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

Word count: 13,985

Abstract

This paper challenges the assumption of universal stratum-internal transparency maintained in some versions of Stratal Optimality Theory. On this view, phonological processes that apply in the same stratum can only interact transparently, with opacity emerging solely as an epiphenomenon of phonology-morphosyntax interleaving. I present a previously unexamined case of countershifting opacity in Gallipoli Serbian. In this dialect of Bosnian/Croatian/Montenegrin/Serbian, stress falls on the word's only High-toned syllable, unless the High-toned syllable is light and final, in which case stress falls on the penult. Crucially, final light syllables that derive from original heavies by final shortening bear stress on the surface, rendering the ban on stressed final lights non-surface-true. The opaquely interacting processes, namely Stress Assignment and Final Shortening, demonstrably apply in the same phonological stratum. Moreover, even if additional, language-specific stratal domains are posited, isolating all opaquely interacting processes into separate strata remains impossible. This study offers evidence for within-stratum opacity, even under more flexible stratal architectures, and suggests that opacity arises from multiple sources, not only from between-stratum process ordering.

Keywords: opacity, countershifting, Stratal Optimality Theory, prosody, stress

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 $\rightarrow$ 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 and 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 an unjustified markedness violation: 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 and Halle, 1968 *et seq.*) uniformly captures most types of opacity through extrinsic process ordering.

Stratal OT (Kiparsky, 2000; Bermúdez-Otero, 1999, 2003), a derivational multi-level version of OT, offers a solution to this 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 in Stratal OT. One line of work within this framework (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 and Rasin, 2025).

A sizable body of work has challenged the stratum-internal transparency assumption in its strongest form, reporting opaque interactions between processes that apply in the same stratum (Kavitskaya and Staroverov, 2010; Broś, 2016; Broś and Nazarov, 2023; Stanton, 2023; Obiri-Yeboah and Rasin, 2025). A more nuanced 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 (cf. Bermúdez-Otero, 2019). Crucially, this approach holds that opacity has multiple sources and cannot be fully reduced to phonology–morphosyntax interleaving.

This paper supports the latter view, informing phonological theory in two ways. First, it reports a new case of within-stratum opacity, adding to the existing evidence for this phenomenon. Gallipoli Serbian (GS; Ivić, 1957) presents an interesting case of countershifting, i.e. misapplication opacity (Rasin, 2022; Baković and Blumenfeld, 2024). Stress falls on the word's only High-toned syllable (2a–2b). 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 heavies by Final Shortening bear stress on the surface (2e). This study demonstrates that Stress Assignment and Final Shortening 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.	/ɡlaa.vá/	[ˈɡlaa.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 beyond 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 and Kiparsky, 2020) could solve this problem by creating more space to isolate opaquely interacting processes into separate strata.

Nevertheless, Obiri-Yeboah and 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. It shows 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 stem 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 set of phenomena, with multiple sources—both non-phonological and, crucially, purely phonological.

The paper is structured as follows. Section 2 provides background information on GS and its phonological system. Section 3 outlines the dialect's stress system and highlights the opaque interaction between two active prosodic processes. Section 4 presents a failed parallel OT account of this interaction and proposes an alternative Stratal OT analysis. Section 5 discusses process affiliation in GS phonology, furnishing evidence for within-stratum opacity. Section 6 provides a formal account of all 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 tɕ dʑ		
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.

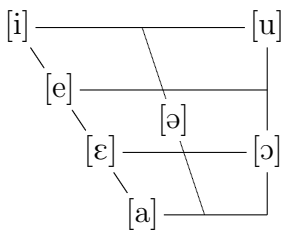


Figure 1: GS vowel inventory (Ivić, 1957, 41-79).

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 pre-tonic syllables (3).[1]

(3) Optional vowel raising

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

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 and Zec (1988); Zec (1999); Zec and Zsiga (2010), GS pitch accents represent combinations of two prosodic features: stress and tone. The dialect distinguishes between two kinds of pitch 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 accented vowel, while rising accented vowels are characterized by a pitch plateau, followed by a High tone on the post-tonic syllable (Zsiga and Zec, 2013; Zec and 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 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 the Kosovo-Resava dialect. These acoustic 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. This pattern in Old Štokavian parallels the existing descriptions of Standard BCMS pitch accents (Lehiste and Ivić, 1986; Zsiga and Zec, 2013).

Ivić (1957) uses traditional BCMS pitch accent notation to mark stress and tone. Throughout this paper, I adopt an IPA notation in which tone and stress 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.

(4)

a. Short falling			b. Long falling			c. (Long) rising		
kr̀ava	[ˈkrá.va]	'cow'	sûnce	[ˈsúun.tsɛ]	'sun'	rúka	[ˈruu.ká]	'arm'

