

## Quasi-opacity and headed spans in Silly and Megisti Greek

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**Abstract:** A number of Greek dialects developed a phonological process very similar to Vowel Harmony (VH) due to a long period of contact with Turkish. In this paper, we focus on Silly (Asia Minor Greek) and Megisti (Southern Greek), hitherto unknown in the literature, in order to study the interaction between VH and epenthesis. This interaction poses a puzzle for surface-based accounts of phonology since it looks opaque. We propose that no extra theoretical devices – such as Comparative Markedness, Output-Output Correspondence or Sympathy – are needed to account for these phenomena, once we accept appropriate theories of phonological representations and extend the notion of CONTAINMENT (Prince & Smolensky 1993) to the phonology-morphology interaction.

### 0. Introduction

- One of the central issues of discussion within Optimality Theory over the past few years has been the proper description of opacity. Various theoretical devices have been proposed over the years, but none of them has met general acceptance.
- We argue that certain ‘opaque’ phenomena are no longer ‘opaque’ in the computational sense, given certain plausible assumptions on phonological structure and the phonology-morphology interface.
- We demonstrate this point on the basis of a new set of data from Megisti and Silly Greek. These dialects developed a pattern of *vowel harmony* (VH), presumably under the influence of extensive language contact with Turkish. In Megisti Greek, *vowel epenthesis* and *VH* seem to be in a ‘counterfeeding’ relationship.
- PROPOSAL: under a theory of the representation of vowel harmony (*headed spans*, i.e. foot-like structures) and a theory of phonology-morphology interaction (*Consistency of Exponence*, i.e. the morphological affiliation of segments is inalterable), there is no opacity. Together, these two assumptions already give us enough computational power to analyze the phenomena under investigation without invoking extra representations.

### 1. Vowel harmony in Greek

#### 1.1. VH domains

The Asia Minor dialects of Greek (henceforth AMG) as well as a few dialects of the southern zone display two vowel spreading processes that look superficially like the VH which is familiar from Turkish. There are, however, some interesting differences between Greek and Turkish VH.

- ✓ a disyllabic harmonic domain is constructed either at the beginning or at the end of the word. Consider the following examples:<sup>1</sup>

VH in word final domains

(1) *Megisti*

a.	ájir-a	águra	‘anchor’ Meg, P102 <sup>2</sup>
	sic-á	sutsá	‘fig tree’ Meg, P108
	/fím-a/	fúma	‘fame’ Meg, P102
	zíl-j-a	zúlja	‘jealousy’ Meg, P102
b.	zervá	zavrjá	‘left’ Meg, P102
	/kagrén-a/	kagrána	‘gangrene’ Meg, P105
c.	kin-ó	kunó	‘move’ Meg, P102
d.	kalójer-os	kalójoros	‘monk’ Meg, P99
e.	vraçól-i	vraséli	‘bracelet’ Meg, P102
	anófli	anéfli	‘intel’ Meg, P102

- The final vowel requires the preceding vowel to agree in backness (and roundness):



- High vowels are triggers, e.g. *vraséli* (vraçóli) (1e).
- The directionality of VH is right-to-left.

(2) *Silly*

a.	/ómixl-a/	ómurxa	‘mist’ Sil, Ko61
b.	ónoma	ónama	‘name’ Sil, Ko33
	pandeleímon-as	pandeleímanas	‘merciful’ Sil, Ko151
c.	ðeksiá	loksá	‘right side’, Sil, Ko31
d.	óksin-o	óksunu <sup>3</sup>	‘acid’ Sil, Ko31
	áxir-o	áfuru	‘straw’ Sil, Ko33
e.	ánem-os	ánumus	‘wind’ Sil, Ko31
f.	á(n)θrop-os	ártupus	‘man’ Sil, Ko33
g.	θεύ	soyú	‘god-GEN.SG’ Sil, Ko 31

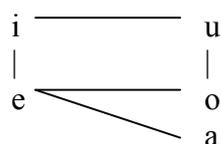
- A final vowel requires the preceding vowel to agree in backness (and roundness), e.g. *óksunu* (2b):

<sup>1</sup> The examples are organized as follows: in the left column, the underlying representation of the Standard Greek form is given. In the next column, the dialectal forms are provided together with glosses and information about the dialect and the particular source they are drawn from. When different from the standard language, the underlying representation of the dialectal form is provided within slashes /.../.

