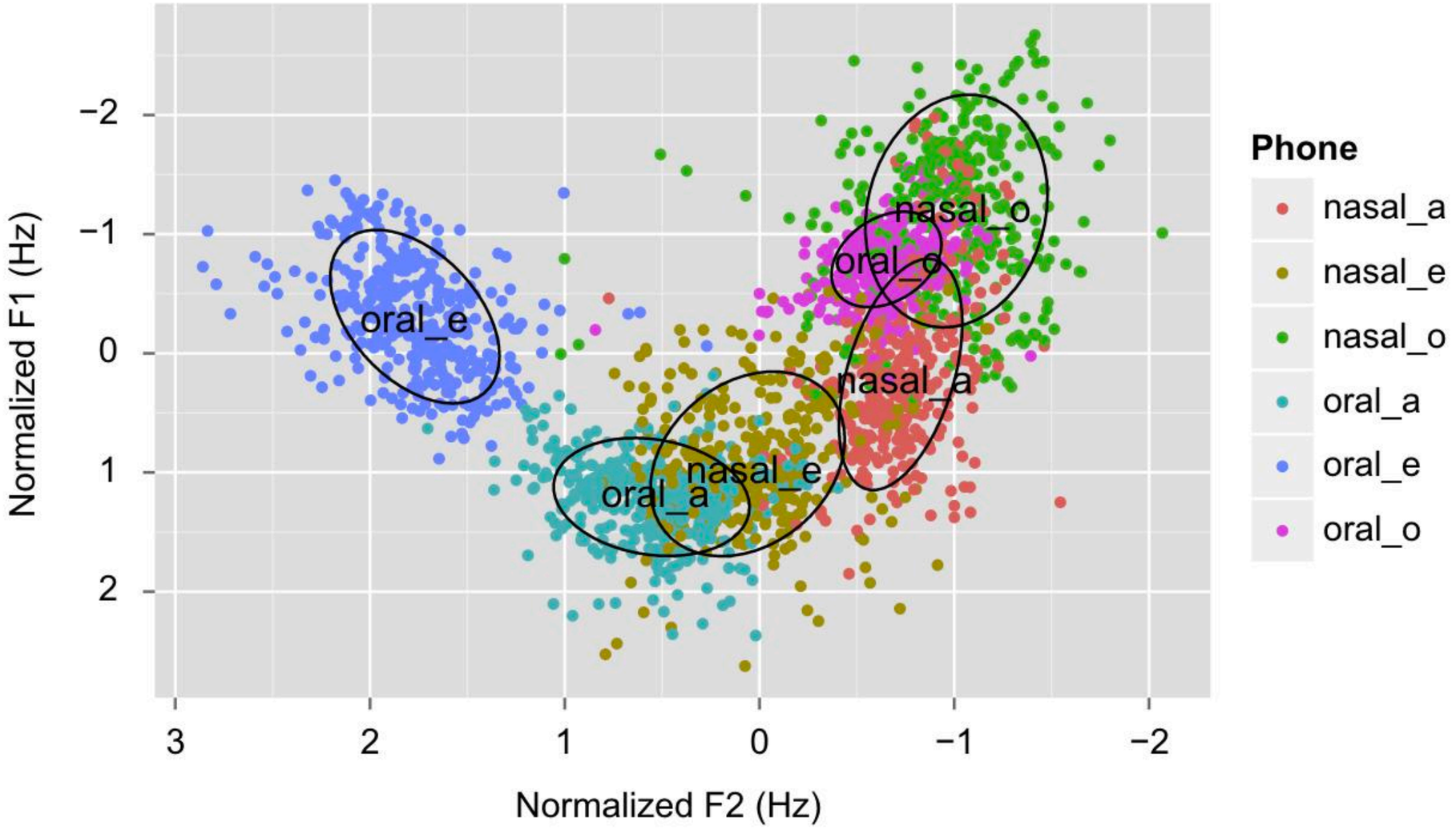
/ṽ/ -> /V/

/h̃/ : /h/

Baina ez hiztun guztien baitan

Formakinen eta iraupenaren azterketa

/o/ ≠ /õ/, /e/ ≠ /ẽ/…


Normalized F1 (Hz)
−2
−1
0
1
2
Normalized F2 (Hz)
3
2
1
0
−1
−2
oral_e
oral_a
nasal_e
nasal_a
oral_o
nasal_o
Phone
nasal_a
nasal_e
nasal_o
oral_a
oral_e
oral_o

