

**Greek voiced stops:  
prosody, syllabification, underlying representations  
or selection of the optimal?**

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**Περίληψη**

Οι μέχρι τώρα αναλύσεις των επιφανειακών ηχηρών κλειστών της ελληνικής, [<sup>(m)</sup>b], [<sup>(n)</sup>d] και [<sup>(ŋ)</sup>g] – είτε υποστηρίζουν ότι αυτά αντιστοιχούν σε υποκείμενα κλειστά, είτε υποστηρίζουν ότι αντιστοιχούν σε συμπλέγματα έρρινου με άηχο κλειστό – αδυνατούν να ερμηνεύσουν την ποικιλία που παρατηρείται στην προφορά τους (π.χ. παρουσία/απουσία προερρινοποίησης). Προτείνεται εδώ ότι τα επιφανειακά ηχηρά κλειστά αντιστοιχούν σε υποκείμενα συμπλέγματα έρρινου με άηχο κλειστό και ότι η ποικιλία των πραγματώσεών τους είναι αποτέλεσμα επιλογής της βέλτιστης κατά περίπτωση μορφής, βάσει διαφόρων περιορισμών. Καταδεικνύεται έτσι ότι η εφαρμογή της Θεωρίας του Βελτίστου (Optimality Theory) μπορεί να ερμηνεύσει ικανοποιητικά ένα από τα μέχρι τώρα δυσεπίλυτα προβλήματα της φωνολογίας της ελληνικής.

**1. Introduction**

For the past four decades, one of the most extensively discussed aspects of Greek phonology has been the status of the voiced stops, [<sup>(m)</sup>b], [<sup>(n)</sup>d] and [<sup>(ŋ)</sup>g]. Several analyses have been proposed spanning a wide range of phonological theories [e.g., Householder, 1964; Newton, 1972; Nespor & Vogel, 1986; Malikouti-Drachman & Drachman, 1992; Pagoni-Tetlow, 1994; Viechnicki, 1996]. However, none of these analyses can satisfactorily address all the facets of this issue, which includes not just the underlying representation (UR) of the surface voiced stops but also the observed variation in their pronunciation and its relation to the postulated UR.

**2. Previous analyses of surface voiced stops in Greek**

The analyses proposed so far fall into two broad groups, *concrete* and *abstract* analyses. The concrete analyses advocate that the URs of the surface voiced stops of Greek are also voiced stops. Analyses which fall into this category (though they differ substantially in their details) include Newton (1961), Householder (1964), Setatos (1974), Efstathiadis (1974) and Viechnicki (1996).

The strongest argument of the proponents of these analyses is that they are faithful to the surface structure. On the other hand, however, they cannot account for the morphophonological alternations of the type *λάμπω* : *έλαμψα* [la<sup>(m)</sup>bo] : [elampsa], and the

intuition of the native speakers that these reflect the intimate relation between surface voiced stops and nasal+stop clusters (henceforth NT). In addition, they leave unexplained the presence of prenasalisation in voiced stops and the alternation between the oral and prenasalised variants (henceforth D and ND respectively).

Some of the above-mentioned problems are addressed in the abstract analyses which, despite considerable differences, have one important thing in common: they derive the surface voiced stops of Greek from underlying clusters of nasal+voiceless stop in a *processual* way, i.e., through a series of assimilation rules (Newton, 1972; Nespors & Vogel, 1986), syllabification procedures (Malikouti-Drachman & Drachman, 1992) or a combination of the two (Pagoni-Tetlow, 1994).

Although these analyses avoid some of the pitfalls of the concrete solutions and do justice to the intuition of the native speakers, they are not devoid of problems. First, they fail to account for the application of the relevant processes in some cases and their non-application in others; compare, e.g., (1) and (2) below.

(1) *έλαμψα* [elampsɑ] (not \*[el<sup>(m)</sup>bzɑ])

(2) *συμψηφίζω* [sibzifizo] ~ [si<sup>m</sup>bzifizo] ~ [simpsifizo].

Second, they cannot explain the obligatory lack of prenasalisation word-initially or after liquids, as in

(3) *μπάλα* [bala] (not \*[<sup>m</sup>bala])

or

(4) *παρμπούνι* [barbuni] (not \*[<sup>m</sup>bar<sup>m</sup>buni]).