<sup>2</sup> The following written sources have been used in this paper: Kostakis (1968) for Silly; Pantelis (2002) for Megisti; Dawkins (1916), Mauroxalyvidis & Kesisoglou (1960) for Axo; Andriotis (1948) for Farasa; Andriotis (1961) for Livisi; Dawkins (1916), Kesisoglou (1951) for Ulaghatsh.

<sup>3</sup> In Silly, unstressed mid vowels raise. Some illustrative examples are given in (i):

(i)	a.	éklep-s-e	éklipsi	‘steal-3SG.PAST’ Sil, Ko30
	b.	xeliðón-i	xiliróni	‘swallow’ Sil, Ko30
	c.	évrek-s-e	évriksi	‘rain-3SG.PAST’ Sil, Ko31
	d.	á(n)θrop-os	ártupus	‘man’ Sil, Ko33



- The high front vowel /i/ is not a trigger, e.g. *forónusi* ‘put on-3PL.PRES’ Ko126, *kimískami* ‘sleep-3PL.PAST’, Ko116, /éfaɣe/ *éfayi* ‘eat-3SG.PAST’ Ko30, etc.

Note: Words ending in /u/ and unstressed /e/ are scarce.

(3) *other AMG dialects*

a.	ḏáskal-os	ḏáskolos	‘teacher’ Far, An48:20
	ánem-os	ánomos	‘unlawful’ Axo, MK9
b.	ksanástrofa	ksanástrafa	‘name’ Liv, An61:33
c.	filak-s-e	filekse	‘guard-3SG.PAST’ Ax, MK188
	/é-ḏok-en/	éḏeken	‘give-3SG.PAST’ Ul, D376
d.	tínos	túnus	‘whose’ Liv, An61:33
e.	xristú	xrustú	‘Jesus-GEN.SG’ Liv, An61 :33

- The final vowel requires the preceding vowel to agree in backness and roundness, regardless of sonority considerations, e.g. *ḏáskolos* (3a) vs. *ksanástrafa* (3b). The directionality of the process is right-to-left.
- High vowels do not participate in VH.

**VH in word initial domains**

(4) *Megisti*

a.	eryáti-s	aryátis	‘worker’ Meg, P101
	éksafna	áksafna	‘suddenly’ Meg, P101
b.	zavolj-á	zavaljá	‘naughtiness’ Meg, 102
c.	velón-i	volóni	‘needle’ Meg, P102
	óreks-i	óroksi	‘appetite’ Meg, P102
d.	pirostj-á	porostjá	‘fireside’ Meg, 102
e.	cenúrj-o	tsunúrjo	‘new’ Meg, P105
f.	liturj-á	ludurjá	‘liturgy’ Meg, P105

(5) *Silly*

a.	lekán-i	lakáni	‘basin’ Sil, Ko30
	meɣalón-a	maɣalóna	‘first toe’ Sil, Ko30
b.	monastír-i	manastíri	‘monastery’ Sil, Ko65
c.	kamiláfki-i	kamaláfki	‘orthodox priest’s hat’ Sil, Ko31
d.	xelón-a	folóna	‘turtle’ Sil, Ko31
	velón-i	volóni	‘needle’ Sil, Ko31
e.	pondik-ós	puntzukós	‘mouse’ Sil, Ko33
f.	pliyúr-i	pulyúri	‘groats’ Sil, Ko187

