A chain shift paradox for classic OT and Harmonic Serialism

In this squib I examine a paradox posed by the interacion of three processes affecting mid vowels that seem to be quite common in Italic dialects. Whereas classic Optimality Theory (Prince and Smolensky 1993/2004) can deal with one aspect of the phenomenon but is unable to handle another aspect, the reverse situation obtains in Harmonic Serialism (McCarthy 2008a, 2008b, 2010).

1 The interaction of vowel raising processes

1.1 Servigliano and Cervara

In the dialects of Servigliano and Cervara[1] we find very similar raising processes that affect mid vowels, that I shall illustrate with Servigliano first. As in many Romance varieties of Italy a seven vowel system [a, ɛ, e, i, ɔ, o, u] is subject to a process of vowel reduction that raises unstressed mid-open vowels to mid-close. In Servigliano (Camilli 1929, Mascaró 2011, Walker 2011) we find the following regular alternations:

(1) *Vowel Reduction*

ɲɛ́l-o	ɲel-á	'I cool down/to cool down'
merɛ́nn-a	merenn-ét -a	'lunch/afternoon snack'
gɔ́l-o	gol-á	'I fly/to fly'
besɔ́ŋŋ-a	besoŋŋ-á	'need (N)/need-INF'

Servigliano also has two harmony processes by which a high vowel causes raising of a preceding mid vowel. There is gradual raising of a stressed vowel, a process usually referred to as metaphony, that I will call here *Tonic Metaphony.* By another process a high stressed vowel causes raising of preceding unstressed vowels, a process I will term *Pretonic Metaphony*. As shown in the second column of (2), in Servigliano /ɛ/ and /ɔ/ become [+ATR]

[1] Most Romance languages arising from Latin in the Italic Peninsula are traditionally referred to as "dialetti", a term that I reserve here for specific subvarieties of a municipality or small area. Servigliano is spoken in this town and neighboring municipalities in the Marche in central Italy; Cervara di Roma is a small village in the Lazio, 70 km east of Rome; Grado is a town in the Friuli-Venezia Giulia, at the northen end of the Adriatic Sea, 87 km northeast of Venice.

([e] and [o], respectively), and /e/ and /o/ become high ([i] and [u], respectively); the examples in the third column illustrate again regular vowel reduction in unstressed position.

(2) *Tonic Metaphony* / __...i, u: /ɛ/→[e], /ɔ/→[o]; /e/→[i], /o/→[u]

pɛ́d-e	péd-i	pedó	'foot-SG/PL/footprint'
pɔ́r-a	pór-u	por-ét-a	'poor (prenom.)-F.SG/M.SG/(postnom.)F.SG'
mét-e	mítt-i		'he puts/you put'
fónn-a	fún-u		'deep-F.SG/M.SG'

As already indicated, harmonic raising can spread further to the left, affecting pretonic vowels. In this position underlyingly close mid vowels raise to high ([i], [u]):[2]

(3) *Pretonic Metaphony of* e, o /__...í, ú: /e/→[i], /o/→[u]

vérd-e	vird-ú	'green-SG/deep green-M.PL'
rréʃʃ-o	rriʃʃ-í	'I go out/to go out'
trént-a	trint-ín-a	'thirty/quantity about thirty'
fjór-e	fjur-í	'flower/to flower'
kommónok-o	kummunik-ímo	'I communicate/we communicate'
móʃk-e	muʃk-ítt-u	'fly-PL/small fly, midge'

But for mid-open vowels, we do not get the chain shift found in stressed position with the gradual raising /ɛ/→[e], /ɔ/→[o]. Instead, we get the fell-swoop mappings /ɛ/→[i], /ɔ/→[u], as exemplified in the second column of (4); in the first column the alternating vowel is in stressed position and shows its underlying value; the third column presents some examples with reduction of the same vowel in the absence of a metaphonic trigger.[3]

(4) *Pretonic Metaphony of* ɛ, ɔ /__...í, ú: /ɛ/→[i], /ɔ/→[u]

ʃtɛ́nn-e	ʃtinn-í	ʃtenn-nɛ́nno	'he extends/to extend/extending'
kanéʃtr-a	kaniʃtr-í	kaneʃtr-éll-a	'basket/DIM/kind of basket'

[2] As shown by kommónok-o – kummunik-ímo, and also by some examples in (4) below, raising also affects mid vowels whose [ATR] value cannot be determined because they never appear in stressed position.

