Greek Phonology

A contemporary perspective^{*}

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1. Overview

The present review of problems of Greek Phonology continues that in Malikouti-Drachman (1994), which continued itself to the theoretical framework of Autosegmental and Metrical Phonology and discussed problems of Modern Greek (MG) Phonology related to the Lexical and Post Lexical components of the language.

The main problems related to the Lexical Component discussed were the representation of segments and stress. It was pointed out that of the three dreams of Householder (1964), the voicing of stops had recently been given three different treatments. In the first, by Malikouti-Drachman & Drachman (1988/1992, 1990) under autosegmental underspecification and filling in of empty features, the voiced stop is treated as a contour prenasalised segment under onset. In the second, by Pagoni (1993 a,b) under government phonology it is treated as a bisegmental cluster under coda and onset, and in the third, by Arvaniti and Joseph (1993), the prenasalisation was reinterpreted — for some idiolects — as phonemic. On this topic two new proposals will be discussed.

As for the semivocalisation problem, Malikouti-Drachman & Drachman (1990) proposed a unified representation of the segments [i] and [j] as a high segment /I/ unspecified for consonantality/vocalicity, and receiving its proper consonantal/vocalic phonetic values from the syllabic node to which it is assigned. This problem is not further examined here. In contrast the affrication problem, which has not so far been discussed, finds a fresh treatment in Pagoni-Tetlow (1994a), to be discussed below.

For the representation of stress, I discussed both lexical and clitic stress. For lexical stress two approaches have been presented: a metrical one by Malikouti-

Drachman & Drachman (1980, 1989) and Papademetre (1983), and a morphological computational one by Touratzidis and Ralli (1992). An important feature of the analysis under Metrical Theory is the reduction of the then-current trisyllabicity (either as a rule or as a WFC) to a left-headed bound foot, that is a trochee, plus extrametricality of the last syllable. The advantage of this approach is that it explains clitic stressing as well as deviations from the Standard Modern Greek (SMG) pattern of verbal stressing in the dialects homogeneously. On the topic of lexical stress I merely note that a new and most interesting proposal has been made by Revithiadou (1999) under Optimality Theory (OT). This will unfortunately not be discussed here, for lack of space to do it proper justice.

The Post Lexical Component is mainly devoted to problems of prosodic phonology (Nespor & Vogel 1986). On the basis of Athenian Greek sandhi rules, the modularity problem is discussed under two approaches: Kaisse's (1977) proposal that syntactic information is needed for phonological rules is compared with Condoravdi's (1990) approach, in which syntactic information is mediated by a prosodic structure, so that the "piece-meal listing of syntactic environments" (Kaisse 1990) takes a unified formulation.

Concerning the prosodic constituents in Greek two problems arise. Whereas prosodic constituents such as Phonological Phrase, Intonational Phrase and Utterance are fully justified by Phonological rules in Nespor & Vogel (1986), two of their proposed constituents, the Clitic group and the Foot have been disputed. The clitic group has been disputed by Malikouti-Drachman and Drachman (1988/1992), Arvaniti (1991) & Prinz (1991). However, in a recent book (Nespor 1993/1999) the clitic group in Greek is still supported, though without discussion of the problems raised in the above critiques. The second constituent disputed — but only by Arvaniti (1992: 417) — is the foot. However, since *contra* arguments have already been offered (Malikouti-Drachman 1994) and since Arvaniti (1998) is in fact based on the foot, to account for a Cypriot game, I will not discuss such a claim further.

The final topic discussed is post-lexical rhythmic stress in Greek, two opposing views being presented. First, the view of Malikouti-Drachman & Drachman (1980) that slogan-chanting is based on the lexical stress but also on the formation of a post-lexical trochaic foot. Second, the views of Nespor & Vogel (1988) supporting universal status for a rhythmic component formalised on a grid. Arrhythmicities are repaired by language-specific strategies; e.g. in Greek, lapses are defined on the first level, on an unfooted sequence of unstressed syllables, and are avoided by beat addition. A counter proposal is given

in Arvaniti (1991, 1992), for whom Greek stressing is by syllable counting, through grouping regulated by the stressed syllables, ignoring foot and rhythm. However cf. the comment above concerning the foot constituent.

In the present article I confine myself to problems of MG Phonology, under Autosegmental Theory as well as under OT. I will discuss first some new proposals concerning problems of Lexical Phonology as discussed above: thus, problems not so far discussed, such as the affrication problem (cf. above) in Pagoni (1994a), or some new proposals concerning the status of voiced stops, as in the work of Viechnicky (1995) under Autosegmental Phonology, or Arvaniti (1999) under OT.

However, the larger part of this review will be devoted to the problem of syllabification in SMG, not discussed at all in my 1994 review. This section will be followed by one discussing applications of OT, which has lately been applied not only to the problem of nasal voicing, but also to syllabification, formation of hypocoristics, (first-language) acquisition of Onsets, and stress.

Although further applications under Opacity and the related Sympathy theory (McCarthy 1997) have also been made (Malikouti-Drachman, 2001), and disputed (Coutsougera & Fudge 2001), I will not refer to them further in this review.

2. Voiced stops under new theoretical approaches

2.1 An Autosegmental Approach

Earlier approaches to the problem of nasal + stop are mentioned in the Overview above, and discussed in Malikouti-Drachman (1994). There are also interesting attempts to account for the realisation-variants of nasal + stop in a sociolinguistic framework which, however, will not be discussed here.

Viechnicky (1995) constitutes a systematic and interesting approach to the problem of the voiced stops. Viechnicky (V) finds that “the phonology of a language provides a perfect example of a tension between the desire to define a formal grammar and the desire to incorporate all phenomena of the language, core and peripheral” (pg. 59). The Greek case of Nasal + Stop exemplifies this tension well, and this is what he sets out to explicate in the framework of Autosegmental Phonology.

V follows Goldsmith’s (1976) proposal for an autosegmental representation of phonological segments. This will allow him to assign the variety of the

phonetic realizations of the voiced stops to four different underlying representations, as shown below. He also accepts Goldsmith's view that contrastiveness forms a sort of cline from full to zero contrast in the grammar of a language, covering: a) contrastive segments; b) modest asymmetry cases; c) not yet integrated semi-contrast; d) just barely contrastive, and e) allophones in complementary distribution. This cline of contrastiveness seems to apply to the Greek data, and will justify the representations that Viechnicki proposes.

One further theoretical proposal is added, viz. that the range of phonetic variation may reflect variation in underlying forms and representation. This is supported by two cases in the literature. On the one hand by the proposal of Ito & Mester (1995) that, in Japanese phonology, the lexicon must be divided into two strata, the core and the periphery, where different constraints are at work, these relaxing on their way from core to periphery. The second case is the Turkish problem of disharmonic vowel harmony, where the solution in Clements & Sezer (1982) is to allow for enriched autosegmental representation in the lexicon.

With this theoretical armament, Viechnicki proposes the following analysis of the problem of stop voicing. First, phonetically voiced stops [b, d, g] form part of the phonetic inventory of M. Greek. The historical origin of these voiced stops from nasal + voiceless / voiced stops justifies the proposed phonological representation as /N + Cstop (voiceless)/, and is supported by alternations as well as by the spelling. However, apart from this historical origin, another source for the voiced stops in Greek is borrowing from other languages: e.g. Turkish *meydan* as in Gk. [meydáni], and Venetian Ital. *bagno* as in Gk. [báño]. What is interesting is that these later cases of loans are treated differently phonetically. Thus there is synchronic justification for splitting the Greek lexicon, just as in Japanese (cf. above), into core and periphery. The core will consist of the "native" words, with the historically derived voiced stops as N+stop, thus reducing the segment inventory by avoidance of the feature [voice] for stops. However in the case of borrowings there is a "large number" of words with voiced stops, and these belong to the periphery.

In relation to the "multitudinous" nature of the Greek data, there is variation in the reported facts, and this was confirmed by V's personal tests with Greek informants. His conclusion is that such variety cannot be handled as in Hamp (1962:641) or Newton (1972:93), viz. as a single monolithic representation /N+voiceless stop/. V thus adopts Householder's (1964) classification into the well-known four classes: 1) words with only voiced segments [b, d, g, dz] e.g. [adío], [karabína], 2) words with only [mp], etc., as [kantína], 3) words

where there is a tendency to prefer [mb, nd, ŋg, ndz] but [b, d, g, dz] also occur — the normal case, and 4) words in which [mb] etc. are normal, and [b] etc. are rare or non-occurrent, e.g. [zambón].

An adequate contemporary account of such data must explain the following: the curious and limited distribution of the voiced stops; the wide variation of the phonetic realisation of the segments discussed; and finally, why exactly these four classes — to the exclusion of others — exist in the language. V explains these points under two assumptions: first, that the feature [voice] is underlyingly distinctive in Greek even for stops, thus e.g. /t/, /d/, /n/, as confirmed by contrasts such as [tínos] : [dínos] and the wide distribution of the voiced stops. His second assumption is that Greek phonology may also profit from the possibility of autosegmental representations, not only — in his terminology — of singly-linked structures but also of multiply-linked alignment of features and skeletal slots. He uses the historical derivation of voiced stops to show that such representations may be illustrative for the phonological facts of Greek too. Thus the cluster [nd], etc. of Koine becomes a single multiply-linked segment in Modern Greek by deletion of a skeletal point and reanalysis. This reorganization of the grammar took place under the pressure of foreign words.

It is appropriate here to remark that Viechnicki is well informed theoretically, but seems to be unfamiliar with the literature on Greek phonology. In fact the monosegmental representation has already been proposed in the case of multiply-linked prenasalized stops (Malikouti-Drachman & Drachman 1988/1992, 1990), vs. a singly-linked structure (Pagoni-Tetlow 1993a), as well as for the multiply-linked structure of affricate /ts/ (Pagoni — Tetlow 1994a), and with especially profitable results in the representation of geminates as monosegmental in Cypriot (Malikouti-Drachman 1987). The same remark applies also below to Warburton's (1970) discussion of the representation of Householder's four classes.

Viechnicki proposes that the Greek lexicon, so far as the above-mentioned problems of voicing are concerned, has the following autosegmental representations.

Singly-linked structures for a nasal, e.g. éna, voiceless stops, e.g. poté, and voiced stops, e.g. adío. Singly linked structures also for sequences of nasal +singly-linked stop, e. g. kantína, mandáto, as in (a) below. These representations cover classes 1, 2, and 4 of Householder. However cases like [péde, peⁿde, pénde] will have a multiply linked representation, as in (b) below, corresponding to Householder's class 3:

At this point Viechnicki might well have compared (for the same spread of data) the analysis of Houholder’s four classes in Warburton (1970) in the theoretical framework of early Generative Phonology. Warburton discusses two possible phonological analysis. She rejects one which would eliminate a voiced stop phoneme /b/ etc. as “counterintuitive and not revealing the facts about these four classes”. In contrast the analysis she finally proposes aims to show that class 3 is the normal, and conforms to the regular rules of the language, whereas classes 1, 2 and 4 are the odd cases. Thus, she proposes the representation classes in (a) below, supplemented by the rules in (b):

- (2) a.

Class 1	Class 2	Class 3	Class 4
/b/	/mp/	/mp/	/mb/
- b. Rules

1. Stop → voiced / Nasal —
2. Nasal → zero / — voiced stop (optionally)

As the above comparison shows, Viechnicki’s and Warburton’s representations differ in only one feature: the multiply- linked structure for the “native” words. This is a structure available to Viechnicki — but not to Warburton — with the advance of Phonological theory from a linear representation of features to a non-linear one, where features are represented in different autosegmental tiers connected to the skeletal slots singly, multiply or not at all. What remains unaccounted for in Warburton’s proposal is the variation in the phonetic realization of the proposed representations. And the phonological explanation of this variation is exactly what Viechnicki offers as justification for his representational categories, especially for the multiply-linked structure of class 3, which will also account for dialect data. This multiply-linked structure is subject to autosegmental tension of the representation (Goldsmith 1983), which languages tend however to minimize over time by restructuring. Thus the phonetic variation in a word like [péⁿde] ~ [pénde] reflects on the one hand the multiply-linked structure of the first form, as in (a) below, and on the other the restructured representation to a singly-linked structure as in (b).

The same explanation holds for the alternation in words like [garðiakós] ~ [ⁿgarðiakós] with or without prenasalisation word-initially, or even with a full nasal [ŋgarðiakós] after a vowel-final prefix, whereas in words like [bíke] there is no trace of nasalization in any context. The variation is again due to different representations; the instability of a multiply-linked structure with possibility of restructuring in the first form, but a singly-linked structure without possible restructuring in the second.

The multiply-linked structure with possible reanalysis could also account for dialect variation. The reanalysis of such a structure could take the following forms, all of which are attested in the dialects:

Form (a) is a reanalysis by addition of a skeletal position and is attested in most Peloponnesian dialects where a word like *pénde* is pronounced as [pénde], [péⁿde], but not *[péde]. Form (b), resulting from the loss of the nasal element of the complex representation, is attested in Cretan with the realization [péde]. The form (c) with the second element lost is rather rare, though still attested in certain Cappadocian dialects. Cf. from Axos the form [kostonínos] for the name Kostandínos (Mavrochalividis & Kessisoglou 1960, 16 ff).

Viechnicki's article is characteristic of the theoretical approach of the most recent period of Generative Phonology, especially the autosegmental approach of Non-Linear Phonology. Variant phonetic facts are best accounted for by enrichment of the representations in the lexicon and modification of these representations by linking or delinking of association lines instead of phonological rules. As V himself points out, the advantage of such an approach is that "by enriching the representation system only slightly and in accordance with universal phenomena ... we enable ourselves to deal with all the surface forms of the language, not just the core ones" (pg. 68).

A different approach is seen in the next account of the voiced stop problem under Optimality Theory. Here variation is accounted for not by employing different representations, but by the direct evaluation of phonetic forms through constraints and their ranking.

2.2 Nasal Voiceless stop cluster in Optimality Theory

2.2.1 *Optimality Theory*

An important feature of the new theoretical approach of OT (Prince & Smolensky 1993) is the absence of processes that derive the proper output surface forms through a set of rules (in a feeding or bleeding order) involving intermediate stages of input. Instead, in OT, a set of constraints functions as a single simultaneous parallel filter system evaluating output forms.