(6) *other AMG dialects*

a.	/meɣaríz-o/	maɣarízo	‘mess up-1SG.PRES’ Ax, MK8
	kateváz-i	kataváz	‘lower-3SG.PRES’ Ax, MK192
	sevast-í	savastí	‘name’ Ax, MK8
b.	meḥópor-o	moçóporo	‘fall’ Ax, MK9

	ékso	ókso	‘out’ Ul, D366
	embrós	ombró	‘in front’ Ax, MK216
c.	evðomáð-a	ovdomája	‘week’ Ax, MK9
	fóver-ó	fóvoró	‘frightening’ Ax, MK9
d.	miruð-já	murudjá	‘smell’ Ax, MK111
	lizmon-ó	zolmonó	‘forget-1SG.PRES’ Ax, MK9
	lustrínin	lustrúnin	‘patent leather’ Liv, An61:33
e.	pipér-i	pepér	‘pepper’ Ax, MK116

- In word initial domains, vowel-copying and NOT just spreading of features takes place.
- The process is clearly sonority-driven: the most sonorous vowel replaces the least sonorous one, regardless of whether it precedes or follows. Compare *aryátis* (4a) with *zavaljá* (4b), *kataváz* with *mayarízo* (6a), and so on.

(7) Comparison between final-domain and initial-domain VH:

DOMAINS	DIRECTIONALITY	SONORITY-DRIVEN	DESCRIPTION
...# FINAL	right-to-left	no	spreading of backness (& roundness)
#... INITIAL	bidirectional	yes	copy of vowel

## 1.2. Harmonic spans

Q: Can both harmonic spans be constructed within the word?

A: No, final HS > initial HS. KEY: the behavior of stressed vowels.

- ✓ A harmonic domain is formed at the end of the word, provided that, first, there is a harmony-triggering vowel, i.e. a vowel from the set {a, o, e, u} for AMG and {a, o, e, i, u} for Megisti, and, second, the target nor the trigger vowel is stressed:

(8)	a.	ájir-a	águra	‘anchor’ Meg, P102
		/ómixl-a/	ómurxa	‘mist’ Sil, Ko61
	b.	zervá	zavrjá	‘left’ Meg, P102
		tésara	tésara	‘four’ Far, An48:20
	c.	ónoma	ónama	‘name’ Sil, Ko33
		pandeleímon-as	pandeleímanas	‘merciful’ Sil, Ko151
	d.	kin-ó	kunó	‘move’ Meg, P102
		óksin-o	óksunu	‘acid’ Sil, Ko31
	e.	ánem-os	ánumus	‘wind’ Sil, Ko31
		ánem-os	ánomos	‘wind’ Ax, MK9
	f.	filak-s-e	filekse	‘guard-3SG.PAST’ Ax, MK188

- ✓ Otherwise, the harmonic domain is formed at the beginning of the word:

(9)	a.	eryát-is	aryátis	‘worker’ Meg, P101
		lekán-i	lakáni	‘basin’ Sil, Ko30

	éksafna	áksafna	‘suddenly’ Meg, P101
	sevast-í	savastí	‘name’ Ax, MK8
	meyalón-a	maya-lóna	‘first toe’ Sil, Ko30
	meyaríz-o	maya-rízo	‘mess up-1SG.PRES’ Ax, MK8
b.	zavolj-á	zavaljá	‘naughtiness’ Meg, 102
	monastír-i	manastíri	‘monastery’ Sil, Ko65
c.	velón-i	volóni	‘needle’ Meg, P102
	óreks-i	óroksi	‘appetite’ Meg, P102
	xelón-a	folóna	‘turtle’ Sil, Ko31
d.	pirostj-á	porostjá	‘fireside’ Meg, 102
	pondik-ós	puntzukós	‘mouse’ Sil, Ko33
e.	cenúrj-o	tsunúrjo	‘new’ Meg, P105
f.	liturj-á	luturjá	‘liturgy’ Meg, P105
	pliyúr-i	pulyúri	‘groats’ Sil, Ko187

In previous work (Revithiadou et al. 2005), we have shown that VH in the dialects under investigation is actually different from VH in Turkish:

- A disyllabic harmonic domain is constructed either at the last two or at the first two syllables of the word; each domain obeys different conditions.
- Both processes are stress-sensitive.
- ...