Lau aldagaiko eredu bayestar gaussiarra *brms*rekin

Lau aldagaiko eredu bayestar gaussiarra *brms*rekin

$$\begin{pmatrix} \log(\text{F1}) \\ \log(\text{F2}) \\ \log(\text{F3}) \\ \log(\text{iraupena}) \end{pmatrix} \sim 0 + \mathit{taldea} : \mathit{ahoskunea} + (0 + \mathit{taldea} : \mathit{ahoskunea} \mid \mathit{hiztuna}, \mathit{hitza})$$

Lau aldagaiko eredu bayestar gaussiarra *brms*rekin

$$\begin{pmatrix} \log(\text{F1}) \\ \log(\text{F2}) \\ \log(\text{F3}) \\ \log(\text{iraupena}) \end{pmatrix} \sim 0 + taldea:ahoskunea + (0 + taldea:ahoskunea \mid hiztuna, hitza)$$

Aldez aurrekoak:

$\beta_{F1} \sim Normal(5.5, 0.5)$

$\beta_{F2,i} \sim Normal(7.5, 0.5),\ \beta_{F2,u} \sim Normal(7, 0.5)$

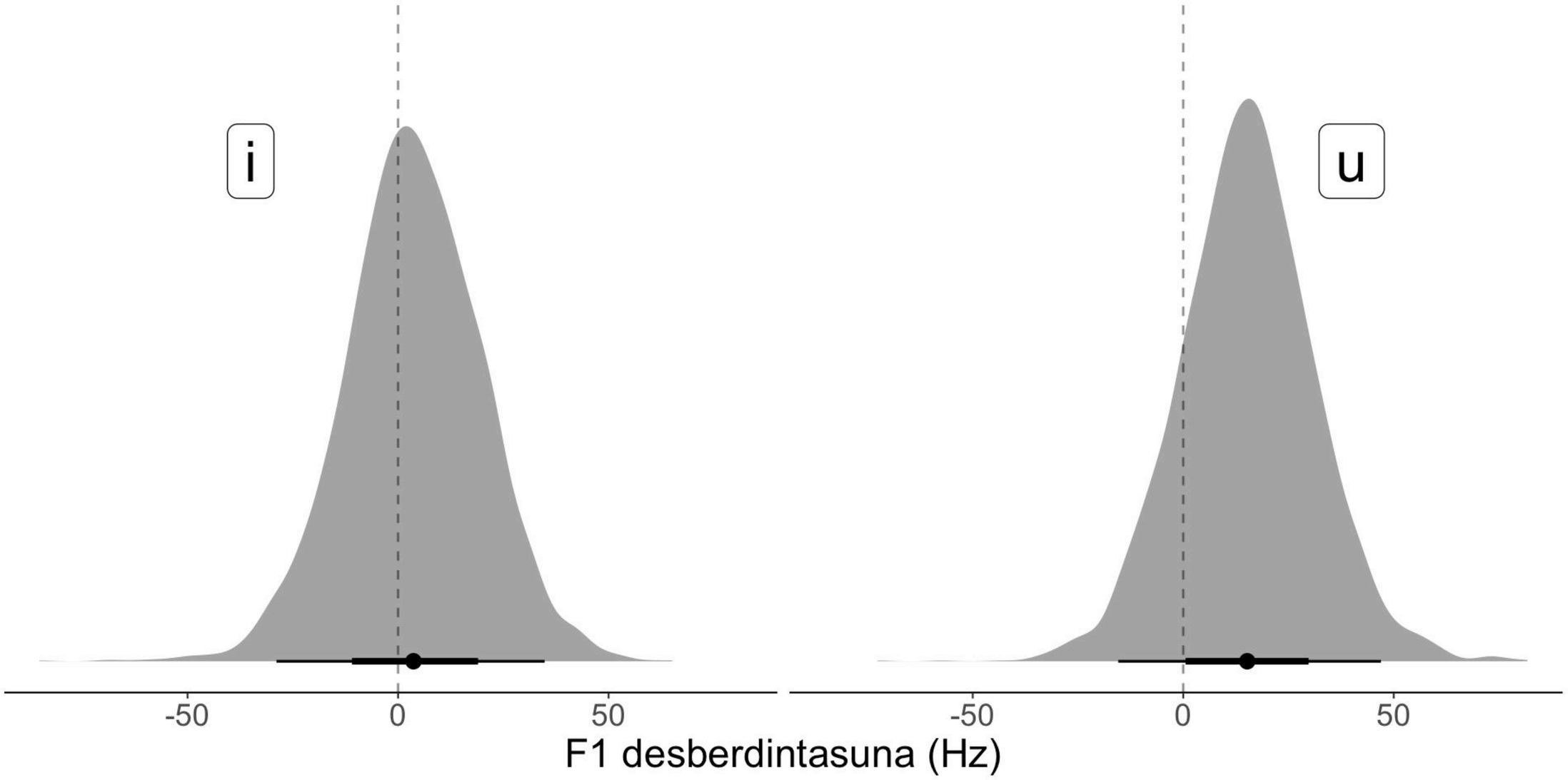
$\beta_{F3,i} \sim Normal(8, 0.5),\ \beta_{F3,u} \sim Normal(7.9, 0.5)$

