Arguments for a Metrical(*s*/*w*) Model of Reduplication

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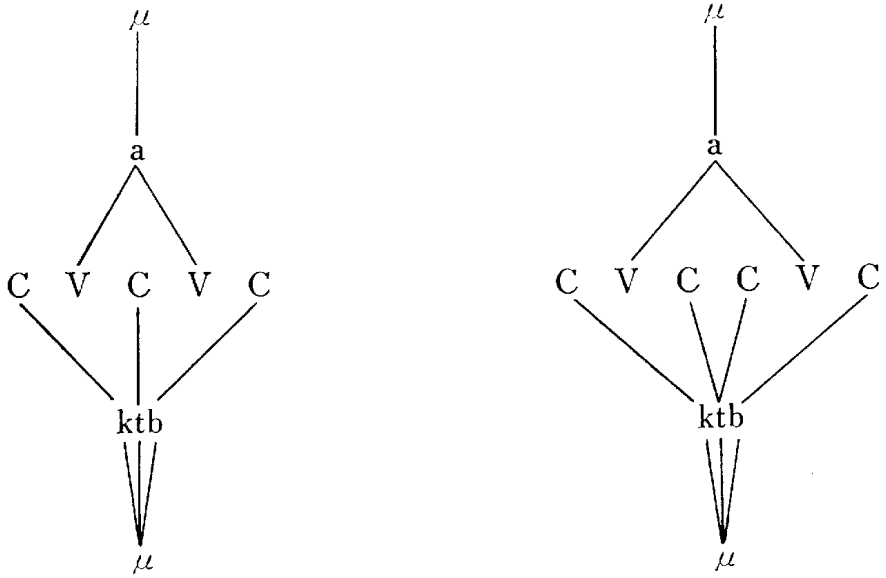
1. Introduction: Theoretical Background

Ever since the first proposal of autosegmental phonology (Goldsmith 1976), a wide range of phenomena has received reanalysis in this vein, with a concomitant deepening of our understanding of the issues concerned. The area of morphology is no exception. In particular, problems of reduplication are fruitfully placed in an autosegmental perspective. McCarthy (1979 and 1981), in dealing with Arabic verbal morphology, develops a prosodic model of reduplication, which constitutes the point of departure in the subsequent application of autosegmental analysis onto the issue. (Cf. Halle and Vergnaud 1980; Harris 1980; Stemberger 1981.)

The key of the model is a dual representation of morphemes, a prosodic template, which is a pure *CV* concatenation with no specification given about melodic properties of segments concerned, and a melodic tier which is a configuration of melodic properties substracted from corresponding segments. Moreover, the latter structure is provided for on a morpheme-to-morpheme basis, that is to say, each morpheme constitutes a melodic tier on its own. The following sample derivatoins clarify the point (cf. McCarthy 1981: 388ff; 1982: 192ff.):

(1) a. *katab* 'write' b. *kattab* 'cause to write'



In this framework, reduplication is characterized as a many-to-one association between a prosodic template and a melodic tier (see (1b) above). By thus giving to reduplication an analogous mode of representation as in the case of tone, some otherwise recalcitrant phenomena are subject to principled explanation (cf. McCarthy 1981). Without adumbrating here the advantages of this approach over the linear, in particular, transformational counterpart, for the sursequent discussions of this paper, I will presuppose the reader's acquaintance with the prosodic approach.

The main architecture of this article is as follows: section 2 serves as an introduction to my new model of reduplication, which is crucially based on a metrical structure *s/w*, as opposed to the current *C/V* structure. In the following two sections, I will offer substantial arguments for my proposed model and against the current approach: Section 3 deals with Gothic, and Section 4, ancient Greek. The last section contains some concluding remarks.

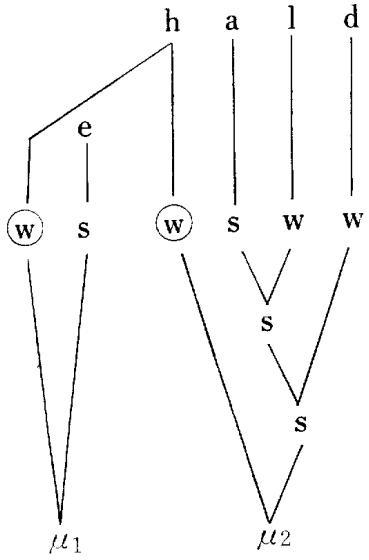
2. Outline of a *s/w*-based Model of Reduplication

The essential claim of my model is that association between a prosodic template and a melodic tier should require a more

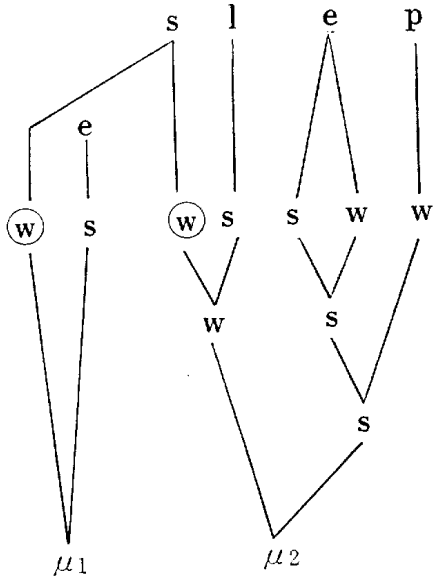
structured representation than the current *C/V*-based model allows for. More specifically, the matching between the elements of the tiers to be associated makes a crucial reference to the upper metrical structures to which they are subordinated.

In anticipating some examples detailed later, let us consider how the derivation proceeds within my framework:

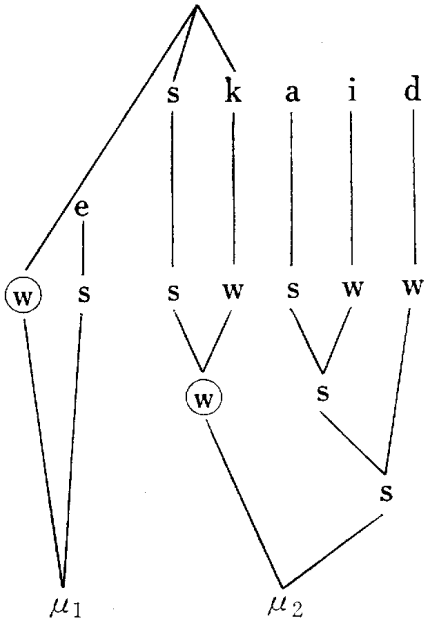
(2) a. *hehald* 'hold'



b. *seslēp* 'sleep'



c. *seskaid* 'divide'



Key: μ_1=prefix; μ_2=stem.

The mapping between a prosodic template (represented as a ter-

minal *s/w* concatenation) and a melodic tier is subject to the following constraint:

(3) Well-Formed Mapping Constraint (WFMC)
The mapping of a melodic element onto an unspecified slot in a prosodic template is well-formed only if the corresponding node values in terms of *s/w* are identical.

By this principle, the mapping of /h/ in *hald* and /s/ in *slēp* to *w* of the prefix counts as well-formed, hence the desired outputs *hehald* and *seslēp*, respectively. In case (2c), however, the possible association of /s/ with *w* violates (3), by virtue of its being dominated by *s* while the slot to be filled is designated as *w*. Hence, the ill-formed **seskaid*. At this point, another mechanism enters the picture, whose job it is to secure the matching of /sk/ with *w*. This is something like a cyclic mode of rule application, which stipulates:

(4) Continue to try mapping upwards.

This takes care of the mapping of /sk/ onto the unfilled slot. This time, the matching works well because of the shared node value *w*. Hence, the required form *skeskaid*.

The following two sections then are devoted to formal and empirical consenquences of the proposal above outlined.

3. Gothic Reduplication

3.1. Facts

In Gothic reduplication is utilized to form the preterite for the seventh class strong verbs. The process has properties which can be summarized as follows:

(5) a. If stems begin with /st/ or /sk/, then reduplicate these initial clusters:
b. Otherwise, reduplicate an initial consonant if there is any:
c. Add /e/(〈aí〉) to the immediate left of the stem initial.

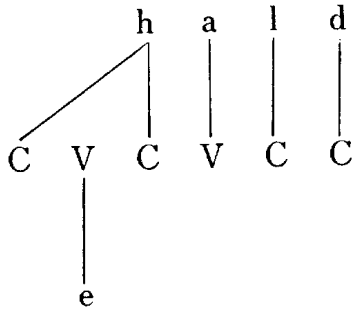
Hence, the following examples:

(6) *hald- / haíhald* 'hold'
-stald- / -staístald 'possess'
skáid- / skaískáid 'divide'
fráis- / faífráis 'tempt'
áuk- / aíáuk 'add'
slēp- / saíslēp 'sleep'

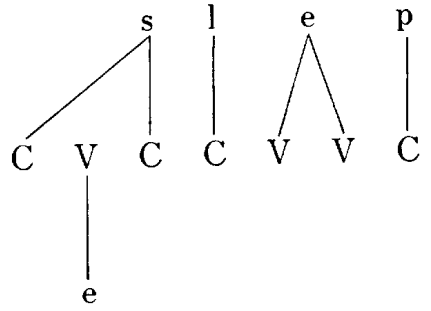
3.2. A C/V-based Model

Within the *C/V*-based prosodic model of reduplication, the phenomena illustrated in 3.1. receive the following analysis (cf. van der Hulst and Smith 1982: 27ff; hereafter H-S):

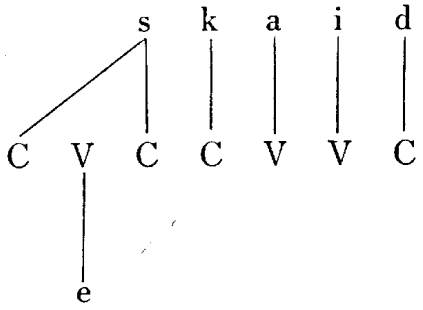
(7) a.



b.

