Distinctive features and phonological change: vowel fronting and gravity interactions in Altamurano*

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Altamurano (a southern Italo-Romance variety) displays a set of phonological processes and/or diachronic changes which are best explained with reference to the gravity of the vowels, glides and consonants involved. These processes (insertion and deletion of a labio-velar glide, back vowel fronting; cf. §1), for which I propose the overall label of *gravity interactions*, represent a counterpart to the often discussed *coronal interactions*. While the latter are neatly accounted for within Feature Geometry models (cf. e.g. Hume 1992, Clements & Hume 1995), Altamurano gravity interactions provide a challenge to some basic assumptions underlying mainstream research on phonological processes and change in Generative Phonology. In §2, it is demonstrated that a sensible account of the phonological processes at issue requires direct reference to the acoustic substance linguistic sounds are made of.

After developing my account, I move on to discuss alternative analyses of the Altamurano data which have been recently put forward (§§3-4). In the Appendix, I discuss a further process of Altamurano, viz. open syllable diphthongization, and, based on this discussion, briefly tackle the collateral issue of the relationship between dialectological fieldwork and theoretical speculation in phonology.

0. Introduction

The relationship between synchrony and diachrony in the study of language can be conceived in either of the following ways: there is a system, viewed synchronically, and then change modifies that system; or, alternatively, there are phonological processes which bring about changes, and the system itself is viewed as the product of these changes. This sort of hen-and-egg story tells us that the basic assumptions and the technical machinery by means of which we describe phonological systems, on the one hand, and phonological change, on the other hand, cannot radically diverge, a fact on which most linguists of different theoretical beliefs nowadays agree. Take for instance Labovian sociolinguistics: it describes synchronic variation by quantifying the behaviour of (classes of) speakers by means of indexes for any given variable, and then it applies the same descriptive tools to account for change in the speech community, in real or apparent time (cf. Labov 1994). Or take Optimality Theory (Prince &

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Smolensky 1993). It describes synchronic patterns by means of hierarchically ordered constraints, and then goes on to describe change as mutual re-ranking of (some of) these constraints (cf. e.g. Löhken 1997).

A further, quite banal fact is that language is used by human beings, who have with it a two-fold relationship: as speakers (speech-producers) and as hearers (speech-perceivers). Once this elementary observation is brought into the picture, however, a paradox quickly arises. In this respect, in fact, there is a striking difference between what is common practice in the two fields of synchronic analysis of phonological patterns, on the one hand, and of the study of sound change, on the other.

In the latter field, there is a fair amount of work which shows that the factors conditioning language change have to be sought in either production or perception: some changes are better explained as due to articulatory constraints, others as due to perceptual ones.[1] This holds true for several lines of research, which can be defined – in epistemological terms – as either substantialist (like e.g. Ohala's 1989 Experimental Phonology) or functionalist (such as e.g. Dressler's 1985 version of Stampe's Natural Phonology).[2] But the paradox becomes evident as soon as we consider the descriptive machinery currently used in the synchronic analysis of phonological systems. Here, the most fully developed models all share a conventionalist-formalist orientation: what matters is the production of the most economical formalized description of patterns and processes. In this connection, the theory of distinctive features (henceforth **DFs**) plays a major role. And since descriptive economy must be achieved first and foremost, emphasis is placed on the elaboration of a maximally constrained set of DFs. One major economy, to spare descriptive redundancy, has been to choose to have DFs grounded in only one of the two dimensions, either acoustic (like Jakobson *et al.* 1952) or articulatory, like all other current systems since then, starting with Chomsky & Halle (1968) up to more recent Feature Geometry models such as e.g. Halle *et al.* (2000).

However, if at the same time we take seriously the idea that generalizations about phonological systems must be expressed in terms of DFs, as well as the idea that phonological change and its output (phonological systems) are determined by both production and perception, then a straightforward conclusion ensues: models that choose only one of the two dimensions, singling out either production or perception as the only relevant foundation for generalizations about language structure and change, cannot be correct.[3]

A further, more general problem of these models is the fact that they tacitly assume that sound change can be satisfactorily and exhaustively described in terms of DFs which, although grounded in the phonetic dimension, build a self-contained formal system. This follows from a well-established view according to which phonology is linguistic *form*, by definition, and is best described in purely internal terms (cf. e.g. Hyman 2001). However, there are alternative views of phonological systems, according to which these are best understood as the formal reflex of *substantial* constraints (cf. e.g. Stampe 1979, Ohala 1989).

In this paper I intend to argue in favour of the latter position, and show that the exclusive focus on form (vs. substance), on the one hand, and on the articulatory (vs. perceptual) dimension both prove disadvantageous for the analysis of phonological change. Rather, successful elucidation of change requires that the form/substance and the articulation/perception dichotomies be taken into account seriously. The empirical material I will discuss is provided by a set of phonological processes at work in a dialect of south-eastern Italy, Altamurano, spoken by some 60,000 people in the town of Altamura (in the province of Bari, Apulia). In §1 I describe these processes: *w*-insertion (§1.1), *w*-deletion (§1.2), and back vowel fronting (§§1.3-1.4). In §2 I develop my account of the facts, which relies crucially on the assumption that the changes at issue – or, more precisely, the conditions constraining them – must be understood in the light of acoustically motivated perceptual constraints, much in the spirit of Ohalian experimental phonology. To demonstrate this, it is necessary to refute alternative explanations of the same data that have been proposed by several scholars after the Altamurano facts were first described, in Loporcaro (1988).

These alternative analyses are discussed in §§3-4, with special focus on Cox (1997) and Calabrese (2000), who propose separate accounts of *w*-deletion and back vowel fronting, respectively. I will show that these accounts have several shortcomings: first of all, they single out only some of the processes at issue, while I argue that a conjoint consideration of all these processes is essential to a correct characterization of them. Secondly, Cox and Calabrese both assume that the processes follow from articulatory constraints and can be expressed formally, as a consequence, in terms of articulatorily based DFs. I will show that this basic assumption inevitably leads to bad descriptive results and makes a sensible explanation impossible. Finally, with specific reference to Calabrese (2000), I show in §4 that this reanalysis is also flawed by both empirical and theoretical short-

comings, as it is based on a conception of the relation between phonological form and phonetic substance in phonological research which turns out to be misguided.

1. The facts: four phonological processes in the dialect of Altamura

1.1. [w]-propagation

In this dialect, an assimilation process propagates a labio-velar glide, under the appropriate conditions, as shown in (1):[4]

(1) a.

/ʊ # 'pɛnə/	→ [ʊ 'pwɛi̯n]	'the bread'
/ʊ # 'bbenə/	→ [ʊ 'bːwei̯n]	'the good'
/'kʊssʊ # 'melə/	→ ['kʷʊsːʊ 'mwei̯l]	'this honey'
/ʊ # 'felə/	→ [ʊ 'fwei̯l]	'the gall'
/ʊ # 'vaɲɲə/	→ [ʊ 'waɲː]	'the tub (to wash sheep)'
/'kʊddʊ # 'kɛnə/	→ ['kʷʊdːʊ 'kwɛi̯n]	'that dog'
/nʊ # gga'raddʒə/	→ [nʊ gːwa'radːʒ]	'a garage'

b.

/ʊ # 'taʊ̯lə/	→ [ʊ 'taʊ̯l]	'the table'
/nʊ # 'dɪʃtə/	→ [nʊ 'dɪʃt]	'a finger'
/ʊ # 'nɛsə/	→ [ʊ 'nɛi̯s]	'the nose'
/'kʊssʊ # 'rɛnə/	→ ['kʷʊsːʊ 'rɛi̯n]	'this wheat'
/ʊ # 'lattə/	→ [ʊ 'latː]	'the milk'
/ʊ # 'sɛlə/	→ [ʊ 'sɛi̯l]	'the salt'
/nʊ # 'tsɛmbrə/	→ [nʊ 'tsɛmbr]	'a he-goat'
/ʊ # 'ddzɪrrə/	→ [ʊ 'dːzɪrː]	'the oil-jar'
/ʊ # 'ʃekə/	→ [ʊ 'ʃei̯k]	'the game'/'you.SG play it.M'
/ʊ # 'tʃɛrnə/	→ [ʊ 'tʃɛrn]	's/he sifts it.M'
/ʊ # 'cevə/	→ [ʊ 'cei̯f]	'the nail'
/'kʊddʊ # 'jattə/	→ ['kʷʊdːʊ 'jatː]	'that cat'

As is apparent from a comparison of the underlying and the surface forms in (1a-b), some more processes apply which we will neglect for the moment. (In particular, final schwa deletion and non-low vowel diphthongization, to which we will return in the Appendix.) As is also apparent from the two columns in (1), the propagation of the labio-velar glide [w] takes place whenever a particular morpheme containing a /ʊ/ vowel (either the definite article /ʊ/, or the indefinite article /nʊ/, or the direct object clitic /ʊ/, or the determiners /'kʊssʊ/, /'stʊ/ 'this', /'kʊddʊ/ + noun/adjective) is added before one of the words in (1a), not before those in (1b). Evidence for the underlying

representation, and hence for the process, is provided by the fact that in all other contexts, the words in (1a) surface without [w]: e.g. [ʊ 'pwaʃː] '(s/he) pastures it.M' vs. ['kwanːə 'paʃː] 'when (s/he) pastures'.

Propagation is subject to some conditions. The initial consonant must be labial or velar ((1a)), while dentals, palato-alveolars and palatals block the process ((1b)).[5] A further condition requires that the initial consonant be followed by a non-back vowel. As shown in (2), back vowels block propagation:[6]

(2)

	_ɔ	_o	_ʊ
p_	[ʊ 'pʷɔrdʒ] 'the flea'	[ʊ 'moʊ̯f] 'I move it.M'	[ʊ 'muʊ̯t] 'the funnel'
k_	[ʊ 'kɔnd] 'I count it.M'	[ʊ 'koʊ̯r] 'the heart'	[ʊ 'kuʊ̯l] 'the arse'
t_	[ʊ 'tsɔmb] 'I jump it.M'	[ʊ 'noʊ̯f] 'the nine'	[ʊ 'tuʊ̯f] 'the (block of) volcanic tufa'

For clarity, table (3) shows the relevance of the two conditioning factors: place of articulation of the initial consonant, on the vertical dimension, and of the following vowel, on the horizontal dimension. (The borderline underscores the role of place of articulation).[7]

(3)

	_a	_ɛ	_e	_ɪ
p_	[ʊ 'pwaʃː] 's/he pastures it'	[ʊ 'pwɛi̯n] 'the bread'	[ʊ 'mweiʊ̯l] 'the honey'	[ʊ 'fwɪi̯l] 'the thread'
k_	[ʊ 'kwallə] 'the heat'	[ʊ 'kwɛi̯n] 'dog'		([nʊ 'kɪi̯l]) **'one kilogram'**
t_	[ʊ 'taʊ̯l] 'the table'	[ʊ 'rɛi̯n] 'the wheat'	[ʊ 'sei̯n] 'the sound'	[ʊ 'tsɪi̯t] 'the bridegroom'

Note that propagation is not triggered by just any preceding /ʊ/, but only by the /ʊ/ contained in the morphemes listed above. Thus, for instance, the subject pronoun /'tʊ/ has no effect (cf. (4b) vs. (4a)):

(4)

a. /ʊ # 'paʃʃə/	→ [ʊ 'pwaʃː]		's/he pastures it.M'
b. /'tʊ # 'paʃʃə/	→ ['tʊ 'paʃː/*'pwaʃː]		'you pasture'

This clearly shows that the rule has been morphologized.[8] Summing up, the generalization is that a [w]-glide is inserted after a word-initial labial or velar consonant before a non-back vowel, whenever a /ʊ/ morpheme carrying the morphological specification [msg]

precedes. We will discuss a possible explanation of these facts in §2 (elaborating on the account in Loporcaro 1988: 185-196).[9]

Before closing this section, however, let us briefly discuss the non-application of propagation in (2). Note, firstly, that inserting a *w*-glide would pose no articulatory problems at all: on the contrary, it would smooth out the transition from the initial consonant to the following back vowel. Thus, an explanation in terms of a perceptually motivated phonotactic constraint seems to be more promising *a priori*. If propagation were to apply in (2), the output would be a string of /w/ + back vowel, a combination which appears to be cross-linguistically disfavoured (diphthongs aside, of course). Ohala & Kawasaki (1984: 122ff) consider in particular the rarity of /wu/ (as well as /ji/) strings in the languages of the world. This rarity, they argue, cannot be explained in terms of the sonority hierarchy, since the symmetrical strings /wi/ and /ju/ are not subject to any such restrictions, and account for it by the acoustic circumstance that "[wu] and [ji] [...] create minimal modulations in amplitude, periodicity, and spectrum" and are therefore perceptually bad.

This would be the case in (2): if /w/-propagation were to apply, the output would be perceptually bad, because of the minimal syntagmatic contrast between /w/ and the following back vowel. Hence, the process is blocked in this context, whereas it applies before non-back vowels (cf. (3)).

1.2. [w]-deletion

Altamurano has undergone a diachronic change which is in a way complementary to the synchronic *w*-propagation rule just considered. As shown in (5a-b), lower-mid PRom /ɔ/ and /ɛ/, from Latin short ŏ and ĕ respectively, diphthongized through metaphony to /we/ and /ɪə̯/ under stress, when originally followed by the final high vowels /i u/ (which ultimately merged into schwa as a consequence of a later change).[10]

(5)	a.	PRom	/ɔ/	FŎCUS	> /'fweɟkə/	→	['fweɟk]	'fire'
	b.	PRom	/ɛ/	LĔGIS	> /'lɪə̯ʃə/	→	['lɪːʃ]	'read.2SG'

The output of /ɔ/-metaphony, viz. the diphthong /we/, was not preserved in all environments. Rather, when preceded by a coronal consonant, the /w/ glide was deleted, whereas it was preserved when preceded by a labial or a velar consonant:

(6)

	[–voice]	[+voice]	[+nasal]
a. /p/_	PŎTES (PŎTIS) /'pwetə/ 'you can'	BŎNU /'bbwenə/ 'good.MSG'	MŎDU /'mwetə/ 'manner(s)'
b. /k/_	COLLU /'kweddə/ 'neck'	IN+CŎLLU /'ngweddə/ 'on (one's shoulders)'	
c. /t/_	TŎXICU /'teskə/ 'poison'	SŎNU /'senə/ 'sound'	NŎSTRU /'nestə/ 'our.MSG'

Actually, the data provided in (6) could also authorize the opposite interpretation, viz. that a coronal consonant triggered the process. But it is easy to show that this would be incorrect and that (6c) is indeed the elsewhere case. The proof is elementary. As shown in (7), the glide was deleted word-initially as well:

(7)	HOMINES	>	*/'wemmə/	>	/'emmə/	→	['emː]	'men'
	HORTUM	>	*/'wertə/	>	/'ertə/	→	['ert]	'vegetable garden'
	HORDEUM	>	*/'werʃə/	>	/'erʃə/	→	['erʃ]	'barley'
	OSSUM	>	*/'wessə/	>	/'essə/	→	['esː]	'bone'
	OCULUM	>	*/'weccə/	>	/'eccə/	→	['ecː]	'eye'

In functional terms, what happened is that a deletion process applied, one that was blocked by a preceding labial or velar consonant.

