Chapter 5

Compensatory Lengthening in Tiberian Hebrew

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0. INTRODUCTION

Compensatory Lengthening (henceforth CL) is a classical problem of phonological analysis.

In this paper we will discuss a well documented case: synchronic CL and its relation to Consonant Gemination in Tiberian Hebrew (henceforth TH). This study is part of a research programme illustrated in Kaye & Lowenstamm (1982, 1984, in preparation a, b, c, d). While not radically different from other recent work in phonology, in its technical aspects, our approach reflects a strong commitment to what has been called the 'Principles and Parameters' approach to the study of the language faculty, or to what Jean-Roger Vergnaud has called with reference to our work the 'no rule' approach.

The general idea is that the contribution of individual grammars to the ultimate shaping of a particular language is widely overestimated. Consider for instance the rule of Japanese which affricates *t* before *u* ($t \rightarrow t^s$ / — u); it is difficult to think of this process as anything other than a peculiarity of the Japanese language. Take on the other hand a process such as the shortening of a long vowel in a closed syllable[1]. Such a process is found in language after language. Yet, the fact is that a majority of languages do not exhibit it, so that a markedness rationale cannot be invoked to explain its popularity. If this process does not represent an unmarked option, it will have to be distinguished from 'crazy rules' in some other way[2]. Why is its occurrence not as narrowly limited as Japanese affrication? The correct answer, in our opinion, is that Closed Syllable Shortening and Japanese Affrication have quite a different status: the presence of the latter in the grammar of Japanese is totally idiosyncratic and unsystematic (which is not to say that it is without consequences on the grammar of the language): it is a genuine rule of Japanese. By contrast, Closed Syllable Shortening is a parameter[3], an option confronting in principle every grammar and, in principle, requiring it to make a decision with respect to the selection or non- selection of such a parameter. We

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say in principle because in the state of our understanding we want to reserve the possibility that not every parameter is set individually. Indeed it is not unreasonable that transitive relationships obtain between the selection of a parameter and the selection of another. If this is correct we might have the beginning of an explanation for the recurring, yet not ubiquitous nature of certain processes: it may simply be the case that the setting of a certain parameter is often preempted by a prior decision.

In the case of CL and Gemination in TH we will show that the fairly complex array of facts that can be observed on the surface, results from the interaction of a number of principles pertaining to different sub theories. Under the appropriate idealizations the grammar of TH need not incorporate any mention of CL or Gemination.

At the same time we intend our analysis to be a contribution to our understanding of the nature of phonological representations. Much recent work on the organization of sound systems of natural languages has focused on the interaction of various levels of phonological representation: the tonal tier, the accentual tier, the segmental tier as well as a harmonic tier &c. This approach has been illustrated in work by Kaye (1982), McCarthy (1979,81,82), Hayes (1981), Halle & Vergnaud (1980) and others. It is usually taken for granted that the prosodic/accentual tier and the segmental tier are autonomous levels of representation, that is, they display their own properties and are structured according to specific principles of organization. In most studies, however, the prosodic/accentual level of representation is viewed as basically interpretive of the segmental representation, i.e. prosodic structure is erected according to properties of the segmental string. This is exemplified in work by Liberman & Prince (1977), Selkirk (1984) and Hayes (1981). If, however, the two levels of representation under discussion are truly autonomous, one would expect that their interaction will not be limited in such a way. Indeed one would expect that the prosodic level will in turn determine certain aspects of the segmental representation[4]. It is our contention that major aspects of prosody are determined in just that way, specifically on the basis of the geometrical properties of prosodic structure. In conjunction with this claim we will discuss the role of the CV skeleton as described in Clements & Keyser (1981), Halle & Vergnaud (1980), Marantz (1982), McCarthy (1979, 1981) and others.

The utilization of the CV skeleton in conjunction with tiered representations of non-contiguous morphemes related to the former by autosegmental mapping, has met with considerable success, especially in the description of languages whose morphology is non-concatenative. We refer the reader to McCarthy's (1981) treatment of Classical Arabic verbal morphology to see how his framework provides elegant, and sometimes long-awaited, solutions to problems that lay within its scope.

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Of course, not every problem of phonology reduces to the mapping of auto-segments. The processes bringing about the structures supporting the spreading of auto-segments, may vary greatly. How they can best be described is an empirical matter. But, there can be no presumption that the most revealing way of expressing such phenomena is in terms of operations defined over the CV tier itself. In fact, the results of the past few years of productive research in phonology show that prosodic phenomena are to be characterized not in terms of operations manipulating strings, but by reference to hierarchical structure and most notably to prosodic categories.

Because prosodic phenomena are usually, but not always, insensitive to specifications beyond major class membership i.e. V or C, and because of the enormous descriptive power of a model of grammatical description permitting operations to be performed at the CV tier, it is difficult, in fact almost impossible to find a single prosodic process that cannot be expressed as an addition to, or subtraction from, the CV tier.

While the characterization of an individual prosodic process in terms of its prosodic rationale always has a corresponding notational variant as a change on the CV tier, we find that clear differences emerge when we look at more complicated cases involving the interaction of several processes.

Our discussion of the interaction of Consonant Gemination and Vowel Lengthening will be a case in point. We will see that a satisfactory treatment of the Tiberian Hebrew facts crucially depends on a conception of the CV tier whereby the latter is a non-autonomous level of representation, an object whose properties can all be derived from other tiers.

1. PRELIMINARIES

In this section we wish to briefly review and comment on some of the results of Kaye & Lowenstamm (1984) concerning the role and distribution of null elements in phonological representations.

1.1. On the notion 'inventory of syllable types'.

Basic to this discussion is the notion of an inventory of syllable types. In Kaye & Lowenstamm (1982) we showed that languages do not pick out randomly from the set of universally available syllables. Rather an implicational universel constrains in very severe fashion the inventory of syllable types of each language. We found that if a language allows onsets and rimes of a certain complexity, it also allows all the onsets and rimes of lesser complexity[5]. Thus a language displaying VCCC rimes will also display VCC, VC and V rimes. Moreover we found that for a

given language the richest possible onset may not exceed the complexity of the most complex rime.

A language such as Yawelmani whose syllables are CV or CVC is thus a (I,2) language; the ordered pair expresses the maximal complexity of the onset and the rime, respectively. A language such as post-contact Quechua is a (2,2) language as it exhibits both branching onsets and branching rimes. The situation may be summed up by saying that the syllabic index of a language is an ordered pair (m,n) where m and n are the values of the most complex onset and rime of the language. This formula is moreover associated with the condition that $m \leq n$.

In fact it is not necessary to stipulate this state of affairs. When markedness conventions are correctly formulated for the feature [segment], all that is required is to identify m and n and the entire inventory of syllable types for a given language will follow automatically[6].

In Yawelmani, for instance, the inventory of syllabic types is limited to CV and CVC[7]. In the case of the non-past morpheme /hin/, prosodic structure is associated to segmental string as shown in (1)

(1)

The syllable of (1) is part of the inventory of Yawelmani and the analysis is entirely trivial. Next to such straightforward cases, interesting discrepancies arise when the segmental string is in a sense 'too rich' for the available syllable types of the language. This is what happens in a number of verbal radicals of the form CVCC which are syllabified as in (2)

(2)

Thus /ʔugn/ is analyzed as in (3)

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We see that the parsing of the CC substring as a closed syllable has determined the presence of a null element.

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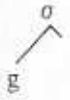

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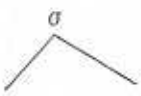
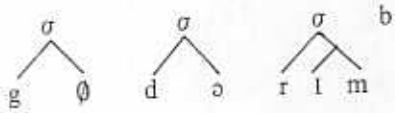
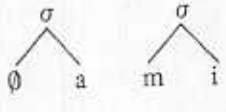
1.2. On the minimal syllable.

Another result of Kaye & Lowenstamm (1982) is that every syllable branches. In other words every syllable necessarily has the structure of (4a). Representations such as (4b, c) are thus excluded.

(4) a.  b.  c. 

This means that every syllable will have an Onset and a Rime although these positions may not correspond to phonological segments in underlying representations, much in the sense of (3) above.

