When glides are obstruent, or Turkish [j]

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Problem

When segments are represented as bundles of (supposedly universal) universal phonological features, sometimes we observe mismatches between the phonetic properties of a segment and its phonological patterning

In Turkish a segment most commonly (but not always) realized as a palatal approximant does not pattern with sonorants in phonological processes and phonotactics, but with (fricative) obstruents

/j/ = [+sonorant, −consonantal]

But apparently in Turkish [−sonorant, +consonantal]

Problem

In such cases, one option is to conclude that there isn't such a thing as universal phonological features; 'natural' classes are the product of phonetic and diachronic factors, not of universal synchronic limits on the type of phonetic properties they can share

Thus, phonologically active classes of segments may sometimes consist of heterogeneous elements, not sharing any of the phonetic properties which define supposedly universal phonological features

Nature of phonological features

However, we want to explore here an alternative hypothesis

Phonological features are universal, but they do not define positive phonetic properties of speech sounds

They just encode phonological contrasts, relative differences between sounds, whose exact phonetic instantiation can vary across languages (and sometimes even within the same language)

Nature of phonological features

Jakobson, Fant & Halle (1952: 5-6): in Danish the contrast between /t/ and /d/ is implemented as [tʰ] vs. [t] in onsets, but as [t] vs. [ð] in codas

The same phonetic substance - [t] – implements two different stops in different environments

Phoneme	Position	
	onset	coda
'strong' /t/	[tʰ]	[t]
'weak' /d/	[t]	[ð]

A palatal fricative?

Our analysis of the Turkish consonant most commonly realized as [j]

It is a voiced palatal fricative /ʝ/: [+continuant, +consonantal, −sonorant]

In absolute terms [j] (its most common phonetic implementation) usually has little constriction, but still more than vowels

So, no compelling reason to consider it [−consonantal]

A palatal fricative?

Our supposed /ʝ/ is often a phonetic approximant, and so produced with a largely non-turbulent airflow and a high degree of periodicity

But vowels or nasal consonants have even less turbulence

So, no need to consider it [+sonorant]

A palatal fricative?

Other properties compatible with an underlying fricative:

- In utterance-final position we often have [ç] instead of [j]

- The distribution of the phonetic approximant [j] is partially parallel to the lenited allophone of the other non-coronal voiced fricative, i.e. /v/

Turkish approximants as lenited fricatives

Turkish has another phonetic approximant, i.e. [ʋ]

An allophone of /v/ when intervocalic and followed or preceded by a [+round] vowel (Göksel & Kerslake 2005: 6)

[taʋuk] *tavuk* 'chicken'

It can also be deleted in fast speech: [tauk]

[j] too can be deleted in fast speech when intervocalic and next to a front vowel

[iji] ~ [ii] *iyi* 'good'   [byjyc] ~ [byyc] *büyük* 'big'

Turkish approximants as lenited fricatives

The back glide /w/ is not a phoneme in Turkish

This might be considered an accidental gap: although usually languages having glides have both /j/ and /w/, some languages having /j/ do not have /w/

However, languages are more likely to borrow a new sound if they already have segments of the same class in their inventory

But Turkish speakers consistently adapt [w] as [v] in loanwords

Wisconsin [viskonsin]

Washington [vaʃinton]

The Phonological behaviour of [j]

Two questions:

→ Does [j] ever pattern with vowels?

→ Is [j] a sonorant consonant?

Does [j] ever pattern with vowels?

- Does not participate in vowel harmony.

Gloss	Nom.Sg	Gen.Sg
'rope'	[ip]	[ip-in]
'girl'	[kɨz]	[kɨz-in]
'end'	[son]	[son-un]
'cove'	[koj]	[koj-un] / *[koj-in]

Does [j] ever pattern with vowels?

- A consonant is not inserted to avoid hiatus.

Gloss	Nom.Sg	Poss.Sg	
'pipe'	[boru]	[boru-su]	
'snake'	[jɨlan]	[jɨlan-ɨ]	
'cove'	[koj]	[koj-u]	/ *[koj-su]

Does [j] ever pattern with vowels?

Process	Vowels	Consonants	[j]
Vowel Harmony	✔	✘	✘
C-insertion to avoid hiatus	✔	✘	✘

Is [j] a sonorant consonant?

Turkish onsets do not allow consonant clusters.

- Coda Consonant Clusters

  Available coda clusters in Turkish (Taylan, 2015):
  [+sonorant] + [-sonorant]
  [-sonorant, +continuant] + [-sonorant, -continuant]
  [-continuant] + /s/

Is [j] a sonorant consonant?

- Coda Consonant Clusters

  Available positions for sonorants in CCCs (Taylan, 2015):
  [+sonorant] + [-sonorant]
  [-sonorant, +continuant] + [-sonorant, -continuant]
  [-continuant] + /s/

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  Available positions for sonorants in CCCs:
  [+sonorant] + [-sonorant]
  [-sonorant, +continuant] + [-sonorant, -continuant]
  [-continuant] + /s/

- adaptation of Arabic borrowings: epenthesis
- *kayf* ‹كيف› becomes [kejif],
- *hayf* ‹حَيْف› becomes [haji̵f],
- *χayr* ‹خَيْر› becomes [haji̵r],
- *halt* ‹خَلْط› stays as [halt]

Is [j] a sonorant consonant?

- [h]-deletion: Turkish optionally deletes [h] before sonorants (Mielke 2002)

Gloss	Nom.Sg	Fast speech
'index'	[fihrist]	[fi:rist]
'danger'	[tehʎice]	[te:ʎice]
Mehmet	[mehmet]	[me:met]

But before [j], there is no [h]-deletion:

'butler'	[cahja]	*[ca:ja]
Mühye	[myhje]	*[my:je]

Is [j] a sonorant consonant?

