

Greek Vowel Harmony is No Vowel Harmony

(Or: What Greek Dialectology Can Teach Us About Word Structure)

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Warning

This is a typical workshop handout; none of the results here can be considered definitive.

1 Greek Vowel Harmony

A group of Greek dialects displays a process which is at least reminiscent of vowel harmony:

(1)	Standard Greek form	Dialect form	Dialect name
a	ónoma	ónama	'name' Silli
b	koskin-ó	koskun-ó	Silli
c	evđomáđa	ovdomája	Axo
d	é-θe-k-a	éθaka	Farasa
e	zerv-á	zavrá	Livisi

Since most of these dialects have been in a state of intensive language contact with Turkish, the idea may obviously arise that this phenomenon has been caused by this contact, hence that the vowel harmony is very similar to Turkish:

(2)		<i>nom.sg.</i>	<i>gen.sg.</i>	<i>nom.pl.</i>	<i>gen.pl.</i>
'rope'	ip	ipin	ipler	iplerin	
'girl'	kız	kızın	kızlar	kızların	
'face'	yüz	yüzün	yüzler	yüzlerin	
'stamp'	pul	pulun	pullar	pulların	
'hand'	eğ	eğın	eller	ellerin	
'stalk'	sap	sapın	saplar	sapların	

However, Revithiadou & Van Oostendorp (2004, 2005; henceforth R&vO, and to be distinguished from Revithiadou & Van Oostendorp 2006–2057) have shown that Greek VH is very different from Turkish VH. To list a few differences — I refer to the works just mentioned for full explication:

- Turkish VH runs from stems to affixes, Greek VH can go in both directions.

(3)	Standard Greek form	Dialect form	Dialect name
a.	<i>within the stem</i>		
	tésara	tésara	Farasa
	ékso	ókso	Ulaghatsh
	ónoma	ónama	Silli
	ektóte	ektéte	Axo
b.	<i>between stem-suffix</i>		
	petsét-a	petjáta	Silli
	ánem-os	ánom-os	Axo
	fílak-s-e	fílekse	Axo

- Turkish VH seems insensitive to stress, but Greek VH is sensitive to it.

(4)	Standard Greek form	Dialect form	Dialect name
a.	kerat-ás	tʃaratás	Farasa
b.	monax-ós	manaxós	Axo, Silli
	orfan-ós	arfanós	Livisi
	perpat-ó	parpató	Farasa
	aðelf-ós	áðarfós	Livisi
	elin-ik-ó	elen-ik-ó	Farasa
c.	kirek-í	kerekí	Axo
d.	alep-í	alapú	Livisi

- Turkish VH only concerns [\pm back] and (very restrictedly) [\pm round], but the Greek pattern can sometimes involve the whole pattern.

(5)	Standard Greek form	Dialect form	Dialect name
a.	ánem-os	ánomos	Axo
	ðáskal-os	ðáskol-os	Farasa
b.	ónoma	ónama	Silli
	pandeleímon-as	pandeleímanas	Silli
c.	ektóte	ektéte	Axo
	fílak-s-e	fílekse	Axo
	erxó-maste	erúmeste	Axo

(6) (Megisti)

a.	eryátis	aryátis	‘worker’, Meg, P101
b.	zavólja	zaválja	‘naughtiness’, Meg, P102
c.	velóni	volóni	‘needle’, Meg, P102
	óreksi	óroksi	‘appetite’, Meg, P102
d.	pirostjá	porostjá	‘fireside’, Meg, P102
e.	cenúrjo	tsunúrjo	‘new’, Meg, P102
f.	liturjá	luturjá	‘liturgy’, Meg, P102

R&vO also show that some of these properties are better understood with reference to (Southern) Greek dialects. Further, we assume:

- a. A harmonic span of two syllables is constructed at the end of the word and at the beginning of the word (for various implementations of the notion of harmonic span)
- b. The two spans obey different requirements:
 - The span at the end of the word is (a bit) like Turkish vowel harmony. It concerns mainly spreading from roundedness and backness. There is no spreading from stressed vowels, or such spreading is very limited in this position.
 - The span at the beginning of the word is less restricted. It copies one vowel to the other vowel, along the lines of sonority à la Karpathos and other Southern Greek dialects (e.g. Symi, Rhodes, etc.).
- c. The span at the end takes precedence over the one at the beginning in the case of possible conflict. (I will concentrate here on the final domain, since it the most VH like.)