1.3. /ʊ/-fronting

Let us now consider an allophonic process that affects the back high vowel /ʊ/. When occurring in stressed syllable, this vowel phoneme shows the three different phonetic realizations in (8):

(8)	a.	[ʊʊ̯]	b.	[ʏ]	c.	[ʷʊ]
	['pʊʊ̯r]	'also'	['tʏnː]	'round'	['pʷʊtːs]	'well'
	['tʊʊ̯f]	'tuff'	['nʏtːs]	'stone' (of a cherry, olive, etc.)	['abːʷʊtː]	'inflate.2SG'
	['kʊʊ̯s]	'sew.2SG'			['fʷʊnː]	'deep.M'
	['ʃʊʊ̯t]	'gone'	['ʃʏɲː]	'rush' (bot.)	['mʷʊnː]	'world'
	['sʊʊ̯t]	'sweat.SG'	['sʏtːs]	'dirty.M'	['kʷʊsː]	'this.M'
	[a'cʊʊ̯t]	'close.SG'	['cʏmː]	'lead'	['ŋgʷʊːtənə]	'anvil'
	['mʊʊ̯l]	'mule'	['jʏʃk]	'smart.3SG'	['wʊɟː]	'boiling'
	['nʊʊ̯t]	'knot'	[a'cʏːtənə]	'close.3PL'	['wʊːnətʃə]	'eleven'
	['cːʊʊ̯]	'more'	[a'bːʀʏːʃənə]	'burn.3PL'		
	['tʊʊ̯]	'you'	['dʏːdətʃə]	'twelve'		
	['jʊʊ̯n]	'one'	['ʏrs]	'bear'		
	['ʊʊ̯s]	'use'	['ʏltəmə]	'last'		

In (8a) diphthongization takes place. Consider that, as already shown in (1) above, all words in this dialect end in a schwa that is deleted prepausally (as in the quotation forms in (8)) but is phonetically realized when it occurs sentence-internally (cf. Loporcaro 1988: 159ff). Therefore, stressed vowels in (8a) are underlyingly in an open syllable and the process affecting them can consequently be characterized as an instance of open-syllable diphthongization. More precisely, since the process does not apply in proparoxytonic words (cf. (8b-c)), the environment contrast in (8a) vs. (8b-c) is best captured in terms of morae, as shown in (9) (from Loporcaro 1996: 172):

(9) V → VV̂/_μ_0^1 ##

This characterization of the relevant environment is a revision of the one proposed in Savoia (1987: 240) for a similar diphthongization in a dialect of Lucania, viz. _μ_1^1 (see also Savoia 1990 on Abruzzese). Savoia's formulation is at odds with the fact that, in all varieties of south-eastern Italy including Altamurano and the dialect he analyses, such diphthongizations also apply to word final stressed vowels, as first recognized as early as Merlo (1926: 87).[11]

In the data in (8b-c), the structural description of diphthongization in (9) is not satisfied, since the stressed vowel is in a closed syllable and/or in an antepenult. Therefore, instead of diphthongization, two other processes apply: in (8b), /ʊ/ is fronted to [ʏ], whereas in (8c) no fronting takes place, and labialization of the preceding consonant is found instead.[11]

Speakers exhibit some variation in realization of the fronted allophone: while [ʏ] largely prevails, some elderly speakers (especially, though not exclusively, women) have a somewhat tenser [ʏ̞], even approaching [y] in some occurrences. Note that this purely phonetic variable tensing only affects the fronted allophone ((8b)), whereas the allophones in (8a) and (8c) are invariably lax throughout the speech community (a fact we will return to in §4.2).

Also here, just as for /w/ deletion in (6), there is clearly an elsewhere case, viz. (8b). Fronting applies, in fact, either after a coronal consonant or word initially (see the last two examples in (8b)). On the other hand, the condition on labialization in (8c) can be stated positively: whenever (9) is not met, after [+grave] consonants the [+grave] vowel /ʊ/ did not front, and labialization of the preceding consonant was triggered instead. Elsewhere, fronting did apply. In other words, the vowel lost its acoustic gravity via fronting, if the process was not blocked by the presence of an adjacent consonant that could enhance that property (as labials and velars did, in (8c)).

1.4. /o/-fronting

We turn finally to the last set of empirical data to be considered, which concerns the allophonic realizations of the phoneme /o/ under stress. This is the Altamurano outcome of the same etymological vowel considered in (6)-(7), viz. PRom /ɔ/ < Lat. ŏ, in the environments in which it was not affected by metaphony:

(10)	a.	[oʊ̯]	b.	[ø]/[œ]	c.	[ʷo]
	['poʊ̯t]	'can.3S'	['tøst]	'hard.F'	['pʷort]	'door'
	['bːoʊ̯n]	'good.F'	[an'døn:]	'Antony'	['pʷorʃ]	'hand.3SG'
	['woʊ̯f]	'ox'	['køs:]	'thigh'	['fʷort]	'strong.F'
	['koʊ̯s]	'sew.3S'	[a'k:øɟ:ənə]	'gather.3PL'	['mʷo:nəkə]	'monk'
	['loʊ̯r]	'they'	['ʃø:kənə]	'play.3PL'	['wok:ələ]	'brood hen'
	['ʃoʊ̯k]	'play.3SG'	['sørd]	'your sister'		
	['soʊ̯r]	'sister'	['cø:vənə]	'rain.3PL'		
	['coʊ̯f]	'rain.3SG'	['jørd]	'warp.3SG'		
	['moʊ̯r]	'die.3SG'	['tørt]	'crooked.F'		
	['noʊ̯f]	'nine'	['ɲ:øt:]	'swallow.3SG'		
	['oʊ̯f]	'egg'	['øb:r]	'hubbub'		
	['moᵘ]	'now'	['øm:]	'man'		

Also here, we find three allophones which closely parallel what we saw in (8), generated by basically the same processes. In (10a) we find diphthongization in open stressed non-antepenultimate syllable (i.e. in the environment stated in (9)), which is a general process, applying to all non-low vowels in this dialect (cf. (40) below). In closed syllables, a fronting process applies ((10b)), which is again the elsewhere case, as it is found also word-initially.[13] Here as well, the fronting process was blocked by the presence of an adjacent consonant which could enhance the [+grave] specification of the vowel concerned ((10c)).

But, crucially, in this case only labials blocked the fronting, not velars.

2. Altamurano gravity-interactions: description and explanation

In this section I will propose a unified account of the facts discussed in §1. Let us begin by providing in (11) a summary of the environments in which the above mentioned processes apply:

(11)

		p__	k__	t__	#__
a.	/w/-propagation	+	+	–	–
b.	/w/-deletion	–	–	+	+
c.	/u/-fronting	–	–	+	+
d.	/o/-fronting	–	+	+	+

A first observation is that the two processes in (11a-b) show a mirror-image distribution. This is not at all surprising, since the processes themselves are symmetrical, one involving *w*-insertion, the other *w*-deletion. The generalization is that the presence of [w] (either its insertion or its preservation) is conditioned by a preceding labial or velar consonant. If we now look for an explanation of these facts, and in particular of the relation between the changes and their contexts, we can try to account for this relation from one of the perspectives outlined in the introductory section with reference to the two basic dichotomies: form vs. substance and articulation vs. perception.

If we first focus on phonetic substance, we can say that both labial and velar consonants display an articulatory affinity with [w], because the latter involves both a labial and a velar (tongue-body) gesture. Acoustically, we can say that both labial and velar consonants, in the environments considered in (11a-d), display a concentration of energy in the lower part of the spectrum. In this, they resemble back rounded vowels, an elementary fact for which the reader can be referred to introductory handbooks in acoustic phonetics (cf. e.g. Pickett 1980: 50-53, Giannini & Pettorino 1992: 162-163).

Let us now leave the ground of phonetic substance and try to translate both of these characterizations (viz. the articulatory and the acoustic-perceptual one) into a formalized phonological description making use of DFs. The history of binary DF models begins with Jakobson *et al.* (1952). Among their acoustically based features, one seems to suit our case best:

> "When the lower side of the spectrum predominates, the phoneme is labeled grave; when the upper side predominates, we term the phoneme acute" (Jakobson *et al.* 1952: 29).

The feature [±grave], like other features in that system, applies to both consonant and vowel phonemes. Among consonants, labials and velars are [+grave], as opposed to dental/alveolars, palatals, and palato-alveolars, and they share this feature specification with back vowels and glides, due to the fact that all of these segments display a concentration of energy in the lower frequency range. (As is well

known, a major innovation of Jakobson *et al.* 1952 was the assumption of a unified feature set for both consonants and vowels.) Consequently, at least for the processes (11a-c), reference to the feature [±grave] seems to provide an elegant account. In (11a), insertion of a [+grave] glide is triggered by a [+grave] vowel (plus extra morphological specification) and applies only in the environment of a [+grave] consonant. In (11b), conversely, a [+grave] glide is deleted unless a [+grave] consonant precedes, and in (11c) a [+grave] vowel (in a stressed closed or antepenultimate syllable) becomes [–grave] unless a [+grave] consonant precedes.

For the process (11d), however, such a revealing formalization does not seem directly within reach. Here, a [+grave] vowel (in a stressed closed or antepenultimate syllable) becomes [–grave] unless preceded by only a subset of [+grave] consonants, i.e. by labials (which are specified [+grave, –compact]). Velars, in spite of their being formally specified as [+grave] as well, are unable to prevent the fronting process. This clearly requires a more complicated statement of the environment, with the introduction of a disjunction, and makes it impossible to achieve such a neat formalization of the relationship between structural change and context as is available for (11a-c). Crucially, the two processes (11c-d) will have to be formalized in substantially different ways, which blatantly contradicts the intuition that they are tightly related.

The prospects for a successful account of our Altamurano changes do not improve if we now consider DF systems which followed that of Jakobson *et al.* (1952). As is well known, since Chomsky & Halle (1968) (henceforth **SPE**) formal DF systems returned to an articulatory foundation, projecting Jakobson's binarism onto Trubetzkoy's (1939) articulatory-based taxonomy. Consequently, after SPE the feature [±grave] is no longer a part of the descriptive machinery of current phonological theory. In the SPE system, the generalizations in (11a-c) would have to be expressed not in terms of [±grave] but rather of the mirror-image feature [±coronal], as shown by the correspondences in (12):[14]

(12)

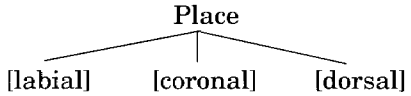
	/p/	/t/	/k/
[grave]	+	–	+
[coronal]	–	+	–

This however entails a complete loss of the insight that all of the processes at issue are clearly guided by the affinity between the vowels, consonants and glides involved, either in the change or in the

environment. In (11a), a [+back] glide is inserted and in (11b) it is not deleted after a [–coronal] consonant; in (11c) /ʊ/ becomes [–back] unless preceded by a [–coronal] consonant. Change and context are totally unrelated formally.

Things become even worse if we move on to consider more recent developments of DF systems within the 'Feature Geometry' line of research inaugurated by Clements (1985). Most current submodels, in spite of differences in other respects, agree on representing place of articulation by means of unary features, included in a feature tree whose nodes correspond to articulators (cf. e.g. Halle 1992, Clements & Hume 1995, Halle *et al.* 2000). The nodes (and thus the monovalued DFs) standardly available to describe place for consonants are shown in (13):[15]

(13)



From (13) it stands out clearly that no node captures labials and velars at the same time while opposing them to coronals. This implies that such systems are incapable of characterizing the set of segments {p b m k g ŋ} as a natural class. And this in turn has led many authors to question the empirical evidence in favour of this natural class, i.e. the substantial bulk of phonological rules in the languages of the world in which labials and velars pattern jointly. An example for this line of argument is provided by Yip (1989):

> "in fact the classes [+anterior], [–anterior] and [–coronal] do not occur. These are exactly the groups of sounds that are not natural classes in the Articulator model, and so their non-occurrence is predicted in that model." (Yip 1989: 350).

Yip (1989) goes on to reconsider some of the data previously adduced in the literature as supporting evidence for the existence of the natural class of [+grave] segments. But (as I will show in more detail in §3.1) the Altamurano data in (11a-c) clearly fly in the face of such a claim, as far as [–coronal] is concerned, as do the host of sound changes in which labials and velars pattern together. To quote just one example, consider Klingenheben's law in Haussa, discussed in Vennemann (1988: 26). This is a coda-weakening process by which all coda labials and velars turn to [w], whereas all dentals undergo rhotacism:

(14) Haussa, Klingenheben's law (Vennemann 1988: 26)

/p/	>	/u̯/	} in codas:	*ma.kā.fo*/*ma.kaw.ni.ya* 'a blind one.M/F'
/k/	>	/u̯/		*ta.la.ka* 'a poor one'/*ta.law.či* 'poverty'
/t/	>	/r/		*fa.tā.ke* 'merchants'/*far.ke* 'merchant'

For many of these phenomena, of course, it will be possible to claim that the change actually involves coronals, and that what happens to labials and velars (or in the context of labials and velars) is just the elsewhere case. However, for Klingenheben's law such an alternative account would lead us to say that the concrete implementation of *p*/*k*-weakening (i.e. vocalization to *u̯*) is merely coincidental, which is of course hard to believe. Both $t \rightarrow r$ and $p/k \rightarrow u̯$ represent perfectly natural changes, by which a stop weakens to a more sonorous sound which shares basic properties with the input segment. In the latter case this shared property is clearly acoustic gravity.

If this is so, then we must conclude that a descriptive system which limits available categories for the description of change to articulation only, categorically excluding that natural classes can be defined also in acoustic/perceptual terms, represents an impoverishment in our understanding of the sound structure of human language.

There was actually a debate about this problem until the early Eighties, concentrated on the need for preservation of the acoustically based DF [±grave] within different models, and eventually settled in Generative Phonology after the advent of Feature Geometry (cf. e.g. the statement by Yip 1989 quoted above). To mention just two classics of our discipline, Martinet (1955: §3.16), commenting very critically on Jakobson's approach, nevertheless admits:

> "Ecartant la théorie dans son ensemble, nous pourrions peut-être en retenir certaines suggestions, celle par example selon laquelle labiales et dorsales sont acoustiquement plus étroitement apparentées que ne le laisserait attendre la distance qui sépare les points d'articulation respectifs."

