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Citation: Kenstowicz, Michael. "Vocale Incerta, Vocale Aperta." in Proceedings of the 40th Linguistic Symposium on Romance Languages, LSRL 40, 2010, March 26-28, University of Washington.

As Published: http://depts.washington.edu/lssl2010/lssl2010_Program.pdf

Publisher: John Benjamins/University of Washington

Persistent URL: <http://hdl.handle.net/1721.1/71768>

Version: Author's final manuscript: final author's manuscript post peer review, without publisher's formatting or copy editing

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Vocale Incerta, Vocale Aperta*

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Omaggio a P-M. Bertinetto

Ogni toscano si comporta di fronte a una parola a lui nuova, come si nota p. es. nella lettura del latino, scegliendo costantemente, e inconsciamente, il timbro aperto, secondo il principio che il Migliorini ha condensato nella formula «vocale incerta, vocale aperta»...è il processo a cui vien sottoposto ogni vocabolo importato o adattato da altri linguaggi.

(Franceschi 1965:1-3)

1. Introduction

Standard Italian distinguishes seven vowels in stressed nonfinal syllables. The open $\epsilon, \text{ɔ}$ vs. closed e, o mid-vowel contrast (transcribed here as open $\text{è}, \text{ò}$ vs. closed $\text{é}, \text{ó}$) is neutralized in unstressed position (1).

(1)	<u>3 sg.</u>	<u>infinitive</u>	
	tócca	toccàre	‘touch’
	blòcca	bloccàre	‘block’
	péla	pelàre	‘pluck’

* A preliminary version of this paper was presented at the MIT Phonology Circle and the 40th Linguistic Symposium on Romance Languages, University of Washington (March 2010). Thanks to two anonymous reviewers for helpful comments as well as to Maria Giavazzi, Giovanna Marotta, Joan Mascaró, Andrea Moro, and Mario Saltarelli.

gèla gelàre ‘freeze’

The literature uniformly identifies the unstressed vowels as closed. Consequently, the open è and ò have more restricted distribution and hence by traditional criteria would be identified as "marked" (Krämer 2009). In this paper we examine various lines of evidence indicating that the open vowels are optimal in stressed (open) syllables (the *rafforzamento* of Nespor 1993) and thus that the closed é and ó are "marked" in this position: {è,ò} > {é,ó} (where > means “better than” in the Optimality Theoretic sense).

The paper is organized as follows. First, we survey various stress contexts in which the Italian open-closed contrast is suspended, noting that they converge on open and thus indicate that this is the optimal choice. We then report our count of the frequency of open vs. closed vowels in several contexts that show a statistical bias for open vowels. Next we turn to loanwords and note that for both early Latin loans as well as contemporary ones the open vowels are normally selected even if a closed vowel would be a better phonetic match, a phenomenon dubbed “retreat to the unmarked” in Kenstowicz (2005). This is followed by a phonological analysis of the open vs. closed distribution and its harmonic relation with stress. We then note some parallels in the seven-vowel systems of Brazilian Portuguese and Catalan. The following section explores the phonetic basis of the preference. We then note some challenging data from Slovene which indicates that it optimizes closed mid vowels instead of open ones in loanword adaptation. We offer an explanation based on dispersion of vowels in phonetic space. The final section summarizes and concludes the paper.

2. The Preference for Open Mid Vowels 1: Native Vocabulary

The derivational morphology of Standard Italian offers several situations in which stress shifts onto an unstressed mid vowel of the base and so presents the speaker with a choice between whether to realize the vowel as open vs. closed. We find that the open vowel is chosen over its closed counterpart in the vast majority of cases. However, the range of circumstances where a stress shift on the base can be detected is actually rather limited in Italian. Most derivational suffixes attract stress to themselves rather than permit it to recede to the preceding vowel of the base; and due to the fact that a suffix is normally followed by an inflection and that stress must fall within a three-syllable window, a shifted stress is restricted to the final syllable of the base if it falls on the base at all.

The most regular of these accent shifts is before the adjectival suffix *-ic*, which systematically stresses the preceding syllable. As seen in (2), both stress-advancing and stress-retracting bases are associated with this change to an open vowel.

(2)	àtomo	‘atom’	atòm-ic-o	‘atomic’
	nùmero	‘number’	numèr-ic-o	‘numeric’
	gènere	‘kind, sort’	genèr-ic-o	‘generic’
	gènesi	‘genesis’	genèt-ic-o	‘genetic’
	perìodo	‘period’	periòd-ic-o	‘periodic’
	sìmbolo	‘symbol’	simbòl-ic-o	‘symbolic’
	schèletro	‘skeleton’	schelètr-ic-o	‘skelectric’
	anemìa	‘anemia’	anèm-ic-o	‘anemic’

armonĩa	‘harmony’	armòn-ic-o	‘harmonic’
ironĩa	‘irony’	iròn-ic-o	‘ironic’
melodĩa	‘melody’	melòd-ic-o	‘melodic’
parodĩa	‘parody’	paròd-ic-o	‘parodic’

In the vast majority of zero nominalizations and verbalizations the derivative remains faithful to the open vs. closed vocalism of the base when they share the same stress location (3a). But when the derivation involves a suffix that does not attract the stress to itself then a change from closed to open is also found (3b) although these cases are limited in number. We are not aware of any examples where open vowels of the base become closed under such «restressing»¹.

