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Against strict stratum-internal transparency: Within-stratum countershifting in Gallipoli Serbian

Aljoša Milenković, Harvard University, aljosamilenkovic@g.harvard.edu

Some versions of Stratal Optimality Theory maintain the view that phonological processes applying in the same stratal domain can only interact transparently, with opacity emerging solely from between-stratum process interactions. This paper challenges the universality of stratum-internal transparency, presenting a previously unexamined case of countershifting opacity in Gallipoli Serbian. In this dialect of Bosnian/Croatian/Montenegrin/Serbian, final light syllables are barred from receiving stress. However, final lights derived by the regular shortening of underlyingly long final vowels bear stress on the surface, rendering the ban on stressed final lights non-surface-true. Opacity arises stratum-internally: Stress Assignment and Final Shortening apply in the same stratal domain. Even if additional, language-specific domains are posited, isolating the two opaquely interacting processes into separate strata remains unfeasible. This study offers evidence for within-stratum opacity, even under more flexible stratal architectures, and suggests that opacity arises from multiple sources, not being universally an epiphenomenon of phonology-morphosyntax interleaving.

1 Source(s) of phonological opacity

Phonological opacity, defined in (1), has played a pivotal role in the advent and development of generative phonology (Chomsky 1964; Kiparsky 1973; McCarthy 2007).

(1) Opacity (Kiparsky 1973)
Phonological rule $\mathbb{P}$ of the form A → B / C__D is opaque if:
a. There are surface forms that display A in the environment C__D (*underapplication*), or
b. There are surface forms that display B derived by $\mathbb{P}$ in environments other than C__D (*overapplication*).

Opacity has much relevance for constraint-based frameworks, such as Optimality Theory (OT; Prince & Smolensky 1993/2004): It undermines the assumptions of parallelism, optimization, and surface-orientedness of input-output mappings, which are central to OT. Classical OT lacks intermediate representations and is therefore unable to accommodate many instances of phonological opacity. Specifically, opaque forms are dispreferred to their transparent contenders because they incur unjustified constraint violations. In *counterfeeding*, or *underapplication* opacity, the opaque form is insufficiently optimizing because it incurs a markedness violation for no apparent reason: An otherwise available markedness repair fails to take effect. Similarly, in *counterbleeding*, or *overapplication* opacity, the intended winner is gratuitously unfaithful to the input form. Rule-based phonology (RBP; Chomsky & Halle 1968 *et seq.*) uniformly captures most types of opacity through extrinsic process ordering.

Stratal OT (Bermúdez-Otero 1999; 2003; Kiparsky 2000), a derivational multi-level version of OT, offers a potential solution to the opacity problem. By introducing intermediate levels between the underlying and surface representations, Stratal OT replicates RBP's ability to accommodate opaque interactions at intermediate levels of representation while maintaining the theoretical appeal of OT. A central ingredient of Stratal OT accounts of phonological opacity is between-stratum ordering: Phonological processes are transparent in their respective stratal domains but can be rendered opaque by processes applying in later-ordered strata.

Whether between-stratum process ordering is the only source of phonological opacity is a point of ongoing debate, even within Stratal OT. One line of work in this framework (e.g. Kiparsky 2015) assumes strict transparency within individual strata, whereby opacity can only arise from interactions between processes that operate at different levels. This approach makes strong predictions about the sources and possible types of opaque interactions. Process ordering is only possible through domain affiliation. Opacity is therefore expected to correlate with morphosyntactic structure, arising exclusively as a by-product of phonology-morphosyntax interleaving (Kiparsky 2000; 2015; Obiri-Yeboah & Rasin 2025).

A sizable body of work has challenged the stratum-internal transparency assumption in its strongest form, reporting opaque interactions between processes that demonstrably apply in the same stratum (Kavitskaya & Staroverov 2010; Broś 2016; Broś & Nazarov 2023; Stanton 2023; Obiri-Yeboah & Rasin 2025). A more relaxed position within Stratal OT is therefore taken by Bermúdez-Otero (2013; 2019), who acknowledges the existence of within-stratum opacity. Such process interactions can be modeled by purely phonological mechanisms, with no recourse to morphosyntactic structure (Bermúdez-Otero 2019).

This paper supports the view that opacity has multiple sources and cannot be fully reduced to phonology-morphosyntax interleaving. Therefore, it pursues alternatives to stratal ordering as a formal mechanism for modeling opaque interactions in OT. The study informs phonological theory in two ways. First, it reports a new case of within-stratum opacity, adding to the growing evidence for this phenomenon. Gallipoli Serbian (GS; Ivić 1957) presents an interesting case of countershifting opacity (Rasin 2022; Baković & Blumenfeld 2024). GS exhibits tone-stress interaction, usually assigning stress to the word's only High-toned syllable (2a)–(2b). However, if the High-toned syllable is light and final, stress falls on the toneless penult (2c). Long final vowels regularly shorten (2d). Final Shortening countershifts stress: Final High-toned lights that derive from underlying heavies by Final Shortening bear stress on the surface (2e). Stress Assignment and Final Shortening, I show, apply in the same phonological domain.

(2)	a.	/kaan.dí.sa.la/	[kaan.ˈdí.sa.la]	'agree.PTCP.PST.F.SG'
	b.	/braa.dɔ́ɔm/	[braa.ˈdɔ́ɔm]	'beard.INS.SG'
	c.	/glaa.vá/	[ˈglaa.vá]	'head.NOM.SG'
	d.	/jáa/	[ˈjá]	'1SG.NOM'
			[ˈjáa=sam]	'I am'
	e.	/ruu.kɛ́ɛ/	[ruu.ˈkɛ́]	'arm.GEN.SG'
			[ruu.ˈkɛ́ɛ=mi]	'of my hand'

Second, this paper goes one step further than most existing studies which document within-stratum opacity: It demonstrates that introducing additional levels in Stratal OT does not help salvage the strong version of the stratum-internal transparency hypothesis. Previous studies have shown that within-stratum opacity cannot be dispensed with under the standard three-level architecture, which comprises the Stem, Word, and Phrase strata (Kiparsky 2000; Bermúdez-Otero 2003). However, the use of additional, language-specific strata (in the spirit of Jaker 2012; 2023; Jaker & Kiparsky 2020) could solve this problem by creating more space to isolate opaquely interacting processes into separate strata.

Against this backdrop, Obiri-Yeboah & Rasin (2025) argue that within-stratum opacity in Gua persists even when postlexical phonology is partitioned into multiple levels. This paper makes a similar theoretical point. I argue that even if an additional stratum is introduced between the regular Word and Phrase strata in GS, stratum-internal opacity cannot be eliminated. This finding makes a compelling case against the universality of stratum-internal transparency, suggesting that phonological opacity can arise from sources other than phonology-morphosyntax interleaving. Thus, the main theoretical contribution of this study is the demonstration that what is traditionally labeled as “opacity” constitutes a heterogeneous class of phenomena, with multiple sources: both non-phonological and, crucially, purely phonological.

Given the limitations of the Stratal OT framework, I propose a formal analysis of GS opaque phonology couched in Harmonic Serialism (HS; Prince & Smolensky 1993/2004: 94–97; McCarthy 2000), a monostratal derivational version of OT. HS is a particularly suitable analytical choice here, given that base HS readily captures countershifting interactions involving stress (Elfner 2016; Ryan 2020; Rasin 2022; Pruitt 2023). The HS account replicates RBP’s extrinsic process ordering through constraint ranking rather than multiple serially ordered grammars, deriving the opaque phonology of GS under a uniform constraint hierarchy.

The paper is structured as follows. Section 2 provides background on GS and its phonological system. Section 3 outlines the dialect’s stress system, with special emphasis on opaque final stress. Section 4 presents a failed parallel OT account of opaque stress. Section 5 discusses process affiliation in GS phonology, offering evidence for within-stratum opacity. Section 6 provides a formal account of opaque interactions in GS. Section 7 concludes.

2 Background

2.1 Gallipoli Serbian

GS is an extinct Old Štokavian dialect of Bosnian/Croatian/Montenegrin/Serbian (BCMS) (see Ivić 1958 for the background on BCMS dialects). The dialect was historically spoken by the Gallipoli Serbs, a Serbian community in Bayramiç, a town near the Gallipoli Peninsula in Turkey. The Serbian population of this area is believed to have been forcibly relocated from Central Serbia in the 16th century (Filipović 1946; Ivić 1957). During the Greco-Turkish War of 1922, GS speakers migrated to Pehčevo in Eastern Macedonia, where the dialect was extensively documented in the early 1950s. The dialect became extinct soon after. The Serbian population in Pehčevo has been recently reported to have switched to Standard BCMS (Pavlović 2018).

The GS data used in this paper come from a comprehensive descriptive grammar of the dialect by Pavle Ivić (Ivić 1957). Ivić collected the data during two field trips to Pehčevo in the early 1950s, primarily from older individuals who had lived in Bayramiç before the migration. Younger generations, born in Pehčevo after the relocation, were reportedly not fully fluent in GS during Ivić’s field trips due to exposure to Standard BCMS and Macedonian. The data were obtained from two sources: narration (legends and folk stories) and spontaneous dialogues between GS speakers, recorded by Ivić. No data were collected through targeted elicitation.

Ivić transcribed and annotated the recorded data with pitch accent markings. Some of these transcribed texts, with accentual information, were published as an appendix to Ivić's grammar (Ivić 1957: 439–465). This prosodically annotated corpus is the primary source of data for this study.

2.2 Consonants

The consonant inventory of GS is presented in **Table 1**.

	labial	dental	alveolar	postalveolar	palatal	velar
stop	p b	t̪ d̪				k g
fricative	f v		s z	ʃ ʒ		x
affricate		t̪s d̪z		ʧ ʤ ʨ ʥ		
nasal	m		n		ɲ	(ŋ)
lateral			l		ʎ	
trill			r			
glide					j	

Table 1: GS consonant inventory.

Although the consonant inventory of GS appears to only minimally diverge from that of Standard BCMS (on which see Morén 2006), the GS consonant system has undergone substantial changes. The voiceless velar fricative [x] and the palatal lateral approximant [ʎ], both part of the Standard BCMS consonant inventory, were lost historically in GS. These segments were later reintroduced through contact with Greek and are restricted to Greek loanwords in Ivić (1957)'s data. Under the influence of neighboring Greek dialects, GS neutralized the contrast between dental/alveolar and postalveolar fricatives and affricates, which led to the elimination of the postalveolar series ([ʃ], [ʒ], [ʧ], [ʤ]). Following the community's migration to Macedonia and subsequent exposure to Standard BCMS and Macedonian, some speakers began to partially restore this contrast. This partial restoration led to variation in the realization of coronal fricatives and affricates in the dialect (Ivić 1957: 131–134).

2.3 Vowels and word prosody

GS features seven vowel segments and the syllabic sonorant [r̩]. The dialect's vowel inventory is presented in **Figure 1**.

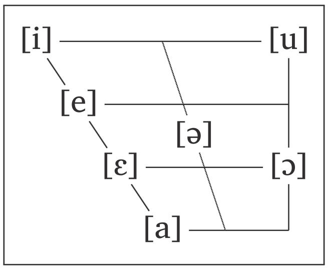


Figure 1: GS vowel inventory (Ivić 1957: 41–79).

The central vowel [ə] occurs exclusively in Turkish loanwords (Ivić 1957: 76–77). GS differs from Standard BCMS in that it contrasts two mid front vowels: [e] and [ɛ]. Short mid vowels /ɛ/, /e/, and /ɔ/ optionally raise to their high counterparts [i], [u] in unstressed syllables (3).[1]

(3) Optional vowel raising

a.	/vɛ.ʧɛ́.ru/	‘dinner.ACC.SG’	[vɛ.ˈʧɛ́.ru]	(439)
			[vi.ˈʧɛ́.ru]	(441)
b.	/de.vɔ́ɔj.ka/	‘girl.NOM.SG’	[de.ˈvɔ́ɔj.ka]	(441)
			[di.ˈvɔ́ɔj.ka]	(61)
c.	/vɔ.dɛ́ɛ/	‘water.GEN.SG’	[vɔ.ˈdɛ́]	(34)
			[vu.ˈdɛ́]	(89)
d.	/ɔd.nɛ.sɛ́ɛm/	‘carry.away.PRS.1SG’	[ɔd.nɛ.ˈsɛ́ɛm]	(48)
			[ud.ni.ˈsɛ́ɛm]	(90)

All vowels, along with [r̩], can be short and long. Vowel length is contrastive in stressed and post-tonic syllables, as well as in syllables immediately preceding stress. In pre-tonic syllables not adjacent to stress, only short vowels are allowed.