Ladefoged (1975: 265), in his eclectic list of DFs, mostly articulatory in nature, salvages precisely the acoustic feature [±grave], as it proves useful in the analysis of both synchronic rules and diachronic processes in many languages of the world. It is not my intention to revive this dispute here (cf. e.g. Hyman 1973, Vennemann & Ladefoged 1973, Odden 1978, Vago 1976, all adducing evidence in favour of [±grave] from several languages). For our present concern,

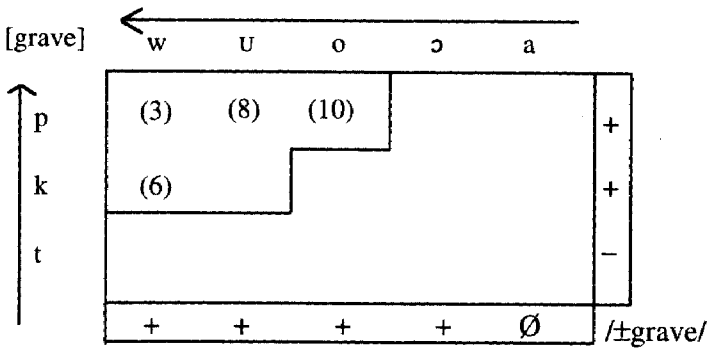
on the formal side the conclusion is that among the three types of DF systems considered, the one proposed by Jakobson *et al.* (1952) is best suited to describe the Altamurano facts. SPE and Feature Geometry totally fail, even descriptively. However, also within the system of Jakobson *et al.* (1952) (or in any revised form of the SPE set with the addition of [±grave]), an insightful formalization of (11d) and of its relationship to the other processes seems to be precluded. Moreover, from such a formal expression of the changes at issue we gain no hints as to the differences between (11d) and (11a-c). This seems to point to a more radical conclusion, the same one reached by Pagliuca & Mowrey (1980: 513), with specific reference to the debate on the feature [±grave] in Generative Phonology:

> "Of two possible sources of input into the feature system, contrast-oriented classification and process-oriented description, the former has dominated the latter to such a degree that processes have been judged unnatural or 'crazy' if their expression in contrast-oriented features looks clumsy. The solution to clumsy expression lies, of course, in improved expression, not in a condemnation of the process. The persistence of essentially structuralist biases has resulted in a gulf between our ability to understand and describe phenomena and our ability to formalize such descriptions".[16]

Now, to pursue our search for an explanation, let us reconsider the Altamurano changes from the point of view of phonetic substance, rather than phonological form. We can take the articulatory or the acoustic route here as well, but the former clearly does not lead us to an insightful account in this case. We have said above, commenting on (11a-c), that both labial and velar consonants display an affinity with /w/ and with /ʊ/. However, the crucial issue is to explain why fronting is more pervasive with /o/ (affecting it after both /t/ and /k/; (11d)) than with /ʊ/ (which is affected only after /t/; (11c)). And here, consideration of the articulatory dimension is of no use. In fact, no gradient can be established between the consonants /p k t/ (in this sequence). The only gradient dimension unifying these articulations is antero-posteriority, which does not yield the order we need (but rather /p t k/) and is clearly irrelevant here.

The gradient we are looking for, however, becomes readily apparent as soon as we focus on the acoustic/perceptual dimension. This proves crucial for an explanation of our empirical evidence, provided that we do not stick to a formalized representation of acoustics in terms of (binary) DFs but rather consider, more broadly, the interplay between form and substance. This interplay is schematically represented in (15), with reference to the four Altamurano processes at issue, indicated by the numbers in brackets in the gray zone.

(15) [phonetic substance]



The horizontal and vertical dimensions in (15) display vowels/glides ordered according to place of articulation and consonants, respectively.[17] In the lower corner on the right-hand side we find the phonological feature [±grave]: the two boxes show the binary specifications with respect to this feature for consonants and vowels/glides. The upper corner on the left-hand side shows gravity in substantial terms, to be understood as the acoustic (gradient) reality the phonological binary feature is based on. As symbolized by the two converging arrows, the farther we go from the left upper corner, the lesser the gravity of the segments involved. The gray zone delimits the area of the gravity interaction phenomena described in §1.

This picture has an elementary acoustic motivation, which resides in F2-height for vowels and in the height of the locus for consonants (cf. the classical theory of loci, inaugurated by Cooper *et al.* 1952). Among vowels, /u/ has the lowest F2 value, followed by /o/, /ɔ/ and /a/ etc., with F2 values gradually increasing. As for consonants, labials are the most strongly grave, as they have the lowest locus in F2 transition (at 600-800 Hz); dentals have a locus at about 1800 Hz, whereas the locus of velars depends on the adjacent vowels: it reaches up to 3000 Hz in the environment of non-back vowels, whereas it coincides with the labial locus when the velar stop is adjacent to a back rounded vowel. This is easily explained (cf. e.g. Giannini & Pettorino 1992: 195-203, elaborating on Delattre 1969): velars are the only consonants among those listed in (15) whose articulation crucially involves the tongue-body:

consequently, their locus, as opposed to the loci for labials and velars, crucially interacts with (the F2 of) adjacent vowels.

The scale along the vertical dimension in (15) is directly reflected in perception, e.g. with regard to the release burst of stops. As shown by Cooper *et al.* (1952: 597), a noise burst at 2800 Hz or higher correlates with the categorization of the stop as dental; a noise burst at the same frequency as the vowel's F2 (or slightly higher) causes the stop to be perceived as velar; finally, a noise burst at a frequency lower than the vowel's F2 (or at the same frequency level, for /o/ /u/) induces perception of the stop as labial.

Now, we have to ask how this substantial gradient is reflected in phonological structure. The latter builds on phonetic substance, and converts acoustic/articulatory continua into discrete choices, i.e. into discrete processes/rules/alternations: either there is fronting, or there is not; either propagation takes place, or it does not, and the like. For the description of these processes/rules/alternations, a formal apparatus of DFs is needed, which has to do justice to both articulation and perception.

With all this, we have not yet said anything about explanation. In fact, we can further ask why processes are the way they are, and not the other way around. More specifically, in our case, we can ask questions such as those in (16):

(16) a. why don't we find a process of /w/ deletion which applies after labial consonants and not after velars?
b. why isn't back vowel fronting more pervasive with /u/ than with /o/? (Formally, they are both [+grave] – or [–coronal] – consonants, after all.)

In keeping with a general epistemological criterion, the answers to such questions – or, in other words, the explanation for phonological patterns – must come from outside the domain we are describing. This is the chief maxim for a sound explanation as formulated in Vennemann (1983: 9):

> "We can gain interesting explanations" [for a given domain] "only by turning to theories that are not theories for that particular domain".

An obvious candidate is the experimental inspection of phonetic reality (that is, the left upper corner in (15)). Again, in Vennemann's words (concerning one specific aspect of phonological form, viz. syllable structure):

> "The preference laws for syllable structure have their basis in the human productive and perceptive phonetic endowment. They, as well as their natural gaps, would be derivable – and thus explained – in a sufficiently rich phonetic theory" (Vennemann 1988: 4).

This is precisely what we have done in this section, developing a comprehensive account of Altamurano gravity interaction phenomena involving [+grave] vowels, glides and consonants. The answers to the questions in (16a-b) come from inspection of the acoustic signal. The fact that velar consonants pattern alternatively with either labials ((11a-c)) or dentals ((11d)) follows from the in-between nature of velars in acoustic terms. More specifically, the probability that velars will behave like labials is higher when the environment crucially involves a sound which displays acoustic gravity to a higher degree (i.e. either /w/, in (11a-b), or /u/, in (11c)). Therefore back vowel fronting, a process implying a rise in the vowel's F2, applied in Altamurano after dentals and palatals, which always have a high locus, and never applied after labials, whose locus is invariably low. After velars, it applied to /o/ but not to /u/, because the latter has a lower F2 and was consequently more suited to resist the change, which in *ko* → *kø* strings implied a rise in both the F2 of the vowel and the locus of the consonant. (Remember that the velar locus is crucially sensitive to the backness of the vowel, not to lip rounding.)

3. Alternative analyses of the Altamurano data

We will consider now some alternative analyses of the facts for Altamurano discussed in §§1-2. These data, first described in Loporcaro (1988), have attracted some attention since then. For instance, diphthongization and schwa deletion (cf. (8)-(10) above) were discussed in Kenstowicz (1994: 448) (cf. Loporcaro 1998: 168 fn. 10). More recently, Cox (1997) and Calabrese (2000) have reanalysed some of the phonological processes I have just described as gravity-effects in §§1-2, arguing for radically different accounts. The rest of this paper is devoted to a discussion of these alternative accounts.

3.1. Cox (1997) on Altamurano /w/-deletion

Cox (1997) discusses /w/-deletion, and maintains that the acoustic gravity of the segments involved is irrelevant to the analysis.[18] In his view, /w/-deletion is a dissimilative process which was triggered by a preceding coronal consonant. This is apparently at odds with the

fact that deletion also applied word-initially, as shown in (7). Cox's solution for this difficulty is summarized in (17):

(17) a. /l # 'weccə/ → *[l 'wec:] /n # 'weccə/ → *[n 'wec:] 'the/an eye'
b. /l # 'weccə/ → [l 'ec:] /n # 'weccə/ → [n 'ec:]
c. /l # 'eccə/ → [l 'ec:] /n # 'eccə/ → [n 'ec:]

It consists in assuming that deletion in such cases as (7) first arose in sentence phonetics ((17b)) in the context where the word was preceded by a determiner. In fact, the prevocalic form of the definite and indefinite articles (for both genders) consists of a coronal consonant: /l/ and /n/ respectively. In a later step, the /w/-less form was generalized and became eventually the new lexical form of the words involved ((17c)).

This account is appealing. I can even add some further data which seem to support it. In fact, the few lexical exceptions to /w/-deletion concern precisely forms that are normally used without a determiner. One such case is the numeral ['wet:] 'eight'.[19] Furthermore, the word for 'eye', reported in (17), still retains the glide only in some lexicalized derogatory expressions such as ['wec:ə də 'la:tr] literally '(you,) thief's eye!', in which the word occurs without an article. This clearly represents a remnant of a former stage.

However, the difficulty for Cox's account is represented by the fact that the numeral ['wet:] 'eight' can actually occur with an article. In this case, however, the preconsonantal form of the determiner is selected, not the prevocalic one: e.g. [ʊ 'wet:] 'the eight', [nʊ 'wet:] 'an eight' (in card games). In fact, in this dialect word-initial glides of any origin always pattern with consonants and never with vowels for the selection of the allomorph of determiners, as shown in (18):

(18) a. [ʊ 'wʊst] 'the taste' b. [ʊ 'kwɛi̯n] 'the dog' c. [l 'ary] 'the tree'
[nʊ 'wʊst] 'a taste' [nʊ 'kwɛi̯n] 'a dog' [n 'ary] 'a tree'
[ʊ 'jat:] 'the cat' [ʊ 'ceif] 'the nail'
[nʊ 'jat:] 'a cat' [nʊ 'ceif] 'a nail'

This means that the intermediate step postulated by Cox in (17a) is entirely *ad hoc*, lacking any independent evidence from the phonological system of the language.

Furthermore, the shortcomings of Cox's account become even more apparent if we try to extend it to the other processes considered in §§1-2 above. Extending Cox's approach to /w/ propagation, we

could simply say that a coronal consonant blocks the process. For /o/ and /ʊ/ allophony, on the other hand, following Cox's line of argument we should assume that the presence of a preceding coronal consonant induced fronting. For the application of fronting word initially (cf. the data in (8b), (10b)), Cox's argument in (17) could be replicated, this time without problems, since the forms in (19) – with the determiners' coronal consonant immediately preceding the word-initial vowel – actually occur in Altamurano, unlike the assumed intermediate steps in (17a):

(19) [n 'ʏrs] 'a bear' [l 'ʏrs] 'the bear'
[n 'øm:] 'a man' [l 'øm:] 'the man'

This explanation, however, is totally incapable of accounting for the different distribution of fronting with /o/ and /ʊ/ which, as we have shown, fit into a neat picture, under the assumption that the acoustic gravity of the segments involved is crucial. Under Cox's assumptions, fronting would have to be treated as an instance of coronal consonant/vowel interaction, of a kind not uncommon in the languages of the world (cf. Hume 1992).

We can compare the similar processes found in the now extinct Agn dialect of Armenian, where precisely the two back vowels /o/ and /u/ are fronted to [ø] and [y] respectively after all coronal consonants, whereas they remain unaffected after non-coronals (cf. Halle *et al.* 2000: 400 with further references):

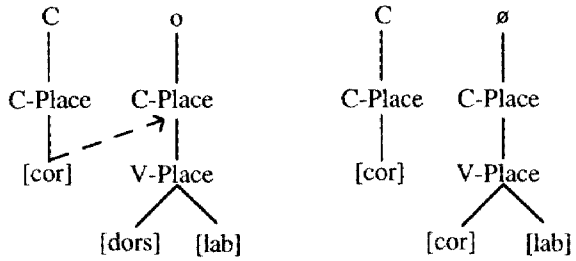
(20)		Classical Armenian	Agn	
	a.	nor	nør	'man'
		dʒur	dʒʰyr	'water'
		χoʃor	χoʃør	'large'
		soχ	søχ	'onion'
		heru	hery	'last year'
	b.	port	bord	'navel'
		pʰoɬk	pʰoχg	'throat'
		kotsʰ	gʰotsʰ	'closed'
		gud	gud	'grain'
		χutsʰ	χurtsʰ	'room'

Stating the change in a classical binary SPE model entails the loss of the generalization concerning the interaction, as the assimilative nature of the process becomes obscured:

(21) [+son, –cns] → [–back]/ [+cor] __

Within Feature Geometry, articulator models offer various ways of capturing this assimilatory nature. In particular, Unified Feature Theory (UFT; cf. Clements' 1989, Clements and Hume 1995), which employs a single set of place features for both consonants and vowels (extending to the latter the nodes seen in (13) above), would allow expressing the change in a straightforward way, as shown in (22) (irrelevant nodes are omitted):

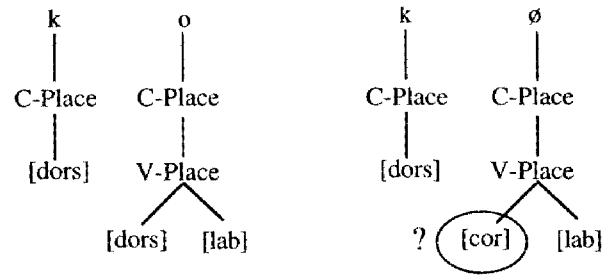
(22) a. b.