(3) a.	pésce	‘fish’	pescàre, péSCO	‘to fish’
	sécco	‘dry’	seccàre, sécco	‘become dry’
	códa	‘tail’	scodàre, scódo	‘remove tail’
	mòla	‘millstone’	molàre, mòla	‘polish’
	gèlo	‘cold’	gelàre, gèla	‘freeze’
	volàre, vólo	‘to fly’	vólo	‘flight’
	segàre, ségo	‘to cut’	séga	‘saw’
	snodàre, snòdo	‘untie’	snòdo	‘solution’
	pregàre, prègo	‘to pray’	prègo	‘request’

¹ Bertinetto and Loporcaro (2005) cite *Malèsia* ≈ *Malése* as a possible example but this is probably better treated as substitution by the *-ese* suffix seen in *Siam* ≈ *Siamése* and *Giappone* ≈ *Giapponése*.

b. <i>crédere</i>	‘to believe’	<i>crèdulo</i>	‘credulous’
<i>depórrere</i>	‘to put down’	<i>depòsito</i>	‘deposit’
<i>Napoleóne</i>	‘Napolean’	<i>Napoleònide</i>	‘descendant of Napolean’
<i>coróna</i>	‘crown’	<i>corònide</i>	‘apostrophe’
<i>carbóne</i>	‘coal’	<i>carbònio</i>	‘carbon’
<i>Platóne</i>	‘Plato’	<i>Platònico</i>	‘Platonic’
<i>oròscopo</i>	‘horoscope’	<i>microscòpio</i>	‘microscope’

Another situation in which derivational morphology presents the Italian speaker with a choice between open vs. closed mid vowels are various types of truncations (hypocoristics, abbreviations, acronyms), where stress shifts to an unstressed syllable of the base. Here as well we find a general preference for open mid vowels. The following data in (4) survey these cases. First, hypocoristics formed by right-edge truncation (4a) retract stress to the initial syllable as the base is minimized to a trochaic foot (Thornton 1995, Marotta 1999). They contrast with left-edge truncations (4b), which preserve the stressed syllable and remain faithful to the open vs. closed quality of the vowel in the base. A few isolated cases such as *Elisabétta* -> *Bétta* exhibit the same close -> open shift under “restressing” seen in (3b).

(4) a. hypocoristics with right-edge truncation

<i>Eleonòra</i>	'Ele [ɛ]
<i>Edoàrdo</i>	'Edo [ɛ]
<i>Enrìco</i>	'Erri [ɛ]

Cecilia	Cèci
Cloilde	Clòti
Federica	Féde
Lorenza	Lòre
Roberto	Ròbe
Stefania	Stèfi
Teresa	Tère
Tommàso	Tòmmi

b. hypocoristics with left-edge truncation

Salvatore	Tóre
Francesca	Césca
Nicola	Còla
Elisabetta	Bètta
Filomena	Mèna
Eleonora	Nòra
Maddalena	Lèna
Lorenzo	Rènzo
Antonio	Tòto
Guglielmo	Mèmo
Giuseppe	Pèppe

The data in (5a) illustrate some *accrociamenti* formed by truncation on the right edge, while (5b) are selected acronyms where the stressed vowel corresponds to an unstressed mid vowel in the base. Here as well open vowels regularly occur.²

(5) a. right-edge truncations

fotogràfia	fòto	‘photograph’
metèora	mèteo	‘weather bulletin’
televisione	‘tele/’tele	‘television’ (Sabatini-Coletti)

b. acronyms

BOT	[bɔt]	Buono ordinario del Tesoro
CED	[tʃɛd]	Comunità Europea di Difesa
CERN	[tʃɛrn] DPI	Consiglio Europeo per le Ricerche Nucleari
COMIT	[ˈkɔmit]	Commerciale Italiana
CONI	[ˈkɔni]	Comitato Olimpico Nazionale Italiano
D.O.C.	[dɔk]	Denominazione di Origine Controlata
GEPI	[ˈdʒɛpi]	Gestione Editoriale Periodici italiani
ONU	[ˈɔnu]	Organizzazione delle Nazioni Unite

² Another possible locus of stress shift is the phrasal retraction from oxytones under stress clash discussed by Nespor and Vogel (1986:174) in examples like *metá tórta* -> *méta tórta*. Several native speakers we have polled do not detect a change of vowel quality in this context. This could indicate that the preference for stressed open vowels is a word-level phenomenon. Alternatively, such rhythmic shifts may not be associated with a change in vowel duration--the factor that we believe underlies the change in vowel quality. See section 5.

3. The Preference for Open Mid Vowels 2: Statistics

The lexical contrast between open and closed mid vowels is well entrenched in the basic inventory of nominal, verbal, and adjectival roots. But even here the preference for open stressed vowels is manifested statistically. In the inflection of the verb stress regularly alternates between the stem and the desinence in the present tense. In (6a) we show our counts of the distribution of the open vs. closed contrast as a function of stress type (proparoxytone vs. paroxytone) for underived, disyllabic bases in the Delmonte (1999) corpus of the 32,000 most frequent words in Italian. The data reveal a strong bias for open vowels in proparoxytones such as *meritàre*, *mèrito* 'to deserve' and *oneràre*, *ònero* 'to burden' while a much weaker preference appears in paroxytones.

(6) disyllabic underived verb bases

a. proparoxytones

CéCVC	11	CóCVC	17	(chi sq = 28.74	p < 0.001)
CèCVC	37	CòCVC	48		

b. paroxytones

CVCéC	23	CVCóC	20	(chi sq = 2.22	p > 0.05)
CVCèC	34	CVCòC	24		

These results mirror in part the findings of Krámský (1964), who reports the counts in (7) for open-syllable proparoxytones and paroxytones for all word types (nouns, adjectives, verbs) based on a corpus of 8,804 words drawn from the dictionaries of Locella (1918) and Stoppani (1937).

(7)		<u>é</u>	<u>è</u>	<u>ó</u>	<u>ò</u>
	bàbaba	14	85	14	71
	babàba	174	123	214	86

These data evidence a strong correlation between stress type (proparoxytone/paroxytone) and mid-vowel realization (open/closed). The preference for closed mid vowels in paroxytones reflects in part the regular development of original Latin long vowels, which are stress attracting and realized as closed in Late Latin/Early Italian. When this factor is controlled for, it appears that there is a statistical bias in favor of open vowels in stressed syllables--at least in proparoxytones.

The data in (8) show our hand counts of the monosyllabic C_0VC_0 underived mid-vowel verbal stems in first conjugation *-are* verbs from Alinei (1962). Some interesting asymmetries between front and back vowels emerge here. First, back vowels are more frequent overall. Second, their distribution correlates well with the nature of the following consonant cluster: the open ɔ favors an open syllable context C_0VC- while closed o favors a closed syllable context C_0VCC- . The ɔ also predominates before geminate consonants or a cluster that terminates in a jod. The front mid vowels are fewer in number and their distribution is more evenly balanced across these various contexts.