[3] Notice that Pretonic Metaphony can be triggered by an underlying high vowel, as in most examples in (4), or by a stressed vowel that has become high by Tonic Metaphony, as in the last example in (4).

pɛ́rsak-a	pirsik-í		'peach tree/DIM'
besɔ́ŋŋ-a	bisuŋŋ-ímo		'need (N)/we need'
ŋenɔ́cc-o	ŋinucc-ú		'I kneel down/on one's knees'
pɔ́r-a	pur-ítt-u	por-étt-a	'poor (prenom)-F.SG/(postnom.)-M.SG/F.SG'

These three processes appear summarised in (5):

(5) a. *Vowel Reduction* /ɛ/ → [e], /ɔ/ → [o] (Unstressed Raising)

b. *Tonic Metaphony* /é / → [í], /ó / → [ú] / __ ... i, u (One-step raising)

/ɛ́ / → [é], /ɔ́ / → [ó] / __ ... i, u (One-step raising)

c. *Pretonic Metaphony* /e/ → [i], /o/ → [u] / __ ... í, ú (One-step raising)

/ɛ/ → [i], /ɔ/ → [u] / __ ... í, ú (Fell-swoop raising)

The fell-swoop raising of Servigliano is not an isolated phenomenon. The same interactions appear in the dialect of Cervara (Merlo 1922). (6), (7), and (8) illustrate Vowel Reduction, Tonic Metaphony, and Pretonic Metaphony, respectively.[4]

(6) *Vowel Reduction*

mmɛ́rda	skommerdátu	'shit/filthy'
pɛ́lle	pelleccóne	'skin/leather jacket'
pɔ́rta	portóne	'door/large door'
sɔ́re	soréʎʎo	'sister/brother'

(7) *Tonic Metaphony*

a. dɛ́nte	dénti	'tooth-SG/PL'	tɔ́kko	tókki	'touch, stroke-SG/PL'
frɛ́e	fréi	'fever-SG/PL'	ɔ́mo	ómini	'man-SG/PL'

[4] Unlike Servigliano, Cervara adjectives and those nouns that have a regular masc.-fem. pair have morphologised the metaphonic alternation. Raising is no longer triggered by a high vowel, but by the masc. gender feature; masc.sg and masc.pl nominals show raising, and fem.sg and fem. pl. nominals appear with the underlying values: bbóno, bbóni 'good-M.SG/PL', bbɔ́na, bbɔ́ne 'good-F.SG/PL'. In verbs there is what Maiden (1991: 179-187) calls *hypermetaphony*: both mid-open and mid-close vowels raise to high vowels under metaphonic conditions.

b.	paése	paítʃi	'village-SG/PL'	spósa	spúsi	'wife/husbands'
	grélle	grílli	'cricket-SG/PL'	krótʃe	krútʃi	'cross-SG/PL'

(8) *Pretonic Metaphony,* e, o[5]

récca	riccíni	arreccá	'ear/earrings/to eavesdrop'
péʃʃe	piʃʃítti		'fish-SG/DIM.PL'
tʃéʌʌo	tʃillíttu		'bird-SG/DIM.PL'
ókka	ukuntʃíʌʌu	okkóne	'mouth/mouthfull/mouthfull-DIM.'
cóo	cuíttu		'nail/DIM.'
kórpo	kurpíttu		'body/petticoat'

(9) *Pretonic Metaphony,* ɛ, ɔ[6]

finéstra	finistríʌʌo	finestrélla	'window/DIM/DIM'
fritɛ́lla	frittillíccu		'fritter/DIM'
jintʃéstra	jintʃistríllu		'lizard/DIM'
kɔ́na	kunícca	konócca	'hole, burrow / DIM/DIM'
mɔ́ttso	muttsíttu		'cigarette butt/DIM'
ntɔ́nio	ntuní		'Anthony/Tony'

1.2 Raising in Grado

The dialect of Grado differs from Servigliano and Cervara in that Tonic Metaphony raises mid-close vowels, i.e. /é/→[í], /ó/→[ú] (11a), but does not affect mid-open /ɛ́/, /ɔ́/ (11b). Vowel Reduction works as in the other two dialects (10). Data come from Ascoli (1898), Battisti (1914), Cortelazzo (1978), Rosamani (1990), and from the texts in Marin (1951,

[5] Like in Servigliano, unstressed vowels whose underlying [ATR] value cannot be determined because they never appear in stressed position also raise: frellénka – frillínku 'vulva/penis', tʃepólla – tʃipullítti 'onion/DIM.', fíkora – fikuríʌʌu 'fig/wild fig'.