Finally, similarly to the concrete analyses, they cannot explain the ND ~ D variation word-medially<sup>1</sup>.

### 3. A constraint-based approach

#### 3.1. Does the problem lie in the input?

The problem with the types of analysis presented in Section 2 lies in the fact that they are all processual, and as such focus on finding the right input and processes governing the derivation of the surface voiced stops. In contrast, Optimality Theory, a theory that has been gaining ground since its first appearance in 1991, is a constraint-based framework in which the onus is put *not* on the input but on regulating the output via universal constraints. The role of the constraints is to evaluate possible outputs generated on the basis of the input; since constraints are hierarchically ranked in a language-specific order, outputs that violate lower ranked constraints will be preferred to outputs that violate higher ranked constraints; this formulation assumes that a given form may not satisfy all constraints but still be selected as the optimal output when no other form can satisfy fewer or more highly ranked constraints. It will be shown here, for example, how the different ranking of constraints can account for the variation observed among speakers of Greek with respect to prenasalisation.

### 3.2. Accounting for the ND ~ D variation

Incorporating the insight of previous analyses, notably Malikouti-Drachman & Drachman (1990; 1992), I will assume here that in Greek it is always the input NT that yields the output ND ~ D. The phenomenon observed here is known as postnasal voicing (PNV) and has occupied OT theorists before (Itô, Mester & Padgett, 1995; Pater, 1996; to appear; Pulleyblank, 1997).

The output ND is easily accounted for in Pater's analysis. Specifically, Pater – on the basis of data from several languages – postulates the existence of  $*NC_{\sigma}$ , a constraint that “penalizes nasal/voiceless obstruent sequences” (Pater, 1996: 229). In languages like Greek this constraint is highly ranked; concretely it is more highly ranked than IDENT(voice), which demands that the value of the feature [voice] be the same in the output as in the input (in ND the voicing of the stop differs between input and output). Formally, this ranking of constraints is represented as follows.

(I)  $*NC_{\sigma} \gg \text{IDENT(voice)}$

Input: /pente/	$*NC_{\sigma}$	IDENT(voice)
a. pente	*!	
εb. pende		*

What about D, however? Pater (1996), although he cites Newton (1972) as his source on Greek, does not mention this output at all; similar silence characterises many studies that address Greek PNV. One possible reason could be that the ND ~ D variation is considered to be a matter of phonetic realisation, and hence beyond the scope of a phonological analysis. However, there are strong arguments against this view. Consider the distribution of D and ND: both of them may appear intervocally and in clusters in which D or ND is *followed* by a liquid, e.g.,

(5) *αγκινάρα* [a<sup>h</sup>ginara] ~ [aginara]

(6) *εμπρός* [e<sup>m</sup>bros] ~ [ebros].

However, ND cannot appear word-initially or *preceding* a liquid; e.g.,

(7) *ντουλάπι* \*[<sup>h</sup>dulapi]

(8) *άλμπουρο* \*[al<sup>m</sup>buro],

even in the speech of those who otherwise prefer ND to D (Newton, 1972; Arvaniti & Joseph, in press). As will be shown, the positions in which ND cannot appear are those in which the nasal cannot be parsed due to syllabification constraints. This strongly suggests that the distinction between ND and D is not a matter of phonetic interpretation but is phonologised in Greek; moreover, it shows that syllabification constraints are directly involved in the choice of output for NT clusters, *contra* Pater (to appear).

How are we then to account for D? At first glance D seems problematic: in addition to violating IDENT(voice), it appears to violate MAX, a normally highly ranked constraint

requiring that every segment in the input is represented in the output (McCarthy & Prince, 1995). If this syllogism were correct, then the output ND should always be preferred, since it violates only one of these two constraints, IDENT(voice).