After spreading of [coronal] in (22a), and some other intermediate steps involving re-association of [coronal] to the V-place node, and delinking of the incompatible feature [dorsal], the output representation is that in (22b).[20] By virtue of this representation, the functional (assimilatory) nature of the process is formally expressed under the form of [coronal] spreading.

It might be tempting to extend the same account to Altamurano vowel fronting. However, while /ʊ/-fronting would fit the statement in (22) perfectly since it applies after coronals only, an account of /o/-fronting along the same lines would lead to major complications. Here, fronting occurs not only after coronals but also after velars. Since the two classes are described formally with alternative unary features ([coronal] vs. [dorsal]), /o/-fronting would have to be expressed disjunctively, in the first place. Moreover, after coronals the same representations in (22) could be proposed. But /o/ fronting also applies after dorsals: cf. Altamurano words such as ['køs:] 'thigh', ['køc:] 'couple' etc. ((10b)). After dorsals, a rule formulated in (any version of) the articulator model would have no chance of formally conveying the assimilatory nature of the change, since there would be no source in the input configuration (23a) for the feature [coronal] to spread from, so as to yield the desired output in (23b) (where fronting to [ø] has applied). This is graphically conveyed in (23b) by the circle around [coronal] plus the question mark:

(23) a. b.



Thus, of the two members of the disjunction (*to* → *tø*, *ko* → *kø*) the former would appear formally to be an assimilation, while the latter would appear dissimilatory, since a dorsal vowel becomes coronal (hence non-dorsal) after a dorsal consonant.

This is an insurmountable problem for such an account. We can therefore conclude that a description in terms of articulatory based features, such as the one proposed by Cox (1997) for Altamurano /w/-deletion, has no chance of grasping the essence of the Altamurano gravity interactions we have elucidated in §2 with crucial reference to the acoustic substance of gravity effects.

3.2. Calabrese (2000) on Altamurano back vowel fronting

In this section, I will briefly summarize Calabrese's (2000) treatment of Altamurano vowel fronting. I will further devote §4 to an in-depth discussion, both of Calabrese's analysis and of the primary phonetic and phonological data. Comparison of Calabrese's account with the one developed above in §2 will turn out to be instructive, since both are specifically concerned with the interplay of form and substance in the explanation of phonological patterns and changes, yet they diverge dramatically in both conception and results. This comparison thus raises the general question of how substantial evidence can be brought to bear in phonological analysis.

Calabrese singles out the allophonic processes (8)-(10) and devotes to them a lengthy article on *The feature [advanced tongue root] and vowel fronting in Romance*. The feature [ATR], which is the successor of the Jakobsonian feature [±tense], plays a central role in these phenomena, according to the author:[21] for this claim, comparative experimental evidence is provided.

The analysis is the product of the application to these data of a general theory of phonological inventories and operations developed

in Calabrese (1985, 1995, 1998) and other publications. The basic idea is that phonological inventories are constrained by a universal set of hierarchically ordered marking statements (henceforth abbreviated **MS**), or constraints (cf. also Halle *et al.* 2000: 398). Consider the two examples in (24a-b):

(24) a. *[–back, +round] if active, this MS prohibits */y ø œ/
b. *[+ATR, +back] if active, this MS prohibits */u o/

(24a) is a relatively uncontroversial MS. If active in a given language system, this MS prohibits front round vowels */y ø œ/. In languages such as Italian or English this constraint must be active, while in German or French it must be deactivated, in order for the front rounded vowels to be allowed in the phonemic inventory. Since many languages show the effect of this specific MS, it must be ranked relatively high among the UG marking statements.

(24b) is another example of a MS which is, however, ranked much lower, as not many languages show its effects in their phonology. Calabrese (2000: 77) adduces phonetic evidence for (24a), by invoking the mechanics of speech production:

> "There is natural motivation for this constraint [i.e. (24b), M.L.] involving the mechanics of tongue root movement. Lindau (1975: 30) first observed that advancing the tongue root tends to push the tongue body up and forward [...]. Therefore in pronouncing [+ATR] back vowels speakers need to suppress the natural tendency to front them. The need for this suppression makes the configuration [+ATR, +back] articulatorily complex and therefore phonologically marked."

Figures 1-2 reproduce the experimental evidence Calabrese is referring to. It concerns Akan (a Niger-Congo language, spoken in Ghana and the Ivory Coast), studied in Lindau (1978). Figure 1 shows the vocal tract positions, based on cineradiographic recordings, while Figure 2 is a formant chart of Akan vowels.

From both it is apparent that tense /u o/ are produced with the tongue body more fronted than their lax counterparts. This constraint has been shown to be at work – Calabrese argues – in several languages and language families, including Tungusic, several Armenian dialects (e.g. Van), Somali, etc. For Somali, Calabrese (2000: 78) gives the following description: "the [+ATR] vowels are also fronted, as shown by the [+ATR] [u], [o] and [a] which surface as [y], [ø] and [œ]".

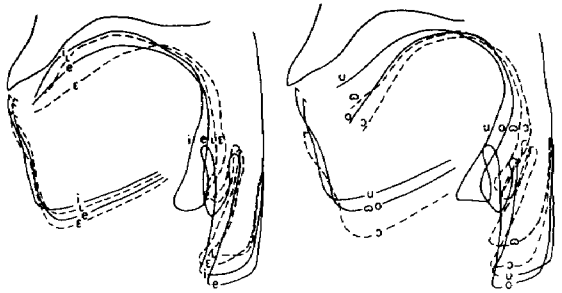


Figure 1. Superimposed tracings of front and back vowels from a speaker of Akan (after Lindau 1978: 551).

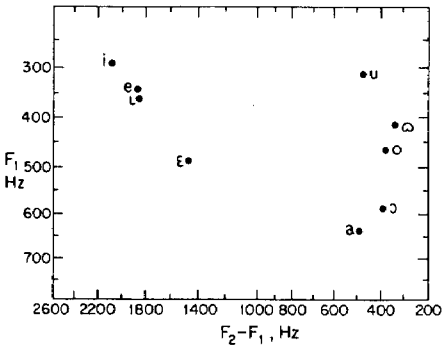


Figure 2. Formant chart of Akan vowels (after Lindau 1978: 552).

(25)	[+ATR]	[–ATR]	Somali vowel system
	i	ɪ	(Calabrese 2000: 78,
	e	ɛ	after Antell *et al.* 1974: 38)
	ø	ɔ	
	y	ʊ	
	æ	a	

It is apparent from the vowel charts and the spectrographic evidence in Farnetani (1981: 54) that Somali back high and higher-mid tense vowels are centralized rather than fronted. Therefore, they should actually be transcribed as [ʉ], [ɵ], rather than [y], [ø] (cf. also Cardona 1981: 14). But, apart from this detail, it is a fact that back tense vowels are more fronted than their lax counterparts, which in this theory is the product of the MS in (24b).

Both this and the MS (24a) play a crucial role in the description of Altamurano vowel fronting. To understand how, we still have to introduce an important part of the theory, viz. the fact that it pro-

vides for *repair strategies* (somewhat in the spirit of similar models such as Paradis & Prunet's constraint and repair model; cf. Paradis 1988). A configuration disallowed by a MS active in a given language can nevertheless arise in that language, e.g. as the product of the application of a phonological rule, or via borrowing from another language in which that MS is not active. At this point, an operation on features must intervene, called 'simplification procedure', which will repair the feature pattern and turn it into an admissible one for that language. There are three types of simplification procedures: *fission*, *delinking* and *negation* (cf. Calabrese 1998: 12f). Negation is the one relevant to our Altamurano case: it implies that the values of the features (or of some of the features) whose combination is barred by the MS switch from + to – or vice versa.

Using this framework, the Altamurano data are analysed. The feature matrix in (26) is assumed, and fronting is described as an effect of the interaction between the two constraints (24a-b).

(26)	i	e	ɛ	a	ɔ	o	u	ø	y
high	+	–	–	–	–	–	+	–	+
low	–	–	–	+	–	–	–	–	–
back	–	–	–	–	+	+	+	–	–
round	–	–	–	–	+	+	+	+	+
ATR	+	+	–	–	–	+	+	+	+

The starting observation is the following: since fronting affects the high and higher-mid but not the lower-mid back vowel, in order to account for fronting "we need a feature which is common to [u] and [o], and distinguishes them from [ɔ] [...] This feature must be an appropriate trigger of vowel fronting." (Calabrese 2000: 76). This feature, it is proposed, must be [+ATR]:

> "I would like to propose that this fronting is a repair due to the marking statement in (33) [= (24b), here, M. L.], which characterizes the use of the feature [+back] in the context of the feature [+ATR]." (Calabrese 2000: 77).

In other words, given a universal phonetic tendency for tense vowels to front – supported by independent substantial evidence (cf. the experimental data from Akan, Figg. 1-2) – in Altamurano, this tendency was grammaticized into an allophonic rule. However, the MS (24b) does not prevent /u/ and /o/ from occurring in the underlying phoneme inventory of Altamurano. This means that (24b), barring tense /u/ and /o/, "is active only in the phonological component"

and that "the repair it triggers is ordered after lengthening, diphthongization, and application of the rules in (43) and (44)." (Calabrese 2000: 80) [(43) and (44) are the rules which describe the labialization of the preceding consonant, seen above in (8c), (10c); they are reproduced below as (30 a-b); M.L.].

Thus, the crucial claim is that the two vowels involved were fronted *because* they are tense vowels. This is the independent explanation which is brought into the picture.

Note that the application of fronting implies that constraint (24a) *[–back, +round] be deactivated, which can also happen only in the phonological component. In fact, the constraint (24a) must be active underlyingly, since there are no contrastive front rounded vowels in Altamurano (unlike, say, in French or German).

Summing up, the interaction of the two constraints (24a-b) is crucial to the analysis. This interaction is governed by a general principle, which is stated as in (27) (Calabrese's (40)):

(27) "A constraint [aF, –bG] cannot be active if there is an active constraint [bG, gZ], and if the features aF, gZ are prized." (Calabrese 2000: 80)

In this theory, «prized» is a label for features which resist modification more than others present in the input. This is apparent in the following definition:

> "Consider the case in which both the output repairs [aB, –bG], [–aB, bG] of a disallowed configuration *[aB, bG] are convergent and equivalent in terms of markedness. *We can choose* between them *by assigning a certain value to one of the features* of the input configuration. I call this feature the prized feature. The prized feature needs to be preserved in the input [*sic*; probably 'in the output', M. L.], otherwise a cost is assigned to its modification." (Calabrese 2000: 76) [emphasis added, M.L.]

As is apparent from the emphasized sentences, *prizing* is an analytical choice performed by the linguist, not something which is objectively there, *in re*, as, say, [roundness] or [backness].

With this descriptive machinery, the interaction of the MS (24a-b) in Altamurano is specified as follows:

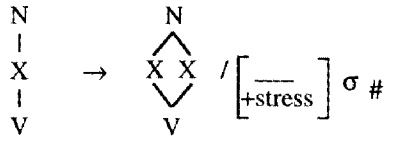
(28) "We know that the feature [+ATR] is prized because of the repair in (37) [i.e., because fronting, not laxing, applies to repair the configuration *[+ATR, +back], M.L.]. *Let us suppose* that the feature

> [+round] is also prized. This constraint interaction *therefore* satisfy [*sic*] the conditions of principle (40) [= (27), here; M.L.]. Constraint *[+ATR, +back] cannot be active unless *[–back, +round] is deactivated. This is what happens in the dialect of Altamura, but with one restriction: the marking statement in (27) [= (24a), here, M.L.] is deactivated only in the nucleus of stressed syllables. Therefore, in stressed syllables, the marking statement in (33) [= (24b), here, M.L.] can be active, and trigger the repair that produces a front rounded vowel." (Calabrese 2000: 80) [emphasis added, M.L.]

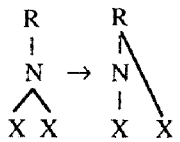
Thus, the explanation for Altamurano fronting rests crucially on an *assumption* (cf. "Let us suppose", in (28)), viz. the assumption that the features [+ATR] and [+round] are "prized".

Calabrese (2000: 81-3) also provides an explanation for the lack of fronting in the (8a)/(8c) and (10a)/(10c) cases, that is, in open syllables, and in closed syllables when the preceding consonant is labialized. This explanation elaborates on Schein & Steriade's (1986) *Uniform Applicability Condition*: basically, fronting applies exclusively to a uniquely linked vowel, which is not the case for either diphthongs or vowels which induce secondary labialization of the preceding consonant. The relevant configurations are reported in (29) (diphthongization) and (30) (labialization):

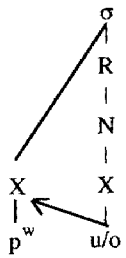
(29) a.



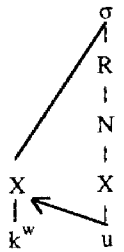
b.



(30) a.



b.



We will not be concerned further with these specific aspects in the present paper, since the specific account in (29)-(30) depends on

the correctness of the general view on Altamurano fronting.[22] This is the basic point we question in §4.

4. High vowels in Altamurano: phonetics and phonology

The account summarized in §3.2 differs from the one developed above in §§1-2. Missing in the former analysis is an encompassing global approach to the totality of the phenomena involving labials and velars. Fronting is singled out and the other phenomena involving gravity-interactions between consonants, glides and vowels are neglected. Thanks to this move, it becomes possible to imply that gravity is irrelevant (in fact, it is not even mentioned) and that tenseness (that is, the specification [+ATR]) is indeed the crucial factor. This is claimed to provide independent motivation for fronting, which would render the proposed account superior to available alternatives.

This addresses a fundamental question of historical linguistics, that of causation of phonological change, well exemplified in a passage of Ferdinand de Saussure's (1922^2: 293) *Cours* which concerns precisely vowel fronting:

> "Un *u* devient *ü* à un moment donné, dans un milieu donné; pourquoi a-t-il changé à ce moment et dans ce lieu, et pourquoi est-il devenu *ü* et non pas *o*, par exemple? Voilà ce qu'on ne saurait dire".

The account provided in §2 is in keeping with Saussure's stance. We take notice of a change, once it has applied (in our case, vowel fronting), and we then go on to elucidate the conditions constraining this change. In other words, we ask questions such as those in (16a-b), §2:[23] and it turns out that the best available answers to these questions, in our case, have to build upon considerations of phonetic substance.

The alternative account summarized in §3.2, on the contrary, is argued to provide independent motivation for the change itself, which is of course a much stronger claim. Substantial considerations are adduced in support in this case as well (cf. (25) and Figures 1-2). And this obviously invites closer comparison of the two accounts.