In this talk I will discuss an issue which is hitherto unresolved in the work of R&vO: how can we fit this idea of a ‘harmonic span’ with current theories of feature spreading in OT? This appears to be a nontrivial task.

2 Theories of harmony in OT

The term ‘harmonic span’ refers explicitly to McCarthy (2004), providing the framework in which R&vO try to implement their proposal. However, on closer inspection, this is not really a viable option.

Within Autosegmental Phonology, harmony is seen as feature spreading:

(7)	Input	Output
	F	F
		/
	x x x	x x x

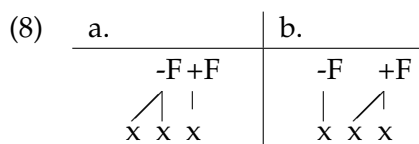
The question is why we would violate faithfulness and go from the input structure in (7) to its output structure. There have been many attempts at formulating the relevant constraint within OT; we will briefly discuss several

of them here (partly following the typology of such theories in McCarthy, 2004), and study their relevance for Greek VH.

2.1 Feature-driven markedness

One obvious idea is that the optimal output consist of fewer features, since segments do not need an independent specification can change. The segments in the output in (7) only need one feature F. Therefore the interaction of a constraint against features *F with faithfulness the desire of all segments to have a specification — the latter may be built into Gen or a constraint — will give us harmony (Beckman, 1998).

This theory crucially implies autosegmental representations, but in addition also binary feature values. The problem is, however, that it does not give us binary harmony. Consider the following two structures:



Both forms are equally (un-)economic as far as their forms are concerned: they have the same number of features, association lines, etc. Both of them would lose to a representation which spreads all over the place (like the output of (7)). A constraint against ternary spreading would be arbitrary. In autosegmental terms, the crucial distinction is between a feature being linked to one position — satisfying the classical WELL-FORMEDNESS CONDITION of Autosegmental Phonology — or being linked to two positions; the difference between 2 and 3 is irrelevant.

We conclude that feature-driven faithfulness is not the way to go.

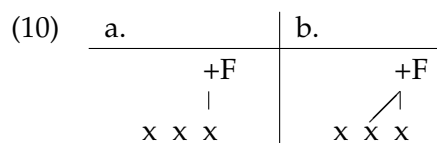
2.2 AGREE

One of the most well-known implementations of spreading in OT involves the constraint AGREE (Lombardi, 1999; Bakovic, 2000; Pulleyblank, 2004):

- (9) AGREE[±F]: Adjacent segments have the same value for [±F].

This theory does not seem directly building on autosegmental theory, in fact its formulation seems antithetical to it, and segment-based.

The problem with this is again that the constraint is designed to deal with unbounded harmony systems. The following two candidates both violate AGREE[±F], and to exactly the same degree:



There therefore is no way to derive binary spreading with this constraint. This is a particular instance of what McCarthy (2004) calls the *sour-grapes property* of AGREE-based analyses: spreading is all or nothing; even blocking by individual segments in the word cannot be derived. Feature-driven markedness shares this sour-grapes property.

We conclude that AGREE is not the constraint we need.

2.3 ALIGN

Another idea is to invoke the constraint family ALIGN (McCarthy & Prince, 1995):

- (11) ALIGN[±F](L/R, \mathcal{C}): The feature [±F] occurs at the left/right edge of morphological or phonological category \mathcal{C} .

Although this particular implementation fits very well with an autosegmental view of the world, and although it does not suffer from the sour-grapes problem, it still cannot derive binarity. There is no reason why we would stop short of the word edge if that is what ALIGN is targeting.

We conclude that ALIGN is not the constraint we need.

2.4 Positional Markedness

Yet another possible analysis is Positional Markedness, which has been proposed by Walker (2001, 2004) to play a role in vowel harmony processes in Italian dialects. These show some abstract resemblance to what we see in Greek Vowel Harmony:

- (12) *Ascrea (Lazio) Italian*
- | | | | |
|-------|----------------|-------|-----------------|
| sórda | ‘deaf-FEM.SG.’ | súrdu | ‘deaf-MASC.SG.’ |
| véfte | ‘this-FEM.SG.’ | vífti | ‘this-MASC.SG.’ |

In Ascrea, a high vowel in the suffix induces lengthening on the stressed vowel in the stem. Walker (2001) argues that the reason for this is that the marked feature [+high] is only licensed in the stressed position. For this reason she invokes a Positional Markedness constraint.

