The Cross-Linguistic Phonological and Phonetic Identity of /v/

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Russian /v/ patterns anomalously

Like voiced obstruents:

/v/ ⇒ [f] / {__#, __T}

- Undergoes final devoicing
  [prav-a] ∼ [praf], *right (fem./masc.)*
- Undergoes regressive voicing assimilation
  /v supe/ > [f supe], *in the soup*

Unlike voiced obstruents:

/T/ ↛ [D] / __v

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

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

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

	Final Devoicing	RVA	
		Target	Trigger
Russian	✓	✓	✗
Bulgarian	✓	✓	✗
Slovak	/v/ → [w]	✓	✗
Hungarian	N/A	✓	✗
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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 (1999), Padgett (2002), Petrova and Szentgyörgyi (2004) Lulich (2004), Kiss and Bárkányi (2006)

What people have said about ambiguous /v/

1. It's special
2. It's intermediate between obstruents and sonorants

Recipes for borscht/goulash/challah. . .

Ambiguity ⇔ Sonority

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

– Jakobson (1978)

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Ambiguous /v/ is:

- actually underlying /w/ (Hayes, 1984)
- of sonority 3; triggers ≤ 2; targets ≤ 3 (Barkai and Horvath, 1978)
- actually /v̪/ = [-wide, +sonorant] (Padgett, 2002)
- gets classified with sonorants by Contrastive Hierarchy (Hall, 2003)

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Language-specific rule/representation/feature/contrast used to account for anomalous sonority of ambiguous /v/.

Question: Do we have beets?

1. Is ambiguous /v/ special?
   - Typology of patterning ⇒ Case studies
   - Typology of inventory structure ⇒ Database study
2. Is ambiguous /v/ intermediate? ⇒ Acoustic study

Acoustic study

Padgett (2002) on ambiguous /v/

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

Assumption: phonological identity ⇔ phonetic realization

obstruent	ambiguous	sonorant
v	v̞	ʊ

/v̞/ "unstable"

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

Controls

To adequately test whether ambiguous /v/ is intermediate (1) across languages and (2) within inventory, must use control cases:

1. Control languages:
   - Greek: obstruent distribution; triggers RVA
     /tis varvaras/ → [tiz varvaras] *Barbara's*
   - Serbian: sonorant distribution; neither triggers nor targets RVA
     [ovca] *sheep* [svariti] *digest*
2. Control segments:
   - /f/ ⇐ voiceless member of "pair"
   - /s, z/ ⇐ uncontroversial obstruent fricative pair
   - /m/ ⇐ sonorant (sanity check)

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3. Control for local inventory structure: all three languages lack labial approximant (e.g., /w, ʋ/)

Stacking the deck

If we want to find [ɣ̟], need to look in favourable positions:

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

Assessing intermediacy of /v/ tokens

Assessing degree of frication in /v/ tokens

Question: Modulo the effect of voicing, are tokens of voiced and voiceless fricatives realized with similar degree of frication?

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Spectral Centroid

Measure of how high frequencies in spectrum are on average (Boersma and Weenink, 2011).

Voicing and frication

- Voicing introduces low frequency energy and "multimodal" distribution of frequency
  $\Rightarrow$ can't interpret centroid of voiced fricative!
- **solution:** high-pass filtered at 1500Hz
  $\Rightarrow$ remove effect of voicing

Assessing frication relationally

Normalization

For each speaker s,

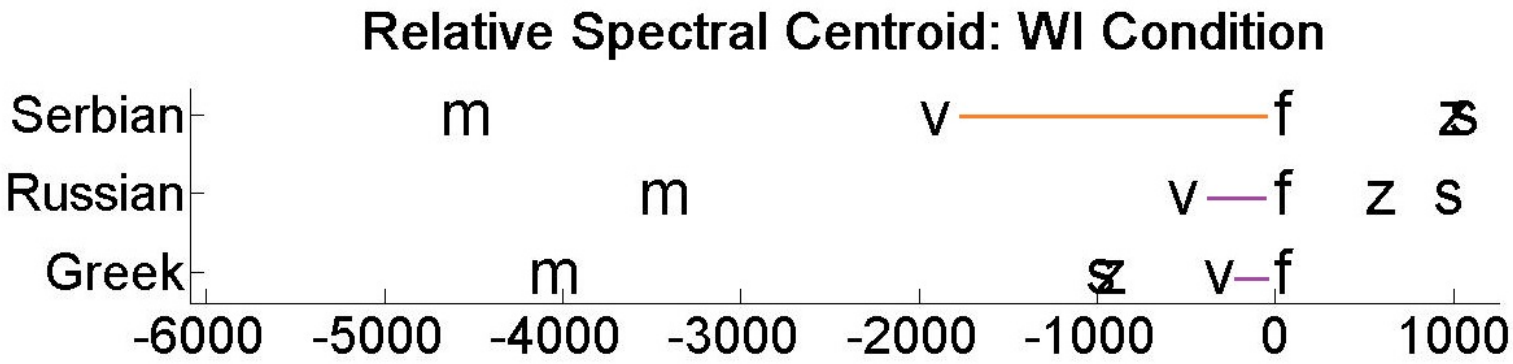
- $\mu_{[f],s}$ = mean centroid value for utterances of [f], averaged across words and repetitions of that speaker
- For each centroid c_i of speaker s, the *relative* measure $\tilde{c}_i$ is $c_i - \mu_{[f],s}$