Calabrese's account has some aspects which can easily be agreed upon. The assumption that a MS *[–back, +round] is deactivated "in the phonological component" (Calabrese 2000: 80), while still constraining the underlying phoneme inventory, is but the

reformulation in this specific framework of a more traditional, entirely reasonable view. In Stampean Natural Phonology, such a fronting would be described as the effect of the limitation of a phonological process (unrounding of front rounded vowels) which is instead given free rein as a paradigmatic process and therefore constrains the underlying phoneme inventory of the same language. Stampe (1979: 25-27) exemplifies this with vowel nasalization in American English (e.g. ['kʰæ̃:ʔ] *can't*), which arises as a syntagmatically conditioned allophonic process in spite of the fact that, paradigmatically, all nasal vowels are denasalized: so, they cannot be preserved in the pronunciation of foreign words such as French *maman*. Lexical Phonology inherited this idea: postlexical processes are mostly not structure-preserving, i.e., they introduce new feature configurations which are not present underlyingly in the language.

The problems with the account under discussion concern a more fundamental aspect, viz. the claim that a *cause* for fronting – independent from the description of the phenomenon itself – has been identified in the interaction between the two MS (24a-b). This explanation has some shortcomings, both theoretical and empirical. As to the theoretical side, we will first see (in §4.1) that it is circular; empirically, on the other hand, it is based on erroneous data, as will be shown in §4.2.

4.1. Theoretical problems: circularity

We have seen that fronting of back vowels is explained by Calabrese (2000: 77) as the consequence of deactivation of the constraint barring front rounded vowels. As a *description*, this is surely correct. But, since it is claimed to be an *explanation*, it turns out to be circular. What we have here is a restatement of the explanandum (Altamurano vowel fronting) with a new label (deactivation of the constraint (24a)), that has no independent foundation since the only evidence on which it rests is the explanandum itself (i.e. Altamurano vowel fronting).

Moreover, we can ask why the deactivation of the constraint (24b) results in fronting rather than, say, unrounding. The answer is that the feature [+round] is "prized". That means, it resists alteration. Again, as seen in (28), this rests on pure stipulation, as is apparent from Calabrese's (2000: 80) wording: "*Let us suppose* that the feature [+round] is also prized". The same holds for [+ATR]. If we ask why [+ATR] is "prized", the only answer is that it is because

fronting occurs in Altamurano, not laxing. Again, our explanandum is the only evidence for this "prizing".

The passage after the quotation in (28) goes on to describe what happens in unstressed position, where fronting does not take place. The argument is the following:

> "In all other positions, however, the constraint against front rounded vowels remains active. Therefore, the constraint in (33) [= (24b) here, M. L.] must be deactivated and thus [+ATR, +back] vowels are allowed. This *immediately explains* why [+ATR] back vowels are not fronted in stressless syllables." Calabrese (2000: 80) [emphasis added, M. L.]

This is again circular, much in the style of the notorious medieval explanations of the fact that poppies induce sleepiness "because they possess a virtus dormitiva": a descriptive label (they cause you to fall asleep) is surreptitiously presented as an explanation.

4.2. Empirical problems: dialectological fieldwork and theoretical phonology

Let us move on to consider the empirical problems of the analysis under discussion. These concern the putative operation in Altamurano of the constraint (24b), disallowing [+back, +round] vowels. We have seen that there is cross-linguistic phonetic evidence in favour of this constraint. This would consequently appear to be a clear case of a perfect Ohalian explanation, in which the condition inducing phonological change is located in the mechanics of articulation (cf. e.g. §3.1 in Ohala 1989: 176ff or the contributions in Fowler 1995). In fact, Halle *et al.* (2000: 406) underscore that Calabrese's approach to phonological constraints is based on "articulatorily grounded claims". In our specific case, however, this substantive grounding in articulation turns out to be questionable. To see why, it is crucial to understand that the primary data from Altamurano are not entirely accurate. Rather, they display several differences with respect to the source, that are crucial for the argument.[24]

Consider first the Altamurano vowel system in (31) (from Loporcaro 1988: 17):[25]

(31)

/ɪ/		/ʊ/
/e/		/o/
/ɛ/		/ɔ/
	/a/	

It is easy to see that there is an unusual aspect to this system: it displays a tenseness contrast for mid vowels, but not for high vowels. Of course, this poses a problem because, for a traditional structuralist phonologist, the lack of a contrast between tense /i u/ and lax /ɪ ʊ/ means there is no need to represent the latter as underlyingly specified for tenseness. If we do so specify, we depart from classical structuralist phonology. There is evidence in support of this analytical move, which is summarized in (32):

(32) a. Standard Italian: */ji/, */wu/
b. Altamurano: ['jɪnd] 'inside', ['jɪd:ɪ] 'he', ['jɪɲɬ] 'fill.2SG'
['wʊst] 'taste', ['wʊ:nətʃə] 'eleven'

As seen in (32a), standard Italian has a phonotactic constraint which bars strings of glide + homorganic high vowel. This happens in many languages, and has been explained by Ohala & Kawasaki (1984) in acoustic-perceptual terms (see above, §1.1). Altamurano, however, does possess strings of glide + homorganic high vowel, both underlyingly and at the surface, as shown in (32b). This contrast between Altamurano and standard Italian is explained in Loporcaro (1991): it depends on the fact that high vowels are lax in Altamurano, so that in the strings /jɪ/ /wʊ/ there is sufficient room for perceptual contrast. But if this is true – and no alternative explanation for this fact has been proposed so far – then these high vowels must be specified as [–tense] underlyingly, because this specification is visible to a phonotactic (or morpheme structure) constraint, which by definition constrains the *lexical* shape of words.

Thus, we have to reconstruct a context-free diachronic change, by which PRom high vowels, which were originally tense, became lax not only in Altamurano but, more broadly, in most southern Italian dialects. A confirmation of this hypothesis is provided by the fact that several of these varieties have actually acquired a [±tense] contrast in high vowels. This is shown in (33)-(34) with examples from an Apulian and a Northern Calabrian dialect: (The data are from Loporcaro 1991: 477 and Trumper 1980: 268, respectively.)

(33)

a.	['sʊt:s]	'dirty.M'	≠ b.	['su'tːs]	'alike.M'	Canosa di Puglia
	['rʊs:]	'red.M'		['gru's:]	'big.M'	(province of Bari)
	['tʊrd]	'thrush'		['tu'rt]	'wrong' (n.)	
	['vɪnd]	'twenty'		['vi'nd]	'wind'	
	['vɪst]	'seen'		['vi'st]	'(women's) clothes'	

(34)

a.	['vɪndə]	'twenty'	≠ b.	['vində]	'winds'	Amendolara
	['pɪn:ətʃə]	'bedbug'		['pin:ətʃə]	'bunch of grapes'	(province of
	['rʊs:ə]	'red'		['(ɣ)rus:ə]	'big'	Cosenza)

While the lax vowels in (33a), (34a) are the outcomes of PRom /i u/, the tense vowels arose as the result of monophthongization of the metaphonic diphthong from PRom /ɛ ɔ/ (a process we saw for Altamurano in (5) above).

The explanation put forward in Loporcaro (1991) is in the framework of Natural Phonology, a research line for which distinctiveness, albeit important, is not the entire story about the phonology of a language. Rather – as Wolfgang U. Dressler once put it in one of his phonology lectures, using a Viennese analogy – distinctiveness can be compared with the ladder mentioned in the conclusion of Wittgenstein's *Tractatus*: it can and must be used, first, but then it has to be thrown away, if we really want to understand what underlies phonological systems, viz. phonological processes (in the sense of Stampe 1979). The analysis proposed in Loporcaro (1991) is precisely in this spirit. It suggests that the data in (32)-(34) are accounted for if we suppose: a) that there is a natural phonological process [+high] → [+tense]; and b) that this process is suppressed in these dialects. This suppression had the consequence of turning the PRom high vowels /i u/, which were originally tense, into lax vowels.

In Altamurano, the only evidence we find for this is the phonetic realization as lax vowels plus the evidence from phonotactics in (32b), so that the possibility for a distinctive contrast for tenseness in high vowels remains unexploited. But neighbouring dialects such as Canosino do make use of this possibility, as do several other dialects of southern Italy, owing to a subsequent change (monophthongization of the metaphonic diphthongs) which brought about the contrasts in (33a-b), (34a-b).

To the explanation proposed in Loporcaro (1991), Calabrese (1998: 64 fn. 21) objects as follows:

> "Loporcaro (1991) [...] argues that this process is due to the relaxation [actually, suppression, M.L.] of the natural phonetic process assigning the feature [+ATR] to high vowels. He, however, fails to

recognize that in terms of Natural Phonology such relaxation should automatically lead to a contrast between [+ATR] and [–ATR] high vowels."

Actually, as shown in (33)-(34), in Loporcaro (1991) it is demonstrated that there are systems in southern Italy in which precisely this contrast in high vowels has arisen, and that this has been made possible by the previous laxing of high vowels.[26] This laxing must therefore be phonological, rather than a mere low-level phonetic fact.[27] Calabrese's view differs on this point:

(35) "The high vowels are phonetically realized as lax [ɪ ʊ] (Loporcaro 1988: 29). I *assume* that this is due to a late phonological process" (Calabrese 2000: 61 fn. 2) [emphasis added, M.L.].

To this assumption, two objections can be raised, the first theoretical in nature, the second empirical. First of all, no alternative account of the evidence from Altamurano in (32b) and from neighbouring dialects in (33)-(34) is provided. In the absence of proof to the contrary, these data show not only, quite trivially, that a tenseness contrast exists in some of these dialects, but also that no low-level phonetic laxing process was ever at work in any of them. Otherwise, the outcome of the monophthongization in (33b)-(34b) would have simply fed such a laxing process, and no contrast would have arisen.

In search for a motivation for the assumption of "a late phonological process" of laxing ((35)), one might perhaps suppose that some principles of the theory militate against the presence in the phonological representation of features which are not distinctive. However, that this is not the case can be easily seen by reading the *speculatio quarta* developed by way of conclusion of a paper on 'Metaphony in Salentino' (Calabrese 1984-85: 108-120). This speculation is introduced by Calabrese (1984-85: 108) with the following words: "In this paragraph, we shall propose a hypothesis so speculative that it might be called fantasy". It concerns the changes in the vowel system from Proto-Indo-European (= **PIE**) to Proto-Indo-Iranian, which have led to the merger of the original phonemes /e/ and /o/ into /a/.[28] As Calabrese (1984-85: 108) puts it "We may hypothesize that this occurs because proto-Indo-european had the following vocalic system":

(36) i u PIE vowel system
ę ǫ
a

Indo-Iranian lowering is then accounted for by means of the rule in (37a), which derives the system (37b):

(37) a. [–low] > [+low] / X
|
[–tns]
|
—

b. i u
a

The following comment is added:

"Rule (10) [= (37a) here, M. L.] is not as farfetched as it may seem. Given that low vowels are usually [–tense], we can suppose that [–tense] was interpreted as connected to [+low] in the language that developed into Sanskrit" (Calabrese 1984-85: 109).

In spite of this *occupatio*, however, the sole reason to attribute a [–tense] specification to the PIE mid vowels is the need to account for the subsequent development in Indo-Iranian. There is no phonological evidence whatsoever, within the reconstructed PIE system itself, which warrants this assumption.

This means, in turn, that there are no principled grounds in the theory to support the assumption in (35) and which consequently could force us to exclude that Altamurano high vowels may be underlyingly lax. It is merely "assume[d]" that they are underlyingly tense. And the entire analysis of Altamurano vowel fronting rests solely on this assumption. Recall that the fronting observed in (8b) and (10b) was explained as ultimately due to tenseness, via the interaction of the two constraints (24a-b).

Let us finally address the empirical flaws of the account based on the constraint (24b). This constraint is grounded in the general mechanics of speech articulation: the motivation adduced rests on phonetic data from several languages and language families (cf. (25) and Figures 1-2 above). Yet, the Altamurano *phonetic* data do not support it. The response to this empirical challenge involves an 'adjustment' of the phonetic data themselves: all high vowels, which are transcribed [ʏ ʊ] in Loporcaro (1988) as well as above in (8), are systematically re-transcribed as tense [y u], not only between slashes but also in square brackets. Some examples are provided in (38) (from Calabrese 2000: 62-65):

(38) a. ['luwnə] 'moon' b. ['yrsə] 'bear' c. ['kʷuddə] 'that.MSG'
['muwlə] 'mule' ['tynnə] 'round.ms' ['pʷuttsə] 'well'
['luwʃə] 'light' ['fryttə] 'fruit' ['fʷumənə] 'smoke.3PL'

Now, while adjustments in the phonological representation, as in (35), are a matter of analytical preferences, adjustments in the primary phonetic data are not.

Figures 3-5 present experimental evidence concerning each one of the three allophones of /U/ as uttered by an Altamurano male speaker in his later Seventies (by the date of the recording, in Autumn 1985).

Note first of all that deletion of word-final schwas in prepausal position is apparent on all of these sonagrams, since no vocalic signal follows the release of the last consonant. Thus, the citation forms in square brackets as reported in (38) (after Calabrese 2000: 62-65) do not correspond to what actually occurs phonetically in this respect.

Let us now consider stressed vowels.

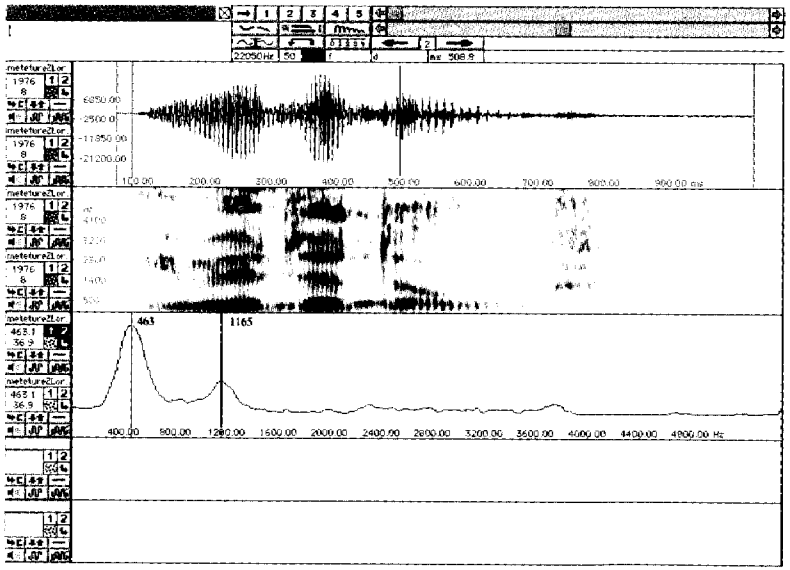


Figure 3. Altamurano [ɪ mətə'tuu̯r] 'the harvesters', male speaker, 78 years old.

