

The degree to which the phonological patterning of a segment correlates with its phonetic properties lies at the heart of understanding how sound systems come to be structured as they are. This paper presents the results of a cross-linguistic phonological and phonetic investigation of /v/ that aims to assess (a) what the cross-linguistic phonological identity of /v/ is, and (b) how the phonological status of /v/ in certain languages correlates with diverent phonetic properties. The phonetic study is considered in light of a database study that examines the phonological status of /v/ in terms of inventory structure, phonotactics and participation in phonological processes, specifically focussing on its relationship to sonority and its valuation of the [sonorant] feature. The results of this investigation suggest not only that the correlation between phonological status and acoustic realization is not one-to-one, but also that our understanding of what it means to be a voiced-voiceless obstruent pair (as in /z, s/) is inadequate to capture the relationship between /v, f/.

The motivating case for this study comes from Russian, in which /v/ patterns ambiguously with respect to the feature [sonorant]. Like obstruents, Russian /v/ undergoes final devoicing (hence [prav-a] ~ [praf], 'right (fem./masc)'), and regressive voicing assimilation to [f], so that /v supe/ is realized as [f supe] 'in the soup'. However, like sonorants, it does not trigger regressive voicing assimilation, thus the contrast [tverʲ] 'Tver', [dverʲ] 'door' (Padgett, 2002). Russian is not the only language to display such patterning: /v/ displays the same asymmetry in Slavic languages, such as Bulgarian (Scatton, 1984) and Czech (Hall, 2003), as well as in non-Slavic languages, such as Hebrew and Hungarian (Barkai and Horvath, 1978; Kiss and B ark anyi, 2006). Such patterning presents a puzzle for phonological theory: if /v/ is specified as an obstruent, then it should trigger regressive voicing assimilation, as do other obstruents, but if /v/ is specified as a sonorant, then it should not undergo the obstruent voicing processes of voicing assimilation and final devoicing.

The existence of "ambiguous /v/" challenges the frequent, if tacit, assumption that if an inventory contains both /v/ and /f/, they form a voiced-voiceless obstruent pair. This is indeed the case for Greek, in which /v/ distributes as the voiced counterpart of voiceless /f/: both occur in fricative-fricative clusters ([fxaristo] 'thank you'; [vyazo] 'I remove') and as the first member of a fricative-sonorant cluster ([flova] 'flute'; [vlakas] 'idiot'); moreover both are subject to the general requirement that obstruent clusters agree in voicing ([evylotos] 'eloquent'; [efstaθia] 'steadiness'). However, one need not look to pathological cases to find counterexamples to the traditional classification. In Serbian, /v/ has the distribution of a sonorant, in that it can follow both voiced and voiceless obstruents yielding contrasts such as [tvoj] 'your' vs. [dva] 'two'. Moreover, while obstruents trigger regressive voicing assimilation, sonorants do not, and nor does /v/ (hence /s-variti/ is realized as [svariti], not \*[zvariti] 'digest'). Thus, in addition to the phonological ambiguity /v/ exhibits with respect to the sonorant-obstruent divide in languages such as Russian, /v/ also displays what has been dubbed ambivalence (Mielke, 2008a) with respect to the feature [sonorant].

The three-way classificatory typology of /v/ exemplified by Russian, Greek and Serbian casts doubt on what is known about the phonological identity of /v/. A database of over 500 languages (Mielke, 2008b) was analysed to assess co-occurrence relations with other segments (e.g., /f/, /w/) and natural classes (e.g., whether the presence of /v/ correlates with the presence of a voicing contrast in plosives). For example, Maddieson (1984) discusses implicational relations with respect to voicing contrasts, including that the presence of a voiced fricative implies the presence of its voiceless counterpart. With respect to the sibilants /s, z/, this tendency is a near-universal, with only two languages in the PBase (out of 548) containing /z/ but not /s/. In contrast, 32 languages in the PBase have /v/ without /f/. Such asymmetries call into question the assumption that the relationship between /f, v/ parallels that of /s, z/. Considerations of inventory structure are rarely made explicit in the literature, but are often used in heuristic reasoning about a segment's phonological identity. For example, it is perhaps unsurprising that Serbian does not contain a

