The Mystery of Fricative-Final Stems in Slovak
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I Introduction Slovak is a West Slavic language spoken by about 5 million native speakers primarily in Slovakia, Central-Eastern Europe. It is syntactically more closely related to other West Slavic languages, such as Czech or Polish (Sereant, 2021), but retains a number of features from the East Slavic phonology (e.g. Hall, 2003). However, Slovak has also undergone sound changes that East Slavic languages generally avoided or committed (e.g. Danylenko (2005)), which prevent certain rules of the East Slavic phonology (oftentimes referring to Russian) from applying to modern Slovak to begin with.

An example of one such change is West Slavic Spirantisation, which refers to a historical sound change affecting stops in West Slavic languages and turning them into continuants. An example of an affected consonant relevant to the present paper is an underlying /g/, which becomes /h/, as shown in (1) and described in Danylenko (2005). This means that several East Slavic phonological rules, such as palatalisation of stem-final velar consonants /k/ and /g/ before front vowels (appended as morphemes) (2), no longer apply. This study investigates how these otherwise well-studied rules change more general fricative-, rather than merely dorsal-, final stems.

(1) a. drug → druh (*friend*)
b. bog → boh (*god*)
c. rog → roh (*horn*)

(2) DORS → [COR –ant]/ _____ + [V –back] (shamelessly plagiarised from a 5320 handout)

II Relevant Background In this section, the author provides more morpho-phonological context to the environment and specific sounds studied in the present work. Relevant observations are outlined, leading up to discrepancies that this paper will attempt to explain.

Observation #1

Fricative-final word stems come in multiple underlying forms.

Slovak allows for word stems to end in various fricative sounds. Note that Table 1 shows multiple surface-level stems corresponding to different lexical terms. It is indeed possible for the surface forms of non-declined forms to correspond to multiple stems due to word-final devoicing (3) (see *forest* versus *climb* in Table 1). However, much like other Slavic languages, Slovak is highly fusional, meaning that a lot of grammatical features of the language (such as person, gender, number, tense, aspect, or even mood) get marked by affixing suitable morphemes (Press, 2024). Thanks to this characteristic, we are able to observe the varying underlying forms of these stems when declined.

Interestingly enough, we also observe that the word-final glottal fricative /h/, which is already devoiced as is, still undergoes a word-final change to /ç/. (This sound change is described in

Sussex and Cubberley (2006) as /h/ → /x/ shift, but the transcription is either flawed or is missing an additional palatalisation step of /x/ → /ç/). This will become relevant when examining inflected forms later on.

FRICATIVE	STEM	INSTRUMENTAL	TRANSLATION
/s/	les	les-om	*forest*
/z/	les	lez-om	*climb*
/ʃ/	keʃ	keʃ-om	*cash*
/ʒ/	mroʃ	mroʒ-om	*walrus*
/h/	roç	roh-om	*horn*
/ç/	diç	diç-om	*breath*

Table 1: Fricative-final stems: devoiced word-finally, voiced in declined forms.

(3) [-son, +/-cont] → [-voice] / _____ #

Observation #2

Verbs formed from fricative-final stems conform to two SF infinitive patterns: /-ac/ and /-ic/.

All Slovak infinitives are formed by suffixing /c/. Fricative-final stem may convert into DERIVED—rather than inherent—verbs, which, in Slovak, require the insertion of a verbaliser prior to adding the infinitive suffix (Rubach, 1993, p.46). Rubach (1993, p.46-47) also defines a non-exhaustive list of seven verb classes that differ by the verbalisers the stems adopt to form an infinitive. At least on the surface level, fricative-final stems in Slovak seem to conform to strictly one of two of these classes ending in /-ic/ or /-ac/. This difference must be lexical rather than derived, as minimal pairs, like the one shown in (4), yield either result.[1]

(4) a. beç → beh-ac (*run*)
b. sneç → sneʒ-ic (*snow*)

An attentive reader may have noticed that /ç/ in (4) undergoes similar alternation to what previous research observed in examples with word-final velar consonants (1), as described in (2). The /ç/ ∼ /ʒ/ alternation could be potentially explained by the velar palatalisation rule described in (2)—that is, if we agree to extend the dorsal environment to laryngeal place of articulation as well. However, this rule alone does not suffice to explain more elaborate morphology based on fricative-final stem verbs.