$\Rightarrow$ $\tilde{c}_i$ denotes *relative* difference of centroids of [v, s, z, m] to [f]

Prediction: phonological pairing $\Leftrightarrow$ phonetic pairing

Greek	Russian	Serbian
v − f	v̪ − f	ʋ − f
small	medium	large

Results: relativized spectral centroid



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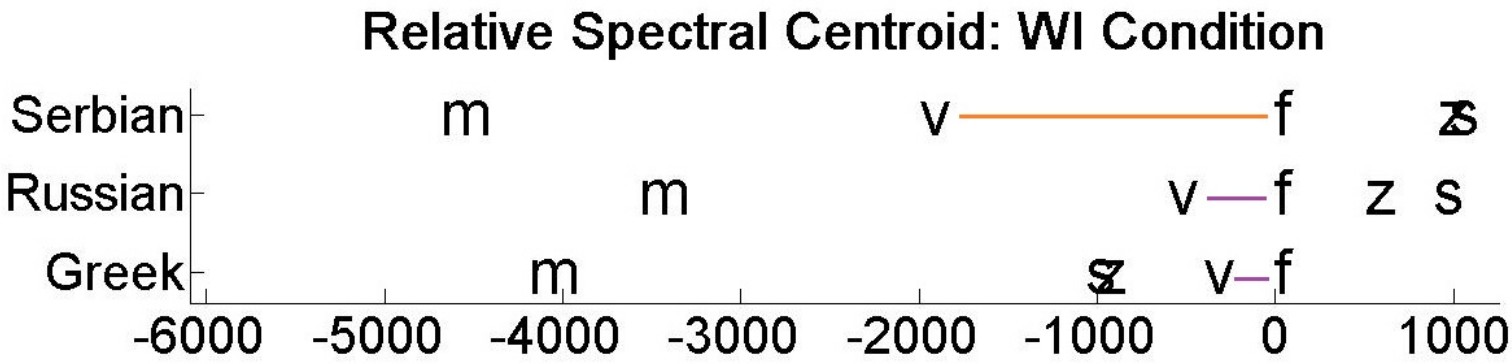

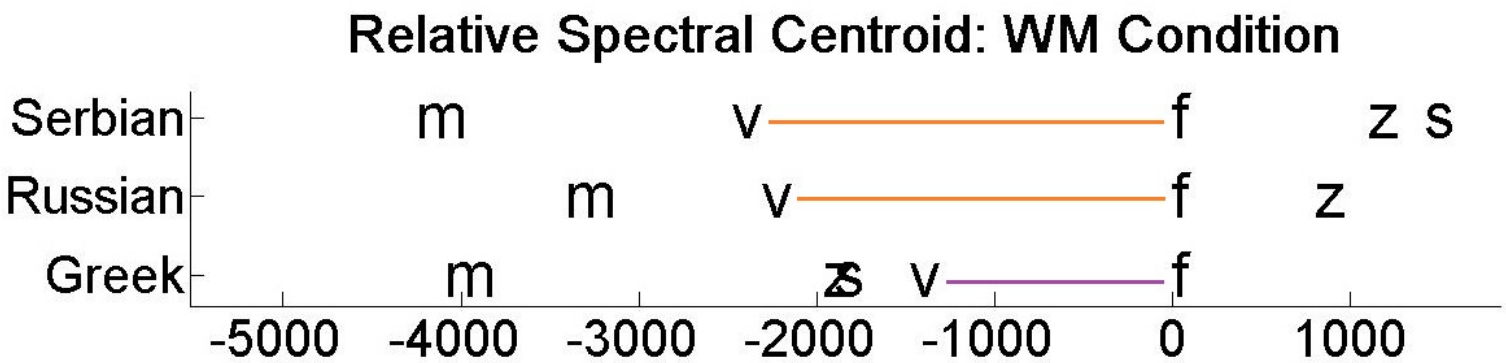

Note that no tokens of /v/ exhibited significant devoicing in any language.