This argument, however, is based on the mistaken assumption that the nasal is “missing” in the output D. Instead, following Correspondence Theory (McCarthy & Prince, 1995; McCarthy, 1995), I would like to propose that in Greek D is the result of *fusion* and as such corresponds to *both* the nasal and the stop of the underlying cluster NT. This in turn means that MAX is not violated, since both N and T have a correspondent in the output, namely D. On the other hand, fusion violates UNIFORMITY, which “prohibits two or more input segments from sharing an output correspondent” (McCarthy, 1995: 49). This means that there must be some other, more highly ranked constraint in Greek which makes D preferable to ND. The data from the cases where the variation between ND and D is impossible suggest that this constraint must be related to syllabification. As a preliminary answer, I would like to propose that the relevant constraint is NOCODA. Thus, for the speakers who select D, NOCODA is ranked higher than UNIFORMITY, whereas the ranking is the other way round for the speakers who select ND<sup>2</sup>. This is shown in tableaux (II) and (III).

(II) MAX >> NOCODA >> UNIFORMITY >> \*NC<sub>ɔ</sub> >> IDENT(voice)

Input: /pente/	MAX	NOCODA	UNIFORMITY	*NC <sub>ɔ</sub>	IDENT(voice)
a. pen.de		*!			*
εb. pe.de			*		*
c. pe.te	*!				

(III) MAX >> UNIFORMITY >> NOCODA >> \*NC<sub>ɔ</sub> >> IDENT(voice)

Input: /pente/	MAX	UNIFORMITY	NOCODA	*NC <sub>ɔ</sub>	IDENT(voice)
εa. pen.de			*		*
b. pe.ne	*!				
c. pe.de		*!			*

We still need to account for the fact that the variation between ND and D is impossible word-initially and after liquids. As noted, this lack of variation must be due to constraints on syllabification and in particular to the parsing of the nasal. The relevant constraint is SONCON (for “sonority contour”), which states that “complex onsets rise in sonority and complex codas fall in sonority”<sup>3</sup> (Benua, 1995). This constraint, in combination with the undominated PEAK, which requires that only vowels be peaks of syllables, and the highly ranked MAX and DEP, which prohibit deletion and insertion respectively, results in D being the only possible output in the cases examined here. The ranking of all the constraints examined so far is shown in (IV)<sup>4</sup>,

where MAX and DEP are separated by comma since there is no evidence of their ranking in the present data; tableaux (V) and (VI) show only the constraints relevant to these cases.

(IV) PEAK >> MAX, DEP >> SONCON >> UNIFORMITY >> NOCODA >> \*NÇ >> IDENT(voice)

(V) PEAK >> MAX, DEP >> SONCON >> UNIFORMITY

Input: /mpanana/	PEAK	MAX	DEP	SONCON	UNIFORMITY
a. m.ba.na.na	*!				
b. pa.na.na		*!			
c. me.pa.na.na			*!		
d. mba.na.na				*!	
εε. ba.na.na					*

(VI) PEAK >> MAX, DEP >> SONCON >> UNIFORMITY

Input: /am puro/	PEAK	MAX	DEP	SONCON	UNIFORMITY
a. al.m.bu.ro	*!				
b. al.pu.ro		*!			
c. al.me.pu.ro			*!		
d. alm.bu.ro				*!	
e. al.mbu.ro				*!	
εf. al.bu.ro					*

### 3.3. \*NÇ and NCC clusters

The analysis so far does not exhaust all the possible outputs of underlying NT clusters. In addition to the above cases, we know that Greek exhibits alternations between voiced stops and nasal+stop clusters as in

(9) *λαμπρός* [la<sup>(m)</sup>bro̥s]

but

(10) *κομψός* [kompsos].

According to Pater (1996) the constraint responsible for this output is VOICEASSIM<sup>5</sup>, which requires regressive voicing assimilation between obstruents (c.f. Malikouti-Drachman & Drachman, 1990, on the voicing patterns of obstruents in Greek]. This constraint being more highly ranked than \*NÇ selects the output [kompsos] rather than \*[kombsos] or \*[kombzos]. On the other hand, *λαμπρός* /lampros/ surfaces as [lambros], since VOICEASSIM does not hold in this case (the only obstruent involved is /p/), and therefore \*NÇ takes over.

This analysis needs further refinement, however, since the sequences /mps/ and /ŋks/ surface as such within roots but not across morpheme boundaries; compare

(11) *έλεγκσα* [eleŋksa], not \*[ele<sup>(ŋ)</sup>gza]

but

(12) *συμψηφίζω* [simsifizo] ~ [si<sup>m</sup>bzifizo] ~ [sibzifizo].