In line with work by McCarthy (2004), as well as numerous other authors, we assume that harmony is a property of *spans*. These spans can be seen as binary feet, constructed either at the beginning of the word and/or at the end of the word. Foot-sized spans are indicated by ‘S’:

(10)	a.	word-final	b.	word-initial
		S		S
		$\diagup$ $\diagdown$		$\diagup$ $\diagdown$
		ó n a m a		a r γ á t i s
	St.Gr	ó n o m a	St.Gr	e r γ á t i s

- (10a): the span at the end of the word involves mainly spreading of the features [back] and [round]. In this sense it is closer to Turkish VH. Within this span stressed vowels are neither triggers nor undergoers unless harmony would fail to apply altogether.
- (10b): the span at the beginning of the word is sonority-driven and involves vowel-copying. Stressed vowels can be both triggers and undergoers.
- In this talk, focus is on dialects where VH interacts with epenthesis. The differences between the two harmonic spans are, therefore, of no central concern.
- Of crucial importance is the fact that these harmonic spans are:
  - Headed
  - Binary

## 2. VH and epenthesis

The epenthetic vowel breaks up onset clusters in Silly and coda-onset clusters in Megisti.

(11) *epenthesis in Silly*

a.	xliar-ó	xiliaró	‘lukewarm’ K37
	splín-a	spilína	‘spleen’ K37
	fíð-i	fíri	‘eye-brow’ K37
	trén-o	tiréno	‘train’ K37
	krío	kirió	‘cold’ K36
	ðákri	rákiri	‘tear’ K36
	vriázo	viriázu	‘shout-1SG.PRES’ K36
b.	áspr-o	áspuru	‘white’ K36
	pró-persi	purópersi	‘the year before last year’ K37
	kástr-o	kásturu	‘castle’ K36
	gastr-ón-o	kasturónu	‘make pregnant-1SG.PRES’ K167

(12) *epenthesis in Megisti*

a.	pátmos	pátinos	‘Patmos island’ P104
b.	patmiótis	patinjótis	‘inhabitant of Patmos’ P104
c.	atmós	atimós	‘steam’ P104
d.	vaθmós	vaθimós	‘grade’ P104
e.	ðen zvíni	enizvíni	‘NEG-erase-3SG.PRES’ P104
f.	ðen skávo	eniskávo	‘NEG-dig-1SG.PRES’ P104
g.	ðen stróno	enistróno	‘NEG-lay out-1SG.PRES’ P104

The interaction between vowel harmony and epenthesis is different in the two dialects:

- In Silly, epenthesis *feeds* VH: the epenthetic vowel is subject to rounding harmony
- In Megisti, epenthesis and VH are in a *counterfeeding* relationship: the epenthetic vowel is never harmonic (except by accident, e.g. *enizvíni* (12e))

This poses (once again) a problem for phonological theory. Most of the well-known ‘opacity killers’ of OT (such as Sympathy or Comparative Markedness) can technically solve the problem, but none has met with general satisfaction. By way of an example, here is a Sympathy tableau for the Megisti example (12a) (compared to the regular example *kinó* in (1c)):

## (13)

/patnos/	☞-IDENT(round)	*CLUSTER	HARMONY	★DEP-V
☞ a. patnós		*!		
☞ b. patinós			*	*
c. patunós	*!			*
d. patinés	*!		*	*

## (14)

/kino/	☞-IDENT(round)	*CLUSTER	HARMONY	★DEP-V
☞ a. kunó				
b. kinó	*!		*	
c. kiné	*!		*	

Next to various formal and technical problems related to Sympathy Theory in general, this approach does not seem particularly insightful for the VH facts discussed here.