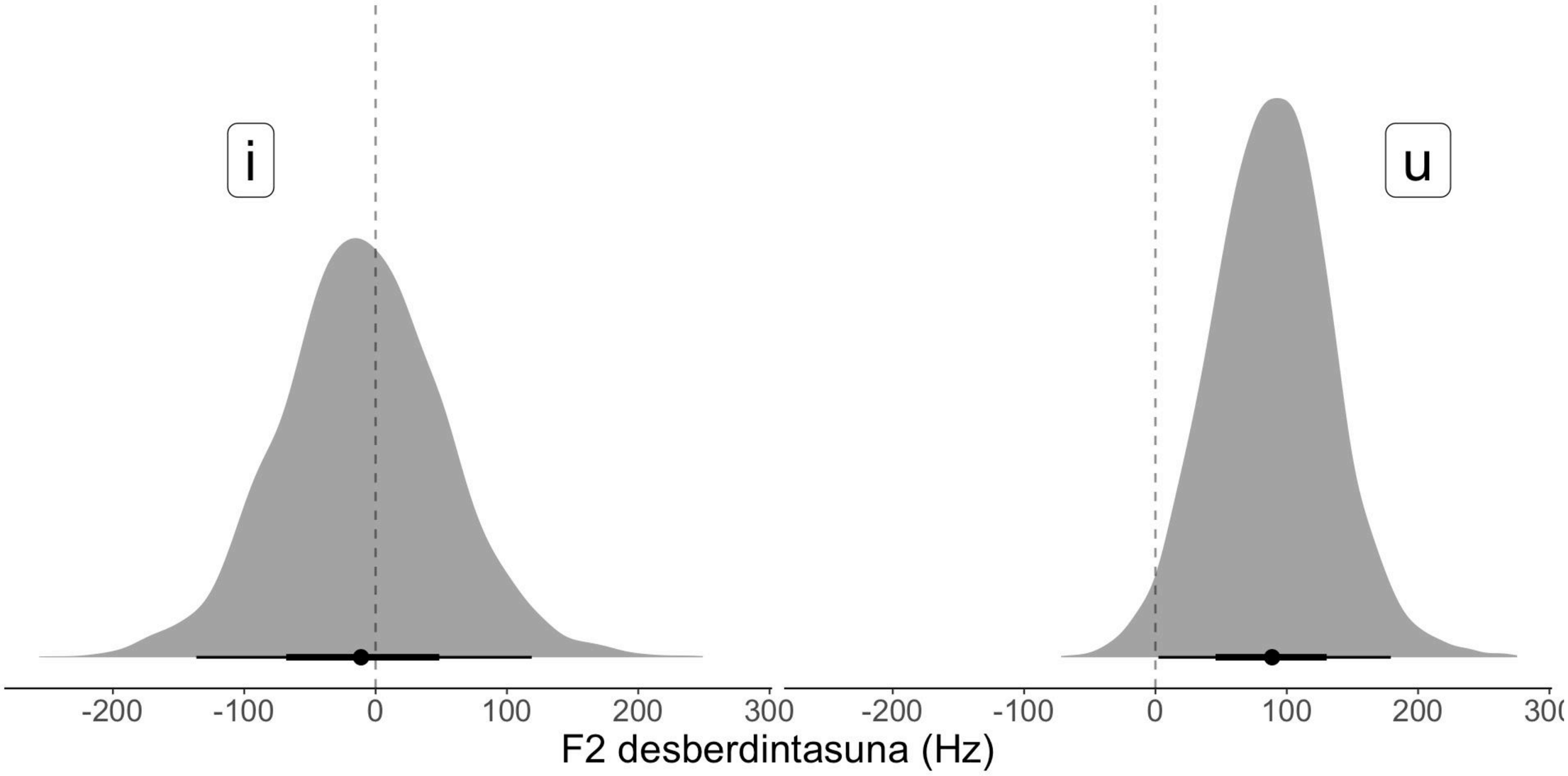
$\beta_{iraupena} \sim Normal(-2, 0.5)$