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

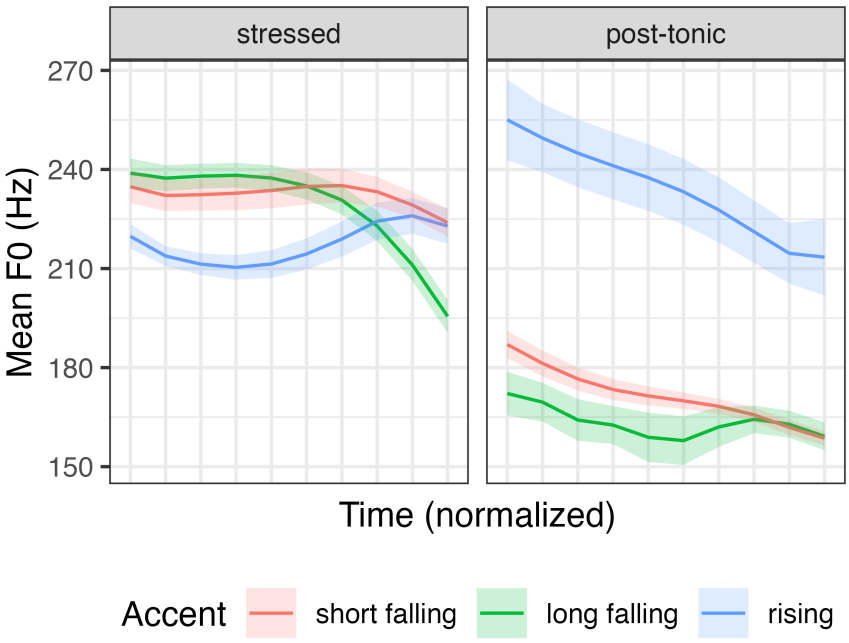


Figure 2: Mean pitch contours for three pitch accent types in the Old Štokavian dialect group of BCMS, based on F0 measurements taken at 10 equidistant time points in each vowel. The vertical axis represents mean F0 in Hertz; the horizontal axis represents normalized time. Data are split by syllable position: stressed (penultimate) vs. post-tonic (final) syllables (panel facets). Shaded areas present 95% confidence intervals. Recordings were made at a sampling rate of 44.1 kHz (mono) by a 24-year-old female speaker from Jagodina, Central Serbia. All target words had penultimate accent and consisted of either two or three syllables. All items (total: 138; long falling disyllabic: 22, long falling trisyllabic: 23, rising disyllabic: 21, rising trisyllabic: 23, short falling disyllabic: 27, short falling trisyllabic: 22) were elicited using the carrier sentence *Reci [target word] sad.* ('Say [target word] now.'). F0 values were extracted in Praat (Boersma and Weenink, 2025) using the `measure_f0` script by Jessamyn Schertz. The data were analyzed in R (R Core Team, 2023).

In addition to pitch accent (i.e., tone and stress) 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 since clitics play a central role in the present study.

(5) a. pȁdne u‿gróbu ['pád.nɛ u='grɔɔ.bú] (459) 'He fell in the grave.' (proclitic)
b. jâ‿je zakŕpi ['jáa=jɛ za.'kr̩r̩.pí] (456) 'I patched it up.' (enclitic)

3 Stress, quantity and opacity in GS

3.1 Tone, stress and weight

GS is a lexical tone system 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.[2]
   b. CULMINATIVITY: GS is a restricted tone system (in the sense of Hyman, 2006), since the dialect 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 default High on the initial mora (17).

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.

(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 strictly prohibited (8c), as in most other Štokavian dialects of BCMS (Ivić, 1958; Inkelas and 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)

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

i. /u.kraa.dɛ́ɛ.mɔ/ [u.kraa.ˈdɛ́ɛ.mɔ] ‘steal.PRS.1PL’ (26)

The only deviation from the stress pattern in (9) stems from the avoidance of final prominence. GS avoids stressing final light syllables. If a final light is High-toned, stress shifts to the toneless penult (10–11). Recall that, in contrast to final lights, High-toned final heavies regularly receive stress in GS (9f–9h). Both CV (10) and CVC (11) High-toned ultimas are unable to bear stress, which indicates that final consonants do not contribute weight in GS.

(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.ˈʧaa.gɔ́m]	‘pot.INS.SG’	(27)

Final High-toned lights remain unstressed when they do not host enclitics (10–11), However, they regularly receive stress in enclisis (12). This results in a productive alternation between penultimate stress in (10–11) and final stress in enclisis (12).

(12)	a.	/glaa.vá/	[glaa.ˈvá=jɛ]	‘head.NOM.SG=is’	(308)
	b.	/lee.pɔ́/	[lee.ˈpɔ́=mi]	‘nice(ly)=me.ACC’	(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)

Underlyingly light toneless penults which receive stress due to nonfinality undergo vowel lengthening (13).[3] The underlying quantity of lengthened vowels is preserved in unstressed position (14). The absence of vowel shortening in unstressed syllables in GS (9c–9d; 9h–9i) indicates that the alternation between (13) and (14) is due to vowel lengthening in stressed position rather than vowel 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)

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

(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 that final prominence avoidance and penultimate lengthening were productive in GS comes from prosodic adaptation of Turkish loanwords. Word-final prominence in the donor language has been reinterpreted as a lexical High in GS. Analogous to High-toned lights in the native lexicon, High-toned lights in Turkish loanwords are unstressable, repelling stress to the penultimate syllable (15). If the penult is light, it undergoes vowel lengthening. The data in (16) reveal the original quantity of the penultimate vowels.

(15)	a.	/ʧar.ʃáf/	[ˈʧaar.ʃáf]	‘sheet.NOM.SG’	(364)	Tu. çarşav
	b.	/ja.stə́k/	[ˈjaa.stə́k]	‘pillow.NOM.SG’	(367)	Tu. yastık
	c.	/saan.də́k/	[ˈsaan.də́k]	‘crate.NOM.SG’	(77)	Tu. sandık
	d.	/kal.pa.zaan.lə́k/	[kal.pa.ˈzaan.lə́k]	‘laziness.NOM.SG’	(77)	Tu. kalpazanlık
(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 and Zec, 1988; Zec and Zsiga, 2010).

(17)	a.	/gɔ.sti/	[ˈgɔ́.sti]	‘guest.ACC.PL’	(171)
	b.	/pa.mɛɛ.ti/	[ˈpá.mɛɛ.ti]	‘mind.GEN.SG’	(464)
	c.	/pr̩.bɛ.se.di/	[ˈpŕ̩.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/	[ˈbés=pa.mɛɛ.ti]	‘without=mind.GEN.SG’	(36)
	c.	/pr̩.bɛ.se.di/	[ˈné=pr̩.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.NOM.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.NOM.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, since they affect the position of stress (12–17). This indicates that in GS, the stress domain comprises the morphological word plus its clitics, i.e. the Clitic Group.

In sum, stress is attracted 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 clitic-host combination. 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 toneless 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

$$\begin{bmatrix}+\text{syllabic}\\ +\text{long}\end{bmatrix} \rightarrow [-\text{long}] \; /\_\_\#$$

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). Given that the process is sensitive to enclitics, the domain of application of Final Shortening includes enclitics, parallel to the stress domain (Section 3.1).

(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.3SG’	(267)
	e.	/glɛ́.daa.ju/	[ˈglɛ́.daa.ju]	‘watch.PRS.3PL’	(235)
	f.	/í.maa.mɔ/	[ˈí.maa.mɔ]	‘have.PRS.3SG’	(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, the dialect regularly shortens long final vowels (23). In forms with an underlyingly long final vowel that bears a High, Stress Assignment and Final Shortening crucially interact.[4]

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 (10–15). Final lights brought about by Final Shortening are therefore treated differently from erstwhile light High-toned final syllables, which are barred from receiving stress.