(8)	<u>e</u>	<u>ɛ</u>	<u>o</u>	<u>ɔ</u>
closed syllable	11	19	43	21
open syllable	21	24	20	47
geminate	13	13	11	26
C plus jod	10	8	10	28

This front-back asymmetry mirrors another one in Italian phonology. Bertinetto and Loporcaro (2005: 137) state that the open-closed contrast is neutralized in favor of $[\text{ɔ}]$ in

word-final position: «final stressed /o/ only occurs in the pronunciation of foreign names such as Bordeaux». They note that the corresponding loanword has been adapted as *bordò* with an open vowel.

Scholars have noted other contexts in which open vowels are preponderant. For example, Turchi (n.d.) finds that *esC* and *osC* sequences favor open vowels by a factor of 3 to 1, extending the same observation made earlier by Marotta (1995) for word-initial position.

4. The Preference for Open Mid Vowels 3: Loanwords

Another situation in which the Italian speaker is presented with a choice between the open vs. closed realization of mid vowels occurs in loanword adaptation. Here as well open vowels are systematically selected—often overriding faithfulness to a closed pronunciation in the source language. The loans can be divided into several categories. First are the so-called *voci dotte* (loans from Latin). A few examples appear in (9). They contrast with the directly inherited words from Latin such as *téla* < *tēlam* 'cloth' and *sóle* < *sōlem* 'sun', where the long mid vowels *ē,ō* appear as closed.

(9) voci dotte (Franceschi 1965)

<u>Italian</u>	<u>Latin</u>	<u>Italian</u>	<u>Latin</u>
e'stremo	extrēmum	'mɔto	mōtum
cru'dele	crudēlum	'nɔto	nōtum
'rɛgola	rēgulam	de'vɔto	devōtum

Second are loans from more recent periods. They can be divided into a number of subcategories in terms of the source language as well as the degree of integration into the native grammar. In (10) we sample recent loans from a variety of sources. They typically lack any native Italian morphology and often reflect phonetic properties of the donor language that are not apparent from the spelling of the source word and hence presuppose oral transmission or at least familiarity with the pronunciation of the source word and hence some degree of bilingualism. Nevertheless, even for this outermost stratum of the lexicon, stressed mid vowels are generally realized with open vowels in Italian--even if this is at variance with the source language. Unless otherwise indicated, data are taken from Canepàri (1999), de Mauro (1997), as well as Sabatini-Coletti (2006).

(10)	a.	doberman	'dɔberman
		drone	drɔn
		Edison	'ɛdizon
		bébé (French)	be'be
		kimono	ki'mɔno
		Toyota	To'yɔta
		Logan	'Lɔgan
		Las Vegas	Las 'Vɛgas
		babysitter	ˌbeby'sitter (Canepàri 1999)

b. American Italian (Repetti 2006)

dago	[di'gɔ]
crazy	['kresi]

window [win'dɔ]

lazy ['lɛzi]

c. foreign sigle (mostly English)

MOMA ['mɔmə] Museum of Modern Art

OPEC ['ɔpek] Organization of Petroleum Exporting
Countries

COBOL ['kɔbɔl] Common Business Oriented Language

COMECON ['kɔmekɔn] Council for Mutual Economic Aid

ECU ['ɛku] European Currency Unit

IVECO ['i'veko] Industrial vehicles company

SECAM ['sekam] Séquentiel Couleur à Memoire

TESOL ['tezɔl] Teaching of English to Speakers of Other
Languages

As seen in (11), there are often doublets with variable stress: the open vs. closed realization of the mid vowels tracks the stressed vs. unstressed variation.

- (11) teflon 'teflɔn; te'flɔn (Canepàri 1999)
Reebok 'ribɔk; ri'bɔk
robot ro'bɔt; 'rɔbɔt
rodeo ro'dɛɔ; 'rɔdeɔ
roast beef 'rɔzbif; roz'bif
Fidel Castro fi'dɛl; 'fidel

We also find occasional exceptions in which a closed adaptation occurs. They typically have another mid vowel in the adjacent syllable and seem to exhibit a height harmony in which the expected open variant is rejected in favor of agreement with the closed vowel of the adjacent syllable. Such harmony is more systematic in Catalan loanword adaptation, which otherwise parallels Italian in favoring the open adaptation for stressed syllables (Cabr  2009, Mascar  2008).

(12)	blazer	bl�zer	De Mauro (1997)
	sudoku	sod�ku	
	col�n	col�n	Sp. Monetary unit of Costa Rica and El Salvador
	cholo	ch�lo	region of Mexico (cf. ch�l language and people)

The recent loanword literature has documented a number of cases where a word's faithfulness to the source is diminished as it is accommodated to the morphology of the native L1 grammar (e.g. Jurec 2010b). The data in (13) contain words drawn from the appendix to de Mauro (1997) where a loan has acquired Italian inflection. In the vast majority of cases the open vowels of the external adaptation have been retained. The only systematic exception are loans terminating in [one] which have taken on the closed vowel of the native Italian suffix *- ne*. The dates in (13) indicate the initial citation of the word.

(13) nativized loans (de Mauro 1997)

bancon�ta	1849
arm�nica	1769
c�todo	1875

clóne	1934	(suffix -óne)
dróne	1987	(Sabatini-Coletti)
ióne	1875	
isòtopo	1905	
naftòlo	1875	
placèbo	1958	[pla'tʃɛbo]
robòtica	1964	
telèfono	1878	comp. di tele- e -fono su base fr. téléphone

Summarizing the results of sections 2, 3 and 4, we find that when a word is derived by affixation or by truncation and a stress must be positioned on a formerly unstressed syllable of the base containing a mid vowel, an open ε and \circ are regularly chosen in preference to closed e and o . Occasionally, even when the vowel of the derivative retains the stress of the base, an open mid vowel may emerge³. In addition, while the open-closed contrast is well entrenched in the basic stems, there is a statistical preference for open stressed vowels, especially in proparoxytones. Finally, mid vowels in loanwords are systematically adapted as open even if this entails unfaithfulness to the source language.