This difference suggests that in Greek as in other languages (see Pulleyblank, 1997, and references therein) some constraints hold only within certain domains; in this case, the constraint VOICEASSIM appears to hold within the root but not at the root's edges. Therefore, it must be a more specific constraint, ROOTVOICEASSIM<sup>6</sup>, that is ranked above \*N<sub>Ḷ</sub>, while VOICEASSIM (which refers to everything except the root) is ranked below \*N<sub>Ḷ</sub>, so that when NCC clusters appear at the edges of roots, \*N<sub>Ḷ</sub> takes precedence and such clusters surface voiced. Obviously, for the speakers who always have [simsifizo], never [si<sup>m</sup>bzifizo], the ranking is VOICEASSIM >> >> \*N<sub>Ḷ</sub> in all cases.

### 3.4. Clitics and NT

A similar approach can be taken with respect to NT clusters resulting from the juxtaposition of clitics and hosts. These, as has been noted before (Arvaniti, 1991; Malikouti-Drachman & Drachman, 1992), exhibit an asymmetry between the right and left edge of the prosodic word (PrWd) that acts as a host to the clitics. Thus,

(13) *των παιδιών τους* /ton+peðjon+tus/

surfaces as

(14) [to<sup>m</sup>beðjontus] ~ [tobeðjontus] (not \*[to<sup>m</sup>beðjo<sup>n</sup>dus] ~ \*[tobeðjodus]).

The reason for this asymmetry must lie in paradigm uniformity (McCarthy & Prince, 1995; McCarthy, 1995; Benua, 1995) which requires that the onset of the clitic retain its identity, i.e., does not become voiced. As a preliminary step, I will follow here Pater's informal suggestion of calling the relevant constraint SPECIALFAITH, "a Faithfulness constraint that demands Identity in [voice] specification between correspondent Output segments" (Pater, 1996: 233). In our case this constraint requires identity between the different outputs of the clitic /tus/ with respect to the voicing of the /t/; the same holds for all similar clitics (as in, e.g., *άφησέ την του* [afisetintu]). Clearly the details of this proposal need further elaboration, which space does not allow me to do here.

### 4. Conclusion

In conclusion, it has been argued here that the underlying representation of surface voiced stops in Greek is sequences of nasal+voiceless stop. These sequences are sufficient to generate all the outputs found in Greek, provided a constraint-based approach, such as Optimality Theory, is adopted. Such an OT-based analysis has been presented here; certain

aspects of this analysis are still in a preliminary form but the overall success of the framework in accounting for the present data suggests that these aspects are certainly worth exploring further.

#### NOTES

<sup>1</sup> Pagoni-Tetlow (1994) alone mentions the case exemplified in (4) and accounts for it by using *Magic Licencing* a rather *ad hoc* solution to the problem.

<sup>2</sup> As is well established of course, NOCODA can be violated in Greek (see, e.g., Kappa, 1997). This point certainly requires more detailed examination.

<sup>3</sup> Obviously, some fine-tuning is necessary here, since both fricative+stop and /s/+obstruent clusters are allowed in Greek. Clusters with /s/ are irregular in many languages. As for the fricative+stop clusters, one possible solution would be to specify that fricatives and stops have the same sonority in Greek and that sequences of equal sonority are allowed. The details of this or other possible proposals about Greek onsets are beyond the scope of this paper.

<sup>4</sup> The relative ranking of UNIFORMITY and NOCODA is inconsequential with respect to these cases.

<sup>5</sup> Pater wrongly assumes deletion of the nasal here, following Newton (1972: 114f.). The pattern presented by Newton is probably correct for Demotic Greek but it is not the pattern observed in Standard Greek today; there is probably variation here between learned and demotic vocabulary; c.f. *σφιζιμο* [sfiksimo] (not \*[sfɪŋksimo]), but *λάμψη* [lampsɪ] (not \*[lapsɪ], as Newton reports).

<sup>6</sup> It has been argued of course that /s/ in examples like (11) is a separate morpheme (e.g. Newton, 1972). If this analysis is accepted, then ROOTVOICEASSIM would be PRWDVOICEASSIM instead, while affixes like /sin/ would be considered as forming a separate prosodic word.

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