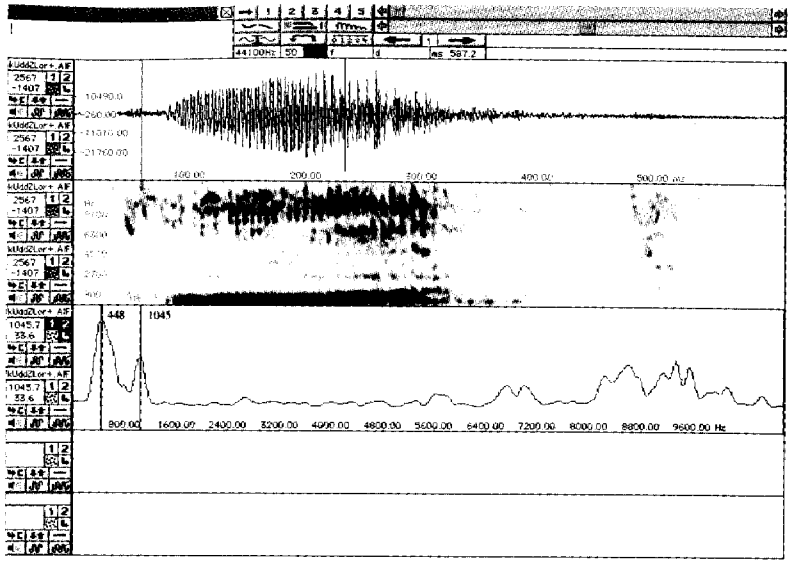


Figure 4. Altamurano [ˈkʷʊdː] 'that.MSG', male speaker, 78 years old.

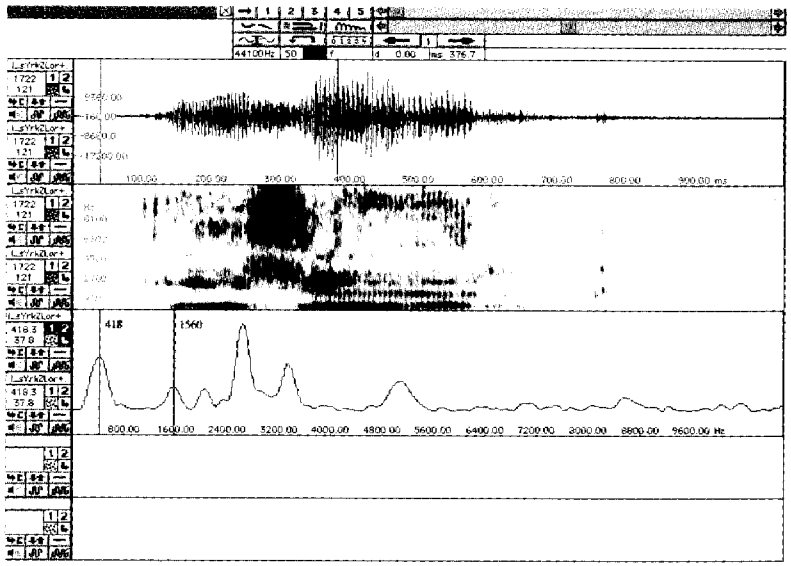


Figure 5. Altamurano [ɪ 'sʏrk] 'the mice', male speaker, 78 years old.

Figure 3 contains the waveform and the sonagram corresponding to the NP [ɪ mətə'tuu̯r] 'the harvesters'. The stressed vowel is the diphthongized allophone of /ʊ/ ((8a)), which Calabrese retranscribes as [uw] (cf. (38a)). The spectral envelope underneath refers to the point at 508 msecs on the time scale (at about the end of the [ʊ]'s steady state, which is very short since the vowel diphthongizes). On the envelope, the central values of F1 and F2 are marked (F1 = 463 Hz, F2 = 1165 Hz respectively).[29]

Similarly, Figure 4 shows a sonagram of the word ['kʷʊdɪ] 'that' (retranscribed by Calabrese 2000: 63 as ['kʷuddə], see (38c)), which contains the [(ʷ)ʊ] allophone inducing labialization of the preceding consonant ((8c)). Also here, the pointer on the waveform marks the instant (at 224.6 msecs) to which the frequency envelope refers. And on this, the Hertz values for the two first formants are F1 = 448 and F2 = 1045 respectively.

Figure 5 displays the sonagram of the word [ɪ 'sʏrk] 'the mice', an example of the fronted allophone ((8b)). Also here, F1 and F2 values are highlighted on the envelope, which refers to the point marked on the waveform (at 376 msecs).

If we now look at reference work in phonetics (e.g. Ladefoged 1975: 193 for American English, or Delattre 1981: 73 for German), we find that in languages such as English or German the rounded high vowels have the mean formant values reported in (39):

(39)

		F1	F2
American English	/u/	310	870
	/ʊ/	450	1030
German	/u/	300	825
	/ʊ/	375	875
	/y/	300	1750
	/ʏ/	350	1600

In comparison with the English or German values in (39), the Altamurano allophones of the /ʊ/ phoneme [uu̯] and [(ʷ)ʊ] clearly qualify as lax, with F1 values over 400 Hz and F2 values over 1000 Hz respectively. The fronted allophone, on the other hand, also has F1 values over 400 Hz, while the F2 at 1500 Hz is comparable to German lax /ʏ/.

All of Calabrese's analysis of fronting rests on the assumption that the vowels involved, such as Altamurano /ʊ/ in (8), are phonologically specified as tense ([+ATR]). The empirical evidence shows, however, that high back vowels in Altamurano are *never* tense.[30] This

should be regarded as a serious problem for this analysis, especially since it is based on a phonological theory that strives for phonetic grounding (cf. Halle *et al.* 2000: 406)

5. Conclusion

To conclude, the alternative accounts recently proposed for Altamurano /w/-deletion and vowel fronting, discussed in §§3-4, do not withstand close inspection. The best available account is still the one sketched in the footnotes of Loporcaro's (1988) description and refined here in §2. To achieve this account, we have to admit that an efficient modelling of language change must consider seriously the interplay between phonological form and phonetic substance. Without reference to phonetic substance – and, specifically, to auditory perception – the Altamurano facts, described in §1 and analysed in §2 as part of a set of gravity interactions, would resist explanation.

This suggests in turn – coming back to the dichotomies mentioned at the outset: form vs. substance, production vs. perception – that the widely held view of phonology as a self-contained formal system, described in terms of DFs which are only articulatorily based, proves once more to be a serious impediment to the understanding of phonological change.

Appendix. Diphthongization in Altamurano: phonetic data and phonological analysis

In the present Appendix I discuss open syllable diphthongization in Altamurano; or, more precisely, diphthongization of stressed vowels in open non-antepenultimate syllables (the environment specified in §1.3, (9)). This process was introduced only cursorily in the text (cf. §1.3, (8a); §1.4, (10a); §3.2, (29)), since it occurs in complementary distribution with fronting, which is limited to closed syllables and to antepenults (either closed or open). Discussion of this process also offers an opportunity to further pursue the matter of the relationship in theoretical phonology between primary (phonetic) data and speculation, one of the central topics in §4.

Before dealing with diphthongization, however, it will be useful to highlight additional disparities between the description of

Altamurano in Loporcaro (1988) (henceforth abbreviated **Lop**) and the Altamurano data presented in Calabrese (2000) (henceforth abbreviated **Cal**), purportedly based on the former (which is written in Italian, and thus perhaps not fully accessible to all theoretical phonologists interested in the facts and the analysis). Below are some of these divergences. (Page numbers in brackets follow each quotation. Forms in the right-hand column stem from my own field-notes: while most of them can be traced through the index in Loporcaro 1988, unreferenced ones are not mentioned in that description).[31]

Calabrese (2000)		**Loporcaro (1988)**	
['kørnə]	'horn' (62)	['kørn]	'horns' ('horn' is ['kwern]) (48)
['styʃənə]	'smoke' (62)	['stʏːʃənə]	'clean up.3PL', or 'tortoise' (56, 136)
['ŋgʷutənə]	'smoke' (63)	['ŋgʷuːtənə]	'anvil' ('smoke.3PL' is ['fʷuːmənə]) (56)
[tu'towrə]	'tutor' (64)	[tu'tɔu̯r]	'tutor' (53) (/ɔ/ → [ɔu̯] vs. /o/ → [ou̯] are distinct phonemes) (47, 52f, 203)
[fu'sijmə]	'spill.1PL' (64)	no such verb exists	
['mʷɔkkə]	'mouth' (64)	['wɔkː]	'mouth' (54) [32]
['neve 'nejv]	'new.MSG' (65)	['nevə 'nei̯f]	'new.MSG' (27) [33]
[ʃu'ka]	'play' (67)	[ʃu'kwɛ]	'play.INF' (185)
['ʃwejkə]	'play.2SG' (67, 70)	['ʃei̯k]	'play.2SG' (50)
['nwestə]	'our.M' (67)	['nest]	'our.M' (245)
[arrəkur'da]	'remember' (67)	[arːəkur'dɛ]	'remember.INF' (92)
[ʃu'kʷejmə]	'play.1PL' (67, 70)	[ʃu'kwei̯m]	'play.1PL' (254) [34]
[ʃu'kʷejtə]	'play.2PL' (67)	[ʃu'kwei̯t]	'play.2PL' (254)
[annu'ʃejmə]	'bring.1PL' (67)	[anːu'ʃɪi̯m]	'bring.1PL' (58) [35]
[annu'ʃejtə]	'bring.2PL' (67)	[anːu'ʃɪi̯t]	'bring.2PL' [36]
['mørənə]	'die.3PL' (67)	['mʷoːrənə]	'die.3PL'
['ʃowke]	'play.1SG' (70)	['ʃou̯k]	'play.1SG' (47)

Some of the forms in the left-hand column may well be due to misprints. However, that some are not is revealed by explicit comments, as in the following passage:

> "Crucially a three-step derivation is required in the case of the form ['ʃwejkə]. As we will see in more detail later, a derivation involves the serial application of rules and repairs. The alternant [wej] is obtained by the application of the rule of metaphony in (18) followed by the application of lengthening and diphthongization as shown in (25):

> (25) 'ʃokə → (18) → 'ʃwekə → (19) → 'ʃweːkə → (21) → 'ʃwejkə". (Calabrese 2000: 70).

For this word, which in Altamurano is pronounced ['ʃei̯k] 'play.2SG', an "alternant [wej]" does not exist. This is due to the fact that the /w/ glide in the metaphonic diphthong /we/ has been deleted after coronal consonants, as shown in (6c) above. This process did not apply in other cognate dialects spoken further south; among these Campiota, the Salentino variety Calabrese is a native speaker of, in which 'play.2SG' indeed is ['ʃwɛːki], with the metaphonic diphthong preserved (cf. Mancarella 1998: 102). Thus, an interference from the author's native dialect may explain Cal ['ʃwejkə] (vs. Altamurano ['ʃei̯k], Lop 50). The same goes for Cal 67 ['nwestə], which is a blend between Altamurano ['nest] (Lop 245) < *['nwest] < Lat. NŎSTRUM and Northern Salentino ['nwɛʃːu].

We now move on to discuss Altamurano open syllable diphthongization, comparing the two accounts provided in Loporcaro (1988: 27-29, 176-182) and Calabrese (2000: 64-67). The latter account is meant to clarify things, since "Loporcaro's discussion of the process is somewhat unclear" (Calabrese 2000: 64).

Altamurano possesses two types of diphthongs (Loporcaro 1988: 27f): on the one hand, the polarized diphthongs /ai̯ au̯/ which developed out of PRom /e o/ in the environment in (9), §1.3 (viz. stressed open non-antepenultimate syllable). E.g. ['sai̯r] 'evening' < Lat. SĒRAM, ['sau̯l] 'alone.F' < Lat. SŌLAM. This diphthongization resulted in restructuring of the underlying representation, which did not occur for the second type of diphthongs. The latter are the product of a synchronically active allophonic process, which turns any vowel occurring in stressed open non-antepenultimate syllable (again, the context defined in (9) above) into a falling diphthong (= vowel plus homorganic glide). (*/a/ does not occur in this position, owing to historical reasons: /a/ > /ɛ/. Remember further that, as already mentioned in §1.3, an underlying final /ə/ is deleted pre-pausally: e.g. /'fɪlə/ → ['fɪi̯l] 'thread').[37]

(40)	/ɪ/ → ['ɪi̯]	['fɪi̯l]	'thread'	/ʊ/ → ['ʊu̯]	['kʊu̯s]	'sew.2SG'
	/e/ → ['ei̯]	['mei̯l]	'honey'	/o/ → ['ou̯]	['kou̯r]	'heart'
	/ɛ/ → ['ɛi̯]	['pɛi̯ʃ]	'peace'	/ɔ/ → ['ɔu̯]	['krɔu̯ʃ]	'cross'

The empirical evidence for the distinction of the two categories of diphthongs is many-fold. From a typological point of view, it is well known that polarized diphthongs tend to become phonologized (via

restructuring) cross-linguistically (cf. Donegan 1978: 106ff). External evidence for the underlying representation in (40) is provided by the fact that the same allophonic process applies in the pronunciation of Italian by Altamurano speakers, who have a tendency to say ['seɪrɐ] 'evening' (SIt *sera*), ['koʊsɐ] (SIt *cosa*) 'thing' although their mental representations for the Italian words obviously coincide with the standard ones in having no diphthong: e.g. /'sera/. Finally, internal evidence for the distinction between the two categories of diphthongs in Altamurano is also available. In fact, while the polarized diphthongs are systematically realized as such in all positions within the utterance, the diphthongs in (40) occur only in utterance-final (i.e. prepausal) position, as seen in the contrast between (41a) and (41b) (cf. Loporcaro 1988: 27):

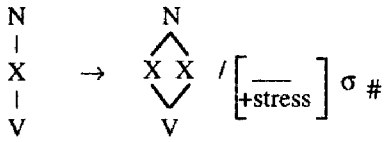
(41)	a.	['caɪna 'caɪn]	'really full.F'	(lit. 'full full')
		['saʊla 'saʊl]	'really alone.F'	(lit. 'alone alone')
	b.	['cɛːnə 'cɛɪn]	'quite slowly'	(lit. 'slowly slowly')
		['bːoːna 'bːoʊn]	'really good.F'	(lit. 'good good')
		['neːvə 'neɪf]	'brand new.M'	(lit. 'new new')

This description is questioned by Calabrese (2000: 65), who objects that this cannot be the case, since:

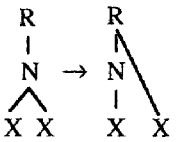
> "Diphthongization in most other Romance varieties has a close relationship with vowel lengthening. Vowels lengthen in an open stressed syllable in penultimate position at the word level regardless of their position in the phrase".

Rather, it is argued, vowels must be diphthongized in Altamurano regardless of their position within the utterance. This diphthongization is formalized by means of the rule reported in (29) above and repeated here as (42) (Calabrese 2000: 66):

(42) a.



b.