- (13) LICENSE(F, S-Pos): Feature [F] is licensed by association to strong position S.
- i. f be an occurrence of feature [F] in an output O (optional restrictions:

- (a) f is limited to a specification that is perceptually difficult,
- (b) f belongs to a prosodically weak position,
- (c) f occurs in a perceptually difficult feature combination),
- ii. s be a structural element (e.g. σ , μ , segment root) belonging to perceptually strong position S in O ,
- iii. and $s\delta f$ mean that s dominates f . Then $(\forall f) (\exists s) [s\delta f]$.

In earlier work by R&vO, it is argued that the case of Cappadocian dialects, the relevant features F are (possibly) [round] and [back]. The S -Pos would be the head of a domain-final harmonic foot:

- (14) LICENSE([round, back], HeadHarmony): Features [round, back] are licensed by association to the head of a harmonic domain.

The problem with this account, however, is that it depends on an abstract ‘harmonic’ foot, which is more or less independent from the stress foot. It is not clear how this ‘harmonic’ foot is ‘perceptually salient’, as the definition of LICENSE requires. The harmonic feature can spread over more than one position in Ascrea Italian, which seems impossible in the Greek dialects:

- (15) védoa ‘widow’ víduu ‘widower’

The problem thus is that a Positional Markedness account does not explain anything, unless it refers to an abstract bipositional harmonic foot; but if we have to posit that in any case, the need for Positional Markedness may evaporate.

We conclude that LICENSE is not the constraint we need.

2.5 Span Theory

The conclusion we can draw from the preceding overview is that we need some theory about the domains of harmony, which allows us to restrict these domains to bisyllabic units (Hulst & Weijer, 1995). The theory within OT which comes closest to this is McCarthy (2004), as we have already mentioned.

In this theory (Span Theory, ST), “the segments of a word are exhaustively parsed into spans for each distinctive feature”. Each span of the feature $[F]$ has a head segment, and it is the head segment’s value for $[F]$ that determines the pronunciation of the other segments in the span.” A number of faithfulness and markedness constraints apply to spans and to heads of spans. For instance, the following constraint ensures that harmony happens at all, i.e. that as many segments as possible are within the same span:

- (16) *A-SPAN(F): Assign one violation mark for every pair of adjacent spans of the feature $[F]$.

Various constraints can counteract to make sure that spreading is not total in cases where this is not necessary. Even though binarity is not discussed in

McCarthy (2004) at all, it would not be a big problem to integrate it with this framework; we would just need a constraint of the following type (on a par with familiar word-minimality constraints):

- (17) SPANBIN: A harmonic span has to be bisyllabic.

However, eventually also ST will not really help us formalize the properties of Greek Vowel Harmony.

In the first place, observe that ST as a matter of fact is *not* an implementation of autosegmental phonology, even if McCarthy (2004) suggests otherwise. For instance, it is not possible to formalize the idea of a floating (underlying) feature. The reason for this is that featural faithfulness (IDENT and MAX) is replaced by a constraint family of the following type:

- (18) FTHHDSF(α F): If an input segment s_i is [α F] and it has an output correspondent s_o , then s_o is the head of an α F span.

In a footnote, McCarthy (2004) suggests that the theory of faithfulness may be extended to include floating features; but this only means that autosegmentalism is not the core of his own proposal. (Similarly, it is not clear how we could represent a structure of two features linked to one segment in span theory.) But in this way the proposal becomes less compatible with other work of Revithiadou and of Van Oostendorp (individually), as well as with the body of research on input-output relations in segmental phonology.

More importantly, however, the proposal implies again a binary view of features: every segment on the surface will be part of a span, be it a [+F] or a [-F] span. This means that we get representations which look a bit like (8), except that they are not autosegmental. But now the following two observations about Greek VH become problematic:

- (19) a. The harmonic spans are found at the left and right edges of the word.
 b. The left and the right edge spans of the word pose different requirements.
 c. Every word contains at least one harmonic span.

Although McCarthy (2004) defines the notion of a harmonic span, we cannot make constraints refer to it: every word will consist of many harmonic spans — at least as many as there are autosegmental tiers in the word. How can we pick out some of these spans and make them special enough in order to refer to them? For instance, it is very tempting to see (19a) as an indication that spans should be subject to ALIGNment, for instance of the following type (we will stay ignorant as to the status of the Word category mentioned here):

- (20) ALIGN(Word, L, Span[F], L): The left edge of a word should be aligned to the left edge of a span for feature F.

