Peering into the obstruent-sonorant divide: The view from /v/

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Why /v/?

Russian /v/: Final Devoicing

Final Devoicing: /D/ → [T] /__#

1)	[sleda]	[slet]	'track (gen./nom.sg)'
2)	[soka]	[sok]	'juice (gen./nom.sg)'
3)	[mil]	*[mil̥]	'dear'

Russian /v/: Final Devoicing

Final Devoicing: /D/ → [T] /__#

1)	[sleda]	[slet]	'track (gen./nom.sg)'
2)	[soka]	[sok]	'juice (gen./nom.sg)'
3)	[mil]	*[mil̥]	'dear'

Final Devoicing: /v/ → [f] / __#

4)	[prava]	[praf]	'right (fem./masc.)'

Russian /v/: Regressive Voicing Assimilation

Regressive Voicing Assimilation: /D/ → [T] / ___T

5)	/pod-nesti/	[podnesti]	'to bring (to)'
6)	/pod-ʒetʃ/	[podʒetʃ]	'to set fire to'
7)	/pod-pisatʲ/	[potpisatʲ]	'to sign'
8)	[volk]	*[vo̥lk]	'wolf'

Russian /v/: Regressive Voicing Assimilation

Regressive Voicing Assimilation: /D/ → [T] / ___T

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6)	/pod-ʒetʃ/	[podʒetʃ]	'to set fire to'
7)	/pod-pisatʲ/	[potpisatʲ]	'to sign'
8)	[volk]	*[vo̥lk]	'wolf'

Regressive Voicing Assimilation: /v/ → [f] / ___T

9)	/v ruke/	[v ruke]	'in one's hand'
10)	/v gorode/	[v gorode]	'in the city'
11)	/v supe/	[f supe]	'in the soup'

Russian /v/: Regressive Voicing Assimilation

Regressive Voicing Assimilation: /T/ → [D] / __D

12)	/ot-jexat^{j}/	[otjexat^{j}]	'to ride off'
13)	/ot-stupit^{j}/	[otstupit^{j}]	'to step back'
14)	/ot-brosit^{j}/	[odbrosit^{j}]	'to throw aside'

Russian /v/: Regressive Voicing Assimilation

Regressive Voicing Assimilation: /T/ → [D] / __D

12) /ot-jexat^{j}/ [otjexat^{j}] 'to ride off'

13) /ot-stupit^{j}/ [otstupit^{j}] 'to step back'

14) /ot-brosit^{j}/ [odbrosit^{j}] 'to throw aside'

Regressive Voicing Assimilation: /T/ ↛ [D] / __v

15) /ot-vesti/ [otvesti] 'lead away' *[odvesti]

Summary: Russian /v/

Like voiced obstruents, unlike sonorants:

/v/ ⇒ [f] / {__#, __**T**}

- A target for final devoicing
  [prav-a] ∼ [praf], ‘right (fem./masc.)’
- A target for regressive voicing assimilation
  /v supe/ > [f supe], ‘in the soup’

Unlike voiced obstruents, like sonorants:

/T/ ↛ **[D]** / __v

- Does not trigger regressive voicing assimilation
  /ot-vesti/ > [otvesti], ‘lead away’ *[odvesti]

The intermediacy of Russian /v/

Jakobson (1978)

"...the Standard Russian *v* ...occupies an obviously *intermediate* position between the obstruents and the sonorants"

Russian /v/ in a (cross-)linguistic context

Linguists on /v/ (non-exhaustive)

Halle (1959), Lightner (1965), Andersen (1969), Coats and Harshenin (1971), Daniels (1972), Barkai and Horvath (1978), Jakobson (1978), Vago (1980), Hayes (1984), Burton and Robblee (1997), Kavitskaya (1998), Padgett (2002), Petrova and Szentgyörgyi (2004) Lulich (2004), Kiss and Bárkányi (2006), Reiss (2018) and many others...

Russian /v/ in a (cross-)linguistic context

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Languages with ambiguous patterning of /v/ (non-exhaustive)

	Final Devoicing	RVA	
		Target	Trigger
Russian	✓	✓	✗
Bulgarian	✓	✓	✗
Slovak	/v/ → [w]	✓	✗
Hungarian	N/A	✓	✗
Hebrew	N/A	✓	✗

Cross-linguistic comparison of [v]

Question

Does the phonological classification of /v/ correlate with the acoustic properties of [v] tokens in a given language?

Padgett (2002) on ambiguous /ʋ/

Patterning of ambiguous /ʋ/ derives from its *intermediate phonetic nature* together with a cue-based approach to phonology.

Hypothesis

obstruent	ambiguous	sonorant
ʋ	ʊ̯	ʊ

/ʊ̯/ "unstable"

- prone to devoicing
- only realized as [ʊ̯] in positions of perceptual salience (i.e., pre-sonorant)

Linguistic controls

Languages

- Greek: obstruent /v/
- Serbian: sonorant /v/

Segments

- /f/ ⇐ voiceless member of "pair"
- /s, z/ ⇐ uncontroversial obstruent fricative pair

Other factors

- voicing languages
- no labial approximant (e.g., /w, ʊ/)

Greek: Consonant inventory

	Labial		Interdental		Alveolar		Velar	
Stop	p	b			t	d	k	g
Fricative	f	v	θ	ð	s	z	x	ɣ
Affricates					ts	dʒ		
Nasal		m				n		
Lateral						l		
Rhotic						r		

Greek: Word-initial clusters

	p	b	t	d	k	g	f	v	θ	ð	x	ɣ	s	z	r	l	m	n
p			pt										(ps)		pr	pl		pn
b															br	bl		
t													ts		tr		tm	
d														dz	dr			
k			kt										(ks)		kr	kl		kn
g															gr	gl		
f			ft						fθ		fx				fr	fl		
v										vð		vɣ			vr	vl		
θ															θr	θl		θn
ð															ðr			
x			xt						xθ						xr	xl		
ɣ										ɣð					ɣr	ɣl		ɣn
s	sp		st		sk		sf				sx						sm	
z								zv				zɣ						
r																		
l																		
m																		mn
n																		

Greek: Phonological processes

No final devoicing.

Little evidence of voicing assimilation as an active process; words can only end in vowels, [s, n]

Regressive Voicing Assimilation

16)	/tis ðino/	[tiz ðino]	'I give her'
17)	/tis varvaras/	[tiz varvaras]	'Barbara's'
18)	/tous barbaðes/	[touz barbaðes]	'the uncles, acc.'
19)	/tis mamas/	[tiz mamas]	'the mother's'

20)	[evɣlotos]	'eloquent'	
21)	[efstaθia]	'steadiness'	(same prefix)

Serbian: Consonant inventory

	Labial		Alveolar		Palatal				Velar	
Stop	p	b	t	d					k	g
Fricative	f	v	s	z			ʃ	ʒ	x	
Affricates			t͡s		t͡ʃ	d͡ʒ	t͡ʃ	d͡ʒ		
Nasal		m		n				ɲ		
Lateral				l				ʎ		
Rhotic				r						
Approximant								j		

Serbian: Word-initial clusters

	p	b	t	d	f	s	v	z	x	m	n	l	r	j
p												pl	pr	(pj)
b												bl	br	(bj)
t							tv					tl	tr	(tj)
d							dv					dl	dr	(dj)
k							kv					kl	kr	
g							gv					gl	gr	
f												fl	fr	(fj)
v												vl	vr	(vj)
s	sp		st		sf		sv		sx	sm	sn	sl	sr	(sj)
z		zb		zd			zv			zm	zn	zl	zr	(zj)
x							xv					xl	xr	
m												ml	mr	(mj)
n														(nj)
l														(lj)
r														
j														

Serbian: Phonological processes

No final devoicing.

Regressive Voicing Assimilation

22)	/s-paziti/	[spaziti]	'observe'
23)	/s-gaziti/	[zgaziti]	'trample'
24)	/s-ložiti/	[složiti]	'put together'
25)	/s-variti/	[svariti]	'digest'

26)	[ovca]	'sheep'

Russian: Inventory

	Labial		Dental		Palato-Alveolar		Velar	
Stop	p	b	t	d			k	g
	p^j	b^j	t^j	d^j			(k^j)	(g^j)
Affricates			ts		$t\int^j$			
Fricative	f	v	s	z	∫	ʒ	x	
	f^j	v^j	s^j	z^j			(x^j)	
Nasal		m		n				
		m^j		n^j				
Lateral				l				
				l^j				
Rhotic				r				
				r^j				
Approximant						j		

Russian: Word-initial clusters

	p	b	t	d	k	g	f	v	s	z	ʃ	ʒ	x	m	n	l	r	j
p									ps		pʃ				pn	pl	pr	pj
b																bl	br	bj
t					tk			tv								tl	tr	tj
d								dv							pn	dl	dr	dj
k	kp		kt					kv	ks					km	kn	kl	kr	
g		gb		gd				gv		gz					gn	gl	gr	
f			ft		fk				fs							fl	fr	fj
v				vd						vz		vʒ		vm	vn	vl	vr	vj
s	sp		st				sf	sv					sx	sm	sn	sl	sr	sj
z		zb		zd		zg		zv						zm	zn	zl	zr	zj
ʃ																		
ʒ																		
x								xv								xl	xr	
m											ʃm					ml	mr	mj
n																		nj
l																		lj
r																		
j																		

Languages: Summary

Summary of phonological identity of /v/

	Greek	Russian	Serbian
Undergoes FD?	N/A	yes	N/A
Undergoes RVA?	yes	yes	no
Triggers RVA?	yes	no	no
	obstruent	ambiguous	sonorant
Predicted realization:	[v]	[ʋ̟]	[ʊ]

Methodology: Stimuli

Environments

- word-initial stressed (WIS)
- word-medial unstressed (WMU)
- flanking vowels /a, o/
  (no palatalization, spirantization)
- $C_1VC_2V(C)$
- real words

Recording details

- 7 speakers
- Cornell University or University of Toronto
- SD722 digital recorder; 44100 Hz, 16-bit
- Hand-segmented in Praat
- Resampled to 22050 Hz & analysed in Praat

Greek

[eɣrapsa _____tris fores]

Serbian

[kaʒe jetsa _____opet]

Russian

[sveta skazala _____opet]

Acoustic measures

1. Harmonicity
2. Spectral centroid

Acoustic measures: Harmonicity

Measure of the relative contribution of voicing and frication in the acoustic signal; measure of the degree of acoustic periodicity. Computed over middle 80% of consonant to avoid vowel transitions.