GS is a pitch accent variety. Following Inkelas & Zec (1988); Zec (1999); Zec & Zsiga (2010), GS pitch accents represent combinations of two prosodic features: stress and tone. The dialect distinguishes between two types of accented vowels: falling-accented vowels, which can be short ([à]) and long ([â]), and rising-accented vowels ([á]), which are invariably long. BCMS falling accents feature a pitch peak (i.e. High tone) at the onset of the stressed vowel, while rising-accented vowels are characterized by a pitch plateau, followed by a High tone on the post-tonic syllable (Zsiga & Zec 2013; Zec & Zsiga 2022).

Given that GS is an extinct dialect, instrumental data for its pitch accents are unavailable. As the best approximation, data were collected from another Old Štokavian variety—the Kosovo-Resava dialect (BCMS *kosovsko-resavski*), one of GS's closest relatives. The Kosovo-Resava dialect

[1] Hereafter, numbers in parentheses indicate the page number in Ivić (1957) where the form is attested.

shares the same word-prosodic inventory as GS, with short falling, long falling, and rising accents, and exhibits identical distributional restrictions: The long falling accent is unrestricted, the short falling accent is limited to non-final syllables, whereas the rising accent is restricted to the penult (Ivić 1958; 1985).

Figure 2 displays representative pitch tracks for the three pitch accents in Old Štokavian.[2] The data show clear F0 peaks (i.e. High tones) on the stressed syllable in the falling accents, and on the post-tonic syllable in the rising accent. Thus, the acoustic realization of the falling-rising contrast in Old Štokavian parallels the Neoštokavian dialects of BCMS, which have been studied more extensively (Lehiste & Ivić 1986; Zsiga & Zec 2013).

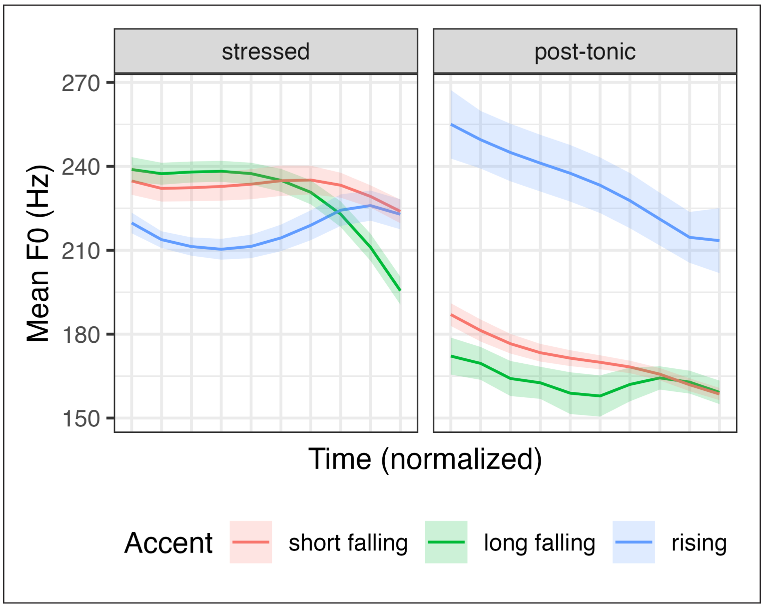


Figure 2: Mean F0 (Hz) trajectories for stressed (left) and post-tonic (right) vowels by pitch accent (short falling, long falling, rising). Time is normalized to 10 equidistant points from vowel onset to offset. Ribbons represent 95% confidence intervals.

Ivić (1957) uses traditional BCMS pitch accent notation to mark stress and tone. Throughout this paper, I adopt a more reader-friendly IPA-based notation in which stress and tone are rendered as separate entities. I mark High tone and leave all non-High-toned moras tonally unmarked. Example (4) shows how Ivić (1957)'s pitch accent notation translates into IPA.

[2] Mean pitch contours in **Figure 2** are based on F0 measurements taken at 10 equidistant time points in each vowel. F0 values were extracted in Praat (Boersma & Weenink 2025) using the `measure_f0` script by Jessamyn Schertz. The data were analyzed in R (R Core Team 2023). Recordings were made at a sampling rate of 44.1 kHz (mono) by a 24-year-old female speaker from Jagodina, Central Serbia. The dataset comprises 138 items in total (long falling disyllabic: 22; long falling trisyllabic: 23; rising disyllabic: 21; rising trisyllabic: 23; short falling disyllabic: 27; short falling trisyllabic: 22), which were elicited using the carrier sentence *Reci [target word] sad.* (‘Say [target word] now.’).

(4) a. Short falling
kȑava [ˈkrá.va] ‘cow.NOM.SG’
b. Long falling
sûnce [ˈsúun.tsɛ] ‘sun.NOM.SG’
c. (Long) rising
rúka [ˈruu.ká] ‘arm.NOM.SG’

In addition to pitch accent (i.e. stress and tone) information, Ivić’s prosodic annotations indicate which accent-bearing words clitics adjoin to. Ivić consistently used the undertie symbol (‿) to link clitic forms to their hosts (5). This information is particularly important because clitics play a central role in the present study.

(5) a. Proclitic
pȁdne u‿gróbu [ˈpád.nɛ u = ˈgrɔɔ.bú] (459) ‘He fell in the grave.’
b. Enclitic
jâ‿je zakŕpi [ˈjáa = jɛ za.ˈkr̩r̩.pí] (456) ‘I patched it up.’

3 Stress, vowel length, and opacity in GS

3.1 Tone, stress, and weight

GS is a restricted tone system (in the sense of Hyman 2006) characterized by tonal privativity, culminativity, and obligatoriness (6).

(6) GS tone
a. PRIVATIVITY: GS displays a two-way contrast between High-toned and toneless moras.[3]
b. CULMINATIVITY: GS prohibits multiple Highs in the same word domain: Only one mora per word can bear a High, while all other moras lack tone.
c. OBLIGATORINESS: GS requires that each content word surface with exactly one High-toned mora. Underlyingly toneless forms receive a High on the initial mora by default (17)–(18).

In line with (6), configurations (7a)–(7b) are well-formed in GS. By contrast, configurations that lack High tone (7c) or display a High spanning over multiple moras (7d) constitute impermissible surface representations in the dialect.

[3] For arguments that the mora rather than the syllable functions as the tone-bearing unit in BCMS, see Zsiga & Zec (2013: 101).

(7) a. [pá.ta]
b. [pa.tá]
c. *[pa.ta]
d. *[pá.tá]

High tone is restricted to the first mora of a syllable (8a)–(8b). Forms with a High on the second mora of a heavy syllable are prohibited (8c), as in most other Štokavian dialects of BCMS (Ivić 1958; Inkelas & Zec 1988).

(8) a. [pá.ta]
b. [páa.ta]
c. *[paá.ta]

GS exhibits unbounded tone-driven stress. High tone consistently attracts stress, irrespective of syllable weight (9). This is particularly evident in (9c)–(9d), where stress falls on light High-toned syllables, leaving toneless heavies unstressed.

(9)	a.	/mé.sɛ.ʧi.na/	[ˈmé.sɛ.ʧi.na]	‘moonlight.NOM.SG’	(55)
	b.	/pɔ.kva.rí.la/	[pu.kva.ˈrí.la]	‘spoil.PTCP.PST.F.SG’	(47)
	c.	/ɔ́.blaa.ki/	[ˈɔ́.blaa.ki]	‘cloud.NOM.PL’	(37)
	d.	/kaan.dí.sa.la/	[kaan.ˈdí.sa.la]	‘agree.PTCP.PST.F.SG’	(452)
	e.	/de.vɔ́ɔj.ka/	[di.ˈvɔ́ɔj.ka]	‘girl.NOM.SG’	(61)
	f.	/u.bɔ.dɛ́ɛʃ/	[u.bɔ.ˈdɛ́ɛʃ]	‘stab.PRS.2SG’	(26)
	g.	/ju.náak/	[ju.ˈnáak]	‘hero.NOM.SG’	(26)
	h.	/braa.dɔ́ɔm/	[braa.ˈdɔ́ɔm]	‘beard.INS.SG’	(26)
	i.	/u.kraa.dɛ́ɛ.mɔ/	[u.kraa.ˈdɛ́ɛ.mɔ]	‘steal.PRS.1PL’	(26)

The only exception from (9) stems from nonfinality: Stress cannot be assigned to final light syllables in GS. If a final light is High-toned, stress falls on the toneless penult (10a)–(10b). In contrast to final lights, High-toned final heavies regularly receive stress (9f)–(9h). Both CV (10) and CVC (11) High-toned ultimas are unstressable, which indicates that final consonants do not contribute weight in the dialect.

(10)	a.	/glaa.vá/	[ˈglaa.vá]	‘head.NOM.SG’	(27)
	b.	/lee.pɔ́/	[ˈlee.pɔ́]	‘nicely’	(91)
	c.	/rɛɛk.ní/	[ˈrɛɛk.ní]	‘say.IMP.2SG’	(28)
	d.	/pɔ.tuuk.lí/	[pu.ˈtuuk.lí]	‘fight.PTCP.PST.M.PL’	(27)

(11)	a.	/nii.sám/	[ˈnii.sám]	‘not.be.PRS.1SG’	(69)
	b.	/jaa.rám/	[ˈjaa.rám]	‘yoke.NOM.SG’	(27)
	c.	/ʒɛ.raa.ták/	[ʒɛ.ˈraa.ták]	‘ember.NOM.SG’	(46)
	d.	/kr̩.ʧaa.gɔ́m/	[kr̩.ˈʦaa.gɔ́m]	‘pot.INS.SG’	(27)

Whereas final High-toned lights are unstressable in (10)–(11), they regularly receive stress in enclisis (12). This results in a productive alternation between penultimate and final stress.

(12)	a.	/glaa.vá/	[glaa.ˈvá = jɛ]	‘head.NOM.SG = is’	(308)
	b.	/lee.pɔ́/	[lee.ˈpɔ́ = mi]	‘nice(ly) = me’	(200)
	c.	/rɛɛk.ní/	[rɛɛk.ˈní = mu]	‘tell.IMP.2SG = him’	(396)
	d.	/pɔ.tuuk.lí/	[pu.tuuk.ˈlí = sɛ]	‘fight.PTCP.PST.M.PL = REFL’	(27)
	e.	/nii.sám/	[nii.ˈsám = sɛ]	‘not.be.PRS.1SG = REFL’	(69)
	f.	/jaa.rám/	[jaa.ˈrám = sɛ]	‘yoke.NOM.SG = REFL’	(27)
	g.	/ʒɛ.raa.ták/	[ʒɛ.raa.ˈták = jɛ]	‘ember.NOM.SG = is’	(27)
	h.	/kr̩.ʧaa.gɔ́m/	[kr̩.ʦaa.ˈgɔ́m = ga]	‘pot.INS.SG = him’	(27)

When stressed, underlyingly light toneless penults undergo vowel lengthening (13).[4] The underlying quantity of lengthened vowels is preserved in unstressed position. Unstressed heavies do not shorten in GS (9c)–(9d), (9h)–(9i), which indicates that the alternation in (13)–(14) results from lengthening in stressed position rather than shortening in unstressed position.

(13)	a.	/ɔ.mí/	[ˈɔɔ.mí]	‘wash.AOR.1SG’	(101)
	b.	/ɔ.ríz/	[ˈɔɔ.rís]	‘rice.NOM.SG’	(135)
	c.	/stɔ.já/	[ˈstɔɔ.já]	‘stand.AOR.1SG’	(292)
	d.	/vɔ.dá/	[ˈvɔɔ.dá]	‘water.NOM.SG’	(28)
	e.	/ja.stə́k/	[ˈjaa.stə́k]	‘pillow.NOM.SG’	(77)

(14)	a.	/ɔ.mí/	[ɔ.ˈmí = ga]	‘wash.IMP.2SG = it’	(277)
	b.	/ɔ.rí.za/	[ɔ.ˈrí.za]	‘rice.GEN.SG’	(135)
	c.	/stɔ.já.vɔ/	[stu.ˈjá.vɔ]	‘stand.PTCP.PST.M.SG’	(85)
	d.	/vɔ.dɔ́ɔm/	[vɔ.ˈdɔ́ɔm]	‘water.INS.SG’	(214)
	e.	/ja.stə́.ka/	[ja.ˈstə́.ka]	‘pillow.GEN.SG’	(77)

Additional evidence for the productivity of nonfinality and penultimate lengthening comes from prosodic adaptation of Turkish loanwords. Word-final prominence in the donor language has been reinterpreted as a lexical High in GS. As in the native lexicon, final High-toned lights in Turkish loanwords are unstressable, repelling stress to the penultimate syllable

[4] See Milenković (to appear) for the driving force behind penultimate vowel lengthening.