5. Analysis

The preference for open vowels in stressed position can be subsumed under a more general markedness hierarchy that optimizes vowels for their capacity to bear stress in terms of

³ Alternations like *coróna* \approx *corònide* are reminiscent of the "restressing" alternations like *króm* \approx *króm-ik* in Catalan discovered by Mascaró (1978, 2003) where the prestressing associated with the derivational suffix suffices to create a "derived" environment that releases the vowel from the grasp of faithfulness to the underlying base.

their sonority (relative “power”). Starting with Kenstowicz (1997), the generative literature has documented a number of cases where stress seeks out a more sonorous vowel within some window (de Lacy 2004, 2006; Crowhurst & Levy 2005). This phenomenon was formalized in Kenstowicz (1997), following Prince & Smolensky (1993), in terms of a fixed ranking on a phonetic sonority scale, evaluating candidates in an OT grammar from worst to best. For the case at hand, the hierarchy in (14a) is relevant for stressed position and the one in (14b) for unstressed position, where the breve mark indicates an unstressed vowel.

- (14) a. $\ast\{i, \acute{u}\} \gg \ast\{e, \acute{o}\} \gg \ast\{e, \acute{ɔ}\} \gg \ast\{a\}$
 b. $\ast\{\breve{a}\} \gg \ast\{\breve{e}, \breve{ɔ}\} \gg \ast\{\breve{e}, \breve{o}\} \gg \ast\{\breve{i}, \breve{u}\}$

In Italian, instead of stress displacing from its normal position to a more sonorous vowel (though recall the predominance of open vowels in proparoxytones), the stress is held constant while the vowel quality is altered to better accommodate to the hierarchy in (14). Other instances of this phenomenon have been observed. Crosswhite (1998) points to the allophonic lowering of stressed high vowels in closed syllables in Chamorro and Pearce (2006) finds that /e, o, ə/ lower (and lengthen) to [ɛ, ɔ, a] in Kera stressed/high-tone syllables.

In the light of these findings we propose the following analysis for the *rafforzamento* of mid vowels in Italian. First, the metrical stress constraints that impose a quantity-sensitive trochaic foot within the three-syllable window at the right edge of the word above rank above the markedness constraints that optimize stress and sonority. This ranking ensures that stress will not shift to a more sonorous vowel. Second, we assume that the contrast

between closed and open mid vowels is a function of a feature [open], abstracting away from the question of whether the primary articulatory correlate of this feature is pharyngeal width (cf. [ATR]) or tongue-body position (Clements 1991). The closed vowels *e* and *o* are [-open] while *ɛ* and *ɔ* are [+open]. The shift of stress onto an unstressed vowel of the base in derivational morphology such as seen in *nùmero* ≈ *numèrico* or *Terèsa* ≈ *Tère* will require a [+open] specification to be supplied by the constraints optimizing sonority and stress. Third, we accept de Lacy's (2004) reformulation of the sonority hierarchy for vowels as a stringency relation among constraints that themselves can be freely ranked, as in (15). This alternative has the advantage of allowing conflation of the scales to permit only certain subparts of the hierarchy to optimize stress and vowel sonority, as in Italian.

(15) *{i,ú}, *{i,ú, é,ó}, *{i,ú,é,ó,é,ó}

In the case of Italian, the *{i,ú,é,ó} constraint is in play. Faithfulness to the degree-1 sonority high vowels *i* and *u* will block any sonority augmentation for them (16).

(16)

/CiC/	Faith-{i,u}	*{i,ú}	*{i,ú, é,ó}	*{i,ú,é,ó,é,ó}
☞ CíC		*	*	*
CéC	*!		*	*
CéC	*!			*

But as seen in (17), some faithfulness constraint is needed to prevent a closed mid vowel from being fully optimized to [á]. As de Lacy (2006) notes, stringency constraints do not

permit incremental decreases in markedness. Once faithfulness is breached, full optimization is predicted.

(17)

/CeC/	*{í,ú,é,ó}	Faith-{i,u,e,o}	*{í,ú,é,ó,é,ó}
CéC	*!		*
CéC		*	*!
☞ CáC		*	

In order to solve this problem it seems legitimate to allow a vowel to be referred to in two different ways in the phonology—by its degree of sonority or by the features [high], [low] and [back] that describe its placement with respect to other vowels in the overall vowel space. These correlate with different phonetic dimensions: duration-intensity vs. color-timbre (F1, F2). Given these two alternative way's of identifying a vowel, we can block full optimization to [á] by ranking faithfulness to the feature [low] above the markedness constraint *{í,ú,é,ó,é,ó} that disfavors stressed open vowels. As shown in (18), a closed mid vowel is lowered by just one step.

(18)

/CeC/	*{í,ú,é,ó}	Faith-{i,u,e,o}	Faith-[low]	*{í,ú,é,ó,é,ó}
CéC	*!			*
☞ CéC		*		*
CáC		*	*!	

The rankings in (19) summarize the crucial ingredients of the analysis.

- (19) Stress » *{í,ú,é,ó} (prevents stress drifting from its expected position)
 *{í,ú,é,ó} » Faith-{i,u,e,o} (degree-1,2 sonority vowels may increase their sonority)
 Faith-{i,u} » *{í,ú,é,ó} (protects degree-1 sonority vowels)

Faith-[low] » *{í,ú,é,ó,é,ó} (blocks change of input degree-1,2,3 sonority vowels to a)

We now turn briefly to the derived contexts where stress is not shifted to see how the open vs. closed contrast plays out. The data from (3) suggest that two subcases can be distinguished. First are examples like *Platón-e*, *Platòn-ic-o* where the opening of the mid vowel occurs under Mascaró's "restressing." They appear to contrast with cases of zero-derivation such as *volàre*, *vól-a*, *vól-o* where the closed vowel is retained under stress. Assuming that this difference is a real one, it suggests that the presence of an overt derivational suffix is needed to create the "derived" context that releases the closed vowel from the grasp of faithfulness to the base form. One possible interpretation of the phenomenon is to take seriously the idea that stress reflects a metrical grouping in Italian. Then *Platón-e*, *Platòn-ic-o* involves reparsing the trochaic foot by extending its right edge: Pla(to)ne -> Pla(toni)co. If faithfulness to [open] under stress is formulated in terms of metrical constituency then *Pla(to)ne* -> *Pla(toni)co* and *(vo)l-a* -> *(vo)l-o* differ in the appropriate way.⁴ We thus posit the faithfulness constraint in (20) that dominates *{í,ú,é,ó} in the context of identity for metrical structure.

