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Transparency and locality in Piveronese vowel harmony

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Abstract

The Piedmontese dialect of Piverone exhibits a peculiar vowel height harmony process, in which word-final vowels alternate between high and mid depending on the height of the stressed vowel. This harmony occurs in both paroxytones and proparoxytones, although the penultimate vowel in the latter does not alternate in height. The seemingly non-local nature of harmony in proparoxytones is argued to depend on the role of metrical structure in determining the harmony domain. Drawing on evidence from neutralization and syncope phenomena, the penultimate vowel of proparoxytones is interpreted as occupying a metrically weak position, which also accounts for its transparency to vowel harmony. The same mechanism in paroxytones and proparoxytones percolates an 'openness' component from the word stress node to the immediately lower metrical node to its right, ignoring the penultimate vowel in proparoxytones due to its weak metrical status.

Keywords: vowel harmony, Piedmontese, transparency, metrical phonology, locality, Dependency Phonology.

1. Introduction

This paper investigates a vowel height harmony process attested in Piverone, a small town (currently ca. 1200 inhabitants) located about 50 km north-east of Turin where a transitional variety between western and eastern Piedmontese is spoken. In Piveronese,

word-final vowels alternate between high and mid depending on the height of the stressed vowel.[1]

The primary focus of this study centers on harmony in proparoxytones, which display transparency of the penultimate vowel. I argue that this apparently non-local behaviour can be accounted for locally once the role of metrical structure in determining the domain of harmony is properly recognized. Therefore, Piverone harmony adds to our understanding of stress-dependent harmonies (see e.g. Mascaró 2016, 2024) and locality in phonology.

This paper is structured as follows. The next section presents the vowel system of Piveronese in stressed and unstressed syllables, while section 3 describes the harmony process. Section 4 presents a formal analysis of the vowel system in terms of Dependency Phonology components, while section 5 discusses empirical and theoretical issues raised by transparency in Piveronese and outlines my assumptions about its interaction with stress and metrical structure. Section 6 examines metrical aspects of Piveronese and their relevance for the account of harmony in proparoxytones, concluding that the harmony process is always local; I argue that its domain is metrically defined, and assimilation from the stressed vowel ignores the penultimate vowel of proparoxytones because the word-final vowel is the structurally closest vowel. Concluding remarks are presented in section 7.

2. Piverone vowel system

The Italian dialectologist Giovanni Flechia (1811-1892), himself a native of Piverone, was the first to describe this harmony process in an unfinished manuscript posthumously published as Flechia (1898); an unfinished short vocabulary of Piveronese, posthumously published as Flechia (1914), also includes many relevant examples. All the examples reported in this paper come from these two sources or from my own fieldwork in 2007. Other descriptions of Piverone vowel harmony can be found in Loporcaro (1997) Savoia (2005: 228-230), Canalis (2008: ch. 2). Sketches of Piedmontese phonology (without specific reference to Piverone) can be found in Berruto (1974), Parry (1997), Tosco *et al.* (2023).

Piveronese still preserves the same vowel system originally described by Flechia. Nine monophthongal vowels are contrastive in stressed syllables (1).[2] Its vowel system is typical of eastern Piedmontese varieties, whereas western ones have [ə] instead of [ɪ].

1 To the best of my knowledge, this process is not attested in any other Piedmontese variety.

2 The phonetic transcription adopted throughout this paper is relatively broad. The sound represented by [ɛ] is more precisely a slightly lower [ɛ̨], unstressed [e] and [o] vary in their degree of aperture, mostly depending on their syllabic position, stressed vowels are longer than unstressed, especially in open syllables, etc.

(1)

		i		y					u
			ɪ						
				e					
					ɛ	œ		ɔ	
							ɑ		

Stressed syllables can also host the falling diphthongs [ɑi̯ ɑu̯ ɛi̯ ɛu̯ ɔi̯].

In pretonic syllables several contrasts are neutralized, resulting in the simplified vowel inventory below.

(2)

		i		y					u
						ɪ			
					e				
								a	

The alternations created by pretonic vowel neutralizations are shown in (3), and examples are given in (4).

(3)

Stressed vowel:	ɑ	ɛ, e	ɪ	i	ɔ, u	œ, y
Unstressed vowel:	a	e	ɪ	i	u	y

(4)

[ˈɔ] / [u]:			
[ˈkɔla]	‘glue’	[aŋkuˈlɑ]	‘to glue’
[ˈmɔbil]	‘piece of forniture’	[muˈbilja]	‘forniture’
[ˈœ] / [y]:			
[amˈbrœi̯]	‘cheat’	[ambryˈjɑ]	‘to cheat/cheated’
[ˈdœrme]	‘to sleep’	[dyrˈmia]	‘sleep’
[ˈɛ] / [e]:			
[buˈlɛ] ‘mushroom’		[buleˈtiŋ]	‘small mushroom’

[ˈɑ] is not involved in neutralizations, but becomes [a] when destressed.

(5)

[ˈkrɑva]	‘goat’	[kraˈvɔt]	‘kid’ (literally ‘small goat’)
[ˈkɑsja]	‘crate’	[kɑsjɔt]	‘small crate’

Unstressed vowels in post-tonic syllables undergo an even more radical reduction than pretonic vowels. In many Piedmontese varieties only four vowels are possible in this context, as shown in (6).

(6)

				i					u
					e				
						a			

In Piveronese, [o] too is possible as a surface segment word-finally (7). However, vowel harmony causes word-final [o] and [e] to be in complementary distribution with [u] and [i], respectively (cf. the next section). Hence, the only contrastive segments word-finally are /a, i, u/.

(7)
i u
e o
a

Lastly, the penultimate vowel of a proparoxytone can only be [a], [i] or [u], resulting in an even more restricted set of surface vowels than those found word-finally.