(15). If the penult is underlyingly light, as (16) shows for the items in (15), it undergoes vowel lengthening.

(15)	a.	/ʧar.ʃáf/ < Tu. çarşav	[ˈʧaar.ʃáf]	‘sheet.NOM.SG’	(364)
	b.	/ja.stə́k/ < Tu. yastık	[ˈjaa.stə́k]	‘pillow.NOM.SG’	(367)

(16)	a.	/ʧar.ʃá.fa/	[ʧar.ˈʃá.fa]	‘sheet.GEN.SG’	(130)
	b.	/ja.stə́.ka/	[ja.ˈstə́.ka]	‘pillow.GEN.SG’	(77)

In (17)–(18), stress and High tone alternate between the word-initial syllable and the proclitic. Forms that exhibit this alternation are underlyingly toneless and receive initial prominence by default (Inkelas & Zec 1988; Zec & Zsiga 2010).

(17)	a.	/gɔ.sti/	[ˈgɔ́.sti]	‘guest.ACC.PL’	(171)
	b.	/pa.mɛɛ.ti/	[ˈpá.mɛɛ.ti]	‘mind.GEN.SG’	(464)
	c.	/pr̥.bɛ.se.di/	[ˈpŕ̥.bi.si.di]	‘speak.AOR.2/3SG’	(83)
	d.	/straa.nu/	[ˈstráa.nu]	‘side.ACC.SG’	(36)
	e.	/glaa.vu/	[ˈgláa.vu]	‘head.ACC.SG’	(89)

(18)	a.	/gɔ.sti/	[ˈná = gɔ.sti]	‘on = guest.ACC.PL’	(36)
	b.	/pa.mɛɛ.ti/	[ˈbɛ́s = pa.mɛɛ.ti]	‘without = mind.GEN.SG’	(36)
	c.	/pr̥.bɛ.se.di/	[ˈnɛ́ = pr̥.bi.si.di]	‘not = speak.AOR.2/3SG’	(465)
	d.	/straa.nu/	[ˈná = straa.nu]	‘on = side.ACC.SG’	(36)
	e.	/glaa.vu/	[ˈná = glaa.vu]	‘on = head.ACC.SG’	(36)

By contrast, forms with an initial lexical High do not display stress alternation in proclisis (19)–(20).

(19)	a.	/drú.gɔ/	[ˈdrú.gɔ]	‘another.ACC.SG.N’	(453)
	b.	/jɔ́.bu/	[ˈjɔ́.bu]	‘both’	(454)
	c.	/má.mɛɛ/	[ˈmá.mɛ]	‘mother.GEN.SG’	(81)
	d.	/svád.bu/	[ˈsvád.bu]	‘wedding.ACC.SG’	(441)

(20)	a.	/drú.gɔ/	[na = ˈdrú.gɔ]	‘on = another.ACC.SG.N’	(451)
	b.	/jɔ́.bu/	[du = ˈjɔ́.bu]	‘from = both’	(453)
	c.	/má.mɛɛ/	[du = ˈmá.mɛ]	‘from = mother.GEN.SG’	(334)
	d.	/svád.bu/	[za = ˈsvád.bu]	‘for = wedding.ACC.SG’	(348)

Both proclitics and enclitics are part of the stress domain in GS, given that Stress Assignment is sensitive to their presence (12)–(18). This indicates that in GS, the stress domain comprises the morphological word and the clitics hosted by it, i.e. the Clitic Group.

In sum, GS assigns stress to the High-toned syllable unless the High-toned syllable is light and final. In the absence of a lexical High, stress defaults to the initial syllable of the stress domain. The GS stress rule is summarized in (21).

(21) GS stress rule

a. Stress the syllable that contains the only High-toned mora of the stress domain.
b. Stress the penult if the High-toned mora is the rightmost mora of the stress domain.
c. Else stress the initial syllable.

3.2 Final Shortening

Long vowels shorten word-finally in GS (Ivić 1957: 33–35). The process is defined using SPE-style rule formalism in (22).

(22) Final Shortening

$$\begin{bmatrix} +\text{syllabic} \\ +\text{long} \end{bmatrix} \rightarrow \begin{bmatrix} -\text{long} \end{bmatrix} \; / \underline{\quad}\#$$

Final Shortening is observed in both monosyllabic (23a)–(23d) and polysyllabic forms (23e)–(23f).

(23)	a.	/jáa/	[ˈjá]	‘1SG.NOM’	(33)
	b.	/tríi/	[ˈtrí]	‘three.NOM’	(33)
	c.	/spíi/	[ˈspí]	‘sleep.PRS.3SG’	(33)
	d.	/jée/	[ˈjé]	‘eat.PRS.3SG’	(33)
	e.	/glɛ́.daa/	[ˈglɛ́.da]	‘watch.PRS.3SG’	(308)
	f.	/í.maa/	[ˈí.ma]	‘have.PRS.3SG’	(39)

The original quantity of shortened final vowels is preserved in word-internal position, as well as in enclisis (24). The latter fact suggests that enclitics are part of the domain of application of Final Shortening.

(24)	a.	/jáa/	[ˈjáa = sam]	‘1SG.NOM = be.PRS.1SG’	(34)
	b.	/tríi/	[ˈtríi = li]	‘three.NOM = Q’	(34)
	c.	/spíi/	[ˈspíi = mi = sɛ]	‘sleep.PRS.3SG = 1SG.DAT = REFL’	(34)
	d.	/jéem/	[ˈjéem]	‘eat.PRS.1SG’	(267)
	e.	/glɛ́.daa.ju/	[ˈglɛ́.daa.ju]	‘watch.PRS.3PL’	(235)
	f.	/í.maa.mɔ/	[ˈí.maa.mɔ]	‘have.PRS.1PL’	(39)

3.3 Opaque final stress

GS assigns stress to the word's only High-toned syllable (9), except when the High-toned syllable is light and final, in which case stress falls on the penult (10)–(15). In addition, long vowels regularly shorten word-finally (23). In forms with an underlyingly long final vowel that bears a High, Stress Assignment and Final Shortening crucially interact.[5]

Final Shortening renders the ban on stressed final lights non-surface-true: High-toned final syllables that become light by the shortening of originally long final vowels bear stress on the surface. Consider the forms in (25), which display final rather than penultimate stress. This runs afoul of the transparent pattern in (10)–(11). Final lights brought about by Final Shortening are therefore treated differently from originally light High-toned ultimas, which are barred from receiving stress.

(25)	a.	/vɔ.dɛ́ɛ/	[vu.ˈdɛ́]	not *[ˈvɔɔ.dɛ́]	'water.GEN.SG'	(33)
	b.	/slat.kɔ́ɔ/	[slat.ˈkɔ́]	not *[ˈslaat.kɔ́]	'sweet.NOM.SG.N.DEF'	(363)
	c.	/ɔd.nɛ.sɛ́ɛ/	[ud.nɛ.ˈsɛ́]	not *[ud.ˈnɛɛ.sɛ́]	'carry.away.PRS.3SG'	(34)
	d.	/glaa.vɛ́ɛ/	[glaa.ˈvɛ́]	not *[ˈglaa.vɛ́]	'head.GEN.SG'	(34)
	e.	/mr̩r̩.zíi/	[mr̩r̩.ˈzí]	not *[ˈmr̩r̩.zí]	'hate.PRS.3SG'	(34)
	f.	/dɛ.snáa/	[di.ˈsná]	not *[ˈdɛɛ.sná]	'right.NOM.SG.F'	(33)

That the final vowels in (25) are underlyingly long is indicated by their realization before enclitics (26).

(26)	a.	/vɔ.dɛ́ɛ/	[vu.ˈdɛ́ɛ = mi = sɛ]	'water.GEN.SG = 1SG.DAT = REFL'	(34)
	b.	/slat.kɔ́ɔ/	[slat.ˈkɔ́ɔ = jɛ]	'sweet = be.PRS.3SG'	(364)
	c.	/ɔd.nɛ.sɛ́ɛ/	[ud.ni.ˈsɛ́ɛ = ga]	'carry.away.PRS.3SG = 3SG.N.ACC'	(34)
	d.	/glaa.vɛ́ɛ/	[glaa.ˈvɛ́ɛ = mu]	'head.GEN.SG = his'	(336)
	e.	/mr̩r̩.zíi/	[mr̩r̩.ˈzíi = ga]	'hate.PRS.3SG = 3SG.M.ACC'	(34)
	f.	/dɛ.snáa/	[di.ˈsnáa = mi]	'right.NOM.SG.F = 1SG.DAT'	(34)

Particularly instructive is the existence of minimal pairs that differ solely in the length of their final vowels at the underlying level. Since the contrast in vowel length is neutralized in final position, these items are distinguished on the surface only by stress position. Forms with an originally light final syllable (27a)–(28a) are subject to the ban on final prominence, displaying penultimate stress. By contrast, items that undergo Final Shortening (27b)–(28b) exhibit final stress, defying the prohibition against stressed final lights. If stress were assigned transparently in the latter group, the underlying contrast between the two sets of forms in (27)–(28) would be lost.

[5] Recall that Highs must be attached to the first mora of a heavy syllable (8), which makes the first mora of a final heavy syllable the only permissible position for a High.

(27)	a.	/taŋ.kɔ́/	[ˈtaaŋ.kɔ́]	‘thin.NOM.SG.N.INDF’	(362)
	b.	/taŋ.kɔ́ɔ/	[taŋ.ˈkɔ́]	‘thin.NOM.SG.N.DEF’	(362)

(28)	a.	/ʒɛ.nɛ́/	[ˈʒɛɛ.nɛ́]	‘woman.NOM.PL’	(25)
	b.	/ʒɛ.nɛ́ɛ/	[ʒɛ.ˈnɛ́]	‘woman.GEN.SG’	(39)

The original length of the final vowels in (27b)–(28b) is revealed in enclisis (29).

(29)	a.	/taŋ.kɔ́ɔ/	[taŋ.ˈkɔ́ɔ = da]	‘thin.NOM.SG.N.DEF = and’	(364)
	b.	/ʒɛ.nɛ́ɛ/	[ʒɛ.ˈnɛ́ɛ = mu]	‘woman.GEN.SG = his’	(451)

The opaque interaction between Stress Assignment and Final Shortening lends itself to a straightforward rule-based analysis (30), which makes crucial use of extrinsic process ordering. On this account, Stress Assignment applies before Final Shortening. This ordering explains why the context-changing effect of Final Shortening is invisible to stress: Final Shortening applies too late in the derivation to affect the application of Stress Assignment.

(30)	UR	/ʒɛ.nɛ́/	/ʒɛ.nɛ́ɛ/
	Stress Assignment	ˈʒɛ.nɛ́	ʒɛ.ˈnɛ́ɛ
	Penultimate Lengthening	ˈʒɛɛ.nɛ	N/A
	Final Shortening	N/A	ʒɛ.ˈnɛ́
	Surface form	[ˈʒɛɛ.nɛ́]	[ʒɛ.ˈnɛ́]
		‘woman.NOM.PL’	‘woman.GEN.SG’

The interaction in (30) is a showcase of *countershifting*, i.e. *misapplication* opacity (Rasin 2022; Pruitt 2023; Baković & Blumenfeld 2024). Countershifting occurs when a later-ordered process $\mathbb{B}$ changes the environment of an earlier-ordered process $\mathbb{A}$. Crucially, the context-changing effect of $\mathbb{B}$ happens too late to affect $\mathbb{A}$’s application. Instead, $\mathbb{B}$ renders the previously transparent environment for $\mathbb{A}$ opaque. Shifting interactions and countershifting opacity differ from more familiar interaction types, such as (counter)bleeding and (counter)feeding, in that $\mathbb{B}$ neither prevents $\mathbb{A}$ from applying nor enables its application. Rather, $\mathbb{B}$ only modifies the environment of $\mathbb{A}$. Therefore, what is at stake in (counter)shifting is not *whether or not* $\mathbb{A}$ applies, but rather *how* it applies.