As for the dependency on utterance-final position, described in Loporcaro (1988: 159ff), it must be the product – it is suggested in Calabrese (2000: 67) – of misperception by the transcriber. The glide

has to be there, given that diphthongization must apply "at the word level", but it might be a bit shortened, so that

> "the shortness of the glide component of the non-phrase final diphthong in opposition to its length when it occurs phrase finally may lead to its misperception as non-existent".

This account is inaccurate for Altamurano because it projects on it generalizations which are legitimate (to some extent) only for standard Italian. Actually, for standard Italian as well, research in experimental phonetics (at least since Bertinetto 1981: ch. 4) has shown that open syllable lengthening is actually most noticeable in utterance-final position and much less prominent (if present at all) in utterance internal position. Thus, it has to be understood as the product of a conspiracy of the condition based on syllable-structure and of the cross-linguistically well-known phonetic phenomenon called 'final (or prepausal) lengthening' (cf. Bertinetto 1980, 1981: 183 or, more recently, D'Imperio 2000: 72: "duration is an important correlate of prominence in Italian, not at the word level [...], but also at the sentence level."). Consequently, the deductive principle on which Calabrese's objection to the description of Altamurano in (40) is based, is factually inaccurate for standard Italian as well.

Altamurano, however, is not standard Italian, but a Romance variety in its own right, in which vowel quantity and diphthongization conform to a pattern which differs from the one observed in the standard language. In Altamurano as well, prepausal lengthening plays a role, as suggested in Loporcaro (1988: 181), enhancing the duration of vowel nuclei in open syllables. But as to the organization of the formal reflexes of this phonetic tendency within the phonological component, the two systems are simply distinct. To see how, let us first summarize the phonetic facts concerning the diphthongs of type (41b).

Of course, a certain amount of deviation in the formant profile during the articulation of stressed vowels cannot be excluded entirely, even in utterance internal position. Speakers of Altamurano have a strong tendency to diphthongize all lengthened vowels, and phonetic lengthening is a matter of degree. Yet the distinction between the two types of diphthongs in (41a) vs. (41b) argued for in Loporcaro (1988) is supported by experimental evidence. Calabrese (2000: 66) finds "Loporcaro's spectrograms [...] difficult to read". Thus, I provide some more acoustic evidence here:

In Figure 6, the spectral envelope refers to the point at 982 ms. on the time scale, about 200 msecs from the beginning of the diph-

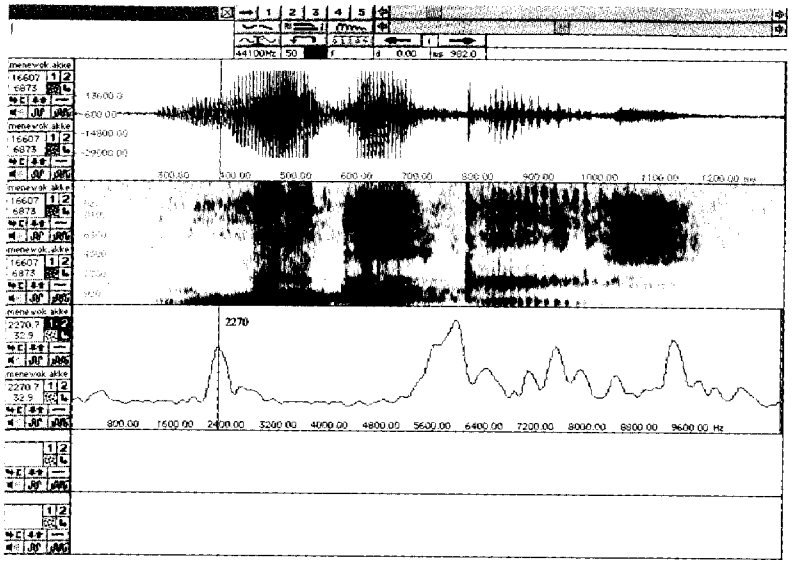


Figure 6. Altamurano [mə nə 'wɔːk a 'kːɛi̯s] 'I'm going home', male speaker, 78 years old.

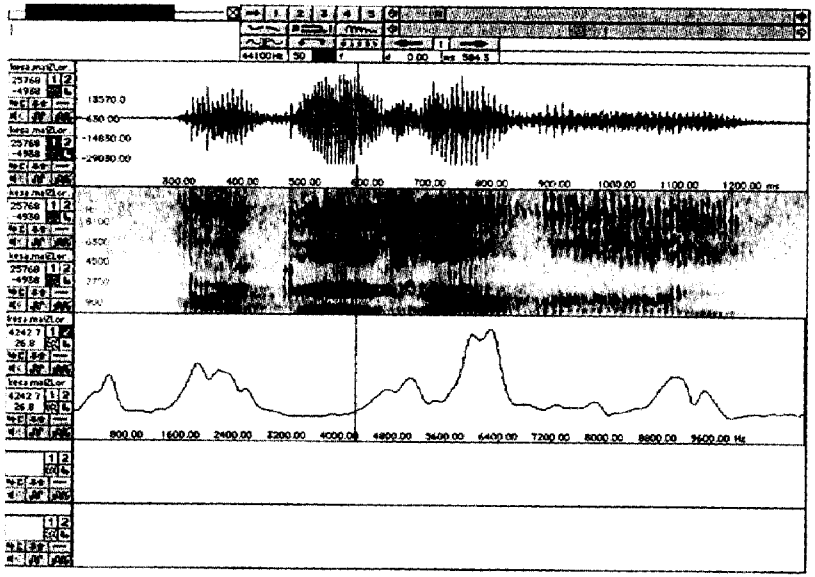


Figure 7. Altamurano [la 'kɛːsa 'mai̯] 'my home', male speaker, 78 years old.

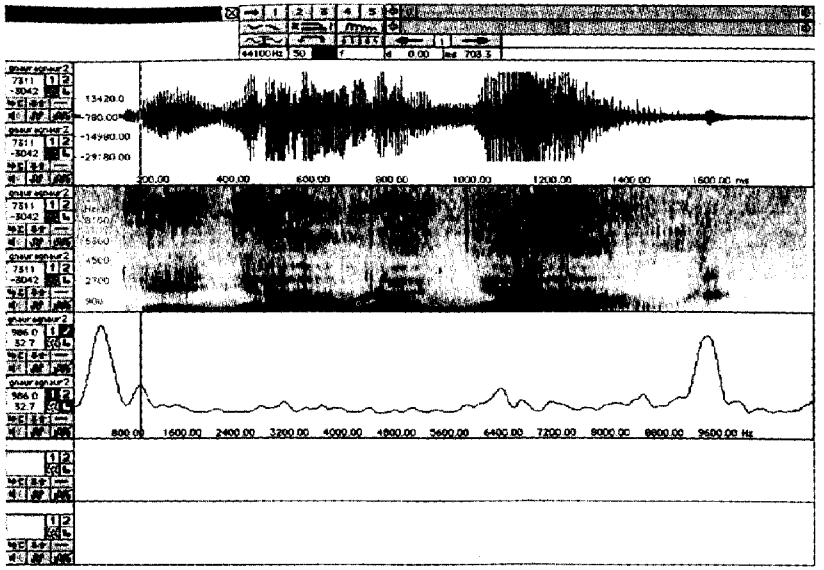


Figure 8. Altamurano ['je 'ɲːau̯ra 'ɲːau̯r] 'it's really black.F', male speaker, 78 years old.

thong ['ɛi̯]. The F2, marked with the pointer on the envelope, is at 2270 Hz: that is a clear [i̯]. In Figure 7, on the other hand, towards the end of the stressed ['ɛ] of ['kɛːsa] (see pointer on the waveform), the F1 and F2 values are respectively at 522.9 Hz and 1867.4 Hz (cf. the envelope underneath): these are canonical values for [ɛ]. Thus, comparison of Figures 6 and 7 confirms the description of the derived surface diphthongs in (41b) and disconfirms the hypothesis of "misperception" of an existing glide in utterance internal position.

The acoustic basis of the phonological contrast in (41a-b) becomes manifest from comparison of Figures 6-7 with Figure 8, where an underlying diphthong of category (41a) is displayed. Here, the envelope refers to the point at 703.3 msecs on the time scale, about the end of the diphthong [au̯] in the first occurrence of the word ['ɲːau̯r] 'black.F': the formant values are F1 = 403, F2 = 986 (= a clear [u̯]). This means that underlying diphthongs do not reduce, unlike those in (41b), in utterance internal position, a fact that can also be seen immediately in comparing the overall acoustic structure of the two occurrences of ['ɲːau̯r], which display much the same formant profile.

Thus, if the contrast proposed in (41a-b) is rejected, as Calabrese does implicitly in claiming that diphthongization has to take place "at

word level" in (41b) as well, some other explanation should be put forward to account for the objective differences between the two categories of diphthongs. Clearly, however, the diphthongization rule in (42) is not a sound foundation on which to build an alternative account. This rule is the product of an unwarranted inference from standard Italian, as shown by the fact that the environment of (42a) contains the symbol σ. This implies that a following syllable must be present for diphthongization to apply.

However, it has been shown repeatedly in the literature on Italo-Romance comparative phonology that the condition implying the presence of a following syllable constrains vowel lengthening in standard Italian but not in the dialects of south-eastern Italy, as first recognized by Merlo (1926: 87). In the discussion in Loporcaro (1997: 71-72) it is shown that final vowels display lengthening (or diphthongization) processes on a par with stressed vowels in open syllables (cf. examples (8a)-(10a) above) in all of the dialects of the above-mentioned area. In order to capture this fact, the environment must be stated in terms of morae, as shown in (9), §1.3, following the formalization provided in Loporcaro (1996: 172).

Experimental proof of the presence of diphthongization in word final position as well was already provided for Altamurano in Loporcaro (1988). I reproduce in Figure 9 the sonagram which appears on page 190.

The sonagram shows that in ['tu 'fɛ̯ⁱ] 'you do.SG' (from underlying /'fɛ/) the F2 of the stressed vowel goes up to around 2000 Hz, just like in [la 'pɛi̯ʃ] 'the peace' (from an underlying bisyllabic /'pɛʃə/).

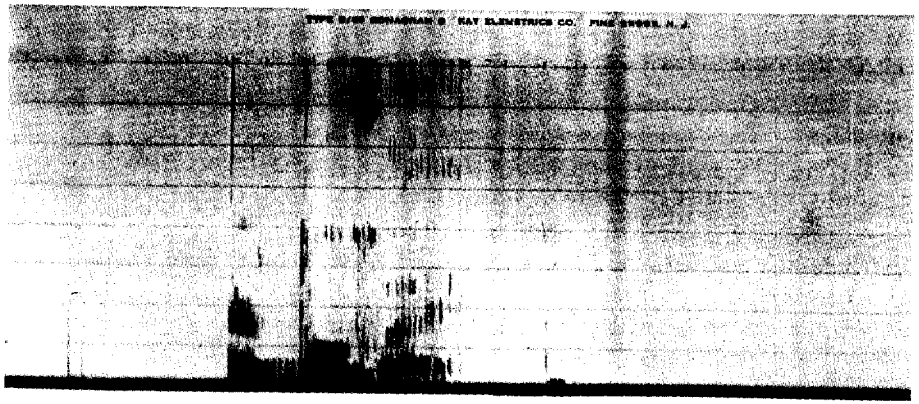


Figure 9. Altamurano [e 'tːu 'fɛ̯ⁱ] 'and you do.SG', male speaker, 78 years old (after Loporcaro 1988: 190).

The underlying form contains a monophthongal /'ɛ/. Note that this specific form used to have an etymological final /-i̯/. However, original */-'ɛi̯/ was reanalysed as /'ɛ/ via abduction, because ['ɛi̯] is the normal surface realization of stressed /'ɛ/ in open non-penultimate syllable. That this is in fact so, and that no final /-i̯/ is now present underlyingly, is demonstrated by the fact that the infinitive /'fɛ/, where no final */-i̯/ ever existed (< FA(CE)RE), is perfectly homophonous: ['fɛ̯ⁱ] 'to do' (and the same goes for all -ARE infinitives: e.g. ['stɛ̯ⁱ] 'to stay' = 'stay.2SG', ['dɛ̯ⁱ] 'to give' = 'give.2SG', etc.). Figure 10 displays the sonagram of another infinitive form. Here as well, the F2 towards the end of the formant profile is clearly that of an upgliding diphthong (i.e. with high offglide).

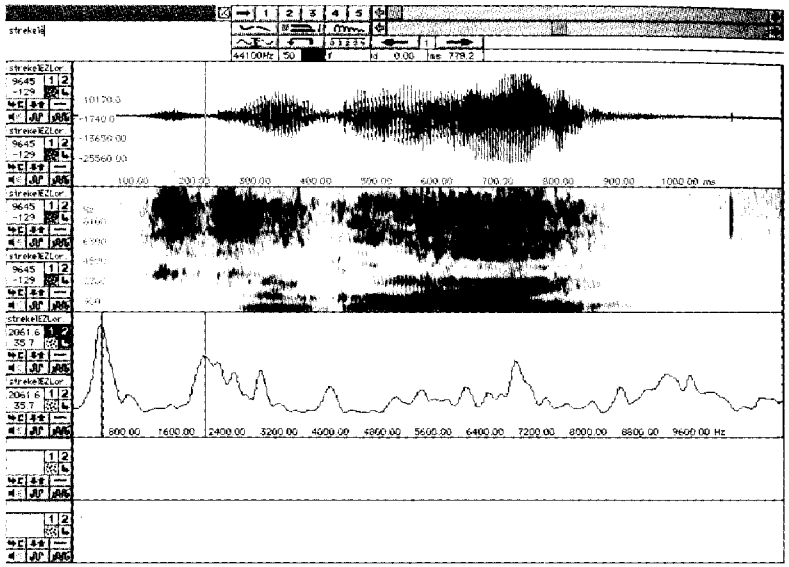


Figure 10. Altamurano [strəkə'lɛ̯ⁱ] 'to rub (laundry)', male speaker, 78 years old.

These acoustic data are incompatible with monophthongal [ɛ], which demonstrates that diphthongization occurs not only in (underlyingly) paroxytonic ['pɛi̯ʃ] but also in oxytonic ['fɛ̯ⁱ], [strəkə'lɛ̯ⁱ] etc. Consequently, the formalization of Altamurano diphthongization in (42) must be rejected. The environment must be stated as shown above in (9), so as to account for the application of the process in word-final position as well.

By way of conclusion, we can observe that rejection of rule (42) has been achieved through simple inspection of primary phonetic data, that were already available (and had been already analysed) before this statement of Altamurano diphthongization was put forward.