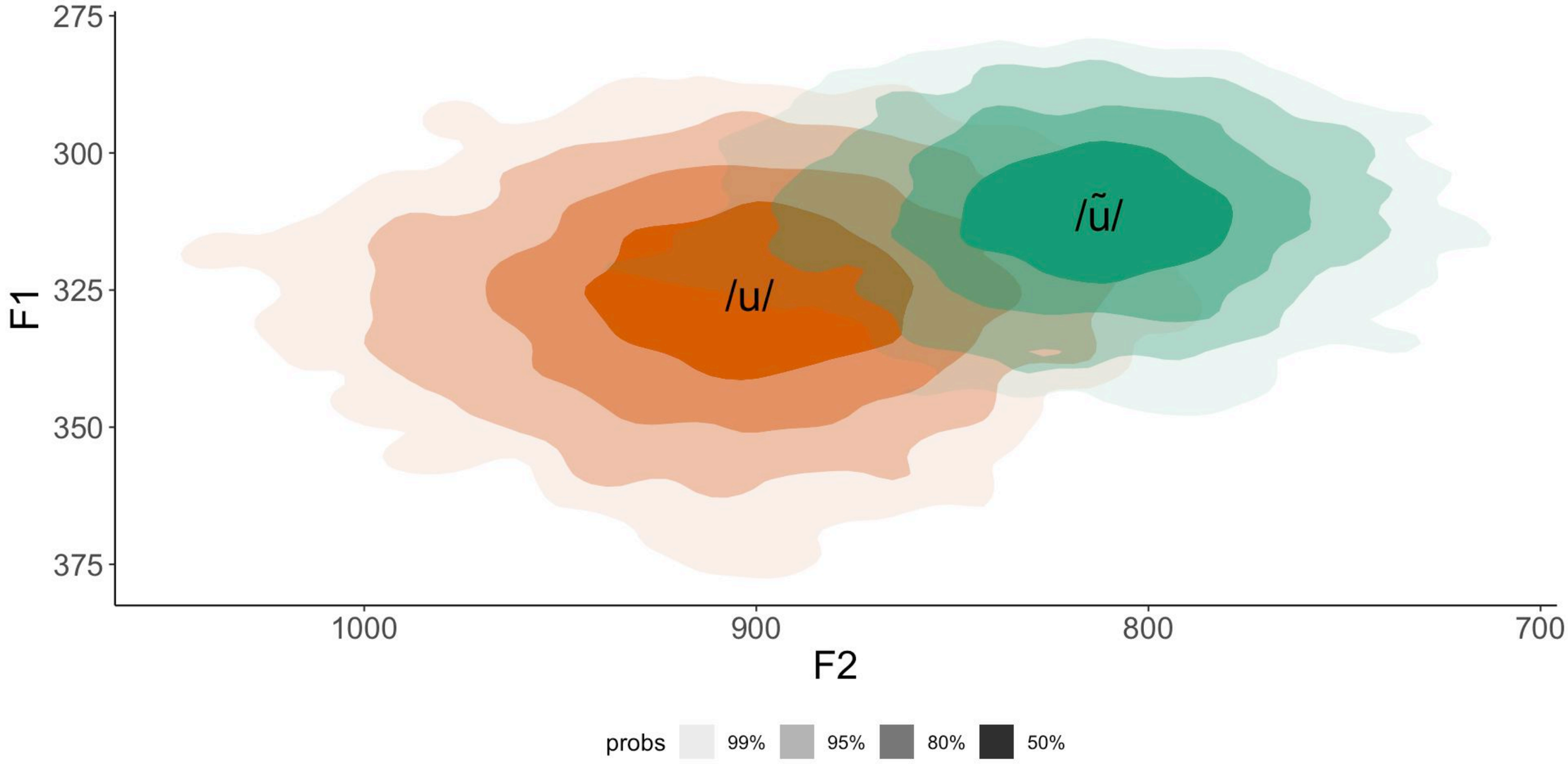
$\sigma_{F1,F2,F3} \sim Normal(0, 0.5),\ \sigma_{iraupena} \sim Normal(0, 0.25)$