In GS, Final Shortening ($\mathbb{B}$) countershifts Stress Assignment ($\mathbb{A}$). In forms like /ʒɛ.nɛ́ɛ/ (30), stress is initially assigned to the final High-toned heavy, in line with the dialect’s stress rule: Final heavies with a High-toned first mora regularly receive stress (9f)–(9h). The subsequent application of Final Shortening opacifies this hitherto transparent stress environment, causing stress to occur in a suboptimal environment—on a final light syllable—where it is otherwise avoided. Reassigning stress to the penult to eliminate this marked configuration is not possible, since Stress Assignment has already ceased to apply at the time Final Shortening applies.

4 Constraint-based analysis

4.1 Parallel OT

In this section, I present an OT analysis of the data in Section 3, identifying the active constraints and establishing their ranking.

Stress-to-tone mapping falls out from HEAD-H (Yip 2001), the markedness constraint requiring that foot-heading moras bear a High.

(31) HEAD-H
Assign a violation for every foot-heading mora not associated with a High.

Default initial stress follows from ALL-FEET-LEFT (Hyde 2012), which assigns a violation for every syllable intervening between the foot-heading syllable and the Prosodic Word's left edge. High insertion in the initial syllable of underlyingly toneless forms satisfies HEAD-H at the expense of DEP-H, which requires that every High tone in the output have an input correspondent (32).

(32)

/pa.mɛɛ.ti/	HEAD-H	ALL-FEET-LEFT	DEP-H	ALL-FEET-RIGHT
a. ☞ ˈpá.mɛɛ.ti			*	**
b. ˈpa.mɛɛ.ti	*!			**
c. pa.ˈmɛ́ɛ.ti		*!	*	*
d. pa.mɛɛ.ˈtí		*!*	*	

In non-default cases, High-toned syllables receive stress regardless of their distance relative to the Prosodic Word's left edge. This shows that HEAD-H outranks ALL-FEET-LEFT (33).

(33)

/pɔ.kva.rí.la/	HEAD-H	ALL-FEET-LEFT
a. ˈpɔ.kva.rí.la	*!	
b. ☞ pɔ.kva.ˈrí.la		**

HEAD-H also outranks WEIGHT-TO-STRESS PRINCIPLE (WSP; Prince 1990), defined in (34). This is demonstrated in (35): Compliance with HEAD-H leads to the violation of WSP.

(34) WSP
Assign a violation for every unstressed heavy syllable.

(35)

/kaan.dí.sa.la/	Head-H	All-Feet-Left	WSP
a. ☞ kaan.ˈdí.sa.la		*	*
b. ˈkaan.dí.sa.la	*!		

WSP is likewise dominated by All-Feet-Left. The two constraints clash in (36), where All-Feet-Left is satisfied at the expense of WSP.

(36)

/pa.mɛɛ.ti/	All-Feet-Left	WSP
a. ☞ ˈpá.mɛɛ.ti		*
b. pa.ˈmɛ́ɛ.ti	*!	

The moraic version of Nonfinality (Hyde 2007) explains the avoidance of final prominence. This constraint, formally defined in (37), penalizes foot-level grid marks on the rightmost mora of the Prosodic Word. Specifying final moras rather than final syllables as the locus of Nonfinality violation correctly ensures that only stressed final lights, but not stressed final heavies, are prohibited in GS.

(37) Nonfinality(x_F, μ, ω)
Assign a violation for every foot-level grid mark (x_F) that occurs over the final mora (μ) of the Prosodic Word (ω).

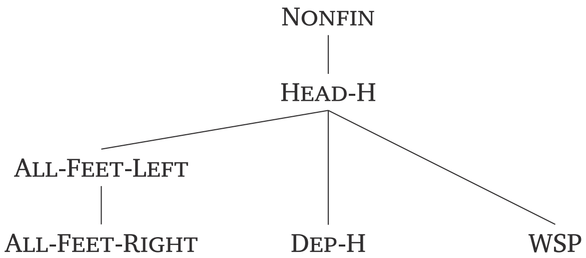
In GS, Nonfinality dominates Head-H. This follows from cases like (10)–(15), where stress falls on the toneless penult to avoid the violation of Nonfinality (38).

(38)

/ruu.ká/	Nonfin	Head-H	WSP
a. ☞ ˈruu.ká		*	
b. ruu.ˈká	*!		*

Putting the pieces together, GS stress rule emerges from the constraint hierarchy in (39).

(39)



Final Shortening is triggered by the markedness constraint *V:#, which penalizes long vowels in final position. *V:# outranks the antagonistic faithfulness constraint MAX-μ, which militates against vowel shortening (40).

(40) Final Shortening

/jáa/			*V:#	MAX-μ
a.	☞	ˈjá		*
b.		ˈjáa	*!	

The independently motivated rankings in (39)–(40) fail to capture opaque stress in Final Shortening environments. The current constraint hierarchy incorrectly selects penultimate stress as optimum for inputs with shortened final vowels. This is because the transparent contender fares better on top-ranking NONFINALITY than the intended opaque winner. The failed OT account is presented in (41).

(41)

/ruu.kɛ́ɛ/			NONFIN	*V:#	HEAD-H	MAX-μ
a.		ruu.ˈkɛ́ɛ		*!		
b.	☹	ruu.ˈkɛ́	*!			*
c.	💣	ˈruu.kɛ́			*	*

For the intended winner with final prominence to prevail against its transparent contender, HEAD-H has to dominate NONFINALITY. This is at variance with (38). The two patterns are therefore irreconcilable, requiring conflicting rankings of NONFINALITY and HEAD-H.

4.2 Stratal OT

The upshot of the rule-based analysis, summarized in (42), is that Stress Assignment must apply before Final Shortening. This ensures that the context-changing effect of Final Shortening is invisible to Stress Assignment, which results in opaque final stress in forms like (10)–(15).

(42) Rule-based analysis
Stress Assignment, the opacified process, applies before Final Shortening, the opacifying process.

RBP models opacity using extrinsic process ordering, stipulated in the phonological grammar. RBP therefore offers a unified account of opaque process interactions, deriving all instances of this phenomenon from a purely phonological device—extrinsic process ordering, although the picture may be more complicated (see Baković 2007; 2011).

By contrast, Stratal OT (Kiparsky 2000; 2015; Bermúdez-Otero 1999; 2003) directly links phonological opacity to morphosyntactic structure. This multi-level derivational framework retains the parallel architecture of classical OT but assumes that phonology operates across multiple serially ordered domains—strata. Each stratum constitutes a parallel OT grammar with its own constraint ranking. Most versions of Stratal OT posit three strata in the phonological grammar: the Stem, Word, and Phrase strata.

The multi-level architecture enables Stratal OT to replicate RBP's analysis of opacity without recourse to extrinsic ordering. The output of each non-terminal stratum is fed back to the phonological grammar as the input to the next stratum. This cyclic mechanism ensures that opaquely interacting processes are crucially ordered by virtue of their stratal affiliation.

A key property of Stratal OT (at least some versions of it) is the principle of *stratum-internal transparency* (Bermúdez-Otero 2003; Kiparsky 2000; 2015), which holds that input-output mappings are transparent within each stratum (43).

(43) Stratum-internal transparency
Phonological processes that apply in the same stratum interact transparently.

Each stratum of phonology, being a parallel OT grammar, selects a transparent winner as its optimal output. However, the transparent output of a non-terminal stratum can become opaque at later strata. For example, a word-level process applies before, and can consequently be opacified by, a postlexical process. Between-stratum ordering obviates the need for RBP-style extrinsic process ordering.

Some proponents of Stratal OT maintain the strict version of (43), according to which opacity only arises between processes that apply at different levels. As a corollary, between-stratum process ordering is argued to be the only possible source of phonological opacity (Kiparsky 2015). This view has been challenged by more recent work in Stratal OT, which adopts a less restrictive perspective on the sources of opacity (Bermúdez-Otero 2019).

Stratal OT sidesteps the ranking paradox encountered by the failed parallel OT account in (41), where no self-consistent constraint grammar could be found which outputs both transparent and opaque stress in GS. In Stratal OT, Stress Assignment and Final Shortening need not apply in the same stratum of GS phonology. Both processes can be transparent in their respective strata, with opacity emerging from their stratal affiliation.

For Stress Assignment to be transparent in the output of its stratum, Final Shortening must be inhibited at the level at which stress is assigned, which I tentatively label Stratum 1. Thus, the shortening-inducing markedness constraint *V:# ranks below MAX-μ in Stratum 1 (44). Top-ranking MAX-μ knocks out both candidates with shortened final vowels in (44). Stress falls on the final heavy, consistent with (9f)–(9h).

(44) Stratum 1: Stress Assignment

/ruu.kέε/		MAX-μ	NONFIN	HEAD-H	*V:#
a. ☞	ruu.ˈkέε				*
b.	ruu.ˈkέ	*!	*!		
c.	ˈruu.kέ	*!		*	

Subsequently, in Stratum 2, *V:# gets promoted over MAX-μ, which gives rise to Final Shortening. Opaque stress could be avoided by stress retraction. However, the winner of Stratum 2 retains the stress position established in Stratum 1, in compliance with the NOFLOP constraint (Alderete 1999):

(45) NOFLOP$_{\text{stress}}$
Assign a violation for every output stress whose surface position differs from its input position.

NOFLOP$_{\text{stress}}$ dominates NONFINALITY, which inhibits stress retraction. Constraint grammar (46) selects the opaque form as the winner.

(46) Stratum 2: Final Shortening

/ruu.ˈkέε/		*V:#	NOFLOP	NONFIN	MAX-μ	HEAD-H
a.	ruu.ˈkέε	*!				
b. ☞	ruu.ˈkέ			*	*	
c.	ˈruu.kε		*!		*	*

Taking stock, the gist of the Stratal OT analysis of GS opaque stress is that Stress Assignment and Final Shortening must be assigned to separate stratal domains. In the version of Stratal OT that assumes universal transparency within strata, opacity is not attributed to a purely phonological mechanism, being treated as an epiphenomenon of phonology–morphosyntax interleaving. This approach makes a strong prediction about opacity: Stratum-internal opaque interactions should not exist (Kiparsky 2015). Whereas Kiparsky (2015) demonstrates that many oft-quoted cases of within-stratum opacity actually involve between-stratum processes interactions, ample evidence has emerged for the existence of within-stratum opacity (Kavitskaya & Staroverov 2010; Broś 2016; Broś & Nazarov 2023; Stanton 2023; Obiri-Yeboah & Rasin 2025). The remainder of this paper tests whether stratum-internal transparency in its strongest form withstands the empirical challenge posed by countershifting opacity in GS.

5 Domain stratification in GS

The Stratal OT account in Section 4.2 requires that Stress Assignment applies in a stratum ordered before that of Final Shortening (44)–(46). In this section, I show that the position of stress is unaffected by phrase-level cliticization, and that Final Shortening is counterfed by postlexical deletion of final consonants. These interactions suggest that the latest instances of both Stress Assignment and Final Shortening must occur before postlexical phonology. Meanwhile, both processes operate in a domain larger than the regular word domain. I explore procedural and representational analyses of this intermediate status of the Stress Assignment/Final Shortening domain. I ultimately demonstrate that neither account is able to dispense with stratum-internal opacity in GS.

5.1 Strong and weak pronouns and domain of Stress Assignment

In Section 3.1, it has been established that both proclitics and enclitics affect the position of stress. Two pieces of evidence support this: (i) proclitics bear stress when the host lacks a High-toned mora (18), and (ii) enclitics trigger stress alternations in words with final High-toned light syllables (10)–(12).

The stress domain in GS corresponds to the Clitic Group. However, not all clitic forms affect the position of stress. A subset of pronominal enclitics resists shifting stress onto the host's final syllable, defying the pattern in (12):

(47)	/nii.sám/	[ˈnii.sám = ja]	'not.be.PRS.1SG = 1SG.NOM'	(457)

In (47), stress falls on the toneless penult in enclisis, contrary to (12). This discrepancy follows from the fact that GS distinguishes between inherently clitic forms and forms that become prosodically deficient in the course of derivation. This distinction sheds further light on process ordering in GS phonology.

GS distinguishes between strong and weak personal pronouns. Strong pronouns are minimally bimoraic and contain a lexical High, thereby behaving like content words: They form a Prosodic Word and receive stress. Meanwhile, weak pronouns are monomoraic and lack a High. Due to the prosodic minimality constraints in BCMS (Zec 1999), weak pronouns cannot form permissible Prosodic Words and receive stress, thereby being enclitic.