Motivation

Hamann and Sennema (2005) used harmonicity to distinguish German and Dutch labiodentals.

Acoustic measures: Spectral centroid

Measure of the average frequency of spectrum, weighted by energy; concentration of energy in frequency domain.

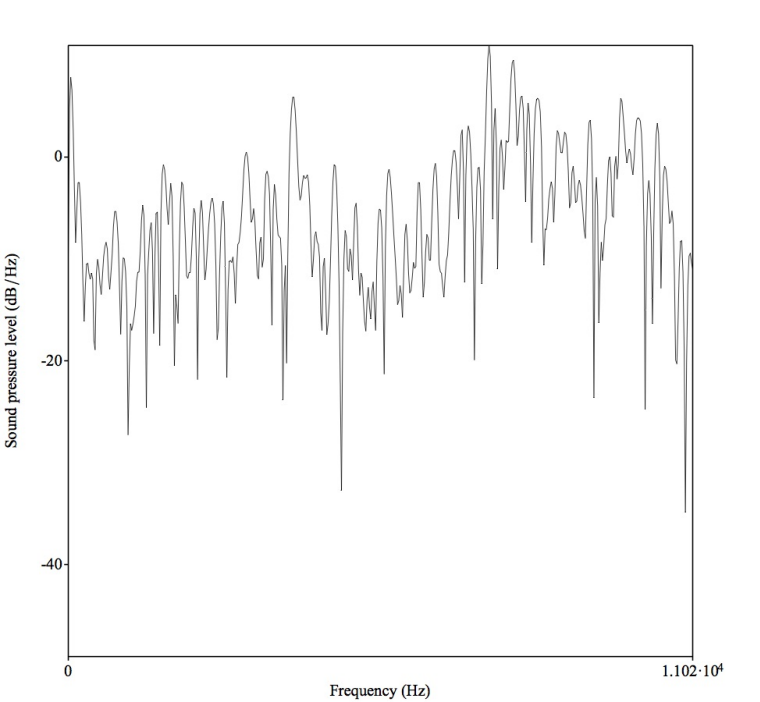


Figure 1: [f]

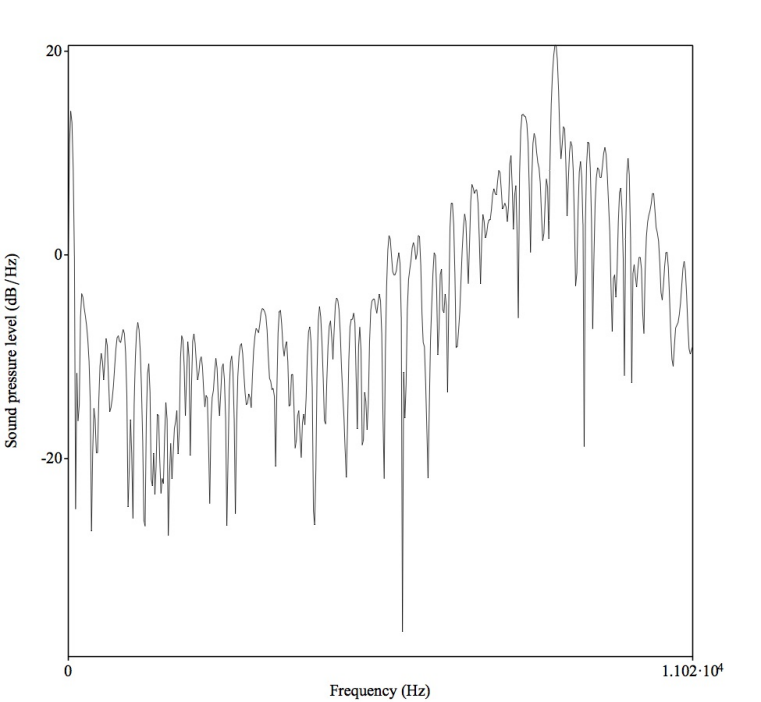


Figure 2: [s]

Acoustic measures: Spectral centroid

Calculated on 1500Hz high-pass filtered signal to remove effect of voicing and first several harmonics, so a measure of noise portion of the spectrum.

Modulo the effect of voicing, is the frication of voiced and voiceless members the same?

1. Harmonicity: `lmer(Harmonicity ~ Language + (1|Sp))`
   Only compared /v/ *tokens.*
2. Spectral centroid: `lmer(CoG ~ Seg*Lang + (1|Sp))`
   Implemented deviation coding; compares mean of dependent variable to overall mean

Hypotheses

Within a given environment:

Harmonicity

Serbian $>$ Russian $>$ Greek

Spectral centroid

Serbian $<$ Russian $<$ Greek

Results: Harmonicity

	WIS				WMU			
	β	SE	*t*-value	*p*-value	β	SE	*t*-value	*p*-value
Se – Ru	-0.63	2.03	-0.31	.95	-0.59	1.77	-0.33	.94
Se – Gr	0.84	2.03	0.41	.91	-2.11	1.77	-1.19	.46
Ru – Gr	1.47	2.03	0.72	.75	-1.52	1.77	0.86	.67

Table 1: Post-hoc Tukey tests comparing harmonicity values of [v] between languages

Results: Harmonicity

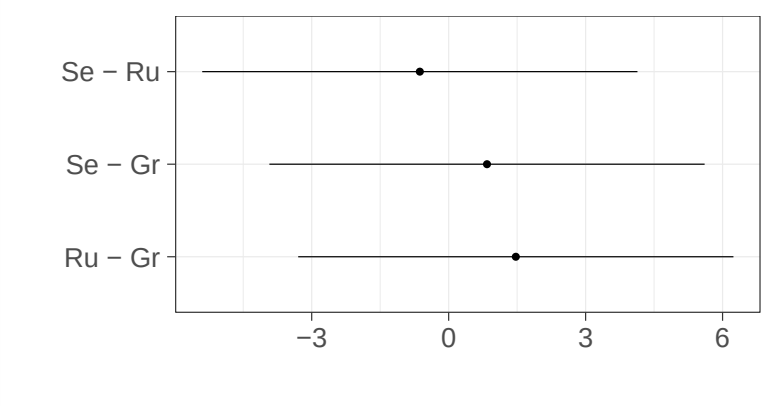


Figure 3: WIS

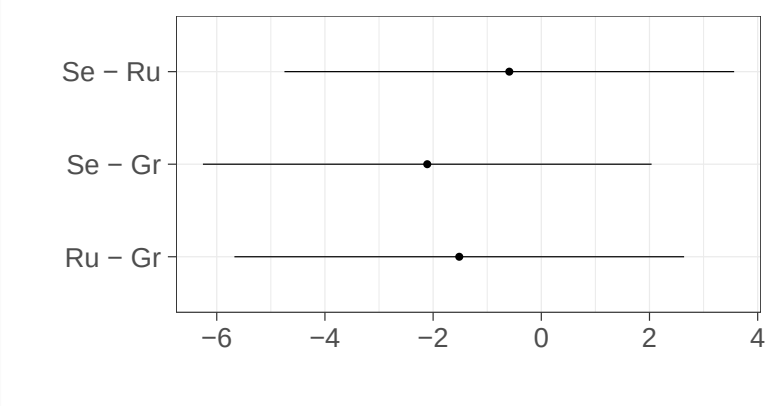


Figure 4: WMU

What's going on with harmonicity

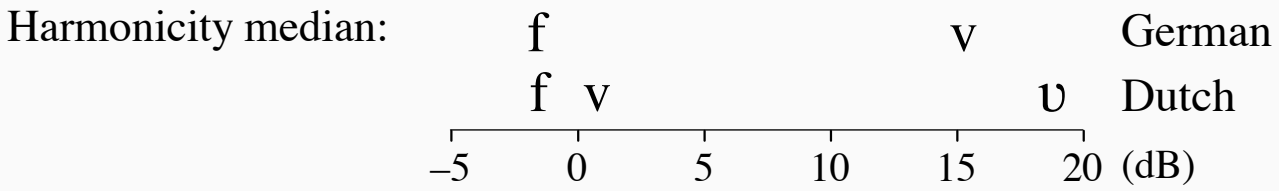


Figure 5: Harmonicity values of German and Dutch labiodentals, reproduced from Hamann and Sennema (2005)

What's going on with harmonicity

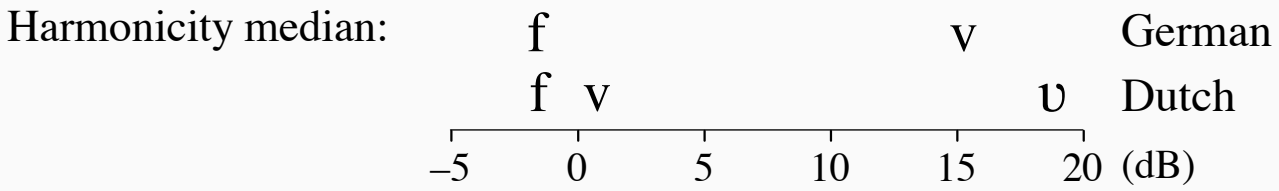


Figure 5: Harmonicity values of German and Dutch labiodentals, reproduced from Hamann and Sennema (2005)