(20) Id-[open]-V): penalize a stressed vowel that differs from its base with respect to the feature [open] when it forms the right (and left) edge of a metrical foot.

⁴ Another possible interpretation of the contrast between (3a) and (3b) would look to the phonetics. It is well known that Italian stressed vowels are longest in (open-syllable) penults. It is conceivable that the faithfulness holding the zero-derivation forms in check is defined over the phonetically longest, most salient position. See Giavazzi (2010) for recent discussion of another phonological process of Italian phonology where questions of phonetic salience play a crucial role.

The tableau in (21) shows how the contrast between (3a) and (3b) is treated. The faithfulness constraint (20) on [open] in stressed vowels that form a foot by themselves penalizes a change in vowel sonority in *vólo*. The open vowel candidate is thus eliminated before the markedness constraint optimizing sonority can intervene. But in *Platònico* the stressed syllable is not at the right edge of the foot and so the constraint (20) draws no distinction between the open and closed vowels leaving it up to the lower-ranked markedness constraint to promote the open vowel.

(21)

/vó)l-o/	Id-[open]-V)	*{í,ú,é,ó}
☞ (vó)l-o		*
(vó)l-o	*!	
/pla(tón-ic-o/		
pla(tón-i)c-o		*!
☞ pla(tón-i)c-o		

The shift from close to open vowels in *Platón-e*, *Platòn-ic-o* bears an uncanny resemblance to the trochaic shortening found in English pairs like *se'rēne*, *se'rēnity* and *'cōne*, *'cōnic*, leading one to wonder whether the process does not go back to Late Latin. The shortening of Latin *ō, *ē would yield a closed-open alternation in Italian by the regular sound correspondences. Following up this conjecture must be left as a task for future research.

6. Portuguese and Catalan

The other Romance languages that have retained the Vulgar Latin seven-vowel system in stressed syllables include Portuguese and Catalan. Like Italian, they also show preferences

p[ɔ̃]rcos	m[ɔ̃]rtos	masc. pl.
p[ɔ̃]rca	m[ɔ̃]rta	fem. sg.
p[ɔ̃]rcas	m[ɔ̃]rtas	fem. pl.
‘pig’	‘dead person’	

In contrast to Portuguese, Catalan seems to be more conservative, preserving the open vs. closed contrast in a larger number of contexts, parallel to Italian. It also seems to have a larger number of examples than Italian that bring out the same generalizations. Our discussion relies on Mascaró (2003) and Cabre (2009).

First, Catalan exhibits the preference for open mid vowels when stress is shifted onto an unstressed vowel of the base in the presence of a derivational suffix. These include native words where the underlying mid vowel has been reduced (23a) as well as loans where an unstressed mid vowel has been retained in the base form (23b). Second, it exhibits the derived-environment effect where stressed closed vowels of the base are opened when appearing before a derivational suffix that restresses the same vowel of the base (23c). But zero affixation does not seem to lead to this effect—even when the stress is shifted from proparoxytone to paroxytone in the denominal verbal inflection (23d). Finally, citing Fabra (1912:459-60), Mascaró (2003: 119) remarks that «marked stressed words (proparoxytones and paroxytone stems) tend to show low mid vowels».

- (23) a. apóst[u]l ‘apostle’ apost[ɔ̃]l-ic ‘apostolic’
 áng[ə]l ‘angel’ ang[é]l-ic ‘angelic’
- b. kánon ‘canon’ kən[ɔ̃]n-ic ‘canonical’

	tótem	‘totem’	tut[é]m-ic	‘totemic’
c.	cr[ó]m	‘crome’	cr[ó]m-ic	‘chromic’
	Hom[é]r	‘Homer’	hom[é]r-ic	‘Homeric’
	Falc[ó] <n>	‘falcon’	falc[ó]n-ids	‘Falconidae’
	ib[é]r	‘Iberian’	Ib[é]r-ia	‘Iberia’
	carb[ó] <n>	‘carbon’	carb[ó]-i	‘carbon’
	mod[é]st	‘modest’	mod[é]st-i-a	‘modesty’
d.	número	‘number’	num[é]ra	‘to number’
	áncora	‘anchor’	anc[ó]ra	‘to anchor’

As far as loanword adaptation is concerned, Cabré (2009) observes that stressed mid vowels tend to be adapted with open vowels (24a). However, this correspondence is rather systematically overridden by harmony to an unreduced mid vowel in an adjacent (especially following) syllable (24b). We saw scattered instances of this phenomenon in Italian (12); it seems to be more general and regular in Catalan.

(24)	a.	V[é]nus	‘Venus’
		T[é]xas	‘Texas’
		[ó]NU	‘United Nations’
		vox p[ó]puli	‘voice of the people’
		Z[é]us	‘Zeus’
		t[ó]fu	‘tofu’

b.	B[ó]ston	‘Boston’
	p[é]sto	‘pesto sauce’
	[ó]pel	‘Opel’
	Ir[é]ne	‘Irene’

7. Phonetic Underpinning

A key assumption of the sonority-based analysis proposed above is that the open vs. closed contrast can be characterized as some measure of the power or strength of the vowel and that this relative sonority synergizes or integrates with stress to enhance the prominence of the accented syllable. It is well known that duration is one of the major correlates of stress in Italian (Bertinetto 1981). Since Lehiste (1971) it is also known that the inherent duration of vowels tracks vowel height in many languages. Is this true for Italian? In an effort to answer this question we conducted a small experiment collecting duration and intensity measures from one male (from Pavia) and one female (from Milan) Italian speaker pronouncing a set of disyllabic *'sVta* and trisyllabic *se'tVfo* nonsense words under laboratory conditions. Each set was repeated five times to give ten observations per vowel. The charts in (25) depict the pooled results for each speaker. We see that on both phonetic dimensions there is a good correspondence between relative vowel height and sonority. In particular on both counts the open mid vowels are stronger than the closed mid vowels. Thus, the phonological strengthening (*rafforzamento*) of *é,ó* -> *é,ó* and the weakening (*riduzione*) of *ě,ǔ* -> *ě,ǔ* can be said to have phonetic motivation.