### 3. Phonology-morphology interaction: mirroring

We assume that the phonology-morphology interface is subject to the following general condition:

- (15) **Mirroring:** phonological structure should mirror morphological structure.

Many well-known constraints in the OT literature seem to be implementations of this general idea: ALIGNMENT, HEAD-FAITHFULNESS, FAITH(root) >> FAITH(affix), etc.

In particular, we propose to take seriously the principle of CONSISTENCY OF EXPONENCE (Prince & Smolensky 1993):

- (16) Gen cannot alter the morphological affiliation of segments.

This principle has always been assumed in the OT literature (see Walker & Feng 2004 for an – unsuccessful – attack). Its implication is that every segment has to bear its morphological affiliation on its sleeves. Epenthetic material, however, does not bear a morphological affiliation. We thus get structures such as the following:

- (17)  $p_\alpha a_\alpha t_\alpha i_\emptyset n_\alpha o_\alpha s_\alpha$

Furthermore, we propose the following constraint:

- (18) **STRONG CONTAINMENT (SC):** All segments in a HS should be in the morphological domain of the head.

This is a reflection of mirroring in the sense that it requires phonological structure to be isomorphic to morphological structure in some respect.

- ✓ Megisti is subject to SC. A potentially harmonic form such as *pátunos* (from *pátnos*, (12a)), would have the following domain structure:

- (19) 
$$\begin{array}{c} S \\ \wedge \\ p_\alpha a_\alpha t_\alpha u_\emptyset n_\alpha o_\alpha s_\alpha \end{array}$$
 where  $\alpha$  is the morphological word, i.e. *pátnos*.

The epenthetic vowel is outside of the  $\alpha$  domain and hence is forbidden by (18). Ranking SC above the Harmony constraints results in the desired outcome.

- (20)

/patnos/	STRONGCONTAINMENT	*CLUSTER	HARMONY
a. pátnos		*!	
☞ b. pátinos			*
c. pátunos	*!		

We would expect dependence on morphological domains to show up in other aspects of grammar as well. And indeed, in this respect, VH in Megisti looks surprisingly like stress in Dakota:

- (21) *Dakota stress* (Alderete 1999)
- a. stress is on the second syllable:
- chi-kté 'I kill you'  
 ma-yá-kte 'you kill me'  
 wichá-ya-kte 'you kill them'
- b. except if this contains an epenthetic vowel:
- céka 'stagger' (</cek/)  
 khúsa 'lazy' (</khus/)  
 cápa 'trot' (</cap/)

Epenthetic vowels, therefore, cannot be part of a foot in Dakota just as they cannot be part of a headed span in Megisti Greek.

- ✓ Silly Greek is obviously not subject to SC, since epenthetic vowels can be harmonic. Consider a form such as (11b), repeated here as (22):

- (22)
- S  
 ^  
 á<sub>α</sub> s<sub>α</sub> p<sub>α</sub> u<sub>∅</sub> r<sub>α</sub> u<sub>α</sub>

The epenthetic vowel does not share the same morphological domain with the head of the span. It is still included, however, because the need to build a harmonic foot is greater in this dialect (an additional reason may be that we avoid spreading from the stressed /a/ in this case).

- (23)

/aspro/	*CLUSTER	HARMONY	STRONGCONTAINMENT
a. áspru	*!		
b. áspiru		*!	
☞ c. áspuru			*

Given these assumptions then, a purely monostratal theory can easily account for these facts, and no reference to extra levels of representation is necessary. However, we still want to derive one important generalization:

- (24) The epenthetic vowel can never be the source of harmony/spreading.

In principle, this could follow for Silly from the fact that, first, epenthetic vowels are high vowels and, second, underlying high vowels are not the source of harmony. But we are a little more ambitious, since (24) seems to be a much more general constraint on VH and other types of vowel assimilation. For instance, it holds for the famous case of Icelandic *u*-umlaut as well (Anderson 1969).