Dutch [v] is known to be mostly voiceless
(Gussenhoven and Bremmer Jr., 1983)

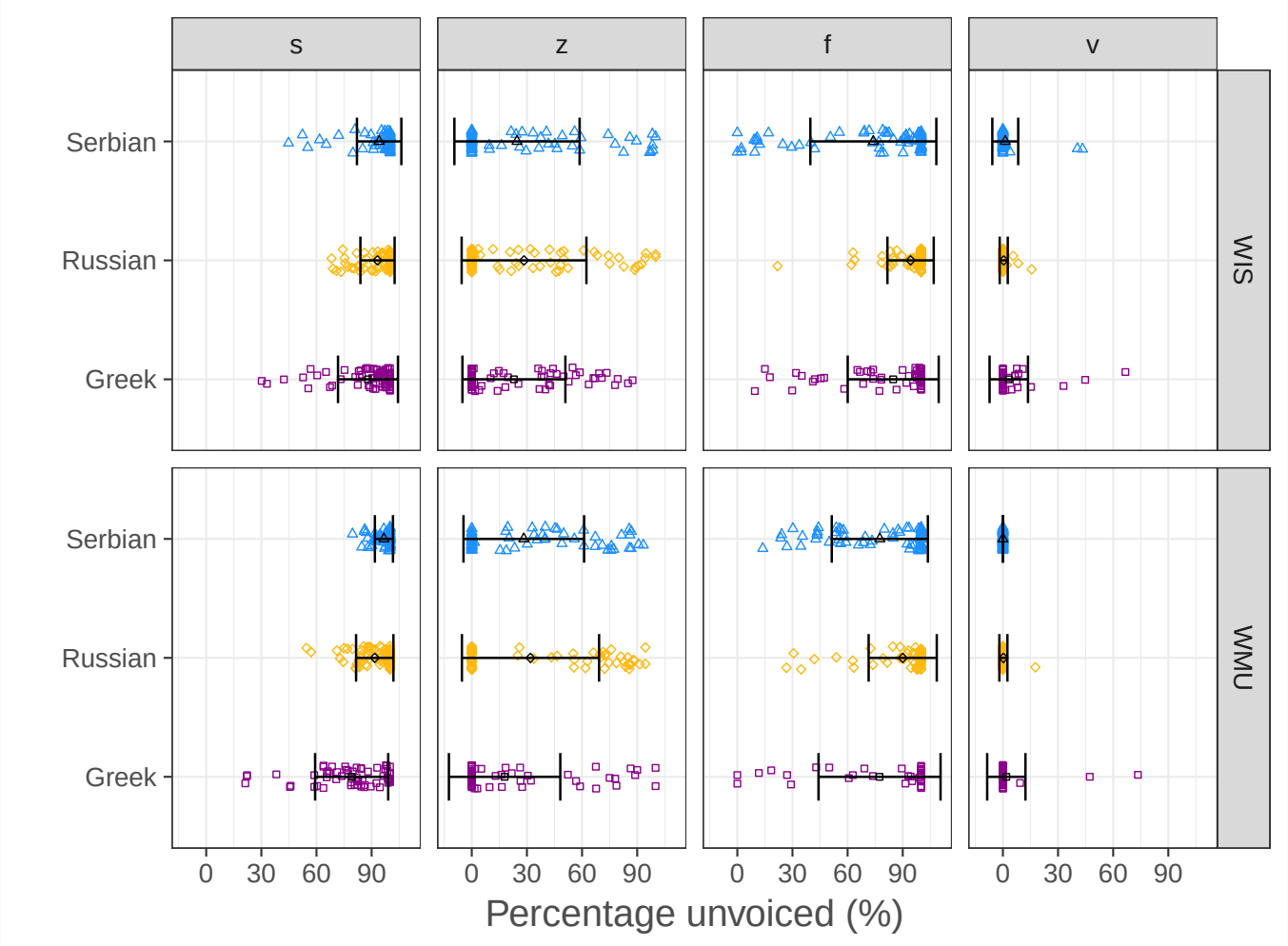


Figure 6: Voicing percentage

Results: Spectral Centroid

	β	SE	z-value	p-value
Ru − Se	1144.7	149.2	7.674	$< .0001$
Gr − Se	1612.3	235.9	6.836	$< .0001$
Gr − Ru	467.6	235.9	1.982	.142

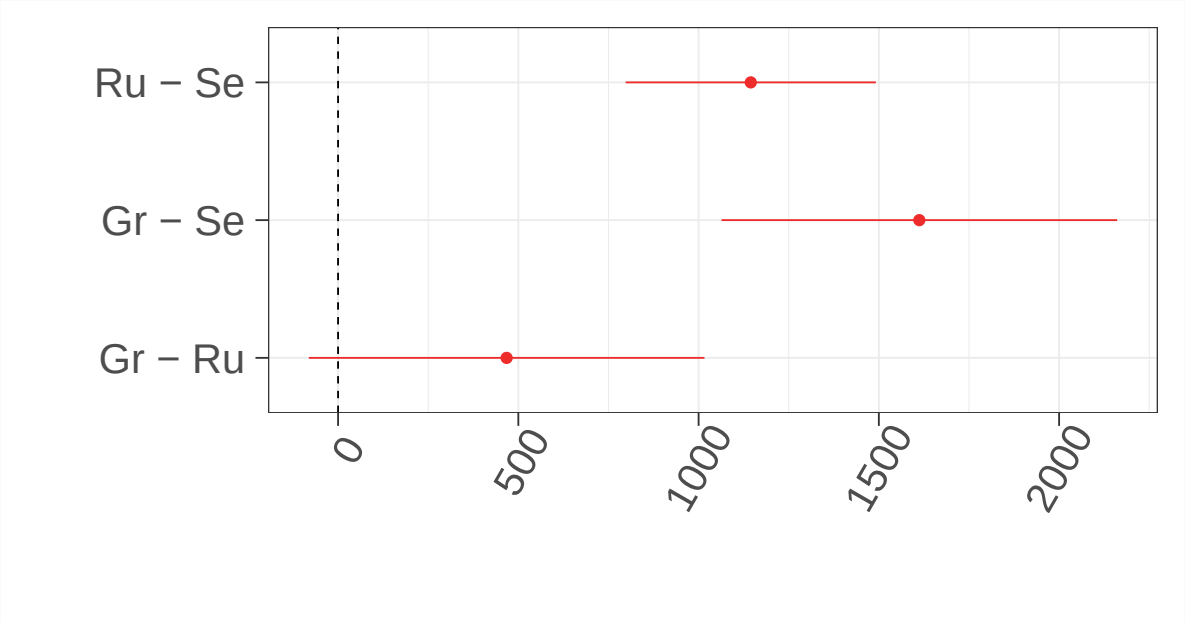


Figure 7: Post-hoc tests (WIS)

Results: Spectral Centroid

	β	SE	z-value	p-value
Ru – Se	303.6	146.0	2.080	0.113
Gr – Se	1673.7	234.2	7.147	$< .0001$
Gr – Ru	1370.1	235.8	5.812	$< .0001$

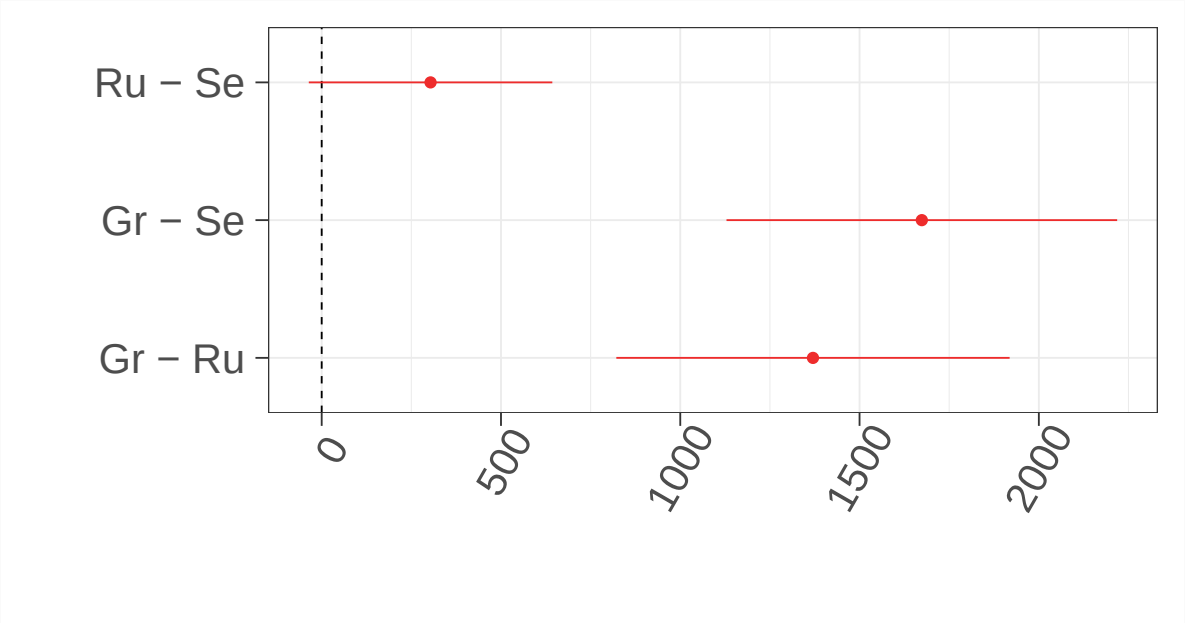


Figure 8: Post-hoc tests (WMU)

Acoustic study: Conclusion

These results suggest that, to the extent that Russian [v] is special, it is due to the variability in its realization, not due to inherent intermediacy.