There are three components in the Grammar: the *Lexicon*, consisting of representations of basic lexical (underlying) forms. These become the *Input* to the second component, the *Generator*, which generates every potential (surface) *Output* structure from a given input. These are submitted to the *Evaluator*, where the optimal — not necessarily the absolute best — output form is selected by filtering through a set of ranked constraints.

There are two types of constraints. The first type are Faithfulness constraints, which demand similarity between input from the *Lexicon* and surface output forms: The second type are the Markedness constraints, which refer only to the output and define its structural simplicity. They can be stated positively, e.g. VOICE ASSIMILATION, or negatively, as with the $*N\check{C}$ constraint (cf. 2.2.2 below). The Constraints are universal, but violable. Ranking between them defines their relative dominance, and their language specific application. This schema covers the absolute Universals plus Parametrisation of Generative Phonology.

2.2.2 *Constraints on nasal+voiceless stop in some Greek dialects*

In contrast to Ito, Mester & Padget (1995), who had proposed that Post Nasal Voicing is the result of the licencing of the redundant feature [voice] of the nasal, Pater (1996 & 1999) suggests that Post Nasal Voicing is one of the four strategies employed by different languages to avoid the offending sequence $*N\check{C}$. The other three universal strategies are: nasal deletion, denasalization and nasal substitution (by coalescence). These strategies are realised by domination of $*N\check{C}$ (which bars a sequence of Nasal +voiceless stop) over the corresponding Faithfulness constraints (see also Kager 1999: 78), thus:

(5) Post Nasal Voicing	(NT > ND): $*N\check{C} \gg$ IDENT-IO (obstruent voice),
Nasal loss	(NT > T): $*N\check{C} \gg$ MAXIMAL-IO,
Denasalization	(NT > TT): $*N\check{C} \gg$ IDENT-IO (nasal), and
Nasal substitution	(NT > N): $*N\check{C} \gg$ LINEARITY-IO.

Among the different languages exemplifying his proposal, data from Greek dialects are given as illustrating cases of the conspiracy of three of the above strategies, namely Post Nasal Voicing, Nasal Loss and Denasalization.

The conspiracy of the two first strategies — Post Nasal Voicing and Nasal Loss — is seen in the voicing of a stop followed by a vowel or a resonant as in (a) below but loss of the nasal before an obstruent cluster as in (b) (data from Newton 1972):

- (6) a. /pémp-o/, /ton# tópon/ > pémbo, ton dópon
- b. /e-pemp-s-a/, /ton# pséftin/ > épepsa, to pséftin

The constraints involved in these strategies are defined as follows:

- VOICE ASSIMILATION. Regressive voice assimilation between obstruents.
- *N_C. Contextual markedness, penalizing a sequence of nasal+voiceless obstruent.
- MAXIMAL-IO. Every segment in the input is represented in the output. This penalizes segment deletion.
- IDENTITY-IO [voice]. Correspondent obstruents are identically specified for voice. This penalizes changes in the voicing of obstruents.

Pater’s ranking of this constraints-conspiracy is: (X,Y = a tie between X and Y):
VOICE ASSIM., *N_C >> MAX-IO>> IDENT-IO (voice)

(7)

/mps/	VOICE ASSIM.,	*N _C >>	MAX-IO>>	IDENT-IO (voice)
mps		*		
ps			*	
mbz	*			*

These data are based on Newton (1972,114) and refer not to Standard Greek but e.g. to Cypriot, where nasal-loss is also found before a geminate: ton #ttempélin> to tempélin, the treatment of which, we note, demands a further constraint. Cf. below 3.2.2 for a proposal for a feature-linked structure configuration in both cases: a voiceless cluster and a geminate.

Arvaniti (1999, 389, Fn. 5) remarks that Pater, following Newton, wrongly assumes deletion of the Nasal and that the pattern presented by Newton (lápsi-sfiksi) is probably correct for Demotic Greek but not for learned Greek. It seems that both remarks may be questioned. The pattern lápsi – sfiksi is the dialect pattern vs. lámpsi – sfiksi of Standard Greek, the difference being not stylistic,

as Arvaniti assumes, but morphological. Cf. the forms: lámbo – élamp-sa but sfíngo – ésfík-sa. In the first form the nasal is part of the stem but in the second it is in fact the Present stem formative, as is seen in the aorist forms of both verbs: élampsa but ésfíksa.

Pater’s second conspiracy consists again in the voicing of voiceless stops — as the main avoidance strategy — in conjunction with denasalization of a word initial stop. Cf. Karpathos (Newton 1972): /tin#pórtan/ > tip pórtan, /tin#kórin/ > tik kórin. Two new constraints are needed for this data. The first is: IDENTITY-IO (nasal). This demands that a nasal in the input should have a correspondent nasal in the output (i.e. no denasalization, cf. (5) above). The second constraint must refer to the positional blocking, for which either positional faithfulness or paradigm uniformity can be invoked. Pater prefers the first alternative and proposes the constraint SPECIAL FAITH — which penalizes denasalisation in the context of article + noun. The ranking follows the conspiracy schema (6) above:

SPECIAL FAITH, *N_o >> IDENT-IO (nasal) >> IDENT-IO (voice)

The application word — internally is seen below in tableau (a) and denasalisation at a word-boundary in tableau (b):

(8) a.

/NT/	SPECIAL FAITH,	*N _o >>	IDENT-IO (nasal) >>	IDENT-IO (voice)
NT		*		
TT			*	
ND				*

b.

/N#T/	SPECIAL FAITH,	*N _o >>	IDENT-IO (nasal) >>	IDENT-IO (voice)
N#T		*		
T#T			*	
N#D	*			*

2.2.3 Constraints on nasal+voiceless stop in SMG

In Malikouti-Drachman (1994: 34) it was pointed out that, as it then seemed, the latest work of Arvaniti & Joseph (1993) solved at least one problem of the three dreams of Greek phonology, viz. that concerning the status of the nasal + voiced stop. As stated in their analysis, “there are sociolects where language-change has occurred. Prenasalisation has been reinterpreted as voice. It then seems that in some sociolects voiced stops have become phonemes distinct from voiceless stops”. However in Arvaniti & Joseph (2000: 132 fn.) the term “voiced stop”, rather than nasal+stop is used as “phonetically accurate”, without “any claims in this paper about the phonological status of surface voiced stops in Greek”. For this problem, Arvaniti (1999), which re-examines the status of the nasal+voiced stop in the framework of OT, is referred to.

Following Pater’s proposal, Arvaniti (1999) sets out to explain all surface realisations of the *NÇ clusters in Standard Greek through a set of constraints and their relative ranking. She accepts that the ND~D variation is not a matter of phonetic interpretation, but has phonological status in Greek, as justified by the stability of the environment of occurrence for the D-variant: word initially or after a liquid word medially, a context where the N-loss can be seen to be due to syllabification. She thus assigns the two variants to an /NT/ input so that both seem to result from a conspiracy of two different strategies for avoiding the offending phonotactic configuration *NÇ. That is, on the one hand we have the universally attested *NÇ constraint to avoid the offending cluster, ranked above the IDENT(voice) constraint, as seen above in Pater’s account of the Greek dialect data: NÇ >> IDENT(voice). And on the other hand we have fusion of /NT/ to an output D, an avoidance strategy not yet attested in other languages. Fusion, as a coalescence of two segments, violates the correspondence constraint of UNIFORMITY (McCarthy 1995:49), which prohibits “two or more input segments from sharing an output correspondent”, but honours the constraint MAX-IO (for the constraint see 2.2.2 above), whereby for Arvaniti the latter is “normally a high ranked constraint”. Arvaniti further attributes the distribution of the fused segment to syllabification; that is, the D variant occurs exclusively (a) in the Onset position word initially, e.g. *banána* and not **mbanána* or **panána*, and (b) word medially after a liquid as in *albuo*, *barbúni* and not **almburo* or **alpuro* (as shown in Pagoni 1993a). These are environments justifying the SONORITY constraint, by which complex onsets rise in sonority and complex codas fall in sonority. Now, whereas word-medially in cases like: *albuo* only the Onset position is available, due to the presence of a consonant in Coda, the variation between D and ND word

medially after a vowel is accounted for — at least preliminarily — by the constraint NoCODA in Greek. The alternative ranking of NoCODA and UNIFORMITY accounts for the word internal variation of ND~D. Cf. tableau (a) below for variant D, and (b) for variant ND:

(9) a.

/pén-te/	MAX >>	NoCODA >>	UNIFORMITY >>	*NÇ >>	IDENT (voice)
1. pén.de		*			*
2. pé.de			*		*
3. pé.te	*				

b.

/pén-te/	MAX >>	UNIFORMITY >>	NoCODA >>	*NÇ >>	IDENT (voice)
1. pén.de			*		*
2. pé.ne	*				
3. pé.de		*			*

Two remarks are relevant. First, both the forms pé.te in tableau (a) and pé.ne in (b) are rejected as violating the higher MAX-IO constraint. Notice that in Pater’s typology of *NÇ effects, whereas a form like pé.te with n-loss is obtained by MAX-IO violation, a form like pé.ne illustrates fusion, violating not MAX-IO but LINEARITY-IO, which guarantees the order of input segments. Cf. his example from Indonesian: /məŋ+pilih/ > məmilich “to choose, to vote”, where the nasal survives in coalescence with the place stop features, whereas the manner feature of the stop is lost. In a way this constraint corresponds to Mc Carthy’s UNIFORMITY, which Arvaniti accepts in her analysis of the fusion of ND > D. Cf. further the discussion in Kager (1999:63, fn 4) as well as in Pater (1999:31). However, apart from whether one or two different constraints are needed, it will be interesting to see what exactly causes the coalesced segments /NT/ to surface as a nasal in Indonesia and other languages, but as a voiced stop in Greek.

The second remark refers to the constraint NoCODA in Greek. Of course, as Arvaniti admits, this proposal is a preliminary answer (pg. 386) to the variation problem, and both NoCODA and SONORITY need further refinement and investigation (pg. 389, fn. 2 & 3). Notice that in fact only CODA CONDITIONS

hold for Greek, as shown in Drachman & Malikouti-Drachman (1997) (see further under 3.5.2). This is clearly shown by Arvaniti's own analysis of e.g. [barbúni] (not * [mbarmbúni]), where only the existence of a CODA excludes the variant ND word medially. Such data demand at least a liquid in CODA position. Cf. further forms like: kompsós, lámpsis, discussed below. What is the syllabification of the nasal, if it is not in the coda position? Extending the coda condition optionally to a nasal homorganic with a following stop — as in other languages too — accounts for the variant ND for speakers including the nasal coda condition in their Grammar, as against D for those who do not. The variation may then be due not to the different ranking of two constraints but to the different content of the conditions on CODA formation. So it seems that the two syllabification constraints — SONORITY which she proposes, and CODA COND instead of her NOCODA — account for the distribution of the two variants. Then, the faithfulness violation in the case of the variant D may be not violation of MAX-IO, but loss of features such as Nasality.

A further question might be how to reconcile the present analysis of D and ND variants word initially and medially after a vowel, with the sociolinguistic findings of Arvaniti & Joseph (2000). They found occurrences of ND — although very limited — word initially, and a preference for the D-variant medially, especially for the younger generation.

The second case discussed by Arvaniti is the blocking of post-nasal voicing of a voiceless obstruent in a NCC sequence cf. [la^(m)brós] but [kompsós]. Here she follows Pater's proposal of a higher ranked VOICE ASSIMILATION constraint, by which Post Nasal Voicing as an avoidance strategy is blocked, as shown in the Greek dialect data above. However since for Standard Greek this blocking applies root internally, that is in non-derived words, whereas it is optional in derived words (cf. [simsifizo] ~ [si^mbifizo] ~ [sibzifizo]), she properly confines the constraint to the ROOT domain. Ranking this specific domain-constraint (ROOT VOICE ASSIMILATION) higher than *NÇ accounts for the proper output of voicing of the cluster in the remaining cases of the non specific environment of ROOT, whereas the general VOICE ASSIMILATION is ranked lower (see also Pater (1999: 324). However for speakers who never voice NCC even in derived environments, the domain of OBSTRUENT VOICING is irrelevant, so that *NÇ voicing does not apply at all. Thus, notice that in the present case too the variants may well be the output, not of different ranking — as Arvaniti suggests — but of the specification of the constraint VOICE ASSIM. as ROOT VOICE ASSIM. or not (cf. also the comment on the Coda constraint above). Here some refinement would help. Confining ourselves to some examples: for the

affricates, why *ítsa* but *vándzos*; and in the domain of the article, why *ti* (m) *bzifo* and not **tim psífo*, as in [simsifizo] ~ [si(m)bzifizo] or proclitic *tom psifizo* ~ *to(m) bzifizo*?

In the case of the asymmetrical treatment of nasal voicing for pre- and post-clitics: [tom beðjón tus] ~ [tobeðjón tus] but not **[tom beðjón dus]* ~ [tobeðjó-dus], Arvaniti follows Pater's proposal for a SPECIAL FAITH constraint (as defined above), demanding identical voicing for correspondent segments. Notice, however, that such a constraint does not hold for cases like: *plíndo*, *kándo*, and that it may equally be replaced by an Output-to-Output constraint, by which paradigmatic uniformity is achieved.

Overall this is an interesting OT analysis of one of Householder's "three dreams of Greek phonology". It accounts in a unified and principled way for the different surface manifestations of the /NT/ cluster in SMG.

3. Syllable structure in Standard Modern Greek

3.1 Introduction

The necessity for the syllable as a primitive in phonological theory is justified by its use in phonological rules, phonotactic constraints, metrical structure and prosodic licensing, that is, the fact that only prosodically aligned segments can be realised on the surface. However in SPE under Generative Phonology the syllable is absent; instead, the feature [+/- syllabic] is employed. The syllable itself was introduced only after the main changes under Autosegmental Phonology occurred. The new theoretical approach, in which the linear representations were replaced by autosegmentalisation on different tiers, all connected by a central tier, the timing tier or skeleton, made it possible to represent syllabic structure on different tiers. However, there is no unanimity in the literature so far as either the inner structure of the syllable and its constituents, or the assignment of the relevant segments to the proper syllabic positions is concerned. This will become clear in what follows, where different approaches to SMG syllabification are discussed.