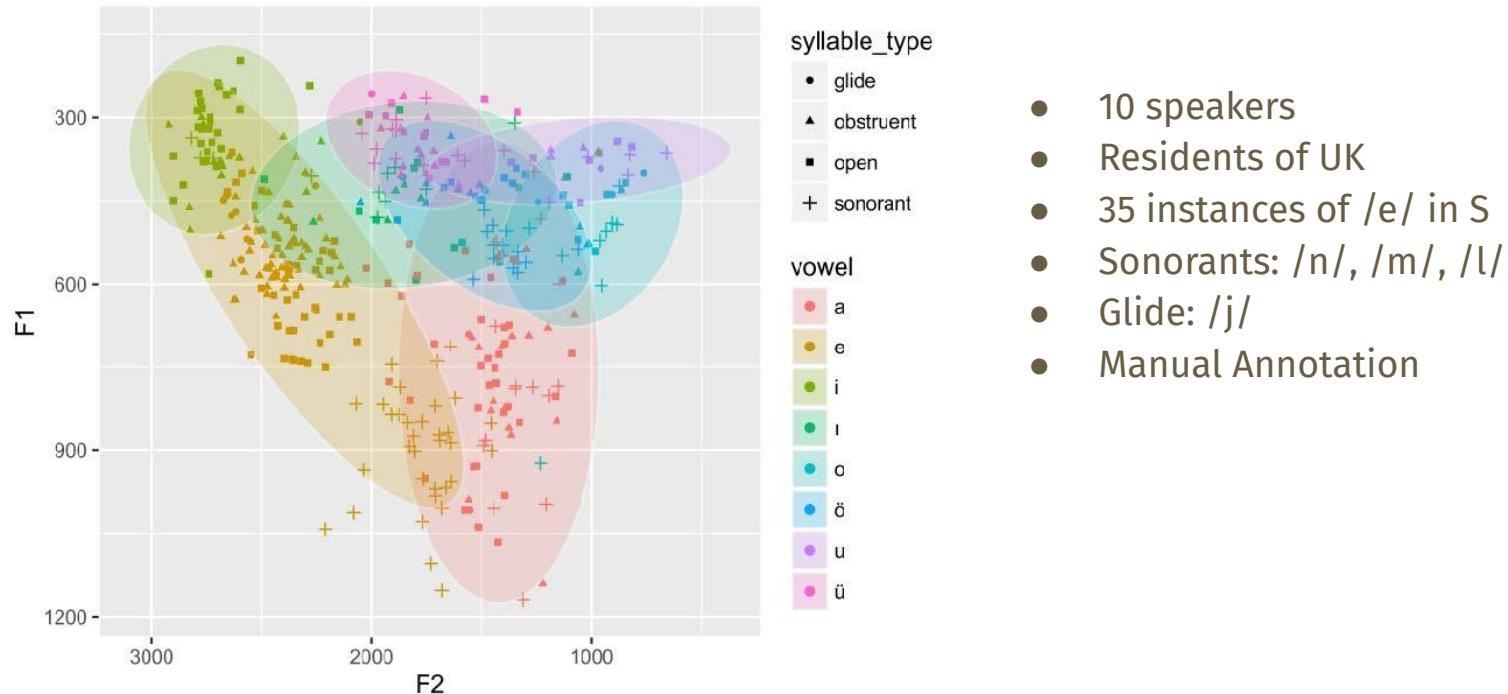- /e/-lowering: /e/ becomes [æ] before a coda sonorant (Göksel & Kerslake 2005)

Gloss	Phonemic	Phonetic
'come'	/gel/	[ɟæl]
'alike'	/hem/	[hæm]
'crab'	/jengetʃ/	[jæɲɟetʃ]
'sweat'	/ter/	[tæɾ̥]

However, before [j] there is no /e/-lowering.
| 'mister' | /bej/ | [bej]/*[bæj] |

Is [j] a sonorant consonant?

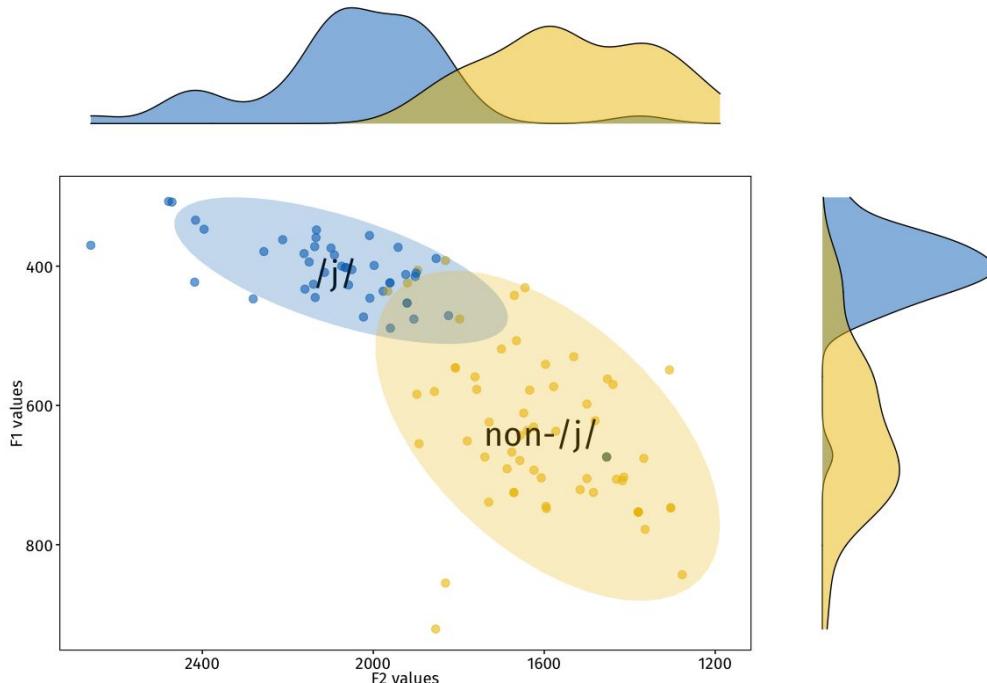- /e/-lowering: experimental evidence (Gopal & Nichols, 2017)

- 10 speakers
- Residents of UK
- 35 instances of /e/ in S
- Sonorants: /n/, /m/, /l/
- Glide: /j/
- Manual Annotation

Is [j] a sonorant consonant?