However, this is very hard to do, especially for the initial span of the Greek words, where it is usually the whole vowel that is affected, as we saw in (6).

This harmony further follows a sonority scale, according to the following algorithm. Choose the most sonorous of the first two vowels of the word according to the scale in (21). That vowel is copied in its entirety to the other of the two positions:

- (21) $a > o, u > e > i$

Since the resulting structure can have many different features, reference to one specific span is not possible.

Also the last requirement, (19c), seems impossible to implement in this requirement, especially since it does not matter to this constraint whether there is a span at the left or at the right, even though they have very different requirements. It is therefore not possible to pick one out.

We conclude therefore that even ST is not the theory we need.

3 Towards a solution

We are now clearly in trouble. None of the theories on vowel harmony we discussed can deal with the Greek VH facts. I propose that the reason for this is simple. R&vO have rightly shown that Greek VH is very different from Turkish VH. However, they have made the mistake to still assume that it is VH of some sort and therefore it has to be dealt with in terms of an autosegmental/OT account of VH.

I propose we should take more seriously the thought in R&vO that Greek 'VH' really developed out of phenomena which are independently present in (Southern Greek) dialects. The pattern in (6) is very similar to things we find in e.g. Karpathos Greek:

- | | | | |
|------|---------|----------|----------|
| (22) | orfanós | arfanós | 'orphan' |
| | elafrís | alafriís | 'light' |
| | velóni | volóni | 'needle' |
| | sirópi | sorópi | 'syrup' |
| | stomúxi | stumúxi | 'muzzle' |
| | éksi | ékse | 'six' |
| | kukíði | kukúi | 'bullet' |

How can we account for this kind of copying behaviour, and the fact that it is specific for the beginning of the word? I propose that we look outside of autosegmental phonology, and to word structure.

In the first place, the Karpathos pattern of spreading complete vowels seems to be quite marked typologically, except that this behaviour is sometimes displayed by epenthetic vowels. The following example is from Winnebago (Miner (1979); Hayes (1995); Alderete (1999)) other languages with echo epenthesis include Bedouin Arabic, Hebrew, Yoruba, Wolof, Mohawk and Japanese, cf. Kawahara (2005):

- (23) šwažokjĩ šawažokjĩ ‘you mash hard’
 xrojike xorojike ‘hollow’
 hojisna hojisána ‘recently’
 hirupnĩ hirupĩ ‘twist’

A reasonable assumption about these facts is that the exceptional prosodic status of the epenthetic vowel plays a role in this behaviour. In particular, the epenthetic vowel can be seen as an empty vocalic root without any features of its own; in order to be maximally specified, it needs to borrow the features of its neighbours. This can be seen in terms of Positional Faithfulness or Positional Markedness (or Coloured Containment).

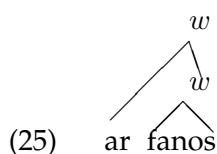
It is thus a property of weak vowels that they are potentially subject to this kind of complete assimilation. I propose that we carry over this conclusion to Southern Greek: the reason why the two vowels are complete copies of each other is because one of them is weak. Since we are dealing with an edge phenomenon, it would be sensible to say this is the first syllable.

In a number of recent papers, Myers & Hansen (2005, to appear) have shown that the edge syllables of words behave as weak and less contrastive than other syllables. Note that this conflicts with the assumptions of Positional Faithfulness as laid out in Beckman (1998), where it is usually assumed that especially the first syllable of the word is more prominent. Myers & Hansen (to appear) show, however, that in Bantu languages, for instance the length contrast is lifted on the final syllable of the word, in favour of only the short vowel. For instance, in Kinyarwanda has distinctive vowel length:

- (24) a. [gutaka] ‘to scream’
 b. [guta:ka] ‘to decorate’

But no similar contrast is found in the last syllable of the word, where only short vowels appear. Similar patterns can be found in many languages, including Lithuanian, Tagalog, Cairene and Syrian Arabic, etc. Initial shortening is also found, albeit in a smaller number of languages.