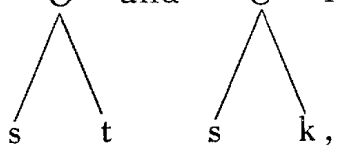


c. *



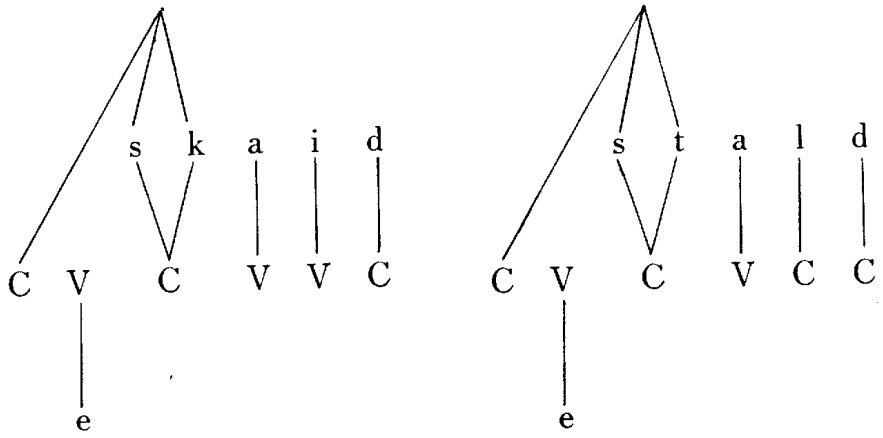
This amounts to saying in effect that reduplication is a prefixation of C V where C is left underlyingly unspecified and thus

receives phonetic interpretation according to the stem initial values. What deserves particular notice is H-S's treatment of /st/ and /sk/. They take these clusters to be complex consonants, namely C and C respectively. By doing so, H-S ascribe



the peculiarity that the clusters at issue reduplicate as a unit to their status as a single C:

(8)

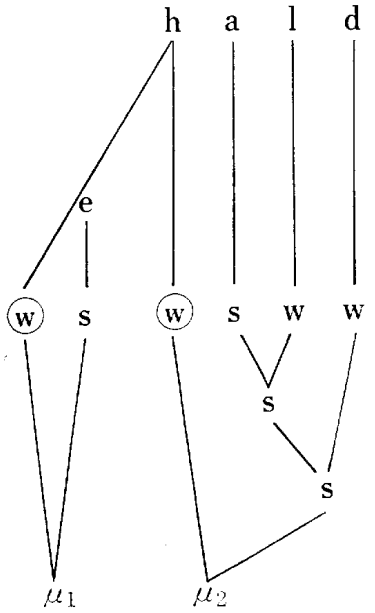


Their proposed analysis of /st/ and /sk/ is, however, ill-founded. For details, see 3.4. below.

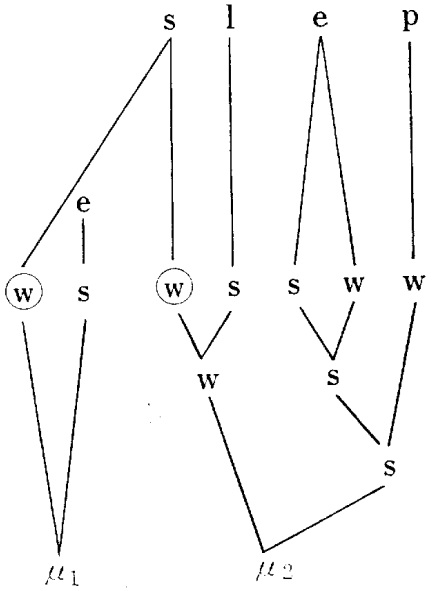
3.3. A s/w-*based Model*

In my proposed apparatus, the processes under discussion lend themselves to the following derivations:

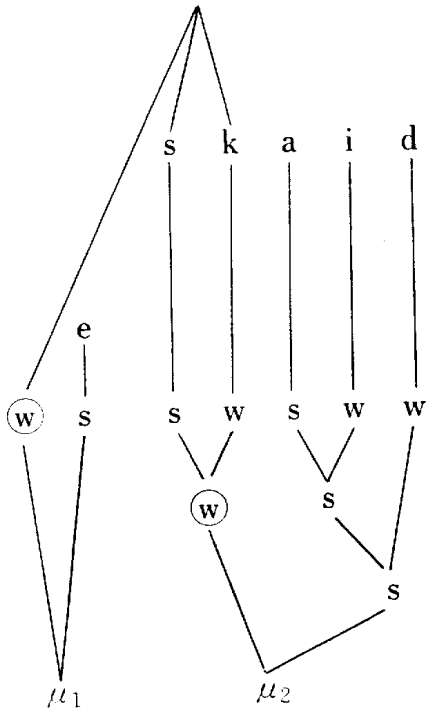
(9) a.



b.



c.



As sketched earlier, my model crucially refers to metrically structured hierarchical organisations in an associating process. Although at this moment this may appear to be little more than a notational variant, it will be demonstrated in the next subsection that it entails empirical consequences of much interest. What is to be noted here is that the new apparatus need not presuppose /st/ and /sk/ to be complex consonants as H-S assume them to be.

3.4. Evaluation of the Two Models

3.4.1. Bisegmental Status of /st/ and /sk/

As pointed out earlier, H-S treat /st/ and /sk/, by postulating a single C for each, in parallel to single simple consonants. This entails necessarily, therefore, that /st/ and /sk/ (and /sp/ by implication) exhibit the identical pattern as simple consonants with respect to phonological processes which essentially depend on segmental, as opposed to melodic, information. The purpose of this subsection then is to reveal that this empirical claim is falsified by the facts.

Two phenomena constitute a testing ground: Sievers' Law (SL) and High Vowel Apocopation (HVA). Let us begin with SL. Consider the following examples, first:

(10) a. Nom. and gen. sg., *ja*-stem:

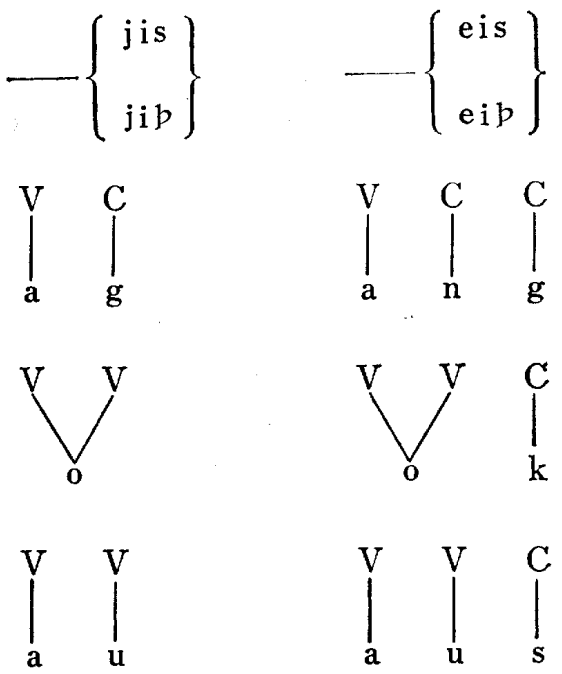
har*jis* 'army'	and*eis* 'heardsman'
	ƕait*eis* 'wheat'
	lēk*eis* 'physician'

b. 2 and 3 pers. sg. and 2 pers. pl. pres. ind., weak verb I:

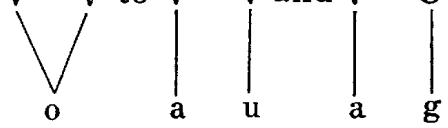
lag*jis* 'lay' (2 sg.)	waurk*eis* 'work'
lag*jiþ* (3 sg. and 2 pl.)	gadragk*eiþ* 'drink'
stō*jis* 'judge'	sōk*eis* 'seek'
stō*jiþ*	sōk*eiþ*
tau*jis* 'do'	haus*eis* 'hear'
tau*jiþ*	haus*eiþ*

A case in point is the alternation between *jis* (*jiþ*) and *eis* (*eiþ*). From the examples adduced above, it can be said that *jis* and *jiþ* come about when not more than one segment stands between the stem vowel and the endings in question. Expressed in an autosegmental framework, this is equal to saying that the alternation is sensitive to a segmental tier, rather than to a melodic counterpart. To see this more clearly, observe the following representations:

(11)



Of particular interest is the behavior of stems with a long vowel, e.g. *stō-* vs. *stōk-*. If the process were regarded as melodically-sensitive, then the parallelism of



would defy explanation.

With this characterization in mind, let us examine how stems ending in /st/ and /sk/ behave in this regard:

(12) witodafast*eis* 'expert in law' nom. sg., *ja*-stem: Luk 10, 25.
fraquist*eiþ* 'destroy' 3 sg. pres. ind., weak verb I:
Mat 10, 39, etc.
usqist*eiþ* 'destroy' 3 sg. pres. ind., weak verb I:
Luk 20, 16, etc.

All the attested stems of the relevant phonological make-up have *eis* and *eiþ* attached to them, in accordance with those with the VCC configuration. This clearly testifies to the bisegmental, rather than monosegmental, property of /st/ (and by extrapolation /sk/ and /sp/), in contradiction to H-S's treatment.

Let us move on to HVA, next. It is a fact in Germanic[1] that word-final /i/ and /u/ are subject to deletion only if the preceding

(monosyllabic) stems are long, which can be expressed as # C_0VS_2____# (S stands for a segment):
(For purposes of exposition, the examples are drawn from OE, Cf. Suzuki 1983:)

(13) a. VC_1^1____#
wine<**wini* 'friend' (masc. nom. acc. sg., *i*-stem)
scinu<**scinō* 'skin' (fem. nom. sg., *ō*-stem.)
fatu<**fatō* 'vessel' (neut. nom. acc. pl., *a*-stem)
sete<**seti* 'set' (2 sg. imp., weak verb I)

b. VC_2____#
dynt<**dunti* 'dint' (masc. nom. acc. sg., *i*-stem)
mund<**mundu*<**mundō* 'hand' (fem. nom. sg., *ō*-stem)
word<**wordu*<**wordō* 'word' (neut. nom. acc. pl., *a*-stem)
drenc<**drenci* 'drink' (2 sg. imp., weak verb I)

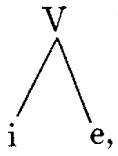
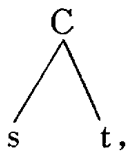
c. $\overline{V}C$____#
blǣd<**blādi* 'blast' (masc. nom. acc. sg., *i*-stem)
brōd<**brōdu*<**brōdō* 'brood' (fem. nom. sg., *ō*-stem)
lām<**lāmu*<**lāmō* 'clay' (neut. nom. acc. pl., *a*-stem)
dēm<**dēmi* 'judge' (2 sg. imp., weak verb I)

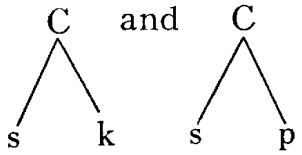
d. $\overline{V}uC_1^1$____#
hlīep<**hlaupi* 'leap' (masc. nom. acc. sg., *i*-stem)
fēol<**feulu*<**feulō* 'file' (fem. nom. sg., *ō*-stem)
lēoþ<**leuþu*<**leuþō* 'song' (neut. nom. acc. pl., *a*-stem)
hīere<**hauri* 'hear' (2 sg. imp., weak verb I)

What is worthy of particular consideration is the behavior of 'short diphthongs' with respect to HVA. As I have demonstrated elsewhere (Suzuki 1983), they follow the pattern of VC:

(14) *ciele* 'cold' (masc. nom. acc. sg., *i*-stem)
giefu 'gift' (fem. nom. sg., *ō*-stem)
geocu 'yoke' (neut. nom. acc. pl., *a*-stem)

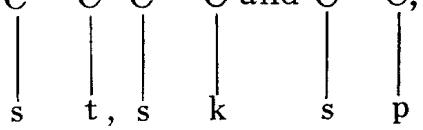
giere 'prepare' (2 sg. imp., weak verb I)

New, if, following an autosegmental representation, short diphthongs are to be analysed as  then it follows that, 

 as H-S propose them, would, by virtue of being monosegmental, block the apocopation in the environment $C_0Vs\begin{Bmatrix} p \\ t \\ k \end{Bmatrix}$___#. This test implication, however, receives disconfirmation. This is substantiated by the following examples:

(15) *nest*<**nestu*<**nestō* 'nest' (neut. nom. pl., *a*-stem)
hlyst<**hlusti* 'sense of hearing' (masc. nom. sg., *i*-stem)
rest<**resti* 'rest' (2 sg. imp., weak verb I)
hysp<**huspi* 'scorn' (2 sg. imp., weak verb I)
dwæsc<**dwasci* 'extinguish' (2 sg. imp., weak verb I)
geþysc<**-þysci* 'press' (2 sg. imp., weak verb I)

Obviously, /st/, /sk/, and /sp/ count as bisegmental as regards HVA. Thus, here is another piece of evidence speaking against H-S's monosegmental analysis of them.