Problem #1

Surface imperative forms of fricative-final stems do not match the verbaliser classes.

An example of verbal morphology that demands more explanation is the imperative form of verbs formed off of fricative-final stems. Based on example data in Table 2, selected to represent the variation between /-ic/- and /-ac/-class verbs, we observe two surface-level imperative morphemes: /-aj/ and -∅ + stem-final segment sound change. More specifically, we also observe that a typically /-ic/-class infinitive form, -∅, appears on an /-ac/-class stem /res/.

[1] Rubach (1993) also identifies multiple classes that correspond to /-ac/ in their surface form, which will be dicussed more closely later in this paper.

STEM	INFINITIVE	IMPERATIVE	TRANSLATION
caç	cah-ac	cah-aj	*pull*
res	rez-ac	reʒ-∅	*cut (with knife)*
sneç	sneʒ-ic	sneʒ-∅	*snow*

Table 2: Mismatch between infinitive forms and verbaliser classes.

Furthermore, this situation does not correspond to previously described patterns. Rubach (1993, p. 49) identifies four infinitive patterns: (1) /-i/ (as in /tr-iec/ → /tr-i/), (2) -∅ (/tʃui-c/ → /tʃui-∅), (3) reflex of palatalisation (/kla:s-c/ → /klaɟ/, derived from the underlying stem form /klad/), and (4) truncation (/kopac/ → /kop/). First, note that *pull* in Table 2 does not seem to immediately correspond to any of the above patterns. Furthermore, Rubach (1993, p. 215) also argues that the /-i/ form is only ever used when the stem cannot be otherwise syllabified. Second, *cut* and *snow*, due to the sound change in stem, only vaguely correspond to the palatalised pattern.

Problem #2

Surface gerund forms of /-ajc/-class verbs of interest come in at least three forms.

We also observe that the surface forms of the present participle morphemes are not only different between these categories but also that the surface forms for an individual class of verbs (i.e. /-ic/ versus /-ac/) are not a homogeneous group. More specifically, we observe that /-ac/-class fricative-final stems may show surface present participle morphemes of /-aju:tsc/, /-u:ts/, and /-iatsi/, as shown on *pull*, *cut*, and *lay* in Table 3.

STEM	INFINITIVE	GERUND	TRANSLATION
caç	cah-ac	cah-aju:ts	*pull*
res	rez-ac	reʒ-u:ts	*cut (with knife)*
ʎaç	leʒ-ac	leʒ-iats	*lay*
ruç	ruʃ-ic	ruʃ-iats	*disturb*

Table 3: Discrepancies between gerund forms of /-ac/-class verbs.

Now Rubach (1993, p.53) identifies two types of gerunds in Slovak: (1) /-iats/, for verbs with stems ending in a front vowel, and (2) /-u:ts/ everywhere else. First, we see that the former case clearly applies outside stems ending in front vowels. It could perhaps be argued that the author actually meant the whole derivation (that is, including verbalisers) rather than just the stem, but this proposal still does not account for the sound change of the stem in the gerund of *cut* as described above.

III Goals & Claims. This paper aims to offer a concise account of the morpho-phonology of Slovak word stems ending in underlying fricatives that can also account for discrepancies between the present data and the proposals made in Rubach (1993). More specifically, this work makes the following claims: (i) velar palatalisation extends to glottal palatalisation on fricative-final stems in Slovak, (ii) surface /-ac/ suffixes come in at least three underlying forms: /-ac/, /-ic/, /-ajc/, (iii) none of the previously proposed accounts explains the derivation of gerunds of stems ending in alveolar fricatives and a new strategy is necessary: this paper proposes an analysis with at least two unique gerund morphemes with an underlying /j/.

IV Analysis This section presents all of the above claims and relevant derivations. All data used for and presented in this study is also listed in Table 13.

Claim #1

Velar palatalisation in Slovak extends to underlying fricatives /h/ and /ç/.