(25) Opaque final stress

a.	/vɔ.dɛ́ɛ/	[vu.ˈdɛ́]	not *[ˈvɔɔ.dɛ́]	'water.GEN.SG'	(33)
b.	/slat.kɔ́ɔ/	[slat.ˈkɔ́]	not *[ˈslaat.kɔ́]	'sweet.NOM.SG.N'	(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.	/mɾ̩ɾ̩.zíi/	[mɾ̩ɾ̩.ˈzí]	not *[ˈmɾ̩ɾ̩.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.	/mɾ̩ɾ̩.zíi/	[mɾ̩ɾ̩.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 quantity 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 by the locus of stress. Forms with an originally light final syllable (a-examples in 27–28) are subject to the ban on final prominence, displaying penultimate stress. By contrast, items that undergo Final Shortening (b-examples in 27–28) 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 neutralized. The original length of the final vowel in the b-examples in (27–28) is revealed in enclisis (29).

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

[4]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.

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

In sum, I outlined the complex interplay between tone, stress and quantity in GS and showed that the regular final vowel shortening process countershifts stress.

4 Constraint-based analysis

4.1 Parallel OT

In this section, I present an OT analysis of the GS stress pattern. I identify the active constraints in GS prosody and establish their ranking.

I assume that the propensity of stress to coincide with High tone falls out from HEAD-H (Yip, 2001), the markedness constraint requiring that foot-heading moras bear a High.

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

Default initial stress is the product of ALLLEFT(σ_{Hd}) (Hyde, 2012), which pushes primary stress towards the Prosodic Word's left edge, assessing a violation for every syllable intervening between the primary stressed syllable and the left edge of the Prosodic Word. 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. The default pattern is illustrated in (32).

(32)

/pa.mɛɛ.ti/	HEAD-H	ALLLEFT(σ_{Hd})	DEP-H	ALLRIGHT(σ_{Hd})
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 ALLLEFT(σ_{Hd}) (33).

(33)

/pɔ.kva.rí.la/	HEAD-H	ALLLEFT(σ_{Hd})
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
Assess a violation for every unstressed heavy syllable.

(35)

/kaan.dí.sa.la/	HEAD-H	ALLLEFT(σ_{Hd})	WSP
a. ☞ kaan.ˈdí.sa.la		*	*
b. ˈkaan.dí.sa.la	*!		

WSP is likewise overridden by ALLLEFT(σ_{Hd}). The two constraints clash in (36), where ALLLEFT(σ_{Hd}) is satisfied at the expense of WSP.

(36)

/pa.mɛɛ.ti/	ALLLEFT(σ_{Hd})	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 entries on the rightmost mora of the Prosodic Word. Specifying final moras rather than final syllables as the loci 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)
Assess a violation for every foot-level grid mark (x_F) that occurs over the final mora (μ) of the Prosodic Word (ω).

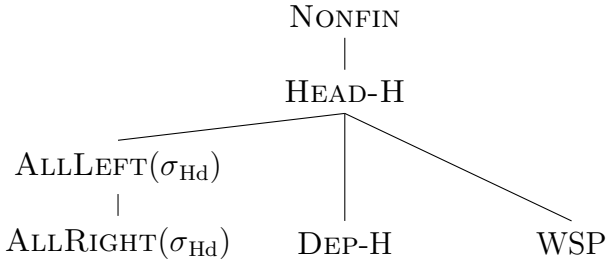
In GS, NONFINALITY dominates HEAD-H. This follows from cases like (10–15), where stress falls on the toneless penult to avoid the violation of NONFINALITY (38).

(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 final long vowels. *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 the ranking needed to derive (38). The two patterns require conflicting rankings of NONFINALITY and HEAD-H, which results in a ranking paradox.

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. RPB therefore offers a unified account of opaque process interactions, deriving all instances of this phenomenon from a purely phonological device—extrinsic ordering (although the picture may be more complicated; cf. 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 process 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, which holds that input-output mappings are transparent within each stratum (43). 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 subsequently become opaque at later strata. For example, a word-level process applies before, and can consequently be opacified by, a postlexical process. This obviates the need for RBP-style extrinsic process ordering.

(43) Stratum-internal transparency (Bermúdez-Otero, 2003; Kiparsky, 2000, 2015)
Phonological processes that apply in the same stratum interact transparently.

Some proponents of Stratal OT maintain the strict version of (43), whereby 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 more nuanced perspective on the sources of opacity (Bermúdez-Otero, 2019).

Stratal OT sidesteps the issue encountered by the failed parallel OT account in (41), where no self-consistent constraint ranking could be arrived at which outputs both transparent penultimate stress and opaque final 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 between-stratum ordering.

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 GS stress rule (9f–9h).

(44) Stratum 1: Stress Assignment

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

In a subsequent stratum, Stratum 2,[5] *V:# gets promoted over MAX-μ. This ranking difference produces Final Shortening, which in turn gives rise to opaque final prominence.

A NONFINALITY violation and opaque stress could be avoided by stress retraction. However, the winner of Stratum 2 remains faithful to the stress position established in Stratum 1, in compliance with the faithfulness constraint in (45).

(45) NOFLOP$_{\text{stress}}$ (Alderete, 1999)
Assess a violation for every output stress that appears on a different syllable than its input correspondent.

NOFLOP$_{\text{stress}}$ dominates NONFINALITY in Stratum 2. This ranking rules out stress retraction, correctly deriving [ruu.ˈkɛ́] as the winner (46).