Phonetics: Relationship between voicing and frication

Research question

Assumption: voiced fricatives are a unified class

$$/\mathrm{v}/ : /\mathrm{f}/ :: /\mathrm{z}/ : /\mathrm{s}/.$$

Question

Does the acoustic relationship between [v] and [f] parallel the acoustic relationship between [z] and [s]?

Methodology

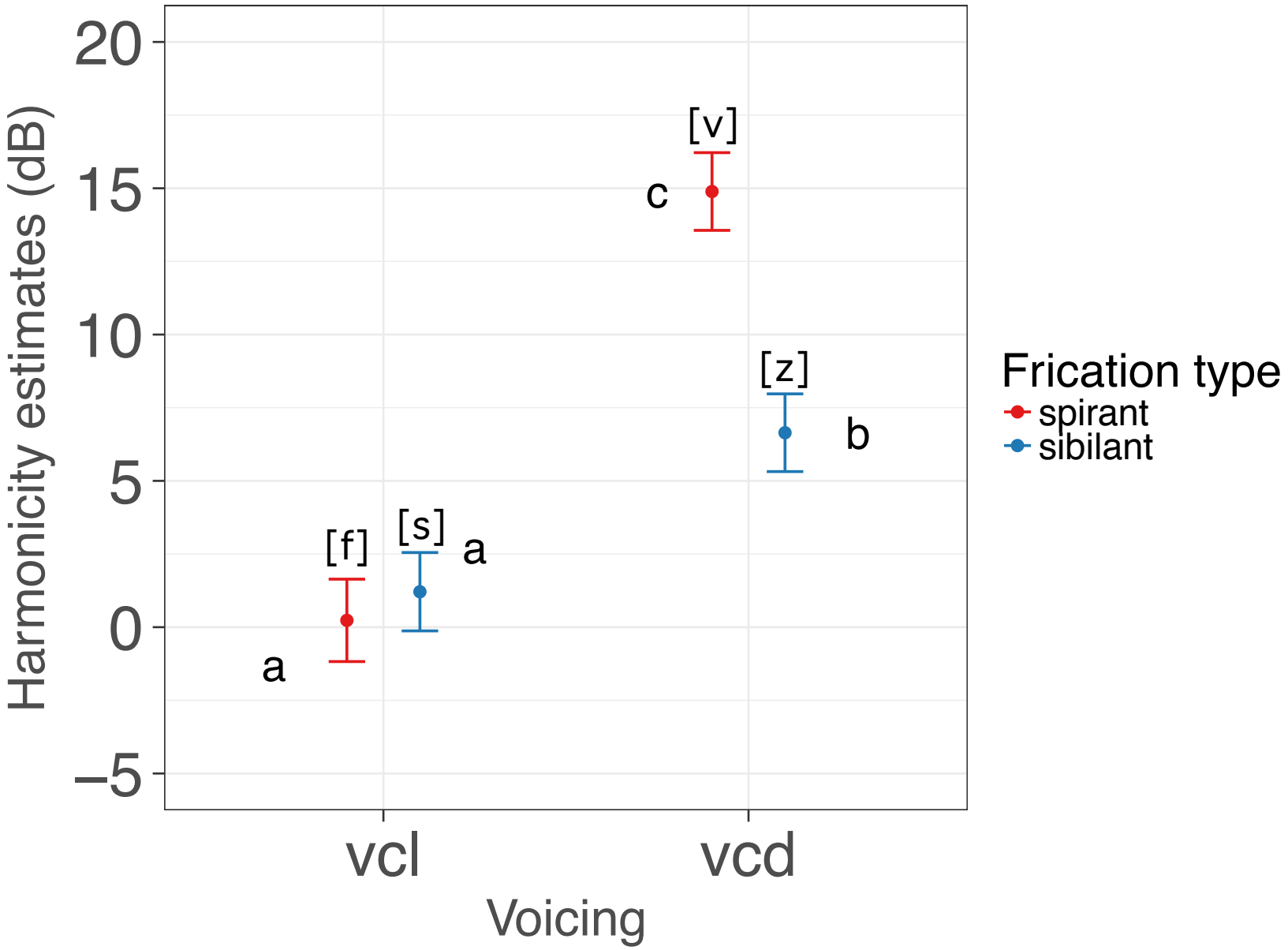
- Same data, but within-language investigation
- English:
  - 8 speakers
  - nonce words <*CahCa*>

Statistical analysis

- Linear mixed model; `lme4` package
- Random effect: Speaker; random slopes not fit (convergence)
- Fixed effects:
  - Environment
  - Voicing type (voiced vs. voiceless)
  - Frication type (spirant vs. sibilant)
- Model selection: based on BIC