Recall that velar palatalisation in Russian allows for declension of conjugation forms where stem-final velar stops get replaced by their palatalised counterparts (2) before front vowels such as /i/ or /e/. However, we also observed that /-ic/-class stems ending in an underlying /h/ alternated with /ʒ/. Also recall that the "devoiced counterpart" of /h/ is, in Slovak, considered to be /ç/. Interestingly enough, both of these sounds get further palatalised and fully replaced by the voiced and unvoiced post-alveolar fricatives /ʒ/ and /ʃ/ respectively.

STEM (SF)	INSTRUMENTAL	INFINITIVE	TRANSLATION
buç	buç-om	bu:ʃ-ic	*beat, bang*
ruç	ruç-om	ruʃ-ic	*distrub*
sɳeç	sɳeh-om	sɳeʒ-ic	*snow*
kruç	kruh-om	kru:ʒ-ic	*circle*

Table 4: Sound change between

What is wildly interesting is that the palatalisation preserves the voiced pseudo-feature of /h/. This suggests that what is oftentimes transcribed as /h/ in Slovak, could actually by the voiced equivalent of /h/, /ɦ/. In that case, both the word-final shift /ɦ/ → /ç/ and the derivation of both infinitive forms could be explained by only two rules total, described as HSHIFT in (5) and PALAT in (6). HSHIFT moves cycle-final laryngeal fricatives /h/ or /ɦ/ to the front, as the language doesn't allow non-palatalised laryngeal fricatives in this position in the surface form (word-final devoicing follows for relevant segments). PALAT palatalises any dorsal (or coronal-dorsal) consonants before front vowels, as preserved from Russian.

(5) HSHIFT: [LAR +cont] → [DORS/COR -ant]/ _____]

(6) PALAT: [DORS] → [COR –ant]/ _____ + [V –back]

A final derivation of the infinitive forms of *disturb* and *snow* would therefore look as follows:[2]

UR	ruç-ic	sneɦ-ic
CORPAL	N/A	sɳeɦ-ic
HSHIFT	N/A	sɳeɣ-ic
PALAT	ruʃ-ic	sɳeʒ-ic

Table 5: Derivation of /-ic/-class infinitive forms using the proposed.

Note that for the derivation in 5 to work, PALAT must come after HSHIFT. This is because HSHIFT is feeding PALAT, which only takes. A potential problem with this rule could be declension. In declined, suffixed versions of *snow*, the original ɦ is preserved. This means that any declension morphemes would have to be a part of the same cycle as the word stem for

[2]CORPAL used in the derivation in 5 is a commonly recognised rule responsible for palatalising pre-front-vowel coronal consonants, as described in a piece on Coronal Palatalisation, (Rubach, 1993, p.111).

HSHIFT to make the right prediction. In that case, the rules would have to be reordered and PALAT would have to be re-adjusted to also accept laryngeal continuants. Likewise, HSHIFT may not happen without another rule that changes the /ɣ/ sound (e.g. word-final devoicing or PALAT) because /ɣ/ is an illegal surface-form sound in the studied language.

Claim #2

Surface /-ac/ suffixes come in at least three underlying forms: /-ac/, /-ic/, /-ajc/.

Now that we confirmed the presence of the East-Slavic palatalisation rule in Slovak, we may also be able to derive the imperative forms using two additional, but more widely used rules. Consider the following example words, selected to show all known concerns about the possible derivation of the imperative forms:[3]

STEM (UR)	INFINITIVE	IMPERATIVE	TRANSLATION
ruç	ruʃ-ic	ruʃ	*disturb*
beç	beʒ-ac	beʃ	*run*
res	rez-ac	reʃ	*cut (with knife)*
neç	nec-ac	nec-aj	*let be*

Table 6: A comprehensive selection of imperative examples.

Now there are two important reminders to mention before we consider adding any /-i/ or /-j/ suffixes to the stems to form imperatives.

First, the /ij/ sequence is an illegal sequence to occur within a single syllable Slovak (Kenstowicz and Rubach, 1987, p. 476, also Rubach, 1993, p. 228).[4] Anytime this sequence occurs in an underlying form, one of the sound gets deleted (which is unlike East Slavic languages and even Czech, where the /ij/ or /ji/ sequence is very much allowed).[5] This means that if /-ic/-class word take on the /-j/ or /-i/ suffix to form imperatives, this suffix would have to be deleted and we could potentially never observe any remnants of it in our data. We describe the process of reducing two [+high, -cons] segments within one syllable into one in JDEL, as shown in (7).

