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Greek Allomorphy: an Optimality Account

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1. Introduction

There is an abundance of evidence that prosody partly determines morphology. Some evidence involves reduplication and root-and-pattern morphology, in languages with non-concatenative morphology. But even mostly concatenative languages provide clear cases of prosodically governed morphology in the form of stress-dependent suffixation. For example, certain affixes shift stress to the final stem syllable, e.g. English adjectival -*ic*, as in *állomorph* but *allomórphic*; German *Európa* but *européisch*. Another case is English deverbal -*al*, a suffix which again requires the stem to which it attaches to end in a stressed syllable, but is unable to shift the stem stress, e.g. *den'y-dení-al*, but *édit-***édit-al*.

The data for this paper is taken from cases of allomorphy in suffixation involving nominalisations, denominal adjectives, deverbal agent nominals, and certain vocatives. All categories involve allomorphs whose distribution depends (to some extent) upon prosodic properties of the base - its syllable number or stress pattern.

A derivational account of these data is possible, in which allomorph-specific selection frames refer to aspects of a stem's prosody. Such an account lists selectional requirements as essentially arbitrary properties of allomorphs. It thereby obscures the generalisation that allomorphic preferences are to a large extent predictable from the shape of the output stem + affix-allomorph concatenation. This concatenation conspires towards prosodic output targets, e.g. certain preferred stress patterns, the coincidence of morphological and prosodic edges, or the realisation of morpheme-specific stress requirements. In a derivational analysis, this conspiracy cannot be incorporated except by giving up the fundamental assumption that phonological rules apply in a linear order and are not allowed to look ahead to the outputs of derivations. In a constraint-based theory, on the other hand, it is well possible to make choice of allomorph dependent on properties of the concatenation. We claim that patterns of allomorphy, including the cases of free variation, are best understood by assuming that universal constraints will always be in interaction, in the end case in conflict; this speaks strongly for an approach within Optimality Theory, where such interaction is assumed in principle. The paper thus concentrates on providing such an account.

This topic was first discussed in Malikouti-Drachman and Drachman (1994). Written in a circumscription framework, that paper contrasted the licit output forms across possible concatenations of stems with affix-allomorphs. The present paper substitutes alignment for the earlier circumscription; and it formalises the constraints (their definition and ranking) required to guarantee the choice of the optimal member of each set of possible structures assignable to each stem+affix-allomorph concatenation. In particular we will claim that the choice between allomorphs may be made by the requirements of prosody, in particular the constraints on foot well-formedness position of feet in PrWd, and the requirement that a stem equals a PrWd. These constraints are independently motivated in other languages than Greek, in some of which they are actually inviolable constraints. The central idea is that where the lexicon provides two allomorphs of one morphological category, the effect of both allomorphs is evaluated in candidate outputs. Out of these, the 'optimal allomorph' is selected, i.e. the stem-plus-affix-allomorph concatenation which minimally violates the prosodic constraints, for a given ranking of these constraints. Cases of prosody-conditioned allomorphy have been studied in the OT literature before, e.g. Mester (1994) on Latin and Kager (1995a) on Estonian. The study of Greek discloses some interesting twists to add to the general story.

2. The problem

The data falls into four types, viz.,

(1) a. Action nominals like *vréks-imo* 'wetting' vs. *skúpiz-ma* 'sweeping',
b. Derived adjectives like *pétr-ino* 'stone' vs. *moliv-énjo* 'leaden',
c. Vocatives like *Ník-o* 'Nicholas' vs. *Fílip-e* 'Philip',
d. Agent nominals like *kléf-tis* 'thief' vs. *skupis-tís* 'sweeper'.

2.1 Action nominals in /-imo/ ~ /-ma/

With deverbal action nominals, there are two suffixal allomorphs, /-imo/ ~ /-ma/, differing in segmentism and syllable number. These allomorphs are distributed in the following way. Monosyllabic stems take /-imo/ (cf. 2a), while polysyllabic stems (cf. 2b) take /-ma/. Why should we find precisely this allomorphic distribution, and not the reverse?