Syllabic structure in MG is an especially favoured topic, and almost all recent theories have been applied to its study, although not with unanimous results. There are two crucial points in Greek syllabification. First, onset-formation, that is the assignment or not of a cluster of consonants to an onset constituent and under what theoretical conditions; and second (and most

important), the problem of coda formation. I take the second point first.

The earlier literature is largely dominated by the view that one of the historical changes from Classical Greek to Modern Greek is the change from a closed syllable to an open syllable language. See e.g. the discussion in Setatos (1987:189), as well as his analysis of coda in Setatos (1974:21), where even liquid resonants *r/l* are assigned not to coda but to onset: cf. *a.lma*, *δέ.rma*. This tendency of Greek to become an open syllable language is signalled by the changes that occurred during its historical development. An example of this change is the weakening of the nasal in the Coda position both word medially and word finally: cf. word medially the assimilations to a spirant as gemination in dialects: e.g. Cypriot *nímfi* > *níffi*, and the nasal-loss as in acc. sg. *tin iméra*, or support with an epenthetic vowel word final as in *aftón* > *aftóne*. The same change in coda status is shown in the degemination of geminates, which implies loss of coda and thus loss of heavy syllables as in *ál.los* > *á.los*. On the other hand the tendency of Greek to become a CV language is seen in the loss of word initial vowels: *iméra* > *méra*, or the semivocalisation of the vowel /i/ in the sequence *iV* > *yV*: *iatrós* > *yatrós*, *xorío* > *xoryó* etc.

Comparing the synchronic analyses of coda formation in SMG, we see that the prevailing view is that the Coda conditions for word final position are almost as in (Classical) Attic Greek. That is a [+coronal] *n*, *s* is in general accepted. The liquid *r* is disputed. However for most researchers, only the resonants *l/r* are allowed word medially. The nasal is partly accepted. But obstruents are generally excluded, appeal to them being made only as a last resort in the case of medial clusters of three or four consonants (cf. Kappa 1995). The dogma that Greek is a coda-less language dominates the first attempts at syllabification even in recent theoretical frameworks. A characteristic example of this is Malikouti-Drachman (1984), whose analysis of SMG follows Steriade's theoretical approach to syllabification. However, in order to respect the open syllable hypothesis, she joins the rule-linked obstruents — a prerequisite in Steriade's analysis for obstruents to be assigned in coda position — not to the coda but to the onset node, by adjunction. But this violates the notion of extrasyllabicity, which by definition applies only to word-edges (cf. also below in 3.2.1). An opposite attitude to this general view of No CODA in SMG is taken in later work of Malikouti-Drachman & Drachman (1990), Drachman & Malikouti-Drachman (1997) and Karzi (2000), where even non-strident obstruents are permissible in word medial codas.

A consequence of the open syllable hypothesis is the problem of syllabification of medial clusters under the one available syllabic constituent of onset. This

leads to a non-homogeneous description of the onset structure in the Greek literature. The following approaches may be mentioned: 1) Application of the Sonority principle and accommodation of antisonority clusters as extrasyllabic, even in medial position (Malikouti-Drachman 1984 for SMG); 2) Onset structure by X-bar, which provides three onset subconstituents accommodated under Sonority or Strength (Drachman 1990, Malikouti-Drachman & Drachman 1990, Kappa 1995); 3) Government theory, involving a consonant as onset of an empty vowel (Pagoni-Tetlow 1996); 4) Maximal Onset principle (Kappa 1997), with no Sonority (Kappa 2001); and 5) Consonants as syllables, by violation of the peak constraint (Karzi 2000).

A complete analysis of the different theoretical approaches to SMG syllabification follows, according to theoretical viewpoint.

3.2 Hierarchical Syllable Structure

3.2.1 *Syllables in SMG*

Malikouti-Drachman (1984) discusses the syllabic structure of MG under the theory proposed by Steriade (1982). Her aim is to define eventual parameter-changes between Attic, as described in Steriade's work, and MG. Steriade's approach supports the hierarchical structuring of the subcomponents of the syllabic node into two subconstituents: Onset and Rime, with further subdivision of Rime into Nucleus+coda. Thus: $_{\text{Syll}} [\text{Onset } _{\text{Rime}} [\text{Nucleus Coda}]]$.

The assignment of segments to their proper syllabic nodes is controlled by the Principle of Sonority, which defines as an optimal hierarchical distribution of segments an "ascending" Sonority from Onset to Nucleus and a "descending" one from Nucleus to Coda. However, Steriade proposes parametrization of the universal sonority principle by permissible parametric features, such as [voice], as in Attic (cf. below), or [place] as in Mycenaean or Sanskrit. A minimal Sonority distance (MSD) between tautosyllabic consonants is also required. Consonants not conforming to Sonority may be assigned as extra-syllabic to the syllabic node itself, as long as they are word initial, otherwise they remain unsyllabified (as stray consonants) and are thus lost.

Steriade's analysis of the syllabic structure in Attic showed that its Sonority scale is parametrized by the feature [voice], thus ptk, bdg, s, z, mn, lr. The required Minimal Sonority Distance for tautosyllabicity (MSD) is defined at 4. Consonants allowed in coda position word finally are constrained to resonant l/r, nasal n and strident s. However, in coda position word medially, apart from those in final codas, obstruent consonants are also allowed, provided they are

linked by rule to a following onset — a constraint attested from other languages too (e.g. Japanese, Ito 1986). This condition means that consonants undergoing processes such as assimilation or dissimilation are heterosyllabic.

To define the formation of a complex Onset in SMG, Malikouti-Drachman follows Steriade, and notices that non-strident obstruents show voice assimilation if a consonant of lower sonority than liquid follows: cf. kléo – γλίφο, kréas – γράφο, kními – γνόμι – χnúδι with no trace of assimilation of the obstruent. However, zmínos-ozmí but *sm, ptísi, ftoxós but *vt, vdéla but *fð, all with assimilation and no possibility of the voice distinction surfacing. Thus she sets up a Sonority scale with the feature [voice] as a parameter, grouping stops and non-strident continuants together. The formation of a complex onset is determined by an MSD of 4. Thus:

$$(10) \quad \begin{array}{cccccc} \text{P/F-V-s-z-N} & (\text{n/m}) & \text{-L} & (\text{l/r}) & & \\ 1 & 2 & 3 & 4 & 5 & 6 \end{array} \quad \text{MSD}=4$$

The above conditions on onset formation allow a complex onset of maximally two consonants, which satisfy the required MSD, cf. kláma – γράμα, krónos – xrónos, pnoí – kními etc. Initial consonants violating the sonority constraint or the two-consonant complex-onset constraint are assigned syllabic status by the convention of extrasyllabicity, e.g. f.to.xós ~ p.to.xós, x.tí.pos, s.tra.tós.

Thus there seems to be no difference between Attic and MG onset formation. Comparing the changes in the consonantal system for the two stages of the language, this seems to be a “surprising outcome” (p.182), which the author attributes, apart from phonological factors, to the restoring influence of the Higher style (Katharevusa) “seen in the reintroduction of both lexical items with older clusters, and the blocking of Demotic morphophonemic rules” (cf.182).

In contrast, the formation of Codas seems to constitute a clear difference between Attic and SMG. Word finally, leaving out Katharevousa forms and loans, only n and s are found as codas. The change of word-final coda structure from Attic to M.Greek is confirmed by the vocalic epenthesis seen in the case of final n in: pézun~pézune, as also in the lexical item eks > éksi. Morphological restructuring of the consonantal noun class-(C)C# with vocalic epenthesis could also be attributed to coda-change — and not simply to morphological analogy, as in forms like pínaks > pínakas, rítor > rítoras.

The permitted word-internal codas are the liquids. Obstruents, as well as nasals, show assimilation processes. However despite the fact that they are thus linked by rule, they are not assigned to internal coda, as Steriade holds for Attic,

but as extrasyllabic to the word medial onset node, in order to respect the open syllable hypothesis. Nasals are assigned as codas in their own right only in the higher style of Katharevusa, and not in the lower style of Demotic: cf. oksínθike ~ oksíθike. The variants of N+Cvoiceless stop as NCvoiceless~ NCvoiced: simpípti ~ simbípti, are also seen as due to different styles of syllabification (on this problem see also Sec. 2).

3.2.2 Syllables in Cypriot

Malikouti-Drachman (1987) refers to syllabic structure to account for the lexical representation of geminates as monosegmental geminates in the Cypriot dialect. In addition, further phonological phenomena are explained, e.g. loss of a nasal before a geminate: cf. ton ttempélin > to ttempélin, paralleling nasal loss before a cluster: cf. ton pséftin > to pséftin, which she connects with syllabification, since both are similarly represented by two skeletal slots in the syllabic tier. On the other hand she contrasts the parallel behavior of this monosegmental geminate with single consonants in the case of palatalisation as due to their parallel representation as one melody in the melodic tier. Cf. /lákkos/ > lák'k'í > láčči and /sendúkin/ > sendúčin; but /axnIá/ > axn'á, not ax'n'á (data in Newton 1972: 149–150).

In this analysis the following parametric differences from SMG-syllabification are found: the Sonority scale for Cypriot is based on manner of articulation — i.e. stops are grouped separately from continuants — and place of articulation — dentals are stronger than labials and velars (cf. also Steriade on e.g. Mycenaean). The required Minimal Sonority Distance (MSD) is set to 5. Cf.

- (11) p k (č) - t - f x v γ - θ δ s z (šž) - m - n - rl. MSD = 5
 1 2 3 4 5 6 7

This proposal constrains complex onsets to clusters such as: stop +l/r: pró.tos, kló.nos, trí.tos, and labial/velar stop +nasal: pnás.so, kni.zín, which do not undergo assimilation. According to the assumption Malikouti-Drachman follows, all other consonants must undergo a process with a following onset in order to be syllabified. These linked segments are assigned as extrasyllabic to an onset word initially and to a coda word medially, cf. f.lé.a ~ v.lé.a, θ.rum.bín ~ δ.rum.bín, as well as rá.vo but ráf.tis with voice assimilation. The same voice assimilation is seen in the case of a nasal before a permissible onset, as in /láNpo/ > lám.bo, lam.brós, whereas if a non-permissible onset follows, the nasal as non-linked by a process stays unsyllabified and is lost, cf. /láNpsi/ > lápsi. Notice that we may interpret this case as a nasal before a cluster linked by

common features through the voice assimilation rule, a configuration parallel to that of a geminate. For interpretation of this nasal-loss in OT as due to the dominance of a higher ranked Constraint OBSTRUENT VOICE cf. above (2.2.2).

What is interesting here is that first heterosyllabic consonants are defined as extrasyllabic if word initial — as in SMG — but (in contrast to SMG), are assigned to coda and onset if word medial, as in the case of geminates. This different assignment of heterosyllabic consonants in Cypriot and SMG may of course be due to differing inventories — the fact that there are geminates in Cypriot but not in SMG. Compare the relevant arguments for closed syllables in geminating dialects in contrast to the open ones of common Greek in e.g. Seiler (1958). However it also reflects the belief, mentioned above, that SMG is an open syllable language.

Second, on Sonority as a principle of syllabification. Different proposals have been made to parametrise this principle. Apart from those mentioned above, compare also the different Sonority scale in Papademetre & Margariti-Ronga (1983). In their article, deviations from the Sonority principle especially in the Northern Greek dialects but also in SMG are discussed. It is then not surprising that Morelli (1998) finally gives up Sonority together. Her proposal is adopted in Kappa (2001) in an account of onset formation in the Cretan dialect.

A third point is the derivation implied in this model of syllabification. Syllabification is carried out in stages, which presuppose prior application of phonological rules, as in the linking processes for anti-sonorous segments. This derivational approach is avoided in the model of syllabification to be discussed next.

3.3 X- Bar Theory

3.3.1 *Introduction*

Another model exploited in the discussion of Greek syllabification is the X-bar model of syllabification, as discussed in Michaels (1988, based on Levin 1985) and further expanded to onset structure in Drachman (1990) and to coda in Kappa (1995). The model is further applied to Greek by Drachman (1990), Malikouti-Drachman & Drachman (1990), and Kappa (1995). I expand first its architecture.

In Michaels' model (1988:208) "syllables are formed by an X-bar projection of vowels, which licences consonant positions to the left and right. These positions are the coda or complement of the vowel under V' (or rhyme) and the onset or specifier to the rhyme under V'' (or syllable)". Both structure and

terminology obviously signal the parallel with syntactic structure. The main aim of the model is to avoid feature changing rules: missing features are filled in by present ones. A further consequence is that segments are interpreted only in hierarchical syllable constituents (Michaels 1988: 209). Michaels' syllable model is:

$$\text{Syll}'' \text{ [Spec-Syll' Syll' [S}^{\circ}\text{ Complement] }$$

3.3.2 *Expansion of X-Bar Onset*

Drachman (1990) — conceptually indebted to Michaels for the parallel with syntactic constituents — proposes a principled further expansion, viz. of the constituent Onset, to be generalized to “Consonant”. As in Michaels, the expanded model allows for only one element per position. However the expanded Onset now allows three consonants under its three subconstituents, that is Specifier [Spec-Cons], Head [Head-Cons] and Complement [Compl-Cons], only the Head being obligatorily filled. Thus we have:

$$\text{Onset}'' \text{ [Spec-Onset' Onset' [O}^{\circ}\text{ Complement] }$$

Concomitant are the notions Sonority — missing from Michaels' model — and Government, whereby the Head-to-Complement relation is government to the right and the Spec-to-Head relation is left-oriented phonological agreement, parallel to government in syntax (cf. 3.4 below).