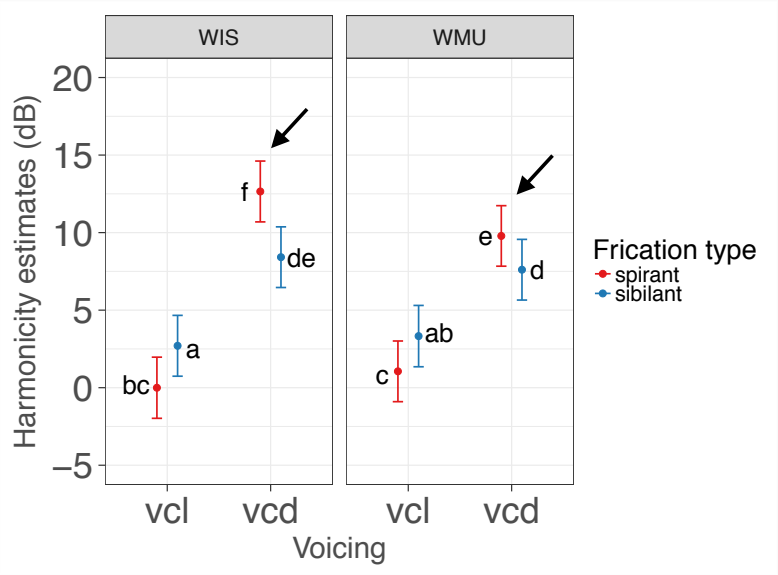
  AIC used when BIC was not definitive

Interaction plots: Greek harmonicity

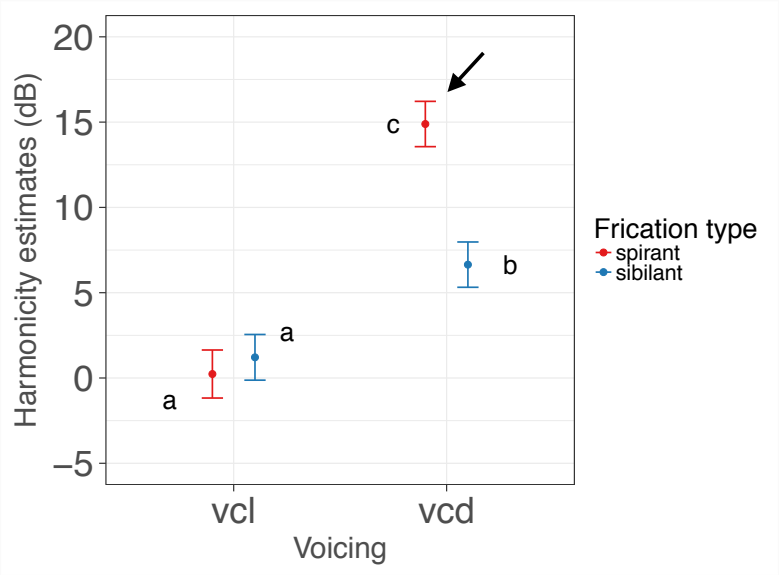


Harmonicity results: summary

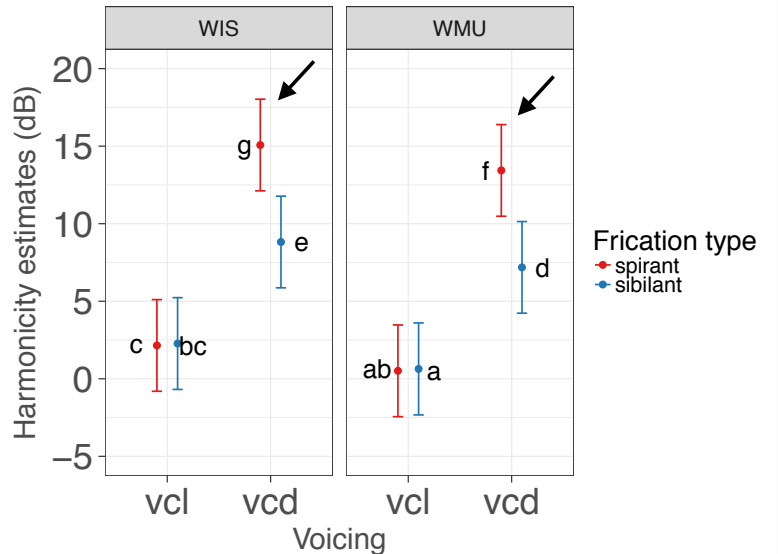
English



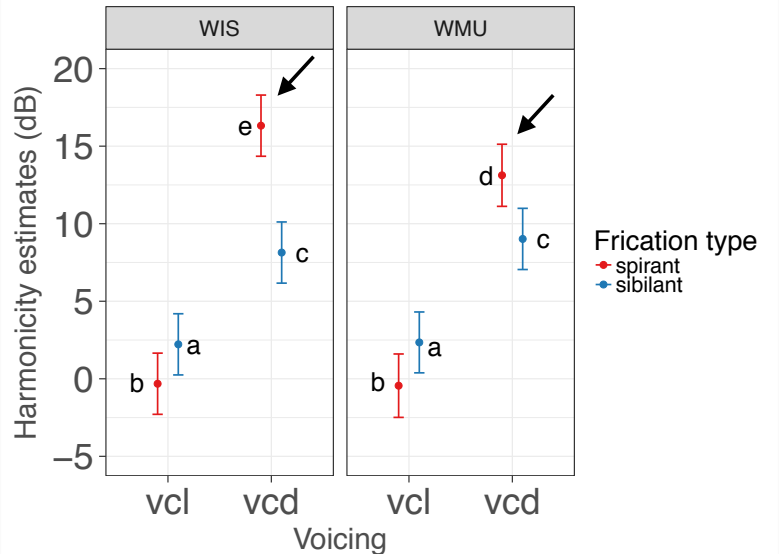
Greek



Serbian



Russian



Harmonicity results: summary

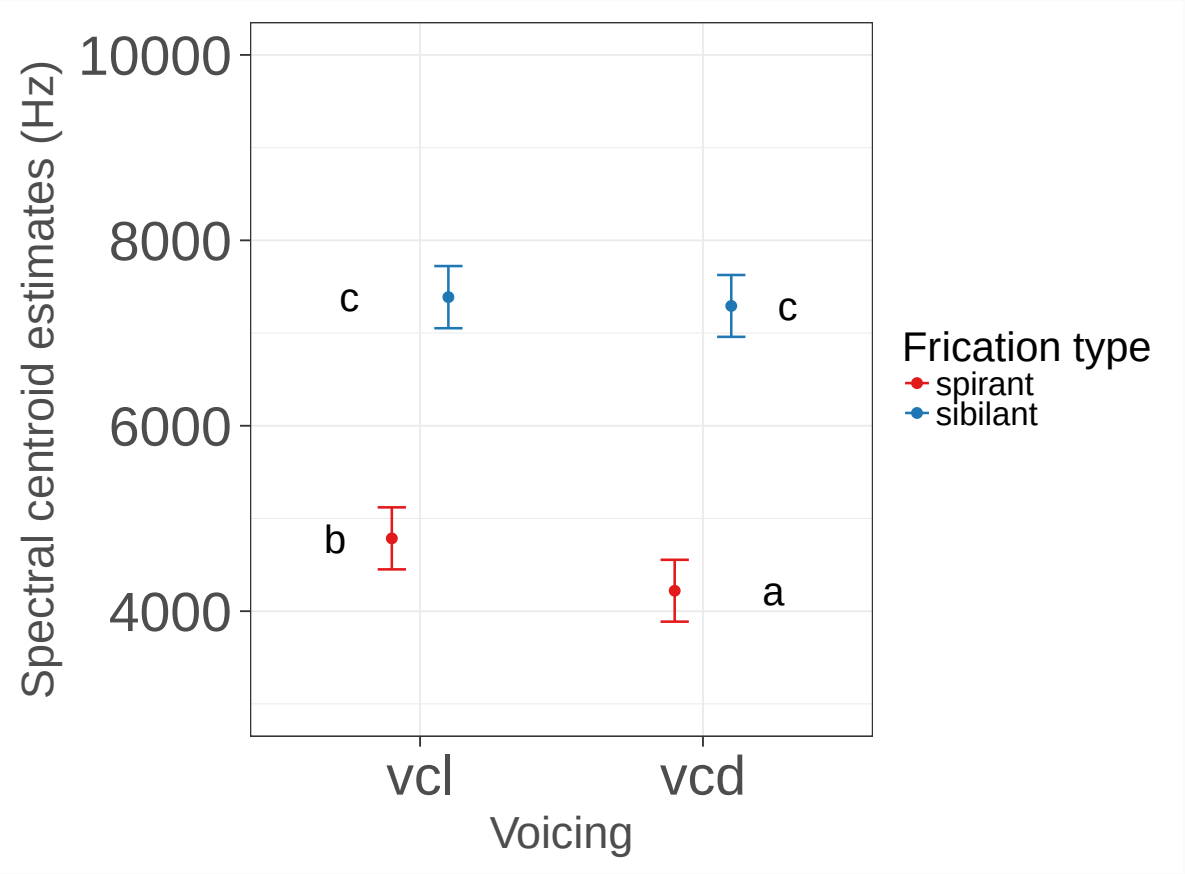
Question

Does the acoustic relationship between [v] and [f] parallel the acoustic relationship between [z] and [s]?

Answer

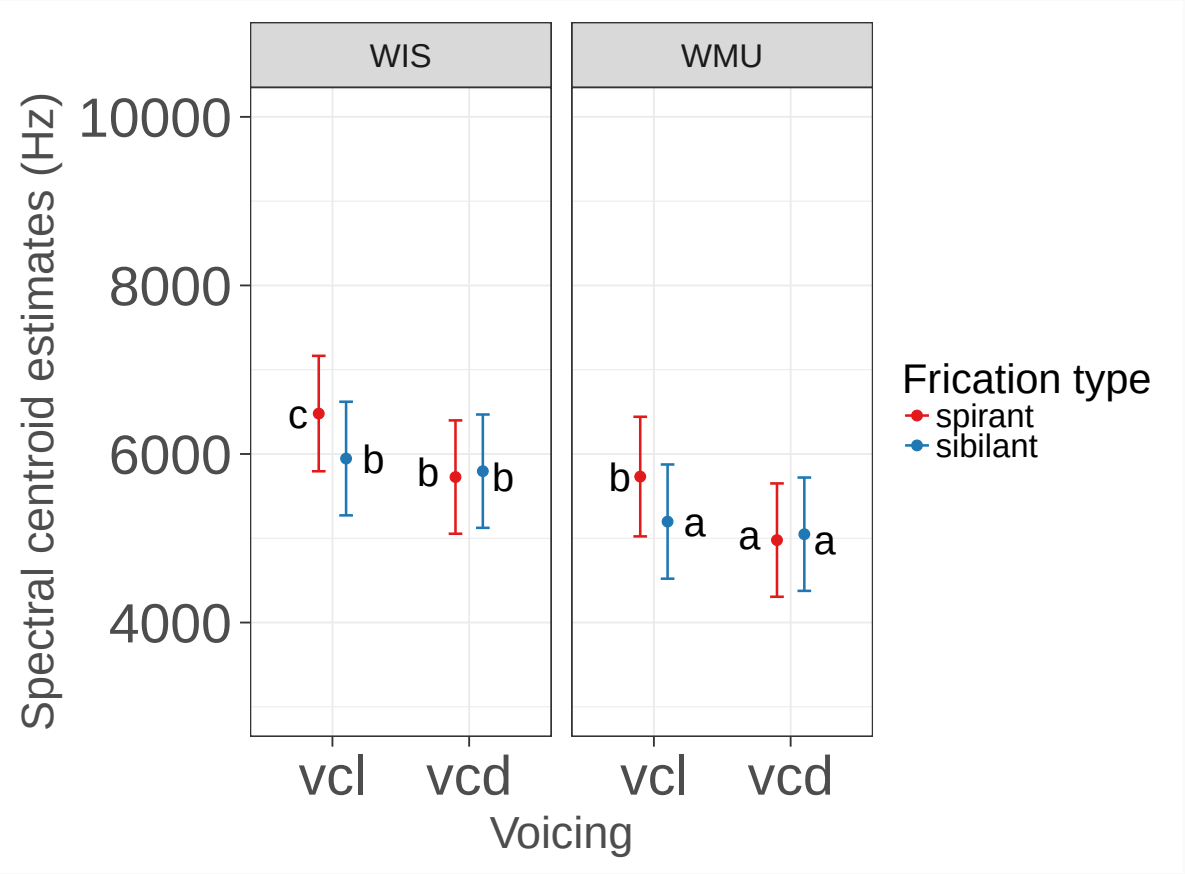
No, according to harmonicity.