(2)	a.	vrek-	'to wet'	>	vréks-imo	'wetting'
	b.	skupis-	'to sweep'	>	skúpiz-ma	'sweeping'

2.2 Denominal adjectives in /-ino/ ~ /-énjo/

The derivation of denominal 'material' adjectives employs two allomorphs: /-ino/ and /-enjo/. Both allomorphs are disyllabic, but only /-énjo/ is stressed. Unstressed /-ino/ adjoins to monosyllabic stems (cf. 3a) and to polysyllabic stems whose final syllable is stressed (cf. 3b). Stressed /-énjo/ attaches to disyllabic stems that have no inherent stress (cf. 3c). Again, we may ask why we find this distribution, rather than any other.

(3)	a.	pétr-a	'stone'	>	pétr-ino	'of stone'
	b.	porselán-o	'porcelain'	>	porselán-ino	'of porcelain'
	c.	móliv-os	'lead'	>	moliv-énjo	'lead-en'

We will also to provide an answer as to why some forms show free variation of allomorphy, as in:

(4)	a.	psáth-a	'straw'	>	psáth-ino,	also psath-énjo
	b.	mármar-o	'marble'	>	marmar-énjo,	also marmár-ino

2.3 Vocatives of masculine proper names in /-o/ ~ /-e/

The vocative of masculine proper names shows two allomorphs, in this case distinguished only by vowel quality. Once more, allomorphs are sensitive to the stem's syllable number and stress pattern, with /-o/ after monosyllabic stems and stems with final stress (cf. 5a-b), and /-e/ after polysyllabic stems that have no final stress (cf. 5c):

(5)	a.	ník-os	>	ník-o	'Nicholas'
	b.	alék-os	>	alék-o	'Alex'
	c.	fílip-os	>	fílip-e	'Philip'

Again, the question arises as to why we find this particular pattern.

2.4 Deverbal agent nominals in /-tis/ ~ /-tís/

As in the previous case, both affix allomorphs are monosyllabic, but this time themselves distinguished by stress. Why do monosyllabic verbal stems take unstressed /-tis/, while polysyllabic stems take stressed /-tís/?

(6)	a.	klév-	'steal'	>	kléf-tis	'thief'
	b.	katháris-	'cleaned'	>	katháris-tís	'cleaner'

Again, there are some deviating stems, e.g.:

(7) a. kri-tís

3. An optimality theoretic approach to allomorphy

We now show that the distribution of suffix allomorphs in the above data, including that showing free variation, results from the resolution of conflicting constraints and is thus well captured within the formalisms available under Optimality Theory. But first a brief outline of the relevant parts of that theory (Prince & Smolensky 1993).

We assume an ínput', whose identity/content must be preserved, in a sense to be clarified below. Suppose this is a set of lexical/morphological items targetting a single semantic representation. The Input may be mapped to prosodic representation in various ways, in turn providing us with a set of candidate structures. This mapping is due to a component 'Generate' (*Gen*), which now means (for this paper) - assign all the possible (prosodic) descriptions to any concatenation of stem and relevant affix-allomorphs. The set generated is now evaluated; its member are submitted in parallel to a language-specific constraint system, 'Evaluate' (*Eval*). This consists of a universal set of constraints ranked in a language-specific way. The sub-set of universal constraints we will need for Greek is:

(8) *Phonotactic constraints*:

	a.	FT-BINARITY	Feet are disyllabic (and actually trochaic for Greek).
	b.	PARSE-2	One of two adjacent syllables must be parsed by a foot. (the 'trisyllabic window', cf. Kager 1994 on Estonian)
	c.	NONFINALITY	The head foot of the PrWd must not be final. (cf. Prince and Smolensky 1993:43 on Latin)

Morpho-prosodic alignment:

	d.	STEM=PRWD	Stem equals PrWd (- hence properly includes a foot).