The onset expansion is tested on the syllabic structure of word initial consonant clusters in SMG. The accommodation of the three consonants under onset is obtained through Sonority and further conditions. Sonority governs the relation between Head and Complement, according to the postulate that “Heads demand more sonorant Complements”. The proposed Sonority scale is thus:

$$\text{Stop} < \text{Fricative} < \text{Resonant} < \text{Semivowel} < \text{Vowel}$$

On the other hand the assignment to Spec is done by the special condition: Spec-onset may contain only a fricative

Under these conditions Drachman explores the distribution of consonants in word- initial clusters in Greek in order to “reinterpret the classical distinction between accidental gap vs. systematic gap in distribution” (p.113).

Thus under onset, Sonority allows not only stop + resonant (e.g. pr, pl) as Head and Complement, but also other clusters with initial stop, such as ps, pn. For ts Drachman points out indications for an affricate — e.g. the non-occurrence of ts at a morpheme boundary in contrast to ps and ks clusters (cf.

Housholder's 1964 argument) — but still assigns it as a cluster to the Head – Complement position, on the ground that a *tsr cluster is not attested. This then is a systematic gap, explained if the cluster analysis of ts is adopted.

Coming now to the Spec-Head clusters; sp, spr are easily accommodated, under the fricative condition on Spec. For the same reason the non-occurring cluster *psr is a systematic gap, since this cluster cannot stand under onset structure. On the other hand the non-occurrence of the clusters *θt and *ftr/*xtr must, despite the initial spirant permissible under Spec, constitute accidental gaps, as also indicated by the occurrence of ftr/xtr word medially: rá.ftra, rí.xtra. However, notice that the exclusion of *θt cannot be an accidental gap, but rather the systematic exclusion of a coronal articulation (cf. Kappa, 3.3.4 below).

More problematic is the accommodation of the clusters pt/kt, not subject either to Sonority or to the Spec condition. Based on the alternating cases pt~ft : kt~xt, Drachman assumes stylistic variation between the higher (Katharevusa) pt/kt and lower (Demotic) ft/xt. “Demotic” forms with an initial continuant are accommodated under Spec-Onset. “Katharevusa” forms may have the same structure, assuming a more permissive condition for Spec-Onset, retained from Classical Greek. This is an interesting interpretation of a sound-change: [stop+stop] > [continuant+stop] “as change in peripheral conditions on syllables” (p.121). Of course, non-alternating forms in pt/kt- e.g. ptísi- must be lexically marked. Finally it is conceded that the non-occurrence of *tp/*tk does not have a constituency-based solution.

Among the sound-changes in peripheral syllable conditions, Drachman includes also historical changes in the word-final coda position in SMG. He does not discuss codas word medially; however he defines word-final codas as [+ Coronal], ([s,n,l,r]) under the following conditions: (i) [+ coronal], (ii) if [– Voi], then [+Cont], (iii) if [+ Voi], then [Resonant].

3.3.3 *Processes in X-bar Theory*

Malikouti-Drachman & Drachman (AMD & D) (1990) explore Drachman's 1990 proposal that “part of the notion sound change” is the result of syllabification, i.e. change in conditions on syllabification. The aim of their analysis is to abandon rules and explain synchronic distribution and historical changes through syllabic structure and underspecification. To this end, they discuss in detail phonological phenomena of dissimilation and assimilation. In their analysis the domain of syllabification examined is constrained to the combination of morphemes inside words. They follow Drachman's model of X-Bar

theory with the following modification. The accommodation of the consonants in the relevant constituents is determined not by Sonority as in Drachman (1990), but by the phonological strength of the segments involved on a scale in which the relative values are in a way the opposite of those of Sonority. Thus: *t, p, k – f/v, θ/ð, x/ɣ, s/z – m,n – l,r – ɣ/i* (strong-to-weak).

The notion of the Head governing Left-to-Spec and Right-to-Complement presupposes that in a cluster the Head must be the strongest consonant in the strength hierarchy, whereas the other two consonants — Complement C(onsonant) as well as the Spec C(onsonant) — must be weaker. Two further constraints follow, these determining the assignment of the segments to their proper onset subconstituents; (i) Spec-onset may contain only a fricative (see Drachman 1990), and (ii) consonants of the same manner of articulation must be heterosyllabic, e.g. *ptísi, ktísi, fθónos, afθonía*. As in Drachman (1990) they point out that by the first constraint the problem of antisonority clusters is avoided, thus making extrasyllabicity unnecessary (contra Malikouti-Drachman 1984). Thus they allow for a three member cluster: of continuant+stop+R: *spró.xno, stro.ʃi* and even *a.spros, ká.stro*; or a two member cluster of continuant + stop: *spá.o, ftá.no* as also *a.spí.ða, a.sta.kós*. The antisonorous first element is assigned to Spec, the second (as the strongest) to the Head, and the third — if present — as weaker, to the Complement.

The second constraint aims to account for cases of (a) two stops, or (b) two continuants — with or without alternation: (a) *ptísi, plektó ~ plectó* (b) *fθóngos, fθáno~ftáno*, which cannot be accommodated in the architecture of the proposed onset. In Drachman (1990) these cases were seen as stylistic variants and assigned to Spec under relaxation of the Spec condition demanding a continuant. In the present work two alternative proposals are made for the two-stop cluster: either assignment to coda position, or formation of a new syllable with an empty inter-syllabic nucleus. The first proposal signals a change in the hypothesis about coda-structure, the second echoes the syllabic theory of Kaye, Lowenstam, & Vergnaud (1990) and others (see 3.4 below). However notice that although the proposal for independent onsets may hold for the non-alternating cases, it leaves the cases of alternation unexplained.

According to the authors, setting aside the antisonority problem, the proposed onset structure, with left- and right-Government of the Head – Consonant, accounts in a principled way for cases of assimilation and dissimilation without recourse to rules. In their analysis such processes consist in filling in empty features under underspecification; to account for these processes they appeal on the one hand to the constituents of the syllabic structure they adopt,

and on the other to a lexicon representation with underspecification of features. As an example illustrating not only the merging of features through assimilation but also the merging of the skeletal slots of the segments involved, AMD & D give the case of palatalisation. Relevant examples are (a) pu.lí – pu.l'á but (b) x'é.ri – x'é.rja. As the syllabification of these forms indicates, the result of the palatalisation of the (a) form are two segments with one skeletal slot instead of the two segments and two skeletal slots seen in the (b) form, where r-palatalisation is excluded. Thus:

A clear indication of this different output is seen in the syllabification of forms where more consonants are involved, cf. múskli – plural (a) múskl'a vs. mistrí – plural (b) mistryá~ (c) mistriá. The different phonetics result from the different syllabifications. The plural form of (a) muskl'a can easily be accommodated under the constituents of the X-Bar Onset projection, under the theoretical assumption that palatalisation means merger of not only features but also skeletal slots. Thus only three consonants with three skeletal slots have to be accommodated in the three available positions: Spec, Head, Complement: (cf. a) mú.sk'l' (a). In contrast, in the plural form (b) mi.stryá only the three consonants-str- can be accommodated under the three constituents of onset, but not the semivowel. This obligatorily either shares the syllabic position of nucleus with the following vowel, forming a rising diphthong, cf. (b) below mi.stryá, or it takes a nucleus position itself and vocalises, as in (c) mi.stri.á:

3.3.4 Clusters under X-Bar Theory

Kappa (1995) adopts the X-Bar model described above, in comparing the syllabic structure of German and SMG (for Greek see also Kappa 1996). However, assuming that the two “consonant projections” (Onset and Comple-

ment) have a parallel structure, she proposes a further modification: an expansion of the complement constituent parallel to but the mirror-image of Drachman's onset constituent, in order to account for the large number of final consonants in German (1995:64). With the expansion of onset and complement, tautosyllabic consonants may now include up to six members: three under onset and the equal number — although in reverse strength — under complement. However, since this complement expansion is irrelevant to Greek I will ignore it here. Instead I will confine myself to the SMG analysis and the differences from the analyses of Drachman (1990) and Malikouti-Drachman & Drachman (1990) mentioned above.

Kappa's analysis is a thorough treatment of the distribution of the surface obstruent clusters and their assignment to the proper onset subconstituent. For the coda formation word finally she follows Drachman (1990): (i) it consists of [Coronal], (ii) if voiceless, then [+continuant], (iii) if voiced, then [+resonant].

Thus the segments allowed are: r,n,s. For coda formation word medially, the conditions are (pg.136) (i) [Coronal], (ii) if voiced, then resonant.

Thus the segments allowed are l,r. The assignment of segments in Onset is controlled by a strength scale. As in Malikouti-Drachman & Drachman (1990) Kappa accepts a strength scale with the reverse values of the Malikouti-Drachman (1984) sonority scale, with the necessary separation of fricatives from the (strongest) stops. The voice distinction remains a parameter, though only for the stridents. Thus (pg.137):

Vowels – Liquids – Nasals – z – s – Fricatives – Stops (Weak → to strong)

Apart from the two constraints mentioned above (Malikouti-Drachman & Drachman 1990), some further constraints on Onset formation are proposed. First, the D(istinctive)F(eature) of place of articulation can be projected only once in the Onset projection (cf. Goldsmith 1990). This constraint is restricted to word-initial position and accounts for the absence of sequences such as: *tl,*dl,*tn,*sn,*sl,*pm,*fm,*vm. Word medially the constraint is suspended, and these medial clusters are thus assigned to the Onset domain, cf. fá.tni, a.tlas, e.fní.ði.a, é.vnia, va.θmós (p.149).

The second constraint refers to [voice] agreement: Spec-Onset and Head-Onset must agree in [voice], otherwise they are heterosyllabic (p 153).

Special care is given to some problems of biconsonantal and triconsonantal clusters which, as we will see, undergo different treatments depending on the theoretical approach. Two-member clusters are easily accommodated in the

X-Bar schema as long as the first consonant is a stop and the second a continuant, as for example in the case of *ps/ks*. The stop is assigned to the Head and the *s* to its Complement in all analyses under X-Bar. Contrast the analysis of Pagoni-Tetlow (3.4.4 below), where the first member is an onset to a cold vowel, and that of Drachman & Malikouti-Drachman (3.5.2 below) where they are heterosyllabic. They are also heterosyllabic in Malikouti-Drachman (1984), since their distance on the sonority scale is smaller than the accepted MSD 4. More problematic are cases of two stops as in *pt/kt* or even two stops +liquid: *ptr/kpl* e.g. *διόπτρα*, *έκπλiksi*.

As mentioned above, the clusters *pt*, *kt* can occur either as alternants to a continuant + stop: *xtíma* ~ *ktíma*, *ftoxós* ~ *ptoxós*, or not: *ptísi*, *ktísi*. In X-Bar theory the syllabification of these clusters with two stops needs a special mechanism and signals a change in syllabification. For Drachman (1990) these are syllabified as Spec-C and Onset-Head under a relaxation of the Spec condition for a continuant. Kappa (1995) follows the same solution. In this way her proposal that only resonants *l/r* can occur in coda — in accord with the view that MG is an open syllable language — is saved. The same view of the coda construction is also found in later work of Kappa (cf. 3.5.1 below).

However Malikouti-Drachman & Drachman (1990) assume that these clusters could be assigned to two different onsets followed by an empty vowel, or possibly assigned to a coda and onset by relaxing the constraint on coda formation, a proposal finding support in their later work.

Pagoni-Tetlow (1993a), on her part, analyses these clusters, as also *ps/ks* above, as onsets followed by a cold (empty) vowel. Kappa's objection to this analysis is that the alternant with a continuant remains unexplained (pg.152). In contrast, this alternation is explained in the framework of X-bar by underspecification of the feature [continuant] for the relevant alternating segments: *p* ~ *f*, *k* ~ *x*, as in Malikouti-Drachman & Drachman (1990). But notice that Kappa's objection to Pagoni-Tetlow's analysis concerns only the alternating cases of *kt* ~ *xt*, *pt* ~ *ft* and not the non-alternating ones. In Pagoni-Tetlow, the continuant alternants are accounted for by their being specified as such in the lexicon.

As a general conclusion on the X-Bar Theory model we note that, although it was never widely adopted, its application to SMG constituted an advantage in the analysis of the syllabification of this language. Thus:

1. By the architecture of the onset construction as Spec-C, Head-C, and Complement-C and the special conditions on the assignment of the segments to their proper constituents, the antisonority problem was solved theory-

internally without requiring an additional mechanism. Further, the view that MG became an open syllable language is supported, since offending obstruents — such as clusters of continuant + stop: *ftinó*, *xtípos*, of two stops: *ptisi*, *ktísi*, or of two continuant. *áftonos*, *móxthos* — can now be assigned to the Spec constituent either in their own right of continuancy or by relaxation of the Spec condition requiring a continuant. However, another possibility is indicated, that is of relaxing not the Spec condition but the coda condition, thus including obstruents in the coda position. For both alternatives the relaxation is due to the influence of a higher style (Katharevousa).

2. Phonological operations are obtained not by phonological rules but by filling in features underspecified in the lexicon in collaboration with syllabic structure. Thus the analysis makes use of the recent developments in Autosegmental Phonology.

3.4 Government Phonology

3.4.1 *Introduction*

In her PhD Thesis, Pagoni (1993a) sets out to account for the phonological variation of nasal+oral stop in strictly adjacent syllabic positions in a variety of syllabic structures. She further investigates the syllabic structure of the clusters *ts*, *ps/ks*, *pt/kt*, *pn/kn*. The same topics are separately discussed in later articles of hers, thus the prenasalized stops in Pagoni-Tetlow (1993b), the status of *ts* in Pagoni-Tetlow (1994a), the *ps/ks* cluster in Pagoni-Tetlow (1996), the *pt/kt* cluster in Pagoni-Tetlow (1998), and the *pn/kn* cluster in Pagoni-Tetlow (1997a). The clusters *ps/ks*, *pt/kt*, *pn/kn* as a whole are finally discussed in Pagoni-Tetlow (1997b). Pagoni follows the framework of Government Phonology, as proposed by Kaye, Lowenstamm and Vergnaud (KLV) (1990), Harris (1990) and others. The main innovations of this theory concern syllabic structure and segmental structure. I outline briefly syllabic structure, as more relevant to the present article (see also Pagoni 1993a:52 ff).

