Appendix A

Stimuli

		/a/	/ɛ/	/i/	/ɔ/	/u/	/ɨ/
/x/	onset	/'xat-a/ 'hut'	/'xɛka-tɨ/ 'blow'	/'ximij-a/ 'chemistry'	/'xɔlɔd/ 'coldness'	/'xutk-ɔ/ 'quickly'	/'xɨb-a/ 'mistake'
	coda	/'ptax/ 'bird'	/'tsɛx/ 'feature' gen.pl.	/'smix/ 'laughter'	/'dvɔx/ 'two' gen.	/'pux/ 'down'	/'vdɨx/ 'breath'
/ɣ/	onset	/'ɣarn-ɔ/ 'well'	/'ɣɛɲij/ 'genius'	/'ɣidn-ij/ 'worthy'	/'ɣɔl-ij/ 'naked'	/'ɣutʃ-n-ɔ/ 'loudly'	/'ɣirl-ɔ/ 'mouth (of a river)'
	coda	/'vaɣ/ 'weight' gen.pl.	/stra'tɛɣ/ 'strategist'	/'stiɣ/ 'stack'	/'bɔɣ/ 'god'	/'druɣ/ 'friend'	/'striɣ/ 'cut' past

Stress and morphological boundaries have been indicated in the transcription.

Appendix B

Results of statistical analyses

I. Tongue height
Best-fit model
Dependent variable: tongue_height
Linear mixed model fit by REML. t-tests use Satterthwaite's method [lmerModLmerTest]
Formula: tongue_height ~ fricative + position + vowel + fricative:position + vowel:position +
+ (1 + fricative | Speaker) + (1 + position | Speaker) + (1 + vowel | Speaker) + (1 + fricative | word) + (1 + position | word) + (1 + vowel | word)
Fixed effects:

	Estimate	Std. Error	df	t value	Pr(>|t|)
(Intercept)	6.87313	0.12051	8.68274	57.036	1.75e-12***
fricativeɣ	-0.06259	0.06135	9.74096	-1.020	0.332312
positiononset	-0.17289	0.06788	43.52760	-2.547	0.014482 *
vowelɛ	0.00155	0.08966	6.58506	0.017	0.986719
voweli	0.02913	0.09387	9.92304	0.310	0.762711
vowelɔ	-0.01207	0.06937	15.74168	-0.174	0.864115
vowelu	0.06120	0.07763	12.61754	0.788	0.445014
vowelɨ	0.02515	0.07105	14.59735	0.354	0.728436
fricativeɣ:positiononset	-0.18406	0.04570	106.87517	-4.027	0.000106 ***
positiononset:vowelɛ	0.12460	0.09873	3.38642	1.262	0.286839
positiononset:voweli	0.21819	0.07515	139.14352	2.903	0.004296 **
positiononset:vowelɔ	0.17922	0.07515	137.00148	2.385	0.018461 *
positiononset:vowelu	0.10348	0.07515	139.36608	1.377	0.170758
positiononset:vowelɨ	0.26374	0.07515	139.28450	3.509	0.000605 ***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Means of main effects and interaction effects:
the *emmeans* () function

1. fricative

fricative	mean	SE	df	lower.CL	upper.CL
x	6.88	0.133	8.05	6.57	7.19
ɣ	6.72	0.144	9.39	6.40	7.05

2. position

position	mean	SE	df	lower.CL	upper.CL
coda	6.86	0.143	9.25	6.54	7.18
onset	6.74	0.129	7.71	6.44	7.04

3. vowel

vowel	mean	SE	df	lower.CL	upper.CL
a	6.71	0.111	8.00	6.45	6.96
ɛ	6.77	0.143	8.88	6.45	7.10
i	6.85	0.147	8.22	6.51	7.19
ɔ	6.79	0.141	8.25	6.46	7.11
u	6.82	0.152	8.18	6.47	7.17
ɨ	6.87	0.144	8.24	6.54	7.20