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Is [j] a sonorant consonant?

- /e/-lowering: **replication** of experimental evidence

- 4 speakers
- Residents of Turkey
- 15 instances of /e/ in following either
  - non-/j/ sonorants
  - /j/
- Ongoing exp on PCIbex
  - ~60 speakers
- Montreal Aligner
- Praat Script: https://git.io/JtO0K

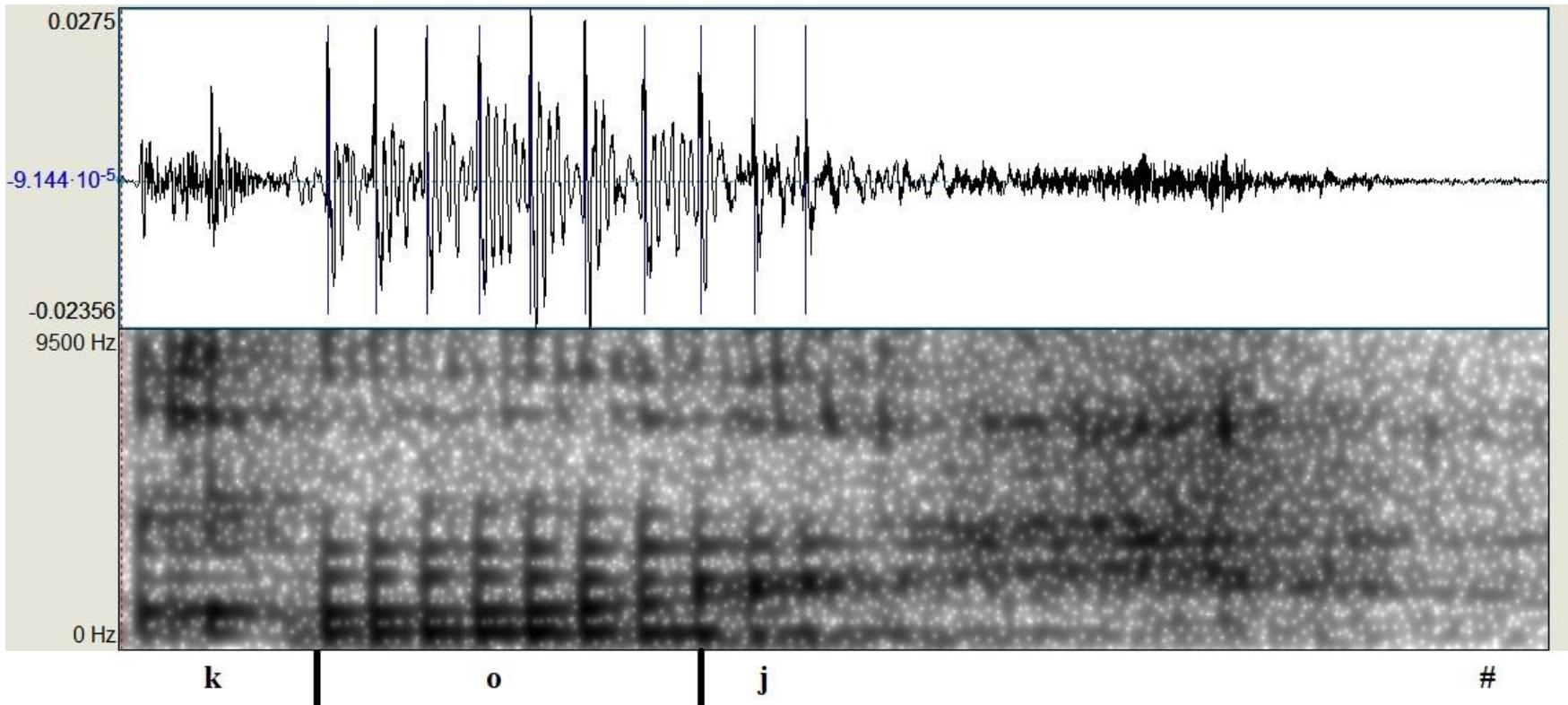# Is [j] a sonorant consonant?

Process	Sonorant consonants	[j]
Cluster availability	✔	�’
[h]-deletion	✔	✗
[e]-lowering	✔	✗