3.4.2 *Government Phonology*

The three tiers of Autosegmental Phonology — the segmental tier, the skeletal tier and the “syllabic” tier — are also basic to Government phonology. However, the traditional Syllable node itself is missing. Leaving aside the segmental tier, the “syllabic” tier consists of the two constituents Onset and Rime, formed by projection of the segmental and skeletal tiers. The traditional coda position is now directly under the rime as a “rimal complement” position.

An important element of this theory is the notion of Government, by which the relations of the skeletal tier are defined. Two conditions determine this relation, reminiscent of the parallel syntactic ones: strict locality — which dictates that Governor and Governee must be adjacent in their projection domain — and strict directionality, by which the Head of the government relation is defined. Thus, inside a constituent, e.g. Onset, the directionality of Government is left to right, whereas between constituents, e.g. Onset and Rime, it is right to left. The first is a case of inner Government and the second of interconstituent Government at the relevant level. The consequence of these two government relations is the theorem of the binarism of constituents, according to which syllabic constituents can be maximally binary branching.

A property “Charm” defines the elements of segmental structure, with the following distribution: (1) obstruents — but not *s* — are [– charm] segments, (2) resonants and *s* are [neutral charm] segments, and (3) most vowels are [+ charm] segments. These values also define the assignment of segments to their proper “syllabic” positions.

I confine myself to Pagoni-Tetlow’s contribution to the problems of Greek syllabification, leaving aside theory-internal problems such as feature representation, projection levels, etc. In the analysis of the above-mentioned topics concerning Greek clusters, Pagoni’s views are based on the “syllabic” structure of Government Phonology. In this theory, there are three possible assignments of a biconsonantal cluster in the case of each segment having a separate timing point — that is, they are bisegmental. First, both segments may be assigned to Onset — as Head-governing — and its Complement, cf. figure (14a) below. This is the case of inner constituent government. In such a structure only a resonant can follow the Onset head (Harris 1990:277). As Pagoni herself admits, this is a stipulation that hopefully “will soon be derivable from some more primitive theoretical notion” (1993a: 172–173). Consequently the Greek clusters examined are automatically excluded from forming part of a complex Onset. Secondly, the two segments may be heterosyllabic, cf. figure (14b) below, that is, with the first segment forming the complement of a preceding nucleus in Rime and the second the governing Head of an adjacent Onset. This is interconstituent government, proposed by Pagoni-Tetlow for the Greek cluster *N+stop*. A third possibility is that each member of these clusters forms an Onset, with an empty nucleus between them. This is the analysis proposed by Pagoni-Tetlow — contra KLV (1990) — for *ps/ks*, *pt/kt* and *pn/kn*, as in (14c).

However, if the two segments form one timing point — that is they are monosegmental (contour segments) — they can be assigned either to an Onset

Head or to a Rime Complement position. Pagoni's analysis for the contour /ts/ is for it to be assigned to the onset head, as in (d).

3.4.3 The cluster *ts*

Although the analysis of /ts/ is part of the three dreams of Householder's (1964) Greek Phonology, I include it here, since the same theoretical framework is employed and the analysis on the one hand completes the possibilities of syllabic structures admitted by Government Theory and on the other contrasts with the analysis of the similar clusters: ps/ks, pn/kn.

KLV (1990) discuss the syllabic structure of the clusters ts/ps/ks as well as pt/kt, pn/kn in various languages, e.g. English, French and Greek. They conclude that /ts/ forms a contour segment, whereas the others are bisegmental and form interconstituent structures, parallel to the clusters pt and kt. Pagoni in turn accepts the contour analysis of ts and even adds further support for it. However, for the other clusters, ps/ks as well as pt/kt, pn/kn, she agrees with the bisegmental analysis but argues against their interconstituent analysis.

One of the arguments for the analysis of ts as a contour segment concerns reduplication (cf. the same argument in Householder 1964). Reduplication in M. Greek — leaving aside onomatopoeic sequences (titivízo, xaxanízo) as well as reduplication of the whole base-stem (tsáka-tsáka) — consists of repetition of a non-branching onset: le-léki, ku-kúla. Since the sequence ts participates in reduplication cf. tsitsíði, tsatsára, it must also form a non-branching onset, thus a monosegmental contour segment as KLV propose.

A further argument is the occurrence of ts after another non-nucleus segment: cf. órtsa, káltsa. Such data show first that ts cannot be bisegmental with interconstituent structure between Rime-Complement and Onset, since the Rime-Complement position is already filled. Neither could it form a complex onset, since only a resonant can be a complement to an Onset Head. Nor could it form two onsets separated by an empty nucleus (see the argumentation for the other bisegmental clusters with such a structure, below), since in

contrast to the ps/ks clusters, ts cannot stand in morpheme final position, that is across an analytic morpheme boundary, as is theoretically expected for a bound segment. For the clusters ps/ks, compare data such as: plék-o, plék-so, plék-si, vráf-o vráp-so, vráp-simo. In contrast, parallel data for ts show avoidance of a potential analytic *tv^o-si either by (i) t-loss: θet-o : θe-si, (ii) change of the *tv^os to the acceptable kv^os : plít-o : plík-si, or finally (iii) use of a different morpheme: rot-ó : rot-íso, zit-ó : zit-íso-zít-isi. The conclusion is that the contour ts occurs only in words which form one analytic domain and both t and s belong to this morphological domain (1994a: 205) (for the monomorphemic context of ts cf. also Housholder 1964). Thus ts must be a contour segment under Onset.

These last three arguments ((i), (ii), (iii) above) showing avoidance of ts across “an analytic morpheme boundary” are of course theory internal, but still notice that: for (i) not only t but also interdental θ is lost before s. Cf. aléθo: álesa, pláθo : éplasa, plásimo, though there is no clear example for the voiced δ: cf. spévðo : éspéf-sa, diapsevð-o diépsef-sa with three consonants; for (ii) that here there is a stem-alternant seen also in sequence with other segments: plý-ma; and for (iii) that a different morpheme is in use for this type of verbal stem in general: cf. ayap-ó, ayap-ís-o.

3.4.4 *The clusters ps/ks, pt/kt, pn/kn*

For the other clusters ps/ks, pt/kt, pn/kn, Pagoni-Tetlow proposes, instead of the interconstituent analysis of KLV (1990), that both members of these clusters form an Onset to a cold (i.e. empty) Vowel: e.g. pV s/kV s etc., since all show parallel phonological behaviour. One of her arguments against the interconstituent analysis is distributional. Thus another non-nuclear segment may precede the clusters — cf. for ps/ks, élksi, térspi; for pt/kt árktos; and for pn/kn ispnoí, ekpnoí. Such occurrence in an interconstituent analysis would be theoretically impossible, contradicting the theorem of binarism for constituents.

However, a remark here concerning the clusters pt/kt. One argument of KLV(1990) for assigning them an interconstituent analysis comes from co-occurrence restrictions. The fact that there is no reverse order of the kt/pt clusters, ie.*tk/*tp, implies that t is in a governing relation with p/k. Since governing relations are either constituent or interconstituent, and since a constituent relation — that is a governing relation inside a branching Onset — is excluded for these clusters (cf. above the stipulation that only a resonant can be a complement in an Onset), their governing relation must be interconstituent.

Pagoni-Tetlow’s response to this argument of KLV is that the same co-

occurrence restriction holds in Classical Greek, cf. the metathesis of: *ti-tk-o: > ti-kt-o:, and that “the absence of *tp/*tk sequences in the main lexical input to MG would have contributed to their absence in the later stage” (1998: 5, fn.3). However, this is not really an answer. The metathesis of *ti-tk-o: > ti-kt-o: that she mentions needs an explanation, and as she herself points out (1998: 10) this distributional gap is found in many languages. This is a peculiarity which KLV attribute to the coronal nature of t, although for Pagoni-Tetlow “they cannot offer an explanation as to why coronality is capable of exerting such an influence on the behavior of t”. But the coronality problem is well known and discussed in the literature, even outside Government Theory, and cannot be dismissed so easily. (Cf. Paradis & Prunet 1991, also Malikouti-Drachman 2001 for a proposal concerning the hierarchy of strength in MG, 3.5.3 below).

As a general conclusion notice that Pagoni-Tetlow’s main contribution to Greek syllabification is the support of the contour analysis of ts and the distributional fact that all the clusters she examined — ps/ks, pt/kt, pn/kn — may be preceded by a non-nuclear segment, that is, by the traditional coda. In Pagoni-Tetlow (1997b) this is an important argument, quite apart from other theory-internal arguments. According to her theory, these facts exclude such clusters from the Rime Complement position. Also the theory-internal constraint on Onset Complement excludes them from a complex Onset position. This justifies the proposal that they form two Onsets with an empty Vowel between them.

3.5 Syllables in Optimality Theory (OT)

3.5.1 *Onset and Coda in OT*

Building on an earlier attempt in Kappa (1997a), Kappa (1997b) investigates the structure of onset and codas in SMG under OT (for the theoretical framework of OT, see 2.2.1 above).

Complex Onsets of two consonants — word initial and medial — may consist of (1) a stop or continuant (non-strident) + liquid/nasal: trίvo, knίmi, flúδα, θnitós (cf. also 3.2.1 above, in Malikouti-Drachman 1984, etc.). In both cases this amounts to a cluster with a second member of lower strength. (2) However, a continuant + stop may also form an Onset: xtipó, spáo.

A further constraint concerns different points of articulation (but cf. the optimal syllabification in a.tlas (pg. 77) with violation of this constraint). Notice that a cluster of the first type above is accepted in general and shows a relation of strength (or sonority?) between its two consonants. In contrast, the relation

of the second type deviates from sonority. In turn, a word initial or medial three-member cluster may consist of s+stop + liquid /nasal: splína, sknípa. Word medially it may also consist of continuant + stop+ liquid: ráftra, or s + continuant + nasal: isxnós.

Notice that in all these cases the relation of the clusters is antisonorous, and the interpretation of such data varies. Thus, in hierarchical syllables such clusters are handled either by extrasyllabicity or by modification of the Sonority scale, and in X-bar theory by consonant projection to Spec. However for OT, where all constraints are violable, the antisonority clusters are not problematic, provided that the relevant constraint SONORITY (see 2.2.3) is lower ranked than others and thus violable. However, Kappa prefers to handle the antisonorous clusters not under SONORITY but rather under the constraint ONSET, which also covers the special onset-formation conditions (cf. below tableau (15)). But this may not be sufficient, since the ONSET constraint only demands the presence of a consonant syllable-initially.

Coming now to Coda formation, Greek is once again declared “an open syllable language par excellence. This is the unmarked case, but exceptionally closed syllables also occur” (pg.75). Consonants occurring in coda position are the coronal [r>l>n>s] with r more sonorant than the others. Word-medial only the higher-sonority r and l occur, whereas word-final in Demotic only the lower-sonority n, s, and in Katharevousa also the r. The constraints are:

NUCLEUS undominated, demands a Vowel as minimal syllable content.

ONSET (including the constraints for its formation)

CODA MEDIAL and CODA FINAL (including the relevant constraints)

FILL avoids segment addition

PARSE avoids unsyllabified segments and hence segment-loss

A comment on the two last constraints: the anti-epenthesis FILL is modified later to MAX-IO, and the anti-segment-loss PARSE of Prince & Smolensky (1993) used in Kappa (1977a,b), to DEPENDENCE-IO in the Correspondence Theory of Mc Carthy & Prince (1995a). Cf. their later use in Pater and Arvaniti (2.2.2/3 above). These constraints are ranked as below. Some data with the relevant tableaux follow (<X> means that X is unparsed, thus unsyllabified):

ONSET >> CODA MEDIAL (tied with) CODA FINAL >> FILL >> PARSE

(15)

/anθropos/	ONSET >>	CODA-MED/CODA-FIN >>	FILL >>	PARSE
1. a<n>.θro. pos				*
2. an.θropos		*		
3. a.nθro.pos	*			

Here form 1 is optimal, i.e. [áθropos] with n-loss by violation of the lower ranked constraint PARSE. Form 2 is less optimal, since it violates the CODA condition of non-Nasal. Form 3 is “fatal“, since the conditions of the top ranked (undominated) constraint ONSET are violated.

However, there is a discrepancy here. Not all speakers find form 1 [áθropos] more Optimal than form 2 [án.θropos] with presence of the nasal in the CODA position (cf. form 3, where the cluster *nθr makes for an ONSET violation). This means that a Nasal may also form a Coda, even optionally, cf. Kappa’s (op.cit 84) reference to Papademetre (1988) and Pagoni (1993), as allowing also nasals in medial position. It seems that PARSE here refers to a medial nasal, which is not accepted as a coda in Kappa’s analysis.

Notice further that in the case of a cluster of four consonants word medially, e.g. afstria, ekstratia, the first consonant has to be assigned to the coda, since only three consonants can be accommodated under Onset.

(16)

/afstria/	ONSET >>	CODA-MED/CODA-FIN >>	FILL >>	PARSE
1. af.stria		*		
2. a. fstria	*			

Comparison of these two candidate forms shows that form 1 is optimal, where a constraint lower than the undominated ONSET constraint is violated. However, addition of further candidate output forms would have shown the incorrect form *astria to be optimal, with f-loss violating only the lowest constraint PARSE. This suggests that Kappa’s constraints &/or rankings must perhaps be modified.

3.5.2 OT extended to Dissimilation

Coming first to dissimilation in SMG. Drachman & Malikouti-Drachman (D & AMD) (1997) treats competing analyses of dissimilation in SMG and the Cypriot dialect, employing OT theory to define the relation between syllabic structure and phonological processes obtaining in certain syllabic positions, especially between a coda and a following onset. At the same time it compares

the OT model with the derivational model of Generative Phonology. The phonological process selected is the well known phenomenon of dissimilation, by which phonological segments within a given domain become more distinct with respect to a particular feature.

After the discussion of dissimilation of continuancy in SMG, the analysis is extended to the case of strengthening of the semivowel *y* in Cypriot, a process already discussed in Newton (1972) in a derivation model. The same Cypriot phenomena are discussed in the more recent literature by Kaisse (1992) under Autosegmental Phonology, and by Harris (1996) under Government Phonology. For comments, see below.