(25) see appendix

Our discussion has also assumed that the unstressed mid vowels are better identified with the stressed closed vowels than with the stressed open vowels and hence that the preference for [é,ó] over [é,ó] is a matter of markedness rather than faithfulness. But how well founded is this assumption? First, we have the strong intuition of the Italian native speaker, as reflected in both the literature (e.g. Maiden (1996), Sabatini-Coletti (2006), Bertinetto & Loporcaro 2005, to name a few) as well as in the judgments of the native speakers we have polled. This intuition is corroborated by the relative location of stressed and unstressed vowels in F1/F2 space. Below in (26) we show plots of the Italian vowels derived from the data reported in the studies of Ferrero et al. (1978) and Albano Leoni et al. (1995). The reported average formant values for each vowel were converted into Barks. The Ferrero study is based on a corpus of ten disyllabic words elicited from ten Florentine speakers under laboratory conditions while the Albano Leoni study draws on a corpus of television newscasts of five male speakers from the Lazio region. Although the data were collected by quite different means, the overall spacing of the vowels is remarkably similar.⁶ In both cases the unstressed mid vowels are much nearer to the stressed closed than to the stressed open vowels, especially for the first formant, which tracks vowel height. We conclude that the choice of open vowels under stress shift reviewed in this paper is thus not due to faithfulness but rather to markedness.

(26) see appendix

⁶ These experimental studies also report duration measures that indicate a good correspondence between vowel height (F1) and duration in stressed syllables. The differences are largely cancelled in unstressed syllables.

A final assumption that we have made, again in line with the literature on Italian phonology, is that there is no contrast between open and closed mid vowels in unstressed position. This point was confirmed by Baroni (1996) who reports an experiment eliciting paired nonsense names of the form *tVti* and the corresponding diminutive *tV't-ina* from four Italian native speakers. The list was repeated seven times to give multiple observations per vowel. Baroni found "almost perfect overlap between /E,O/ deriving from /E,O/ and /E,O/ deriving from /e,o/, and non-alternating /E,O/."

The analysis proposed in section 5 has assumed that optimizing for sonority underlies the preference for open mid vowels in Italian. But another motivation is worth considering. Examination of the charts in (27) showing how the seven stressed vowels are distributed in F1/F2 vowel space reveals that the closed mid vowels are very near to the high vowels while the open mid vowels are relatively well separated from the single low vowel. The exact differences in barks are indicated in (27b). They were computed by converting the reported average F1 values for each vowel in Hz to Barks and then taking the differences.

(27) a. see appendix

b. F1 distance scores in Bark

Ferrero et al.

i vs. e	.6	u vs. o	.69
a vs. ε	2.27	a vs. ɔ	1.76

Albano Leoni et al.

i vs. e	1.08	u vs. o	.98
a vs. ε	1.88	a vs. ɔ	1.46

Thus, an additional (or alternative) interpretation of the preference for open over closed mid vowels in stressed position is that it reflects the selection of a better contrast.

Flemming (2004) has argued that the relative dispersion of Italian vowels in F1/F2 space is an important factor in the loss of the open/closed contrast in unstressed syllables. The information in (27) suggests that dispersion may underlie the neutralization of the contrast in stressed position as well. This line of reasoning implies that when faced with a similar choice but a different spacing with respect to neighboring vowels, closed vowels could be a more optimal choice.

8. Slovene

The data on Slovenian loanwords reported in Jurgec (2010a) become interesting in this regard. According to Jurgec, mid vowels are adapted as closed (overriding faithfulness) rather than open in Slovene; he cites the loanwords in (28).

(28)	'flash'	fleʃ	'ecstasy'	'ekstazi
	'rock'	rok	'podcast'	'potkast

The Slovene vowel inventory is depicted in (29a). It shows the same V shaped system of contrasts as Italian but supplemented with a mid central vowel. In (29b) we indicate the relative positioning of the vowels on the bark scale based on the formant measures reported in Jurgec (2006). While there is virtually no difference between open vs. closed vowels with respect to their low vs. high vowel neighbors in the F1 dimension (29c), the

closed vowels are much better separated in F2 from the central schwa vowel than the open vowels are (29d).

(29) a. Standard Slovene Vowels (Jurgec 2006)

i	u	i	u	i	u
e	o	e	o	e	ə o
	ə		a		a
ɛ	ɔ				
	a				
<u>stressed long</u>		<u>stressed short</u>		<u>unstressed</u>	

b. Jurgec (2006)

see appendix

c. F1 difference in barks

i vs. e	1.06	u vs. o	.99
a vs. ɛ	1.01	a vs. ɔ	1.0

d. F2 differences in barks

ə vs. e	3.3	ə vs. o	3.16
ə vs. ɛ	2.0	ə vs. ɔ	2.01

Hence, on dispersion grounds the closed {e,o} would be a better choice than open {ɛ,ɔ}.

Moreover, to judge from the data reported in Petek et al. (1996), there is no straightforward correlation between vowel height and vowel duration in Slovene, making sonority a poor basis for choosing between {e,o} vs. {ɛ,ɔ} in any case.

9. Summary and Conclusions

In this paper we have examined various contexts in which Italian phonology reveals a preference for open mid vowels in stressed position. First are cases in which the derivational morphology requires the stress to shift onto an unstressed mid vowel in the base and the speaker must decide between an open vs. closed realization. These include stress shifts induced by suffixation (*nùmero* -> *numérico*) as well as truncations of various sorts (*Cecìlia* -> *Cèci*, *fotogràfia* -> *fòto*, *Organizzazione delle Nazioni Unite* -> *òNU*). Second, the preference for open vowels appears in various scattered instances of “restressing” where the final syllable of the base falls under the control of a prestressing suffix such as *coróna* -> *corònide*. Third, open vowels regularly appear as the adaptation of mid vowels in loanwords. These include the *voci dotte* from Latin as well as more recent loans from Western languages such as English. In these cases the {é,ó} > {é,ó} preference overrides faithfulness to the source language even in the outermost stratum of the lexicon. Finally, the preference appears statistically in various contexts such as proparoxytone verbs, mid back vowel verbal roots in *-are*, and in the closed syllable created by an *sC* cluster.