We give examples of the representation of a syllable with no segment matching its rime constituent (5a) and of a syllable with no segment matching its onset constituent (5b): The initial syllable of Yiddish *gɪ dɔ rɪm* 'limits, borders' and the initial syllable of French *ami* 'friend'.

(5) a.  b. 

In each case a null element has once again been determined.

1.3. The resolution of null elements: reanalysis and insertion.

These null elements are dealt with according to various strategies. We consider here derivations involving two such strategies: reanalysis and insertion.

In Yawelmani a verbal root such as /ʔugn/ may be followed by consonant initial suffixes such as the non-past morpheme /hin/ or a vowel initial suffix such as the dubitative /al/. Morpheme juxtaposition, resyllabification and epenthesis lead to the derivations of (6).

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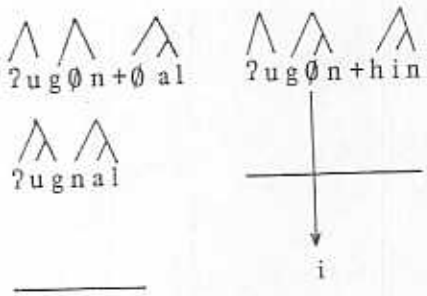

In the first case resyllabification has taken place, all the null elements have been eliminated and the form [ʔugnal] is derived. In the second case, no resyllabification is possible since Yawelmani has neither branching onsets or codas. The null element has survived the attempt at resyllabification and is spelled out as an *i*. We can offer a characterization of the processes involved in (6):

(7) i. Resyllabify eliminating null elements when resyllabification does not lead to a violation of the syllabic constraints[8].
ii. Insert segment.

For a discussion of resyllabification, see Kaye & Lowenstamm (in preparation b). As regards epenthesis a vowel or a consonant will be inserted depending on wether the ∅ constituting the target of (7ii.) is dominated by prosodic category N or not. The phonetic specification of the inserted segment is a language particular parameter[9]. All the other aspects of the process of epenthesis are provided by Universal Grammar in the form of (7ii.).

I.4. On the distribution of null elements.

In Kaye & Lowenstamm (1982) we noted in addition that the proliferation of null elements in phonological representations should not be allowed and that objects such as (8) should be excluded.

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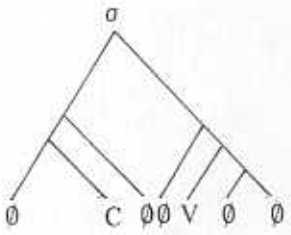

In fact null elements do not seem to be required beyond the following contexts: null onset, null rime, null nucleus and null coda. This is represented in (9)

(9) a. 

b. 

c. 

d. 

We suggest that this distribution is the effect of a principle which we formulate as (10)

(10) Null elements may not appear in branching constituents, where constituent refers to the prosodic constituent immediately dominating the null element.

Principle (10) rules out representations such as (8) and allows all and only the structures given in (9). We will see in our discussion of CL and Gemination that Principle (10) plays a crucial role.

I.5.

The framework just sketched out affords the first coherent account of segment insertion, in our opinion. In a linear framework, epenthesis is viewed as a process usually formalized as in (11).

(11) $\emptyset \rightarrow$ [segment] / A ___ B

Implicit behind a statement such as (11) is some conception of the distribution of null elements among the segments of the representation. Two main logical possibilities emerge:

a. null elements are interspersed in random fashion among segments as in (12).

(12) . . . $\emptyset$ [segment] $\emptyset$ $\emptyset$ [segment] [segment] . . .

In this case one would naturally ask why only a few of these elements are the targets of epenthetic processes. No answer is likely to be forthcoming.

b. null elements have a restricted distribution: they appear only in those positions where a rule will insert a segment in their stead. Under this approach the presence or absence of null elements in phonological representations is an idiosyncratic property of individual lexical items and thus does not express a regularity of the language, clearly, a very undesirable conclusion.
By contrast in a metrical framework the presence or absence of null elements follows from the fact that prosodic structure is part of lexical representations, and their distribution is predicted as a function of the syllabic index of the language. This example, segment insertion and its interpretation in metrical phonology, is the first example of how prosodic structure influences the composition of the segmental string.

2. COMPENSATORY LENGTHENING IN TIBERIAN HEBREW.

2.1. The Problem.

Consider the Tiberian Hebrew forms of (13)

(13)	a.	seefer	'book'
	b.	gešem	'rain'

When these words are preceded by the clitic definite article *ha*, the initial consonant geminates:

(14)	a.	hasseefer	'the book'
	b.	haggešem	'the rain'

A small number of consonants however, call them G consonants, never geminate in any context: ʔ, ʕ, h, r, ḥ. Consider then, the words of (15):

(15)	a.	ʔiiš	'man'
	b.	ʕaam	'people'
	c.	haar	'mountain'

When in construction with the definite article, they can never be realized as in (16)

(16)	a.	*haʔʔiiš
	b.	*haʕʕaam
	c.	*hahhaar

Rather the preceding vowel, in this case the vowel of the definite article, lengthens:

(17)	a.	haaʔiiš	'the man'
	b.	haaʕaam	'the people'
	c.	haahaar	'the mountain'

These are the mechanics of CL[10]. We note at the outset that there exist a number of exceptions. Sometimes, for instance CL is not observed before a G consonant, as if the latter had in effect been geminated. We refer the reader to Joüon (1923) for valuable discussion of such cases of 'virtual gemination'. These exceptions do not detract from the fact that regular cases of Gemination and CL are the overwhelming majority. An analysis of regular cases is necessary at any rate before the exceptions, if systematic,

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can be understood. We thus caution the reader that these forms are exceptions to the data, not to our analysis[11].

2.2. The Data.

In this section we document compensatory lengthening in Tiberian Hebrew. While the sketch given here does not exhaust the set of contexts that give rise to gemination and compensatory lengthening, it will provide the reader with a fairly comprehensive picture of the phenomenon.

The first group illustrates the situation in a number of noun formation patterns (miškalim)[12]. Each of these patterns specifies a certain arrangement of vowels and consonants displayed here in the manner of traditional Hebrew grammar: the sample root *qtl* is mapped onto a consonantal pattern and associated with a vocalic melody. The first miškal of table (18), *qattaal*, thus specifies a morphological template (which could equivalently be encoded as C_1 aC_2C_2 aa C_3), the most interesting property of which, is of course gemination of the medial root. All the miškalim of table (18) have been selected precisely because they display that property. The first form of colum I represents the mapping of the root *ngr* onto the pattern *qattaal*, the second form of the same column shows how *9wr* is mapped onto *qattelet* etc.

In column 2 of table (18), we see that when the medial consonant of the root involved is a G consonant no gemination is observed; rather, the preceding vowel lengthens. Lengthening is straightforward in the case of a: a → aa in lengthening contexts. When *i* and *u* lengthen, however, lengthening is accompanied by lowering to the mid range; thus, long *i* and long *u* are realized phonetically as *ee* and *oo* respectively[13].

(18)	qattaal	naggaar 'carpenter'	paaraaš 'horseman'
	qattelet	9awweret 'blindness'	baaheret 'white spots on skin'
	qitteel	?illeem 'mute'	heereeš 'deaf'
	qittuul	sippuur 'story'	peeruuš 'commentary'
	qattil	?abbir 'strong'	baari^{a}ḥ[14] 'careless'
	qallah	maccah 'matzo bread'	caaraah 'rival'
	qittalon	zikkaron 'memory'	geera9on 'deficit'
	məquttaal	məlummaad 'learned'	məboorak 'blessed'

The same observations can be made in the case of the verbal conjugations (binyanim). In table (19) – see next page – we show how the roots /ktb/ 'write', /brk/ 'bless' and /9md/ 'stand' are conjugated in the derived binyanim nif9al, pi9ēl, pu9al, hif9il, hof9al and hitpa9ēl[15] in the third person masculine singular. The 'strong' binyanim, pi9ēl, pu9al and hitpa9ēl specify gemination of the middle consonant of the root. This can be observed for /ktb/ and /9md/. Because *r* can never geminate, a long vowel, *aa*, *oo* or *ee*, will always be observed on the left of *r* in the corresponding contexts of the conjugation of /brk/. The formatives *yi* and *hi* (historically *yin* and *hin* respectively) in the Imperfect and Imperative of the nif9al specify gemination of the first consonant of the root to which they attach. When this consonant is a guttural, as in the case of /9md/, lengthening takes place thus yielding yee9aameed vs. yibbaareek[16].