labial approximant such as /w/ against which /v/ contrasts, and one might posit this is a necessary condition for sonorant patterning of /v/. A natural follow-up question is whether the absence of a labial approximant is also a sufficient condition for such patterning; the answer in this case is no, where Greek, which also does not have a labial approximant, fills the role of counterexample. A smaller, subset dataset comprising 100 languages, selected for geneological and geographical balance based on the WALS 100-language sample, is examined to assess correlations between inventory structure and the phonological classification of /v/ in terms of patterning and phonotactics. The results of this study suggest that while co-occurrence restrictions do not determine the valuation of /v/ with respect to [sonorant], certain trends emerge; for example, the presence of a labial approximant correlates with obstruent patterning of /v/.

Phonetically, [v] is a prime candidate to straddle the obstruent-sonorant divide, as voiced non-strident fricatives present an aerodynamic tension between maintaining voicing and adequate frication (Ohala, 1983). Such considerations have led some to propose that the phonological ambiguity of /v/ in languages such as Russian arises from some kind of phonetic intermediacy with respect to sonority (Padgett (2002) for Russian and Kiss and Bárkányi (2006) for Hungarian, and Barkai and Horvath (1978) for Russian, Hebrew and Hungarian). Acoustic studies purporting to establish a direct link between the phonology of ambiguous /v/ and its phonetic realization have only looked at the acoustics of [v] in a single language (Lulich (2004) for Russian, Kiss and Bárkányi (2006) for Hungarian), and thus it is not known whether the tight relationship between phonology and phonetics implicitly assumed in these studies extends to cases in which /v/'s patterning is unambiguous. Results comparing the phonetic realization of tokens of Russian [v] with tokens of [v] in "control languages" where /v/ patterns either with obstruents (Greek) or with sonorants (Serbian) are recalled: briefly, tokens of Russian [v] exhibit frication in word-initial stressed position, like Greek, but exhibit little to no frication in word-medial unstressed position, like Serbian. These results are expanded upon in the current study by comparing the results of Greek, Russian and Serbian to English, which differs in local inventory structure by having /w/. Preliminary results suggest that the main difference in realization in English [v] tokens is devoicing, found in the majority of tokens. This is in contrast to, for example, the realization of Greek [v] tokens which, despite their obstruent classification, are almost never devoiced. Devoicing is seen not only in word-initial contexts, but is prevalent in intervocalic contexts, suggesting that partial devoicing of /v/ may in fact be a relevant cue for its phonological categorization as an obstruent in English.

## References

- Barkai, Malachi, and Julia Horvath. 1978. Voicing assimilation and the sonority hierarchy: evidence from Russian, Hebrew and Hungarian. *Linguistics* 212:77-88.
- Fougeron, Cécile, and Patricia A. Keating. 1997. Articulatory strengthening at edges of prosodic domains. *Journal of the Acoustical Society of America* 101:3728-3740.
- Hall, Daniel Currie. 2003. A formal approach to /v/: Evidence from Czech and Slovak. In *Formal Approaches to Slavic Linguistics: The Ottawa Meeting*.
- Kiss, Zoltán, and Zsuzsanna Bárkányi. 2006. A phonetically-based approach to the phonology of [v] in Hungarian. *Acta Linguistica Hungarica* 53:175-226.
- Lulich, Steven. 2004. Russian [v]: An acoustic study. *Folia Linguistica* 38:63-85.
- Maddieson, Ian. 1984. *Patterns of sounds*. Cambridge Studies in Speech Science and Communication. Cambridge: Cambridge University Press.
- Mielke, Jeff. 2008a. *The emergence of distinctive features*. Oxford University Press.
- Mielke, Jeff. 2008b. PBase 1.92. URL <http://aix1.uottawa.ca/jmielke/pbase/>.
- 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.
- Scatton, Ernest. 1984. *Reference grammar of modern Bulgarian*. Columbus, Ohio: Slavica Publishers.