We proposed an analysis in which the preference followed from the Universal Grammar constraint that aligns stressed syllables with the sonority hierarchy. In Italian instead of stress being attracted to a more sonorous vowel, the sonority of a vowel is altered in the presence (or absence) of stress, with closed vowels changing to open in the former situation and open vowels changing to closed in the latter. An analysis employing de Lacy’s (2004) stringency constraints was proposed. In order to block optimization to the most sonorous vowel [a], a faithfulness constraint based on the feature [low] was employed. We then noted parallels to the Italian open > closed preference in Brazilian

Portuguese and Catalan. The next section of the paper explored the phonetic motivation for the open mid vowel preference. It was shown that duration and intensity (key correlates of stress in Italian) align well with vowel height. Data from two different studies of the location of stressed and unstressed vowels in F1/F2 vowel space show that unstressed mid vowels are much closer to {é,ó} than to {é,ó} and hence the preference for open mid vowels in stressed position is a matter of markedness rather than faithfulness. The data also reveal that the open {é,ó} are more separated from {a} than the closed {é,ó} are from {i,u} and hence the overall dispersion of vowels could be an additional motivation for the {é,ó} > {é,ó} preference. The paper closed with data from Slovene where mid vowels are adapted as closed rather than as open. Recent studies of the contemporary standard language suggest that stress is not phonetically correlated with duration and duration is not correlated with vowel height. Consequently, there is no motivation for following the Italian adaptation strategy. Rather, the choice of closed mid vowels may be motivated by dispersion in the vowel space.

The contrasting loanword adaptation strategies of Italian and Slovene suggest that the phonetic correlates of such phonological categories as open vs. closed vowels as well as stress may play a crucial role in determining how a sound is incorporated into the native system of grammar. More generally, they point to the closer integration of phonology and phonetics in trying to reach a deeper understanding of phonological behavior.