D & AMD use the following types of constraint: prosodic constraints — consisting of the Onset and Coda families, Phonotactic constraints and Identity (otherwise Faithfulness) constraints. Prosodic constraints define the structure of Onset and Coda. First, the Onset-Family. Onsets are not obligatory, and any consonant can form a non-branching Onset. A branching onset is subject to the SON(ORITY) relation, defined as [non-palatal obstruent], [palatal obstruent], [resonant]. Second, for the Coda-family. Word final codas are the usual *s/n*. In contrast, any consonant is in general allowed word medially, under the condition that coda-consonants are weaker than onsets; this means that stops, as maximal consonants, are not legitimate codas. Further, neither are consonants specified for voice independent of a following onset. These coda specifications are covered by the constraint WEAK CODA. Complex codas are excluded: cf. (18) below for violation through domination by higher ranked constraints, and 3.5.3 for further dialect constraints on WEAK CODA.

A phonotactic constraint accounting for dissimilation is McCarthy's (1986) Obligatory Contour Principle (OCP), prohibiting identical features in adjacent autosegmental tiers. As further expanded in Holton (1995), the OCP family of constraints covers dissimilation (that is, delinking of relevant features) as well as assimilation or gemination (that is, linking of segments by total or partial feature spreading). For D & AMD the domain of application of OCP (dissimilation in Greek) is between heterosyllabic consonants, and affects continuousness. OCP assimilation affects Voice, and applies between hetero-syllabic consonants as well as in tautosyllabic sequences of consonant + *j* under Onset.

On the other hand Identity constraints are Faithfulness constraints, and ensure preservation of the input in the output, e.g. segment or voice identity (cf. below *s*-identity, voiced continuant identity in SMG *avγó* vs. Cypriot *afkó*).

Now to constraint-ranking in SMG. Forms like *γράφ-θike* > *γράφ-tike*

illustrate the need for the three constraints: SONORITY; OCP(diss.) and WEAK CODA. See tableau (17), simplifying the candidates:

(17)

/γráf-θike/	SON >>	OCP(diss.) >>	WEAK CODA
1. γráf.θike		*	
2. γráf.tike			
3. γρά.θike	*		

In the next tableau, forms like γráf-so > γράp-so show how the WEAK CODA constraint is violated in optimal form 3, in order to honour a higher ranked constraint IDENTITY(s), demanding preservation of the input s, for which no corresponding stop is available. Cf. form 1 with thus illegal t. The relevant candidates are:

(18)

	SON/IDENTITY(s) >>	OCP(diss.) >>	WEAK CODA
1. γráf.to	*		
2. γráf.so		*	
3. γράp.so			*

Forms like ráv-so > ráp-so are explained in the same way. Further the WEAK CODA constraint of *[α voice] forbids an independent voice distinction, so that the unvoicing of the onset spreads to the preceding coda consonant by assimilation. Compare also the assimilation in cases like aníγ-o > a.nix.tó as a result of the same constraint.

A comment is here appropriate. Of course cases like ráv-so > ráp.so, aníγ-o > a.nix.tó justify D & AMD’s analysis under the present framework. However, in earlier work AMD & D (1990) assigned clusters like fs/xs under the Onset Projection and accounted for the change to a stop (f/x > p/k) as due to Onset strengthening. However, it is not clear how the new proposal with heterosyllabicity for such clusters handles cases like térpsis or élsis brought up and handled by Pagoni-Tetlow (3.4.4 above). Under OT, such data demand either (a) relaxation of the *COMPLEX-CODA constraint, giving terp.si, elk.si, or (b) tautosyllabicity of ps/ks giving ter.psis, el.ksis, or even c) assignment of syllabic status to p,f/ k,x, as in the proposal of Karzi (3.5.4 below) giving tér.p.sis, él.k.si.

Consider now the comparison with dissimilation in Cypriot. As far as voiceless consonants are concerned, the above data and the relevant ranking of the constraints are Pan-Greek. However, forms such as SMG *avýó* : Cypriot *afkó* with heterosyllabic consonants and IDENTITY of the input voiced obstruents -vy- in the SMG form but not in the Cypriot, show the need for further constraints and different constraint rankings. This becomes clear in the comparison of the plural formation of i-neuters. Cf. the following data and syllabification, constrained to stem final: labials, (non- strident) dentals (a-b), and r (c), as well as in a cluster of two consonants + y (d): Velars and stridents undergo palatalization and n/l resonants gemination, and are thus excluded.

(19)	Input	SMG	Cypriot
a. stop +y	kupIa mátIa	ku.px'á má.tx'á	kup.k'á máθ.k'á
b. contint+y			
C ₁ [-voice]	ráfIa kaláθIa	rá.fx'á kalá.θx'á	ráf.k'á kalaθ.k'á
C ₂	karávIa láδIa	kará.vja lá.δja	karáf.k'á láθ.k'á
c. r+y	xérIa	xér.ja	šér.ka
d. C ₁ r C ₂ +y	xartIa	xar.tx'á	xar.k'á

For D & AMD the main difference lies in the onset formation. First, ONSET is obligatory in this morphologically derived environment. By this constraint the universal structure CV is obtained by automatic consonantalization under onset of the segment /I/, which is unspecified for the relevant feature (cf. AMD& GD 1990 and 3.3.3 above). Further, the SONORITY constraint, as defined above, allows SMG two consonants under onset, thus obstruent + consonantalized semivowel e.g. *mátIa* > *má.tx'á* *kaláθIa* > *ka.lá.θx'á*. It also explains the domain of voice assimilation of the semivowel to the tautosyllabic preceding consonant. It follows that a cluster of two consonants +y (C₁r C₂ +y) can syllabify in SMG word medially under coda and onset: *xartIa* > *xar.tx'á*.

In contrast, the SONORITY constraint is more restricted in Cypriot, where tautosyllabicity of an obstruent +consonantalized semivowel is not allowed. It follows that in Cypriot syllabification for cases of C₁ + y, the cluster is split between coda and onset and undergoes the relevant constraints of WEAK CODA for C₁, as well as OCP dissimilation with strengthening of the consonantalized semivowel under onset. (For the p in coda, as in *kup.k'á* above, see 3.5.3 below). However, cases like C₁C₂ + y differ. C₂ is excluded from onset as well

as coda; it remains unsyllabified and is thus lost. This justifies the *COMPLEX constraint for codas.

These claims are illustrated by comparing constraints and their ranking in the following tableaux, limited to the most relevant forms for /mátia/ > SMG má.tx'a, Cypriot máθ.k'a. The crucial constraint here is IDENTITY, which demands faithfulness to the segments of the Input (cf. above for the s-Identity). Cumulative violations of this constraint are indicated by stars in the tableaux:

(20) a. SMG

/mátia/	ONSET- >>	SON >>	IDENTITY >>	OCP diss >>	W CODA
1. má.tx'a			*		
2. ma'.tI.a	*				
3. mát.x'a		*			*
4. máθ.k'a		*			

b. Cypriot

/mátia/	ONSET >>	SON >>	OCP diss >>	W CODA >>	IDENTITY
1. máθ.k'a					***
2. ma'.tI.a	*				
3. má.tx'a		*			
4. mát.x'a			*		

As the SMG tableau shows, SONORITY excludes form 3 and 4. In contrast to SMG, the accepted Cypriot form 1 shows violation of Identity of voice and manner, having as output a palatal stop [k'] for /l/ and a continuant [θ] for the stop input /t/. The Cypriot data is explained by the lower ranking of IDENTITY, which however is violated only once in SMG.

As a general conclusion, notice that there are some inconsistencies, eg. lack of indication of constraint dominance, or of a precise definition of the IDENTITY constraint. Nevertheless some interesting theoretical points come up, apart from the comparison with a derivational model, such as in Newton's (1972)

account of the same Cypriot data. Dialect differences are here, as in OT generally, accounted for by re-ranking of the relevant constraints, as well as by differences in the content of one and the same constraint, as e.g. the SONORITY distance between the segments involved in SMG and Cypriot.

It has also been shown that consonantalization of the semivowel in Cypriot is the output of the relation of two heterosyllabic consonants subject to the constraints WEAK CODA and OCP dissimilation. This account covers both Kaisse's (1992) and Harris' (1996) proposals. Kaisse, discussing Cypriot among other languages, proposes to modify the Feature-Geometry tree and assign the feature [consonantality] not at the root of the tree, but as a separate node, from where it may spread to other adjacent segments. Harris' account (1996:323) appeals to a condition controlling the relation of onset to coda. The proposal of D & AMD, that the Cypriot data can be seen as the output of an extension of pan-Greek dissimilation of continuancy, covers both explanations, viz. Kaisse's Spreading of [consonantality] as well as Harris' phonotactic domain. Since the process involved is dissimilation, its domain is of course a cluster; thus we find no strengthening of the semivowel in cases of an onset not preceeded by a consonant e.g. *yos* and not **k'ós*, *loyázo* and not **lok'ázo*. This explains the hesitation of D & AMD to propose a STRONG ONSET for Cypriot (cf. pg. 70, fn 6). However, this proposal for a STRONG ONSET constraint is indeed made below (3.5.3) along a place strength hierarchy.

3.5.3 *Processes and Place hierarchy*

Malikouti-Drachman (2001) discusses phonological processes in regard to the syllabic structure of the segments involved as well as the relative and positional strength of their place of articulation. Theoretically, segments under onset ought to be stronger than those under coda (Pulleyblank 1997), so we expect segments to be either strengthened or weakened depending on their relative position in syllabic structure. On the basis of this assumption Malikouti-Drachman sets out to account for the well-known phonotactic constraint on obstruents in Attic, that only a labial or velar may be the first member of an obstruent cluster, but not a dental, thus *pt/kt lep-tós*, *lek-tós*, but not **tk/ *tp* cf. *tíkt-o*: < **títk-o*-. Notice that on the coda problem in Attic, Steriade (1982:175) as well as Ito (1986:108) discuss mainly the condition under which a stop can be assigned to a coda. The order of dentals as a second member of a cluster of stops in Attic is addressed only by Yip (1991:68), whose account is based on the underspecification of coronals, in conjunction with a further rule associating segments with their syllable position. Malikouti-Drachman accounts for this

order by appealing to a hierarchy of strength of place DENTAL >> VELAR / LABIAL in combination with (a) a constraint WEAK coda, that is, in a cluster only a labial or a velar is allowed in coda position vs. (b) STRONG Onset, that is, in an obstruent cluster only a dental is allowed in onset position.

To support her proposal, historical as well as dialect-data are discussed. This hierarchy of place of articulation strength changed historically from DENTAL >> VELAR / LABIAL, to DENTAL >> VELAR >> LABIAL. A proposed cause for this change is the consonantalisation of the labial semivowel *w* — as the second part of a diphthong — to a labial continuant: cf. *aw.tós* > *af.tós*, *éw.kolos* > *éf.kolos*, by which new clusters of the type labial + dental / velar are created. On the one hand, this indicates weakening of the labial articulation, since it must still occupy the coda position, but on the other also strengthening of the velar articulation, which can now take the role of an onset in parallel with the dentals. This reversal in the strength relation between labial and velar is seen in the relevant metathesis: cf. *vyázo* < (mediaeval) *evvázo* < *ek-vivázo*, *vjéno* < (mediaeval) *evvéno* < *ek-baíno*. A further indication is the fact that a labial does not strengthen to a stop dissimilatorily after an *s* in order to take the strengthened onset position: cf. *-sθ-* > *st* : *jelás-θika* > *jelás-tika*, *sx* > *sk* : *sxízo* > *skízo*, *áximos* ~ *áskimos*, but *sféra* and not **spéra* (though cf. dialectal: *spázo* for *sfázo* in Pontos, or *spistó* for *sfixtó* in Calabria, S. Italy, Triantafyllidis 1938, Kontosópoulos 1994). The weakness of the labial articulation is further supported by dialects like Cypriot. Cf. forms like: *alévria* > *alérka* (in Morfou) with loss of the first consonant of the trisyllabic cluster, or *aléfka* (in Mesaoria) with loss of the second consonant of the same cluster. In OT, these dialect-alternants are accounted for by different ranking of two relevant constraints: SONORITY >> I(NPUT) CONTIGUITY (barring the skipping of a segment) in the case of Morfou, but I(NPUT) CONTIGUITY >> SONORITY for Mesaoria. However velar and dental articulations do not show such alternants: cf. *maθítria* > *maθírka*, *áyrios* > *árkos*, with loss of a first consonant, which is too strong to stand in the weak position of a coda.

Malikouti-Drachman proposes further that historical changes such as the dissimilation of obstruents are accounted for by the Constraint OCP (dissimilation), in conjunction with the constraints WEAK CODA and STRONG ONSET, which specify the type of segments allowed in the relevant syllabic positions. Cf. the dissimilation process which obstruent clusters undergo, so that instead of continuant + continuant, stop + stop or stop + continuant, a cluster of continuant + stop obtains, as in: *vrex-θike* > *vrex-tike*, *plektó* ~ *plextó*, *plek-θike* > *plex-tike*.

Further the semivocalization and consonantalisation of an unspecified front high segment and its strengthening in certain dialects (cf. *karδía* > *kar.δjá*, cypriot *kar.k'á*) are also explained by the constraints *ONSET* and *STRONG ONSET*. This is also suggested in 3.5.2 above, where however the constraint *STRONG ONSET* is not accepted.

It seems that in Malikouti-Drachman's proposal in the OT framework, historical as well as dialect phenomena receive a unified and principled explanation, in comparison with other accounts. As an example, the dissimilation of obstruents in a Generative framework is accounted for by derivation via a set of processes (cf. Newton 1972: 110, 116), whereas in a descriptive Grammar it is understood as a sequence of three separate statements (e.g. in Holton et al. 1997). There is also a certain contradiction in these explanations, avoided in a syllabic account such as is proposed above. Compare the fact that a sequence of two continuant segments, avoided in cases like: *vrex-θika* > *vrex-tika*, is allowed in others: *eláfx'a*, *kaláθx'a*, *vódja*, *peδjá* etc., a contradiction explained as resulting from syllabification. The assumption of a *WEAK Coda* vs. a *STRONG ONSET* accounts for the dissimilation in heterosyllabic clusters. On the other hand, the two continuants in *pe.δjá* etc. are both assigned to an Onset and thus undergo only voice assimilation.