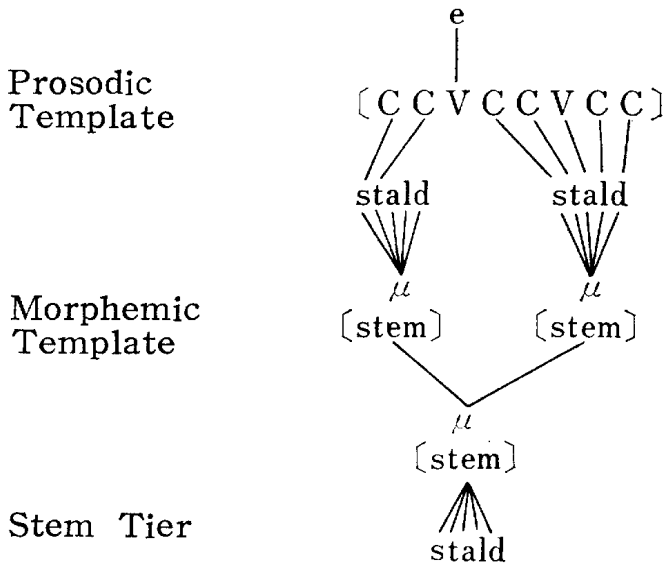
In sum, it has been proved that contrary to H-V's proposal, /st/, /sk/ and /sp/ should be analyzed as  respectively.

3.4.2. Some Consequences

In the preceding, H-S's analysis of /st/ and /sk/ has turned out to be empirically ill-motivated. This is tantamount to saying that reduplication involving /st/ and /sk/ defies anything approaching a principled explanation within H-S's version of the *C/V* model.

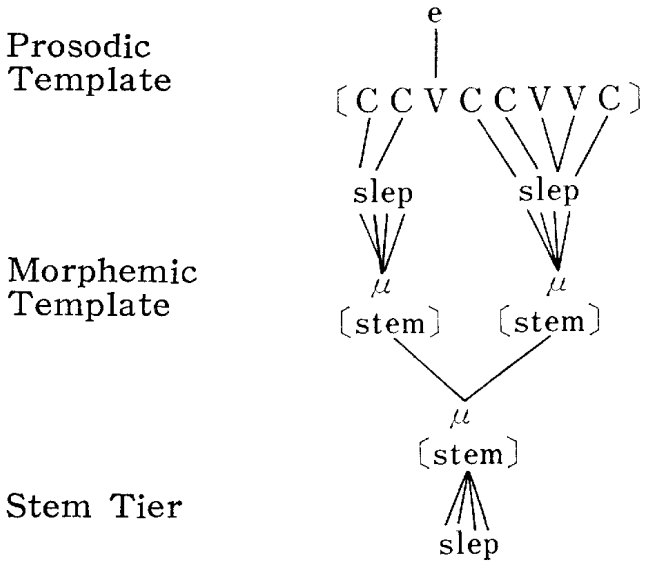
This is not, however, a direct indication of the inadequacy of the *C/V*-based model itself. For there remains another device at disposal within the model, that is, the copying of the whole melodic entity of the word (cf. H-S: 27; Halle and Verganud 1980: 93; McCarthy 1982: 210ff.). This leads to the following derivation:

(16)



The mechanism resorted to above, though capable of obtaining desired outputs, is hardly a step forward. The reason is that it is left totally unexplained why only /st/ and /sk/ to the exclusion of other consonant clusters are subject to reduplication as units. More specifically, it cannot rule out in a principled way the following counterfactual reduplication:

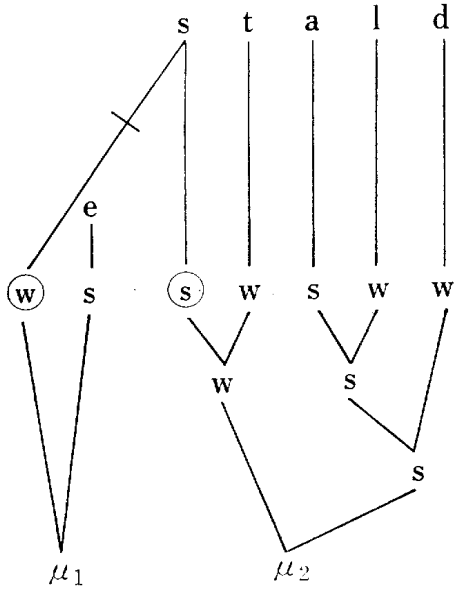
(17) **sleslēp* (actual form *seslēp*)



Thus, within the approach under discussion, one has no choice but to ascribe the problem of unit reduplication (i.e. /st/ and /sk/) to a matter of pure accident and one of stipulation accordingly. Moreover, it seems to cost too much to invoke the copying of the whole word when most of the cases are reducible to a far simpler prefixation of C V
|
e.

The foregoing argument has definitely shown that the current *C/V*-based model is incapable of providing an explanatory account of Gothic reduplication. The next move to be taken then is to argue for a superiority of my *s/w*-based model on this score. This can be done by illustrating how stems with /st/ and /sk/ get reduplicated under my interpretation:

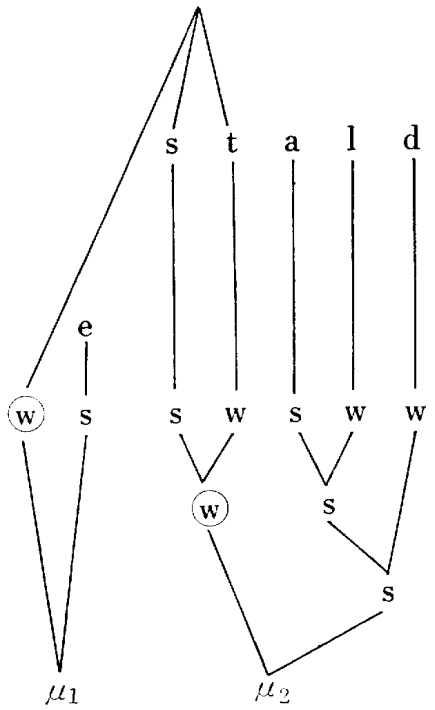
(18)

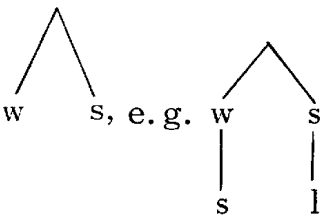


As outlined in Section 2, the mapping of a melodic element onto an unspecified slot (*w* of μ_1) is subject to WFMC, which requires the identity in terms of *s/w* representation between a pair to be involved in association. To put it another way, association proceeds by intermediation of the identity of the *s/w* node. With this requirement, the stem initial /*s*/ could not get associated with the prefix initial under *w* by virtue of its being directly dominated

by *s*. Then, the matching process moves one step upward to the cluster /st/, according to (4). In this case, WFMC is satisfied because of the node identity (/st/ is exclusively dominated by *w*). This then assures the connection between /st/ and the empty slot on the pivot of *w*, resulting in:

(19)

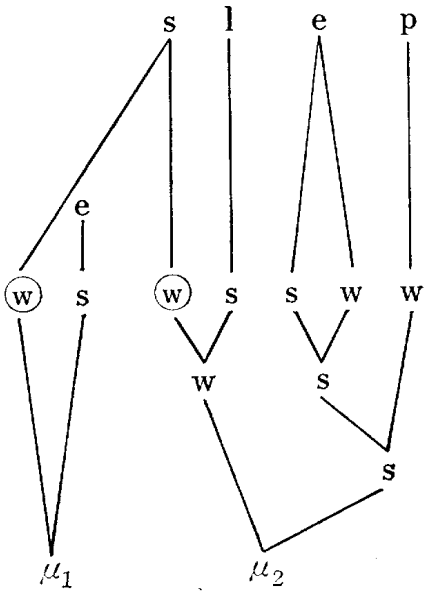


Furthermore, the singular fact that unit reduplication is confined to /st/ and /sk/ receives a principled explanation in my model. Since other permissible initial consonant clusters (cf. Moulton 1972:167) are characterizable as 

, e.g.

(notice that the *s/w* opposition is correlated to the relative degree of sonority in the pairs involved), they are correctly predicted to follow single reduplication:

(20)



Thus, it can be fairly said that the *s/w*-based model can generate all and only the correct reduplicated forms in a non-ad hoc manner. Therefore, a superiority of the proposed model over the currently held counterpart has been substantiated.

4. Greek Reduplication

4.1. Facts

In ancient Greek, reduplication, by means of which the perfect is formed, proceeds as follows:

(21) a. For verbs beginning with a single consonant, or a cluster comprising a mute plus a sonorant, reduplicate it followed by ε.

b. For those with the remaining consonant clusters (including double consonants, φ, ξ), add ε to the initial.