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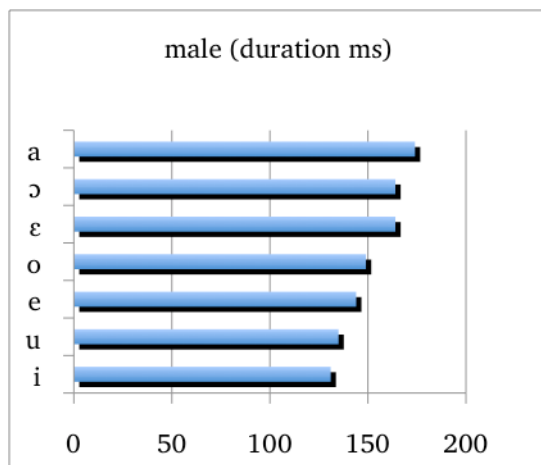
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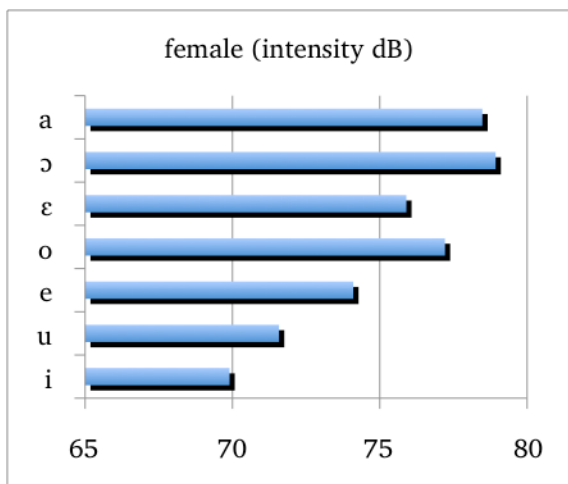
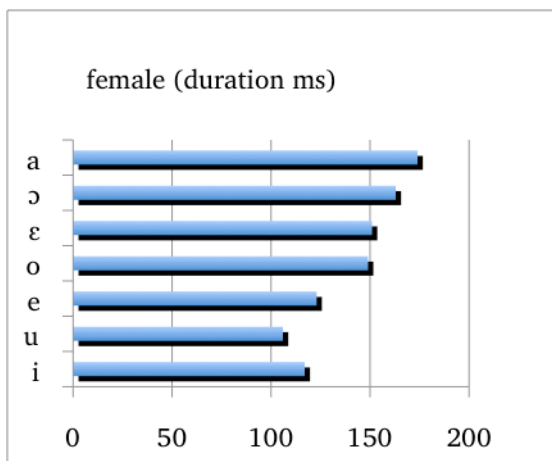
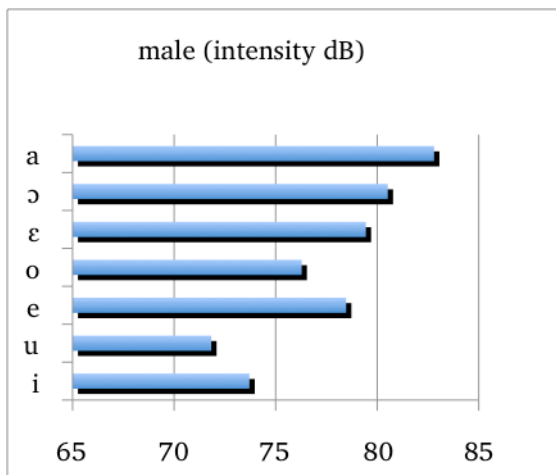
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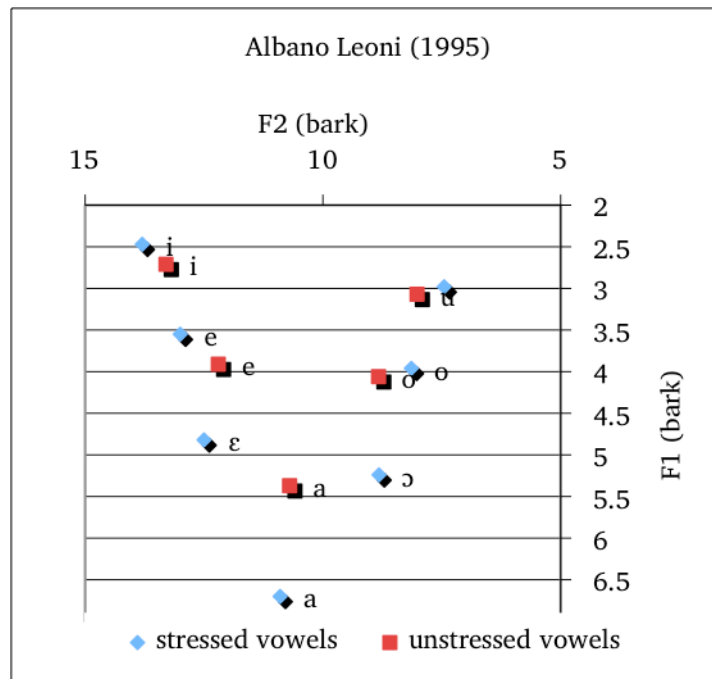
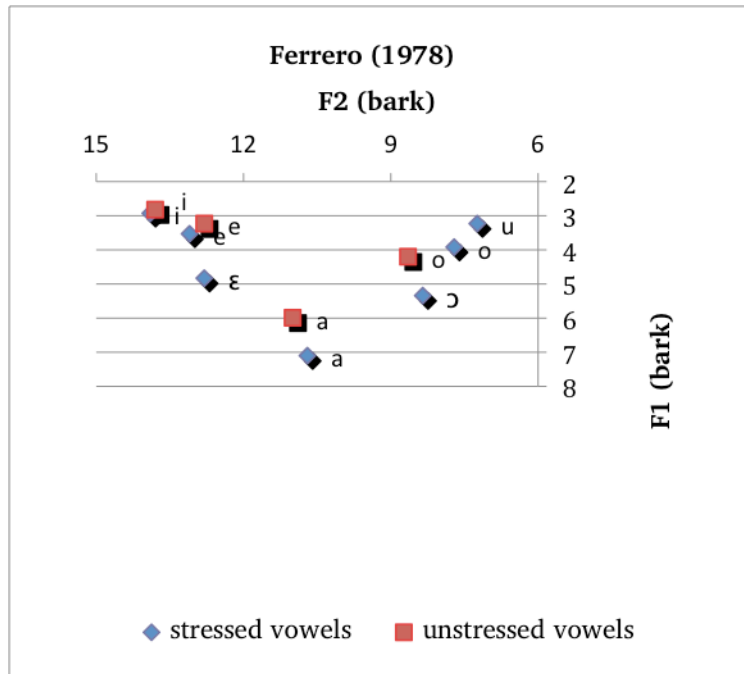
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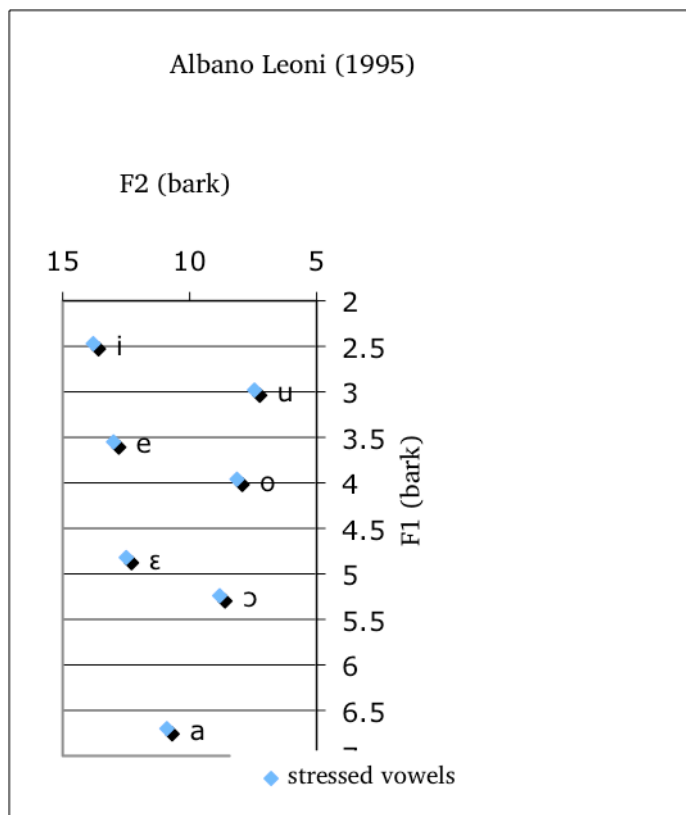
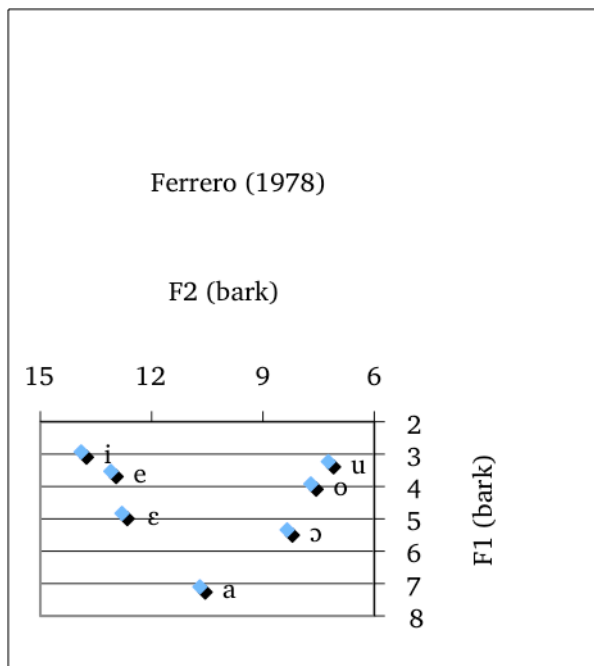




(26)



(27a)



(29b)