All case forms of personal pronouns have strong variants. Only the genitive, dative and accusative forms also have weak variants (Ivić 1957: 199–205) (**Table 2**).[6]

Strong pronouns with an underlyingly long final vowel surface faithfully in enclisis (48a) and otherwise undergo Final Shortening (48b).

[6] See Franks & King 2000; Zec 2005 for background on BCMS clitics.

	1SG		**2SG**		**3SG.M**		**3SG.F**	
	strong	**weak**	**strong**	**weak**	**strong**	**weak**	**strong**	**weak**
NOM	jáa		tíi		ɔ́ɔn		ɔ.ná	
GEN	mi.nɛ́ɛ	mi	ti.bɛ́ɛ	ti	ɲi.gáa	ga	ɲɛ́ɛ	jɛ
DAT	mi.nɛ́ɛ	mi	ti.bɛ́ɛ	ti	ɲɛ.múu	mu	ɲɔ́ɔj	jɛ
ACC	mi.nɛ́ɛ	mi	ti.bɛ́ɛ	ti	ɲi.gáa	ga	ɲúu	jɛ
INS	mɔ́ɔm		tu.bɔ́ɔm		ɲíim		ɲɔ́ɔm	
	1PL		**2PL**		**3PL.M**		**3PL.F**	
	strong	**weak**	**strong**	**weak**	**strong**	**weak**	**strong**	**weak**
NOM	míi		víi		ɔ.ní		ɔ.nɛ́	
GEN	náas	ni	váas	vi	ɲíi	(j)i	ɲíi	(j)i
DAT	ná.ma	ni	vá.ma	vi	ɲí.ma	(j)i	ɲí.ma	(j)i
ACC	náas	ni	váas	vi	ɲíi	(j)i	ɲíi	(j)i
INS	ná.ma		vá.ma		ɲí.ma		ɲí.ma	

Table 2: Personal pronouns in GS (with Final Shortening undone).

(48) Regular prosodic behavior of strong pronouns

a. ˈ**jáa** =ʨɛm nu.ˈʨá.skɛ da= ˈdɔ́ɔ.ʥɛm
1SG.NOM =will.1SG tonight that= come.PRS.1SG
'I will come tonight.' (455)

b. ˈmɔ́.ʒɛm ˈ**já** da= sɛ= u.ˈspíim
can.PRS.1SG 1SG.NOM that= REFL= fall.asleep.PRS.1SG
'I could fall asleep.' (455)

Looping back to (47), note that the 1SG.NOM personal pronoun does not have a weak variant. However, in (47), this form functions as an enclitic. Unlike inherently clitic forms (12), the enclitic in (47) is stress-neutral. This distinction suggests that GS treats "real", i.e. inherently weak pronouns, differently from "contextual", or derived clitics.

Derived clitics (47) include pronouns that are originally strong but become prosodically deficient by an optional deaccentuation process. Strong pronouns can optionally lose their pitch accent (stress and tone), under circumstances that are beyond the scope of this paper. Without stress and tone, the defining attributes of prosodic wordhood in GS, deaccented pronouns cannot function as standalone Prosodic Words. Consequently, they must cliticize to a neighboring accent-bearing word.

Derived clitics can be either proclitic or enclitic. Encliticization is the default strategy, whereas procliticization occurs only when a deaccented pronoun is CP-initial because no clausemate host is available to its left (49).

(49) a.

ja =	ʃɔ =	sam =	u.glaad.ˈní.vɔ
1SG.NOM =	why =	be.PRS.1SG =	get.hungry.PTCP.PST.M.SG

‘[Ask me] why I got hungry.’ (454)

b.

mi =	ti.ˈbɛ́	nii.ˈsmɔ	= sɛ	na.smi.ˈjá.li
1PL.NOM =	2SG.DAT	not.be.PRS.1PL	= REFL	laugh.PTCP.PST.M.PL

‘We did not laugh at you.’ (449)

Example (50) shows a clear prosodic difference between inherent and derived clitics. Inherently clitic (i.e. weak) pronouns are visible to stress: They enable word-final High-toned lights to bear stress, as shown in (12). Contrastingly, derived clitics (i.e. deaccented strong pronouns) do not affect the position of stress in their hosts (50).

(50) a.

ˈnii.sám	= **ja**	ta.ˈlí.kɔ	tɛ.ˈvɛɛ.kɛ́l
not.be.PRS.1SG	= 1SG.NOM	that.much	fool

‘I am not that big a fool.’ (457)

b.

ˈnii.sí	= **ti**	ˈbɔ́.gɔm	bɛ.ˈsé.di.ʋɔ
not.be.PRS.2SG	= 2SG.NOM	god.INS.SG	talk.PTCP.PST.M.SG

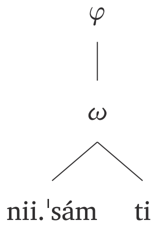
‘You have not talked to god.’ (457)

Regular cliticization, which applies to inherent clitics, precedes Stress Assignment. This explains why inherent clitics are part of the stress domain. Secondary cliticization, which targets deaccented strong pronouns, applies after Stress Assignment. This leaves derived clitics outside the stress domain. This ordering accounts for the stress neutrality of derived clitics.

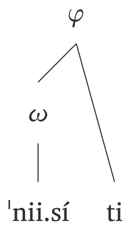
Secondary cliticization is relevant to the analysis of opaque stress because it provides evidence for the ordering of Stress Assignment relative to postlexical processes. Although the exact conditions for the deaccentuation of strong pronouns remain unclear, the process is evidently linked to information structure and sentence-level prosody, which suggests that deaccentuation is postlexical. Deaccentuation feeds secondary cliticization, the output of which is inaccessible to Stress Assignment because stress has already been assigned in an earlier phonological domain.

The stress domain encompasses the morphological word and any inherent clitics it hosts, i.e. the Clitic Group. Secondary clitics are incorporated into a larger structure, thereby being external to the stress domain. The different behavior of inherent and derived clitics therefore stems from their adjunction height. Stress-shifting, inherent clitics are word-level clitics, adjoining to the Prosodic Word domain (51a). Stress-neutral, derived clitics are phrase-level clitics which attach to the Prosodic Phrase (φ) node (51b). Phrase-level clitics thus constitute *free clitics* (Selkirk 1996; Anderson 2005).

(51) a. Word-level clitics

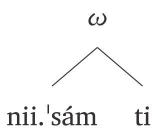


b. Phrase-level clitics

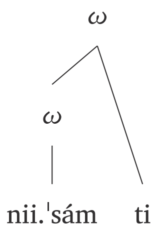


Inherent clitics can be analyzed in two ways. Under the *internal clitic* analysis (52a), inherent clitics attach directly to the ω-node projected by their host and are therefore internal to the lowest ω-projection. Alternatively, under the *affixal clitic* analysis, clitic-host combinations form a recursive ω-structure (52b).

(52) a. Internal clitic



b. Affixal clitic



The data presented thus far are indeterminate between (52a) and (52b). I present evidence in favor of (52b) in Section 5.3.1.

In sum, inherently clitic forms in GS differ from forms that become prosodically deficient in the course of derivation. Inherent clitics undergo word-level cliticization, which precedes Stress Assignment, and are therefore visible to stress. Derived clitics undergo phrase-level cliticization, which takes place after Stress Assignment, and are therefore invisible to stress.

Crucially, this distinction provides evidence for the ordering of Stress Assignment relative to postlexical processes: It shows that Stress Assignment is pre-postlexical, given its “blindness” to context-changing effects in postlexical phonology.

5.2 Domain of Final Shortening

Final Shortening is sensitive to regular, word-level clitics, as evidenced by (24). That is, word-level enclitics are part of the domain of Final Shortening.[7]

The available evidence suggests that Final Shortening is word-bound. Word-final long vowels shorten phrase-internally in (53). The data in (54) illustrate faithful realization in enclisis in similar phrasal environments.

(53) a. di.ˈsná ˈruu.ká
right.NOM.SG.F arm.NOM.SG
‘right arm’ (33)

b. slat.ˈkɔ́ ˈmá.slɔ
sweet.NOM.SG.N butter.NOM.SG
‘sweet butter’ (33)

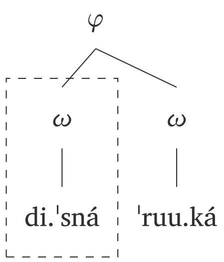
(54) a. di.ˈsnáa =mi ˈruu.ká
right.NOM.SG.F =my arm.NOM.SG
‘my right arm’ (34)

b. slat.ˈkɔ́ɔ =jɛ
sweet.NOM.SG.N =is
‘It is sweet.’ (364)

Conspicuously, Final Shortening applies to the same domain as Stress Assignment: the Clitic Group, i.e. the topmost projection of the ω-domain (55) (the Final Shortening domain is delimited by dashed rectangles).

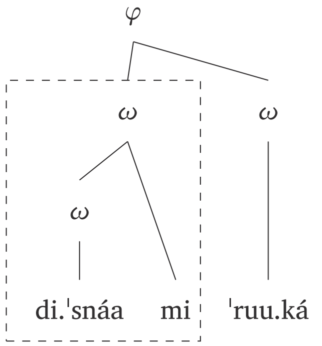
(55) Final Shortening domain

a. [di.ˈsná ˈruu.ká] (53a)



[7] No conclusive evidence is available for the relationship between Final Shortening and phrase-level cliticization in GS, as I have not been able to identify any cases where a word with an underlyingly long final vowel hosts a deaccented pronoun in Ivić (1957).

b. [di.ˈsnáa = mi ˈruu.ká] (54a)



Consistent with this finding is the fact that Final Shortening interacts opaquely with a postlexical consonant deletion process. In GS, stops and fricatives delete before a homorganic obstruent, modulo fricative-stop clusters such as [st] (Ivić 1957: 143). Homorganic Cluster Simplification (56) applies at multiple phonological levels: word-internally, i.e. at morpheme boundaries (57), at clitic-host boundaries (58), and across word boundaries (59).[8]

(56) Homorganic Cluster Simplification

$$\begin{bmatrix}\text{–sonorant}\\ \alpha\text{place}\end{bmatrix} \rightarrow \emptyset \;/\; \underline{\quad} \begin{Bmatrix}+\\ =\\ \#\end{Bmatrix} \begin{bmatrix}\text{–sonorant}\\ \alpha\text{place}\end{bmatrix}$$

where ‘+’ = morpheme boundary, ‘=’ = clitic-host boundary, ‘#’ = word boundary.

(57)	a.		/iz-ʦée.dii/	[i.ˈʦée.di]	‘squeeze.PRS.3SG’	(143)
	b.		/iz-ʧɛ́.ʃjaa/	[i.ˈʧɛ́.ʃja]	‘comb.PRS.3SG’	(143)
	c.	cf.	/iz-plɛ.tɛ́ɛm/	[is.pli.ˈtɛ́ɛm]	‘knit.PRS.1SG’	(450)
(58)	a.		/sád/	[ˈsá = su]	‘now = be.PRS.3PL’	(143)
		cf.	/sád/	[ˈsád = ga]	‘now = 3SG.N.ACC’	(159)
	b.		/kɛt/	[kɛ = za.pɔ.ˈkɔ́.ʃɛ]	‘when = start.AOR.3PL’	(461)
		cf.	/kɛt/	[kɛt = ˈjéeʃ]	‘when = eat.PRS.2SG’	(460)
(59)	a.		/kút/	[ˈkú ˈtɔ́.diʃ]	‘where go.PRS.2SG’	(365)
		cf.	/kút/	[ˈkút ˈí.stɛs]	‘where want.PRS.2SG’	(136)
	b.		/dɛ́.vɛt/	[ˈdɛ́.vɛ su.ˈtíi.na]	‘nine hundred’	(150)
		cf.	/dɛ́.vɛt/	[ˈdɛ́.vɛt ˈjɛ́ɛ.tṛv.ʦa]	‘nine sisters-in-law’	(368)

Crucially, postlexical Homorganic Cluster Simplification counterfeeds Final Shortening. Homorganic Cluster Simplification introduces new instances of final long vowels, which, unlike original final long vowels (23), resist Final Shortening (60).

[8] At the postlexical level, Homorganic Cluster Simplification applies optionally (Ivić 1957: 142–144). This aspect of the process is set aside here. Capturing the observed variation would require adopting a probabilistic framework such as Maximum Entropy Harmonic Grammar (Goldwater & Johnson 2003).