3. Piveronese harmony

Piveronese vowel harmony can be informally characterized as the assimilation of a word-final non-low vowel to the degree of aperture of the stressed vowel. Specifically, when the stressed vowel belongs to the set [ɑ ɛ e ɔ œ] or is a diphthong [ɑi̯ ɑu̯ ɛi̯ ɛu̯ ɔi̯] (that is, is a non-high vowel or a diphthong where the most prominent part is a non-high vowel), the word-final vowel can only be [a], [e] or [o]; [i] and [u] are unattested. Conversely, when the stressed vowel belongs to the set [ɪ i u y] (that is, is a high vowel), the word-final vowel is restricted to [a], [i] or [u], whereas [e] and [o] are unattested.

Examples from nominal and verbal inflection highlight these harmonic alternations. For instance, the plural form of feminine nouns and adjectives alternates [e] with [i] depending on the stressed vowel (8). Likewise, the exponent of the second person singular indicative is [e] or [i] depending on the stressed vowel, while the exponent of the third person plural present indicative (as well as first and third person plural present subjunctive) displays the [o] ~ [u] alternation (10).

(8) a. Feminine nouns and adjectives

[ˈmɑska] / [ˈmɑske]	‘witch/es’
[ˈmɑndula] / [ˈmɑndule]	‘almond/s’
[ˈberta] / [ˈberte]	‘magpie/s’
[ˈleŋgwa] / [ˈleŋgwe]	‘tongue/s’
[fyˈmɛla] / [fyˈmɛle]	‘female/s’
[ˈpɛra] / [ˈpɛre]	‘stone/s’
[byˈrœra] / [byˈrœre]	‘churn/s’
[nɛi̯ˈrœra] / [nɛi̯ˈrœre]	‘blackish-F.SG./PL.’
[ˈpjɔta] / [ˈpjɔte]	‘paw/s’
[ʤilˈɔza] / [ʤilˈɔze]	‘jealuos-F.SG./PL.’

b.

[basˈtɪmja] / [basˈtɪmji]	‘blasphemy/es’
[ˈbɪrɲa] / [ˈbɪrɲi]	‘plum/s’
[kasˈtiɲa] / [kasˈtiɲi]	‘chestnut/s’
[turˈtifula] / [turˈtifuli]	‘potato/es’
[ˈsjula] / [ˈsjuli]	‘onion/s’
[ˈturtura] / [ˈturturi]	‘turtledove/s’

[ˈbryta] / [ˈbryti]	‘ugly-F.SG./PL.’
[ˈlyva] / [ˈlyvi]	‘she-wolf/ves’

9 a. 2nd person singular present indicative

[it ˈkɑnte]	‘you sing’
[it ˈtenze]	‘you dye’
[it ˈlɛze]	‘you read’
[it ˈpɔrte]	‘you carry’
[it ˈfjœre]	‘you stink’

b.

[it ˈzɪmːi]	‘you groan’
[it ˈskrivi]	‘you write’
[it ˈzuwi]	‘you play’
[it ˈspysi]	‘you stink’

(10) a. 3rd person plural present indicative

[a ˈkɑnto]	‘they sing’
[a ˈkrɛdo]	‘they believe’
[a ˈperdo]	‘they lose’

b.

[a ˈskrivu]	‘they write’
[a ˈrumpu]	‘they break’
[a ˈzɪmːu]	‘they groan’

Inflection, both nominal and verbal, is the context where harmony is most easily observed, as the phonetic realization of the same inflectional morpheme alternates between [e] and [i], or [o] and [u], in a phonologically predictable manner. However, it is worth pointing out that Piveronese harmony is not restricted to the selection of inflectional markers; rather, it appears to be independent of morphological categories or boundaries, aside from word boundaries. Harmony applies to words lacking inflectional markers as well. For example, most masculine nouns share identical forms in both singular and plural, lacking an overt inflectional marker indicating number and/or gender. Any word-final vowel is thus part of the stem; crucially, such a vowel is subject to harmony (11).

(11) a. Masculine nouns and adjectives

[ˈɑzo]	‘donkey(s)’
[ˈpɛnto]	‘comb(s)’
[ˈsɛto]	town name (*Settimo* in Italian, [ˈsɛtu] in the other Piedmontese varieties)
[arˈmɑre]	‘wardrobe(s)’
[ˈbɑbe]	‘toad(s)’
[nuˈvɛmbre]	‘November’

b.

[ˈvɪsku]	‘bishop(s)’
[ˈpitu]	‘turkey(s)’
[ˈkuku]	‘pup(s)’
[ˈbyru]	‘butter(s)’

[ˈsybi]	‘whistle(s)’
[uˈtubri]	‘October’

Further instances of harmony targeting a word-final non-inflectional vowel include adverbs (12) and the adaptation of Italian town names (13). Notably, the latter category also shows that the harmony process is fully productive, or at least it was during Flechia’s lifetime.

(12) Adverbs

[ˈwɛro]	‘not much’

(13) Adapted Italian words

Trapani	>	[ˈtrɑpane]	‘town name’
Girgenti[3]	>	[ʤirˈʤente]	‘town name’

The domain of harmony thus appears to be delimited only by the right edge of the word, regardless of the morphological status of the vowel in that position. In fact, its domain does not necessarily coincide with the inflected word, as vowels of enclitic particles undergo harmony as well. When a clitic is attached to an inflected verb, thereby forming a phonological unit with it, the height of the clitic vowel is affected by the stressed vowel (14), just as inflectional and root vowels are (incidentally, in Piedmontese the presence of an enclitic causes the loss of the word-final vowel of (non-oxytone) verbs). This observation reinforces the conclusion that the domain of Piveronese harmony can be stated in purely phonological terms.