3.5.4 Violation of *PEAK*

Karzi (2000) proposes a quite different analysis of the problem of consonant clusters and their distribution. In contrast to Kappa's analysis (3.5.1 above), which ignores Sonority in favour of a Maximal Onset, Karzi decides to respect *SONORITY*, even in violation of the usually high ranked *PEAK* constraint, which demands that a syllable must have a vowel. Her basic assumption is that legitimate clusters under onset must show rising sonority. These are: (cf. the clusters in Malikouti-Drachman 1984, and Kappa 1997b) Stop or Continuant (non strident) + Liquid/Nasal, as in *trívo*, *kními*, *flúða*, *θnítós*. This amounts to a cluster of two consonants. Karzi does not consider Greek to be an open syllable language; thus the coda position provides one further legitimate consonant. This means that up to three consonants can be accommodated word medially: one under coda and two under onset. But word initially, since no coda position is available, only two consonants are acceptable, both under onset.

In the case of an initial antisonorous or triconsonantal cluster, there is a choice to be made: either we have the same syllabic structure medially and initially, or different ones. Karzi chooses the first option, concluding that even

a consonant may form a syllable. Thus Peak may be violated. Karzi proposes the following constraints (cf. also above for the definitions):

SONORITY

FAITHFULNESS requires that outputs preserve the properties of their input

FAITH (continuant) requires faithfulness to the input [cont] specification

PEAK A syllable must have a vowel

OCP (cont)

STRONG ONSET. Between two heterosyllabic consonants the one under onset, i.e. the second, must be stronger (adopted from Malikouti-Drachman, 3.5.3 above). Notice that by this constraint, clusters of two stops such as pt/kt automatically have the dental articulation stronger.

MAXIMAL ONSET. All consonants between two vowels are assigned to Onset

The Constraint Ranking in Karzi is (where X,Y means a tie between X and Y):

SONORITY,FAITH (cont) >> OCP (dissim.) >> STRONG ONSET >> PEAK

We take first the application of the constraints word-initially. Since only clusters obeying Sonority can form a complex Onset, only two consonants are syllabified in this position. All antisonorous initial clusters are heterosyllabic. They consist of a consonant forming a syllable without a peak, followed by a complex syllabic onset. Cf. in the following tableaux a cluster of two tautosyllabic consonants: vrox'í, vs. a cluster of two heterosyllabic consonants: vyázo. In both cases the ranking is SONORITY >> PEAK

(21) a.

/vrox'í/	SONORITY >>	PEAK
1. vro.xí		
2. v.ro.xí	*	

b.

/vyázo/	SONORITY >>	PEAK
1. vyá.zo	*	
2. v.yázo		*

The above tableau (a) shows form 1 as optimal: vrox'í, with a complex onset which satisfies both constraints. However, in (b), form 2 is optimal, where the first consonant of the antisonorous cluster forms a syllable by itself, thus respecting the dominant constraint SONORITY but violating the lower PEAK

Initial tri-consonantal clusters, as consisting of s+stop+Liquid/Nasal: stróma, sknípa that is an antisonorous consonant + legitimate complex onset, have a parallel structure: s.tró.ma, s.kní.pa, with the antisonorous consonant again forming a syllable by itself.

Extending the proposal of Drachman & Malikouti-Drachman (1997), Karzi proposes that in word-medial position any consonant, even a stop, may form a coda, thus legitimately accommodating up to three consonants. More than three consonant – or antisonorous clusters – are structured parallel to word-initial ones. Such cases find homogeneous treatment in her analysis. Cf. the following tableau, which also illustrates the use of the other constraints. Take the form tílos. As the tableau shows, form 1 ti.tlos is optimal, with the sonorous cluster under onset. But since Karzi allows any consonant whatever as coda, a further constraint is required to exclude an alternative candidate such as 2 (tit.los). She chooses MAXIMAL ONSET, dominated by SONORITY. The following tableaux illustrate the use of two sets of constraint:

(22)

/titlos/	SONORITY >>	MAXIMAL ONSET
1. ti.tlos		
2. ti t. los		*

(23)

/optasia/	SONORITY,	FAITH(cont) >>	OCP (cont)
1. o.pta.si.a	*		
2. op.ta.si.a			*
3. o.fta.si.a	*		
4. of.ta.si.a		*	
5. o.pθa.si.a	*		
6. op.θa.si.a		*	

Form 2 [op.ta.si.a] is optimal, violating only the lower ranked constraint of dissimilation of continuants OCP(cont). The ranking of FAITH(cont) as higher than OCP(cont) is here justified by the cluster of the two stops -pt-, which is faithful to its input /-pt-/. These two constraints, with alternative ranking, will be used to account for the alternation between two stops ~ continuant + stop

e.g. ktíma ~ xtíma, októ ~ oxtó and two continuants ~ continuant + stop: xθés ~ xtés. For these forms the input is a cluster of two stops or two continuants respectively: /októ/, /xθés/. Ranking of the constraint FAITH(cont) above OCP(cont) results in the preservation of the input cluster as [continuant], cf. tableau (23) [optasía] above, or [+continuant] in a case like: xθés. In contrast, dominance of OCP(cont) over FAITH(cont) would give the alternant output. Karzi thus proposes treating FAITH(cont) and OCP(cont) as a tie, so that either ranking is possible.

As a general conclusion on this work notice that as she points out (pp. 61–62), Karzi constrains her analysis to the domain of “word”, leaving out clusters of consonant +j, as well as clusters resulting from morphological operations. It will be interesting to see how her analysis will cover such additional data.

The assumption that consonants may form syllables hints at a parallel with the empty vowels of Government Phonology. However empty vowels may assign an edge-syllabic function to the relevant consonant as onset (cf. Pagoni-Tetlow’s analysis of pt/kt etc. in 3.4.4 above) or coda, whereas Karzi seems to want the consonant to cover the whole syllable in order to avoid an arbitrary choice between onset and coda for the operation of dissimilation in obstruents. Similarities to Pagoni-Tetlow’s analysis also come up elsewhere, e.g. in the treatment of the clusters pt/kt or ps/ks as heterosyllabic.

Karzi’s analysis is an interesting and original proposal to account for certain problems concerning consonant clusters in SMG. Theoretically, since all universal constraints can be violated, the demotion of the PEAK constraint is of course permissible. However it remains to support her proposal with other cases demanding parallel constraint-ranking. A further question is whether all types of consonant can function as occupying a whole syllable and what the corresponding phonetic correlates of such syllables would be; cf. Pagoni-Tetlow’s arguments that stops in the clusters kt / pt are released (with aspiration) in Greek. The main cases of syllabic consonants referred to in the literature of course concern resonants, and is generally agreed that s in Chinese can become syllabic. It is an open question what happens with stops but compare Salish languages.

4. OT Extensions

As our last major topic we take two important applications of OT, viz. to the problems of hypocoristic formation and those of the acquisition of syllables, here in particular of syllable onsets.

4.1 Formation of Hypocoristics

What is interesting in the following discussion is the analysis of hypocoristic formation in SMG in an OT framework, which allows comparison with other dialects or languages and other domains of the same language, as will be seen below.

4.1.1 *Hypocoristics in SMG*

Malikouti-Drachman (1997) discusses the formation of two types of hypocoristics of proper names in SMG: (1) reduplicated hypocoristics, as in Sotiría > rirí or sosó and (2) truncated hypocoristics, as Kosta(n)dínos > dínos or kóstas. The framework is Optimality Theory, as modified by the Correspondence Theory of McCarthy and Prince (1995a). In this approach grammatical categories are expressed across the prosodic hierarchy: *mora* (*m*), *syllable* (*σ*), *Foot* (*F*), *prosodic Word* (*PrWd*). In SMG the prosodic unit for both types of hypocoristic is the *trochaic Foot*, which forms a *minimal word*. This foot is formed by minimalisation of the base, which consists of the full name. Relevant constraints for the foot formation are:

FT-BINARITY: Feet are bisyllabic; and

FOOT FORM: Feet are trochaic.

Both types of hypocoristic are based on the disyllabic trochee foot. But whereas the application of high ranked markedness constraints leads to the most unmarked output (CVCV) for the reduplicated hypocoristics, these constraints are lower ranked for truncated hypocoristics and the output is marked and thus closer to their input base. A further common point is the type of prominent syllable for Alignment. For both types of hypocoristic, prominence is defined on the initial or the stressed syllable. However for truncated hypocoristics it seems that, depending on the Base-stressing, the hypocoristic trochee foot may alternatively be anchored to the last syllable of the stem.

I take first the reduplicated hypocoristics. Reduplication imposes specific constraints between base and reduplicant (McCarthy and Prince 1993), such as the constraint MAXIMAL (as above), which demands that every element of the base has a correspondent in the reduplicant, and the constraint BASE DEPENDENCE, which demands that every element in the reduplicant have a correspondent in the base. Both constraints are low ranked in the case of hypocoristics, as shown by the minimal size of the hypocoristic forms.

The two-syllable template $[\sigma \sigma]$ of the trochaic foot consists of one syllable of the base and one of the reduplicant. The syllable of the reduplicant is aligned to the most prominent syllable of the Base, that is the stressed or the initial syllable. Gender defines further the alignment of the reduplicant as prefixal for feminines, but suffixal for masculines. Cf. feminine forms aligned to a word-final stressed syllable: *Paraskeví* > *viví*, *Aθiná* > *naná*, *Marusó* > *sosó*, or to an initial syllable: *Zinovía* > *zizí*, *Fotiní* > *fofó*, vs. masculine forms aligned to the stressed syllable: *Δimitrís* > *mímis* or to the initial syllable: *Mixális* > *mímis*, *Δionísis* > *n'ón'os* (with substitution of the initial weak consonant, as cf. below). Malikouti-Drachman (ibid.) proposes that the difference in the type of the disyllabic foot, viz. trochee for masculines but iamb for feminines, is an epiphenomenon, due to the difference in reduplicant alignment; suffixation for masculines results in a trochaic foot, vs. prefixation for feminines, where the prefix is added as a left-complement to the head of a foot giving an apparent iambic foot.

The disyllabic output of reduplicated hypocoristics takes the most unmarked shape [CVCV], imposed by special well-formedness constraints. The following constraints are required:

ONSET. Cf. *Zoí* > *zozó*, which shows that instead of the onsetless stressed syllable -í, the initial syllable, with onset *zo-* is preferred. Thus Onset is obligatory.

*COMPLEX ONSET. No more than one consonant may be associated to the Onset position. Cf. *Aleksándra* > *sása*, as well as *Δimitrúla* > *túla*.

*CODA. Syllables may not have a coda. Cf. forms such as *Jeorjía* > *γoyó*, *Aleksándra* > *sása*.

STRONG ONSET. Forms like *Θεοδόρα* > *totó* show that a weak consonant such as the interdental *Θ* is replaced by the corresponding stronger stop *t*. Cf. also *Jeorjía* > *γoyó*, where *j* is replaced by *γ*. To support this substitution, a tentative hierarchy of strength is given:

Stops, non coronal continuants and stridents *f*, *v*, *x*, *γ*, *s*, *z*, resonants, coronal continuants *θ*, *δ* and palatal *j*. (strong to weak)

Of course this hierarchy is tentative, since it is as yet not well documented. Another point is that compared with proposals for different hierarchies (above in 3.5.3, and below in 4.2), the question arises whether different hierarchies may hold for historical change vs. hypocoristics vs. acquisition. This question is unfortunately not raised by the author.

Apart from substitution, another way to satisfy the constraints ONSET and STRONG ONSET is by copying the onset of the nearest syllable. Cf. *Ioána* > *naná*, *Ana* > *naná* by reduplication based on the stressed vowel and copying of the

nasal of the following onset: thus $\acute{a} > \acute{n}\acute{a} > na\text{-}\acute{n}\acute{a}$. Alternatively, a truncated form like $\acute{n}\acute{a}na$ may be based on the stressed syllable, with copying of the nasal of the next onset and addition of the morphological vowel: thus $\acute{a}n > \acute{n}\acute{a}n > n\text{-}\acute{a}n\text{-}a$ (cf. below). The same copying device is seen in $\acute{J}\acute{a}n\acute{is} > \acute{n}\acute{a}n\acute{is}$, $\acute{J}\acute{o}r\acute{y}os > \acute{y}\acute{o}yos$. Cases like $\acute{I}f\acute{y}\acute{e}n\acute{ia} > f\acute{if}\acute{i}$ are also accounted by Malikouti-Drachman as copying of the missing onset. However, it seems that the other alternative of omitting the onsetless initial syllable may be preferred, as seen below in truncated forms from vowel initial bases, where the initial vowel is simply ignored.

Hypocoristics illustrate further the constraint S(YLLABLE)-ROLE (McCarthy & Prince 1993), which demands that a segment in the reduplicant and its correspondent in the base must have identical syllabic roles. A final constraint for reduplicated hypocoristics, which however holds also for truncated hypocoristics, is morphological well-formedness; the output must conform to the morphological structure of a lexical form, and thus properly include class makers and inflection, cf. *nom-gen.sg. pípis – pípi, fofó – fofós*. The relevant constraint (McCarthy & Prince 1995a) is: LEXICAL WORD = PR(OSODIC) W(OR)D.

Coming now to Truncated Hypocoristics. As in the case of reduplicated hypocoristics, truncated hypocoristics are formed across two constituents of the prosodic hierarchy: Foot (as trochee) is a PrWd. The base of truncated hypocoristics is also the proper name as a full word. By alignment, the head of the trochee is attached either to the stressed syllable (Right hand formation), or to the initial syllable (Left hand formation) of their base (but cf. below): cf. *Kosta(n)dínos > dínos* vs. *kóstas*, *Panajótis > nótis* vs. *pános*. As the above examples show, the second syllable of the trochee may be filled in not by the vowel of the base but by a morphological class vowel, *a, o, i*, independent of the morphological class of the Base, although the exact conditions for the type of the morphological class are not examined in this article. As in the case of the reduplicated hypocoristics, this is due to a morphological well-formedness constraint, as given above.