(60)	a.	[ˈpɛ́ɛ daa.ˈná]	‘five days’	(176)
		[ˈpɛ́ɛt juu.ˈdí]	‘five people’	(400)
	b.	[ˈpɛ́ɛ su.ˈtíi.na]	‘five hundred’	(143)
		[ˈpɛ́ɛt juu.ˈdí]	‘five people’	(400)
	c.	[ˈʃɛ́ɛ su.ˈtíi.na]	‘six hundred’	(229)
		[ˈʃɛ́ɛs nɔɔ.ˈʨí]	‘six nights’	(399)
	d.	[ˈbɔ́ɔ ˈgɔ́.spɔt]	‘god the master’	(170)
		[ˈbɔ́ɔk=jɛ]	‘god is’	(455)

The underapplication of Final Shortening in (60) cannot be attributed to prosodic minimality. Although the relevant items in (60) happen to be monosyllabic, recall that monosyllables regularly undergo Final Shortening and become monomoraic (23a)–(23d).

Homorganic Cluster Simplification is the only source of final long vowels in surface forms in GS. All other final long vowels shorten without exception. The fact that Final Shortening cannot apply to final long vowels introduced by a postlexical consonant deletion process suggests that the latest instances of Final Shortening must occur before postlexical phonology.[9]

5.3 Between word and phrase strata

5.3.1 Final Devoicing

In GS, underlyingly voiced obstruents undergo devoicing word-finally (61) (Ivić 1957: 135–137).

(61)	a.	[kr̥.ˈʧáak]	‘pot.NOM.SG’	(135)
		[kr̥.ʧaa.ˈgá.ma]	‘pot.DAT.PL’	(26)
	b.	[ˈlúut]	‘crazy.NOM.SG.M’	(135)
		[ˈlúu.dɔ.ga]	‘crazy.GEN.SG.M’	(362)
	c.	[ˈgrúup]	‘rough.NOM.SG.M’	(135)
		[ˈgruu.bɛ́]	‘rough.NOM.PL.F’	(215)
	d.	[ˈmŕ̥.ki.ɲɛʃ]	‘hedgehog.NOM.SG’	(135)
		[ˈmŕ̥.ki.ɲɛ.ʒa]	‘hedgehog.GEN.SG’	(135)
	e.	[ˈɔɔ.rís]	‘rice.NOM.SG’	(135)
		[ɔ.ˈrí.za]	‘rice.GEN.SG’	(135)

[9] One caveat is in order. I treat Homorganic Cluster Simplification in forms like (59)–(60) as a proper phonological rule, albeit a variable one, which operates at the postlexical level. However, as reviewer Pavel Iosad points out, it is equally plausible that what I consider postlexical Homorganic Cluster Simplification is in fact a phonetic phenomenon, rather than a phonological process. If this is the case, any argument that relies on the interaction between Final Shortening and Homorganic Cluster Simplification to diagnose process ordering and stratal affiliation loses its probative force. The coexistence of a postlexical phonological process and its sound change precursor would be an instance of rule scattering (Bermúdez-Otero 2015). Given the nature of the available GS data, adjudicating between these two analyses is difficult, if not impossible. I ultimately adhere to the former view, while acknowledging the implications of the latter view for the analysis of the dialect’s opaque phonology.

In (62), voiceless obstruents do not become voiced intervocalically. This indicates that the alternation in (61) involves final devoicing, not intervocalic voicing.

(62)	a.	[ˈpúut]	‘road.NOM.SG’	(396)
		[puu.ˈtɛ́ɛ.va]	‘road.GEN.PL’	(37)
	b.	[ˈvúuk]	‘wolf.NOM.SG’	(69)
		[ˈvú.kɔ.vi]	‘wolf.NOM.PL’	(112)
	c.	[ˈbɔ́ɔs]	‘barefoot.NOM.SG.M’	(378)
		[ˈbɔɔ.sá]	‘barefoot.NOM.SG.F’	(318)

Devoicing is restricted to word-final position. No devoicing occurs in coda position word-internally (63).[10]

(63)	a.	[pɔ.ˈglɛ́d.ni]	‘look.IMP.2SG’	(143)
	b.	[ˈláad.nɛ]	‘cold.NOM.PL.F’	(143)
	c.	[pɔ.ˈbég.nɛm]	‘run.away.PRS.1SG’	(452)

An interesting property of Final Devoicing, which sets it apart from the pre-postlexical processes discussed so far, is its complete insensitivity to enclitics. Enclitics crucially interact with other pre-postlexical processes, such as Stress Assignment and Final Shortening. However, Final Devoicing behaves differently: Word-final voiced obstruents undergo devoicing even in the presence of enclitics (64).

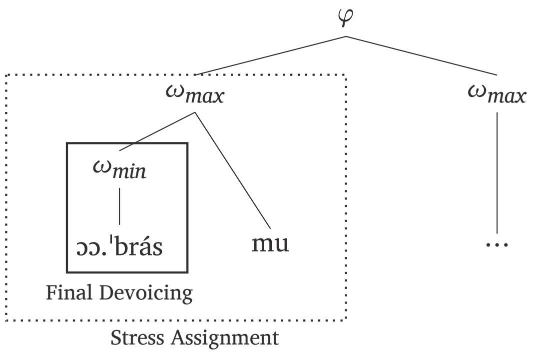
(64)	a.	[ˈgrúup=jɛ]	‘rough=is’	(136)
		[ˈgruu.bɛ́]	‘rough.NOM.PL.F’	(215)
	b.	[ˈlúut=jɛ]	‘crazy=is’	(136)
		[ˈluu.dí]	‘crazy.NOM.PL.M’	(443)
	c.	[ˈbɔ́ɔk=jɛ]	‘god=is’	(455)
		[ˈbɔ́.ga]	‘god.GEN.SG’	(450)
	d.	[ɔɔ.ˈbrás=mu]	‘cheek=his’	(29)
		[ɔɔ.ˈbráa.za]	‘cheek.GEN.PL’	(176)
	e.	[ˈmúuʃ=mi]	‘husband=my’	(375)
		[ˈmúu.ʒa]	‘husband.ACC.SG’	(201)

This pattern indicates that enclitics lie outside the domain of Final Devoicing. By contrast, enclitics are internal to the stress domain, and to the domain of Final Shortening.

[10] The syllable structure in BCMS, particularly the patterning of intervocalic consonant clusters, has yet to be fully understood. I adhere to the standard assumption that stop-nasal sequences are heterosyllabic (Petrović & Gudurić 2010).

To illustrate, consider (64d). Underlyingly, /ɔɔ.bráz/ has a High on the final mora. The form displays final stress in enclisis. Stress Assignment thus applies to the domain that includes both the morphological word and the enclitic: the maximal projection of the Prosodic Word (ω_{max}). By contrast, the enclitic does not block Final Devoicing, which applies to a smaller domain, namely the minimal projection of the Prosodic Word (ω_{min}). The ω_{min} and ω_{max} domains are delimited in (65) by solid and dotted rectangles, respectively.

(65)



This distinction rules out the internal clitic analysis in (52a). The fact that clitics can be ignored by word-level phonological processes shows that they do not form an inner, non-recursive ω-domain with the host. Although I assume word-level prosodic recursion in (65), the existence of which is not universally agreed upon, I remain agnostic as to the prosodic status of the Clitic Group. Whether the Clitic Group is a separate prosodic constituent (as per Hayes 1989; Nespor & Vogel 2007; Miller & Sande 2021) or a projection of ω (Selkirk 1996; Anderson 2005; Itô & Mester 2021) has no relevance here and is, for present purposes, only a matter of labeling. What matters is that GS displays a separate prosodic domain intermediate between the innermost Prosodic Word and Prosodic Phrase.

5.3.2 A procedural account: the Clitic stratum

The distinction between Final Devoicing and Stress Assignment/Final Shortening informs the analysis of opacity in GS by situating Stress Assignment and Final Shortening relative to word-level phonological processes. Although pre-postlexical, Stress Assignment and Final Shortening differ from regular word-level processes, such as Final Devoicing, in terms of how they interact with enclitics. The domain of application of Final Devoicing includes the (morphological) word but excludes enclitics. In prosody, this domain corresponds to ω_{min}. Meanwhile, Stress Assignment and Final Shortening operate in a larger domain which includes the morphological word and the clitics hosted by it, namely ω_{max}.

One way of capturing this intermediate position of Stress Assignment and Final Shortening is procedural, by positing an additional Clitic stratum, separate from and intermediate between the Word and Phrase strata. The Clitic stratum coincides with ω_{max}. The processes that apply in the

Clitic stratum are sensitive to enclitics, unlike proper word-level processes. Clitic-level processes also remain unaffected by context-changing postlexical processes, thus being pre-postlexical.[11]

The need for additional, language-specific phonological strata has been recognized in recent work (Jaker 2012; 2023; Jaker & Kiparsky 2020), where they have been linked to complex morphosyntactic structure rather than prosodic domains. The status of prosodically defined strata has been a contentious issue. Bermúdez-Otero (2012) proposes that phonological domains are universally coextensive with morphosyntactic constituents. A different approach is taken by Rubach (2011; 2016; 2019), who argues that the Clitic level may be needed to account for syllable repair strategies in Macedonian, and Polish yer vowels and velar palatalization. Similarly, Armenian has been argued to require a Prosodic Stem domain between the Stem and Word levels (Dolatian 2021).

However, even with an additional Clitic stratum, Stress Assignment and Final Shortening would still have the same stratal affiliation: Both processes would operate in the Clitic stratum. This is evidenced by their identical patterning with respect to both enclitics and context-changing postlexical processes. The presence of the Clitic stratum does not, by itself, remedy the problem of within-stratum opacity, since the two processes would still apply in the same phonological domain.

GS thus still exhibits both within-stratum and between-stratum opaque interactions. At the Clitic level, Final Shortening countershifts Stress Assignment, resulting in stratum-internal opacity. Final Shortening is in turn counterfed by postlexical Homorganic Cluster Simplification. This interaction instantiates between-stratum opacity: A phrase-level process creates new environments for an earlier-ordered, clitic-level process.

Even the more permissive variant of Stratal OT adopted in this section, one that allows for language-specific strata, fails to eliminate within-stratum opacity and thus cannot salvage the universality of stratum-internal transparency. This finding is in line with Obiri-Yeboah & Rasin (2025), who reach the same conclusion based on productive opacity in the postlexical phonology of Gua.

In **Figure 3**, I summarize the stratal affiliations and process ordering established thus far. Under the four-level architecture, Final Devoicing takes place at the lexical stratum, before word-level cliticization. Stress Assignment and Final Shortening subsequently apply in the Clitic stratum. Finally, Homorganic Cluster Simplification, along with Deaccentuation and ensuing secondary cliticization, all take place in postlexical phonology.

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[11] The failure of enclitics to block Final Devoicing could alternatively be attributed to output-output (OO) correspondence (Benua 1997), whereby Final Devoicing in enclisis satisfies IDENT-voi$_{OO}$, which enforces voicing identity between base forms and corresponding forms in enclisis. However, Stratal OT generally eschews OO-correspondence (Bermúdez-Otero 2012). Even if OO-correspondence were permitted, it would not affect the main arguments regarding opacity in GS.