(46) Stratum 2: Final Shortening

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

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 but is instead treated as an epiphenomenon of phonology–morphosyntax interleaving. Given this assumption, this line of Stratal OT

[5]Stratum 2 need not immediately **follow** Stratum 1. These labels only reflect the fact that the Final Shortening stratum must be ordered later than Stratum 1.

work makes a strong prediction about opacity: stratum-internal opaque interactions should not exist (Kiparsky, 2015). Whereas Kiparsky (2015) argues that many oft-quoted cases of within-stratum opacity actually involve between-stratum processes interactions, growing evidence supports the existence of within-stratum opacity (Kavitskaya and Staroverov, 2010; Broś, 2016; Broś and Nazarov, 2023; Obiri-Yeboah and Rasin, 2025; Stanton, 2023). The remainder of this paper tests whether stratum-internal transparency in its strongest form (à la Kiparsky, 2015) 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. At the same time, 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 and assess their implications for the analysis of GS opaque phonology. I ultimately argue 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: (1) proclitics bear stress when the host lacks a High-toned mora (18), and (2) 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 locus of stress. A subset of pronominal enclitics resists shifting stress onto the host's final syllable, defying the pattern in (12):

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

In (47), stress falls on the toneless penult in enclisis, contrary to (12). This discrepancy can be explained by 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); see Franks and King, 2000; Zec, 2005 for the 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.néɛ	mi	ti.béɛ	ti	ɲi.gáa	ga	ɲéɛ	jɛ
DAT	mi.néɛ	mi	ti.béɛ	ti	ɲɛ.múu	mu	ɲɔ́ɔj	jɛ
ACC	mi.néɛ	mi	ti.béɛ	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		ví		ɔ.ní		ɔ.né	
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). Third person neuter is omitted because it has the same paradigm as masculine forms, differing only in NOM/ACC.SG (/ɔ.nɔ́/) and NOM/ACC.PL (/ɔ.ná/).

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

(48) Regular prosodic behavior of strong pronouns

a. ˈjáa =tɕɛm nu.ˈtɕá.skɛ da= ˈdɔ́ɔ.dʑɛm
1SG.NOM =will tonight that= come
'I will come tonight.' (455)

b. ˈmɔ́.ʒɛm ˈjá 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 /jáa/ 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 through 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 tone and stress—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. ˈpíi.ta mi.ˈnɛ́ CP[ja= ʃɔ= sam=
ask.IMP.2SG 1SG.ACC 1SG.NOM= why= be.PRS.1SG=
u.glaad.ˈní.vɔ]
get.hungry.PTCP.PST.M.SG
'Ask me why I got hungry.' (454)

b. mi= ti.ˈbɛ́ nii.ˈsmɔ́ =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)

The distinction between inherent and derived clitics is evident from (50). Inherently clitic (i.e., weak) pronouns are visible to stress: they enable word-final High-toned lights to bear stress (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.ˈʊɛɛ.kɛ́l
not.be.PRS.1SG =1SG.NOM that.much fool
'I am not that big a fool.' (457)

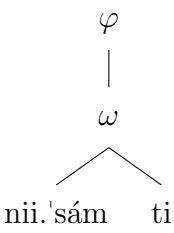
b. ˈnii.sí =ti ˈbɔ.gɔm bɛ.ˈsé.di.ʊɔ
not.be.PRS.2SG =2SG.NOM god.INS.SG talk.PTCP.PST.M.SG
'You have not talked to god' (457)

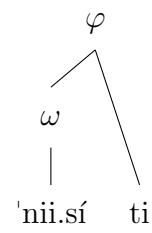
Regular cliticization, which applies to inherent clitics, precedes Stress Assignment. This explains why inherent clitics are part of the stress domain. Secondary cliticization, which targets deaccented strong pronouns, applies after Stress Assignment. This leaves derived clitics outside the stress domain.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

Secondary cliticization is relevant for the analysis of opaque stress because it provides evidence for the ordering of Stress Assignment relative to postlexical processes. While the exact conditions for deaccentuation of strong pronoun remain unclear, the process is evidently linked to information structure and sentence-level prosody, which is indicative of its postlexical nature. Deaccentuation feeds secondary cliticization, the result of which Stress Assignment cannot access because stress had already been assigned in an earlier-ordered 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 stress 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 constitute FREE CLITICS (Selkirk, 1996; Anderson, 2005).

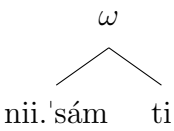
(51)

a. 

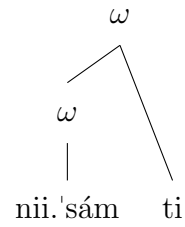
b. 

Inherent clitics can be analyzed in two ways. The INTERNAL CLITIC analysis (52a) holds that inherent clitics attach directly to the ω-node projected by their host; hence they are 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 evidence presented so far is indeterminate between (52a) and (52b). I will return to this issue in Section 5.3.1.

In sum, inherently clitic forms in GS differ from forms that become prosodically deficient during derivation. Inherent clitics undergo word-level cliticization, which precedes Stress Assignment, and are therefore visible to stress. Derived clitics undergo phrase-level cliticization, which happens after Stress Assignment, and are therefore invisible to stress. Crucially, this dual patterning 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

Analogous to Stress Assignment, Final Shortening is sensitive to regular, word-level clitics. This is indicated by the fact that the process is blocked in enclisis (24). Word-level enclitics are therefore internal to the domain of Final Shortening. From this it follows that word-level cliticization precedes this shortening process.[6]

The available evidence suggests that Final Shortening is word-bound, rather than being a phrase-level process. 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

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

‘right arm’ (33)

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

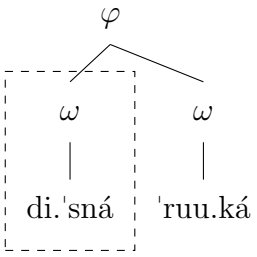
(54) a. [di.ˈsnáa =mi ˈruu.ká]
right.NOM.SG.F =my arm.NOM.SG
‘my right arm’ (34)

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

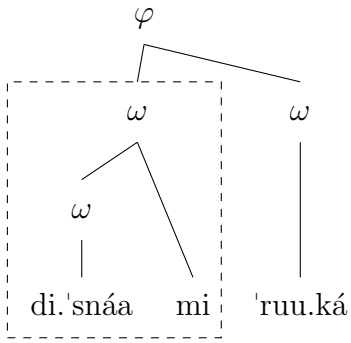
This pattern indicates that the domain of Final Shortening corresponds with the Clitic Group, i.e. the topmost projection of the ω-domain (55) (the Final Shortening domain is delimited by dashed rectangles). This is conspicuously the same prosodic domain in which stress is assigned.