Hence the following examples:

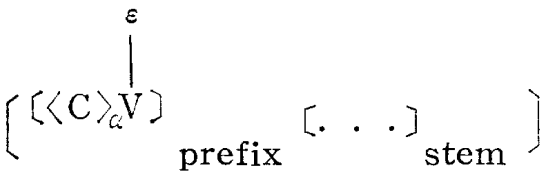
(22)

a.	κείρω / κέκαρμαι	'cut short'
	κρίνω / κέκρικα	'separate'
	κνάω / κέκνησμαι	'scrape'
	πείθω / πέπεικα	'persuade'
	πλέω / πέπλευκα	'sail'
	πρᾶττω / πέπρᾶχα	'do'
	τυγχάνω / τετύχηκα	'happen to'
	τμήγω / τετμημένος	(pf. part) 'cut'
	τρῑ́βω / τέτριφα	'rub'
b.	σκαίρω / ἐσκαίρκα	'skip'
	σπάω / ἔσπακα	'draw'
	στέλλω / ἔσταλκα	'send'
	ψεύδω / ἔψευκα	'cheat'
	ξαίνω / ἔξαιμαι	'scratch'
	κτείνω / ἔκτονα	'kill'
	πτοέω / ἐπτόημαι	'frighten'

4.2. A C/V-based Model

In the absence of any actual proposals, it is nonetheless legitimately expected that the current *C/V*-based approach leads us to the following morphological characterization of Greek reduplication:

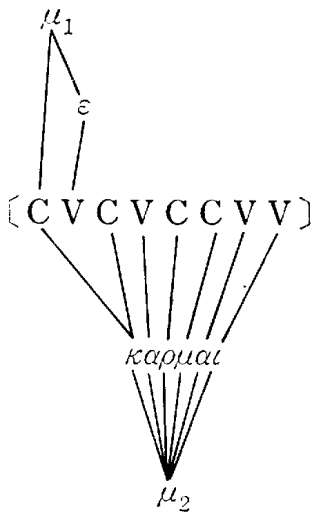
(23)



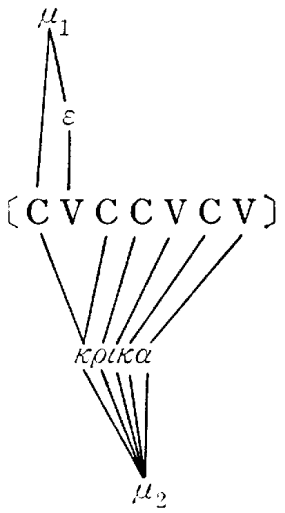
Condition: if a stem begins with a single consonant or a cluster comprising a mute a sonorant, then α.

Observe now how the derivation runs:

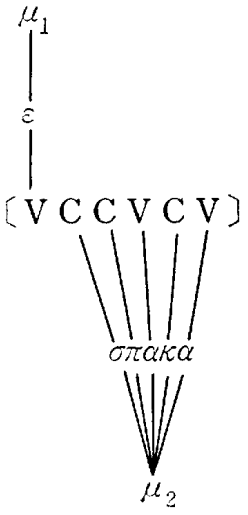
(24) a.


μ_1
ε
〔C V C V C C V V〕
καρμαι
μ_2

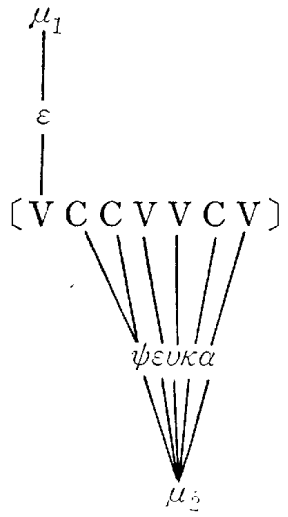
b.


μ_1
ε
〔C V C C V C V〕
κρικα
μ_2

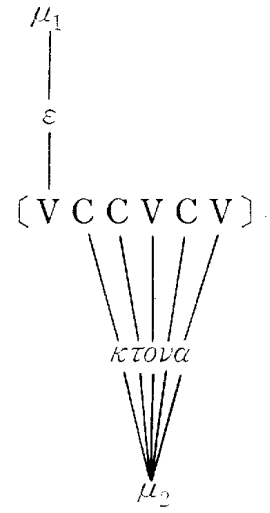
c.


μ_1
ε
〔V C C V C V〕
σπακα
μ_2

d.



e.

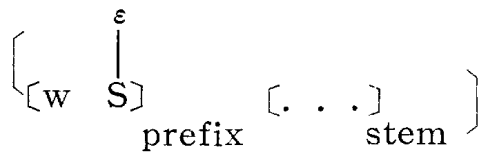


Thus, in this model, Greek reduplication can be uniformally characterized as a prefixation by means of (C) $\overset{\text{V}}{|}_{\varepsilon}$, the presence of the constituent C being conditioned by the phonological make-up of stems.

4.3. A s/w*-based Model*

Following this model, one comes up with a representation as follows:

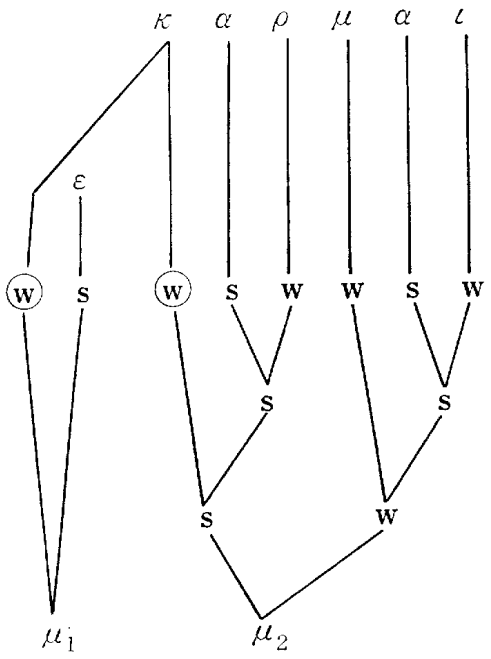
(25)



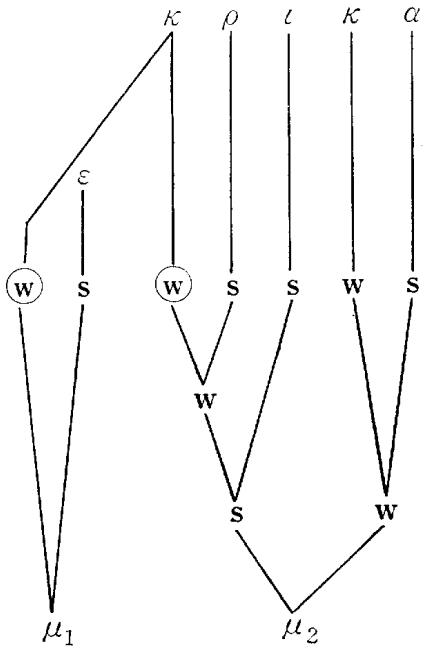
Condition: *w* may not branch off.

Let us look at the following exemplifications:

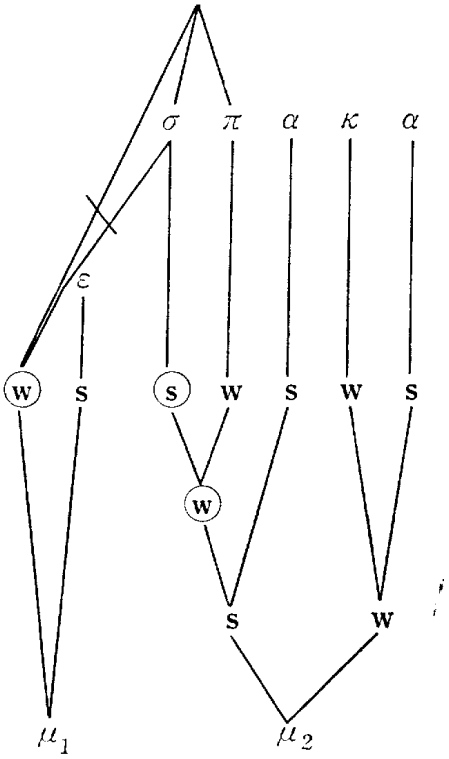
(26) a.



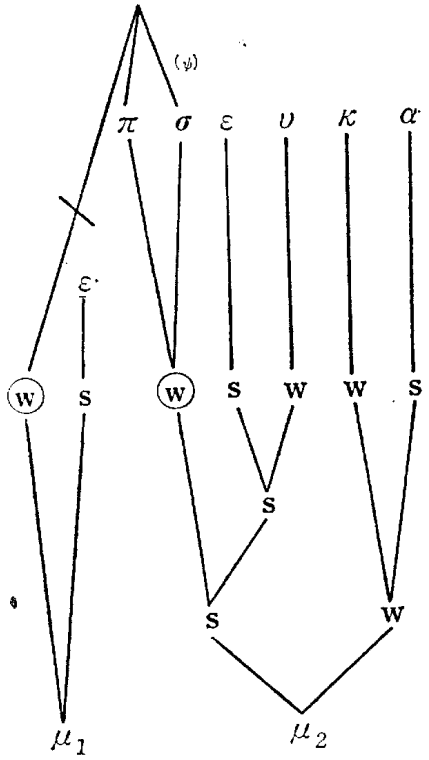
b.



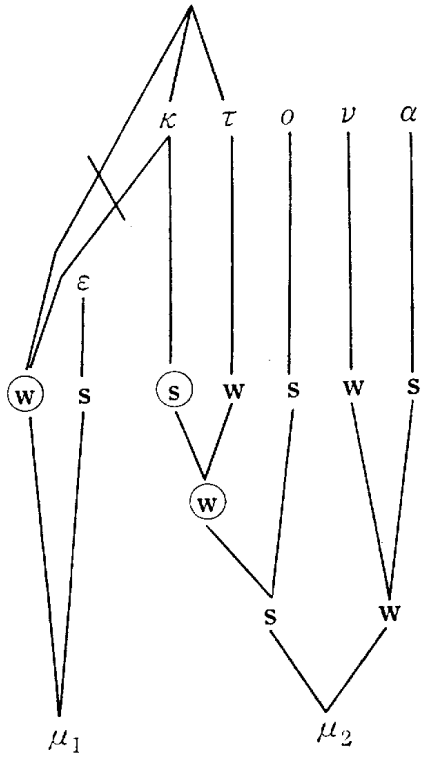
c.



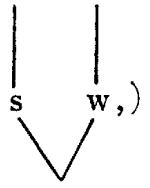
d.



e.



Detailed arguments for the *s/w*-, as opposed to the *C/V*-, based model are deferred until the next subsection. It should be noted at this point, however, that the above analysis presupposes 1) the monosegmental nature of double consonants (*φ*, *ξ*), and 2) *τ* is weaker K T both than *κ* and *π* (as exemplified by the represen-

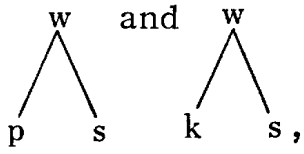


tation of which will be subsequently substantiated in the following.

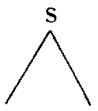
4.4. Evaluation

4.4.1. Monosegmental Status of Double Consonants

As briefly mentioned before, the *s/w* model being developed here presupposes *φ* and *ξ* to be monosegmental, i.e.



respectively. This subsection then is devoted to the substantiation of this claim. The evidence to be adduced falls into three types: 1) distributional properties, 2) sound changes, and 3)

motivation for postulating monosegmental diphthongs 

.

Although each piece of evidence, taken in isolation, seems rather trivial, once placed in the whole perspective, they do converge to point to the monosegmental status of the consonants in question.