(14)

/mat-i=lu/	[ˈmɑtlo]	‘put-IMP.2SG=it’
/kyz-i=lu/	[ˈkyzlu]	‘sew-IMP.2SG=it’
/da=mi/	[ˈdɑme]	‘give.IMP.2SG =me’
/must-i=mi/	[ˈmusmi]	‘show-IMP.2SG=me’

3.1. Harmony in proparoxytones

In proparoxytones, the stressed vowel influences the word-final one independently of the aperture of the penultimate vowel; the latter can exhibit disharmony with both the stressed and final vowel, yet this disharmony does not impede agreement between the other two vowels. Specifically, penultimate [a] may be surrounded by high vowels, and penultimate [i] or [u] may be surrounded by non-high vowels. Thus, the penultimate vowel is an instance of harmonic transparency: it neither undergoes nor blocks the harmony process.

(15)

[ˈmɑndule]	‘almonds’
[ˈmɑkine]	‘cars’
[ˈkɑmule]	‘moths’
[ˈsigali]	‘cigars’
[ˈskɑtule]	‘boxes’

[3] Nowadays *Agrigento*, but still named *Girgenti* when Flechia wrote his article.

3.2. Harmony and diphthongs

The Piveronese falling diphthongs [ɑi̯ ɑu̯ ɛi̯ ɛu̯ ɔi̯] are consistently followed by a word-final non-high vowel (e.g. [ˈlɛu̯te] ‘get lost!’), even if their offglide – which is the part of the diphthong closest to the next vowel – is high. Therefore, offglides too could be deemed transparent. However, the phonetic glide in [ɑu̯] and [ɛu̯] may not be a phonological glide. [v] and [u̯] are in complementary distribution in Piveronese, the former only occurring in onsets and the latter only occurring in rhymes (cf. [brɑu̯] ‘good.M.SG’ vs. [brɑv-a] ‘good-F.SG’). Consequently, [ɑu̯] and [ɛu̯] can be plausibly analysed as /ɑv/ and /ɛv/ respectively. As for the other three diphthongs, I assume that they do no interact with harmony because the harmony trigger must be a nucleus in Piveronese, while phonotactic restrictions related to the offglides suggest they belong to codas. In non-final syllables with a falling diphthong, no consonant can occur in the coda; in final syllables, if a falling diphthong is present at most one consonant can follow. In contrast, after monophthongs one coda consonant is allowed in non-final syllables, and up to two in final syllables, supporting the conclusion that offglides fill a slot of the coda.

4. Phonological features of Piveronese

In the following sections I will discuss the peculiar nature of transparency in Piveronese and offer a metrically-based analysis that accounts for it as a local process. Prior to that, I will address here another issue, i.e. which phonological feature (or set of features) defines the natural classes involved in this harmony process. While these two issues are largely independent – transparency concerns the proper characterization of the process’s domain, whereas features define the intrinsic ‘content’ of the process – they are not entirely unrelated. Given that a key aspect of my analysis hinges on the role of stress in vowel reduction and neutralization processes, the proper characterization of the features of a given vowel also sheds light on its metrical status within a word.

I begin by making a few observations based on the description outlined in sections 2 and 3. Firstly, this harmony process is asymmetric: non-high stressed vowels can only be followed by non-high final vowels, whereas high stressed vowels can be followed by high [i, u] or low [a]. Put differently, Piveronese harmony is a lowering process; the class of high vowels does not play an active role as a trigger.

Secondly, it is noteworthy that most mid vowels are otherwise banned from unstressed syllables (only [e] can occur, and solely in pretonic syllables); however, harmony permits the occurrence of word-final [e] and [o]. In somewhat still informal sense, word-final [e, o] can be seen as /i, u/ plus ‘something else’ provided by a non-high stressed vowel, whereas word-final [i, u] are the segmental content of non-low final vowels when the stressed vowel cannot share anything with them.

Thirdly, the penultimate vowels of proparoxytones exhibit a simpler featural content that word-final vowels, and indeed than any other vowel environment in Piveronese; they are limited to [a, i, u], without the possibility of sharing properties of other vowels.

Fourthly, stress (or lack thereof) determines distinct vocalic inventories in stressed versus unstressed vowels. A featural representation capable of capturing the

differences between these two sets in terms of the relatively higher complexity of mid and front round vowels and the unmarked status of the peripheral vowels [a, i, u] would capture significant aspects of vowel reduction in Piveronese.

Binary features could effectively express the natural classes of trigger and target vowels; a [–high] stressed vowel causes a [+high] final vowel to become [–high]. However, under a binary feature framework other aspects of Piverone harmony and vowel system would appear accidental. Absence of symmetric raising caused by [+high] would merely be a coincidence. The 'supplemental' role of the harmonic feature in final vowels would not be highlighted. A binary feature specification would fail to explicitly capture the complexity asymmetry between stressed and unstressed vowels.

Hence, I will explore a system of phonological primes that enables to formalize the aforementioned empirical observations above in a more insightful manner. I will adopt some tenets of Dependency (cf. for instance Anderson & Ewen 1987, Durand 1990 ch. 8, Anderson 2002) and Government Phonology (cf. for example Kaye, Lowenstamm & Vergnaud 1985, 1990, Harris & Lindsey 1995, as well as Backley 2011 as a relatively recent introduction and overview).

- phonological primes (called 'elements' in Government Phonology and 'components' in DP parlance, which I adopt from now on) are unary: they are either present or absent within a given segment
- the components are **I**, **U** and **A**. Their phonetic interpretations are palatality, labiality/roundness, and openness respectively (or, in acoustic terms, respectively predominance of energy in the higher part of the spectrum – acuteness –, predominance of energy in the lower part of the spectrum – gravity and flatness –, and concentration of energy in the central part of the spectrum – compactness, sonority)
- unlike phonological features (unary or binary), they are pronounceable in isolation: |**I**| is realized as [i], |**U**| as [u], and |**A**| as [a] (where components within '| |' are the phonological primes forming a given segment)
- when two or more components are combined within a segment, each of them is present, but is perceptually less strong than when occurring in isolation. For instance, the mid front vowel [e] is |**I**, **A**| (in languages without an /ɛ/ ~ /e/ contrast – see next point), less front and open than respectively [i] and [a]. A segment may combine one or more components with zero, which results in a less salient realization of the component(s) – see the representation of /ɪ/ in (16)
- components may not only coexist, but also establish asymmetric relationships in which one is more prominent (the 'head' of the segment) and another less prominent (the 'dependent'). For instance, the contrast /ɛ/ ~ /e/ is represented as a difference in headedness (|**I**→**A**| vs. |**A**→**I**|, where 'X→Y' means 'X is head and Y dependent') rather than feature value

(16) presents the stressed vowel system of Piveronese in accordance with the principles outlined above.