Prosodic faithfulness constraints:

e.	HEAD-MAX	Input (dictionary-specified) stress must be realised. (Alderete 1995, cf. Parse-Ft in Inkelas 1994)
f.	HEAD-DEP	Output stress must match input (dictionary-specified) stress (cf. Alderete 1995)

Constraints are unordered, in the sense that they do not affect prosodic structure one after another. But they may be related by dominance or ranking. A given constraint may be undominated (absolutely, or language-specifically), or dominated by other constraints.

'Optimal form' now means the one candidate form that satisfies the constraints best, taking into account their ranking. First the entire candidate set is evaluated by the highest-ranking constraint; forms that obey it are preserved, while all forms that violate it are removed from the candidate set. The remaining set is then submitted to the next-highest ranked constraint, and so on, until, only one candidate remains. Observe that an optimal form may violate low-ranked constraints that other (less optimal) forms obey, as long as it is better in terms of higher-ranked constraints.

We assume that variability of outputs involves an equal ranking of two or more constraints. This produces different outputs, depending on 'random' ranking between variably ranked constraints.

As an auxiliary theory, we also assume that the interface between morphology and prosody takes the shape of Generalized Alignment (McCarthy & Prince 1993). Alignment constraints require that edges of morphological domains coincide with edges of prosodic domains, or vice versa. The main instantiation of this scheme to be used is STEM=PRWD, a constraint requiring that the morphological category Stem equals a Prosodic Word, hence is minimally a foot in size.

4. Analysing the cases

4.1 The action nominals

We now show the workings of 'Gen' and 'Eval', illustrated step-by-step for our first case. Generate sets up all possible concatenations of stem and allomorphs, thus:

(9)	a.	pyas-imo	*and*	pyas-ma
	b.	skupis-imo	*and*	skupis-ma

To each of these it assigns a variety of possible prosodic structures, as in the tableaux (10-11) below. Before we present the analysis, let us state the generalisation that both optimal forms *pyásimo* and *skúpizma* share in common. Both have antepenultimate stress, which we know to be the favored position of stress in Greek for all lexical categories. Drachman and Malikouti-Drachman (in preparation) argue that this is due to the disyllabic trochee as the preferred foot in Greek, in combination with a preference for syllable extrametricality. Notice that if the allomorph /-ma/ had been selected, producing *pyás-ma*, antepenultimate stress could not have been realised, this form being one syllable short.

Turning now to *skúpiz-ma*, this is better than *skupís-imo* since its morphological composition is perfectly signalled by its stress pattern: a trochee coincides with both edges of the stem, as in [(*skúpiz*)-*ma*], rather than [*sku*(*pís-i*)*mo*]. Morpho-prosodic alignment (of stem and foot boundaries) is a strong cross-linguistic tendency (McCarthy & Prince 1993, Kager 1994), and there is no reason to doubt its relevance for Greek. In fact, we will assume that morpho-prosodic alignment may be satisfied by feet that have no main stress, but secondary stress only, e.g. [(*mòliv*)-(*énjo*)] (cf. section 4.2).

Let us now consider the constraint ranking to formalise these ideas. We assume that for Greek, *Eval* contains the parallel filter function of at least the following ranked subset of phonotactic and morpho-prosodic constraints: FtBin, Parse2 » Stem=PrWd » NonFin. Eval also contains the faithfulness constraints HdMax and HdDep, measuring the degree of divergence between 'lexical' and 'surface' stress specifications. The relevance of these constraints will be shown for cases to be discussed in section 4.2.

The evaluation of candidate outputs, all prosodified combinations of stem-plus-allomorph, is depicted in tableau (10). First run your eye across the tableau for each line, and you notice that no potential form based on a monosyllabic stem in fact satisfies all the relevant constraints. Actually, for monosyllabic stems FtBin and Stem=PrWd will always be in conflict, due to the fact that monosyllabic PrWd implies a monosyllabic foot. Now let us scan the tableau from left to right and top to bottom. We star constraint violations, whereby the 'optimal' stress configuration for each concatenation is automatically selected by a process of elimination.