(55) Final Shortening domain

a. [di.ˈsná ˈruu.ká] (53a)



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).[7]

(56) Homorganic Cluster Simplification

$$\begin{bmatrix} -\text{sonorant} \\ \alpha\text{place} \end{bmatrix} \rightarrow \emptyset \; / \; \text{—} \; \begin{Bmatrix} + \\ = \\ \# \end{Bmatrix} \begin{bmatrix} -\text{sonorant} \\ \alpha\text{place} \end{bmatrix}$$

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

[7] 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 shifting from categorical OT to a probabilistic framework such as Maximum Entropy Harmonic Grammar (Goldwater and Johnson, 2003) or a similar model.

(57)	a.		/iz-tsɛ́ɛ.dii/	[i.ˈtsée.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.GEN.PL’	(150)
		cf.	/dɛ́.vɛt/	[ˈdɛ́.vɛt ˈjɛ́ɛ.tr̩v.tsa]	‘nine sister.in.lawGEN.PL’	(368)

Crucially, postlexical Homorganic Cluster Simplification (59) counterfeeds Final Shortening. Homorganic Cluster Simplification introduces new instances of final long vowels, which, unlike original final long vowels (23), resist Final Shortening (60).

(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) are 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 shows that the latest instances of Final Shortening must occur before postlexical phonology.[8]

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).

[8]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 lexical phonological process and its sound change precursor (a phonetic counterpart external to phonology) 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.

(61) Final Devoicing

a.	[kr̩.ˈʧáak]	‘pot.NOM.SG’	(135)	[kr̩.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.	[ˈmḱ.ki.ɲɛʃ]	‘hedgehog.NOM.SG’	(135)	[ˈmḱ.ki.ɲɛ.ʒa]	‘hedgehog.GEN.SG’	(135)
e.	[ˈɔɔ.rís]	‘rice.NOM.SG’	(135)	[ɔ.ˈrí.za]	‘rice.GEN.SG’	(135)

The data in (62) indicate that the alternation in (61) involves final devoicing rather than intervocalic voicing, since voiceless obstruents do not become voiced intervocalically.

(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).[9]

(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).

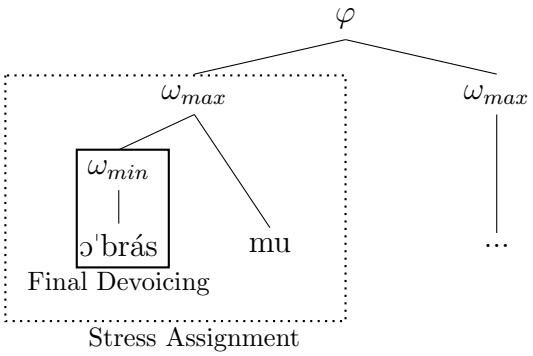
(64) a.	[ˈgrúup=jɛ]	‘rough=is’	(136)	[ˈgruu.bɛ́]	‘rough.NOM.PL.F’	(215)
b.	[ˈlúut=jɛ]	‘crazy=is’	(136)	[ˈluu.dí]	‘crazy.NOM.PL.M’	(443)
c.	[ˈbɔ́ɔk=jɛ]	‘god=is’	(455)	[ˈbɔ́.ga]	‘god.GEN.SG’	(450)
d.	[ɔɔ.ˈbrás=mu]	‘cheek=his’	(29)	[ɔɔ.ˈbráa.za]	‘cheek.GEN.PL’	(176)
e.	[ˈmúuʃ=mi]	‘husband=my’	(375)	[ˈmúu.ʒa]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

To illustrate, consider [ɔɔ.ˈbrás=mu] ‘his cheek’ (64d). Underlyingly, this form displays a final High-toned light syllable and a final voiced fricative: /ɔɔ.bráz-/. In enclisis, stress falls on the High-toned syllable rather than the penult, which indicates that the enclitic is part of the stress domain. However, the enclitic does not block Final Devoicing. Thus, Final Devoicing applies in a smaller phonological domain than Stress Assignment—the minimal projection of the Prosodic Word (ω_{min}), while Stress Assignment applies to the maximal projection of the Prosodic Word (ω_{max}), as depicted in (65).

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

(65)



This finding crucially 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 and Vogel, 2007; Miller and Sande, 2021) or a projection of ω (Selkirk, 1996; Anderson, 2005; Itô and Mester, 2021) has no relevance for the present analysis and is only a matter of labeling. What matters is the existence of a prosodic domain intermediate between the innermost Prosodic Word and Prosodic Phrase in GS.

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 their interaction 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—ω_{max}.

One way of capturing this intermediate position of Stress Assignment and Final Shortening is procedural—by positing an additional stratum, separate from and intermediate between the Word and Phrase strata. This stratum—the Clitic stratum—coincides with ω_{max}. The processes that apply in the Clitic stratum are sensitive to enclitics, unlike proper word-level processes, and remain unaffected by context-changing postlexical processes, thus being pre-postlexical.[10]

The utility of additional, language-specific phonological strata has been recognized in recent work (Jaker, 2012, 2023; Jaker and 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 in Stratal OT. Bermúdez-Otero (2012) proposes

[10]The failure of enclitics to block Final Devoicing could alternatively be handled via 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.

that phonological domains are universally coextensive with morphosyntactic constituents. A different approach is taken by Rubach (2011, 2016, 2019), who proposes that the Clitic level may be needed to account for syllable repair strategies in Macedonian, Polish yer vowels and 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 newly introduced 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.

Crucially, this would only imply that GS 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. The latter interaction is an instance of between-stratum opacity, whereby 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 additional, 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 and 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.

To recapitulate, I explored the consequences of adopting the fourth stratal domain in GS—the Clitic stratum. Even with this additional stratum, within-stratum opacity is unavoidable.

5.3.3 A representational alternative

Adding an extra stratum is not the only way to capture the independent phonological behavior of the Clitic domain. An alternative to the procedural approach, which treats the Clitic domain as a separate stratum, is the representational approach. However, this approach ultimately fails to eliminate within-stratum opacity from GS phonology, just like its procedural counterpart in Section 5.3.2.