The third group consists of three construction types in which a clitic triggers gemination of the first consonant of the item onto which it is cliticized, much as in the article-noun sequences discussed in 2.1. When the initial consonant of the item is a G consonant, lengthening of the vowel of the clitic will be observed. For each of the three groups discussed below, the forms are arranged in two columns. In the lefthand side column, an item appears in isolation. In the righthand side column, the same item appears preceded by the clitic. As before, long *i* and *u* are realized as *ee* and *oo* respectively.

(20) a. *waw haahippux* (waw conversive[17] 'changing meaning from future to past')

yoomar	wayyoomar
'he will say'	'he said'
ʔoomar	waaʔoomar
'I will say'	'I said'
neecee?	wanneecee?
'we will leave'	'we left'
ʔədabbeer	waaʔədabbeer
'I will talk'	'I talked'

b. *mem haššimmuuš* (mem clitic 'from')

po	mippo
'here'	'from here'
šaam	mišša̲am
'there'	'from there'
roš	meeroš
'beginning'	'from beforehand'
haahaar	meehaahaar
'the mountain'	'from the mountain'

(19)

	nif9al	pi9ēl	pu9al	hif9il	hof9al	hitpa9ēl
Perfect	niktab	kitteeb	kuttab	hiktiib	haaktab	hitkatteeb
Imperfect	yikkateeb	yəkatteeb	yəkuttab	yaktiib	yaaktab	yitkatteeb
Imperative	hikkateeb	katteeb		hakteeb		hitkatteeb
Inf. Absolute	niktoob	kattoob	kuttoob	hakteeb	hakteeb	hitkatteeb
				maktiib	maaktaab	mitkatteeb

(19)

	nif9al	pi9ēl	pu9al	hif9il	hof9al	hitpa9ēl
Perfect	niktab	kitteeb	kuttab	hiktiib	haaktab	hitkatteeb
Imperfect	yikkaateeb	yɔkatteeb	yɔkuttab	yaktiib	yaaktab	yitkatteeb
Imperative	hikkateeb	katteeb		hakteeb		hitkatteeb
Inf. Absolute	niktoob	kattoob	kuttoob	hakteeb	hakteeb	hitkatteeb
Participle	niktoob	mɔkatteeb	mɔkuttaab	maktiib	maaktaab	mitkatteeb
Perfect	nibrak	beerak	boorak	hibriik	haabrak	hitbaareek
Imperfect	yibbaareek	yibaareek	yɔboorak	yabriik	yaabrak	yitbaareek
Imperative	hibbaareek	baareek		habreek		hitbaareek
Inf. Absolute	nibrook	baareek		habreek	haabreek	hitbaareek
Participle	nibraak	mɔbaareek	mɔbooraak	mabriik	maabraak	mitbaareek
Perfect	ne9emad	9imneed	9ummad	he9emiid	haa9amad	hit9ammeed
Imperfect	yee9aameed	yɔ9ammeed	yɔ9ummad	ya9amiid	yaa9amad	yit9ammeed
Imperative	hee9aameed	9ammeed		ha9ameed		hit9ammeed
Inf. Absolute	na9amood	9ammood	9ummood	ha9ameed	haa9ameed	hit9ammeed
Participle	ne9emaad	mɔ9ammeed	mɔ9ummood	ma9amiid	maa9amaad	mit9ammeed

c. *ma* ('what . . ? / how . . ! ')

zot	mazzot
'this'	'what is this?'
toov	mattoovuu
'good'	'how good . . . '
?oomar	maa?oomar
'I will say'	'what will I say? '
raa?iitaa	maaraa?iitaa
'you have seen'	'what have you seen?'

3. COMPENSATORY LENGTHENING IN TIBERIAN HEBREW IN A PRE-METRICAL FRAMEWORK.

In this section we wish to discuss the kind of analysis that would be available in a pre-metrical framework, not so much in order to point out the inadequacies of such a framework as to sharpen a number of questions.

In a framework such as that of Chomsky & Halle (1968) the facts of TH would be derived by means of two rules: Consonant Gemination and Vowel Lengthening. We give below a version of the two rules:

(21) Consonant Gemination

$$\emptyset \rightarrow C_i \;/\; \_\_ \begin{matrix} C_i & X \\ [-G] & M \end{matrix}]$$

where [-G] means that the G consonants are excluded from this process, X is a variable standing for a string of unspecified length (possibly null) and M is a morphological category.

(22) Vowel Lengthening

$$\emptyset \longrightarrow V_i \;/\; V_i \_\_ \begin{matrix} C & X \\ [+G] & M \end{matrix}]$$

Interestingly when consonant gemination and vowel lengthening[18] are written as in (21) and (22), their order of application is irrelevant. In addition we note that under an analysis where CL and Gemination are two sharply distinguished processes, a number of things could conceivably happen to the grammar. Perhaps, the two rules could be separated over time by the insertion[19] of one or several rules between them. Ultimately CL or Gemination or both might be lost etc. The general impression that emerges from a grammar incorporating (21) and (22) is that the surface distribution of long vowels and geminate consonants in TH reflects a state of equilibrium due to the somewhat fortuitous presence of two distinct processes.

We find this sort of conclusion unsatisfying. Instead we want to propose an analysis such that, if correct, it would be extremely difficult (although not entirely impossible) for TH to be different from what it is.

For instance we do not want to have to interpret as an accident the fact that CL and Gemination have complementary scope, i.e. that vowels lengthen, exactly where consonants cannot geminate. This complementarity suggests that the two processes discussed here are in fact the effects of a unitary phenomenon. Conceptually, one might make the identification of this cause easier by factoring out what CL and Gemination have in common: in the derivation of a VV sequence on the one hand and the derivation of a CC sequence on the other, we are dealing in each case with an instance of "doubling". We can thus formulate our program as an attempt to answer the two following questions:

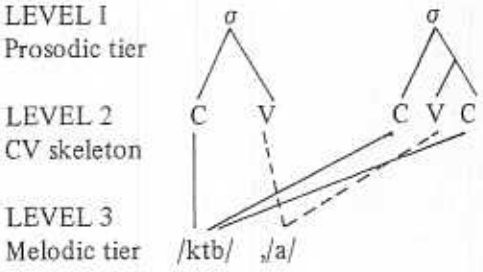
(23) i. what is the cause of "doubling"?
ii. which of VV or CC is the principal case and which is the default case of "doubling"?

If an analysis distinguishing between a default case, or a regular case and a principal case can be carried out, it will have a number of conceptual advantages and empirical consequences that we can already foresee. One of them is that the range of possible interpretations for given situations will be considerably narrowed down, as we will see in 6.4.

4. AN EXCURSUS ON THE FORM OF PHONOLOGICAL REPRESENTATIONS.

In this section we wish to develop a minimal system that will derive the facts discussed in Section 3.2, while at the same answering the questions raised in the preceding section. Our position is that the representation of Semitic morphology and phonology specifies the prosodic information involved in a particular structure, in most cases, the number and shape of syllables that characterize a particular morphological class. Along with this prosodic information, segmental information is incorporated in the form of a consonantal root and a vocalic melody. This segmental information is then mapped according to principles of autosegmental phonology[20] onto elements of the third level of representation, the CV tier, or CV skeleton. This model is familiar from work by McCarthy (1979, 1981) and Halle & Vergnaud (1980) and is known as 3-dimensional phonology. We give below an example of the representation of Arabic *katab* 'write'

(24)



It is our claim that phonology is not 3 dimensional in the sense of the references cited above.[21] To see this we return to McCarthy (1981), carefully looking at this definition of the CV tier. McCarthy offers a formula, which we give below in (25) and which generates all and only the strings of (26), the set of canonical patterns in the perfective of the triliteral conjugation,

(25) a.

$$\left[\begin{Bmatrix} C \\ CV \end{Bmatrix} \quad CV \quad (\ [\ \text{segment}\ ]\ ) \quad CVC\right]$$

b. $V \rightarrow \emptyset \quad / \quad [\ CVC \_\_\_ CVC\ ]$

(26) CVCVC, CVCCVC, CVVCVC, CVCVCCVC, CVCVVCVC, CCVCVC, CCVCCVC, CCVVCVC.