(16) /i/ |**I**| /y/ |**I**, **U**| /u/ |**U**|

/ɪ/ |, **I**|

/e/ |**I**→**A**| /œ/ |**A**, **U**, **I**| /ɔ/ |**A**, **U**|

/ɛ/ |**A**→**I**|

/ɑ/ |**A**|

With these assumptions in mind, Piverone harmony can be formalized as spreading of **A** from the stressed vowel to the final vowel (17a).[4] The occurrence of word-final [i, u] is merely absence of harmony (17b).

(17) a. /ˈk a n t - u/ b. /ˈs k r i v - u/

|**A**| |**U**| |**I**| |**U**|

[ˈkɑnto] [ˈskrivu]

Adopting these representational assumptions, the properties of Piverone vowel system and vowel harmony informally outlined above receive an explicit formulation. Firstly, since only openness is an active phonological property in this framework, while closeness is not (at least in classical versions of DP and GP – see for instance van der Hulst (2018, 2020) for a model including such a component), the only possible form of height assimilation is lowering. Secondly, since mid vowels are represented as structurally more complex than peripheral vowels /a, i, u/ – they must have at least two components – neutralization of vowel contrasts in unstressed syllables is captured as a simplification of their segmental content. Likewise, word-final mid vowels being possible only when aperture is shared with the stressed vowel reflects the need for most component combinations to be sanctioned by either stress or harmony.

5. Transparency and locality in Piverone harmony

As shown in (15), the penultimate vowel is transparent to harmony in proparoxytones. This transparency pattern is unlike most instances of transparency observed in other vowel harmony systems. In the vast majority of harmony systems displaying

[4] Savoia (2005) also uses Government Phonology elements in his analysis of Piveronese, but he explains its harmony in terms of licensing: **A** can occur in a 'weak' position (a word-final unstressed vowel) only if it is also present in a 'strong' position (the stressed vowel) which 'licenses' it – "[l]a presenza di [A] sul nucleo testa autorizza la presenza di [A] sui nuclei deboli del suo dominio" (Savoia 2005: 229). It is not fully clear how this formulation would account for words having an (**A**-less) stressed high vowel and word-final [a] (e.g. the last four singular forms in (8a) and all the singular forms in (8b)). Therefore, I suggest instead that **A** spreads. Alternatively, the licensing approach could be reformulated as '**A** can occur *in a 'complex' vowel* (i.e., a vowel combining two components) in a weak position only if it is also present in a strong position'.

transparency, it is "usually the result of one of two factors, either the vowel in question is not contrastive for the harmonizing feature or the harmony process is restricted to a certain class of vowels and the neutral vowel is simply not part of this class" (Krämer 2024: 246). An illustration of the first factor can be found in Finnish. Finnish has back/front vowel harmony, but phonetically front /i/ and /e/ can occur in a word with back vowels, without blocking assimilation of affix vowels to back root vowels (e.g. *tuule-ssa* 'wind-LOC', where the vowel of the inessive case marker agrees in backness with [u]). These two vowels are also the only front vowels not to contrast with a back counterpart in Finnish (that is, Finnish has neither /ɯ/ nor /ɤ/). An example of the second factor is observable in Chewa (Bantu). Chewa has a vowel height harmony lowering underlyingly high suffix vowels: the vowel is [e] or [o] if the preceding vowel is mid, and [i] or [u] if the preceding vowel is high or low. When preceded by a mid vowel, however, [a] is transparent: a mid vowel occurs in the harmonizing suffix (Krämer 2024: 248).

Therefore, transparency is commonly tied to a specific segmental content, usually independently of the vowel's position within a word. Interestingly, transparency in Piveronese operates inversely: it is the position of a vowel that makes it transparent, whereas its specific quality is irrelevant. All the vowels that can occur in the penult vowel of a proparoxytone (i.e. [a], [i] and [u]) can be transparent, although their underlying make-up is identical (i.e. |**A**|, |**I**| and |**U**|) to that of vowels that *must* be lowered (i.e. word-final vowels).

I take it for granted that relationships among phonological objects (or linguistic objects more generally) are typically – and perhaps necessarily – local: they hold among structurally adjacent units. This makes transparency in vowel harmony a particularly intriguing issue, as it seemingly defies locality. In the following sections, I will argue that explanations developed for 'prototypical' cases of transparency cannot be readily extended to Piveronese vowel harmony. In section 6, I will show that the stress patterns of Piveronese, along with its metrically-driven vowel syncope processes, support a metrical representation that also provides an explanation for transparency in proparoxytones, once the domain of Piveronese harmony is interpreted as metrically conditioned.

5.1 Transparency and contrastivity

Transparency of vowels that are not contrastive for the harmonic feature, such as /e, i/ in Finnish, has often been addressed relating it to the featural content of the transparent vowel(s). One solution is contrastive underspecification. In a framework that allows for featural underspecification, these vowels do not have to be specified for the harmonic feature(s); consequently, their transparency does not constitute a violation of locality, as no disharmonic feature intervenes between a harmony trigger and a harmony target (see Calabrese (2005) and Dresher (2009) for two different theories of phonological underspecification – Visibility Theory and Contrastive Hierarchy Theory respectively – both of which have found application to vowel harmony processes). In another approach to transparency that connects it to the structure of vowel inventories, van der Hulst (2018: 135) argues that whether a non-alternating vowel acts transparently or opaquely is largely predictable from the direction of neutralization of the harmonizing feature. Non-alternating vowels displaying the harmonizing feature, as in Finnish, are predicted to be transparent; non-alternating vowels incompatible

with the harmonizing feature (as the low non-ATR vowel in ATR systems that lack an ATR contrast for low vowels) are predicted to be opaque.