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 and Luís (2009)'s analysis of European Portuguese

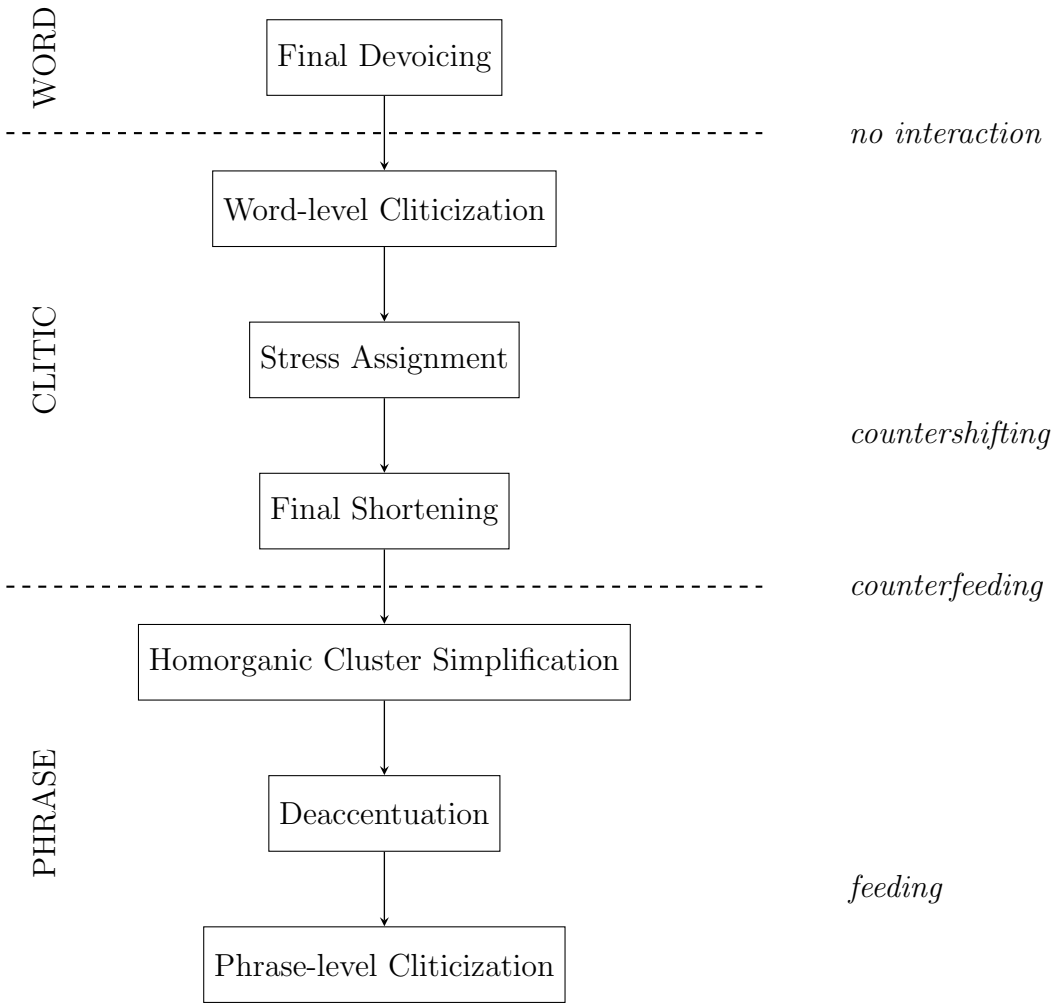


Figure 3: Stratal affiliation and ordering of relevant segmental and prosodic processes in GS under the proposed four-level architecture. The precedence of (morpho)phonological operations is represented in a top-down fashion. The Stem stratum is omitted.

clitics, where Clitic-level processes differ from both lexical and postlexical processes. 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 through representational differences rather than their assignment to separate strata.

Adopting a representational approach along the lines of Bermúdez-Otero and Luís (2009); Bermúdez-Otero (2012) could potentially offer a way out of 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 sensitive to the ω-boundary could be inhibited at the lexical level and take place as late as the postlexical level. This happens when the relevant markedness constraint, which is sensitive to the ω-boundary, is overridden by faithfulness at the Word level, but outranks faithfulness in postlexical phonology.

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

(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 (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.kɛ́]$_{\omega_{min}}$]$_{\omega_{max}}$]$_{\varphi}$	*!			*	*
c.	☞ [[[[ruu.ˈkɛ́]$_{\omega_{min}}$]$_{\omega_{max}}$]$_{\varphi}$			*	*	

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. By that logic, 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, which counterfeeds Final Shortening, would apply.

Tableau (68) outlines the portion of GS postlexical phonology responsible for Homorganic Cluster Simplification. Homorganic clusters are knocked out by *HomorganicCluster. This markedness constraint outranks the anti-deletion constraint Max-C.[11]

(68) Postlexical stratum: Homorganic Cluster Simplification

/⟦ˈdɛ́.vɛt⟧$_{\omega_{max}}$ ⟦suˈtíi.naa⟧$_{\omega_{max}}$/		*HomCl	Max-C
a.	⟦ ⟦ˈdɛ́.vɛt⟧$_{\omega_{max}}$ ⟦suˈtíi.na⟧$_{\omega_{max}}$ ⟧$_{\varphi}$	*!	
b. ☞	⟦ ⟦ˈdɛ́.vɛ⟧$_{\omega_{max}}$ ⟦suˈtíi.na⟧$_{\omega_{max}}$ ⟧$_{\varphi}$		*

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

(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 and Luís, 2009; Bermúdez-Otero and Payne, 2011; 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

This section demonstrated that Stress Assignment and Final Shortening apply before postlexical processes. The crucial evidence for this claim comes from two interactions. First, Stress Assignment is unaffected by phrase-level cliticization, which is fed by postlexical deaccentuation. Second, Final Shortening is counterfeed by Homorganic Cluster Simplification which operates across word boundaries. The deletion of word-final obstruents before homorganic consonants in sandhi brings about new instances of final long vowels. These derived long

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

final vowels do not shorten, unlike long vowels that start out as word-final, indicating that Final Shortening must cease to be operative before postlexical phonology.