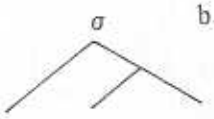
By universal conventions[22] the strings of (26) are uniquely syllabified as in (27):

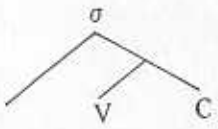
(27) [CV CVC], [CVC CVC], [CVV CVC], [CV CVC CVC], [CV CVV CVC], [CCV CVC], [CCVC CVC], [CCVV CVC].

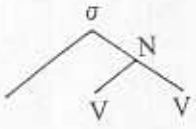
It turns out that the syllables thus specified are exactly the same as those represented at the prosodic tier, Level I of (24). As we see the CV tier incorporates a measure of redundancy. Indeed whether an element of that level of representation is a C or a V, that is to say [+vocalic] or [-vocalic], is entirely derivable from its relation to the prosodic template specified at Level I. So, for instance, an element dominated by the left branch(es) of σ is [-vocalic]. If the right branch of σ branches, its left branch dominates a [+vocalic] element[23], etc. As a result the entire representation can be simplified: The CV skeleton can be made to consist solely of a series of dots, which will be interpreted for major class features as indicated just above[24].

Another area where greater simplicity can be achieved is the iden-

tification of the "syllabic" categories. As already mentioned the geometry provides the information necessary to distinguish between categories such as Rime, Onset and Coda. These distinctions are not sufficient for the interpretation of geometrically ambiguous configurations. Thus, in the case of a branching such as (28a), we want to know whether such a structure should be interpreted as in (28b) or (28c), i.e. whether it is the representation of a closed syllable or a long vowel.

(28) a. 

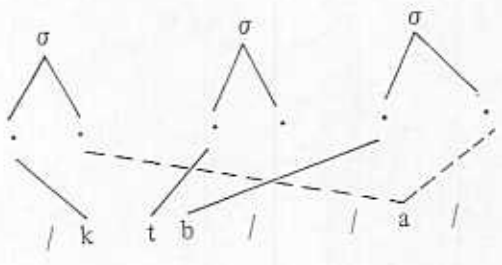
b. 

c. 

Based on general markedness considerations, we feel that (28c) represents the marked case, while (28b) is the default case. Accordingly, a structure such as (28a) with no further specification will be interpreted as being the rime of a closed syllable[25]. In conjunction with other levels of representation a VC sequence will be derived. When a long vowel is involved, the appropriate information will be signaled by the stipulation that the Rime of the syllable under discussion is an N, as shown in (28c). The total representation is now maximally simplified: Level I consists of information encoded in purely geometrical fashion (except for additional stipulations as may be required). Level 2 is a series of dots and Level 3 is basically as in McCarthy (1979, 1981).

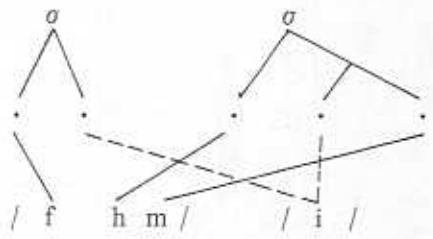
In the course of the preceding discussion we have not eliminated the skeleton as a level of representation. Indeed it is the level onto which segmental melodies will be mapped. Yet, we cannot help raising the obvious logical question: is the skeleton an *independent* level of representation? Does it ever display properties which cannot be derived from level I? Or, to put it differently, is it anything but the projection of the terminal nodes of the prosodic structures of Level I?

We can for instance vary the information at Level I. Thus, instead of the information contained at Level I in (24), we may find a series of three open syllables. This can be observed in (29), which is the representation of Arabic *kataba* 'he wrote'.

(29) LEVEL 1 

Alternatively, as in (30) the information present at Level 3 may vary while the information contained at Level I remains as in (24), namely an open syllable followed by a closed syllable. (30) is, thus, the representation of colloquial Arabic *fihim* 'he understood'

(30) LEVEL 1 LEVEL 2 LEVEL 3



While the information at Level I can vary, as exemplified in (24) and (29), the composition of Level 2 is intimately bound to that of Level I; in each case it seems that the number of dots at Level 2 corresponds exactly to the number of terminal nodes of Level I structures.

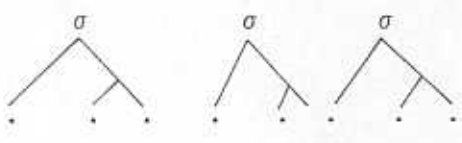
Whether this one to one correspondance obtains in all cases is an important empirical question. If such is indeed the case, then Level 2 is nothing but a derived level of representation, specifically a projection. We will postpone assessing this problem until the next section but one.

5. GEMINATION AND COMPENSATORY LENGTHENING.

In this section we wish to address the question of the representation of gemination and compensatory lengthening. The reader will recall that the guiding insight behind our analysis is the idea that the 2 phenomena under discussion here are but two facets of one and the same process. Consider two forms of the hitpa9el conjugation *hitgaddeel* and *hitpaaPeer*. We will have nothing to say about the prefix *hit*. Of interest to us is the gemination of *d*, the medial consonant of the root /gdl/, matched in the case of /p?r/ by the now familiar compensatory lengthening of preceding *a*.

Clearly these forms are characterized by the presence of three syllables with branching rimes. Furthermore, and more interestingly, we claim that these forms reflect a discrepancy between the number of Level 2 positions and the number of terminal nodes of Level I trees. Specifically, the rightmost branch of the medial syllable does not dominate a position at Level 2. This is represented in (31).

(31) LEVEL I LEVEL 2



We say that this sort of configuration determines the presence of a ∅, as shown in (32), where a branch of the prosodic tree does not dominate a dot at Level 2.

(32) LEVEL 1 σ σ σ

LEVEL 2 ∅

We now proceed to see how the segments of the consonantal root spread in quasi-autosegmental fashion:

(33) a. LEVEL 1 σ σ σ

LEVEL 2 ∅

LEVEL 3 h i t / g d l /

b. LEVEL 1 σ σ σ

LEVEL 2 ∅

LEVEL 3 h i t / P ? r /

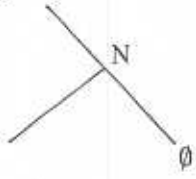
In intermediate representations (33a, b), the ∅ positions have been skipped, as they cannot serve to 'anchor' the elements spread from Level 3. A decision now has to be made regarding the interpretation of the ∅ involved. If the ∅ is a C, it will serve as the support for the spreading of *d* in (33a); if it is interpreted as a V, the position will be invaded by *a*, thus generating either *hitgaddeel* or the ungrammatical **hitgaadeel*. We note that the necessity of interpreting the ∅ position one way or the other is not a logical necessity (although it is an empirical necessity in the case of TH), as one could imagine a grammar such that the null position would simply be ignored. We believe however that this option is in fact not available as such to individual grammars. Rather, we submit that a principle such as (34) is operative

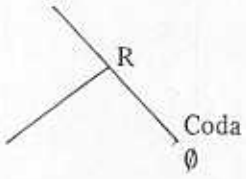
(34) The interpretation of a ∅ element as phonetically null can only result from prior deletion of its matching element at the prosodic level[26].

We moreover submit that no such pruning is part of the grammar of TH. Returning to our analysis we, in fact, find that no additional stipula-

tion is necessary beyond the machinery already developed in order to derive the desired result, i.e. *hitgaddeel* vs. **hitgaadeel*.

What we want is for the right branch of the rime of the unlabelled medial syllable of the representation to be identified as a C, not a V. This amounts to saying that the derived label dominating the branching rime should be an R, not an N. But this is exactly what we expect from our principle (10) which restricts the distribution of null elements to non-branching constituents. (35a) the structure corresponding to the interpretation we wish to exclude is ill-formed, for the prosodic category immediately dominating the ∅, branches.