Myers & Hansen (2005, to appear) attribute this effect to a phonetic factor (utterance-final devoicing) of which I propose to take as a formal correlate: extraprosodicity, to be represented as adjunction. In other words, I propose that in Karpathos Greek, the first syllable became adjoined to the phonological word:

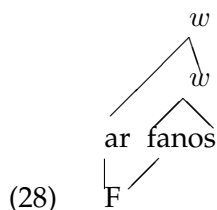


- (26) NONINITIAL: The first syllable of the morphological word should not be incorporated into the phonological word.

In van Oostendorp (2003), I show that phonological adjunction structures in Germanic are responsible for both reduction and spreading. Marked material needs to be licensed by being in a constituent. Material adjoined to X , does not really count as being dominated by X (α is dominated by β iff α is dominated by every segment of β). If stress constituents need to be dominated by ω (or by N, V, A), stress behaviour follows. If segmental material needs to be dominated by ω (or by N, V, A), unmarkedness follows. We then have constraints of the following type:

- (27) WORD(F): A phonological feature F can only occur inside a word.

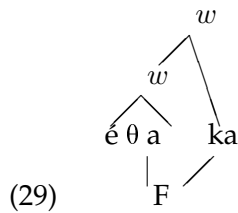
In Karpathos, the first vowel in *arfanós* is adjoined, and all the features it bears have to be shared with the vowel in the root. It does not matter whether these features are underlyingly specified on the first vowel or on the second:



F occurs inside the word, even though it *also* occurs in the adjoined position. Notice that binarity of spreading follows from these assumptions: there is no reason to spread more deeply into the word, once we have touched it, so that spreading once is enough.

The innovation of the Cappadocian (and Silly, Megisti, etc.) dialects is that they extended the possibility of an adjoined structure from the beginning of the word to its end. This final structure allows more independent features in the final domain, so that only [round] and [back] are shared.¹

¹In order to explain why these features sometimes spread from the prefinal to the final vowel, we could either assume that these features are binary and fully specified or alternatively that it is the V-Place which needs to be shared (whereas in the first domain it is some higher-order node in the feature geometry, also including the aperture features).



This analysis also nicely explains a property of the Greek facts, mentioned by R&vO:

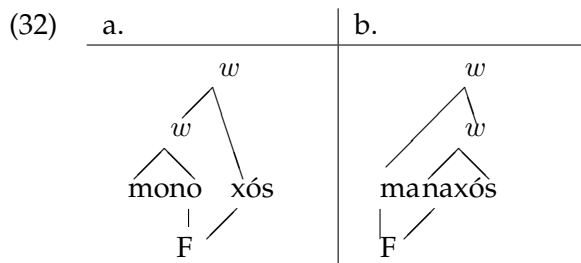
- ☞ Final stressed vowels do not trigger spreading. Although formation of a word-final spreading domain is preferred (in 2- and 3-syllable words), if the final vowel is stressed, the domain is initial.

Thus we find:

- (30) a. *ónama* rather than *ónoma*, but
 b. *manaxós* rather than *monoxós*

This can be easily explained, since like phonological features, stress will avoid the adjoined position, so that the structure in (32a) is not allowed, but the one in (32b) is.

- (31) WORD(accent): Metrical accent can only occur inside a word.



4 Preliminary conclusion

This talk represents a more radical departure from the assumption that Greek Vowel Harmony is like Turkish Vowel Harmony that R&vO; in the latter work, it is shown that the Greek facts are not like Turkish, but here I propose that it is not even vowel harmony.

In this way the properties in (32) can be described and partly explained:

- *The harmonic spans are found at the left and right edges of the word.* This follows from the restrictions on adjunction.

- *Every word contains at least one harmonic span.* This follows from the fact that words want to have adjunction both on the lefthand side and on the righthand side. (If the word is too short, only one of these can show up.)
- *The left and the right edge spans of the word pose different requirements.* This can be described by different restrictions on left and right adjunction.

Especially the latter point is not really ‘explained’ yet, but maybe it should be given a diachronic explanation rather than a synchronic one: the constraints on the left-hand side are obviously directly derived from the Southern Greek dialects, but when the conditions were relaxed so as to also include the right-hand side, the conditions here were actually more in conformity with Turkish vowel harmony. This is then the only influence Turkish had: very indirectly, by determining the conditions on adjunction in the Cappadocian word.

Several questions remain open, of course. Most importantly, we are in need in a clearer theoretical reason why we would have to have these adjoined structures at all; and further, whether there is further evidence for it (in terms of reduction, for instance).

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