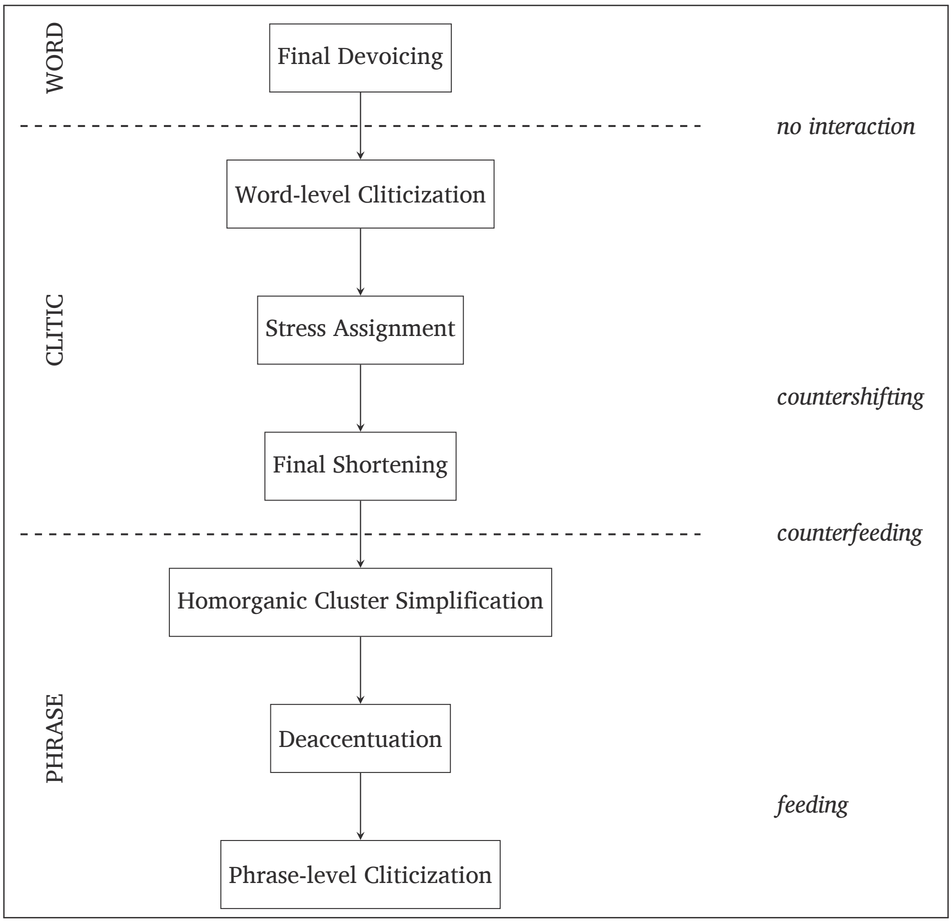


Figure 3: Stratal affiliation and process ordering in GS under the proposed four-level architecture.

Thus, adding a fourth stratum to GS phonology does not offer a clear path towards eliminating within-stratum opacity.

5.3.3 A representational alternative

Adding an extra stratum is not the only way to capture the independent phonological behavior of the Clitic Group. An alternative to the procedural approach, which treats the Clitic Group as a separate stratum, is the representational approach. However, the representational alternative ultimately fails to eliminate within-stratum opacity from GS phonology, just like its procedural counterpart.

The representational analysis builds on the idea that phonological strata are universally coextensive with morphosyntactic domains (Bermúdez-Otero 2012), which precludes prosodic domains from forming their own strata. Instead, prosodic conditioning of phonological processes is captured through representations. Since prosodic structure is available throughout derivation, phonological constraints can directly reference prosodic domains, which obviates the need for treating them as separate stratal domains.

This is the gist of Bermúdez-Otero & Luís (2009)'s analysis of European Portuguese clitics, where clitic-level processes differ from both lexical and postlexical processes, much like they do in GS. The Clitic Group, being a prosodic domain, cannot form a stratum according to Bermúdez-Otero (2012). Since the Clitic domain cannot constitute a stratum, the authors analyze clitic-level processes as lexical. The difference between clitic-level and proper lexical processes is captured by representational differences rather than their assignment to separate strata.

Adopting a representational approach along the lines of Bermúdez-Otero & Luís (2009); Bermúdez-Otero (2012) could potentially offer a solution to within-stratum opacity between Stress Assignment and Final Shortening. This move reduces the number of strata from four to three, allowing lexical processes to be either sensitive or insensitive to clitics, depending on their prosodic domain. By the same token, the representational approach also allows to reclassify Final Shortening as a postlexical process, even though it *de facto* applies to the same prosodic constituent as Stress Assignment. This adjustment is possible due to the nature of prosodic conditioning. Unlike morphosyntactic conditioning, which is captured procedurally, through processes' stratal affiliation, prosodic conditioning is representational and as such accessible to markedness constraints at all computational levels. Thus, a process applying ω-finally could be inhibited at the lexical level and take place as late as the postlexical level. This happens when the relevant markedness constraint, which references the Prosodic Word's right edge, is overridden by faithfulness at the Word level, but gets promoted over faithfulness in postlexical phonology.

On this account, the clitic-host combination in GS forms a word-level phonological domain (see Bermúdez-Otero & Payne 2011 for similar cases). Stress Assignment remains a lexical process, applying transparently at the Word level because Final Shortening is inhibited at this stage (66).

(66) Lexical stratum: Stress Assignment

/ruu.kɛ́ɛ/	NONFIN$_{\omega_{max}}$	MAX-μ	HEAD-H	$*$V:]]$_{\omega_{max}}$
a. ☞ ⟦ ⟦ruu.ˈkɛ́ɛ⟧$_{\omega_{min}}$ ⟧$_{\omega_{max}}$				*
b. ⟦ ⟦ˈruu.kɛ́ɛ⟧$_{\omega_{min}}$ ⟧$_{\omega_{max}}$			*!	*
c. ⟦ ⟦ˈruu.kɛ́⟧$_{\omega_{min}}$ ⟧$_{\omega_{max}}$		*!	*	
d. ⟦ ⟦ruu.ˈkɛ́⟧$_{\omega_{min}}$ ⟧$_{\omega_{max}}$	*!	*!		

At the postlexical stratum, the shortening of ω_{max}-final long vowels is enabled by promoting *V:$]\!]_{\omega_{max}}$ over MAX-μ and NONFINALITY (67).

(67) Postlexical stratum: Final Shortening

/ruu.ˈkɛ́ɛ/		NOFLOP	*V:$]\!]_{\omega_{max}}$	NONFIN$_{\omega_{max}}$	MAX-μ	HEAD-H
a.	⟦ ⟦ ⟦ruu.ˈkɛ́ɛ⟧$_{\omega_{min}}$ ⟧$_{\omega_{max}}$ ⟧$_{\varphi}$		*!			
b.	⟦ ⟦ ⟦ˈruu.kɛ⟧$_{\omega_{min}}$ ⟧$_{\omega_{max}}$ ⟧$_{\varphi}$	*!			*	*
c. ☞	⟦ ⟦ ⟦ruu.ˈkɛ⟧$_{\omega_{min}}$ ⟧$_{\omega_{max}}$ ⟧$_{\varphi}$			*	*	

In sum, once a distinction is drawn between prosodic and morphosyntactic conditioning, opacity that arises within a single prosodic constituent need not arise within the same phonological stratum. Accordingly, Stress Assignment and Final Shortening, which both have ω_{max} as their domain of application, can be assigned to different phonological strata as in (66)–(67).

However, postponing Final Shortening to the postlexical stratum, albeit beneficial for modeling the Stress Assignment–Final Shortening interaction, has adverse effects for the counterfeeding interaction between Final Shortening and Homorganic Cluster Simplification. The reassignment of Final Shortening to the postlexical stratum shifts the issue of within-stratum opacity to the postlexical stratum, where now both Final Shortening and Homorganic Cluster Simplification would apply, resulting in within-stratum counterfeeding.

Tableau (68) outlines the portion of GS postlexical phonology responsible for Homorganic Cluster Simplification. Homorganic clusters are penalized by *HOMORGANICCLUSTER. This markedness constraint outranks the anti-deletion faithfulness constraint MAX-C.[12]

(68) Postlexical stratum: Homorganic Cluster Simplification

/⟦ˈdɛ́.vɛt⟧$_{\omega_{max}}$ ⟦su.ˈtíi.naa⟧$_{\omega_{max}}$/		*HOMCL	MAX-C
a.	⟦ ⟦ˈdɛ́.vɛt⟧$_{\omega_{max}}$ ⟦su.ˈtíi.na⟧$_{\omega_{max}}$ ⟧$_{\varphi}$	*!	
b. ☞	⟦ ⟦ˈdɛ́.vɛ⟧$_{\omega_{max}}$ ⟦su.ˈtíi.na⟧$_{\omega_{max}}$ ⟧$_{\varphi}$		*

However, the rankings in (67)–(68) cannot prevent Final Shortening from applying in cases like (60), where Homorganic Cluster Simplification introduces final long vowels. This is shown in (69): The intended winner (candidate b) loses out to its transparent competitor (candidate c).

[12] Henceforth, ω_{min} brackets are omitted to save space.

(69) Postlexical stratum: counterfeeding

/⟦ˈpɛ́ɛt⟧$_{\omega_{max}}$ ⟦daa.ˈnáa⟧$_{\omega_{max}}$/		NoFlop	*V:⟧$_{\omega_{max}}$	*HomCl	NonFin$_{\omega_{max}}$	Max-μ	Head-H	Max-C
a.	⟦ ⟦ˈpɛ́ɛt⟧$_{\omega_{max}}$ ⟦daa.ˈná⟧$_{\omega_{max}}$ ⟧$_{\varphi}$			*!	*	*		
b. ☹	⟦ ⟦ˈpɛ́ɛ⟧$_{\omega_{max}}$ ⟦daa.ˈná⟧$_{\omega_{max}}$ ⟧$_{\varphi}$		*!		*	*		*
c. 💣	⟦ ⟦ˈpɛ́⟧$_{\omega_{max}}$ ⟦daa.ˈná⟧$_{\omega_{max}}$ ⟧$_{\varphi}$				**	**		*

Similar to its procedural alternative, the representational approach (Bermúdez-Otero & Luís 2009; Bermúdez-Otero 2012), fails to fully dispense with within-stratum opacity in GS, despite its flexibility vis-à-vis prosodically conditioned processes.

5.4 Discussion

Stress Assignment and Final Shortening apply before postlexical phonology, because both processes are insensitive to changes in their environments at the postlexical level. At the same time, the two processes apply before regular word-level processes like Final Devoicing, given their sensitivity to clitics.

One possible way of capturing this intermediate position of Stress Assignment and Final Shortening is by positing an independent Clitic domain situated between the Word and Phrase strata (in the spirit of Rubach 2011; 2016; 2019). However, the available evidence suggests that both Stress Assignment and Final Shortening apply in the Clitic stratum. Thus, within-stratum opacity persists even under this more flexible four-level architecture.

The representational alternative à la Bermúdez-Otero & Luís (2009) is likewise unable to eliminate within-stratum opacity, but for a different reason: It shifts stratum-internal opacity to the postlexical stratum. Ultimately, no extension of the standard Stratal OT framework salvages the universality of stratum-internal transparency.

What does the existence of within-stratum opacity in GS phonology show about the typology of opaque interactions and approaches to opacity within OT?

Most directly, it challenges the strong version of the stratum-internal transparency principle adopted in some versions of Stratal OT. Approaches to within-stratum opacity in Stratal OT fall into two camps. The strict stratum-internal transparency approach rejects the existence of within-stratum opacity altogether (Kiparsky 2015): All instances of phonological opacity result from between-stratum process ordering and are therefore morphosyntactically confined. No cases of opacity arise from a purely phonological device, such as constraint interaction within a single stratum or enriched representations. A more relaxed approach acknowledges the existence of within-stratum opacity but maintains that, as long as such interactions do not involve ordering paradoxes, they do not undermine Stratal OT's cyclic, multi-level architecture (Bermúdez-Otero 2019). This approach allows within-stratum opacity to be captured in OT through additional, non-default mechanisms.

This paper supports the position that in its strong form, the stratum-internal transparency principle is overly restrictive and empirically untenable. Within-stratum opacity exists and is likely more common than traditionally recognized. While the existence of stratum-internal opaque interactions does not fundamentally challenge the main postulate of Stratal OT, namely cyclic organization of phonology, it does show that Stratal OT's built-in machinery is insufficient for capturing the full spectrum of opaque interactions.

More broadly, these findings suggest that phonological opacity arises from multiple sources and is not universally a by-product of phonology-morphosyntax interleaving. Accordingly, it is unlikely that a single mechanism can capture the full range of opaque interactions. Many OT-based approaches pursue a unified analysis of opacity (Kager 1999; McCarthy 1999; 2007; Goldrick 2000; Jarosz 2014, a.o.). However, opacity appears to be too diverse a phenomenon to be amenable to a unified account (Itô & Mester 2003; Baković 2007; 2011; Bermúdez-Otero 2019; Pruitt 2023; Nazarov 2025).

6 Formal analysis

In this section, I develop a formal analysis of multiple opacity in GS, couched in HS (Prince & Smolensky 1993/2004: 94–97; McCarthy 2000). The basic architecture of HS readily captures the countershifting interaction between Stress Assignment and Final Shortening (Section 6.2). To model the underapplication of Final Shortening in Homorganic Cluster Simplification environments, the analysis adopts a special class of faithfulness constraints, which evaluate candidates against the underlying representation rather than their local input (Hauser & Hughto 2020; Section 6.3).