Despite the appeal of these notions in explaining numerous instances of transparency, they are not viable hypotheses to account for Piverone transparency (and in any case, their proponents readily acknowledge that there are reasons other than underspecification or the direction of neutralization why certain segments may block harmony – see e.g. Dresher 2009: 175 fn16). As observed above, any vowel in the penultimate syllable of a proparoxytone is transparent in Piveronese. Moreover, the vowel inventory in this environment is identical to that of the inventory of vowels subject to harmony in word-final syllables, ruling out the possibility of distinct specifications for transparent and target vowels.

5.2 Transparency and Strict Locality

Another approach to transparency is articulatorily-based, and claims that no phonological process can truly skip a segment; true transparency, strictly speaking, does not exist in phonology (hence the label 'Strict Locality'; see, among others, Gafos 1999, Ní Chiosáin & Padgett 2001).

Strict Locality sees vowel harmony as a single uninterrupted articulatory gesture over a span of several segments. Thus, in vowel harmony systems vowels are supposed to always influence intervening consonants and (allegedly) transparent vowels as well, although this influence may only be allophonic and perceptually minor. In fact, for proponents of Strict Locality it is not essential whether articulatory assimilation can be perceived or not: "[i]t is important to bear in mind that there is no requirement that the distinctions we are considering be auditorily robust or even audible, since they need not have contrast potential. The criterion here is that there be a systematic articulatory difference" (Ní Chiosáin & Padgett 2001: 125). Therefore, purported 'transparent' vowels would be cases of perceptually hard-to-detect harmonic vowels that have hitherto gone unnoticed.

However, if there were indeed a stable and uninterrupted tongue lowering gesture in Piveronese proparoxytones, spanning from a non-high stressed vowel to a final [e] or [o] and across a non-low penultimate vowel, the most likely candidate for the latter would be expected to be mid rather than a minutely lower variant of [i] or [u]. The vowels [e] and [o] – and therefore the articulatory gestures needed to produce them – can occur elsewhere in Piveronese words, and unstressed non-low post-tonic vowels are underlyingly /i/ or /u/ both in final and pre-final position. This would pose a problem to Strict Locality even if phonetic measurements revealed that Piveronese proparoxytone vowels previously reported to be [i] and [u] are in fact slightly lower when surrounded by non-high vowels. This quite plausible scenario could be interpreted as evidence of non-high vowels nearly merged with high vowels in that environment; however, such a minor lowering would be difficult to distinguish from coarticulation. Consequently, while transparency in Piveronese does not present an issue for accounts of transparency based on contrastivity – as noted earlier, they do not claim that transparency must result solely from contrast (or lack thereof) – it poses a challenge for Strict Locality.

5.3 ‘Morphemic’ harmony

In most Piveronese words, the vowel undergoing harmony is also the exponent of an inflectional suffix. It has been argued that when phonological features realize an affix, the vowel alternations they induce may follow different constraints than those of prototypical phonological harmony, potentially resulting in skipped vowels. Finley (2009) refers to this as ‘morphemic’ harmony, although her proposal primarily deals with ‘floating’ morphemes – morphemes that are realized without segmental material, but with featural material.

However, this approach cannot be readily applied to Piverone vowel harmony. Presence of harmony does not mark any specific morphosyntactic feature in Piveronese; final [e] in e.g. [ˈleŋgwe] (8a) is the exponent of the features ‘feminine’ and ‘plural’ just as final [i] is in [ˈsjuli] (8b). At most, harmony could be interpreted as an allomorph selection rule, and thus arguably not subject to the same phonological constraints – such as locality – that govern purely phonological rules. Yet, Piveronese harmony is not restricted to suffixes. While in most words the final vowel is the marker of a morphosyntactic category (number in nominal inflection, person in verbal inflection), harmony is regularly observed in root-final vowels as well (cf. (11), (12), (13) and the discussion in section 3). It is a purely phonological process, independent of morphological categories.

5.4 Harmony and metrical structure

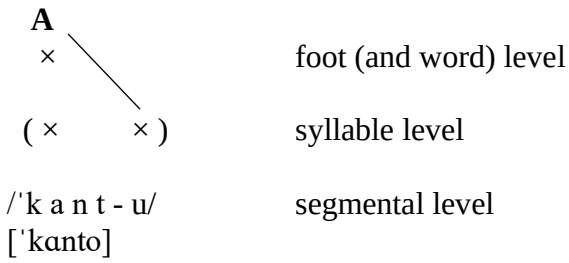
Yet another approach to addressing locality is available in languages where harmony is related to the phonological domains defined by stress and feet. Like in Piveronese, in several languages stressed vowels are triggers of harmony, and unstressed vowels are targets (or viceversa). This fact has prompted several phonologists (e.g. Halle & Vergnaud (1981) for numerous languages, Anderson (1987) for Khalkha Mongolian, Hualde (1989) for several Spanish dialects, van der Hulst (2018: 36-37, 448) for Germanic and Romance) to adopt metrical structure as the representation of the vowel harmony domain and mechanism: the feature of a vowel (usually the stressed one) percolates through the metrical tree and is bounded by metrical domains (the phonological word, the foot, and so on). Since the terminal nodes of metrical trees are vowels, non-local skipping of consonants is achieved, so to say, for free. Moreover, this solution offers additional advantages:

1. it accounts for domains that otherwise have to be stipulated: if harmony is triggered by a stressed vowel, its scope often corresponds to a metrical domain, like the foot, or is blocked by vowels which are at the edge of a metrical domain
2. it can predict directions of assimilation that under other formalisms have to be stipulated: if in a given language the triggering vowel is the stressed one and feet are trochaic, a harmony process having as its domain the foot can only be rightward
3. it does not require new assumptions or machinery, since metrical structure is independently motivated by the need to represent stress patterns

As I will argue in the following section, the seemingly non-local behaviour of Piveronese vowel harmony in proparoxytones can be explained if the domain of its

harmony is metrically defined. For now, I will provide a representation of this solution only for paroxytones, as they are the simplest case. The representation of harmony in (17) is thus revised as (18)[5]: when the **A** component occurs within the metrical head of the word (i.e. the vowel carrying word stress), it percolates to the immediately lower syllable node to its right (i.e. the final vowel, in a paroxytone).