4. position * fricative

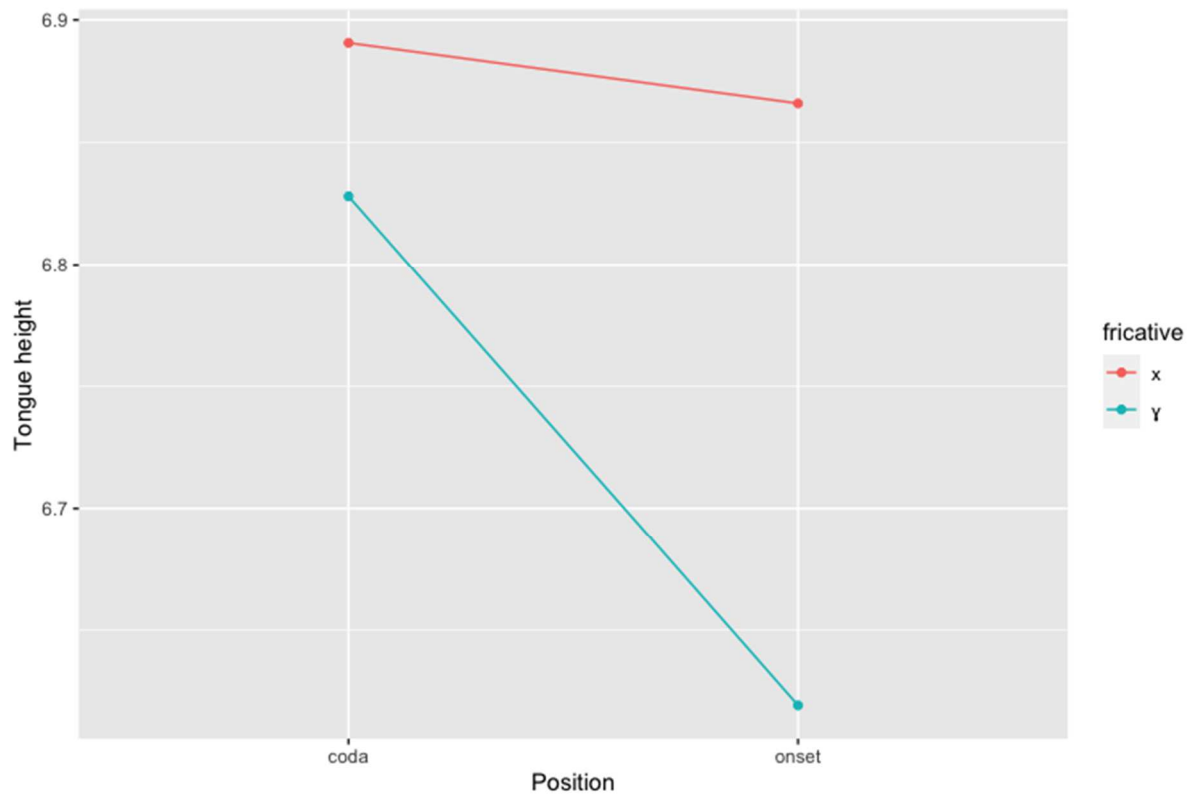| fricative	position	mean	SE	df	lower.CL	upper.CL
x	coda	6.89	0.143	9.04	6.57	7.21
x	onset	6.87	0.130	7.49	6.56	7.17
ɣ	coda	6.83	0.153	10.37	6.49	7.17
ɣ	onset	6.62	0.140	8.83	6.30	6.94

Figure 1. FRICATIVE by POSITION interaction plot (using the *emmip* () function)