6.1 Harmonic Serialism and opacity

HS is another derivational variant of OT. Rather than partitioning the phonological grammar into multiple serially ordered domains, as done in Stratal OT, HS maintains a single self-consistent constraint hierarchy throughout the derivation. HS produces stepwise derivations because its Gen is limited to emitting candidates that undergo at most one structural change (McCarthy 2000) (70). What counts as a permissible structural change in a single HS step is nonetheless a topic of ongoing debate. Structure-changing operations in HS are therefore introduced incrementally, one at a time.

(70) Gradualness requirement on HS's Gen
Candidates for any given input may deviate from it by at most one operation.

At each step, the winner is the most harmonically improving form out of the restricted candidate pool. The order of operations is determined by the ranking of process-inducing markedness constraints: The change that satisfies the highest-ranked constraint takes precedence over other changes. Once determined, the winner loops back to GEN and EVAL as the input to next step. The derivation terminates when no further harmonic improvement is possible, that is, when the faithful candidate wins.

HS successfully models countershifting opacity (Rasin 2022; Pruitt 2023), performing particularly well on deriving stress in suboptimal environments (Elfner 2016; Ryan 2020), and shows limited success in modeling certain counterbleeding interactions (Torres-Tamarit 2016). A key feature shared by these phenomena is that they involve structure-building processes such as (re)syllabification and metrical structure assignment. This success stems from the fact that prosodic structure is built incrementally in HS (Pruitt 2010; Elfner 2016). The stepwise character of HS derivations allows for prosodic structure assigned at earlier steps to be rendered opaque by structural changes at later steps. In Section 6.2, I show that this success carries over to opaque stress in GS.

However, HS faces serious challenges with other types of opacity, much like parallel OT (McCarthy 2007; Wolf 2011; Staroverov & Kavitskaya 2017; Broś 2020; Pruitt 2023, a.o.). To accommodate problematic types of opacity, HS adopts supplementary machinery, including serial markedness constraints (Jarosz 2014) and contextual faithfulness (Hauser & Hughto 2020).

6.2 Stress and Final Shortening

HS provides a straightforward account of opaque stress in GS using only constraints independently motivated in the dialect. The sole addition to the constraint set established in Section 4.1 is LX≈PR (Prince & Smolensky 1993/2004) (71), which triggers Stress Assignment.[13]

(71) LX≈PR
Every morphological word must form a Prosodic Word.

As in the parallel OT account (38), transparent penultimate stress results from NONFINALITY's dominance over HEAD-H (72).

(72) Transparent stress
Step 1: Stress Assignment

/ruu.ká/	LX≈PR	NONFIN	HEAD-H
a. ruu.ká	*!		
b. ruu.ˈká		*!	
c. ☞ ˈruu.ká			*

[13] LX≈PR triggers Stress Assignment because without stress, a morphological word cannot form a Prosodic Word.

The HS account of opaque final stress is shown in (73). Stress Assignment and Final Shortening each constitute a minimal operation. Since (70) mandates that structural changes be introduced one at a time, these two operations cannot take place in a single HS step. The precedence of operations is determined by constraint ranking. Stress Assignment applies first because Lx≈Pr outranks *V:#.

(73) Opaque stress

a. Step 1: Stress Assignment

/ruu.kɛ́ɛ/	Lx≈Pr	*V:#	Nonfin	Head-H
a. ruu.kɛ́ɛ	*!	*		
b. ruu.kɛ́	*!			
c. ˈruu.kɛ́ɛ		*		*!
d. ☞ ruu.ˈkɛ́ɛ		*		

b. Step 2: Final Shortening

/ruu.ˈkɛ́ɛ/	Lx≈Pr	*V:#	Nonfin	Head-H
a. ruu.ˈkɛ́ɛ		*!		
b. ☞ ruu.ˈkɛ́			*	

c. Step 3: Convergence

/ruu.ˈkɛ́/	Lx≈Pr	*V:#	Nonfin	Head-H
a. ☞ ruu.ˈkɛ́			*	
b. ruu.kɛ́	*!			

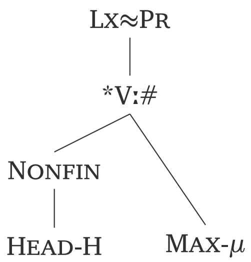
On the first pass through Gen and Eval (73a), Stress Assignment is prioritized over Final Shortening. Stress is assigned transparently to the High-toned final syllable, which is still heavy at this point. The shortening candidate, which would pave the way for transparent stress on later passes, fails to satisfy top-ranking Lx≈Pr.

Final Shortening is enforced on the second iteration in response to *V:# (73b). This is possible because *V:# outranks Nonfinality.

Final Shortening results in a stressed final light, which GS otherwise avoids (10)–(15). Nevertheless, stress cannot be relocated from this suboptimal environment. Following McCarthy (2011); Lamont (2025), I consider stress shift a sequence of two minimal changes: removal and subsequent reassignment of prominence. Stress removal as the necessary first step in stress shift is not harmonically improving, because it violates top-ranking Lx≈Pr. Since no available minimal change is harmonically improving, the derivation converges on the opaque candidate at Step 3 (73c).[14]

To summarize, opaque final stress is captured in HS by the following constraint rankings:

(74)



6.3 Final Shortening and Homorganic Cluster Simplification

To accommodate problematic cases of opacity in HS, Hauser & Hughto (2020) propose a special class of faithfulness constraints known as *contextual faithfulness constraints*. These are reminiscent of the more widely used positional faithfulness constraints (Beckman 1998). Both constraint types penalize unfaithful mappings only in specified environments. A key innovation in Hauser & Hughto (2020)'s approach is that the relevant environments for contextual faithfulness constraints can be defined over the form's underlying representation, rather than the immediate local input.

Standard input-output (IO) correspondence constraints (McCarthy & Prince 1995) evaluate candidates against their immediate local inputs in HS. By contrast, Hauser & Hughto (2020)'s contextual faithfulness constraints, commonly referred to as UO faithfulness, assess violations relative to the underlying representation. This property makes UO faithfulness particularly promising for handling counterfeeding opacity.

The underapplication of Final Shortening in the postlexical phonology of GS can be analyzed as a contextual faithfulness effect. To block Final Shortening from applying to final vowels created by consonant deletion, I introduce the UO constraint in (75):

(75) Max-μ_{UO}/__C#
Assign a violation for every input mora which does not have an output correspondent if the vowel to which the mora in question is attached is followed by a word-final consonant in the underlying representation.

In the relevant environments, word-final consonants are deleted by Homorganic Cluster Simplification.[15] As a result, the context that (75) references is not visible in the local input to a given HS step. What matters is that the long vowel that (75) protects is underlyingly followed

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[14] Alternatively, stress and feature shift may be admissible minimal operations in HS (Pruitt 2022; Gietz et al. 2023). If indeed doable in a single HS step, stress shift would be prevented by NoFlop$_{stress}$ (45).

[15] Unlike McCarthy (2008), I treat consonant deletion as a one-step operation.

by a final consonant. The analysis is outlined in (76). The first two steps, which involve Stress Assignment, are omitted.

(76) Underapplication of Final Shortening

a. Step 3: Homorganic Cluster Simplification

/ˈpέεt daa.ˈnáa/	Lx≈Pr	Max-μ_{UO}/__C#	*HomCl	*V:#	NonFin	Max-C_{IO}	Max-μ_{IO}
a. ˈpέεt daa.ˈnáa			*!	*			
b. ☞ ˈpέε daa.ˈnáa				**		*	

b. Step 4: Final Shortening

/ˈpέε daa.ˈnáa/	Lx≈Pr	Max-μ_{UO}/__C#	*HomCl	*V:#	NonFin	Max-C_{IO}	Max-μ_{IO}
a. ˈpέε daa.ˈnáa				*!*			
b. ☞ ˈpέε daa.ˈná				*	*		*

c. Step 5: Convergence

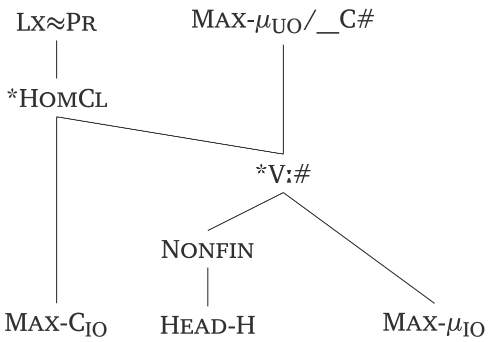
/ˈpέε daa.ˈná/	Lx≈Pr	Max-μ_{UO}/__C#	*HomCl	*V:#	NonFin	Max-C_{IO}	Max-μ_{IO}
a. ☞ ˈpέε daa.ˈná				*	*		
b. ˈpέ daa.ˈná		*!			**		*

Both *HomCl and *V:# outrank the antagonistic IO-faithfulness constraints. This ensures that Homorganic Cluster Simplification and Final Shortening apply on their own. At Step 3 (76a), Homorganic Cluster Simplification satisfies *HomCl. At Step 4 (76b), Final Shortening applies, removing one of the violations of *V:#. However, the remaining violation of *V:# cannot be eliminated by Final Shortening at Step 5 because the long final vowel originally preceded a final consonant. Thus, the derivation reaches convergence at Step 5 (76c).

6.4 Section summary

The HS analysis proposed here derives the two opaque interactions in GS phonology using two different mechanisms. Opaque stress falls out from the baseline HS architecture. The ranking of the relevant markedness constraints ensures that Stress Assignment precedes context-changing Final Shortening. The underapplication of Final Shortening results from contextual faithfulness (Hauser & Hughto 2020). The constraint hierarchy in (77) derives all opaque interactions in GS.

(77)



7 Conclusion

This article examines a previously unnoticed case of countershifting opacity in dialectal BCMS. In GS, stress falls on the word's only High-toned syllable, unless that syllable is light and final. The ban on final prominence is rendered opaque by final vowel shortening: Erstwhile heavy final lights bear stress on the surface. This shortening process is in turn counterfed by final consonant deletion in sandhi.

The earliest instances of Stress Assignment and Final Shortening must occur after regular word-level processes but before postlexical phonology. Two analyses of the intermediate position of the Stress Assignment/Final Shortening domain are proposed: a procedural analysis and a representational analysis. On the procedural account, the Clitic stratum constitutes an independent phonological domain situated between the lexical and postlexical strata. This move is motivated by the observation that phonology may require more domains than traditionally assumed in Stratal OT (see Jaker 2012; 2023; Jaker & Kiparsky 2020 for language-specific cyclic domains, and Rubach 2011; 2016; 2019; Dolatian 2021 for prosodically defined strata). Alternatively, under the representational analysis, Stress Assignment and Final Shortening are assigned to different strata. Because both processes are prosodically conditioned, their conditioning environments can be directly referenced by markedness constraints at all strata (Bermúdez-Otero & Luís 2009; Bermúdez-Otero 2012). Crucially, however, both analyses fail to eliminate within-stratum opacity. I therefore adopt a different derivational approach to multiple opacity in GS, namely HS.

The study adds to the growing evidence for stratum-internal opacity (Kavitskaya & Staroverov 2010; Broś 2016; Broś & Nazarov 2023; Stanton 2023; Obiri-Yeboah & Rasin 2025). Importantly, it demonstrates that even under a more flexible version of Stratal OT, the strong version of the stratum-internal transparency principle is empirically untenable (see Obiri-Yeboah & Rasin 2025 for a similar claim). This finding further suggests that opacity has multiple sources, stemming from both phonology-morphosyntax interleaving, but also from purely phonological devices. As such, opacity is too heterogeneous to be subsumed under a single unified account (Itô & Mester 2003; Baković 2007; 2011; Pruitt 2023; Nazarov 2025), despite longstanding efforts in phonological theory to provide a unified explanation for all opaque interactions.

Abbreviations

ACC = accusative, AOR = aorist, DAT = dative, DEF = definite, F = feminine, GEN = genitive, IMP = imperative, INDF = indefinite, INS = instrumental, M = masculine, N = neuter, NOM = nominative, PL = plural, PRS = present, PST = past, PTCP = participle, Q = question particle, REFL = reflexive, SG = singular

Data availability

The audio files, Praat TextGrids, CSV files, and R code used to generate **Figure 2** are publicly available on Harvard Dataverse. DOI: https://doi.org/10.7910/DVN/9MNLHY.

Ethics and consent

This study was exempt from review by the Ethics Committee of the University of Belgrade. Written consent was obtained from the participant prior to the recordings.

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Competing interests

The author has no competing interests to declare.

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