(18)



5. Metrical properties of Piveronese proparoxytones

Any theory which assumes locality, in one form or another, has to explain the behaviour of proparoxytones in Piveronese. In such words the penultimate vowel is transparent, apparently making harmony a non-local process (19=15).

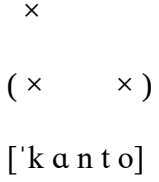
(19)

[ˈmɑndule]	‘almonds’
[ˈmɑkine]	‘cars’
[ˈkɑmule]	‘moths’
[ˈsigali]	‘cigars’
[ˈskɑtule]	‘boxes’

Supposing, as I did in the preceding section, that the domain of Piverone harmony is metrically defined, the proper metrical representation of proparoxytones is a necessary precondition to understand their transparency in the harmony process. Therefore, in this section I present an analysis of the metrical structure of Piveronese, with a special emphasis on proparoxytones.

In Piedmontese, word stress falls on one of the last three syllables. Within this domain, its position is largely unpredictable; I will consider it to be lexically specified. I will also assume a strong-weak, trochaic rhythmic pattern. Consequently, paroxytones are represented as in (20):

(20)



5 The metrical representation I adopt is a bracketed grid – as proposed in e.g. Halle & Vergnaud (1987), Hayes (1995) – which aims at incorporating both the rhythmic nature of stress and its hierarchical constituency.

Oxytones, including monosyllables, are frequent in Piedmontese. A short list of Piveronese stressed monosyllables is given in (21).

(21)

[ˈvel]	‘calf, veal’
[ˈsɛi̯]	‘thirst’
[ˈze]	‘game’
[ˈɔm]	‘man’
[ˈbry]	‘heather, broom’
[ˈmɛk]	‘only’
[ˈfɛ]	‘you do’

Since stressed monosyllabic words must be footed, I consider it uncontroversial that Piveronese allows degenerate, unary feet. Binary and unary feet may coexist within the same word (22).

(22)

```
          ×
    (×    ×)
  (× ×) (×)
[ˌbarbaˈrɔt]        ‘chin’
```

Metrical structure clearly affects syncope in Piveronese. An underlying /e/ is deleted (barring a handful of lexical exceptions) if it occurs in immediately pretonic position, both in word-medial (23a) and word-initial syllables (23b), except when deletion would yield a consonant sequence violating the phonotactics of Piedmontese (23c). Immediately pretonic vowels other than [e] are retained (23d), and so is typically [e] when it carries a secondary stress (23e).

(23) a.

[kaˈpel]	‘hat’	[kapˈliŋ]	‘small hat’
[rasˈtel]	‘rake’	[rastˈlɑ]	‘to rake’
[biˈnel]‘twin’		[binˈlɑ]	‘to give birth to twins’
[marˈtel]	‘hammer’	[martˈlɑ]	‘to hammer’

(23) b.

[ˈstɛra]	‘s/he buries’	[ˈstrɑ]	‘to bury’
		[ˈstrɛu̯r]	‘grave-digger’ (lit. ‘burier’)
[ˈfɛŋ]	‘hay’	[ˈfnɑ]	‘to make hay’
		[ˈfnɛu̯r]	‘hay-maker’

(23) c. [arleˈva] ‘to relieve’ *[arlˈvɑ]

(23) d.

[ˌskaraˈvel]	‘rung’
[ˌviruˈliŋ]	‘splindle’
[ˌambuˈsɑ]	‘to turn down’
[amˈbɔs]	‘turned down’

(23) e. [ˌferaˈgust] ‘Assumption day’

Syncope, whether in pretonic or post-tonic position, suggests that these contexts are prosodically weaker than non-syncope ones. Typically, vowel reduction (neutralization or deletion) is associated with weak metrical positions. In many languages, vowels carrying word stress allow for more contrasts than unstressed vowels; outright deletion is a more radical form of reduction. In Piveronese, this sensitivity to stress position suggests the existence of a prominence hierarchy among its unstressed vowels, with varying degrees of reduction corresponding to different degrees of prominence.

Indeed, the two environments for pretonic syncope are clearly metrically weak positions, even compared to most other syllables not carrying word stress. The first environment is the intertonic vowel (between a secondary stress and word stress): unstressed [e] is banned from occurring between a secondary stress and a primary stress (24).

(24)

		×	×
		× (×)	(× ×)
		× (×)	(× ×)(×)
/rasˈtel/ + /ˈa/	→	[rastˈlɑ]	*[ˌrasteˈlɑ]

The second environment for pretonic syncope of [e] is an unparsed syllable (25): an unstressed [e] is deleted if it cannot be parsed into a foot.

(25)

		(×)	× (×)
/ˈstɛr/ + /ˈa/	>	[ˈstrɑ]	*[steˈrɑ]

It is not enough for /e/ to be pretonic for its deletion; the presence of a secondary stress preserves it (26).

(26)

×
(× ×)
(× ×) (×)
[ˌferaˈgust]

Pretonic syncope has an intriguing post-tonic near-parallel; whenever a clitic is attached to a paroxytonic verbal form, turning it into a proparoxytone, the immediately post-tonic vowel is deleted (27).