5. position * vowel

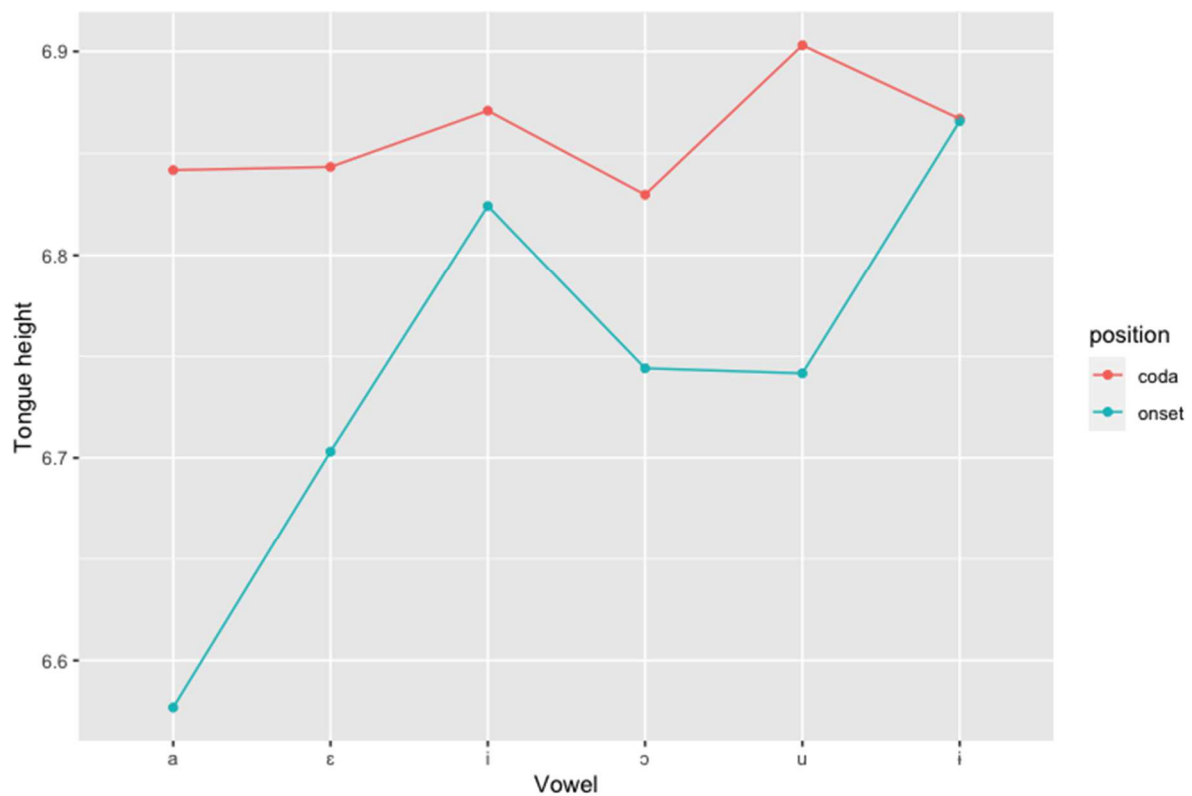| vowel	position	mean	SE	df	lower.CL	upper.CL
a	coda	6.84	0.124	8.75	6.56	7.12
a	onset	6.58	0.108	7.59	6.33	6.83
ɛ	coda	6.84	0.157	10.13	6.49	7.19
ɛ	onset	6.70	0.144	8.57	6.37	7.03
i	coda	6.87	0.158	9.35	6.52	7.23
i	onset	6.82	0.145	7.80	6.49	7.16
ɔ	coda	6.83	0.151	9.38	6.49	7.17
ɔ	onset	6.74	0.138	7.82	6.42	7.06
u	coda	6.90	0.162	9.30	6.54	7.27
u	onset	6.74	0.150	7.78	6.39	7.09
ɨ	coda	6.87	0.154	9.37	6.52	7.21
ɨ	onset	6.87	0.141	7.81	6.54	7.19

Figure 2. POSITION by VOWEL interaction plot (using the *emmip* () function)

II. Front/back position of the tongue
Best-fit model
Dependent variable: front/back_position_of_tongue
Linear mixed model fit by REML. t-tests use Satterthwaite's method [lmerModLmerTest]
Formula: front/back_position_of_tongue ~ fricative + position + vowel (1 + fricative | Speaker) + (1 + position | Speaker) + (1 + vowel | Speaker) + (1 + fricative | word) + (1 + position | word) + (1 + vowel | word)

Fixed effects:

	Estimate	Std. Error	df	t value	Pr(>|t|)
(Intercept)	5.082067	0.267232	7.970078	19.017	6.33e-08 ***
fricativeɣ	0.012244	0.082530	9.216163	0.148	0.88525
positiononset	0.342463	0.077343	20.733626	4.428	0.00024 ***
vowelɛ	0.289403	0.156221	9.744021	1.853	0.09444 .
voweli	0.805200	0.264282	8.118881	3.047	0.01563 *
vowelɔ	-0.119013	0.132680	22.806250	-0.897	0.37909
vowelu	0.006341	0.135732	18.682430	0.047	0.96324
vowelɨ	0.423669	0.211668	8.172013	2.002	0.07957 .

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Means of main effects:
the *emmeans* () function

1. fricative

fricative	mean	SE	df	lower.CL	upper.CL
x	5.49	0.269	7.23	4.86	6.12
ɣ	5.50	0.268	7.20	4.87	6.13

2. position

position	mean	SE	df	lower.CL	upper.CL
coda	5.32	0.267	7.10	4.69	5.95
onset	5.66	0.269	7.33	5.04	6.29

3. vowel

vowel	mean	SE	df	lower.CL	upper.CL
a	5.26	0.274	6.98	4.61	5.91
ɛ	5.55	0.287	7.01	4.87	6.23
i	6.06	0.301	7.70	5.37	6.76
ɔ	5.14	0.305	7.04	4.42	5.86
u	5.27	0.306	7.04	4.54	5.99
ɨ	5.68	0.323	7.05	4.92	6.45