Acoustic study: Conclusion

Ambiguous /v/ is not intermediate.

Why do linguists think that ambiguous /v/ is special?

Apparent assumptions

- /b, z/ → [p, s]; /p, s/ → [b, z]
- /v/ : /f/ :: /b, z/ : /p, s/
- Feature that captures this most elegantly is [-sonorant]; disprefer disjunctions
- /v/ is a fricative, so it ought to pattern with other fricatives

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Do we have *phonological evidence* that the voicing relationships between the stops, sibilants and **spirants** are the same?

Definition

Spirants: non-sibilant fricatives; e.g., /ɸ, f, θ, x/ vs. /β, v, ð, ɣ/

Voiced spirants in voicing assimilation

Classes of obstruents

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Stops	p, t, k	b, d, g	✓	✓

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Conjecture

Voiced spirants cannot trigger obstruent voicing assimilation.

If voiced spirants trigger voicing assimilation, sonorants do too.

Pulling a "de Lacy"...

Is Greek /v/ a "good enough" obstruent?

/tous barbaðes/	[touz barbaðes]	*the uncles, acc.*
/tis ðino/	[tiz ðino]	*I give her*
/tis varvaras/	[tiz varvaras]	*Barbara's*
/tis mamas/	[tiz mamas]	*the mother's*

[evɣlotos] 'eloquent' ∼ [efstaθia] 'steadiness' (same prefix)

Implication: Greek exhibits RVA, but *not* OVA
⇒ Greek /v/ is not a trigger of OVA
⇒ phonological pairing of /f, v/ in Greek reflected in the phonotactics, but evidence is lacking in active phonology

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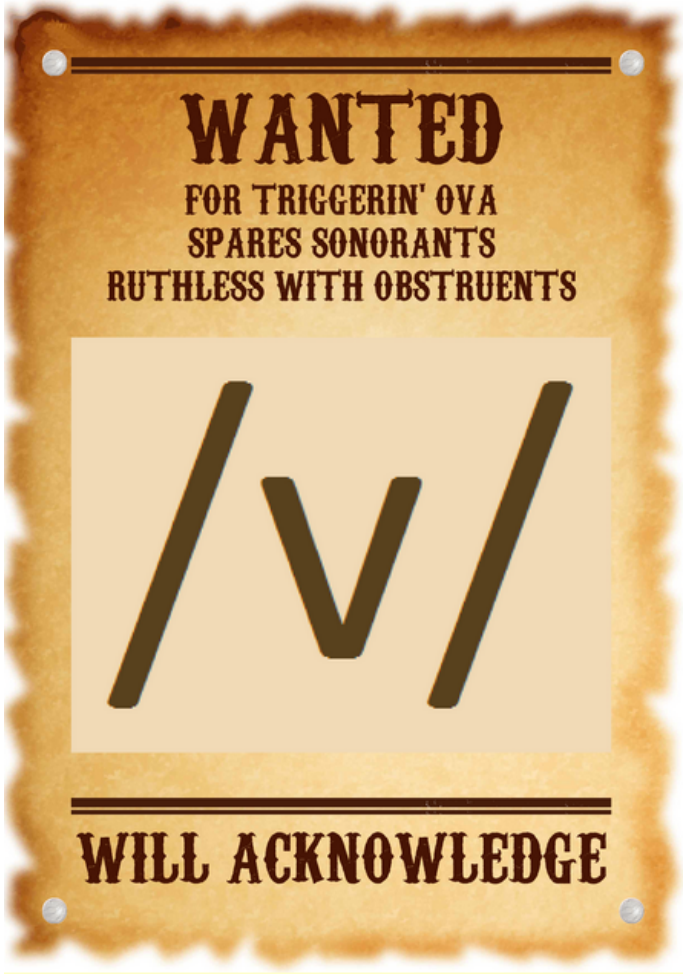
- **Polish?** In Krakow dialect, sonorants also cause voicing; in Warsaw dialect? Conflicting reports

In search of /v/...

Question

Is there a language in which /v/ patterns as an obstruent with respect to voicing assimilation, to the exclusion of the sonorants?



It's not ambiguous /v/ that's special

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It's the voiced (non-sibilant) spirants that are special.

Beets everywhere!

Claim

There is no such thing as "ambiguous /v/" as a special kind of entity, either phonologically or phonetically.

Voiced spirants cannot be triggers of *obstruent* voicing assimilation.

Whatever is special about "ambiguous /v/", namely, some kind of intermediacy on the sonority scale, is special about all voiced spirants.

Other sources of evidence

Phonetic basis

Phonetically, voicing and frication (especially non-sibilant) are difficult to maintain for aerodynamic reasons (Ohala, 1983).