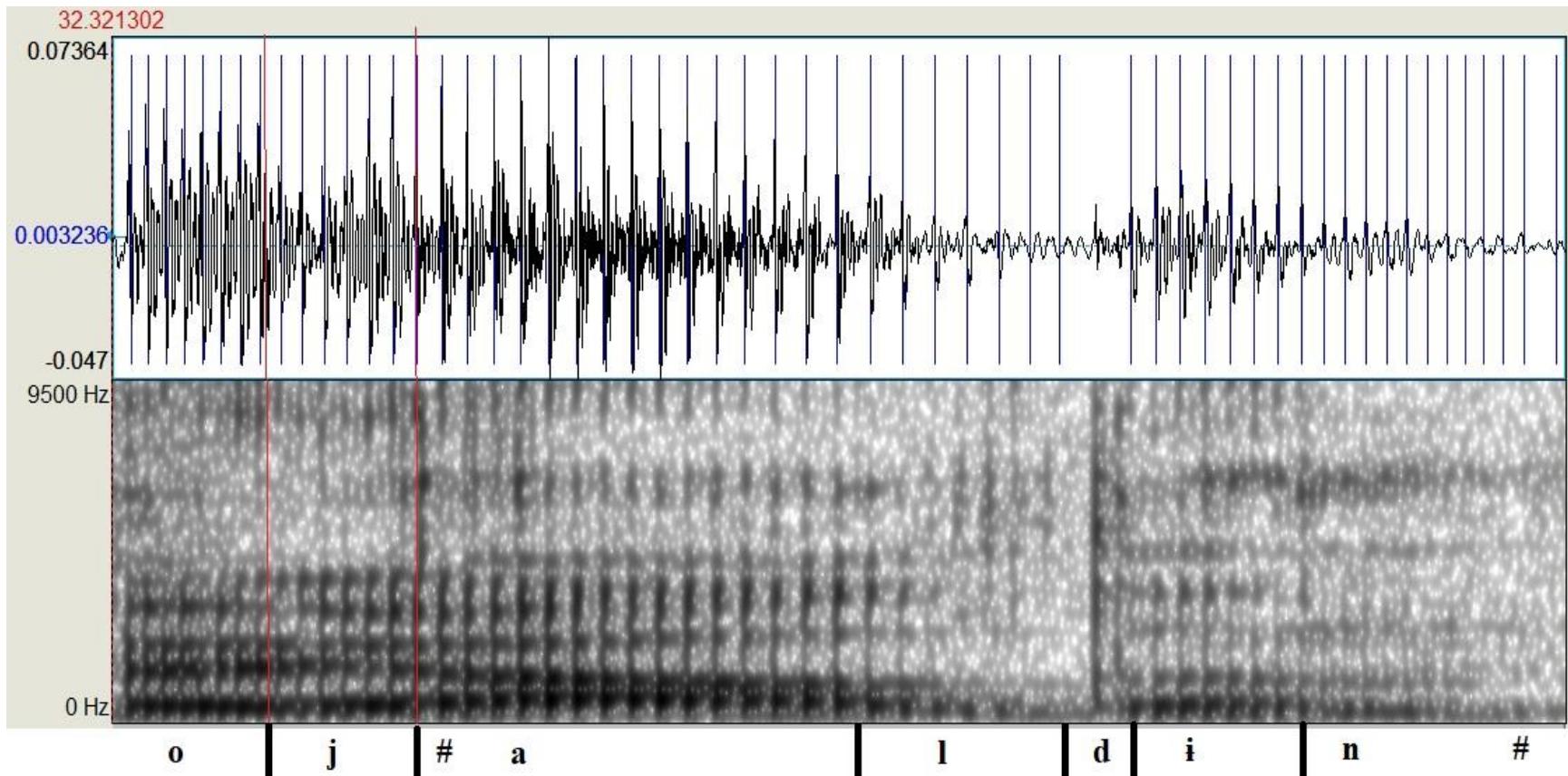# Phonetic data - continuant fricativization/devoicing

In at least one environment - utterance-final position - a (voiceless) fricative optionally occurs instead of a palatal glide

This process is part of a more general optional utterance-final devoicing of continuants (with concomitant fricativization if they are approximants)

Male speaker /koj/ "to put" with devoicing

Same speaker /oj aldɨn/ "(you) got vote" with no devoi.

Mean phonetic values of [j]

mean values (8 instances)	glide length (ms)	voiced portion duration (ms)	pulse count	harmonics to noise ratio (dB)	intensity (dB)	voiced portion duration/ length ratio
(partially) devoiced	149,13	59,25	8,13	3,65	53,95	0,38
voiced	80,13	72,25	11,75	11,01	66,94	0,88

Other consonants - Literature Review

Kornfilt (2009) - reports on word final devoicing of liquids ([ɾ, l, ʎ]) especially observable in the Istanbul dialect of Turkish (Standard)

Taylan (2015) - /ɾ/:   [ɾ̥] / _____#

                          [ɹ] / #_____

                          [ɾ] / elsewhere

Nichols (2016) - A phonetic survey on rhotic: "to say that the rhotic devoices and fricates in any word-final position is an over-simplification. It can be seen that it is in fact in utterance-final position where this is overwhelmingly the most likely option"

Nichols (2016) Table 1

V = Voiced   I = Intermediate/Indeterminate voicing D = Devoiced
T = Tap   A = Approximated   F= Fricated

	V			I			D		
	T	A	F	T	A	F	T	A	F
Word-initial	2	6	0	6	10	2	4	0	2
Inter-vocalic	8	14	0	39	2	0	16	0	0
Pre-Voiceless	0	22	0	9	2	0	10	0	0
Pre-voiced	3	37	0	7	2	0	0	0	0
Post-voiceless	2	5	0	4	1	0	8	1	0
Post-voiced	10	2	0	1	3	0	0	0	0
Word-final	0	15	0	4	9	4	2	3	97
True geminate	3	8	0	3	1	5	0	0	0

Table 1: All tokens of /r/ for all speakers

Nichols (2016) Table 2

V = Voiced   I = Intermediate/Indeterminate voicing   D = Devoiced
T = Tap   A = Approximated   F= Fricated

	V			I			D		
	T	A	F	T	A	F	T	A	F
Inter-vocalic	0	3	0	2	1	0	1	0	0
Pre-Voiceless	0	2	0	0	3	0	0	0	0
Pre-voiced	0	4	0	0	1	0	0	0	0
Utter.-final	0	5	0	2	2	2	1	3	97
False geminate	0	1	0	0	2	2	0	0	0