For truncated hypocoristics formed on the Right side of the base, the Alignment is: ALIGN (Foot edges (Hypoc.) R, L, to R, L Foot edges (PrWd). That is, the left and right edges of the hypocoristic foot must coincide with the left and right edges of the foot of the base. By this definition paroxytones may form Right-side hypocoristics freely, and for feminines this type of hypocoristic formation is in fact preferred. Cf. *Kosta(n)dínos > dínos* or *kóstas*, but for *Kosta(n)dína > only dína* (or *nína* ?), *Panajótis > pános* or *nótis* but for *Panajóta* only *jóta* alternating as *tóta* or *nóta*, with substitution of a STRONG ONSET. Notice that this constraint, high ranked for reduplicative

hypocoristics, may be lower ranked here. However for oxytones this type of formation is excluded, since alignment of the trochee cannot obtain; the only formation type available is by reduplication or by left-hand truncation, cf. Fotiní > fífí, fofó or fóto.

Antepenultimate stressing violates the alignment as defined above, “since their final syllable does not match the edge of the hypocoristic foot”, e.g. Timótheos > tímos, Θεόδωρος > dóros. Two suggestions are made, (a) hypocoristics on the right side can be formed after stress adjustment, or (b) truncation is obtained for proparoxytones by alignment to the last syllable of the stem or to the second member of the compound. Of course, only the second suggestion can be correct; a stress adjustment is in theory excluded, since it would involve a derivational process. On the other hand, notice that in the analysis of Cypriot hypocoristics (Drachman et al., 4.1.2 below) the alignment of the trochee to the base is defined as alignment mainly to the initial syllable (left edge of the base) or the last syllable of the stem (right edge of the stem). Parallel alignment constraints are also attested from other languages, e.g. hypocoristics in Japanese (Poser 1984), as well as truncated loan words in Japanese (Ito 1990). Of Malikouti-Drachman’s two alternatives for antepenultimate stressing, only the alignment to the last syllable of the stem seems to hold for SMG, as in the case of Cypriot.

A special case of truncated hypocoristics formed on the left side are vowel-initial bases such as Aléksandros>alékos, Aristoméniś>aristos, which show that, as in the case of reduplicated hypocoristics, ONSET is also high ranked for truncated hypocoristics. The left side alignment is stated as:

ALIGN (Hypocoristics: Foot Left, PrWd Onset Left).

However, for the initial vowel to be added to the PrWd a further constraint is required, which demands only one foot per word (Kabré & Kenstowicz 1994):

PROSODIC WORD MINIMAL (PrWd Min). By this constraint, special to hypocoristics, the onsetless initial syllable is directly attached to the PrWd constituent rather than to a foot, thus violating the so-called “strict layer hypothesis”.

4.1.2 Cypriot hypocoristics

The discussion of Cypriot hypocoristics in Drachman et al. (2001) continues the treatment of SMG hypocoristics, although in a rather descriptive framework. It is interesting to note some similarities as well as differences between the two systems. As in SMG — and other languages too — Cypriot hypocoristics are based on a disyllabic foot of trochaic form, preferably aligned to the initial or

last stem syllable. Alignment to the stressed syllable also occurs but less commonly than in SMG. The vowel of the second syllable is filled in by the appropriate morphological vowel. This holds for all types of Cypriot hypocoristics; cf. for truncated hypocoristics: *Sokrátis* > *sokrís*, *Zinovía* > *zinú* and for hypocoristics with consonant harmony: *Kirjákos* > *kákos*, *Kirjáka* > *kakú* ~ *káka*. The iambic foot in these forms is, of course, epiphenomenal to the stressed Cypriot endings, cf. *Stavriani* > *stavrú* ~ *stávri*, with both stressings possible.

Two Cypriot hypocoristic formations differ from those of SMG: hypocoristics with consonant harmony and hypocoristics with CONTIGUITY violation (cf. Gnanadesikan 1995, and 3.5.3 above). In a way the first type corresponds to the reduplicated hypocoristics of SMG. Their shape is an unmarked [CVCV] disyllabic foot, the output of markedness constraints such as ONSET, *COMPLEX ONSET, NO CODA etc., as in SMG. However, in Cypriot an empty consonant position is filled in by consonant harmony to the strongest consonant, sometimes progressively, as in (a), but mainly regressively (see Drachman 1976, 1978) as in (b).

- (24) a. *Prokópis* > *pópis*, *Eftérpi* > *pépi*, with *p* instead of *k/t* and loss of coda
 b. *Evδóka* (<*evδokía*) > *kóka*, *Andiyóni* > *nóni*, *Avrámis* > *mamís*.

By regressive consonant harmony the dialect loss of weak consonants, e.g. the voiced fricatives *v*, *δ*, *γ* between vowels, is avoided. The first vocalic position is filled in by the vowel of the base, but the second by relevant morphological markers, class vowel and ending. The difference from the reduplicated hypocoristics of SMG is illustrated by SMG forms such as: *θεοδώρα* > *totó*, *Paraskevί* > *viví*, *Fotinί* > *fofó* etc.

The other type of characteristically Cypriot hypocoristic is formed by violation of the linear order of CONTIGUITY of the segments of the base. Weak consonants are omitted so that hypocoristics are based on the two word edges: initial and final, as in: *Kir(já)ka* > *k'íka*, *Menélaos* > *melís*.

Certain dialect phonological features are special to Cypriot hypocoristics, as seen in *Anθimos* > *aθθís*, with assimilation of *n* to a following continuant, and especially consonant gemination, cf. *Stilianί* > *stillú*, *Pantelis* > *tellis*, *Nikolis* > *kkolis*. Some hints concerning this gemination-feature are advanced, but its phonological conditioning is unfortunately not examined further in this article.

Further analysis of hypocoristics in Cypriot as well as other dialects will be useful, and a comparison will illustrate other features of their formation. As an example, truncated hypocoristics on the left edge from vowel initial bases show that the initial vowel in some cases forms part of the disyllabic foot, cf. *Andro-*

máxi > andrú, Evriðiáðis > Evrís, while in others it is attached to the initial hypocoristic foot, or even lost: cf. Evjenía > fk'enu ~efk'enu, Evriðíki > vrikú. However, the data show that the vowel to be lost may only be the Greek neutral vowel *e*. These points have been neither evaluated nor checked in the analysis of SMG hypocoristics in Malikouti-Drachman (4.1.1 above).

4.2 Acquisition of Onsets

The application of OT to problems of Greek language acquisition is taken up in Kappa (1999), which discusses a longitudinal diary study of the acquisition of onsets by one child over the age span of 1;10–2;10. Kappa follows the theoretical view that in the framework of OT constraints are universal and the difference between child and adult language lies in the different rankings of the constraints. She defines four stages (I–IV) of developmental patterns. At stage I (1;10–2;0) onset is obligatory. At stage II (2;0) onset has become optional. At stage III (2;1) nasals and liquids appear as onsets. Finally at stage IV (age 2;20) fricatives also appear. Some details follow:

Single Onsets are the first topic. At stage I all syllables are CV, with only stops as an onset, that is consonants of minimal sonority, without continuant distinction, cf. fós > [pó], féta > [péta], póði > [bóði], papútsi > [babú]. Although more data are needed, Kappa's examples suggest that a distinction is indeed made between continuants and stops through voicing, cf. the child's [p] for /f/ in [pó] but [b] for /p/ in [bóði]. Words with initial vowel are either avoided or adapted with consonant-epenthesis for the missing onset or omission of the the onsetless vowel: cf. eðó > [dedó], aftó > [tó].

At stage II words with stressed initial vowel appear cf. étsi > [éci], óx'i > [óci]. Examples with unstressed initial vowel are also given, cf. eðó > [edó] ~ [dedó]. It would be interesting to see if there is a distinction in the treatment of initial stressed vs. unstressed vowels.

At stage III mostly nasals appear, cf. mílo > [mío], mamúni > [mamúni]. A few forms with liquids follow: tóra > [tóla], yála > [lála]. For this development Kappa refers to Jakobson's (1962, 1968) remark that first distinction between consonants is the one between *p* and *m*.

At stage IV fricative consonants begin to be used, cf. vréx'i > [béci], gráfo > [báxo], sofía > [fofia]. The transition between stage III and IV is gradual. Cf. *s* only in coda position: áris > [ális], vs. [t] as onset, initial or word medial, cf. tóso > [tóto], kaséta. [téta], síko > [tíko]. However the dental continuants are not produced up to 2;2,28, cf. tsulíθra > [líta].

Complex Onsets are discussed next. Complex onsets of obstruent+resonant, or fricative+plosive are reduced during the first stage of acquisition (up to the age of 2;9,27) to a single stop: kléi > [céi], obréla > [béla]. Since the child has already acquired nasals and liquids as single onsets, the hypothesis is that the constraint *COMPLEX is responsible for the simplification of onset clusters. Of course this hypothesis holds only on the assumption that the child's input is the adult's full form, in which case *COMPLEX in the child's grammar, in contrast to the adults', outranks the constraint MAX-IO demanding correspondence between input and output forms (and banning deletion, see 2.2.2 above). Apart from this violation of MAX-IO faithfulness, the *COMPLEX constraint may be satisfied by vowel epenthesis. This then — although not formalized by Kappa — means that a further constraint must be violated, viz. DEPENDENCE-IO, which demands that the output corresponds the Input (and bans epenthesis, see 4.1 above). This constraint is also lower in the child's than in the adult's grammar, where no epenthesis occurs. These two cases tend to justify the hypothesis that constraints are universals and that the difference between the child's and the adult's grammar lies in their ranking (but cf. below, under last topic).

A further interesting point in the discussion of *COMPLEX ONSET in the child's grammar is that in complex onsets, resonants or fricatives are reduced in favor of plosives, as cf. plíni > [píni]. This Kappa explains as a preference for the least sonorous initial onset. In the case of a fricative + sonorant, the fricative is again realized as a stop at the three first stages of acquisition, when there is no distinction for the feature [continuant] and continuants are realized by the default feature value [–continuant]. Cf. vivlíο > [bibíο] with violation of the constraint IDENTITY(continuant). At stage IV, with distinction of the feature [continuant], this word takes the form [vivíο].

The last topic discussed in this article is the hierarchy of place. In the correspondence theory of Mc Carthy & Prince, a set of constraints demand IDENTITY of features between input and output segments. However child forms may show violation of these constraints by domination of certain place features over others. This section investigates the hierarchy of acquisition of these place features. Comparison of the data shows that labials are stronger than dorsals, since dorsals assimilate or harmonize to labials, cf. kápa > [pápa] ~ [páka], biscóto > [bobóto] (2;2), as well as coronals cf. petséta > [pepéta] (2;2) patáta > [papáta] (2: 17), sofía > [fofía] (2:8,17). Between the two places of articulation dorsal and coronal, the dorsal is the stronger. Cf. k'íta > [cíka] (2:2), siko > [cíko] (2:2). The proposed place hierarchy is thus:

Labial >> Dorsal >> Coronal.

Evidence for this hierarchy comes from the metathesis between labial and coronals, cf. *kápa* > [páka] (cf. [pápa] above), *tubes* > [púdes] (2:4,11), *gráfo* > [báko] at stage IV. It seems that at this stage the child respects FAITH to place features, but not to the LINEARITY constraint banning metathesis. The hypothesis is that two edge constraints account for the metathesis-data, viz. ALIGN Labial left >> ALIGN coronal left.

This is an interesting article in an area not yet discussed for Greek in the OT framework. A comparison with the two articles on hypocoristics mentioned above, especially that on hypocoristics in SMG (Malikouti-Drachman 1999), which also follows OT, is interesting not only empirically but also theoretically, for the constraints involved.

The hypothesis of OT is that all constraints are universal, but their ranking may be language specific. And indeed, the data and analyses above show how Marking constraints (*CODA, *COMPLEX ONSET, etc.) dominate other Identity constraints at early stages, but are demoted later. However, it has also been shown that we may find different ranking for different parts of the Morphology (Mc Carthy 1995, Drachman 2001). The present cases of acquisition of child language and hypocoristics in adult language on the one hand support the universality of constraints, but also on the other that differentiation may obtain not only in the constraint-ranking but also in the content of the constraints themselves. For this proposal see Drachman & Malikouti-Drachman 3.5.2.

Some of the acquisition data and stages resemble the hypocoristic formations. Cf. for example that the parallel constraints ONSET, *CODA, *COMPLEX ONSET form a conspiracy of constraints resulting in the unmarked structure of a CV syllable not only in the reduplicated hypocoristics in SMG, but also in the hypocoristics with consonant harmony in Cypriot. Cf. also the omission of an initial vowel, although apparently under stress conditions in acquisition.

On the other hand an interesting difference in the content of constraints concerns the feature [continuant]. At stages I-III of acquisition only stops are used, also replacing continuants. In hypocoristics, especially the reduplicated hypocoristics, this feature is reduced to STRONG ONSET, which demands the replacement of (only) the continuant coronals *θ*, *δ*, and the palatal *j* by the corresponding stronger consonant: cf. *θeodóra* > *totó*, *yeoryía* > *γoyó*, but *Fotiní* > *fofó*, *Sotiría* > *Sosó* etc., as shown in 4.1 above. Notice that — as is clearly stated by Kappa and seen also in her data — it is precisely the dental continuants that are replaced by stops longer than the other continuants are.

A further difference between acquisition and adult language is the place hierarchy. Kappa cites Kiparsky (1994) in support of FAITH for labials and dorsals over coronals (but not labials over coronals) universally, as found also in the acquisition of one child's onsets. But the question arises, how to reconcile these proposals with historical and dialect facts in Greek supporting a different hierarchy, viz. coronal >> velar >> labial as in Malikouti-Drachman's (2001) analysis. Of course variant ranking is presupposed in OT, and variant place hierarchies in different parts of the grammar of the same language are also acceptable, if well documented.

A final point on the different constraint ranking between adult and child language is that the Alignment constraints, which define metathesis and the place hierarchy, refer in acquisition to the different edges of the prosodic word. In contrast, in historical cases it is seen that metathesis depends not on word edges but on the edges (that is, the strength) of syllabic constituency — coda vs. onset. A further comparison of such differences as well as similarities will be interesting, for example, to establish which syllable is preferred in acquisition for the alignment of the child's output form to the adult word-base.

Note

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