(10)Input: /pyas-, {-ma, -imo}/		FtBin	Parse2	Stem=PrWd	NonFin
a.	(pyas)-(má)	*!*			
b.	(pyás)-ma	*			
c.	(pyás)-imo	*	*		
d.	(pyás-ma)			*	*!
e.	pyas-(ímo)			*	*!
f.	☞ (pyás-i)mo			*	

This tableau can be summarised as follows. Forms (10a-c) violate the highest-ranking constraint FtBin, and (10a) does it twice. Form (10c) in addition violates Parse2, since its final sequence of syllables is unfooted. Since other forms (10d-f) are still available that satisfy both FtBin and Parse2, we forget about them. But the forms surviving can only honour FtBin by violating Stem=PrWd, the constraint requiring a perfect match of stem edges and prosodic word edges. Hence the choice between the allomorphs {/-ma/, /-imo/} is decided by the next lower-ranking constraint, NonFin, in favor of a form with a non-final foot, i.e. the one with the disyllabic allomorph /-imo/.

However, with disyllabic stems as in (11), it is possible to satisfy Stem=PrWd without violating either FtBin or Parse2, while at the same time satisfying NonFin.

(11) I: /skupiz-, {-ma, -imo}/		FtBin	Parse2	Stem=PrWd	NonFin
a.	(skupiz)-(má)	*!			*
b.	(skúpis)-imo		*!		
c.	skupis-(ímo)		*!	*	*
d.	sku(píz-ma)			*!	*
e.	sku(pís-i)mo			*!	
f.	(skupis)-(ímo)				*!
g.	☞ (skúpiz)-ma				

Note that in this case (as opposed to tableau 10) polysyllabics can satisfy Stem=PrWd without any need of violating FtBin (as 11a does), or Parse2 (as 11b does). Of the two remaining candidates (11f-g) that satisfy Stem=PrWd, (11f) has a final foot in violation of NonFin. The tableau shows that the allomorph /-ma/ is ‘optimal’ with disyllabic stems, as it allows the satisfaction of all relevant prosodic constraints.

4.2 Denominal material adjectives

4.2.1 Motivating HdMax and HdDep

These data motivate the activity of the constraints HdMax, which maximally preserves the stress properties of input morphemes in the output (cf. Inkelas 1994), and HdDep, which makes the (logically complementary) assertion that any foot that appears in the output must be a realisation of some input foot (cf. Alderete 1995)[1].

The fact that both allomorphs /-ino/, /-enjo/ are disyllabic apparently weakens our claim that allomorphic distribution is guided by inherent prosody of the stem-allomorph concatenation. But prosody need not be limited to syllable number, since there happens to be a salient difference in stress between the allomorphs. That is, /-enjo/ is always stressed, while /-ino/ never is. Accordingly we assume that the allomorphs are prosodically distinct in their lexical stress properties: while /-ino/ has no inherent stress properties, /-énjo/ is lexically endowed with a foot:

(12) a.   b. (* .)
          -ino   -enjo

Lexical stress requirements are enforced in two ways. High-ranked HdMax penalises any output that contains unstressed /-enjo/, while HdDep penalises any output that has a stress on a syllable that is not lexically specified, e.g. stressed /-ino/.

Here are the main candidate collocations for the derived adjectives, based on the two allomorphs:

(13) a. *mo(lív-i)no vs. (moliv)-(énjo)
b. (pétr-i)no vs. *petr-(énjo)

Then how do we explain that the inherently stressed allomorph /-enjo/ prefers polysyllabic stems, while its unstressed counterpart /-ino/ prefers monosyllabic stems? Observe that output forms are preferred which (i) satisfy lexical stress properties of the allomorphs, while (ii) maximizing prosodic output targets. While (13b) again shows the preference for antepenultimate stress, (13a) shows that morpho-prosodic alignment is higher valued than antepenultimate stress. Actually, all this is already encoded in our constraint ranking.