Table 2: All tokens of word-final /r/ only for all speakers

Nichols (2016) - Figure 2: Fricativization and devoicing of the rhotic
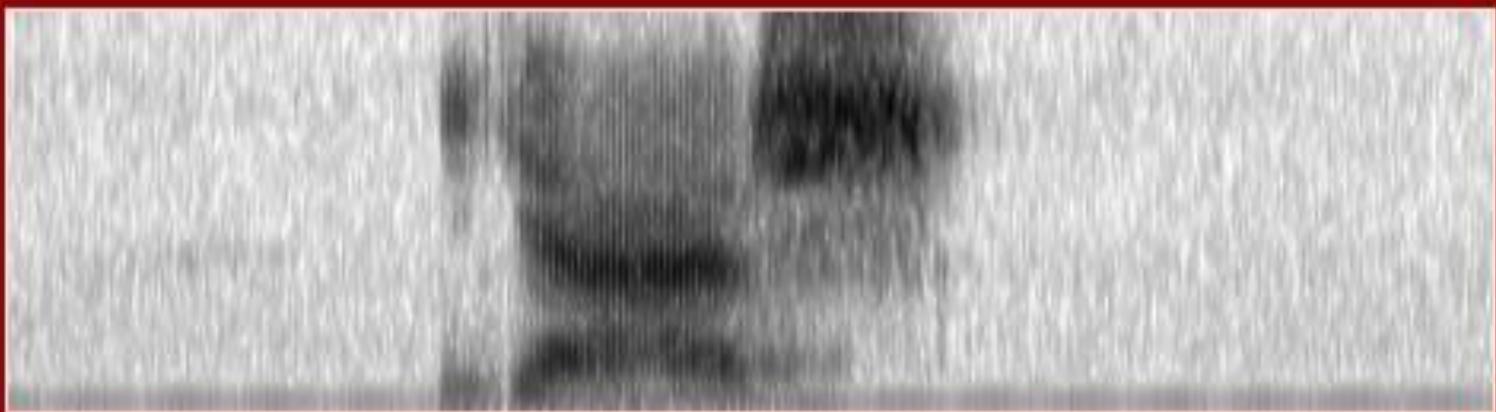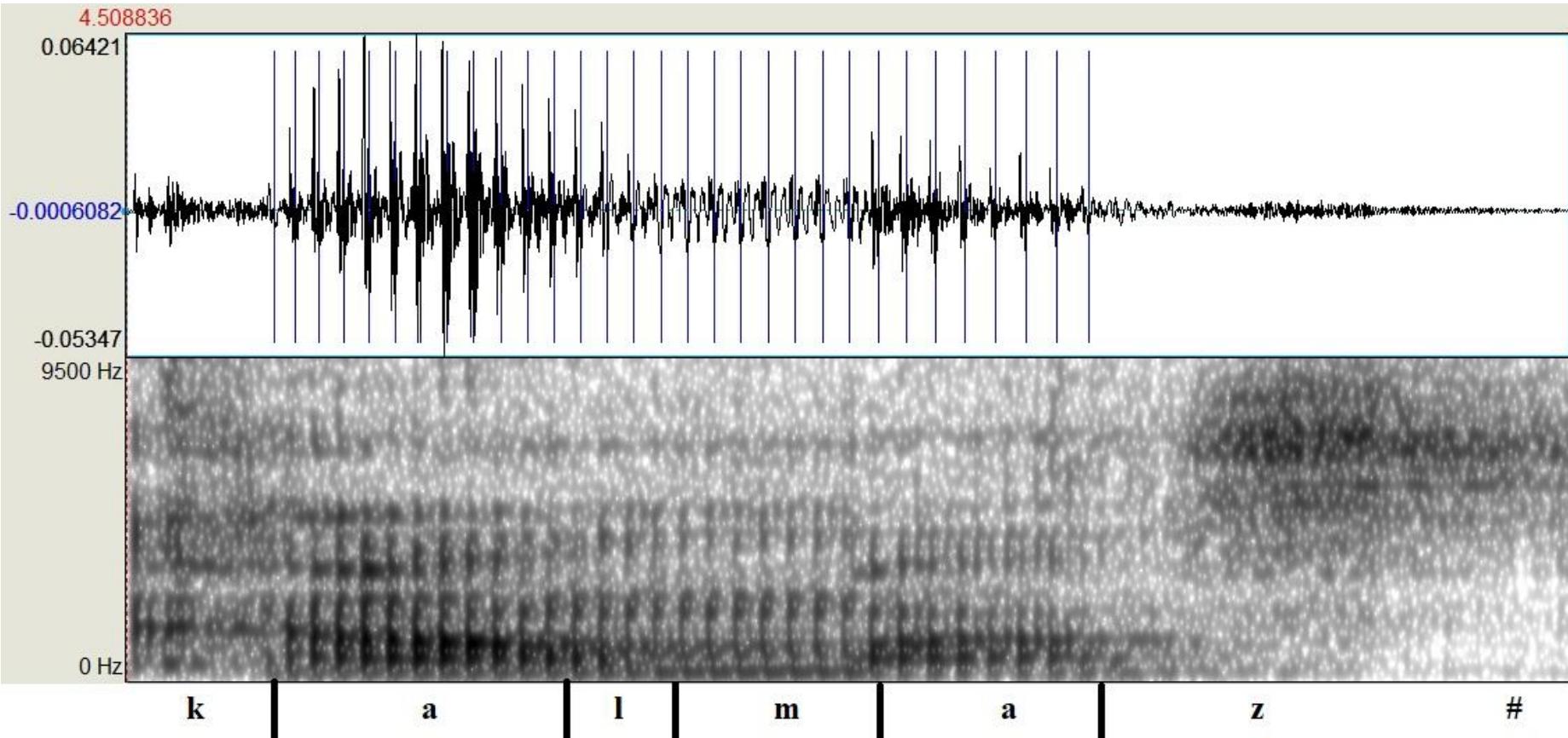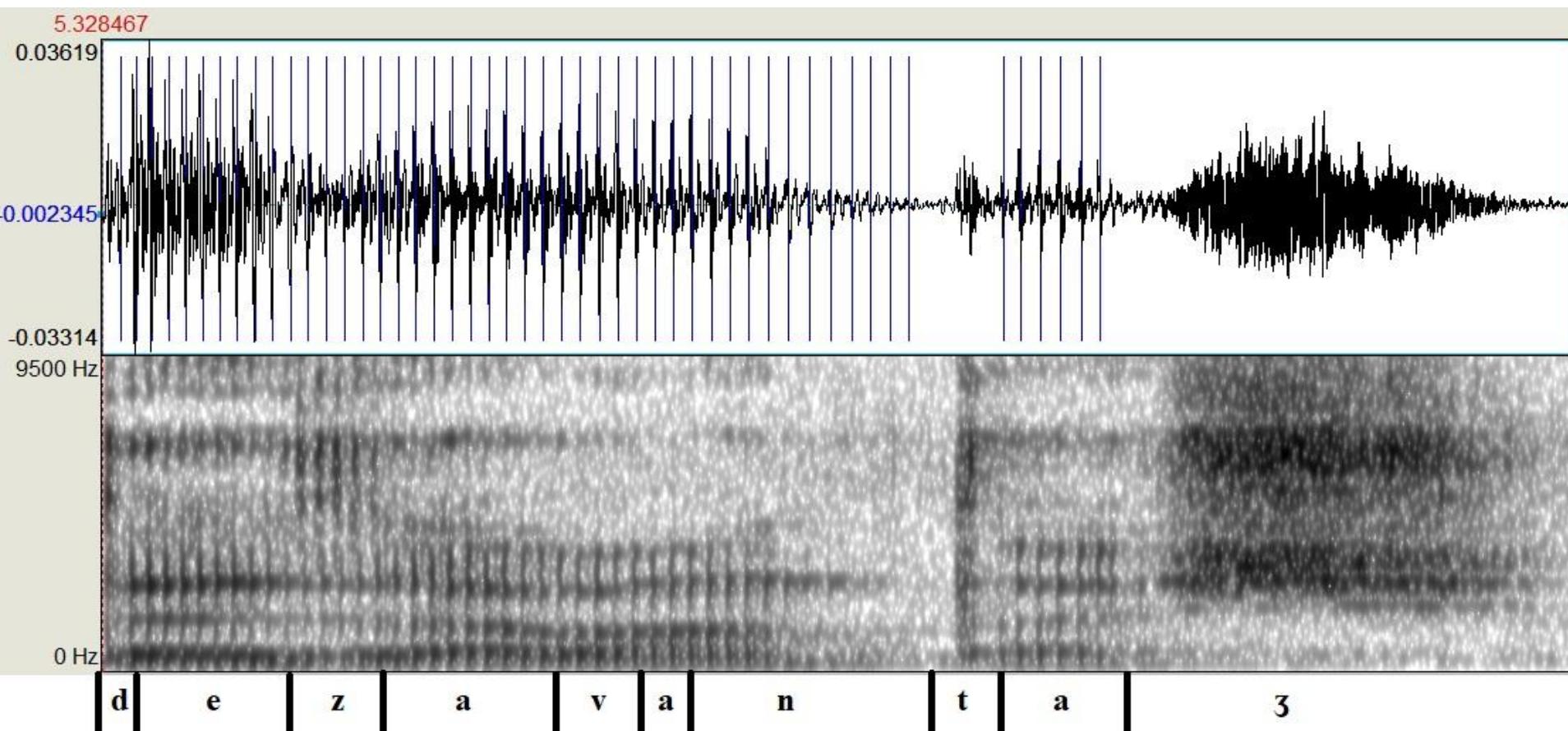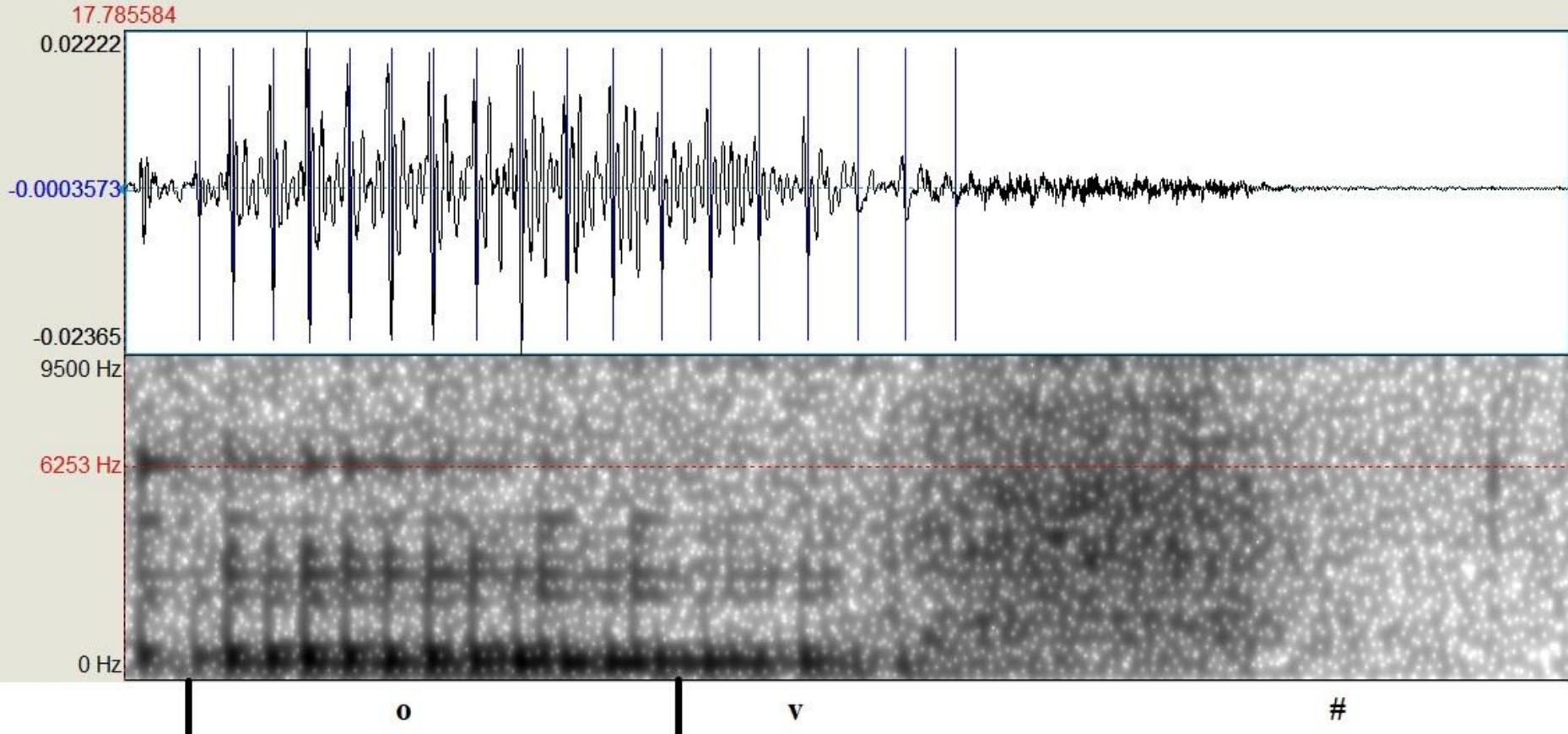