(27)

/mat-i=lu/	[ˈmɑtlo]	‘put-IMP.2SG=it’
/lev-a=ti/	[ˈlɛu̯te]	‘remove-IMP.2SG=you / get lost!’
/kyz-i=lu/	[ˈkyzlu]	‘sew-IMP.2SG=it’
/must-i=mi/	[ˈmusmi]	‘show-IMP.2SG=me’

Just as pretonic syncope does not target any pretonic [e] but only intertonic or unparsed [e], post-tonic syncope similarly does not delete any vowel preceded by a clitic; stressed vowels are preserved (28), implying that metrical structure also plays a crucial role in determining the environment of this deletion process.

(28) [purˈt-a=lo] ‘carry-INF=it’
[maˈt-y=lu] ‘place-PTCP=it’

Deletion of an unstressed vowel when followed by another vowel closely resembles the environment in (24); a vowel must be deleted when it would occur between the stressed syllable and another syllable.

(29) /ˈkyzi/ = /lu/ → [ˈkyz=lu] *[ˈkyzi=lu]

Also, word-final unstressed syllables can sanction mid vowels – provided that a non-high vowel occurs in the stressed syllable – while the antepenultimate syllable of a proparoxytone can only host [a], [i], or [u]. The various types of metrically conditioned reduction processes of Piveronese are summed up in Table 1.

Table 1. Summary of metrically conditioned reduction processes

Environment	Possible vowel qualities	Syncope
Stressed syllables	[ɑ, ɛ, e, ɪ, i, ɔ, u, œ, y]	no
Syllables carrying pretonic secondary stress	[a, i, u, ɪ, y, e]	no
Unstressed final syllables	[a, i, u]; [o, e] when the stressed vowel is non-high	no
Pretonic syllables without secondary stress	[a, i, u, ɪ, y]	underlying [e] deleted
Post-tonic syllables in proparoytones	[a, i, u]	any vowel deleted if followed by a clitic

Taken together, these facts suggest that the antepenultimate syllable of a proparoxytone occupies a metrical position weaker than that of the unstressed final syllable. Since the former is an unstressed syllable, the relatively higher metrical prominence of the latter (essentially, a secondary stress) implies it must occupy a higher position in the metrical structure of a proparoxytone, as outlined in (30).

(30)
```
      ×
    (×   ×)
  (×  ×) (×)
[ˈmɑndu.le]
```

Post-tonic syncope can now be formalized as occurring to avoid an intertonic weak vowel (31), closely resembling the environment of pretonic syncope (although not only [e] but any vowel is deleted post-tonically, and only before a clitic).

(31)

		×	×
		(× ×)	(× ×) (×)
/ˈkyzi/ = /lu/	→	[ˈkyz=lu]	*[ˈkyzi=lu]

With respect to the foot parsing presented in (30), the default foot in Piveronese is a binary trochee, and unary feet are possible (see 21, 22). Consequently, proparoxytones will be parsed as (σ́ σ) (σ̀). Ternary feet or final syllable extrametricality, sometimes employed in analyses of Romance proparoxytones (see Bafile 1999, Meinschaefer 2022 for surveys of Italo-Romance stress patterns and their metrical representations), would not account for the asymmetry in prominence between the penultimate and final syllable of Piveronese proparoxytones. Moreover, they would necessitate additional assumptions, such as those required to generate larger-than-binary feet.

A reviewer suggests exploring whether layered ternary feet (see e.g. Martínez-Paricio & Kager 2015) could account for the prosodic structure of Piveronese proparoxytones. A layered ternary trochaic foot $((\sigma\ \sigma)_{Ft}\ \sigma)_{Ft}$, would assign two distinct levels of projection to the last two syllables of a proparoxytone, and thus would plausibly be able to assign to them two different prominence levels, similar to (30); as a consequence, it would also provide an explanation of harmony transparency comparable to the one we offer in the next section. However, since unary feet are independently motivated in Piveronese and binary trochees are the default foot type, the parsing in (30) provides the most straightforward explanation for the vowel reduction asymmetry observed in the last two syllables of proparoxytones. Any alternative parsing would necessitate additional stipulations – such as positing the possibility of recursion within feet in the case of layered feet – and would require justification for why it should be considered a more optimal candidate than the one in (30).

6. Metrical structure and transparency to harmony

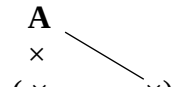
Equipped with this metrical representation of proparoxytones, we can now elucidate the seemingly non-local behaviour of Piverone vowel harmony.

In the paroxytone in (18), harmony was represented as percolation of the **A** component from the stressed vowel to the vowel to its right, which is the weaker part of the foot headed by the stressed vowel; harmony goes from the syllable carrying word stress to the lower metrical node to its right.

This metrical representation enables us to equate the domain of vowel harmony in paroxytones with that in proparoxytones: in the latter case as well, given a representation as in (32) for proparoxytones, **A** percolates from the stressed vowel to the immediately lower metrical node to its right.[6] Since a word such as [ˈmɑndule] contains two feet, the node to the right of word stress is the rightmost foot (which dominates the final vowel) rather than the penultimate vowel.

6 Van der Hulst (2018: 36-37) proposes a very similar analysis for stress-driven harmonies where trigger and target vowels may be separated by a non-alternating vowel, although in his view of metrical structure, unlike in mine, "being a foot head does not automatically imply the presence of overt prominence cues" (van der Hulst 2018: 37 fn. 70).