- (25) a. barn ‘child-ACC.SG.’                      börn-um            ‘child-DAT.PL’  
           tala ‘I speak’                              töl-um            ‘we speak’  
       b. dagur ‘day-M.NOM.SG.’ (< /dag+/r/)

The effect is therefore more general, and it follows from the theory of headed spans. In McCarthy’s (2004) view, these structures are built as the result of a faithfulness requirement:

- (26) FTHHDSpan( $\alpha$ F): If an input segment  $s_i$  is [ $\alpha$ F] and it has an output correspondent  $s_o$ , then  $s_o$  is the head of an [ $\alpha$ F] span.

This constraint replaces IDENTITY in *Headed Span* theory, but it actually predicts that epenthetic vowels (which are not part of the input) will have no reason ever to head a harmonic span of their own. The apparent ‘opacity’ of Icelandic and the generalization in (24) therefore follow from this without further assumptions.

We thus also predict that in a Greek dialect in which high vowels can be the source of harmony (as in Megisti) and in which epenthetic vowels do participate in harmony in principle (as in Silly), epenthetic high vowels should still not be able to be the source of harmony.

- ✓ This prediction is confirmed by Aravan, an AMG dialect in which high vowels trigger harmony but epenthetic vowels are targets without ever initiating the process. The examples in (27) and (28) are illustrative:

- (27) *Aravan VH* (Fosteris & Kesisoglou 1960: 2-3)
- |    |         |         |                 |
|----|---------|---------|-----------------|
| a. | ánemos  | ánomos  | ‘wind’          |
| b. | jéros   | jóros   | ‘old man’       |
| c. | forás   | farás   | ‘wear-2SG.PRES’ |
| d. | katófli | katéfli | ‘doorway’       |
| e. | skjáði  | skeði   | ‘shadow’        |

- (28) *Aravan epenthesis* (Fosteris & Kesisoglou 1960: 3)
- |    |          |          |                    |
|----|----------|----------|--------------------|
| a. | γrjá     | γrjá     | ‘old woman’        |
|    | xrjázome | xrjázome | ‘need-1SG.PRES’    |
| b. | /kriás/  | kiriás   | ‘meat’             |
|    | kríos    | kiriós   | ‘cold’             |
| c. | γðíno    | γðízo    | ‘undress-1SG.PRES’ |

Important: Epenthesis in clitic constructions, e.g. *patéras m* ‘father 1SG.POSS’ is realized as *patérasim* and not as *\*patéresim*. [Cf. /pirpién ta/ *pirpían da* ‘lead-3SG.PAST-them’ (Dawkins 1916: 332) where VH applies within the verb-clitic construction.]

- ✓ A second confirmation of this prediction comes from informal registers of Turkish loanwords (Clements & Sezer 1982: 247), where epenthetic vowels are colored by neighboring segments without ever being the triggers of harmony:

(29)	<i>careful form</i>	<i>colloquial form</i>	
a.	pranga	piranga	‘fettters’
b.	prens	pirens (*pirans)	‘prince’
c.	prova	purova	‘test’
d.	spiker	sipiker	‘announcer’

Thus, in this variety of Turkish, high vowels do participate, but only as targets of VH, not as its source. This conforms to (24), and hence it follows from our explanation in terms of headed spans and morphological mirroring.

#### 4. Conclusions

- Vowel Harmony in Asia Minor Greek as well as in a strip of Southern Greek dialects gives evidence for a headed span analysis, enriched with strict binarity and alignment to edges.
- The apparent opaque interaction of this process with vowel epenthesis does not need to be described with some mechanism invoking abstract alternate representations, such as Sympathy Theory.
- Instead, it can be fully described using the theoretical instruments we already have, such as *Headed Spans* and *Consistency of Exponence*.
- A welcome result of the proposed analysis is that it derives an accurate crosslinguistic generalization regarding the inability of epenthetic vowels to act as triggers of VH.

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