Spectral centroid results: English



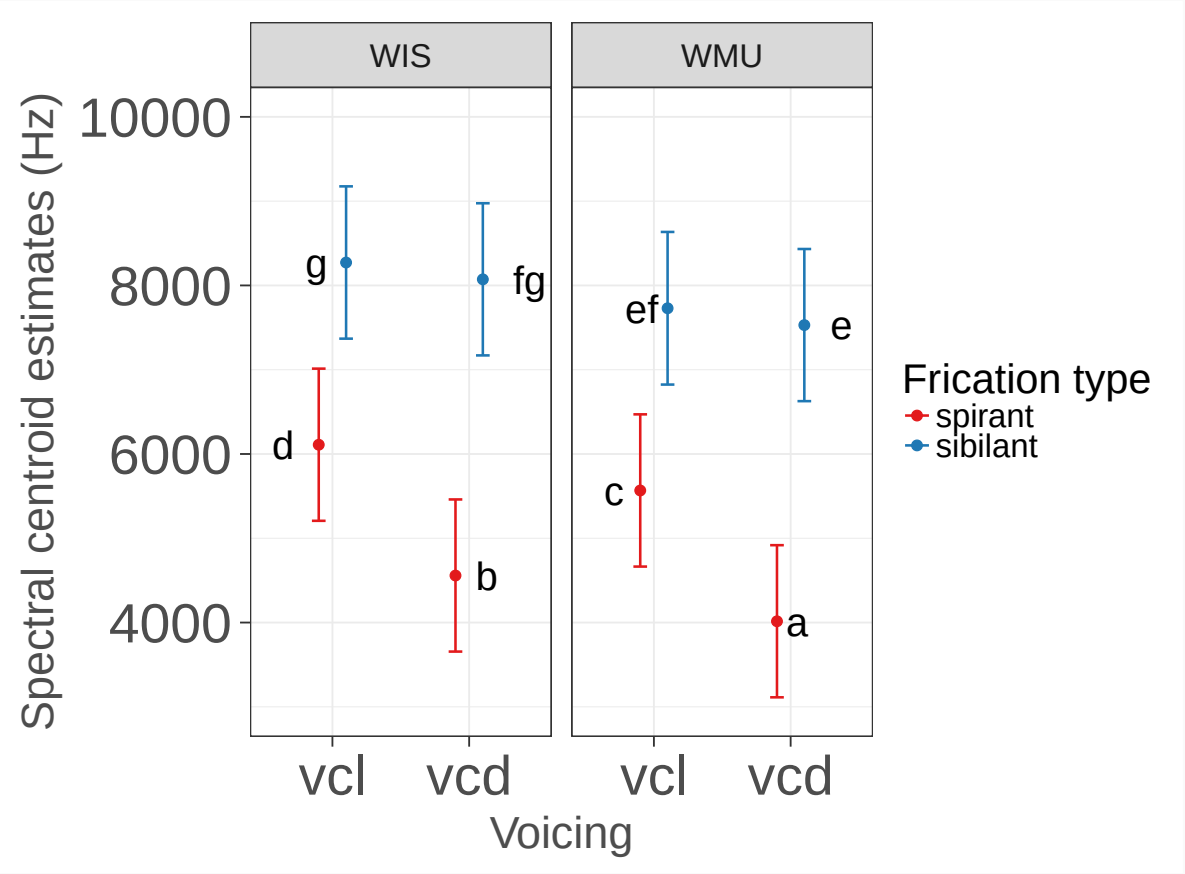
- $[\text{s, z}] > [\text{f, v}]$
- $[\text{s}] = [\text{z}]$
- $[\text{v}] < [\text{f}]$
- Env. N/A

Spectral centroid results: Greek



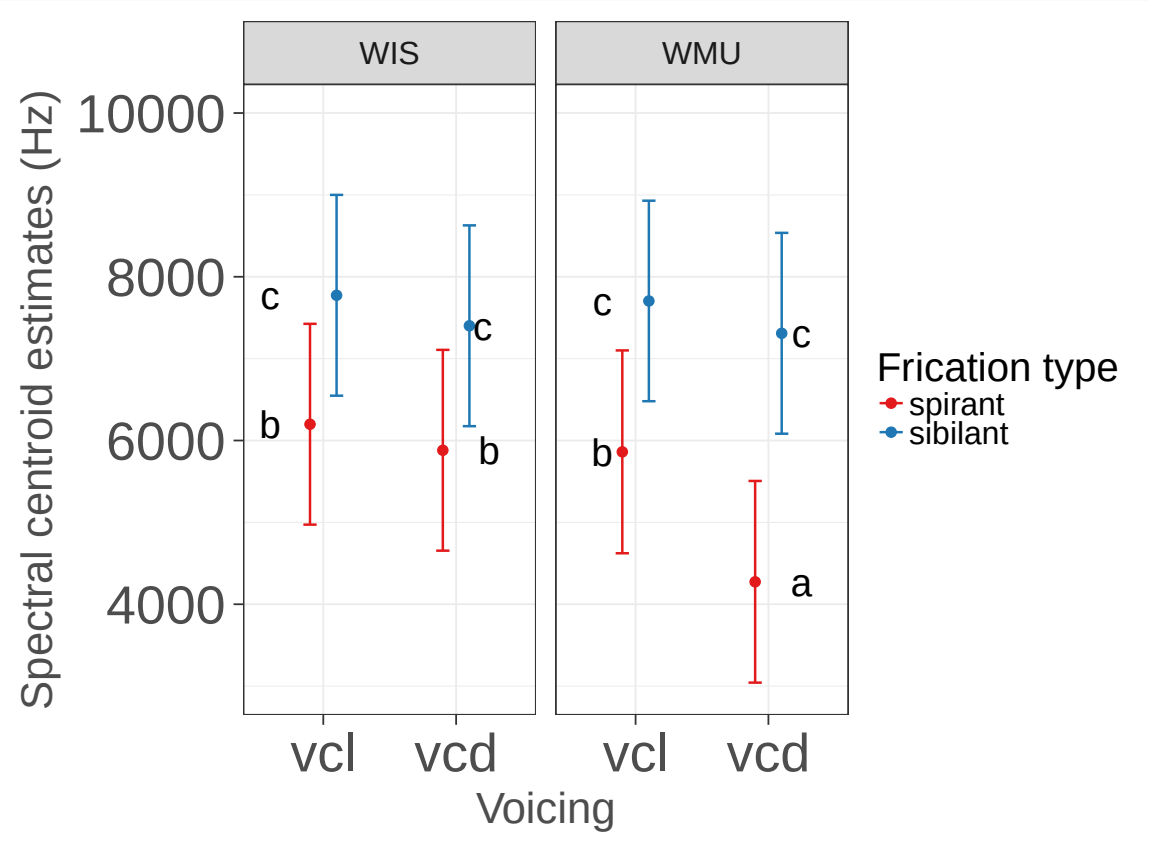
- $[\mathrm{f}] > [\mathrm{s}, \mathrm{z}, \mathrm{v}]$
- WIS $>$ WMU

Spectral centroid results: Serbian



- $[\mathrm{s}, \mathrm{z}] > [\mathrm{f}, \mathrm{v}]$
- $[\mathrm{s}] = [\mathrm{z}]$
- $[\mathrm{v}] < [\mathrm{f}]$
- WIS $>$ WMU
  $[\mathrm{v}, \mathrm{z}]$ only

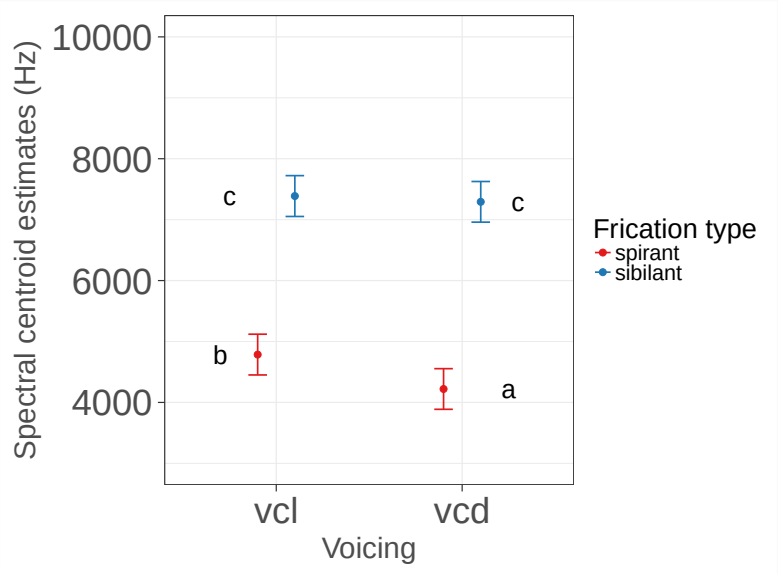
Spectral centroid results: Russian



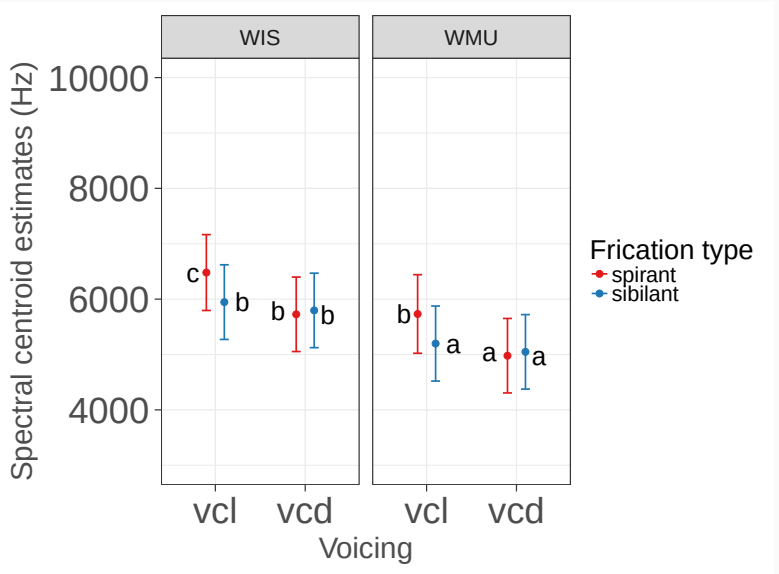
- $[\text{s}, \text{z}] > [\text{f}, \text{v}]$
- $[\text{s}] = [\text{z}]$
- WIS: $[\text{v}] = [\text{f}]$
- WMU: $[\text{v}] < [\text{f}]$