(35) a. 

b. 

If on the other hand the same node is labeled R, then, the node dominating ∅ is a Coda, as in (35b). The latter node does not branch, accordingly the structure is well-formed and the desired result is achieved, namely the ∅ is identified as a C, with ensuing propagation of the nearest C.

Our theory correctly displays Gemination as the unmarked, or 'default' way of resolving the problem of the identity of the null element[27]. We thus expect that a language in which every consonant can geminate, will never display CL. This correlation holds very nicely of Arabic and TH: Consonant Gemination is always possible in the former language and CL, as we expect, is never observed; whereas TH exhibits CL but only in those cases where Gemination is not possible. Italian being unrestricted as to what consonants may geminate does not have recourse to Vowel Lengthening[28]; French, on the other hand displays quite a bit of CL after historical loss of *s* (cf. beste > bête, fenestre > fenêtre etc.); by that time, of course, the option of gemination had long been lost.

Having just seen how from a very general principle we can once more unambiguously derive prosodic labels, we now turn to the derivation of the forms exhibiting CL.

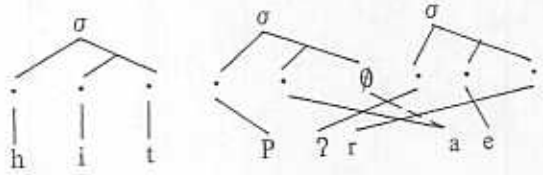
We saw that for a small number of segments, Gemination is not possible. This is not due to any particularly profound grammatical reason, but simply because the objects generated by our system, e.g. *ʔʔ, hh* etc. receive no phonetic interpretation in TH.

In this case we will simply invoke one of the fundamental conventions of autosegmental phonology, which we formulate as (36):

(36) Each syllabic position is linked to at least one segment in the phonetic melody.

As an automatic consequence of autosegmental notation, the ∅ position is linked to *a*, as shown in (37), in dotted line.

(37)



Because of the apparently disparate nature of our account of gemination and compensatory lengthening a comment is in order to put both processes into perspective.

The ∅ is identified in the unmarked case as a C because of its position with respect to syllable structure. One might, thus, ask whether in the residual case, when ∅ supports the spreading of a vowel, that element has been identified as being dominated by a branching N, contrary to what we expect from principle (10).

If such were the case the theory would lose all of its explanatory power; we would indeed invoke a principle in order to rule out a certain analysis, but if it turned out (for an independent reason) that this analysis were the only possible one, we would allow it anyway, regardless of the principle that was supposed to exclude it in the first place. In fact no such logical inconsistency mars our account. What can be observed in the derivation of CL and Gemination is the interaction of three distinct subtheories.

a. The first one is a theory of prosodic well-formedness. Its basic vocabulary allows the expression of generalizations about the relation holding between a prosodic domain and a position of this domain. By analogy with grammatical tradition and recent efforts in syntax (cf. Chomsky (1982) and references therein), we call it a *theory of prosodic government*[29]. One could, for instance, speculate that the Nucleus is the 'head' of the Rime constituent. We could, then, go on to say that this element must in some sense, govern its sister constituents of the Rime. This relationship would be defined, at least in part, configurationally and could explain why long vowels and diphthongs are not found in closed syllables in languages for which such a constraint holds. It is not our purpose to furnish a complete discussion of such a theory, but only to suggest in very general terms what form it might take.

Pursuing the same sort of analogy, one may think of principle (10) as an equivalent of the Empty Category Principle. In the case of Gemi-

nation, the theory of Government defines the identity and shape of domains, thus providing guidelines for further processes, in this case, segment propagation.

b. Segment propagation may be impossible in certain cases for entirely independent reasons. Thus, it is obvious that the fact that the class of G consonants in Hebrew, are all resonants (cf. Prince (1975), is not an accident. In our theory the class of resonants are precisely those segments which may be contained in a nucleus. Following this line, we see that sequences of the type CVG (where G stands for the class of G consonants), are in theory syllabically ambiguous, being analyzable as in (35a) or (35b), where (35a) stands for a heavy diphthong and (35b) for a closed syllable. In Hebrew one may suppose that such sequences are uniformly interpreted as in (35a). It is the selection of this parameter that is the key to the understanding of the special behavior of this class of segments in Hebrew. Cf. Kaye & Lowenstamm (in preparation, c)

c. Finally, a condition such as (36) is a *global well-formedness condition* expressed in the vocabulary of autosegmental notation and is independent of the effects of the theory of government. It therefore does not clash with the latter in the way just suggested above.

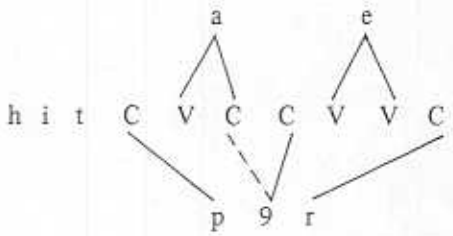
EXCURSUS

We take this opportunity to compare our approach and one in which autosegments are mapped on a level of representation consisting of Cs and Vs. Under the latter approach the skeleton corresponding to the hitpa9ēl forms discussed above will be represented as in (38).

(38) h i t C V Ⓒ C V V C

When the circled position does not support the spreading of a consonantal autosegment, as in the cases when a root medial guttural consonant is involved, it is linked to a vowel autosegment. The sort of object derived is shown in (39), where the dotted line represents an unsuccessful attempt to geminate a G consonant and the solid line linking *a* to a C position represents the ensuing spreading of a vowel autosegment.

(39)



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6. CONSEQUENCE

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While accounts such as the one just sketched are occasionally offered, it is a simple fact that under the definitions of 3-dimensional phonology, (39) is ill-formed.

As no alternative appears to be available we conclude to the presence of a serious flaw in such a framework. By contrast our approach faces no such inconsistencies and its results are automatic consequences of general principles[30].

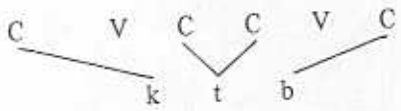
Having clarified these conceptual questions, we now wish to comment on the results of this article.

6. CONSEQUENCES OF OUR APPROACH.

6.1. A theory of gemination.

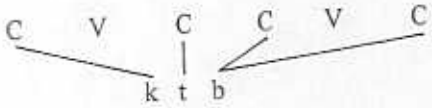
In order to discuss the advantage of the account we have offered we must return to McCarthy's discussion of Arabic verbal conjugation[31]. Consider the form *kattab* with geminate medial consonant. In McCarthy's notation where the skeleton recapitulates information pertaining to syllable structure this form is represented as in (40)

(40)



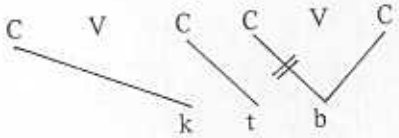
However by McCarthy's conventions we expect that the consonantal melody will spread as in (41), yielding the ungrammatical **katbab*.