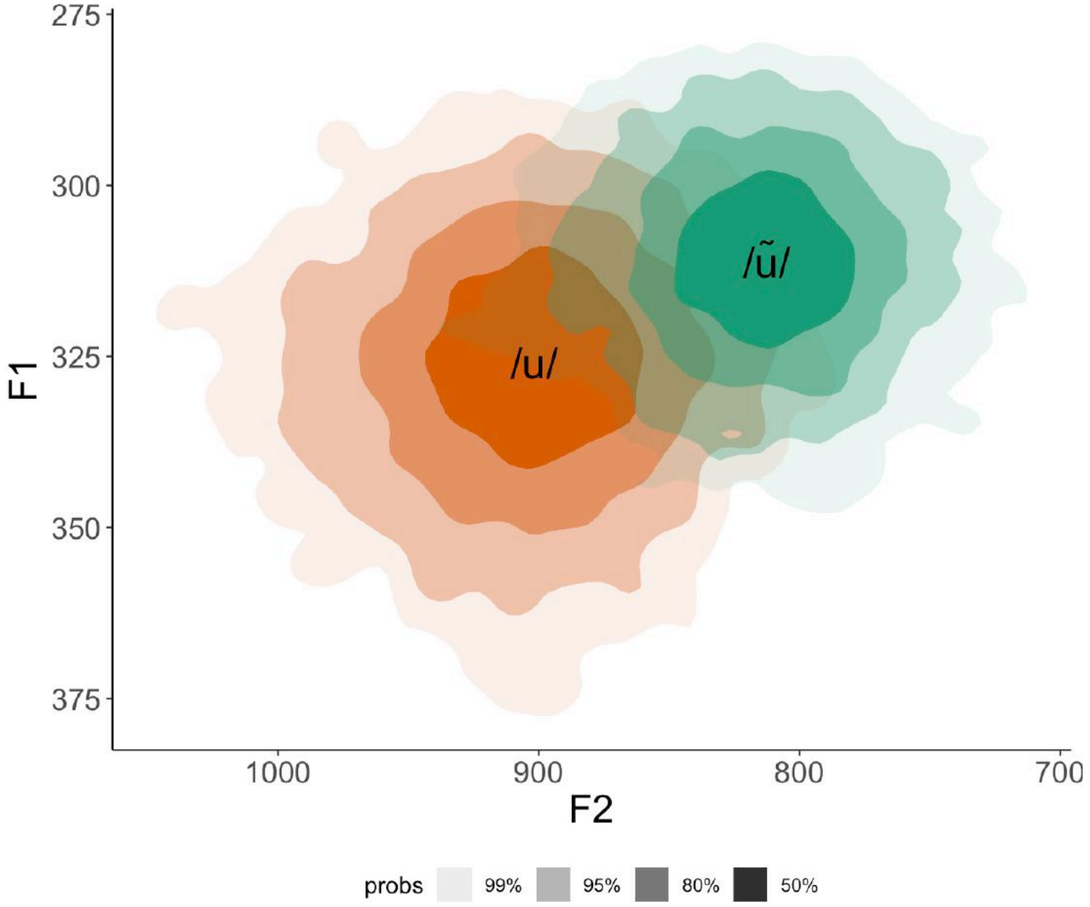
$$sd_{F1,F2,F3} \sim Normal(0, 0.5),\ sd_{iraupena} \sim Normal(0, 0.25)$$

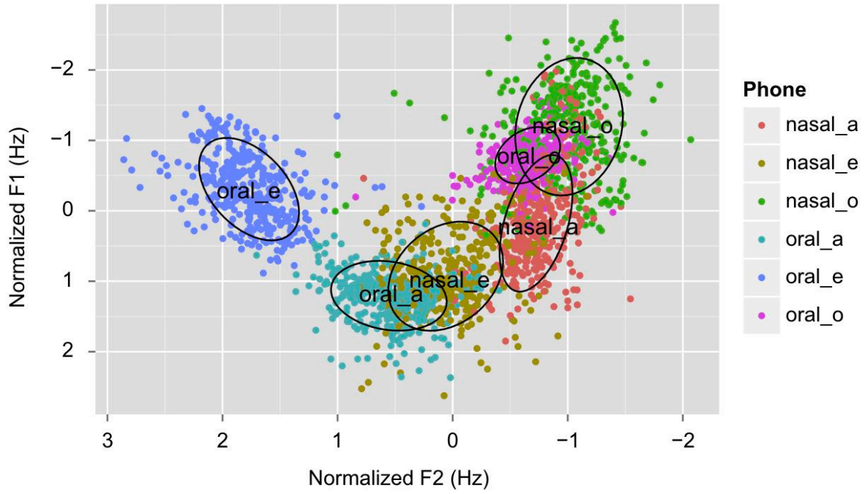
$$\rho \sim LKJ(2)$$


i
u
-50
0
50
-50
0
50
F1 desberdintasuna (Hz)


i
u
-200
-100
0
100
200
300
-200
-100
0
100
200
300
F2 desberdintasuna (Hz)


275
300
325
350
375
F1
1000
900
800
700
F2
/u/
/ũ/
probs
99%
95%
80%
50%


275
300
325
350
375
F1
1000
900
800
700
F2
/ũ/
/u/
probs
99%
95%
80%
50%


Normalized F1 (Hz)
−2
−1
0
1
2
3
2
1
0
−1
−2
Normalized F2 (Hz)
oral_e
nasal_o
oral_o
nasal_a
nasal_e
oral_a
Phone
nasal_a
nasal_e
nasal_o
oral_a
oral_e
oral_o

Eztabaida

F1:

/ĩ/ ≈ /i/

/ũ/ ≃ /u/

Eztabaida

F1:

/ĩ/ ≈ /i/

/ũ/ ≃ /u/

F2:

/ĩ/ ≈ /i/

/ũ/ ≠ /u/?