Let us first consider the tableau for concatenations based on the monosyllabic stem /petr-/. As we found earlier for monosyllabic stems, Stem=PrWd cannot be satisfied due to top-ranking FtBin. Among the four candidates (14e-h) that survive FtBin, (14e) is first excluded by HdMax. Then NonFin steps in to remove both (14f-g), leaving (14h) as the optimal candidate:

(14) I: /petr-, {-ino, -énjo}/	FtBin	Parse 2	HdMax	Stem=PrWd	NonFin	HdDep

[1] Constraints of this type, matching input and output are typical of Correspondence Theory, a recent innovation of OT (McCarthy & Prince 1994).

a. (petr)-(íno)	*!				*	*
b. (petr)-(énjo)	*!				*	
c. (pétr)-ino	*!	*				*
d. (pétr)-enjo	*!	*	*			*
e. (pétr-en)jo			*!	*		
f. petr-(énjo)				*	*!	
g. petr-(íno)				*	*!	*
h. ☞ (pétr-i)no				*		*

Notice how HdMax correctly selects *pétr-ino* (14h) at the expense of **pétr-enjo* (14e), a candidate that is 'unfaithful' to the input prosodic requirements of /-énjo/.

Turning to tableau (15) of the disyllabic stem /moliv-/, we see HdDep come into play ("Output stresses correspond to dictionary-specified feet"). Four candidates (15c-f) survive FtBin and Parse2. One of these (15c) is rejected by HdMax, since it is unfaithful to lexical stress on /-énjo/, and another (15d) by Stem=PrWd. Of the remaining two forms, *moliv-íno* (15e) is excluded by HdDep since its main stress falls on a syllable that is not lexically stressed. Hence the optimal form must be (15f) *moliv-énjo*, which satisfies all constraints but NonFin[2].

(15) I: /moliv-, {-ino, -énjo}/	FtBin	Parse2	HdMax	Stem=PrWd	NonFin	HdDep
a. (móliv)-enjo		*!	*			*
b. (móliv)-ino		*!				*
c. mo(lív-en)jo			*!	*		*
d. mo(lív-i)no				*!		*
e. (moliv)-(íno)					*	*!
f. ☞ (moliv)-(énjo)					*	

Note that this tableau motivates a ranking Stem=PrWd » NonFin. With a reverse ranking, the outcome would have been **mo*(*lív-i*)*no* (15d).

Actually, /-ino/ does occur as the preferred allomorph after stems that are lexically stressed on their final syllable, e.g. *porselán-o* 'porcelain', *porselán-ino* 'of porcelain', rather than **porselan-énjo*. Faithfulness to a stem-supplied stress is another way to satisfy HdMax. This follows directly from the constraint ranking given so far:

(16) I:/porselán-, {-ino, -énjo}/	FtBin	Parse2	HdMax	Stem=PrWd	NonFin	HdDep
a. (porse)lan-(énjo)			*!		*	*
b. ☞ (porse)(lán-i)no						

In sum, our analysis has the advantage of explaining the selectional preferences of both allomorphs with stems of a certain type of prosody (that is, /-ino/ preferring mono-syllabic stems and polysyllabic stems with lexical final stress, /-enjo/ polysyllabic stems)

[2] We assume no lexical stress marking for the stem /moliv-/, since its isolation form is *móliv-os* 'lead', with default antepenultimate stress. This means that both (15e-f) have an additional violation of HdDep for the stem foot, which we have not marked.

as a consequence of their fixed stress patterns (that is, unmarked antepenultimate stress with /-ino/, and lexically marked penultimate stress with /-enjo/). The distribution of allomorphs is due to an interaction of purely prosodic constraints (FTBIN, PARSE2, NONFIN), morpho-prosodic alignment (STEM=PRWD) and prosodic faithfulness constraints (HDMAX, HDDEP). Importantly, our analysis requires no language-specific constraints on the distribution of suffix allomorphs, and is therefore consistent with a basic assumption of OT.