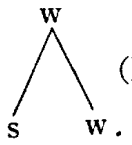
Let us begin by considering distributional properties. Permissible two-consonant clusters in word-initial position are as follows (cf. Lupaş, 1972: 136-137):

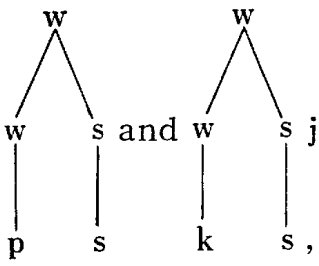
(27)

	P	b	P^{c}	t	d	t^{c}	k	g	–g	k^{c}	m	n	r	l	s	–s	–h
p				⊗								⊗	⊗	⊗			
b					⊗								⊗	⊗			
p^{c}												○	⊗	⊗			
p						⊗									⊗		
t											⊗	○	⊗	⊗			
d											⊗	⊗	⊗				○
t^{c}											○	⊗	⊗	⊗			
k				⊗							○	⊗	⊗	⊗			
g					○				○		○	⊗	⊗	⊗			
k^{c}											○	⊗	⊗	⊗			
K						⊗									⊗		
k—	○	○	○		○	○					○	○	○	○	○		
kk—													○	○			
m	○	○	○									⊗					
n				○	○	○										○	○
N							○	○		○							
r	○	○	○	○	○	○	○	○		○	○	○		○	○		○
l	○	○	○	○	○	○	○	○		○	○				○		○
s	⊗	⊗	⊗	⊗	⊗	⊗	⊗	○		⊗	⊗						○
s—		○			○			○			○	○	○	○	○		

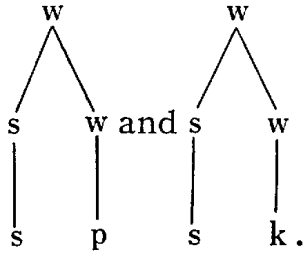
Les groupes qui apparaissent à l'initiale de mot sont notés par le signe ×, ceux qui apparaissent en position médiane par le signe ○, ceux qui sont admissibles a la finale par le signe □.

From the above a general pattern emerges: the asymmetry in terms of order, by which is meant that no permissible cluster is attested which could be obtained by conversing the order of any given existent clusters: e.g. *πρ-*/**ρπ-*, *κτ-*/**τκ-*. This restriction seems something to be expected when one takes into account the function of the syllable. It is a segment-organizing higher unit, the structuring principle of which is based on whatever the hierarchical scale(s) (notably, sonority or degree of aperture) is, wherein segments are placed relative to one another. Thus, if reversing the original order assured a permissible cluster in principle, it would come closest to be contradictory with the function of the syllable itself, by obliterating the scale-based hierarchical relation among segments, in terms of which the integrity of the syllable is organized. This line of consideration leads us to conclude that the asymmetry under discussion is an unmarked linguistic phenomenon. From this it follows that analyses compatible with this property are a null hypothesis to be given credibility in the absence of compelling evidence to the contrary.

Now let us go back to the table above to see what the general argument just given entails. Obviously, *σκ-*, *σπ-* and *στ-* are attested. These clusters could be all represented as 

(Recall that *s/w* is correlatable to the sonority hierarchy.) If one analyzed *φ* and *ξ* as bisegmental consonants, i.e. genuine consonant clusters, one should come out with 

and

just a mirror image of 

This would be an undesirable consequence, given the consideration explored above. Insofar as no compeling empirical evidence presents itself, then such an analysis as that which goes counter to the unmarked structure should

be placed under suspicion.

Turning to word-final position, the following picture obtains: of the clusters given in (27), only ϕ and ξ can appear word-finally. This property, which clusters around single consonants, is a clear indication of being monosegmental. This then requires ϕ and ξ to be subsumed under the same heading as single or monosegmental consonants.

Just to be added here is a mode of orthographic representation, which assigns simplex graphs to /ps/(ϕ) and /ks/(ξ), in contrast to real consonant clusters. This scribal practice can be regarded as a further reflection of ϕ and ξ being treated as monosegmental (cf Palmer 1980: 211).

Sound changes: under this heading two phenomena are treated, first σ-Deletion and second σ-Degemination. Let us begin with σ-Deletion. In the pre-alphabetic period (the former part of the first millennium, B.C.) *σ was subject to deletion in various environments, among others *-V$\sigma\left\{\begin{matrix}\lambda\\ \mu\\ \nu\\ \rho\end{matrix}\right\}$- and *-$\left\{\begin{matrix}\kappa\\ \pi\end{matrix}\right\}\sigma\left\{\begin{matrix}\lambda\\ \mu\\ \nu\\ \rho\end{matrix}\right\}$. In the former, *$\sigma$ became nul and at the same time either the preceding vowel was lengthened (e.g. in Attic-Ionic) or the succeeding sonorants got geminated (in Lesbian and Thessalian). Consider the following derivations:

(28) *$F\varepsilon\sigma\mu\alpha$ 'dress' > $\varepsilon\bar{\hat{\iota}}\mu\alpha$ (Attic-Ionic)
> $\bar{\varepsilon}\mu\mu\alpha$ (Lesbian-Thessalian)
* $\sigma\varepsilon\lambda\alpha\sigma$-$\nu\bar{\alpha}$ 'moon' > $\sigma\varepsilon\lambda\tilde{\eta}\nu\eta$ (Attic-Ionic)
> $\sigma\varepsilon\lambda\acute{\alpha}\nu\nu\bar{\alpha}$ (Lesbian-Thessalian)
* $\chi\varepsilon\sigma\lambda\iota o\iota$ 'thousand' > $\chi\varepsilon\acute{\iota}\lambda\iota o\iota$ (Ionic)
$\chi\acute{\varepsilon}\lambda\lambda\iota o\iota$ (Lesbian-Thessalian)
* $\chi\rho\alpha\sigma\rho o$- 'captain' > -$\chi\lambda\tilde{\eta}\rho o\varsigma$ (Attic-Ionic)

(Cf. Lejeune 1972: §§114-7; Meillet and Vendryes 1979: §§70ff.)

In the latter case, *σ dropped out and the foregoing κ and π became aspirated, hence χ and ϕ, respectively:

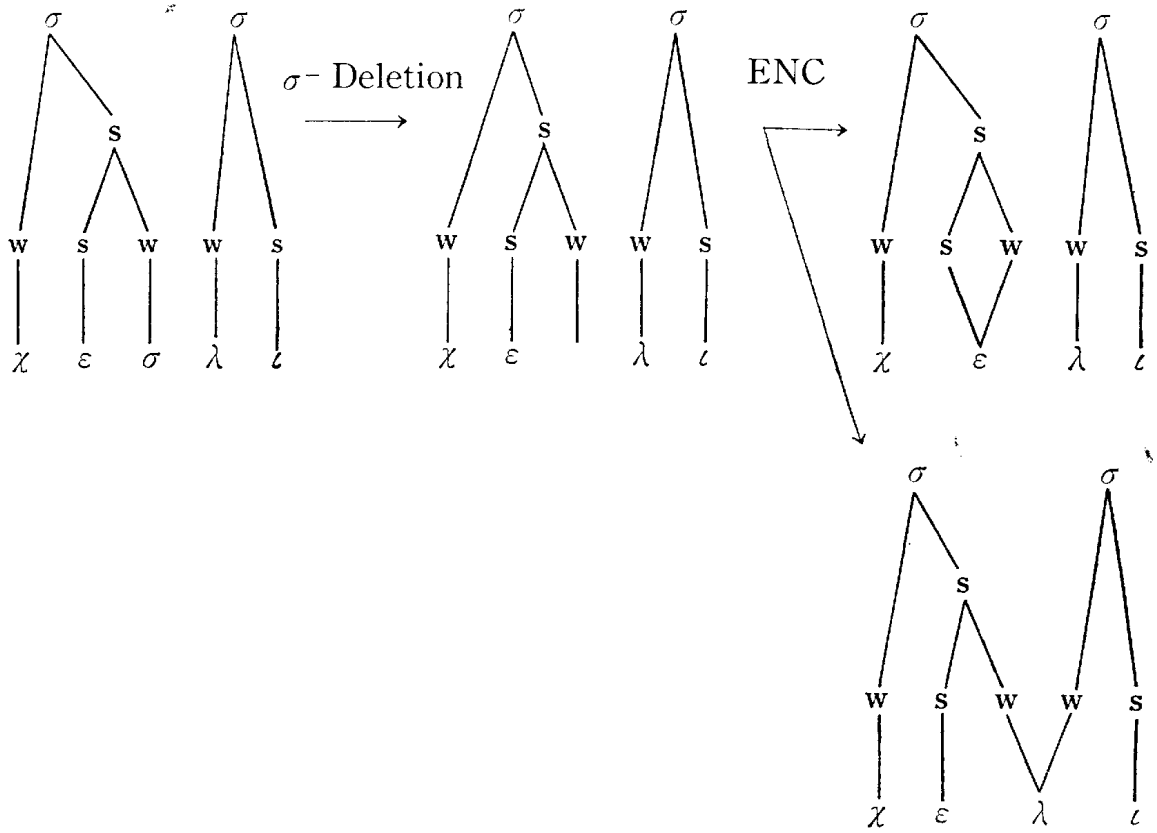
(29) * λύκσνος > λῦχνος 'light'
* πλοκσμῶς > πλοχμός 'hair'
* μυκσλο- > μυχλός 'mule'
* λεκσρι- > λέχρις 'athwart'
* αἰπσνας > αἰφνης 'suddenly'
* στιπσρο- > στιφσός 'close'

(Cf. Lejeune 1972: §§62, 64; Meillet and Vendryes 1979: § 93)

What requires explanation here is why the former case alone allowed compensatory lengthening (either of the preceding vowel or of the following sonorant), when both processes seem to involve the nearly identical phonological conditioning.