(41)



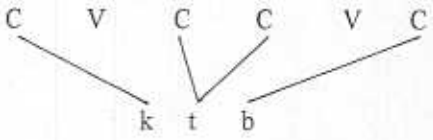
As correctly pointed out by McCarthy (1981) and Halle & Vergnaud (1980) the existence of forms such as *ktabab* or *ktanbab* suggests that the basic machinery responsible for the spreading of segments is not at fault; rather, gemination is exceptional and, therefore, justifies an exceptional treatment. McCarthy, thus, suggests that the undesirable line of association be 'cut' as shown in (42)

(42)



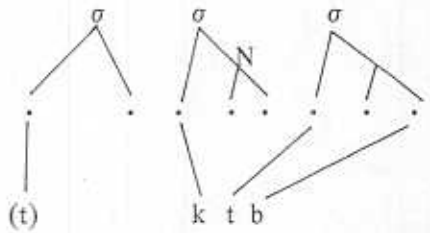
Then, by convention the now unassociated C will be linked to *t* as in (43)

(43)

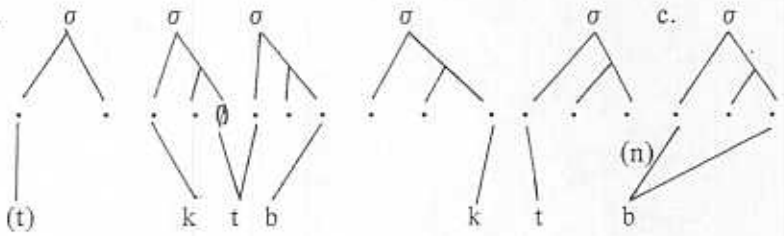


This sums up the effects of McCarthy's *2nd and 5th binyanim erasure*. While we agree that forms exhibiting Gemination represent exceptionality, we feel that this sort of exceptionality is not the property of any particular verbal pattern. Rather, it is an instantiation of a widely spread phonological process requiring its own characterization. We have offered a system in which the ad hoc rule of erasure is not necessary and which rests on an idealization independently motivated in UG, namely, principle (10), thus preserving the overall elegance of McCarthy's treatment. We sum up the situation in (44), where we show the representation of the three possible configurations: long vowel, geminate consonant and, the expected case, reduplication of the root final consonant. These three cases are exemplified by: *takaatab, takattab* and *ktanbab*, respectively. Only the mapping of the consonantal melodies is represented here; and segments which are not part of the root, e.g. prefixes and infixes, are represented as already associated and included in parentheses[32].

(44) a.



b. c.



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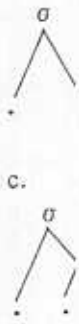
(45) a. CVCV
b. CVCC
c. CVVC

(46)



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6.2. *The Status of the CV tier.*

The possibility of representations such as (44) is considered but rejected in McCarthy (1982). McCarthy's first objection is that representations such as (44) are mere notational variants of representations encoding the same information by means of the CV tier. We have already shown, based on our analysis of Compensatory Lengthening that the syllabic solution is not a notational variant of a CV analysis, but a necessary alternative to it.

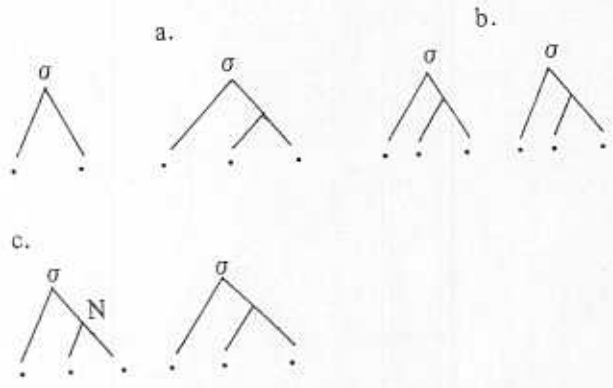
The second argument involves more specifically representations such as (44c).

McCarthy notes that in *Modern Hebrew* a bínyan such as pi9ēl can be defined simply as a sequence of two syllables, [σ σ], where each σ is independently expandable into any well formed syllable of Modern Hebrew. The particular syllabic structure is usually determined by the number of elements in the radical.

McCarthy, then, notes that in Arabic, differing morphological classes may be disyllabic. What distinguishes these classes is the particular shape of the disyllable. As we saw earlier, there are two ways to define such a shape: in terms of a sequence of Cs and Vs as in McCarthy (1982) or in terms of syllabic structure as we propose. Thus, the three classes defined by McCarthy as in (45a,b,c,) can also be defined in syllabic terms as in (46a,b,c).

(45) a. CVCVC
b. CVCCVC
c. CVVCVC

(46)



Furthermore, McCarthy points out that derivational classes with stem-initial clusters might be specified in syllabic terms, as having a free coda as their initial element, as in (44c) above. However, he suggests that such

a stipulation amounts, at best, to a notational variant of a CV-template analysis.

Ignoring for the moment the results of our analysis of Compensatory Lengthening, let us examine the claim that representations such as (45) and (46) are notational variants.

In Arabic, which has no branching onsets, the structures (45a,b,c) are unambiguously analyzable as in (46a,b,c), respectively. One needs a language with syllable structure sufficiently rich to render a sequence like CVCCVC syllabically ambiguous as in, say, (47).

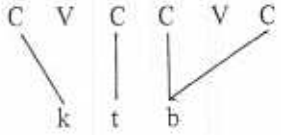
(47) a. CVCCVC

b. c.

There is now a significant difference between the CV representation (47a) and the syllabic representations (47b) and (47c). The CV skeleton represents a sequence of Cs (consonants or glides) and Vs (vowels) in the order given, independent of any syllabic considerations. Thus, the CV representation (47a) can be satisfied by forms having either of the syllabic structures of (47b,c). The question, then, is whether (47a) represents a linguistically utilizable generalization as opposed to one or the other of (47b) and (47c).

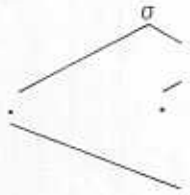
What we need is a language employing templates, like Arabic, but with a richer syllabic inventory, like Modern Hebrew, such that word-internal consonant clusters are potentially ambiguous. Suppose that one template is represented in McCarthy's terms as CVCCVC. Suppose, further, that forms are associated (for this hypothetical morphological class) in a strictly left-to-right fashion. Thus, the CV skeleton (47a) and a triliteral radical, say, /ktb/ yield (48)

(48)



Given the syllabic constraints in a language like Modern Hebrew, (48) will be syllabified as in (49).

(49)



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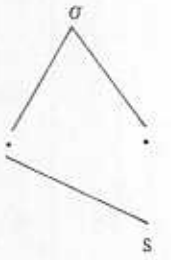
(51)



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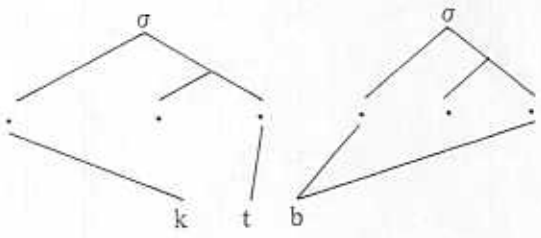
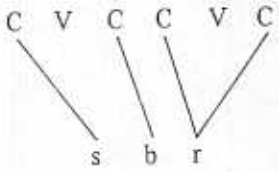
(49)



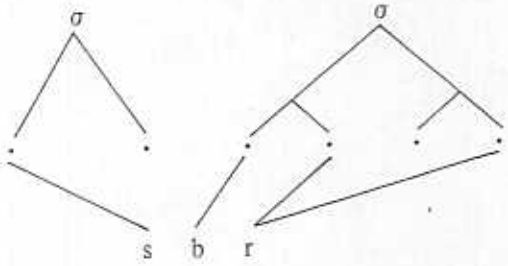
Consider now another possible stem of the form /sbr/. Applying this stem to the CV template (47a) yields the structure shown in (50).

(50)



Now, what is the syllabic structure of (50)? In the unmarked case, the sequence -br- is analyzed as the onset of the second syllable, rather than as a transyllabic cluster involving the coda of the first syllable followed by the onset of the second. The analysis of (50) should, thus, be:

(51)



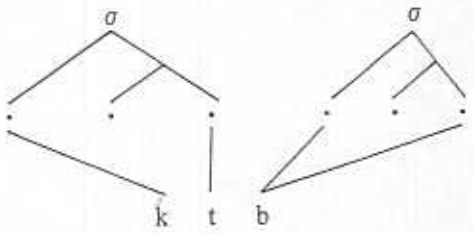
One notes that in CV terms, the structures (48) and (50) are identical. This state of affairs is quite natural in a theory claiming that skeleta of morphological classes are defined by CV sequences. The result is a morphological class that is heterogeneous in syllabic terms: (49) contains two closed syllables while (51) has an open syllable followed by a closed syllable.

If morphological classes are defined by syllabic canonical shapes, but not CV sequences, the state of affairs described above should be impossible. The syllable based theory would claim that a canonical shape for a morphological class can be expressed by a formula such as:

(52) "2 closed syllables"

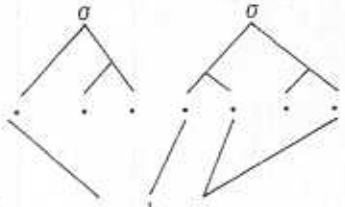
i.e. the derivational form in question consists of two closed syllables. Applying this formula to a stem like /ktb/, we obtain (53), exactly the representation predicted by the CV theory.