Figure 2: Spectrogram of /jer/ 'place' for AF1

Speaker 1 - /kalmaz/ "does not stay" with devoicing

Speaker 2 - /dezavantaʒ/ "disadvantage" with devoicing

Mean phonetic values of [z]

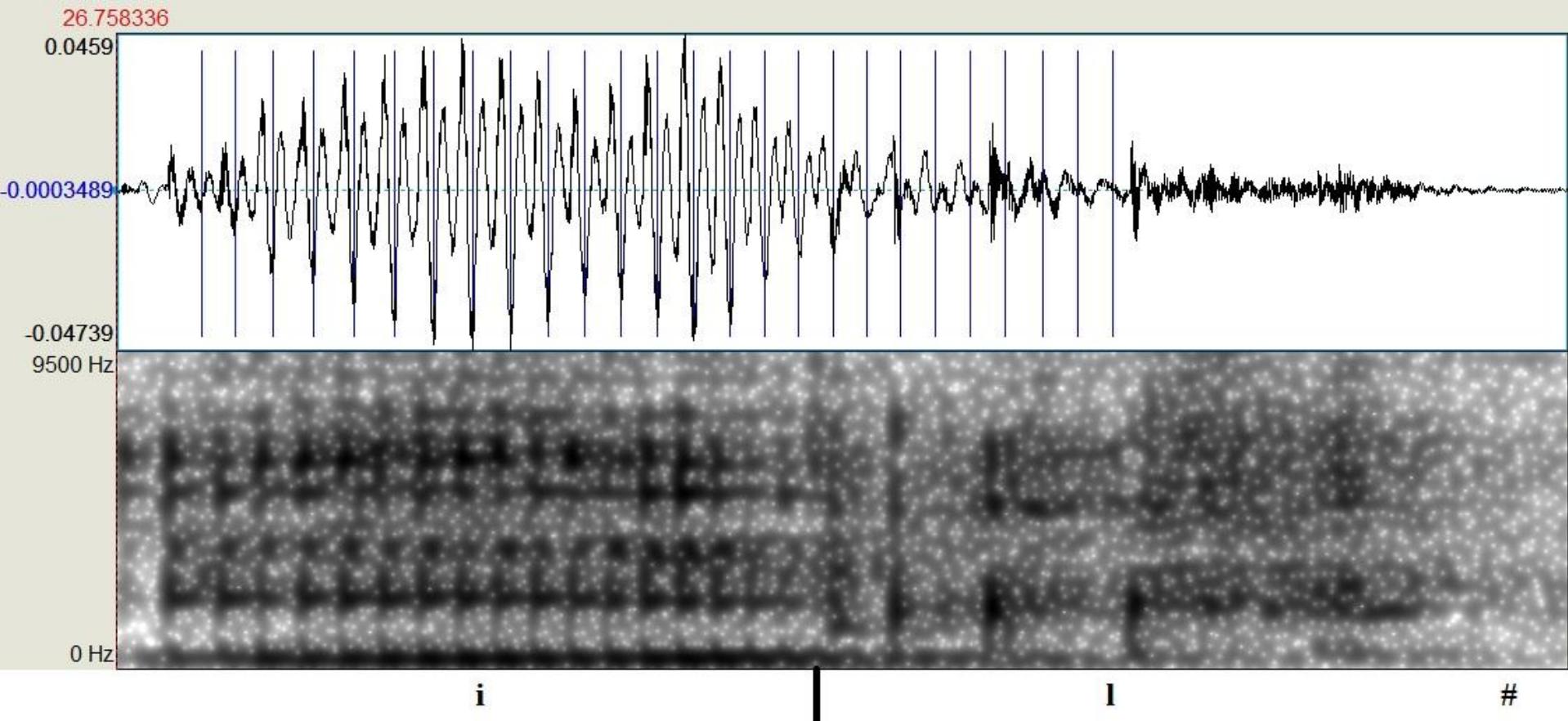| mean values of [z]	consonant length (ms)	pulse duration (ms)	pulse count	harmonics to noise ratio (dB)	intensity (dB)	Pulse duration / length ratio
devoiced (2 tokens)	187,00	0,00	0,00	3,40	43,50	0,00
voiced (7 tokens)	71,71	71,71	10,29	6,73	50,14	1,00

Mean phonetic values of [ʒ]