Derivational models might have postulated stressed vs. unstressed allomorphs, and simply given their selectional environments as monosyllabic vs. polysyllabic stems. However, this would have resulted in arbitrariness, since the selectional environments of allomorphs might just as well have been the reverse, e.g. stressed /-enjo/ selecting monosyllabic stems, and unstressed /-ino/ polysyllabic stems. We claim that the distribution is not coincidental, but is due to the prosodic well-formedness of the output concatenation.

4.2.1 The free variation problem

A limited amount of free variation in denominal material adjectives occurs, and all of it is lexically specific. Typical cases are:

(17) a. mármar-o ‘marble’ > the expected *marmar-énjo*; but also *marmár-ino*
b. psath-a ‘straw’ > the expected *psáth-ino*; but also *psath-énjo*

Importantly, no cases of monosyllabic stems seem to exist that select /-enjo/ only, or of polysyllabic stems that select /-ino/ only. That is, the form that we have come to expect as the optimal output by the constraint ranking given so far, is always an option under lexical variation.

Then how do we account for the unexpected forms marmárino and psathénjo? Note that stress properties of the allomorphs remain constant: it is only the stem size that deviates from expectation. A typical OT solution ought to involve tied constraints, which then alternate in dominance relations, here obviously in a lexically specific manner. Notice that we have justified the following constraints and ranking:

(18) FTBIN, PARSE2, HDMAX » STEM=PRWD » NONFIN, HDDEP

For cases like *marmár-ino* vs. *marmar-énjo*, the tied constraints are STEM=PRWD and NONFIN. When NONFIN takes optional preference over STEM=PRWD, an output lacking a final foot is preferred, hence *marmárino* > *marmarénjo*.

(19) Input: /marmar-, {-ino, -énjo}/	NONFIN	STEM=PRWD
a. ☞ mar(már-i)no		*
b. (marmar)-(énjo)	*!	

Conversely, when STEM=PRWD dominates, the stem /marmar-/ must be prosodically bracketed, resulting in *marmar-énjo* (cf. *moliv-énjo* in tableau 15). Actually it can be shown that a permutation of the ‘dominated’ constraints (HDMAX, STEM=PRWD, NONFIN, HDDEP) produces only attested forms, *marmár-ino* and *marmar-énjo*. This is a nice result, since it shows that the choice of allomorph has some robustness, and is to extent independent of ranking.

In *psáth-ino* vs. *psath-énjo*, however, the allomorph /-enjo/ can only be chosen by free ranking of FTBIN and STEM=PRWD. Now dominant FTBIN dictates the bracketing (*psath-i*)*no*, as usual; but dominant STEM=PRWD dictates the bracketing (*psath-*), which is the precondition for /-enjo/, given PARSE2.

(20) Input: /psath-, {-ino, -énjo}/	STEM=PRWD	FTBIN	PARSE2
a. (psáth-i)no	*!		
b. (psáth)-ino		*	*!
c. ☞ (psath)-(énjo)		*	

4.3 Vocative of masculine proper names

We now revert to the vocalic allomorphy of the Vocative for masculine proper names, as in *fílip-e* 'Philip!' vs. *ník-o* 'Nicholas!' and *alék-o* 'Alex!'. The generalisation is that a masculine proper name takes the Vocative allomorph /-o/ if its stem is monosyllabic, or if its stem is lexically stressed on the second syllable, and the allomorph /-e/ if its stem is polysyllabic and not lexically stressed. As we will see, this allomorphy independently motivates the high ranking of HDMAX, which says that a dictionary stress is respected in the output. We will also find additional support for HDDEP.