[6] Stressed [ú] also causes raising: tɛ́sse – tissitúri – tessetóre 'to weave/weaver-SG/PL', tɔ́rtʃe – turtʃitúru 'wring/wringer', pɔ́rta – purtúni – portóne 'door/large door-PL/ SG'.

1964)[7]; I have eliminated some irrelevant phonetic details from the narrow transcriptions of Battisti (1914).

(10) *Vowel Reduction*

fɛ́rmi	fermá	'still-M.PL/to stop'
bɛ́li	beletísima[8]	'pretty-M.PL/very pretty-F.SG'
nɔ́vi	novitáe	'new-M.PL/novelty'
zvɔ́da	dezvodá	'empty-F.SG/to empty'

(11) *Tonic Metaphony* /é/→[í], /ó/→[ú]

a.	méto	míti	'I put/you put'
	témpo	tímpi	'time-SG/PL'
	rómpo	rúmpi	'I break/you break'
	fjór	fjúri	'flower-SG/PL'
b.	bɛ́lo	béli	'pretty-M.SG/M.PL'
	sɛ́nto	sɛ́nti	'I feel/you feel'
	nɔ́vo	nɔ́vi	'new-M.SG/new-M.PL'
	dɔ́rmo	dɔ́rmi	'I sleep/you sleep'

As expected, Pretonic Metaphony, like Tonic Metaphony raises e to i and o to u. What looks suprising at first sight is that it also affects mid-open vowels: whereas underlying tonic /ɛ/, /ɔ/ are unaffected by Tonic Metaphony, Pretonic Metaphony raises them (optionally) all the way to high [i], [u], respectively, under the same metaphonic conditions.[9] Pretonic Metaphony is

[7] For the data from Marin, since orthography does not indicate the open/close distinction in mid vowels, whenever other sources do not give relevant information I have determined this distinction through the vowel's ability to raise in stressed position: the first vowel in <grelle> has underlying /e/ because it raises in the pl. <grilli>; the first vowel in <dente> has underlying /ɛ/ because it doesn't raise to [í] in <denti>.

[8] Pretonic mid vowels do not raise in this example because Pretionic Raising is optional.

[9] Central Veneto might have the same kind of raising. Vowel reduction, metaphony, and pretonic raising work in the same way as in Grado (Walker, 2005: 922-931), but I have only one case of pretonic raising of mid-open vowel raising in Walker's sources, pɔ́rta/purtúni 'door/large door-PL'.

illustrated in (12). In (12b) the first column shows unaffected underlying /ɛ́/ or /ɔ́/; the examples of the second column show that, as already illustrated in (11b), mid-open vowels do not undergo tonic metaphony to [é], [ó]; in the examples of the third column the stress has shifted to a suffix and the pretonic vowels show the fell-swoop pretonic raising.[10]

(12) a. *Pretonic Metaphony,* e, o: /e/→[i], /o/→[u]

véla	vilíza	'sail (N)/sails (V)'
dólse	dulsí	'sweet/to sweeten'
fjór	fjurío	'flower-SG/in flower-MASC.SG'
defénde	difíndi	's/he defends/you defend'
moménto	mumínti	'moment-SG/-PL'

b. *Pretonic Metaphony,* ɛ, ɔ: /ɛ/→[i], /ɔ/→[u]

sɛ́nte	sɛ́nti	sintí	's/he feels/you feel/to feel'
		sintimínti	'feelings'
poɛ́to	poɛ́ti	puizía	'poet-SG/PL/poetry'
mɔ́rto	mɔ́ri	murí	'dead-M.PL/you die/to die'
	tɔ́ni	tunñí	'Tony/DIM'
dɔ́rme	dɔ́rmi	durmí	's/he sleeps/you sleep/to sleep'
		durmívo	'I was sleeping'
pjɔ́ve		pjuvizína	'to rain/drizzle-SG'

2. The paradox

In metaphonic contexts, Servigliano and Cervara stressed mid-open /ɛ́/, /ɔ́/ raise to [é], [ó], but unstressed /ɛ/, /ɔ/ raise to [i], [u]. In Grado stressed mid-open /ɛ́/, /ɔ́/ do not raise, but unstressed /ɛ/, /ɔ/ raise to [i], [u]. In all three dialects there is rasing of stressed mid-closed /é/, /ó/ to [í], [ú]. The question is why unstressed /ɛ/, /ɔ/ do not follow the same pattern as stressed vowels, and raise one step to [e], [o] in Servigliano and Cervara, and remain unchanged in Grado. There seems to be one good reason. All three dialects have Vowel Reduction of