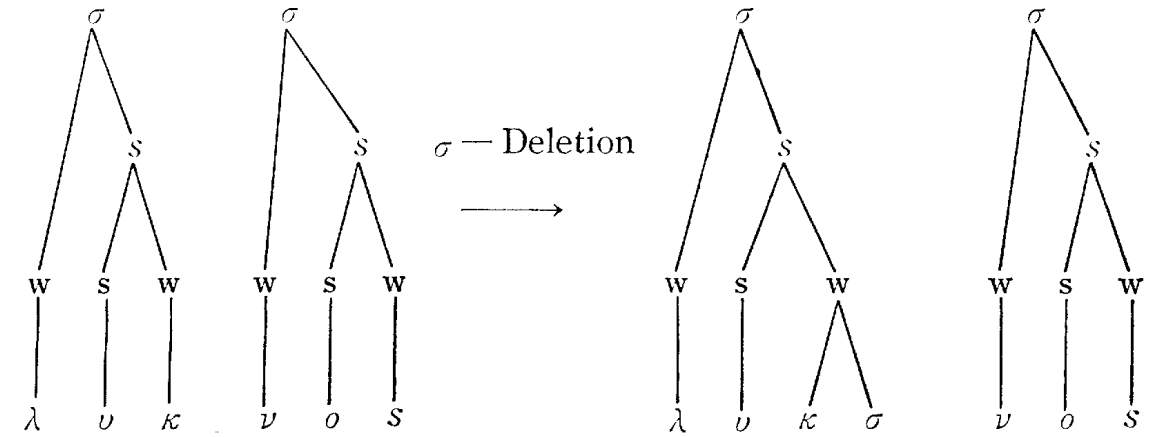
Ingria (1980) explores a metrical model of compensatory lengthening with crucial data drawn from ancient Greek, which in fact includes the first case of our concern here. The point of his proposal is that compensatory lengthening should be considered a deletion of melodic element, with its corresponding metrical slot remaining undisturbed. After the dropping of a melodic element, his proposed Empty Node Convention (ENC)[3], a principle of whatever exact status belonging to a general phonological theory (cf. Ingria 1980: 494), secures an association of the thus emptied slot with an adjacent melodic element. Thus, the derivational process can be represented in the following manner: (cf. Ingria 1980: 482ff.)

(30)

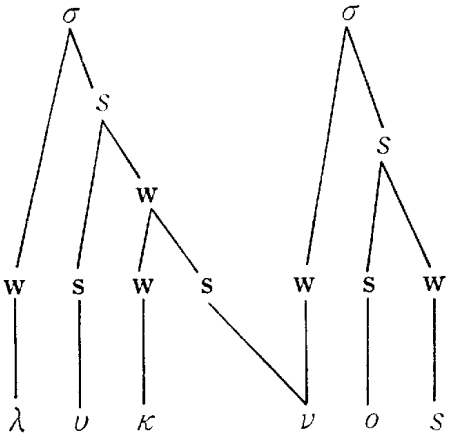


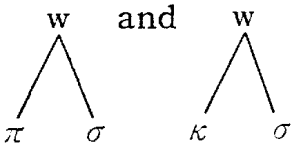
Analogously, if ENC purports to be of general validity as Ingria assumes (and I have no objection to this claim whatever), the second case involving $-\left\{\begin{matrix}\kappa\\ \pi\end{matrix}\right\}\sigma\left\{\begin{matrix}\lambda\\ \mu\\ \nu\\ \rho\end{matrix}\right\}-$ should counter-factually proceed as described below:

(31)



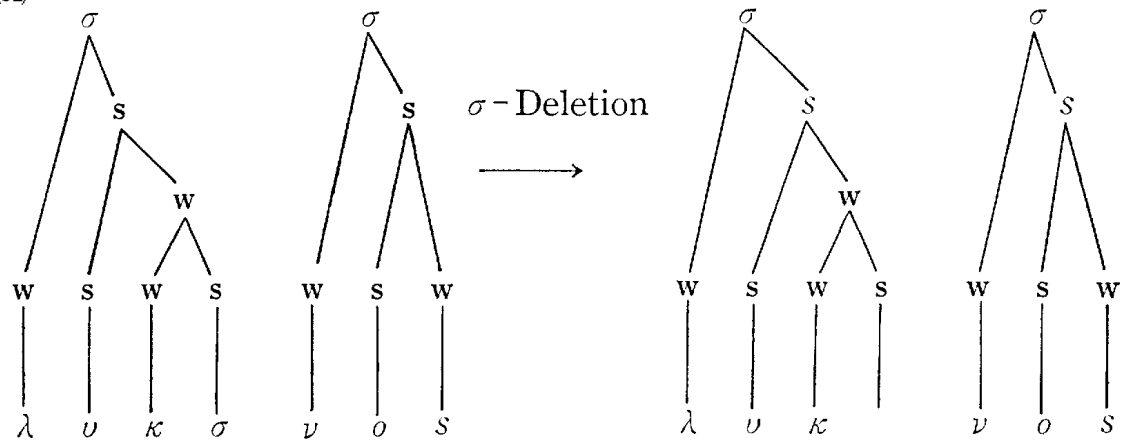
ENC →



In contrast to this, if *πσ* and *κσ* are analyzed as  and

as I repeatedly claim, the just-encountered difficulty will disappear. The following exemplification clarffies this point:[4]

(32)



Taking into account the fuct that one-to-one association between a melodic tier and a segmental tier is an unmarked case, no stipulation is called for to obtain  from  . The process

should be taken care of without recourse to an additional apparatus. Therefore, a well-articulated metrical characterization of compensatory lengthening and the apparently contradicting case render the proposed monosegmental status of *ϕ* and *ξ* easily-justifiable by nullifying the would-be counterevidence.

Let us turn to a second change. *-*τσ*-, which already became

*-σσ- in prehistoric times, has established itself as σ in Attic-Ionic:

(33)

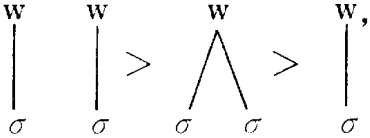
*ποδσι > ποσί 'foot' (dat. sg.)

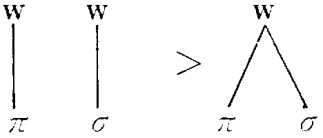
cf. Hom. ποσσί / ποσί

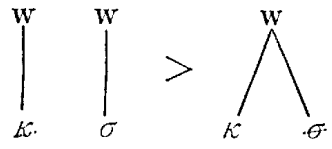
*ἐκομιδσα > ἐκόμισα 'take care of' (1. sg. aorist. ind.)

cf. Hom. ἐκόμισσα / ἐκόμισα

(Lejeune 1972 : §92 ; Meillet and Vendryes 1979 : §74)

What is of particular interest in this connection is the increasing use of distinct single graphs for πσ and κσ approximately at the same date. From the seventh century, B.C. onward, instances are found in the oriental alphabet (a prototype of the current Greek alphabet) (cf. Lejeune 1972: §46 note; Meillet and Vendryes 1979: §§27ff.), where πσ and κσ are represented by ↓ and 王, respectively (Lejeune 1972: §61). The coincidence of the degemination of *-σσ- with the emergence of distinct graphs for πσ and κσ seems something calling for explanation. Suppose then that at the time of the degemination, *-σσ->σ, πσ and κσ were subject to a comparable change. More specifically, if *-σσ->σ is characterized primarily as 

, namely a segmental slot deletion (cf. Ingria 1980:493), the assumed corresponding change of πσ and κσ are represented as 

and 

. The *w*-deletion thus gives rise to monosegmental complex consonants, and subsequently invokes the corresponding change in the scribal practice, finally resulting in the use of ψ and ξ.

In this way the interpretation just proposed makes the apparently accidental coincidence quite intelligible, and this in turn en-

hances the plausiblity of the monosegmentality of ϕ and ξ.

In the remainder of this subsection, I will argue for postulating a couple of monosegmental complex vowels (short diphthongs), i.e.  in connection with the formal characterization of the possible accentual pattern. This then gives some plausiblity (though not of course necessity) to the analogous representation in the consonantal system.

In informal terms, the restrictions on the possible accentual pattern may be stated as follows:

(34) a. Accent cannot go further back from the third syllable.
b. A short vowel may attract only acute accent.
c. A long vowel or diphthong may attract either acute or circumflex accent.
d. In the penultimate, an accented long vowel or diphthong is circumflex if the final vowel is short, and otherwise, acute.
e. The antepenultimate is limited to acute accent and may be accented only if the ultimate vowel is short.

With a mora-counting notation, whereby a short vowel counts as one mora and a long vowel or diphthong as two, one can schematize the permissible accentual pattern of Greek as follows:

(35)
a. ◡́ # : e.g. *παλαιός* 'old'
b. ⏑ ◡́ # : e.g. *πατήρ* 'father'
c. ◡́ ⏑ # : e.g. *πολυτελῶς* 'expensively'
d. ◡́ $ ⏑ # : e.g. *παιδίον* 'a young child'
e. ◡́ $ ⏑ ⏑ # : e.g. *παραμῡθίᾱ* 'encouragement'
f. ⏑ ◡́ $ ⏑ ⏑ # : e.g. *παιδεύοι* 'educate'
g. ◡́ ⏑ $ ⏑ # : e.g. *παντοῖος* 'of all sorts'
h. (⏑) ◡́ $ ⏑ (⏑) $ ⏑ # : e.g. *παράδειγμα* 'paradigm', *πάμπολυς* 'very much', *πλούσιος*' 'rich'.

(Key : '⏑' stands for a mora and $ stans for a syllable boundary.)

To give a unitary description of the above-noted pattern, various proposals have been thus far made, which, however, stand in need of greater precision and elaboration. What requires explanation above all seems as follows:

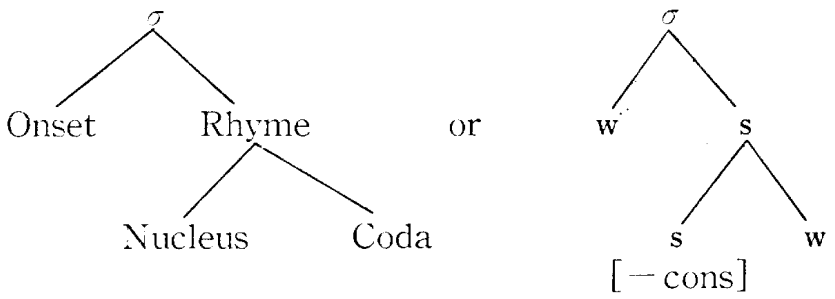
(36) a. Why is *⏑⏑$⏑ not permissible while ⏑$⏑ is acceptable? (This restriction strikes us as more peculiar when we notice that both ⏑ ⏑ and ⏑ ⏑ are attested in the ultimate).

b. Why is the number of morae in the penultimate irrelevant to the accentuation of the antepenultimate? (Note in this regard the contrast between ⏑⏑$⏑⏑ and *⏑⏑$⏑⏑.)

Obviously, to provide a principled account of these peculiarities requires a more structured approach than an appeal to the number of morae.[5]

To account for the general accentual pattern of Greek, with the above recalcitrant restrictions, I propose the following devices: nucleus projection and tree superimposition. With the recent developments of metrical and autosegmental phonology, syllabic nucleus can be represented as follows: (Cf. Halle and Vergnaud 1980)

(37)

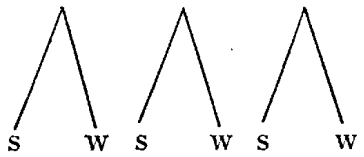


(At this moment I will not enter in any detail into empirical consequences of the two different notations. In purely descriptive terms, however, both notations seem equivalent. Therefore, insofar as it is of any relevance here, the choice of one over the other is a matter of technical execution.)