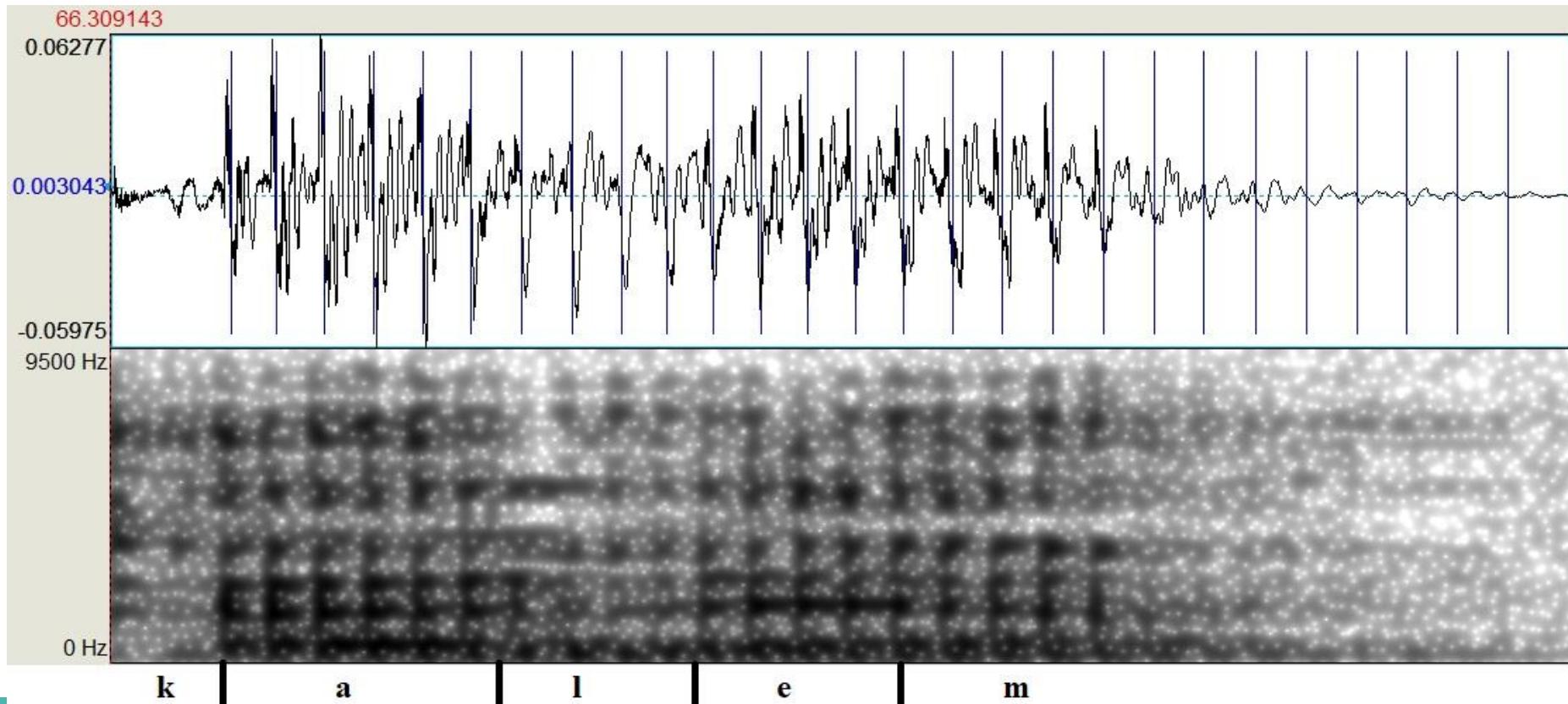| mean values of [ʒ]	consonant length (ms)	pulse duration (ms)	pulse count	harmonics to noise ratio (dB)	intensity (dB)	Pulse duration / length ratio
(Partially) devoiced (4 tokens)	131,50	12,75	2,00	3,90	41,50	0,17
voiced (4 tokens)	83,50	81,50	11,25	7,18	51,25	0,98

Mean phonetic values of [v]

Mean values	glide length (ms)	pulse duration (ms)	pulse count	harmonics to noise ratio (dB)	intensity (dB)	Pulse duration / length ratio
devoiced (5 tokens)	129,60	51,40	5,40	3,08	42,28	0,40
voiced (5 tokens)	58,00	58,00	6,80	12,90	54,88	1,00

Other sonorants - devoiced [lʲ] in /il/ "city"

Nasals are exempt from this process /kalem/ "pencil"

Conclusions

In Turkish, a segment realized as [j] in most environments:

- is never a member of the [+sonorant] natural class
- has the distribution of fricatives
- in one environment it optionally allophonically alternates with a (voiceless) fricative

However, this is problematic for theories of phonological features only if features are defined in terms of constant and positive phonetic properties

But there are segments in Turkish produced with less turbulent airflow and less constriction than [j] - if features are defined relatively, a [-sonorant, +consonantal] /ʝ/ may surface as [j]

References

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Mielke, J. (2002). Turkish /h/ Deletion: Evidence for the Interplay of Speech Perception and Phonology. In *Proceedings of North East Linguistics Society (NELS)*, Vol. 32, No. 2, pp. 383-402.

Nichols, S. (2016). An acoustic study of the Turkish rhotic. Poster presented at the 5th International Workshop on Phonetic, Phonological, Acquisitional, Sociolinguistic and Dialect-Geographic Aspects of Rhotics, Leeuwarden, Netherlands, 18–20 May.

Taylan, E. E. (2015). *The phonology and morphology of Turkish*. İstanbul: Boğaziçi Üniversitesi.

Successive Division Algorithm (Dresher 2009)

[−continuant]

p t tʃ c k n dʒ b d m ɟ g

[+continuant]

[+voice]

[−voice]

f s ʃ h

[+coronal]

[−coronal]

[+ant.]

[−ant.]

ʒ

[+ant.]

v

[−ant.]

ɹ̝

[+son.]

ɾ lj ɬ

[−son.]

z