We first observe that the distribution of {/-e/, /-o/} cannot be due to a difference in syllable number between the allomorphs, both being monosyllabic. As in the earlier case of denominal material adjectives, a line of attack on the problem suggests itself. Allomorphs appear in metrically distinct contexts: /-o/ always occupies post-stress position, while /-e/ occurs in outputs with antepenultimate stress (the 'unmarked' pattern). Accordingly, we assume that /-o/ is lexically specified as pre-accented, while /-e/ is metrically unspecified:

(21) a. -e b. (* .)
-o

These 'dictionary' stress properties are optimally realised with stems of a certain prosody. HDMAX enforces the lexical requirement of /-o/. It favours outputs that contain /-o/ in a post-stress position over outputs those that contain /-o/ in a different prosodic context.

Let us now look into the full analysis. We first consider forms like fílipe, which has a disyllabic unaccented stem. See tableau (22), where HDMAX selects (f) over (e):

(22) Input: /filip-, {-o, -e}/	FTBIN	PARSE2	HDMAX	STEM=PRWD	NONFIN	HDDEP
a. (filip)-(ó)	*!		*		*	**
b. (filip)-(é)	*!				*	**
c. fi(líp-e)				*!	*	*
d. fi(líp-o)				*!	*	
e. (fílip)-o			*!			*
f. ☞ (fílip)-e						*

In sum, HDMAX rules out forms like **fílip-o* (in which suffix requirements are ignored) and **álek-e* (where stem requirements are not met). But what rules out forms like **ník-e*, causing a genuine complementary distribution of allomorphs? The answer is already available in the form of HDDEP: outputs are preferred with stress on a foot that is morphologically sponsored. See tableau (23), for a monosyllabic stem:

(23) Input: /nik-, {-o, -e}/	FTBIN	PARSE2	HDMAX	STEM=PRWD	NONFIN	HDDEP
a. (nik)-(ó)	*!*		*		*	**
b. (nik)-(é)	*!*				*	**
c. (ník)-o	*!		*			*
d. (ník)-e	*!					*
e. (ník-o)				*	*	
f. ☞ (ník-e)				*	*	*!

Observe that the choice of allomorph in polysyllabic accented stems (*alék-o* > **alék-e*) is identical to that of monosyllabic stems. This does not follow from HDDEP since the output stress is in both cases sponsored by the stem. This puzzle may be solved under the natural assumption it is even better for an output stress to be sponsored by both the stem and affix separately, as is the case in alék-o but not in **alék-e*. We implement this idea by breaking up HDDEP into two constraints. HDDEP-STEM requires that output stresses are sponsored by the stem, while HDDEP-AFFIX requires that output stresses are sponsored by some affix:

(24) Input: /alék-, {-o, -e}/	HDMAX	STEM=PRWD	NONFIN	HDDEP-STEM	HDDEP-AFFIX
a. (álek)-o	*!*			*	*
b. (álek)-e	*!			*	*
c. a(lék-e)		*	*		*!
d. ☞ a(lék-o)		*	*		

This analysis is not just a notational variant of selection frames referring to base prosody, for the following reason. Selection frames may only refer to properties of the base that are lexically visible, e.g. its number of vowels, or lexical stress. Consequently the frame of /-o/ must involve a disjunction, e.g. it appears after (i) monosyllabic stems, and (ii) after stems that are lexically stressed on their final syllable. Both cases cannot be united except under the (questionable) assumption that monosyllabic stems must all be *lexically* stressed (on their single syllable). An OT analysis avoids this assumption, since all that matters is whether the lexical requirement of /-o/ is met in the output, regardless of whether the stem syllable is lexically stressed or not.

4.4 Deverbal agent nominals

For our last case, we take a different kind of problem, presented by the deverbal agent nominals, like *kléf-tis* vs. *skupis-tís*. The broad generalisation is that monosyllabic stems take unstressed /-tis/ and polysyllabic stems take stressed /-tís/. Observe that the rhythmic distribution of suffix alternants strongly resembles that of denominal material adjectives. For monosyllabic stems, *kléf-tis* > **klef-tís* is parallel to *pétr-ino* > **petr-énjo*, with the avoidance of stress directly after a monosyllabic stem. For polysyllabic stems, *skupis-tís*

> **skupís-tis* resembles *moliv-énjo* > **molív-ino*, with morpho-prosodic alignment. So we see another instance of a now-familiar generalisation.