Typological evidence

- Botma and van't Veer (2013) argue, based on typological data and patterning, that voiced spirants are really sonorants; they focus mainly on /β, ð, ɣ/, but do include /v/ as well
- My own database investigations corroborate their conclusions, but also suggest that contrast may have an important role to play

Current and future research

- Polish. . . *(Anyone got a student looking for a project?)*

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- If voiced spirants are truly on the boundary between sonorants and obstruents, what's their contrastive status on either side of the boundary?
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  - There are 132/571 examples of /v/ contrasting with /w/, and 13 examples of /v/ contrasting with /ʊ/
- Do voiced spirants pattern as voiced obstruents for different (non-RVA-triggering) phenomena?

Thank you!

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References I

Albright, Adam. 2008. Inflectional paradigms have bases too: evidence from yiddish. In *The bases of inflectional identity*, ed. Asaf Bachrach and Andrew Nevins. Oxford University Press.

Andersen, Henning. 1969. The phonological status of the Russian 'labial fricatives'. *Journal of Linguistics* 5:121–127.

Barkai, Malachi, and Julia Horvath. 1978. Voicing assimilation and the sonority hierarchy: evidence from Russian, Hebrew and Hungarian. *Linguistics* 212:77–88.

Boersma, Paul, and David Weenink. 2011. Praat: doing phonetics by computer [Computer program]. `http://www.praat.org/`. Version 5.2.22.

Botma, E.D., and M. van't Veer. 2013. A fraction too much friction: The phonological status of voiced fricatives. *Linguisticsin the Netherlands* 30:46–60.

Burton, Martha W., and Karen E. Robblee. 1997. A phonetic analysis of voicing assimilation in Russian. *Journal of Phonetics* 25:97–114.

Coats, Herbert S., and Alex P. Harshenin. 1971. On the phonological properties of Russian U. *The Slavic and East European Journal* 15:466–478.

Daniels, W. J. 1972. Assimilation in Russian consonant clusters: I. *Papers in* 5:366–380.

Grijzenhout, Janet. 2000. Voicing and devoicing in English, German, and Dutch; evidence for domain-specific identity constraints. *SFB 282 Working Paper* .

Hall, Daniel Currie. 2003. A formal approach to /v/: Evidence from Czech and Slovak. In *Formal Approaches to Slavic Linguistics: The Ottawa Meeting*.

Hall, Daniel Currie. 2009. Laryngeal neutralization in Breton: loss of voice and loss of contrast. In *Proceedings of the 2009 annual conference of the Canadian Linguistic Association*, ed. Frederic (ed.) Mailhot.

Halle, Morris. 1959. *The sound pattern of russian*. Mouton & Co.'s-Grevenhage.

Hayes, Bruce. 1984. The phonetics and phonology of Russian voicing assimilation. In *Language sound structure*. Cambridge, Massachusetts: The MIT Press.

References II

Jakobson, Roman. 1978. Mutual assimilation of Russian voiced and voiceless consonants. *Studia Linguistica* 32:107–110.

Kavitskaya, Darya. 1999. Voicing assimilation and the schizophrenic behaviour of /v/ in Russian. In *Formal Approaches to Slavic Linguistics: The Seattle Meeting, 1998*, ed. Katarzyna Dziwirek, Herbert Coats, and Cynthia M. Vakareliyska, 225–244. Ann Arbor: Michigan Slavic Publications.

Kiss, Zoltán, and Zsuzsanna Bárkányi. 2006. A phonetically-based approach to the phonology of [v] in Hungarian. *Acta Linguistica Hungarica* 53:175–226.

Lightner, Theodore. 1965. Segmental phonology of Modern Standard Russian. Doctoral Dissertation, MIT.

Lombardi, Linda. 1999. Positional faithfulness and voicing assimilation in optimality theory. *Natural Language and Linguistic Theory* 17:267–302.

Lulich, Steven. 2004. Russian [v]: An acoustic study. *Folia Linguistica* 38:63–85.

Ohala, John J. 1983. The origin of sound patterns in vocal tract constraints. In *The production of speech*, ed. P.F. MacNeilage, 189–216. New York: Springer-Verlag.

Padgett, Jaye. 2002. Russian voicing assimilation, final devoicing, and the problem of [v] (*or*, The mouse that squeaked). Unpublished paper.

Petrova, Olga, and Szilárd Szentgyörgyi. 2004. /v/ and voice assimilation in hungarian and russian. *Folia Linguistica* 38:87–116.

Vago, Robert. 1980. *The sound pattern of Hungarian*. Washington, D.C.: Georgetown University Press.