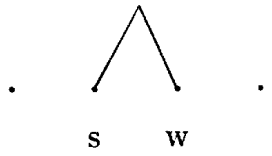
The proposed nucleus projection leads to the following picture:

(38)

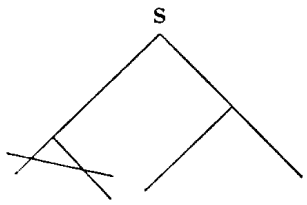
a. (for ⌣ ⌣ S ⌣ ⌣ S ⌣ ⌣ #)



b. (for ⌣ S ⌣ ⌣ S ⌣ #)



To the thus provided structure, then, applies the following rule:

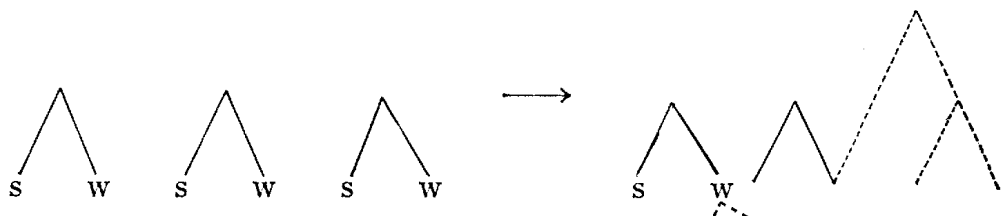
(39) a. Superimpose 

on the right-most end of the segmental (*s/w*) config uration.

b. Node-labeling may proceed freely.[5]

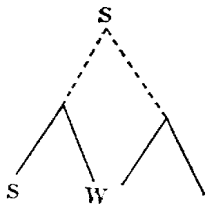
This gives rise to the derivation illustrated below: (Solid and dotted lines correspond to the superimposing and the superimposed structures, respectively.)

(40) a.

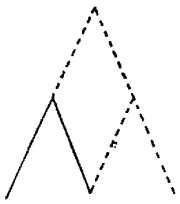


b.

Several words of comment are in order here. First, the prohibition against the branching left-most node exclude the structure



from obtaining. Second, a general constraint on ruleapplication (something like A-over-A Principle)[7] blocks the output



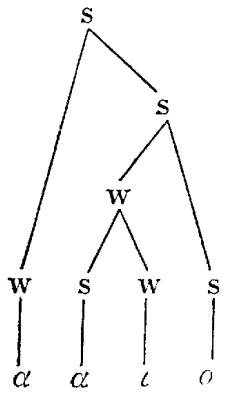
, though it could satisfy the SD of (39a). Third, the stipulation on nodelabeling (39b) concerns the superimposing ('grafting') tree only, thereby leaving the original tree-structure intact.[8] This guarantees the constancy of node-labels on the penultimate nucleus, i.e.

. Fourth, the exact way of interaction between the superimposing and the superimposed trees need not concern us here. I simply assume in this regard that a certain well-formedness condition connects the topmost nodes of the added tree (*s*) and those of the original tree (*w*). (In the exemplifications below, for the sake of exposition the unaffected part of the original tree is left unspecified.)

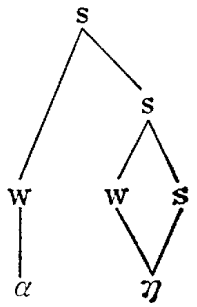
Now let us examine how the model just outlined can derive the desired accentual patterns by taking the examples in (35):

(41)

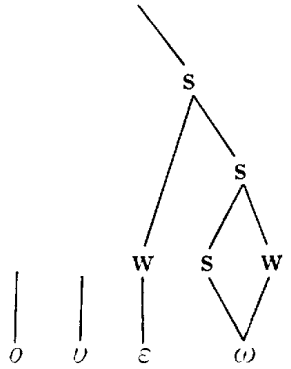
a. παλαιός



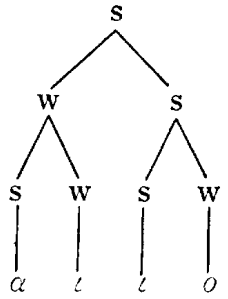
b. πατήρ



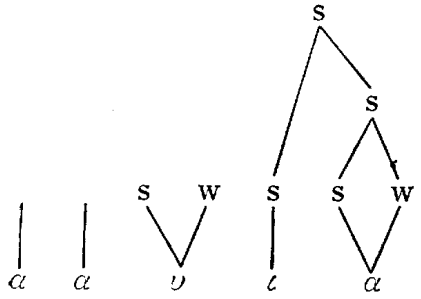
c. πολυτερῶς



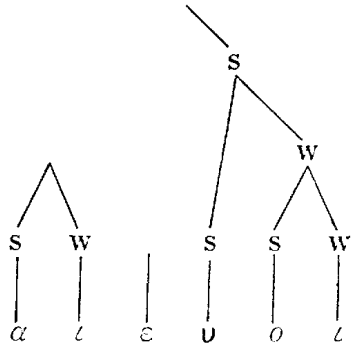
d. παιδίον



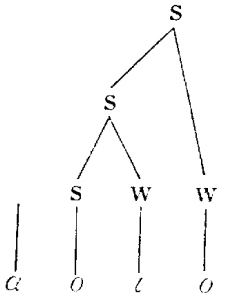
e. παραμῡθία



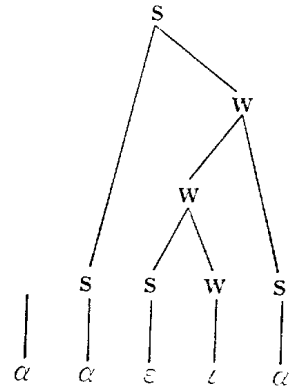
f. παιδεύοι



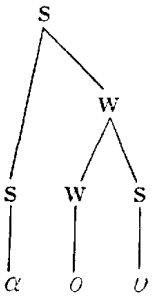
g. παντοῖος



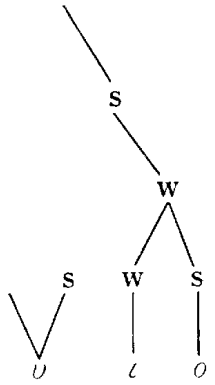
h. παράδειγμα



i. πάμπολυς



j. πλούσιος



Most importantly, the proposed model can exclude in a principled way the impermissible pattern referred to in (36a), which would otherwise defy non-ad hoc explanation. That ⁎⏑ ⏑ $ ⏑ is ill-formed can be reduced to the original structure involving a long vowel or diphthong, namely  , which, by virtue of being original as opposed to being newly built by (39a), falls out of the domain of (39b) and thus could not be in principle converted to  . By the same token, the irrelevancy of the number of morae in the penultimate with respect to the accentuation of the antepenulte is derivable from the undisturbed original structure  . In contrast to this, the unrestricted status of the ultimate as regards the type of accentuation and vowel quantity is a direct consequence of (39b), which in effect allows for all the possible *s/w*, i.e.  and  , It can be claimed on these scores then that the proposed model commands credibility as a principled explanation of the possible accentual pattern of Greek. And it should be noted that the advantages in question stem from the notion of nucleus projection. It is a specific appeal to this device that enables part of the original metrical structure

to remain crucial as it does to the determination of the actual accent patterning.

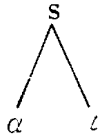
Now bearing this in mind, let us consider the following examples:

(42) *πεπαίδευμαι* 'educate' (1 sg. pres-perf. ind.)
πεπαίδευσαι (2 sg. pres-perf. ind.)
πεπαίδευται (3 sg. pres-perf. ind.)
θάλατται 'sea' (nom.pl.)
στρατιῶται 'soldier' (nom. pl.)
ἄνθρωποι 'man' (nom. pl.)

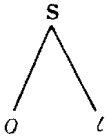
(43) *παιδεύοις* (2 sg. pres. opt.)
παιδεύοι (3 sg. pres. opt.)
θαλάτταιν (gen.-dat. du.)
θαλάτταις (dat. pl.)
στρατιώταιν (gen.-dat. du.)
στρατιώταις (dat. pl.)
ἀνθρώποιν (gen.-dat. du.)
ἀνθρώποις (dat. pl.)

(42) is apparently an anomalous case while (43) is the normal pattern. What is peculiar in (42) is that the final *αι* and *οι* behave as if they were short vowels. Recall in this connection that the only structure that attracts accent on the antepenult has a short vowel in the ultimate. Likewise, circumflex falls on the penultimate only if the final vowel is short (cf. (35) above). Given the nucleus projection, a plausible way out is to analyze these exceptional diphthongs as monosegmental, which then goes as follows:

(44) a.

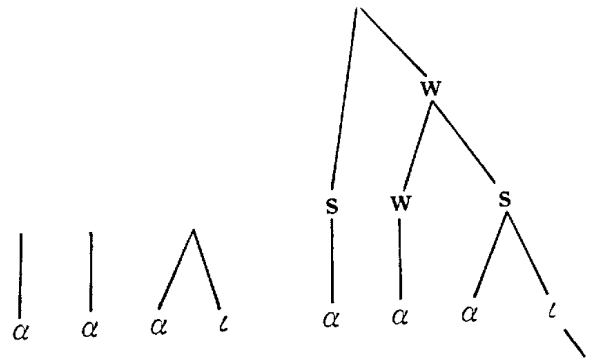


b.

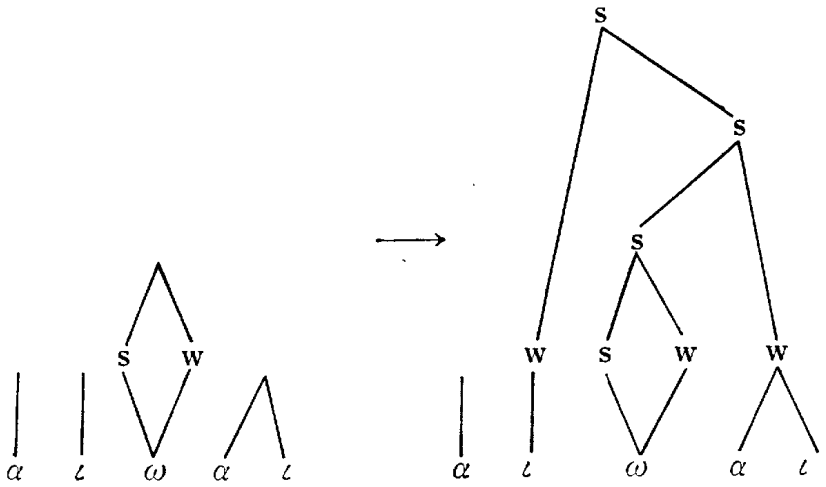


Thus characterized, the already-established model correctly assigns well-formed status to (42), in parallel to the cases involving final short vowels:

(45) a.



b.



In summary, then, the anomalous behavior of certain *αι*'s and *οι*'s, in conjunction with the descriptive model of Greek accentuation, which crucially depends on nucleus projection, requires us to postulate short diphthongs, or monosegmental complex vowels, i.e. 

. This may in turn give a certain amount of plausibility to the analogous mode of representation on the part of consonants (though this is not a matter of direct empirical necessity).