(53)



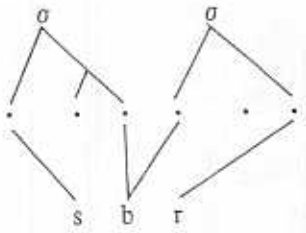
Given a stem like /sbr/, however, we predict something different. (54a,b) seem reasonable possibilities

(54) a.



[sVbbrVr]

b.



[sVbbVr]

The result of the application of a syllable based definition of canonical shape is *syllabic homogeneity*, a requirement not always met under a skeleton based definition. Let us state explicitly the principle that underlies this argument.

(55) Morphological classes defined canonically must observe syllabic homogeneity.

The canonical form of our Semitic hybrid can not possibly be defined in CV terms since this leads to syllabic heterogeneity, which we exclude. Unfortunately, this hybrid is a hypothetical language. While we have not yet encountered such a language, Arabic itself offers some evidence that (55) is correct and consequently the syllable-based approach, as well.

McCarthy (198
CCVCCVC.

He notes that
preceding syllable
This follows from
and involves no
no vowel precede
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In fact, the vo
inserted between
in Tiberian Hebr
catenative morph
the consonant cl
vowel were insert
iCC-, the initial c
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can do. Consider
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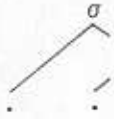
(56)

(57)



In (57) the syll
series of points.
tuents and, acco

McCarthy (1982) discusses cases of the form CCVCVC CCVVCVC and CCVCCVC.

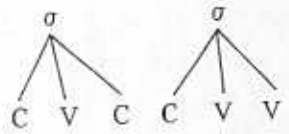
He notes that the initial consonant is resyllabified as the coda of the preceding syllable when the stem follows a vowel-final word or prefix. This follows from principles laid down in Kaye & Lowenstamm (1984) and involves no stipulation of any kind. Now consider the case where no vowel precedes the CC-initial stem. Since Arabic has no branching onsets, epenthesis must occur. But where?

In fact, the vowel is inserted before the CC-cluster. It could have been inserted between the two consonants. Indeed, this is exactly what happens in Tiberian Hebrew in its concatenative morphology. In its non-concatenative morphology, Hebrew works like Arabic: the vowel precedes the consonant cluster. Principle (55) predicts this state of affairs: if the vowel were inserted to the right of the first consonant, i.e. CiC- instead of iCC-, the initial consonant would constitute the onset of the first syllable; while in all other cases, this consonant occupies a coda position.

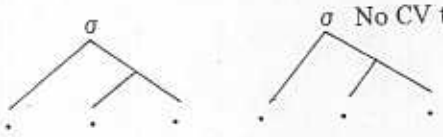
Considering these facts along with the mounting evidence for the subrimal elements, nucleus and coda, it becomes increasingly clear that invoking a CV tier is not only unnecessary but wrong.

We conclude this sub-section by noting that Marantz (1982) is sometimes taken to constitute evidence for a model of phonological representation that includes a CV skeleton. In his detailed treatment of reduplication, Marantz uses a Kahnian type of representation for syllable structure, with n-ary branching syllables and no internal constituency. Cf. Kahn (1976). There is an evident trading relationship between the richness of the internal structure of a syllable and the amount of work a CV-tier can do. Consider, thus, the structure of a form like *tekpa:*. We give it in the two versions under discussion, (56) and (57)

(56) CV tier (Marantz's version)



(57)



In (57) the syllable has internal constituents and the CV tier becomes a series of points. There is now compelling evidence for sub-syllabic constituents and, accordingly, the CV-tier becomes at best redundant.

6.3. *The autonomy of the skeleton.*

In section 4. we raised the question of the autonomy of the skeleton and we suggested that it derives its characteristics from Level I. In the following section we offered an analysis crucially resting on the possibility of a discrepancy between the composition of Level I and Level 2. If correct, this analysis should contribute something to the question raised in 4.
In fact it turns out that our analysis is simply another illustration of the derived status of the skeleton: the observed discrepancy is of a kind that is allowed *only in terms of the geometry of Level I configurations*, viz. the restriction of the occurrence of null elements to non-branching prosodic categories. Once more the composition of Level 2 is determined from above. We therefore conclude that our analysis of Gemination and Compensatory Lengthening strengthens the case for our view of Level 1 as the only primitive level of prosodic representation.

6.4. *The Principles and Parameters Approach.*

Finally, we wish to comment on how our analysis illustrates the interaction of principles and parameters and justifies the need for a richly articulated theory of phonological description. Based on insights of metrical and autosegmental phonology, most studies of CL go as far as idealizing the problem as a decision between the interpretation of a given position as a coda or the right branch of a nucleus. As this point, a rule will usually state which strategy has been selected by a language, viz. which autosegment, a consonant or a vowel, will spread. Under this approach (theory A below), the four logical possibilities of (58) are equally plausible.

(58) A language may display:
- i. CL even though gemination is possible;
- ii. Gemination and no CL;
- iii. CL in the absence of the gemination option in the language;
- iv. Neither CL nor gemination.

On the other hand, our theory (theory B below) assigns quite a different status to the possibilities of (58). Important differences follow as regards individual grammars and their relationship to UG. Both approaches are contrasted below.

(58.i.)
Theory A
Even though the language has the option of geminating consonants, a *rule* will stipulate lengthening of a preceding vowel, i.e., a situation such

as . . . a?t . . . wil
displays . . . tt . . .

Theory B.
This option is sim
guage will have rec

(58.ii.)
Theory A
A *rule* will *stipul*
explaining, when
that a VV sequenc

Theory B
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(58.iii.)
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Theory B
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as . . . a?t . . . will be resolved as . . . aat . . . even though the language displays . . . tt . . . elsewhere.

Theory B.
This option is simply impossible in our system. We predict that no language will have recourse to CL if gemination is possible.

(58.ii.)
Theory A
A *rule* will *stipulate* spreading of a consonantal autosegment, perhaps explaining, when feasible, the presence of such a rule by the observation that a VV sequence is impossible in the language.

Theory B
This situation is exemplified by Arabic. All the facts follow from principle (10.). *The grammar of Arabic requires no rule*, in fact no mention whatsoever of any device, in order to derive the facts discussed in this paper. Alternatively, one might say that nothing has to be learned by the speaker in order for him/her to generate grammatical strings. We note that while the ungrammaticality of a sequence of two vowels may be observationally adequate when such is the case, it fails as an explanatory device in the case of a language such as Arabic: No such constraint holds in Arabic and yet gemination is consistently chosen over vowel lengthening. The reason is of course that gemination is entirely independent of the vowel system in languages.

(58.iii.)
Theory A
Basically, this case will be covered by the same *rule* as (58.i.), but deriving, perhaps, some appeal from the concomitant observation that $C_i\ C_i$ is an impossible configuration in the language, when such is the case.

Theory B
This case provides us with the opportunity to illustrate the difference between a principle and a parameter. (10.) is a principle of UG, and as such immutable. On the other hand, whether a language will have geminate consonants or not is a parameter. We expect that the selection of a parameter will be made in a way that is consistent with what is loosely known as 'phonetic plausibility'. TH is an excellent test case; the effects of the principle can be observed, most of the time but not always, as, for instance, when they are obfuscated by the effects of a parameter. *In this case, again*, which is symmetrical with (58.ii.), *no rule is necessary*. However, the grammar will have to mention exactly how the parameter for

gemination is fixed. This, in turn, will have consequences in unrelated areas such as spirantization, etc.

(58.iv.)
Theory A
Theory A has nothing to say about case (58.iv.).

Theory B
In this case, again, we see how the effects of (10.) may be obscured by the way a given parameter has been set. In this case, the parameter concerns pruning of metrical structure. As mentioned in (34.), loss of an element of the skeleton can only result from pruning. The effects of pruning will not be limited to this case; rather, we expect that they will have consequences in unrelated areas, such as foot formation, etc. As mentioned in Section 6, we do not rule out the possibility that neither CL nor gemination will take place; we simply impose a condition on the above case: pruning.