(7) JDEL: [+high, -cons][+high, -cons] → [+high, -cons]/(_____)$_\sigma$

Concurrently, coda-final glide /j/ in complex codas is not allowed (by the Sonority Sequencing Principle (Sievers, 1876)) and must be dealt with before arriving at the surface-level representation of a sequence. We describe this process in FINJDEL in (8).

(8) FINJDEL: /j/ → ∅/[+cons]_____)$_\sigma$

[3]Note that in this section, the stem /beç/ shows with a /ʒ/ in the infinitive form rather than h as shown in Observation #2. This is because some stems in Slovak may choose one of multiple verbalisers, resulting in a slightly different meaning. Attempting to define the semantics of these verbalisers is beyond the scope of this research, but for this particular example, /beʒac/ means *to move by running* while /behac/ means something closer to *to do running for exercise*. For example, an imperative of the former variant can be used to send someone to the store to buy something quickly while an imperative of the latter variant can be used to instruct a trainee.

[4]Note that this sequence is allowed across syllable boundaries, when /i/ (typically in the nucleus) carries its own mora but /j/ (typically in the onset) does not. We observe many examples amongst conjugated verbs such as /ʒi|juː/ (*they live*), /pi|juː/ (*they drink*), /bi|juː/ (*they beat*).

[5]This is visible in sound differences between cognates of various Slavic languages (e.g. /jiːst/ (eat) is a perfectly legal sequence in Czech but changes to /jesc/ in Slovak.

With this in mind, we are ready to derive the imperative forms for well-behaved stems like *disturb* or *let be*, as shown in Table 7.

UR	ruç-i-j	neç-a-j
JDEL	ruç-j	N/A
PALAT	ruʃ-j	N/A
FINJDEL	ruʃ-∅	N/A
SF	ruʃ	neçaj

Table 7: Derivation of regular /-ic/- and /-ac/-class imperative forms.

It should also be noted that for this analysis to have some merit, both JDEL and FINJDEL must happen before any re-syllabification cycle takes place. Otherwise, the suffixed [-cons, +high] segment could get re-syllabified as a nucleus and neither JDEL nor FINJDEL would no longer apply.

However, the above analysis fails to explain the derivation of the remaining two items, *run* and *cut*, as displayed in Table 12. We arrive at /behaj/ and /rezaj/ instead of /beʒ/ and /reʒ/.

UR	beh-a-j	rez-a-j
JDEL	N/A	N/A
PALAT	N/A	N/A
FINJDEL	N/A	N/A
SF	behaj	rezaj

Table 8: Derivation of less obviously regular surface /-ac/-class imperative forms. (Note that /behaj/ is technically a correct imperative form of the /beç/ stem, as /beç/ can show both. However, this exercise is targetting /beʃ/ to explain the derivation of the palatalised fricative.)

Recall that Rubach (1993, p.46-47) proposes a non-exhaustive list of stem classes based on the verbalisers they merge with to form verbs. Interestingly enough, Rubach (1993) shows that multiple classes that seem to end in /-ac/ on the surface but argues that they must be split based on conjugation patterns. Now if we attempt to conjugate the verbs of interest, we find that they each follow a different pattern. See relevant conjugated forms of verbs from Table 6 in Table 9.[6]

STEM (UR)	INFINITIVE	1SG	3SG	3PL	IMPERATIVE	TRANSLATION
ruç	ruʃ-ic	ruʃ-i:m	ruʃ-i:	ruʃ-ia	ruʃ	*disturb*
beh	beʒ-ac	beʒ-i:m	beʒ-i:	beʒ-ia	beʃ	*run*
res	rez-ac	reʒ-em	reʒ-e	reʒ-u:	reʃ	*cut (with knife)*
neç	nec-ac	nec-a:m	nec-a:	nec-aju:	nec-aj	*let be*

Table 9: The discussed examples, conjugated.