But if this is a case of allomorphy at all, then both allomorphs are lexically distinct by stress alone, since they are otherwise segmentally identical. We believe that the lack of a segmental contrast between suffixal alternants makes an allomorphy analysis somewhat suspect. Instead of having allomorphy in the dictionary, we suggest that there is in fact but a single shape in the lexicon, viz. /-tisV/ with a silent (catalectic) vowel, so that the affix is in fact of foot length. (See for the notion of 'catalexis' Kiparsky 1991 and Kager 1995a). It remains to be seen whether catalexis can be supported for Greek in general.

With this assumption, a judicious appeal to lexical representation, we can achieve three aims. First, we can eliminate /-tis/ as an apparent case of allomorphy, as we said, and second, we strongly support the basis constraint ranking of the whole paper -- for this new case, we need add nothing to the basic constraints already well established. And third, this analysis allows us to capture all rhythmic distributional similarities between deverbal agent nominals and denominal material adjectives.

Take first a form like *klef-tis*.

(26) Input: /klef-, -tisV/	FtBin	Parse 2	HdMax	Stem=PrWd	NonFin	HdDep
a. (klef)-(tísV)	*!				*	**
b. klef-(tísV)				*	*!	*
c. ☞ (kléf-ti)sV				*		*

This tableau can be summarised as follows. Form (26a) violates FtBin, and (26b-c) both violate Stem=PrWd. Because of FtBin » Stem=PrWd, the latter two candidates survive, and are submitted to NonFin, which chooses (26c) over (26b). In (26c) the apparent unstressed allomorph /-tis/ does not come from the lexicon (there is no such allomorph), but derives from the preference dictated by the dominant constraint FtBin.

Coming now to polysyllabic stems like *skupis-tis*, the same analysis picks out the correct candidate. It is by now easy to see why *skupis-tís* is the winner.

(27) Input: /skupis, -tisV/	FtBin	Parse 2	HdMax	Stem=PrWd	NonFin	HdDep
a. (skúpis)-tisV		*!				*
b. sku(pís-ti)sV				*!		*
c. ☞ (skupis)-(tísV)					*	**

In sum: since the suffix as well as the stem is already disyllabic, FtBin need not be violated while satisfying Stem=PrWd. Observe that (27c) with stress on /-tis/ is selected over (27a) by Parse2 - the defeated candidate has a sequence of unparsed syllables since the catalectic vowel projects its own empty syllable.

5. General discussion

We have shown that, as distinct from the listing of allomorphs and their environments, several types of allomorphy in Greek can be modelled in an explanatory way, using an OT model of selecting the 'prosodically-optimal allomorph'. We found evidence for some purely prosodic constraints familiar from the literature, i.e. FTBIN, PARSE2 and NONFIN, for the morpho-prosodic alignment constraint STEM=PRWD, and for the prosodic faithfulness constraints HDMAX (previously 'PARSE-FT') and HDDEP. Since our analysis used no language-specific constraints, it supports a fundamental assumption of OT, namely that language-specific grammars arise from the re-ranking of universal constraints.

The notion of prosodically-governed allomorphy itself of course requires more cross-linguistic study before solid typological results, of the kind that are now known for other areas of prosody-governed morphology (reduplication, word minimality, etc.) can be claimed. But we can already see the connections to the study of reduplication: in both cases the goal is to eliminate affix-specific prosodic statements in favor of the 'general' prosodic constraints. In the ideal case there will exist no field of 'prosodic morphology' since affix-specific requirements follow from the interaction of phonotactic constraints, morpho-prosodic alignment, and faithfulness constraints.

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