Nevertheless, the statement in (42) is now a part of the literature on the phonology of Italian dialects. This might well lead some other scholar working in Romance comparative phonology to conclude that, on this important parameter, the dialects of South-Eastern Italy do not differ substantially from standard Italian. That conclusion, however, would be ill-founded, as we have shown. This simple observation should caution restraint in issuing theoretical hypotheses in phonology: if the primary data are erroneous, even the most theoretically refined analysis of those erroneous data has no chance of being right, and of really contributing to the progress of research in the field.

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Notes

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The following abbreviations will be used throughout this paper: **DF** = distinctive feature, **Lat.** = Latin, **MS** = marking statement, **PIE** = Proto-Indo-European, **PRom** = Proto-Romance, **SIt** = Standard Italian, **SPE** = Chomsky & Halle (1968), **UFT** = Unified Feature Theory. Within glosses, as usual: F = feminine, M = masculine, PL = plural, SG = singular.

1 This double perspective is actually a relatively recent conquest, since empirical and theoretical studies on sound change in their early phase used to work with the assumptions well illustrated in the following statement from Rousselot's (1891: 350) seminal work: "La cause générale qui provoque l'évolution [*scil.* des sons linguistiques] n'appartient ni à l'ordre intellectuel [...] *ni aux organes auditifs* [...] *mais uniquement au système phonateur*" (italics added, M. L.) [The general cause which brings about evolution [*scil.* of linguistic sound] belongs neither to the intellectual dimension [...] nor to the auditory organs [...] but solely to the phonatory system]. If we consider that Rousselot's work is a landmark in the history of research not only in the theory of language change but also in experimental phonetics, comparison of these words with modern work in the theory of distinctive features (see directly) irresistibly reminds one of John Ohala's humorous saying, according to which "today's phonology is yesterday's phonetics".

2 In the former approach, conditions militating in favour of phonological change are located either in the speaker (e.g. aerodynamic or elasto-inertial constraints) or in the hearer (e.g. confusion of similar sounds, acoustic hypo- or hyper-correction). In the latter approach, phonological processes are classified in teleological terms, according to whether they serve production or perception (cf. Dressler & Drachman 1977). There is no agreement between the two, by the way: Ohala (1989: 191) has a section entitled "eschewing teleology".

3 It must be admitted that non-conventionalist models have no systematic alternative to offer. On this issue they basically took two routes: either they neglect the issue of (the formalization of a system of) DFs altogether, as Ohala does, or they simply adopt some version of the current articulatory DF set (like Stampe 1979, Dressler 1985).

4 In (1) and in the rest of the paper, consonant length in phonemic transcriptions is marked with the repetition of the C symbol. This is also the case for non-contrastive geminates: /bb/, /gg/, /ddz/, /ddʒ/ are always long between vowels (cf. Loporcaro 1988:225). Note further that all consonants in utterance-final position (including sonorants) are devoiced, as is apparent from the sonagraphic evidence presented below (Figures 3-4). The devoicing diacritic is omitted here for typographical convenience.

5 A further detail concerns the fact that propagation also applies across word-initial consonant clusters, provided that the second consonant is labial or velar: e.g. /ʊ # sparnʊt'tsɪʃə/ → [ʊ spwarnʊ't:sɪi̯ʃ] 'you scatter it.M', /nʊ # 'skɪttʃəkə/ → [nʊ 'skwɪt:ʃəkə] 'a splash', /ʊ # 'ngapətə/ → [ʊ 'ŋgwa:pətə] 'the boss'.

6 In the first example in (2), the labial stop carries a secondary articulation. This labialization occurs independently from the preceding context, as the effect of a distinct allophonic process to be described below (cf. (8c), (10c)).

7 The gray zone signals the fact that some conceivable combinations are missing, as velar stops cannot precede original front vowels: this is the consequence of Romance palatalization (['kɪi̯l] 'kilogram' is a recent loanword). A seeming exception is the string /kɛ/, where however the vowel derives historically from Latin stressed /a/ in open syllables, which underwent fronting in this dialect (cf. Loporcaro 1988: 45).

8 An alternative view is maintained by Rizzi & Savoia (1993) for /w/- propagation in some other southern Italian dialects. They argue that a syntactic locality-condition constrains the application of the rule. At any rate, it must be recognized that factors other than purely phonological surely play a role in the process. There is external evidence in favour of the morpho-lexical view of the constraint on /w/- propagation. Consider the following slip of the tongue, which I have recorded in a standard Italian utterance by an Altamurano speaker: ['pas:ami l 'kwap ... il ka'p:ɔt:o] 'pass me the coat'. In Altamurano, the same sentence would sound ['pas:əm ʊ kwa'p:ɔt:] (the word /kap'pɔttə/ is an Italian loanword). The slip of the tongue – due to an instance of code-mixing – shows that for *w*-propagation to apply, it is no longer necessary that a back high vowel be there. The fact that the speaker applied propagation after the Italian definite article m. sg. /il/ shows that it is precisely this morphological specification which has become the crucial trigger for the rule. However, since the original phonological context was not

obscured, this still qualifies as a morpho-phonological rule in Dressler's (1985) taxonomy.

[9] We will dwell exclusively on the phonological side of the phenomenon, leaving morphology aside.

[10] There is quite a rich literature in theoretical phonology concerning metaphony in southern Italian dialects: cf. e.g. Calabrese (1984-85, 1998), van Coetsem & Buccini (1990: 198ff), Kaze (1991), Sánchez Miret (1998). In the present paper, we will not be concerned with the analysis of the phenomenon *per se* but only with the reduction of the metaphonic diphthong in Altamurano (cf. (6c)).

[11] On variation in the quantity of final vowels in Italo-Romance cf. Loporcaro (1997: 70-72). Open syllable diphthongization is discussed in the Appendix: spectrographic illustration of the process is provided in Figures 6-10.

[12] Initial /w/ and initial /v/ merge, in the environment [__^{w}u], into the same phonetic string [wu]: e.g. ['wu:nətʃə] 'eleven' begins with an historically prosthetic /w/ whereas ['wʊɟ:ɪ] 'boiling' has initial /v/, deriving from Lat. B- (< BULL(ĪRE)).

[13] Variation across generations affects the realization of the two allophones of /o/ in (10b-c). Much like in the case of /u/ (cf. §1.3), among the speakers surveyed in Loporcaro (1988), elderly women tend to have a tense [ø] as in German *schön*, whereas other speakers have a lower [œ] as in German *Hölle*. Furthermore, for the pre-labialized allophone a transcription [(^{w})o̯] would be more accurate. In the speech of the Altamurano speakers born in the first two decades of the 20th century, this vowel (somewhat lower than a canonical [o], as found e.g. in SIt ['bot:e] 'barrel') contrasts with lower-mid /ɔ/ → [ɔ̯]: cf. e.g. ['wɔ̯k:(ələ)] 'brood hen' ≠ ['wɔ̯k:] 'mouth'. Younger speakers, however, merged the two into a single realization [ɔ̯], through complete laxing of the allophone (10c). The /o/ ≠ /ɔ/ contrast lasted longer in the environment in (9), where ['lo̯ur] 'they' ≠ [l 'ɔ̯ur] 'the hour', [lɪ'o̯un] 'wood' ≠ [lɪ'ɔ̯un] 'lion' are still kept distinct in the speech of informants born until approximately the half of the century. Speakers my age (born in the Sixties or later) mostly merged the two vowels into [o̯u̯] in non-antepenultimate open syllable. Since the same happened to front mid vowels (cf. Loporcaro 1988: 205-7), the resulting system of the younger generations has only five vowel phonemes in stressed syllables and no tenseness contrast at all, but rather a complementary distribution of tense diphthongized [o̯u̯] in non-antepenultimate open syllable vs. lax [ɔ]/[œ] elsewhere.

[14] Actually, in Chomsky & Halle (1968) true palatals are analysed as [–coronal], but it has become common practice to have them specified positively for coronality (cf. e.g. Halle & Clements 1983).

[15] Picture (13) neglects differences between specific subframeworks within Feature Geometry. For instance, in Halle (1992), Kenstowicz (1994: 146-168), Coronal dominates [anterior] and [distributed], Labial dominates [round] and Dorsal dominates [high], [low], and [back]. On the other hand, in Halle *et al.* (2000: 389) the three features in (13) are sister nodes to the other place features and explicit articulator labels are introduced as superordinate nodes: thus, Lips dominates [round] and [labial], Tongue Blade dominates [anterior], [distributed] and [coronal], and Tongue Body dominates [high], [low], [back] and [dorsal].

[16] The solution Pagliuca & Mowrey (1980) argue for, though, takes a different route than the one followed here.

[17] As for vowels, only non-front vowels are listed, since front vowels are irrelevant to the processes under discussion. Note that this dialect lacks a tense */u/ phoneme (cf. §4.2 below).

[18] Cox is only concerned with the formal side, not with acoustic considerations: his point is that, formally, the feature [±grave] must be dispensed with.

[19] This is a somewhat unclear case though, since Lat. ŏctō should not have diphtongized in the first place, given that it has no final high vowel. Moreover, there is also an alternative form ['jɔt:], only in the sense 'eight o'clock', which is phonetically irregular too, as the expected outcome of Lat. ŏctō should be *['jøt:] (cf. the outcome of PRom /ɔ/ < Lat. ŏ in (10b) above).

[20] See the discussion in Halle *et al.* (2000: 400-2, 410-412), who argue against UFT. The differences between the authors' Revised Articulatory Theory and Clements' UFT, albeit important, are immaterial to our present concerns.

[21] There are versions of Feature Geometry (notably Clements' UFT (cf. fn. 20), in which the feature [ATR] is dispensed with and substituted by a multivalued aperture feature (cf. e.g. Vaux 1996 for a recent discussion of the status of [ATR] within the Hallean version of Feature Geometry, which Calabrese assumes).

[22] The statement of diphthongization in (29) will be discussed in the Appendix.

[23] These questions concern conditions, not causes and we provide elucidations (or explanations) for conditions, not for causes. In this respect, Lass' (1980) discussion of the impossibility of causal (deductive-nomological) explanation for language change still warrants caution in issuing claims of causal explanation.

[24] The source of the data is declared at the outset: "This dialect is studied in Loporcaro (1988), from which all the data presented here are taken" (Calabrese 2000: 60).

[25] Diphthongs are omitted in (31). Altamurano has two underlying diphthongs /ai̯ au̯/ (cf. (41a) below).

[26] For Apulian, the existence of a tenseness contrast for high vowels is my own discovery. To the best of my knowledge, it was first described in Loporcaro (1986: 232f, fn. 64), whereas all previous studies on the varieties at issue (cf. in particular Stehl 1980: 213ff) had failed to identify it.

[27] Note that the theory of Natural Phonology provides for the notion 'latent process' (cf. Hurch 1988), a notion recently exploited within Optimality Theory under the label of 'Stampean Occultation' (cf. Prince & Smolensky 1993). In this case, it was the suppression of the tensing process which remained without consequences for the phoneme inventory of some of the varieties in which it occurred. It simply created the structural space for the contrast, not necessarily the contrast itself, until there was something to fill the empty slot in the system, owing to some independent change.

[28] Actually, Calabrese attributes the change to Sanskrit only, but of course the merger at issue is one of the defining features of the Indo-Iranian sub-family.

[29] Had we measured formant values closer to the vowel's onset, we would have observed even more centralization.

[30] As to /u/, elderly speakers, by the time of my description (especially, but not exclusively, women) had a somewhat tenser realization for the fronted allophone only (as already mentioned in §1.3). By now these generations have virtually died out, and lax [ʏ] has generalized. In any case, this somewhat less lax realization [ʏ̞] concerned only the fronted allophone, while the other two, which directly correspond to the input of the fronting process, are *always* very clearly lax. As to /o/, its realization under fronting varies among speakers between [ø] and [œ] (cf. fn. 13), so that tenseness cannot be considered a defining phonetic property of this phoneme either.

[31] On final schwas in the phonetic transcriptions in square brackets see the comment on (8), §1.3. I insert here notation of allophonic vowel length, which was factored out in all transcriptions in Loporcaro (1988).

[32] Calabrese (2000: 64) gives the following derivation: /'mɔkkə/ → ['m^{w}ɔkkə] 'mouth'. The word for 'mouth' is in Altamurano /'vɔkkə/ → ['wɔk:]. A form with

nasalized initial consonant (geminate, however) also exists, arising from the assimilation of the preposition /n/: /n + 'vɔkkə/ → ['mʷːɔkː] 'in (the) mouth'. Both forms are described in Lop 54.

[33] While ['neve] is a misprint, ['nejv] is from Lop 27, where I forgot the diacritic signalling the devoicing of posttonic /v/ (Lop 117).

[34] Actually, [ei̯] in stressed non-antepenultimate syllable is characteristic for the youngest speakers recorded in Lop 205ff (cf. fn. 13 above). But my description, while mentioning these changes in progress, centres on the conservative variety, and it is wise not to mix sociolectal data, in order not to incur problems of sociolinguistic (im)plausibility. In fact, no speaker of Altamurano has at the same time a tense [e] in both ['nest] 'our.M' (cf. Cal ['nwestə], 67) and [ʃu'kwei̯m] 'play.1PL' (cf. Cal [ʃu'kʷejmə], 67, 70). The former is confined to the elderly speakers, the latter to those born from 1960 onward.

[35] [-'ɛi̯m] (not [-'ejm]) is the 1pl ending of the first conjugation (see above, [ʃu'kwɛi̯m] < Lat. IOCĀRE). But [a'nːuu̯ʃ] (< Lat. INDŪCERE) is a verb of the 2nd conjugation, and the 2nd conjugation ending is [-'i̯m] (Lop 254).

[36] [-'ɛi̯t] (not [-'ejt], however) is the 2pl ending of the first conjugation. The corresponding ending in the 2nd conjugation is [-'i̯t] (Lop 254).

[37] Cal 64 recapitulates as follows the description of Altamurano posttonic vowel reduction (Lop 63-65, 159-170): "In posttonic position all vowels except /a/ are reduced to schwa". While there are indeed southern Italian dialects (of Lazio, Campania, Abruzzi, Calabria) in which final /a/ is preserved and all remaining vowels merge into /ə/ (cf. e.g. Schanzer 1989, Romito et al. 1997: 166-169), this is not the case in Altamurano. In this dialect, all final vowels including PRom /a/ merged into /ə/: e.g. CASA(M) > /'kɛsə/ (→ ['kɛi̯s] prepausally, ['kɛ·sə] in utterance-internal position). However, in some syntactic contexts, both final /a/ and /u/ are realized as unreduced vowels. For /u/, the only environment in which this happens is exemplified above in (1) (i.e. unreduced [-u] can only be the final vowel of a m.sg. determiner). Final unreduced [-a] surfaces in a few other syntactic contexts, including f.sg. determiner + noun/adjective, adjective+adjective (superlative iteration; cf. (41) below) and others (cf. Lop 63-65).

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