In concluding this subsection, I have adduced arguments which, viewed in totality, convergingly speak for the monosegmental analysis of *ψ* and *ξ*.

4.4.2. Some Consequences

Below I will show how the incorporation of ϕ and ξ as monosegsmental consonants into the C/V framework brings out an undesirable complication. It should be pointed out that the C/V model as it stands now (cf. (23) above) cannot deal with the monosegmental ϕ and ξ without some extra device. It would incorrectly allow the ill-formed *φέφευκα and *ξέξανκα by virtue of their being counted as a single C. To avoid this result, the already complex condition must be further complicated as in the following:

(46) Condition (revised): if a stem begins with a single SIMPLEX consonant or a cluster comprising a mute and a sonorant, then α.

This is nothing but a stipulation and as such does not approach anywhere near a principled explanation. This deficiency naturally militates against the acceptability of the C/V model.

It is interesting to examine in this respect how much credibility the issue of ϕ and ξ confers on the s/w model. As briefly mentioned earlier, the new model ascribes the non-occurrence of reduplication in stems with ϕ and ξ to the same structural factor, independently motivated for blocking *σεσκ-, *σεσπ- and *σεστ-. Thus, the monosegmental status of the consonants in question brings no complication to our model. To put it another way, our apparatus, by a resort to the identical principle (i.e. non-branchingness of w), can give direct expression to the generalization underlying the non-reduplication on the part of ϕ and ξ on the one hand, and $\sigma\kappa$-, $\sigma\pi$-, $\sigma\tau$- on the other. This is evidently an advantage of the s/w model over the C/V counterpart.

4.4.3. Prblems of $\kappa\tau$- and $\pi\tau$-

With respect to the derivation involving $\kappa\tau$- and $\pi\tau$-, a superficial look at the issue may speak against the s/w model. For the clusters under consideration involve consonants with the same manner of articulation (or the same degree of aperture), which

might imply the identical scale-value of sonority for the segments concerned, hence indeterminacy in discriminating *s/w* specification. This is not, however, a legitimate line of reasoning. As a matter of empirical fact, the identity in the manner of articulation is no guarantee of that in sonority. The consideration of position enters the picture.

Through his extensive investigation of natural phonetic processes, Goman (1981: 127ff.) comes to the following characterization of 'narrowing' (chromatization) and 'widening' (sonorization):

(47) Narrowing (*ibid.*, 128)

$$\begin{bmatrix} & C \\ n & \text{narrow} \\ ! & \text{lighter} \\ ! & \text{Tns} \\ ! & \text{Gloz} \\ ! & / \ S\_\_\_ \end{bmatrix} \longrightarrow [n+1 \text{ narrow}]$$

(48) Widening (*ibid.*, 132)

$$\begin{bmatrix} & C \\ n & \text{narrow} \\ ! & \text{darker} \\ ! & -\text{Tns} \\ ! & \text{Asp} \\ ! & / \ \_\_\_\$ \end{bmatrix} \longrightarrow [n-1 \text{ narrow}]$$

Of particular interest here is the specification [! lighter] (or conversely [! darker]), which constitutes a scaled order (*ibid.*, 129):

(49) T P K Ḳ

←——————

lighter

Key: T: coronal
P: labial
K: dorsal
Ḳ: radical

Since narrowing is a desonorization, and the degree of sonority stands in an inverse proportion to that of the suceptibility to the process (*ibid.*, 127), it follows that the lighter a consonant is, the less sonorous it is. This allows us to equate the lighter hierarchy (40) with the sonority hierarchy:

(50) T P K Ḳ

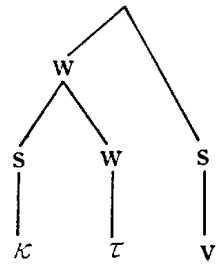
more sonorous

The above hierarchy then assigns 

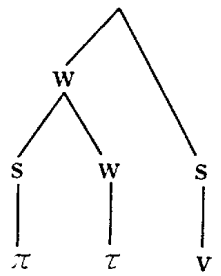
to $\kappa\tau$- and $\pi\tau$-:

(51)

a.



b.



This in turn puts them on a par with $\sigma\kappa$-, $\sigma\pi$- and $\sigma\tau$-. And the same derivational process applies here as in the case of the latter: no association can be matched, hence no reduplication. Thus, the independently postulated hierarchy (49) and its corollary (50), despite the shallow observation to the contrary, do validate our proposed model.

4.4.4. Explanatory Power

One serious objection that can be leveled against the *C/V* model

is its lack of explanatory power. No principled account is provided for:

(52) a. Why do only single consonants, but not clusters (excluding a mute plus a sonorant), allow reduplication?

b. Why do clusters with a mute plus a sonorant behave parallel to single consonants?

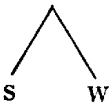
More specifically, the model under criticism, being too poor in its empirical contents, could not rule out the logically possible, but not actually attested, reduplicating patterns like the following (Greek', Greek"•••):

(53)

	Stem	Reduplicated Form
a. Greek'	CV-	εCV-
	CSV-	CεCSV-
	CCV-	CεCV-
b. Greek!'	CV-	εCV-
	CSV-	CεCSV-
	CCV-	CεCCV-
c. Greek"'	CV-	CεCV-
	CSV-	εCSV-
	CCV-	CεCCV-

(Key: S= sonorant)

In other words, the *C/V* apparatus would come closest to stipulating the actual reduplication pattern as a matter of contingency.

The *s/w* model explored thus far, on the other hand, suffers from no such deficiencies. The parallelism between single consonants and clusters comprising a mute and a sonorant as opposed to other clusters stems from their shared metrical structure  s. in contrast to  w. for the latter group. Thus, the phenomena at issue, which defy a unitary treatment within the

C/V model, are reducible to a singel structural property. On this score, then, our new model claims superiority.

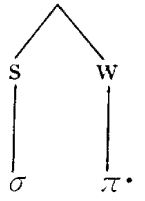
5. Conclusion and Further Research

The *s/w*-based model of reduplication developed in this paper, in the mapping process of melodic tiers onto corresponding prosodic templates, refers to a richer structure than has been allowed for in the *C/V* counterpart: it crucially depends on the metrical structures of the morphemes concerned.

The subsequently-adduced arguments based on Gothic and ancient Greek reduplication, then, definitely show that by being rendered sensitive to more structured organizations the *s/w* model is superior to the current *C/V* counterpart by virtue of its greater explanatory power:it allows significant generalizations which would be hardly attainable within the competing *C/V* model. More specifically, our model is capable of providing principled explanations as to why some clusters go with single consonants while others do not, with respect to exact reduplicating processes. To the extent that it uncovers structuring principles underlying the phenomena under consideration, it is expected that it will also contribute to a better understanding of other analogous processes.

NOTES

1 In Gothic, however, the regularity at issue is considerably obscured by subsequent analogical extension (cf. Krahe and Meid 1969: § 121).

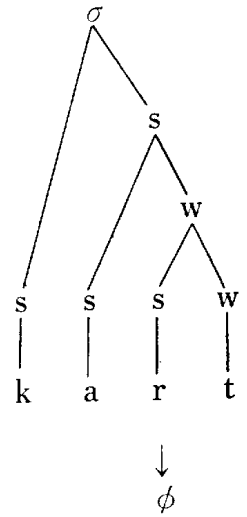
2 Given the obvious difference in sonority between fricatives and stops, it requires no specific argument for, say, 

3 Under Ingria's original proposal, ENC goes as follows:

> *Empty Node Convention*
> Empty *w* nodes which are part of a syllabic coda are to be associated with the terminal element dominated by the immediately preced-

ing syllabic nucleus. All other empty nodes are to be pruned. (Ingria 1980: 471).

However, the above characterisation is too strong in its claims. Among others, of a particularly problematic status is the restriction to *w*. As Clements (1982: 21) points out, ENC as it stands could not deal with the following phenomenon, which involves the deletion and the re-association of the *s* node:



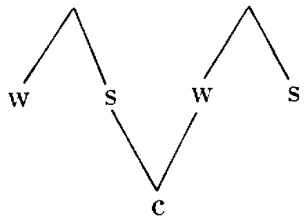
i. e. *cart* [ca:t], not *[cat]

In light of this fact, one is required to weaken ENC to be also applicable to *s* in the coda. (Incidentally, Clements claim based on the same data for eliminating ENC altogether seems too bold. It is, however, beyond the scope of this paper to discuss the issue in any detail.) Therefore, for the following argument, I refer to as ENC the revised convention, which goes as follows:

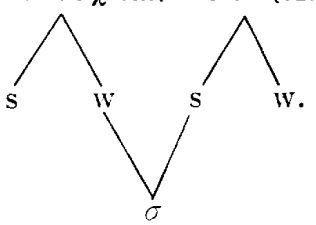
Empty Node Convention (Revised)

Empty nodes which are part of a syllabic coda ... (same as the original).

4 One might attempt to block the derivation *λυκννος by stipulating that



is ill-formed. This way out seems implausible, however, considering the existence of *Fασστῦν*, *Fαλίσσχεται*, etc. (cf. Thumb 1959:245. 11), which can be analysed as



5 It is in order at this point to see briefly how the thus far proposed characterisations of ancient Greek accentual pattern are inadequate.

According to Jakobson (1971), the pattern is formulated as:

> The vocalic morae between the accented vocalic mora and the final one cannot belong to different syllables. In other words, the span between the accented and the final mora cannot exceed one syllable. (*ibid.*, 263).

Garde (1968) holds the three-morae rule:

> L'accent frappe nécessairement l'une des trois dernières mores du mot. Dans les mots à finale brève les trois dernières mores se confondent avec les trois dernières syllabes; en cas de finale longue, l'accent peut tomber sur la dernière more (aigu sur la finale), ou sur la more pénultième (circonflexe sur la syllabe finale), ou sur la more antépénultième qui se confond avec la syllabe pénultième. (*ibid.*, 145).

Allen (1973) introduced the notion 'contonation', which is a falling glide indispensable for the realization of accent (*ibid.*, 234), and proposed the following formulation:

> Not more than one mora may follow the contonation. (*ibid.*, 237).

It should be noted that none of the above characterizations can take care of the ill-formedness of $*\breve{}\,\breve{}\,\underline{S}\,\breve{}$:

i) Although accent falls within the distance of three-morae from word-final, yet is is ill-formed.
ii) Although it involves no more than one mora (since no mora exists between the accented one and the last one), yet is is ill-formed.
iii) Although no mora follows the contonation, yet it is ill-formed.

6 For handling the specific pattern of verbals and vocatives (the so-called 'recessive accent rule'), further restriction is called for. However, I will not enter into the issue here.

7 This issue needs further investigation, of course.

8 In this connection it is interesting to point out the analogous mode of operation in the domain of syntax, namely 'tree-grafting' proposed by Clements (1975: 38ff.).

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