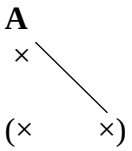
(32)



/ˈmandul-i/ → [ˈmɑnduˌle]

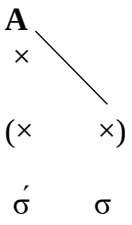
Thus, harmony in both paroxytones and proparoxytones can be expressed uniformly: **A** percolates from the word stress node to the lower metrical node to its right (33a). In paroxytones (33b), the lower node is the weak syllable within the foot carrying word stress, i.e. the word-final vowel. In proparoxytones, the unary foot that follows the foot carrying word stress is the immediately lower node to the right of word stress (33c). This clarifies why in proparoxytones the penultimate vowel is skipped by harmony: it is too low in the metrical tree to be reached by percolation. Hence, harmony is local in proparoxytones as well: in all cases, only adjacent metrical nodes are affected.

(33) a.

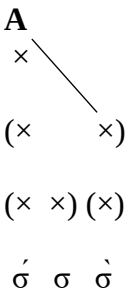


word stress

b. Paroxytones



c. Proparoxytones



While a comprehensive typology of vowel transparency in Romance is beyond the scope of this paper, the extensibility of this account of transparency to broadly comparable Ibero-Romance and Italo-Romance stress-dependent harmony systems – most commonly metaphony – deserves a comment. In many of these systems, the word-final and the stressed vowel are either the trigger or the target; yet, unlike in Piveronese, the penultimate vowel of proparoxytones is affected rather than transparent. For instance, in Grado Venetan proparoxytones a final high vowel raises both the stressed and the penultimate vowel: [ˈzoven-e] vs. ‘young-SG’ [ˈzuvin-i] ‘young-M.PL’ (Cortelazzo 1978: 4 fn5). Many of these varieties can reasonably be assumed to have a metrical structure similar to that of Piveronese, which raises the question of why their penultimate vowel undergoes assimilation if it is metrically ‘invisible’.

Three preliminary considerations can be made. First, the transparent pattern is robustly attested in Romance stress-dependent harmony processes beyond Piveronese

harmony. For example, in Mascioni (north-western Abruzzo), metaphonic alternations such as [ˈsoɾʧ-e] ‘mouse-M.SG’ vs. [ˈsuɾʧ-i] ‘mouse-M.PL’ (Savoia 2015: 240) show that the final vowel raises stressed /o/ but not unstressed /e/.

Second, in harmony systems where the penultimate vowel of proparoxytones harmonizes, the process could be formalized as the percolation of the harmonic feature to the entire foot (this solution would be similar in spirit to Hualde’s (1989) account of laxing harmony in Tudanca Montañés).

Third, raising of the penultimate vowel in proparoxytone words such as Gradese [ˈzuvin-i] may represent a distinct, local harmony process that is independent of the metaphonic raising of the stressed vowel. In many Italo-Romance varieties, post-tonic vowels assimilate to the final vowel. Most often this assimilation is a total copy (cf. [ˈstomːuk-u] ‘stomach-M.SG’ vs. [ˈstomːik-i] ‘stomach-M.PL’ in Serviglianese, Camilli 1929), which clearly indicates it is a process distinct from metaphony. However, in some varieties post-tonic harmony only raises mid vowels to high, as in some areas of Garfagnana in northern Tuscany (Venturelli 1979: 104): [ˈalber-o] ‘tree-M.SG’ vs. [ˈalbir-i] ‘tree-M.PL’. Even in such cases, three criteria distinguish post-tonic harmony from metaphony: a) post-tonic harmony takes place even when the stressed vowel, being low or mid-low, cannot undergo metaphony; b) metaphony takes place in proparoxytones even when the penultimate vowel, being low, cannot undergo post-tonic harmony; c) while metaphony is triggered by the final vowel of the phonological word, post-tonic harmony is triggered by the final vowel of the clitic group: cf. Serviglianese /ˈmett-i=la/ → [ˈmettala] ‘put-IMP.2SG=ACC.3F.SG’. In Gradese, these three properties can all be observed. Post-tonic raising takes place even when metaphonic raising of the stressed vowel is impossible (e.g. [ˈmamol-o] ‘child-M.SG’ vs. [ˈmamul-i] ‘child-M.PL’, Cortelazzo 1978: 160-162). Metaphony takes place even when post-tonic raising is impossible (e.g. [ˈzovan-e] ‘young-M.SG’ vs. [ˈzuvan-i] ‘young-M.PL’, AIS I map 51; the form [ˈzovane] is not reported in the cited atlas, but in all Venetan varieties the word ‘young-M.SG’ has a stressed /o/). Finally, clitic vowels raise post-tonic vowels: [ˈzvɔd-i=li da ˈbeve] ‘pour him (something) to drink’ (ALI IX map 927) vs. [ˈzvɔd-a] ‘pour-IMP.2SG’ (the latter form of ‘to pour’ is not reported in the cited atlas, but the 2sg imperative suffix of first conjugation verbs is [-a] in this dialect). These observations suggest that in Gradese [ˈzuvin-i], final [i] triggers two separate processes: local raising of the penultimate vowel and non-local raising of the stressed vowel. Thus, metaphony may skip the penultimate vowel of a proparoxytone even when this vowel agrees in height with the final vowel. Despite at first glance appearing to generate a non-gapped configuration, metaphony in this word may actually be as non-local as vowel harmony in Piveronese [ˈmɑnduˌle].

7. Conclusions

Underlying specifications of vowels in the final two syllables of Piveronese proparoxytones are limited to the corner vowels /a, i, u/. Despite permitting identical inventories, word-final vowels are sensitive to a vowel-lowering harmony process, while penultimate vowels never alternate; they are harmonically transparent. However, this seemingly non-local vowel harmony process can be reconciled with the idea that trigger and target vowels must be adjacent at some level, even if they are not at the segmental level. An analysis of the metrical structure of Piveronese indicates

that the penultimate vowel of proparoxytones occupies a metrically weak position, whereas the final one carries secondary stress. Since Piveronese vowel harmony can be characterized as a local interaction between the syllable carrying word stress and the immediately lower metrical node to its right, in proparoxytones the weak node occupied by the penultimate vowel lies outside the domain of this interaction, and is therefore invisible to and unaffected by it.

Acknowledgments

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