Eztabaida

F1:
/ĩ/ ≈ /i/
/ũ/ ≃ /u/

F2:
/ĩ/ ≈ /i/
/ũ/ ≠ /u/?

F1, F2 eta iraupen ũ : u desberdintasunak beste hizkuntzetan aurkitu diren noranzko berean doaz

Eztabaida

F1:
/ĩ/ ≈ /i/
/ũ/ ≃ /u/

F2:
/ĩ/ ≈ /i/
/ũ/ ≠ /u/?

F1, F2 eta iraupen ũ : u desberdintasunak beste hizkuntzetan aurkitu diren noranzko berean doaz

Kontrasteari eusten zaio?

Laburbilduz: Bada bokal kontrastiboki sudurkaririk Larraineko euskaraz?

Laburbilduz: Bada bokal kontrastiboki sudurkaririk Larraineko euskaraz?

Sudurkariak behintzat **ez** dira

Laburbilduz: Bada bokal kontrastiboki sudurkaririk Larraineko euskaraz?

Sudurkariak behintzat **ez** dira

Baina baliteke /u/ eta /ũ/ zena berdindu ez izana

Laburbilduz: Bada bokal kontrastiboki sudurkaririk Larraineko euskaraz?

Sudurkariak behintzat **ez** dira

Baina baliteke /u/ eta /ũ/ zena berdindu ez izana

Transfonologizazioa Larraineko euskaraz? (adib. Kirby, Pittayaporn, and Brunelle 2022)

It’s not over!