From the data in Table 9, we observe that *run* conjugates the exact same way as *disturb*, which is a well-behaved /-ic/-class verb. We could therefore assume that *run* is an underlyingly /-ic/-class verb. Why this verb shows as /-ac/-class verb in the surface form remains unclear; *snow*, for instance, a regular /-ic/-class verb constitutes a closely similar phonological environment, but it shows as /-ic/ in the surface form.

[6]Note that *disturb* and *let be* conjugate similar to Rubach (1993)'s /-ajc/ and /-ic/ classes. The fact that the present /-ac/-class verbs are underlyingly /-ajc/ does not change the present analysis of imperatives thanks to JDEL.

(Rubach (1993) resolves this discrepancy by creating a new category of /-æ/-class verbs. This does take care of the issue of different surface forms by brute force but would require multiple new rules paralel to JDEL and FINJDEL to derive the surface imperative form.)

However, we must also finally explain the conjugation of *cut*. We observe that there should not be any underlying front vowel as *run* because the infinitive form does not show signs of palatalisation having taken place. Furthermore, we may deduce that *cut* must be a different verb stem than *let be* because the verbaliser does not show in the imperative form. Based on Rubach (1993), words with declension similar to *cut* are indeed categorised as a third class of stems that show with a surface /-ac/ infinitive. Rubach (1993) assigns the /a/ verbaliser to this class but doesn't provide further commentary.

The above data suggests that the verbaliser does not show in the imperative form but is still a part of the surface representation of the infinitive form. This is an inconvenience because in order to account for this change phonologically, the language would have to erase or insert /a/ in relatively common environments (i.e. in between a strident and a palatal stop for insertion in infinitive or between a strident and a glide for deletion in imperative). This is highly implausible and will probably need to be accounted for morphologically. In that case, we get the correct derivation:

UR	beh-i-j	rez-∅-j
JDEL	beh-j	N/A
PALAT	beʒ-j	reʒ-j
FINJDEL	beʒ-∅	beʒ-∅
SF	beʒ	reʒ

Table 10: Derivation of less obviously regular surface /-ac/-class imperative forms.

Claim #3

There are at least 2 underlying gerund morphemes with an underlying /j/.

Earlier in this piece, it has been mentioned that Rubach (1993) proposes two gerund morphemes: (1) /-iats/, for verbs with stems ending in a front vowel, and (2) /-u:ts/ everywhere else. However, already the data in Table 11 show that this description is not accurate, as *cut* (both stem an verbaliser) only contain front vowels and yet take on a gerund form resembling the latter option. Likewise, *breathe* only contains front (or non-back) vowels and yet take on the latter morpheme.

STEM (UR)	INFINITIVE	GERUND	TRANSLATION
diç	di:c-ac	di:c-aju:ts	*breathe*
res	rez-ac	reʒ-u:ts	*cut (with knife)*
ruç	ruʃ-ic	ruʃ-iats	*disturb*
beç	beh-ac	beʒ-iats	*run*

Table 11: A comprehensive selection of gerund examples.

In this paper, we aim to make the (surface) verbaliser (i.e. /a/ or /i/) the predictor of the gerund form instead. In order for this argument to provide a reasonable account for the data, it needs to explain the variation between the gerunds of /-ac/-class verbs, namely the alternation of /-aju:ts/ ∼ /-u:ts/. We can do that by proposing an analysis in which the gerund morphemes are instead /-jats/ and /-ju:ts/. Applying only previously defined rules and the three uncovered underlying forms, we can account for this discrepancy:

UR	diːc-a-juːts	rez-∅-juːts	ruç-i-jats	beh-i-jats
JDEL	N/A	N/A	ruç-jats	beh-jats
PALAT	N/A	reʒ-juːts	ruʃ-jats	beʒ-jats
FINJDEL	N/A	reʒ-uːts	N/A	N/A
SF	diːcajuːts	reʒuːts	ruʃiats	beʒiats

Table 12: Derivation of less obviously regular surface /-ac/-class imperative forms.