Spectral centroid results: summary

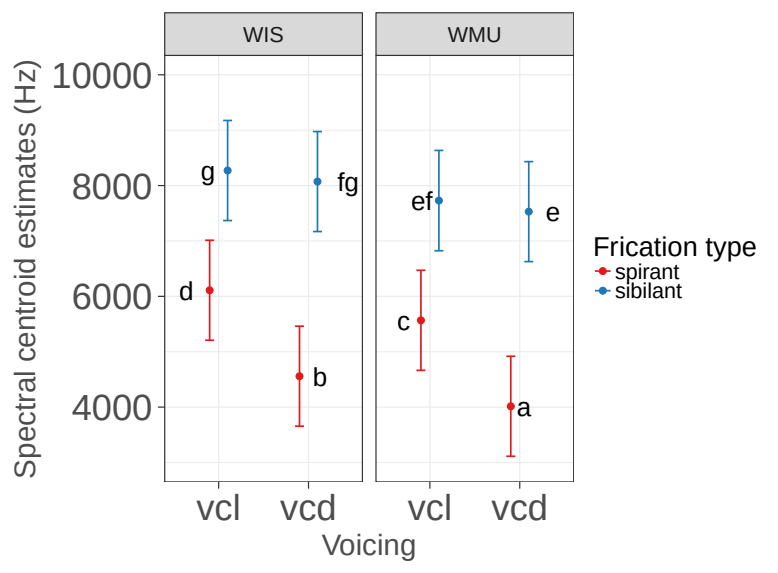
English



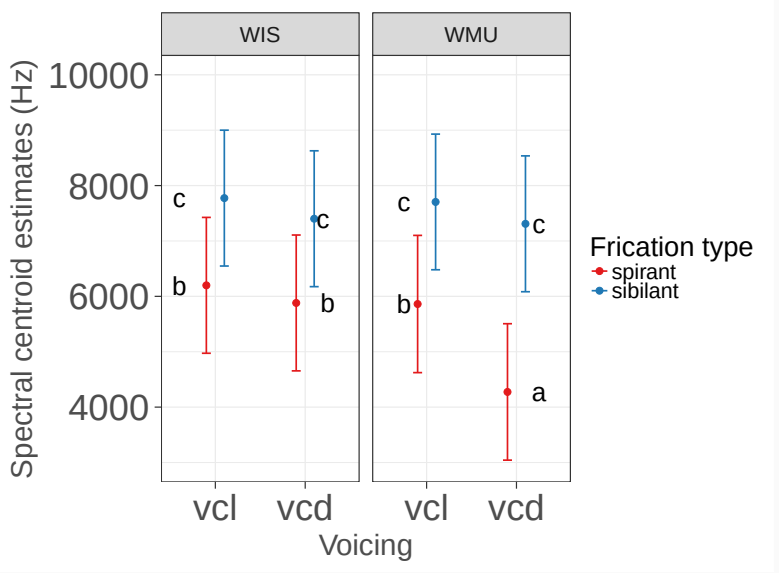
Greek



Serbian



Russian



Relationship between voicing and frication type

Question

Does the acoustic relationship between [v] and [f] parallel the acoustic relationship between [z] and [s]?

Answer

- English, Greek, Russian WIS ✓
- Serbian, Russian WMU ✗

/v/ as a voiced spirant

Situating /v/

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Terminology

Voiced, non-sibilant fricatives /β, v, ð, ɣ/: **voiced spirants**.

Fricatives: spirants and sibilants together.

Typology: Implicational relations

Implicational relations of voicing (Maddieson, 1984)

1. Voiceless sonorants ⇒ voiced sonorants
2. Voiced stops ⇒ voiceless stops
3. Voiced fricatives ⇒ voiceless fricatives

Voiced stops ⇒ voiceless stops

Implicational relation for stops is robust

	Number of series			
	1	2	3	4
Plain voiceless	98.0%	90.1%	89.5%	96.0%
Plain voiced	2.0%	81.5%	69.7%	88.0%
Aspirated voiceless	0.0%	16.0%	63.2%	52.0%
Voiceless ejective or voiceless laryngealized	0.0%	3.7%	42.1%	56.0%
Voiced implosive or voiced laryngealized	0.0%	1.2%	27.6%	48.0%

Table 2: Frequency of stop series by number of series (Maddieson, 1984)

- only 2% of languages violate implicational relation (as series)
- **gaps** most common for /p/ and /g/

Voiced fricatives ⇒ voiceless fricatives

Fricative pair	Unpaired voiced fricative / total voiced fricative	Exceptions as % of cases
/s, z/	0/96	0.0%
/ʃ, ʒ/	2/51	3.9%
/f, v/	11/51	21.5%
/x, ɣ/	15/40	37.5%
/θ, ð/	12/21	57.1%
/ɸ, β/	24/32	75.0%

Table 3: Voiced fricatives without corresponding voiceless fricatives, adapted from (Maddieson, 1984)

Explaining violations

Jumping over the divide

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	no	8 (3)	34

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Plunging into the divide

Voiced spirants make iffy sonorants:

- Are rarely syllabic
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- Often have voiceless counterparts
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Reclassification won't solve the problem of Russian /v/.

Features of voiced spirants

Russian /v/ as [+sonorant, +obstruent]

Clements and Osu (2003): both [obstruent] and [sonorant] are required.

Me: Russian /v/ is [+sonorant, +obstruent]

[sonorant] vs. [obstruent]

[sonorant]

Defined acoustically: sounds with periodic, well-defined formant structure

[obstruent]

Defined articulatorily: presence of pressure increase due to constriction

/p, t, k, b, d, g, f, s, z/	[−sonorant, +obstruent]
/m, n, l, r, j, w/	[+sonorant, −obstruent]

Ikwere surface consonants

Set A: obstruents							
voiceless explosive stops	p	t	c	k	k^w		
voiced explosive stops	b	d	j	g	g^w		
voiceless fricatives	f	s					
voiced fricatives	v	z					
Set B: oral nonobstruents							
voiced nonexplosive stop	ḅ						
glottalized nonexplosive stop	’ḅ						
lateral approximant		l					
central approximants		r	y	ɣ	w		
aspirates					h	h^w	
Set C: nasal nonobstruents							
plain nasal stops	m	n					
glottalized nasal stop	’m						
central approximants		r̰	ỹ	ɣ̃	w̰		
aspirates						h̰	$h̰^w$

Clements and Osu (2003)

Ikwere nonexplosive stops [b̤, ʼb̤] are [−sonorant, −obstruent].

Stop classification (Clements and Osu, 2003, pg. 89)

	explosive stops	nonexplosive stops	sonorant stops
[obstruent]	+	−	−
[sonorant]	−	−	+

Russian /v/

	Analysis 1	Analysis 2
/v/	[−sonorant, −obstruent]	[+sonorant, +obstruent]
/p, t, k, b, d, g, s, z/	[−sonorant, +obstruent]	[−sonorant, +obstruent]
/m, n, l, r/	[+sonorant, −obstruent]	[+sonorant, −obstruent]
Triggers of RVA	[+obstruent]	[−sonorant, +obstruent]
Targets of RVA & FD	[−sonorant]	[+obstruent]

Analysis 2

Definitions of [sonorant] and [obstruent] consistent with Analysis 2

Russian voicing phenomena rules

RVA:

[+obstruent] $\rightarrow$ [αvoice] / _____ [$-$sonorant, $+$obstruent, αvoice]

FD:

[+obstruent] $\rightarrow$ [$-$voice] / _____ #

Claim is that RVA is inherently asymmetric.

Glitches

Russian /v/ as a trigger for RVA

a)	/pod vsemi/	[potfsemi]	'underneath everyone'
b)	/ot vdovɨ/	[odvdovɨ]	'from the window'
c)	/k vzdoxam/	[gvzdoxam]	'to the sighs'

Variable non-feeding of FD when /v/-final

[trʲesf] ∼ [trʲezf] 'sober (short adj.)'

Glitch #1

a)	/pod vsemi/	[potfsemi]	'underneath everyone'	✓
b)	/ot vdovɨ/	[odvdovɨ]	'from the window'	??

Kulikov (2012)

"Voicing in /tvd/ clusters was observed less often, but it was a regular pattern for speakers 3, 6, and 11 even when reading the list. The other speakers did not assimilate /t/s before /v/ followed by a voiced obstruent in the list condition. Speakers 8 and 13 produced half of underlying /t/s in /tvd/ clusters as voiced and half as voiceless."

Inherent tensions?

Variability is unique to /v/, and is a result of its dual specification and positional tensions.

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To hear my speculations on this, let's talk over beer.

Other languages with ambiguous /v/

		/vt/	/tv/	
(rus)	Russian	[ft]	[tv] / [tv̥]	Padgett (2002)
(bul)	Bulgarian	[ft]	[tv] / [tf]	Scatton (1993)
(mkd)	Macedonian	[ft]	[tv] / [tf]	Friedman (1993)
(ces)	Czech	[ft]	[tv] / [tf]	Hall (2003)
(hun)	Hungarian	[ft]	[tv] / [tf]	Kiss and Bárkányi (2006)
(heb)	Hebrew	[ft]	[tv] / [tf]	Barkai and Horvath (1978)

Table 5: Ambiguous /v/ languages. Variable and/or gradient devoicing of /v/ after voiceless obstruents is attested in all cases.

Typology of /v/

	[+sonorant]	[−sonorant]
[+obstruent]	Russian	Maltese
[−obstruent]	Serbian	N/A

Ambiguous /v/ in other places

- German
  - very sonorous realization
  - [kvitʃən] 'squeaks'
  - /aktiv/ → [aktif] 'active'
- distributional data often shows dual specification:
  - Icelandic
  - Swedish
  - Georgian

/v/ as [−sonorant, +obstruent]

Polish is often used as example of language with true obstruent /v/, but realization variable (Gussmann, 2007, pg. 308).

Polish alternations

a)	[ʃɛvɛk]	'seam, dim.'
	[ʃfɨ] ∼ [ʃvɨ]	'seam, nom. sg.'
b)	[tsɛrcɛvnɨ]	'Orthodox, n.sg.'
	[tsɛrkfʲi] ∼ [tsɛrkvʲi]	'Orthodox church, g.sg.'