One possible way of capturing the observed patterning of Stress Assignment and Final Shortening is by positing the independent Clitic domain situated between the Word and Phrase strata (in the spirit of Rubach, 2011, 2016, 2019). While an additional cyclic domain could potentially help separate Stress Assignment and Final Shortening into different strata, within-stratum opacity persists even under this more flexible four-level architecture. Available evidence suggests that both Stress Assignment and Final Shortening apply in the Clitic stratum. Therefore, assuming the four-level architecture with the Stem, Word, Clitic and Phrase strata, opacity in GS arises both stratum-internally and across different strata. Final Shortening countershifts stress within the Clitic domain. Clitic-level Final Shortening is in turn counterfed by Homorganic Cluster Simplification, a postlexical process.

The representational alternative proposed in Section 5.3.3 (Bermúdez-Otero and Luís, 2009; Bermúdez-Otero and Payne, 2011; Bermúdez-Otero, 2012) 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 Stratal OT as a theory of phonological opacity?

Most directly, it challenges the strong version of the stratum-internal transparency principle. Approaches to within-stratum opacity in Stratal OT fall into two categories. The strict stratum-internal transparency approach rejects the existence of within-stratum opacity altogether (Kiparsky, 2015). All cases of phonological opacity result from between-stratum process ordering and are therefore morphosyntactically confined. No cases of opacity can arise from a purely phonological device—constraint interaction within a single stratum or enriched phonological representations. A more relaxed approach acknowledges the existence of within-stratum opacity but argues that it does not fundamentally undermine Stratal OT, particularly its cyclic, multi-level architecture (Bermúdez-Otero, 2019). This approach holds that within-stratum opacity can be captured in Stratal OT through additional, non-default mechanisms.

Given the evidence presented, this paper adopts the latter view: within-stratum opacity exists and may be more common than traditionally recognized. However, as long as these interactions do not involve ordering paradoxes, they do not fundamentally challenge the cyclic organization assumed in Stratal OT. They do, however, indicate that in its strong form, the stratum-internal transparency principle is overly restrictive and empirically untenable.

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 (McCarthy, 1999, 2007; Kager, 1999; Goldrick, 2000; Jarosz, 2014, a.o.). However, opacity appears to be too diverse a phenomenon to be amenable to a unified account (Itô and 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 Harmonic Serialism (HS; Prince and Smolensky, 1993/2004, 94–97; McCarthy, 2000), a monostratal derivational version of OT. The basic architecture of HS readily captures the countershifting interaction between Stress Assignment and Final Shortening (Section 6.2). To derive 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 local input (Hauser and Hughto, 2020) (Section 6.3).

6.1 Harmonic Serialism and opacity

HS is another derivational variant of OT. Unlike Stratal OT, HS does not permit domain-specific constraint rankings, assuming a single, self-consistent constraint hierarchy throughout the derivation. Structural changes in HS are introduced one at a time because HS's 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.

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

The gradualness requirement creates stepwise derivations, with each structure-changing operation taking place at a separate step. 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) and shows partial success in modeling certain counterbleeding interactions (Torres-Tamarit, 2016). A key feature shared by these phenomena is that they involve structure-building processes. 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. HS performs particularly well on deriving stress in suboptimal environments (Elfner, 2016; Ryan, 2020). 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 and 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 and Hughto, 2020).

6.2 Stress and Final Shortening

HS provides a straightforward account of opaque stress in GS using only constraints independently motivated for the dialect (see Section 4.1). The sole addition to the established constraint set is Lx≈Pr (Prince and Smolensky, 1993/2004) (71), which motivates Stress Assignment.[12]

(71) Lx≈Pr
Every morphological word must form a Prosodic Word.

As in the parallel OT account (38), transparent penultimate stress falls out from Nonfinality's dominance over Head-H (72).

(72) Transparent stress
Step 1: Stress Assignment

/ruuká/		Lx≈Pr	Nonfin	Head-H
a.	ruu.ká	∗!		
b.	ruu.ˈká		∗!	
c. ☞	ˈruu.ká			∗

The HS account of opaque final stress is shown in (73). Stress Assignment and Final Shortening each constitute a minimal operation in HS. 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.kέɛ/		Lx≈Pr	*V:#	Nonfin	Head-H
a.	ruu.kέɛ	∗!	∗		
b.	ruu.kέ	∗!			
c.	ˈruu.kέɛ		∗		∗!
d. ☞	ruu.ˈkέɛ		∗		

b. Step 2: Final Shortening

/ruu.ˈkέɛ/		Lx≈Pr	*V:#	Nonfin	Head-H
a.	ruu.ˈkέɛ		∗!		
b. ☞	ruu.ˈkέ			∗	

c. Step 3: Convergence

/ruu.ˈkέ/		Lx≈Pr	*V:#	Nonfin	Head-H
a. ☞	ruu.ˈkέ			∗	
b.	ruu.kέ	∗!			

[12] Lx≈Pr triggers Stress Assignment because without stress, a morphological word cannot form a Prosodic Word.

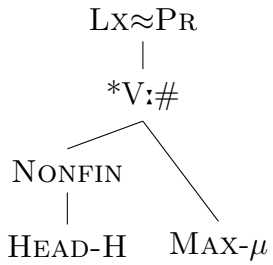
On the first pass through Gen and Eval (73a), Stress Assignment is prioritized over Final Shortening. Stress is assigned transparently to the High-toned final syllable, which is still heavy at this point. The shortening candidate, which would pave the way for transparent stress on later passes, fails 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). Stress cannot be relocated from this suboptimal environment. Following McCarthy (2011); Lamont (2025), stress shift is not an admissible minimal operation, but rather involves two minimal changes: removal and subsequent reassignment of prominence. Stress removal is not harmonically improving as the intermediate step, as it violates top-ranking Lx≈Pr. Since no available minimal change is harmonically improving, the derivation converges on the opaque candidate [ruu.ˈkɛ́] at Step 3 (73c).[13]

To summarize, opaque final stress is captured by the following constraint hierarchy:

(74)



6.3 Final Shortening and Homorganic Cluster Simplification

To accommodate problematic cases of opacity in HS, Hauser and Hughto (2020) propose a special class of faithfulness constraints known as contextual faithfulness. 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 and 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 and Prince, 1995) assess violations relative to the immediate input. In HS, IO faithfulness violations do not accumulate across derivational steps: candidates are only evaluated against their local inputs. By contrast, Hauser and Hughto (2020)'s contextual faithfulness constraints, commonly referred to as UO faithfulness, can be sensitive to the underlying representation.