[10] According to Walker (2005: 928) pretonic raising in Central Veneto "is sporadic and irregular", but this does not apply to Grado where it is optional (deskúlsi ~ diskúlsi 'barefoot-M.PL' sentíva ~ sintíva 's/he felt'), but robust.

unstressed vowels, which independently raises /ɛ/, /ɔ/ to [e], [o]. Rather than fell-swoop raising from mid-open to high what happens is a two-step process, /ɛ/, /ɔ/ raising to [e], [o] by Vowel Reduction, and subsequently to [i], [u] by a general process of Metaphonic Raising that covers both Tonic Metaphony and Pretonic Metaphony. Under a rule-based analysis we would get the derivations in (13). (13a) corresponds to the situation in Servigliano and Cervara and (13b) the situation in Grado; examples are from (2), (4), and (12), with the addition of mor-ént-e 'dying- SG'.

(13) a.	/pɔ́r-ítt-u/	/pɔ́r-u/	/pɔr-ét -a/
Vowel Reduction	por-ítt-u	——	por-étt-a
Metaphonic Raising	pur-ítt-u	pór-u	——
b.	/mɔr-í/	/mɔ́r-i/	/mor-ént-e/
Vowel Reduction	mor-í	——	mor-ént-e
Metaphonic Raising (does not affect /ɛ/, /ɔ/)	mur-í	——	——

But in a classic OT approach such a generalization is, in principle, inexpressible. Consider the Servigliano examples from (2), (4). We get vowel reduction because a constraint requiring faithfulness in stressed position, IDENT-STRESS(Vowel Features), dominates the constraint disallowing mid-open vowels, *[–low,–high,–ATR].[11] We get one-step pretonic raising by markedness constraints that force regressive assimilation, AGREE(+high,+ATR), and by the constraint conjunction IDENT(high)&IDENT(ATR) or a similar constraint which penalises the fell-swoop mappings (Kirchner 1996, Gnanadesikan 1997).[12] As the following tableau shows, we need IDENT(high)&IDENT(ATR)>>AGREE(+high,+ATR).

[11] I follow the analysis in Mascaró (2011), but the same consequences would result under analyses based on a different set of constraints, e.g. an analysis based on positional markedness using *UNSTR ɛ, ɔ (Crosswhite 2004: 219).

[12] Although stress should be introduced by GEN, I mark it already in the initial input for simplification.

(14) *One-step raising:* /pɔ́r-u/ → [pór-u] ID(hi)&ID(ATR)>>AGR(+hi,+ATR)

/pɔ́r-u/	ID(hi)&ID(ATR)	AGR(+hi,+ATR)	ID-STR(VF)	*[–lo,–hi,–ATR]
☞pór-u		1	1	
pɔ́r-u		2W	L	1W
púr-u	1W	L	2	

Hence for the one-step raisings in (2), and for the parallel cases in Cervara (7) and Grado (11), we need the ranking IDENT(hi)&IDENT(ATR)>>AGREE(+hi,+ATR). But in order to get the fell-swoop raisings in unstressed position in (4), and parallel cases in Cervara (9) and Grado (12b), we need the reverse ordering, AGREE(+high,+ATR)>>IDENT(high)&IDENT(ATR), as shown in the following tableau.[13]

(15) *Fell-swop raising:* /pɔr-ítt-u/ → [pur-ítt-u] AGR(+hi,+ATR)>>ID(hi)&ID(ATR)

/pɔr-ítt-u/	AGR(+hi,+ATR)	ID(hi)&ID(ATR)	ID-STR(VF)	*[–lo,–hi,–ATR]
☞ pur-ítt-u		1		
por-ítt-u	1W	L		
pɔr-ítt-u	2W	L		1W

Parallel OT thus leads to a ranking paradox.