There is one potential problem with this derivation and that is the fact that it requires that FINJDEL to not apply to the /-ic/-class gerund form /-jats/. This analysis accounts for this by considering /j/ in /-jats/—but not /j/ in /-juːts/—syllabic. Now this may seem implausible at first, but bear with. The explicit difference in syllabicity not only neatly accounts for the discrepancy when applying FINJDEL, but could also explain the difference in length of the vowels between these two morphemes. If FINJDEL deletes /j/ in the /-ac/- but not /-ic/-class morpheme, there could be a stranded mora that eventually adds weigh to the remaining vowel instead. This additional weight could be the lenght on /uː/ in /-juːts/ that we do not observe on /a/ in /-jats/.

The above derivation would require an appropriate adjustments, namely only adding length on /u/ once FINJDEL removes /j/.

V Conclusion This study examined fricative-final stems in Slovak. By synthesising the rule for the shift of the place of articulation of /h/ (or arguably /ɦ/) sound closer to the palate, as described in (5), and the previously defined palatalisation of DORS consontants, we were able to show the correct derivation of infinitive forms for fricative-final stems ending in underlying /ç/ as well as underlying /h/. (Note that the present study intentionally did not specify for dorsal fricatives, as it appears that the rule nonetheless applies on dorsal stems as well, but it does not further explore the consequences of applying the rule in (6) on stops and instead focuses on fricatives all along.)

Next, we were able to use different verbaliser classes for general stems identified in Rubach (1993), and more specifically their underlying forms, to derive the imperative forms for stems of all examined verbaliser classes using the very same morpheme, /-j/. For a successful derivation, we only needed to consider two additional rules specific to Slovak but not necessarily other Slavic languages. Namely, the reduction of [-cons, +high] segment in a sequence of two within a single syllable, described in (7) (and likely derived from the Obligatory Contour Principle (Leben, 1973)), as well as the deletion of stranded /j/ at the end of a complex coda, specified in (8).

And finally, we also presented a more effectively generative strategy to building Slovak gerunds, using two more obviously related underlying gerund morphemes and only previously specified rules. This strategy not only accounts for the discrepancy between the gerund rules described in Rubach (1993) but also presents a pair of morphemes that are just as generative using no additional rules. Finally, the proposed pair and the differences in the morphemes' syllabicity may explain the weight of the vowels visible in surface forms.

Appendix

STEM	INFINITIVE	IMPERATIVE	GERUND	TRANSLATION
beç	beh-ac	beh-aj	beh-aju:ts	*run*
diç	di:ç-ac	di:ç-aj	di:ç-aju:ts	*breathe*
neç	neç-ac	neç-aj	neçaju:ts	*let be*
caç	cah-ac	cah-aj	cah-aju:ts	*pull*
za:paç	zapa:ç-ac	zapa:ç-aj	zapa:ç-aju:ts	*stink*
mas	maz-ac	maʃ	maʒ-u:tsi	*grease*
res	rez-ac	reʃ	reʒ-u:tsi	*cut (with knife)*
ʎaç	leʒ-ac	leʃ	leʒ-iats	*lay*
beç	beʒ-ac	beʃ	beʒ-iats	*run*
su:ʃ	suʃ-ic	suʃ	suʃ-iats	*dry*
mnoho	mnoʒ-ic	mnoʃ	mnoʒ-iats	*breed, multiply*
pri:-loha	pri-loʒ-ic	pri-loʃ		*attach*
caʒba	caʒ-ic	caʃ	caʒ-iats	*mine*
buç	bu:ʃ-ic	bu:ʃ	bu:ʃ-iats	*beat, bang*
duç	du:ʃ-ic	du:ʃ	du:ʃ-iats	*spirit, passion*
ruç	ruʃ-ic	ruʃ	ruʃ-iats	*hustle*
pi:ça	piʃ-ic	pi:ʃ	pi:ʃ-iats	*pride*
tu:ʒba	tu:ʒ-ic	tu:ʃ	tu:ʒ-iats	*dream, desire*
sɳeç	sɳeʒ-ic	sɳeʃ	sɳeʒ-iats	*snow*
kruç	kru:ʒ-ic	kru:ʃ	kru:ʒ-iats	*circle*
va:ha	va:ʒ-ic	va:ʃ	va:ʒ-iats	*weigh*

Table 13: Fricative-final stems: data.

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