This property makes UO faithfulness particularly promising for handling counterfeeding opacity in HS. In particular, the underapplication of Final Shortening in Homorganic Cluster Simplification environments can be analyzed as a contextual faithfulness effect. To block Final Shortening from targeting final vowels created through consonant deletion, I introduce the UO constraint in (75):

[13] Alternatively, Gietz et al. (2023) propose that stress/feature shift is an admissible minimal operation in HS. On this account, the absence of stress retraction in GS would be attributed to $\textsc{NoFlop}_{\text{stress}}$ (45), which outranks Nonfinality.

(75) MAX-μ_{UO}/_C#
Assess 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 contexts, word-final consonants are deleted due to Homorganic Cluster Simplification.[14] As a result, the environment for constraint (75) is not visible in the surface form. If contextual faithfulness constraints could only reference overt structure, this would be problematic. However, constraint (75) references the underlying representation: what matters is that the long vowel in question was underlyingly followed 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

/ˈpɛ́ɛt daa.ˈnáa/	LX≈PR	MAX-μ_{UO}/_C#	*HOMCL	*V:#	NONFIN	MAX-C_{IO}	MAX-μ_{IO}
a. ˈpɛ́ɛt daa.ˈnáa			*!	*			
b. ☞ ˈpɛ́ɛ daa.ˈnáa				**		*	

b. Step 4: Final Shortening

/ˈpɛ́ɛ daa.ˈnáa/	LX≈PR	MAX-μ_{UO}/_C#	*HOMCL	*V:#	NONFIN	MAX-C_{IO}	MAX-μ_{IO}
a. ˈpɛ́ɛ daa.ˈnáa				*!*			
b. ☞ ˈpɛ́ɛ daa.ˈná				*	*		*

c. Step 5: Convergence

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

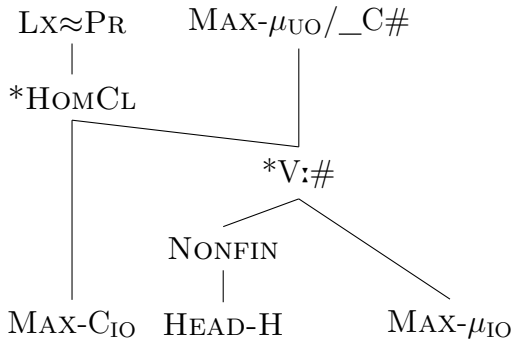
/ˈpɛ́ɛ daa.ˈná/	Lx≈Pr	Max-μ_{UO}/_C#	*HomCl	*V:#	Nonfin	Max-C_{IO}	Max-μ_{IO}
a. ☞ ˈpɛ́ɛ daa.ˈná				*	*		
b. ˈpɛ́ daa.ˈná		*!			**		*

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 in /daa.ˈnáa/ → [daa.ˈná], removing one of the violations of *V:#. However, the other violation of *V:# cannot be eliminated by Final Shortening because the final vowel in [ˈpɛ́ɛ] originally preceded a final consonant. The failed candidate *[ˈpɛ́] therefore fatally violates Max-μ_{UO}/_C#. Thus, the derivation reaches convergence at Step 5 (76c).

6.4 Section summary

In this section, I outlined an HS analysis of multiple opacity in GS, which derives the two opaque interactions in the dialect using two different mechanisms. Opaque stress comes for free under the baseline HS architecture. The ranking of the relevant markedness constraints ensures that Stress Assignment precedes context-changing Final Shortening. The under-application of Final Shortening emerges from contextual faithfulness (Hauser and Hughto, 2020). The constraint hierarchy in (77) derives the full range of opaque interactions in GS.

(77)



7 Conclusion

This study examined a previously unnoticed case of countershifting opacity in dialectal BCMS. In GS, stress is attracted to the only High-toned syllable of the Prosodic Word. When the High-toned syllable is light and final, stress falls on the toneless penult due to a ban on final prominence. This prohibition is rendered opaque by final vowel shortening: final High-toned lights brought about by the shortening of underlyingly long final vowels

bear stress on the surface. In other words, Final Shortening countershifts stress. Moreover, Final Shortening is counterfed by postlexical Homorganic Cluster Simlification. GS therefore displays multiple opacity.

It was shown that the earliest instances of Stress Assignment and Final Shortening must occur after regular Word-level processes. This is evidenced by the fact that Stress Assignment and Final Shortening are sensitive to enclitics, unlike proper lexical processes. At the same time, the latest instances of Stress Assignment and Final Shortening are pre-postlexical, since neither processe is sensitive to context-changing postlexical processes.

I proposed two analyses of the intermediate position of the Stress Assignment/Final Shortening domain: a procedural analysis and a representational one. On the procedural account, there is an additional, prosodically defined phonological domain in GS—the Clitic stratum—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 and Kiparsky, 2020 for language-specific cyclic domains, and Rubach, 2011, 2016, 2019; Dolatian, 2021 for prosodically defined strata). Crucially, both opaquely interacting processes (Stress Assignment and Final Shortening) were found to apply in the Clitic stratum. Thus, within-stratum opacity persists even if phonology is partitioned into more strata than conventionally posited (cf. Obiri-Yeboah and Rasin, 2025).

Alternatively, the representational account allows Stress Assignment and Final Shortening to be assigned to different strata. However, this approach was likewise shown to fall short of eliminating within-stratum opacity, merely shifting the problem to the postlexical level.

The study contributes to the growing evidence for stratum-internal opacity (Kavitskaya and Staroverov, 2010; Broś, 2016; Broś and Nazarov, 2023; Stanton, 2023; Obiri-Yeboah and Rasin, 2025). Importantly, it demonstrates that even under a more flexible version of Stratal OT, the strong version of the stratum-internal transparency principle (à la Kiparsky, 2015) is empirically untenable (see Obiri-Yeboah and 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 and Mester, 2003; Baković, 2007, 2011; Pruitt, 2023; Nazarov, 2025), despite longstanding efforts in phonological theory to provide a unified explanation for all opaque interactions.

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