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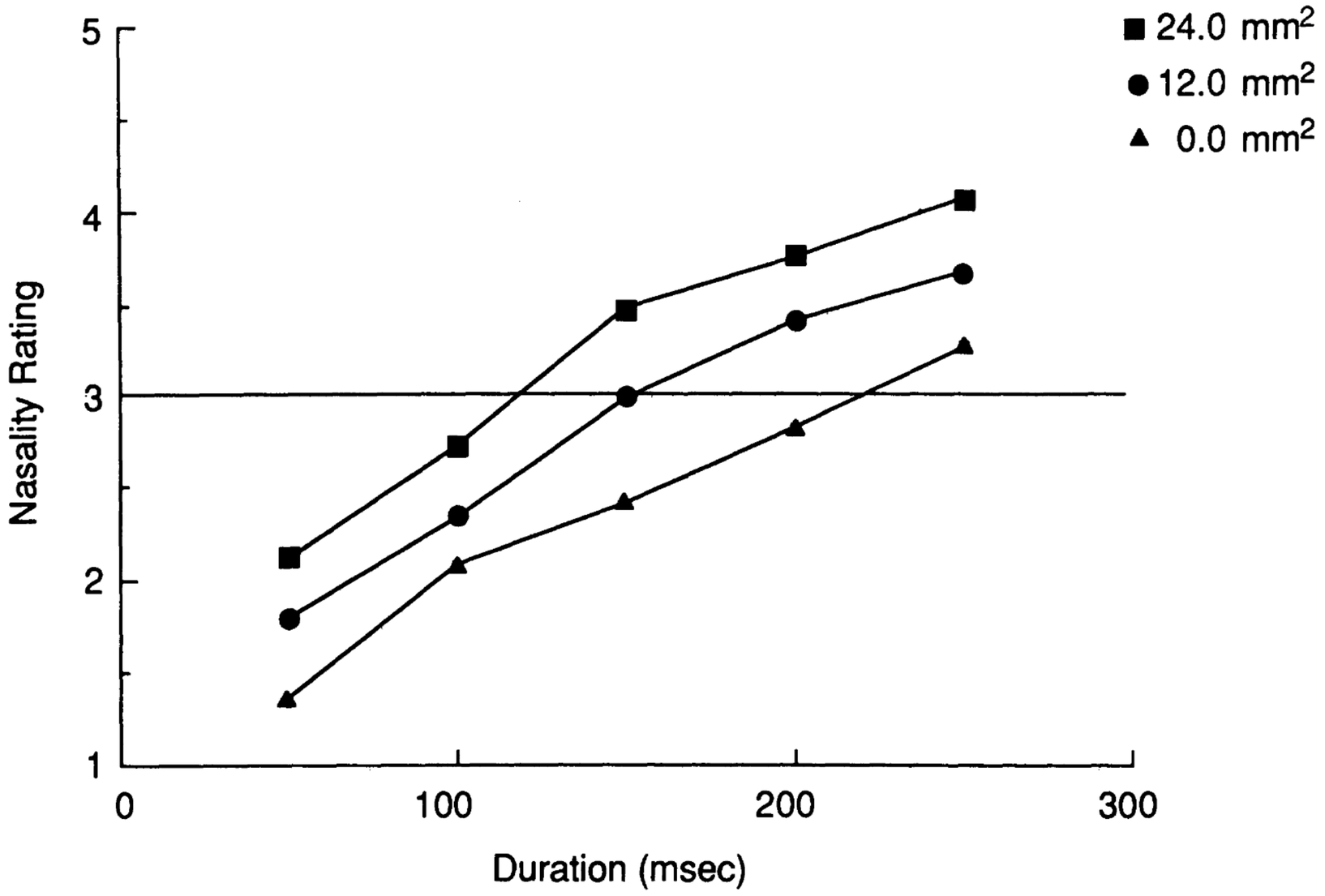
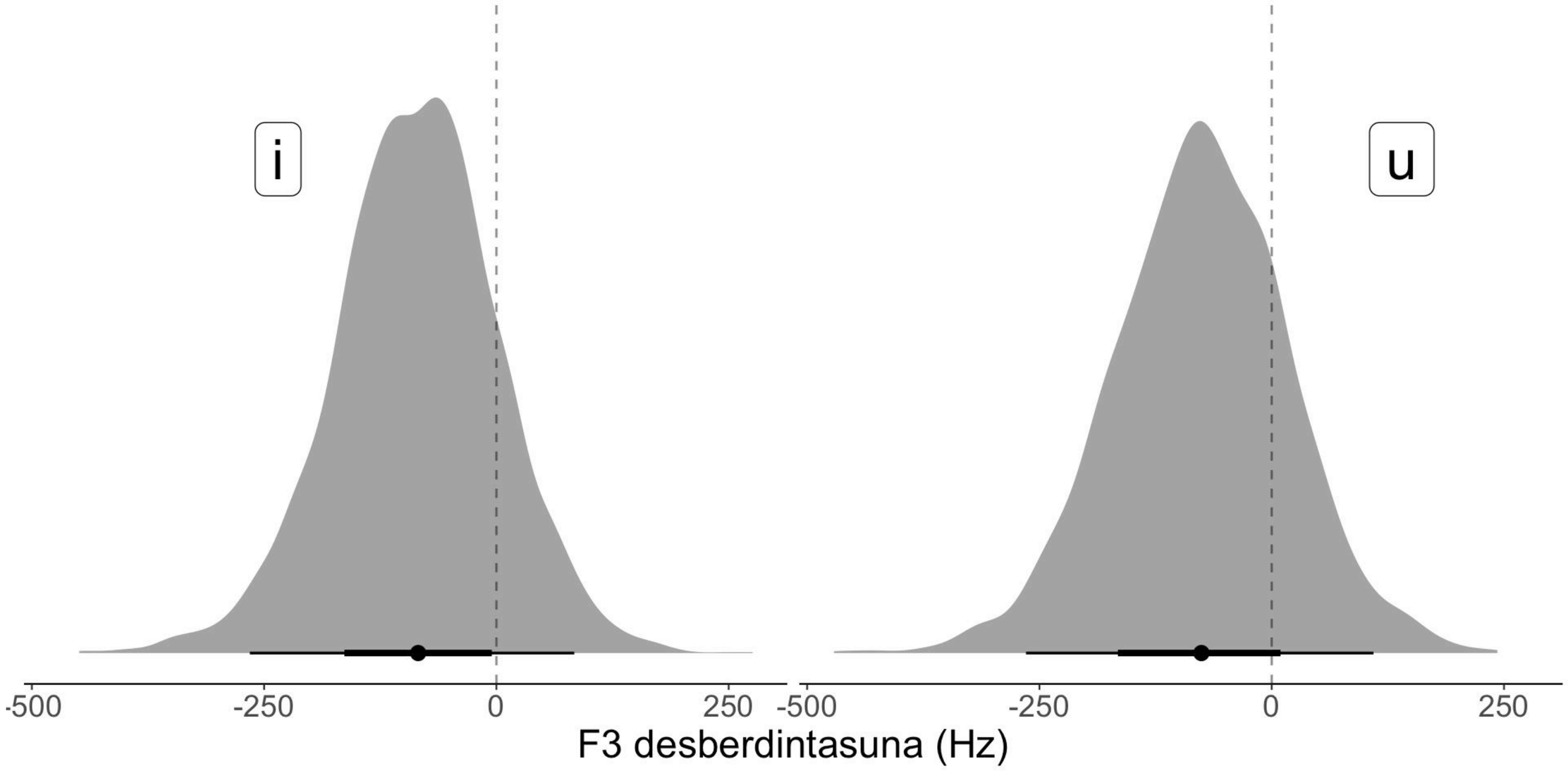
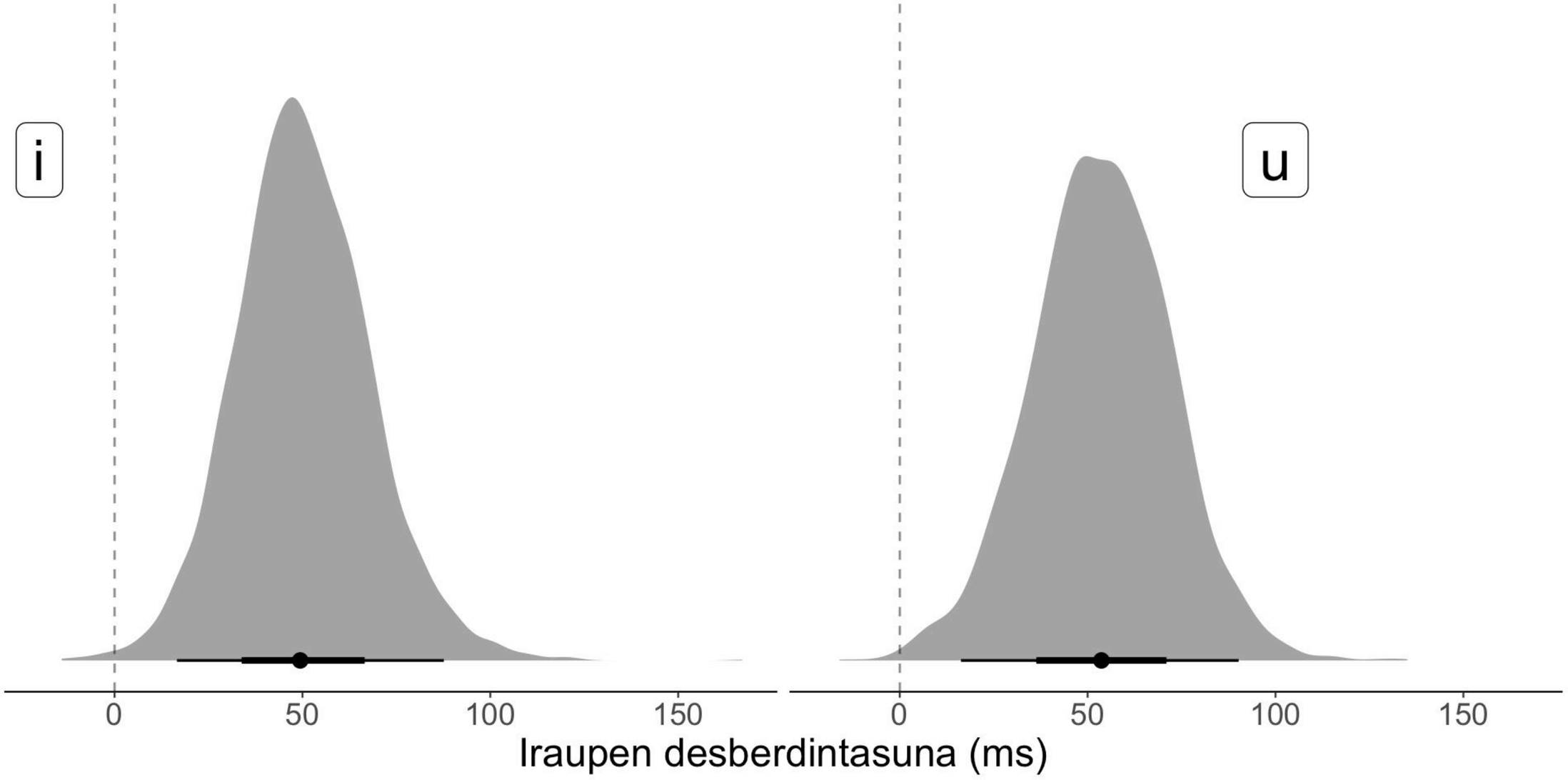
Hiztunek desberdintasunok erabil ditzakete




i
u
-500
-250
0
250
-500
-250
0
250
F3 desberdintasuna (Hz)


i
u
0
50
100
150
0
50
100
150
Iraupen desberdintasuna (ms)

Erreferentziak

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