Consider now how the situation is reversed in Harmonic Serialism. Notice first that the input-output constraint conjunction IDENT(high)&IDENT(ATR) makes no sense in HS: since GEN makes only "one change at a time", a minimal violation of faithfulness, no candidate will differ in both [high] and [ATR] from the input at any step. The constraint IDENT(high)& IDENT(ATR) can be dispensed with, and in the case of the fell-swoop pretonic raising the serial mapping /pɔr-ítt-u/ → por-ítt-u → [pur-ítt-u] is indeed easily obtained:

(16) a. *Fell-swop raising,* Step 1: /pɔr-ítt-u/ → por-ítt-u

/pɔ-rítt-u/	AGR(+hi,+ATR)	ID-STR(VF)	*[–lo,–hi,–ATR]
☞porítt-u	1		
pɔr-ítt-u	2W		1W

[13] We could limit IDENT(high)& IDENT(ATR) to stressed vowels, but then fell-swoop raising would remain unrelated to vowel reduction.

b. *Fell-swop raising,* Step 2: /por-ítt-u/ → pur-ítt-u

/por-ít-u/	AGR(+hi,+ATR)	ID-STR(VF)	*[–lo,–hi,–ATR]
☞pur-ítt-u			
por-ítt-u	1W		

One problem is solved, another problem arises. Now the one-step raising in stressed position becomes impossible. It does work in the case of closed vowels, as in the examples in (2), (7b), (11a), which calls for mappings like /fónn-u/ → [fúnn-u]:

(17) *One-step raising, mid-high to high* AGR(+hi,+ATR)>>ID-STR(VF)

/fónn-u/	AGR(+hi,+ATR)	ID-STR(VF)	*[–lo,–hi,–ATR]
☞fúnn-u		1	
fónn-u	1W	L	

But then for all the cases with mid-open stressed vowels raising one step to close, like [pór-u] from underlying /pɔ́r-u/, after the first mapping /pɔ́r-u/ → pór-u we will not be able to prevent a second lethal pass pór-u → *[púr-u]:

(18) *One-step raising, mid-low to mid-high* AGR(+hi,+ATR)>>ID-STR(VF)

a. Step 1: /pɔ́r-u/ → pór-u

/pɔ́r-u/	AGR(+hi,+ATR)	ID-STR(VF)	*[–lo,–hi,–ATR]
☞ pór-u	1	1	
pɔ́r-u	2W	L	1W

b. Step 2: /pór-u/ → *púr-u

/pór-u/	AGR(+hi,+ATR)	ID-STR(VF)	*[–lo,–hi,–ATR]
☞ *púr-u	W	1	
pór-u	1	L	

We are thus lead to another ranking paradox.

3. Summary, conclusion, and prospects

I have shown that the gradual raising of mid stressed vowels and the fell-swoop raising of pretonic vowels is robustly attested in Italic varieties. I have also shown that classic parallel OT faces a ranking paradox when trying to account for both one-step raising of stressed mid-

open vowels and fell-swoop raising of pretonic mid-open vowels, and Harmonic Serialism faces another paradox in the case of the one-step raising of mid-open vowels because in the first step we need an ordering to raise mid-open to mid-close, and in the second step this ordering forces us to raise to high. It is important to notice that in the case of HS we cannot make use of any constraint with the same effects as IDENT(high)&IDENT(ATR) because such a constraint should make reference to the lexical input at a non-initial step; we cannot do this without abandoning an intrinsic feature of HS altogether—unless we do it in a principled way. Although an exploration of possible remedies goes beyond the squib format, one possibility is that the impossibility of fell-swoop raising in metaphony is a result of preservation of lexical contrasts (Flemming 1996, 2004, 2006, Padgett 2003, Ní Chiosáinn and Padgett 2009, Lubowicz 2003, 2011). Whenever there is no metaphony all seven underlying vowels are preserved in stressed position and two contrasts are lost in unstressed position (/e/-/ɛ/ and /o/-/ɔ/), following a standard pattern of preservation of more contrasts in prominent positions. Under metaphonic influence more contrasts are lost, but the prominent-nonprominent asymmetry is preserved: in stressed position four contrasts are lost (19a), but underlying /í/-/ɛ́/ and /ú/-/ɔ́/ are kept distinct; in unstressed position six contrasts are lost (19b). If preservation of the /e/-/ɛ/ and /o/-/ɔ/ contrasts is the effect of a constraint, then there would be a principled reason (*underlying* contrast preservation) for this constraint to refer to lexical structure.

(19) a. Stressed vowels under metaphony

[í] /í/, /é/		[ú] /ú/, /ó/
[é] /é/, /ɛ́/		[ó] /ó/, /ɔ́/
	[á]	

b. Unstressed vowels under metaphony

[i] /í/, /é/, /ɛ/		[u] /ú/, /ó/, /ɔ́/
	[a]	

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