Polish distributions

c)	[dva]	'two'	[tfuj] ∼ [tvuj]	'your (nom. sg. m.)'
d)	[dʐvʲik]	'crane'	[tʃfartɛk] ∼ [tʃvartɛk]	'Thursday'

Polish /v/ triggering RVA

RVA triggered by /v/ in Warsaw Polish across boundaries

a)	<*gotów pisać*>	[gɔtuf pʲisaɕ]	'ready to write'
	<*gotów drukować*>	[gɔtuv drukɔva]	'ready to print'
b)	<*smak wina*>	[smag vʲina]	'taste of wine'
	<*los wygrany*>	[lɔz vɨgranɨ]	'winning number'

(Gussmann, 2007, pg. 309)

Maltese

	Labial		Alveolar		Palatal		Velar		Glottal
Stop	p	b	t	d			k	g	ʔ
Affricate			ts	dz	tʃ	dʒ			
Fricative	f	v	s	z	ʃ	ʒ			h
Nasal		m		n					
Lateral				l					
Rhotic				r					
Approximant		w				j			

Table 6: Maltese consonant inventory

Maltese

Maltese RVA

a) /ʃ + vɐnn [ʒvɐnn] 'what van'
b) /ʃ + vɛrs/ [ʒvɛrs] 'what a verse'

Maltese

Maltese RVA

a)	/ʃ + vɐnn	[ʒvɐnn]	‘what van’
b)	/ʃ + vɛrs/	[ʒvɛrs]	‘what a verse’

Maltese Romance quadrilateral plurals

a)	ber[r]ítta	brí:ret	‘cap’
b)	furkétta	frí:ket	‘fork’
c)	čavétta	čwí:vet	‘key’
d)	kappéll	kpí:pel	‘hat’
e)	bastún	bsa:ten	‘walking stick’

Obstruent /v/

- Attested
- Not as common as tacitly assumed
- Contrast with ipa/w, V/ may bias [−sonorant, +obstruent], but:
  - not necessary: Polish word-internal forms
  - not sufficient: Greek

/v/ as [+sonorant, −obstruent]

		/v/#	/vt/	/tv/	
(hbs)	Serbo-Croatian	N/A ([v])	[vt]	[tv]	Browne (1993)
(ukr)	Ukrainian	N/A ([w])	[wt]	[tʊ]	Shevelov (1993)
(bel)	Belarusian	[w]	[wt]	[tv]	Mayo (1993)
(slv)	Slovene	[u̯]	[ʍt]	[tw]	Herrity (2000)
(lav)	Latvian	[w]	[wt]	[tv]	Kariņš (1996)
(lit)	Lithuanian	[w]	[wt]	[tʊ]	Mathiassen (1996)

Table 7: Sonorant /v/ realizations.

/v/ as [−sonorant, −obstruent]

Nope.

Inconsistent with definitions of [sonorant], [obstruent]

Advantages: disunity of voiced fricatives

Implicational relations of FD/RVA

No languages group spirants and stops to the exclusion of sibilants *with respect to RVA/FD*:

- Turkish, Dutch: stops vs. {sibilants, spirants}
- Most Slavic languages: {stops, sibilants} vs. spirants
- Unattested: {stops, spirants} vs. sibilants

What is [+sonorant, +obstruent]? Lack of exclusivity

Russian /v/ is both an obstruent and a sonorant, and in virtue of this, it is neither an exclusive obstruent nor an exclusive sonorant. Exclusive obstruents and sonorants give the illusion of a divide.

Exclusive nature of non-exclusivity?

C_1/C_2	Labial	Coronal	Dorsal
Labial	*	pt pt^s pɗ ps ɓs ft ft^s fs fz vt^s vz (pz ɓz)	pk fk (vk)
Coronal	tp tɓ tf tv t^sp t^sf t^sv sp sɓ sf sv zv ($t^sɓ$)	t^sz	tk t^sk sk
Dorsal	kv (kp)	kɗ ks (kt^s)	*

Figure 9: Tsou onset clusters (Kehrein and Golston, 2004)

Where do [obstruent] and [sonorant] come from?

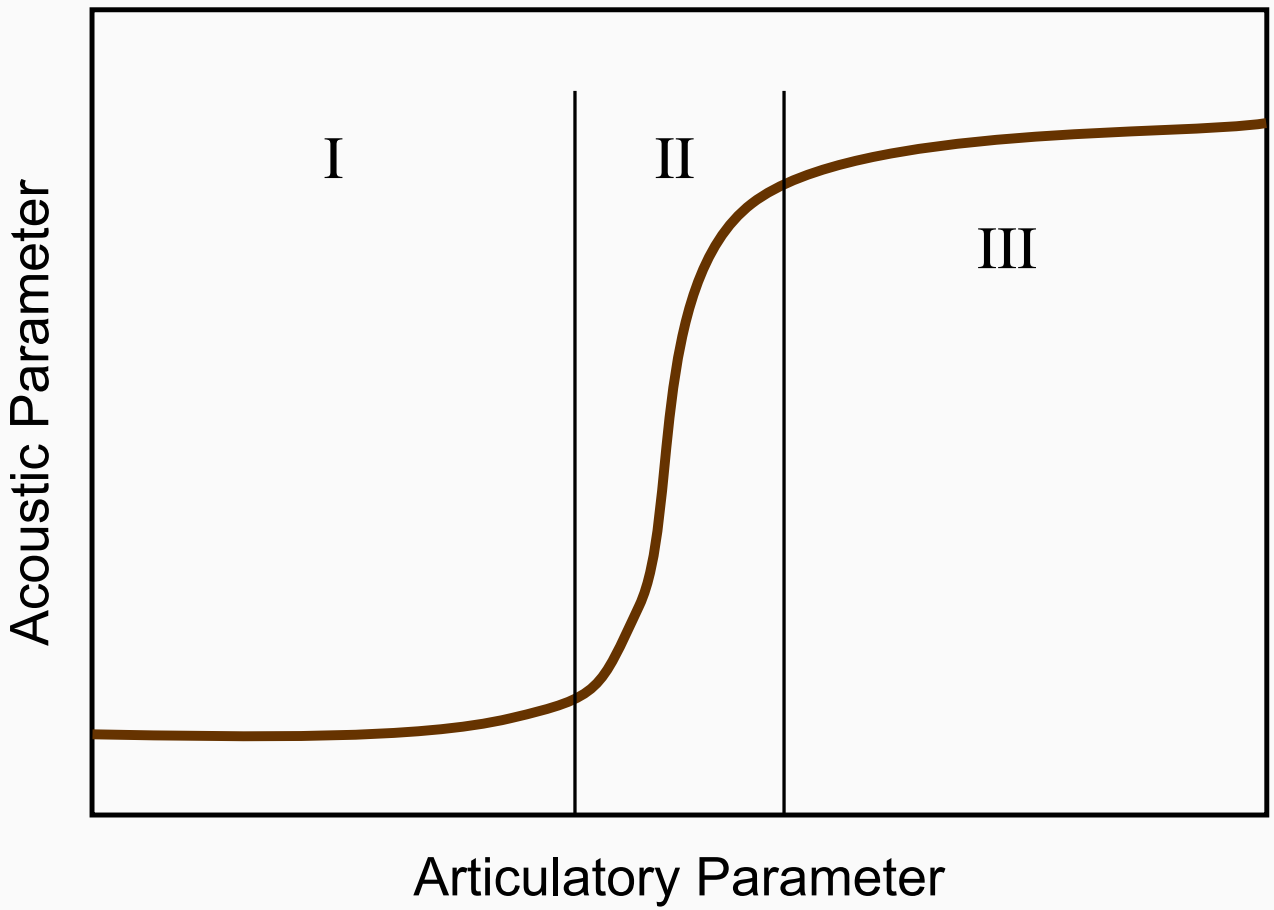

Figure 10: Schematization of relation between articulatory and acoustic parameters, from Stevens and Keyser (2010)

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- [obstruent]≠ [sonorant]

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- QT proposes that distinctive features are universal and correspond to regions of stability
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  - voiceless stops [+obstruent], [−sonorant]
  - exclusive sonorants [−obstruent], [+sonorant]
- [obstruent]≠ [sonorant]
- regions of disagreement induced by the learner
  [+sonorant, +obstruent]
  [−sonorant, −obstruent]

[sonorant] vs. [obstruent]

Where are the regions of stability?

[**sonorant**]
Defined acoustically: sounds with periodic, well-defined formant structure
$\Rightarrow$ articulatory-acoustic / acoustic-perceptual?

[**obstruent**]
Defined articulatorily: presence of pressure increase due to constriction
$\Rightarrow$ articulatory-aerodynamic?

Future research: disentangling articulatory, aerodynamic, acoustic, perceptual relationships

Featural specifications induced by learner

Regions of stability are universal and delineate boundary cases for features.

Learner induces featural specifications.

- Greek, Serbian: consistent cues, distribution/patterning
- Russian: variable cues, distribution/patterning

Unresolved issues

1. Contrast

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1. Contrast
2. /v/ vs. /β, ð, ɣ/

Unresolved issues

1. Contrast
2. /v/ vs. /β, ð, ɣ/
3. Timing of laryngeal and supralaryngeal gestures

Conclusion

Russian /v/: “Idiosyncratic behaviour of a single segment in a single language”

–Me, when I started this project

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Russian /v/: "Idiosyncratic behaviour of a single segment in a single language"
–Me, when I started this project

/v/ represents fault lines of phonology, which cross right over the obstruent-sonorant divide

Thank you!

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