7. CONCLUSION.

In this study we have offered a simple account of the relationship holding between Gemination and Compensatory Lengthening. Specifically, our solution expresses the fact that Gemination takes precedence over Vowel Lengthening. Moreover, by construing these phenomena as the effects of Principles and Parameters of Universal Grammar, we have removed them from the scope of individual grammars, thus capturing an essential feature of the problem, namely the fact that individual grammars do not appear to have the power to reverse the terms of the interaction we have been discussing.

In the course of the discussion we have eliminated the CV tier from the conceptual apparatus of linguistic theory.

ACKNOWLEDGEMENTS

This article is part of a larger work, Kaye & Lowenstamm (in preparation, d). Portions of the material discussed here have been presented at the VIth GLOW Meeting in Paris and the Minifestival on Compensatory Lengthening, held at Harvard University on May 15, 1982, as well as at colloquia at Université du Québec à Montréal, Université Paris VIII and the University of Texas at Austin. We wish to thank Mazal Cohen, who introduced us to the problem of Compensatory Lengthening in Biblical Hebrew, to Daniel Radzinski, who provided us with valuable information and suggestions, and to John McCarthy for his comments. Research for this study was supported by the Center for Cognitive Science at the University of Texas at Austin and by a grant from the Social Sciences and Humanities Research Council of Canada, #410-81-0503.

NOTES

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NOTES

1. On Closed Syllable Shortening, see Kaye & Lowenstamm (in preparation,b) and Lowenstamm (forthcoming).
2. On "crazy rules" and markedness, we refer the reader to Bach & Harms (1972).
3. On notions such as "principles" and "parameters", see Chomsky (1980,82).
4. In connection with the question of the impact of prosodic structure on the segmental representation, see for detailed discussions Lowenstamm & v.d. Wilt (forthcoming) on Dutch Diminutive Formation, Yin (1982) for an analysis of retroflex suffixation in Mandarin Chinese, Rapoport (in preparation) on the hypocoristics in Yiddish.
5. We assume familiarity with a representation of syllable structure similar to a proposal put forth in Fudge (1969), and which rests on an organization in immediate constituents: the onset, the rime, and the daughters of the rime: the nucleus and the coda.
6. Our conception of markedness is based on insights of Trubetzkoy (1939), Chomsky & Halle (1968), Kean (1976), and Cairns & Feinstein (1982).
7. For a discussion of Yawelmani phonology, see Newman (1944), Kuroda (1967), Kisseberth (1969). Obviously, our discussion of Yawelmani does not purport to be the ultimate analysis of this language. We only mean to illustrate certain processes of syllabic analysis.
8. The characterization of resyllabification is given as in (7) for the sake of clarity. In fact, the condition to the effect that no resyllabification will violate the syllabic constraints of the language, can simply be made to follow from a general constraint on the structure preserving nature of prosodic operations. In such a case, (7) might simply be formulated as (i):
   (i) Reanalyze.
9. In many languages, the insertion of a glottal stop seems to be the unmarked case of consonant epenthesis. As regards the insertion of a vowel, it would seem that the favored epenthetic segment is the sound used by speakers when they hesitate: ɨ or ʌ for speakers of English, *e* for speakers of Hebrew, ə in French etc.
10. This phenomenon is well described in a number of classical works on Hebrew grammar. See for instance Bauer & Leander (1922), Bergsträsser (1962), Chomsky (1933), Ewald (1870), Joüon (1923), Lambdin (1971), Gesenius (1881), Nordheimer (1842). See also Barkali (1965).
11. For a discussion of possible patterning of such exceptions, see Prince (1975).
12. In spite of exceptions, it is generally true that members of a miškal usually share a number of semantic features. For instance, *qattelet* is the miškal of diseases, while *qitteel* is the miškal of physical or mental defects.
13. For a discussion of the vowel system of Biblical Hebrew, see Chomsky (1933, 1941) Morag, (1962), Prince (1975), McCarthy (1979), Cantineau (1950), Bauer & Leander (1922). For valuable discussions of the question of length in Tiberian Hebrew, see Faber (1982) and Malone (1980).
14. The superscript in baari^{a}h is an epenthetic vowel known as *pattaḥ g ə nuva* or *pattaḥ furtivum*. This vowel is inserted before any low consonant, when the latter is in Coda position, e.g. /luḥ/ 'calendar' is realized as *luʿaḥ*. When plural formation, for instance, makes the low consonant an onset, there is no need for insertion of the *pattaḥ furtivum*, thus,/luḥ+oot/ is realized as 'luḥoot'.
15. The root /p91/ was chosen as the typical root by medieval Jewish grammarians by analogy with their practice in the study of the grammar of Arabic. This choice proves particularly unfortunate in the case of the strong binyanim (binyanim with

gemination of the root medial consonant), since gutturals do not geminate.

16. Throughout this article we have ignored in our transcriptions the effects of a rule of spirantization converting representations such as e.g. *məboorak* into *məvoorax*.

17. We do not mean to say that the conjunction *waw* litterally has this meaning changing property. This characterization is only intended to help the reader work through the glosses. Cf. Driver (1881):

> . . . The title *waw conversive* is a translation of the name *waw haahippux*, which originated with the old Jewish grammarians, who conceived the waw under these circumstances to possess the power of changing the signification of the tense, and turning the future into a past, just as in a parallel case (. . .), they imagined it capable of turning a past into a future . . .

18. Vowel Lengthening as formulated here collapses two operations: vowel insertion and feature copying. This version is, of course, not the only one available in the SPE framework. Which version is actually offered is, in fact, immaterial for the argument made in this section.

19. On rule loss and rule insertion, see Kiparsky (1965), King (1969) and Dresher (1980).

20. On autosegmental phonology see e.g. Goldsmith (1976), Williams (1971).

21. Since McCarthy conflates what we call Level I and Level 2, his account, as we will see, is not incompatible with ours.

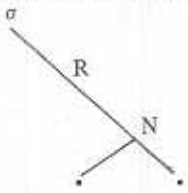
22. A discussion of such universal conventions can be found in Selkirk (1984) Lowenstamm (1981). These universal conventions are, of course, to be interpreted modulo the inventory of syllable types of the language under discussion. On this question, see Kaye & Lowenstamm (1982).

23. The feature [vocalic] is used throughout this paper. The reevaluation of syllabicity and the feature [syllabic] is, of course, a natural part of the programme of prosodic phonology. For the elimination of this feature and the ensuing revision of the feature system, see Kaye & Lowenstamm (1984).

24. On the question of the adaptation of Vergnaud's percolation convention, we refer the reader to Vergnaud (1979) and Kaye & Lowenstamm (1984), which also illustrate the role of the convention in resyllabification processes.

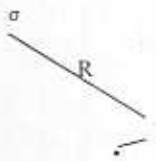
25. The question is by no means trivial. There are a number of cases, Quechua, Hungarian, which contain rimes of the form VC, but lack long vowels or heavy diphthongs, that is rimes of the form (i)

(i)



Implicit in our approach is the claim that no language with long vowels or heavy diphthongs has only open syllables. In evaluating this claim, care must be taken to distinguish sequences of identical vowels forming two distinct syllables and authentic cases of long vowels. Cf. Kaye (1982). The formalism of Kaye & Lowenstamm (1982) can be adjusted (trivially) to give this result, i.e.: (ii) is more marked than (iii), surely a function of the degree of embedding at which the branching takes place.

(ii)



26. This principle
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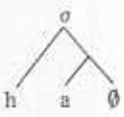

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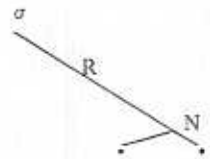
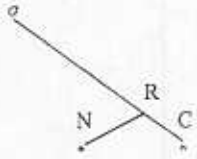
(ii) 

(iii) 

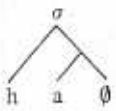
26. This principle is perfectly compatible with a proposal made by J.R. Vergnaud at the VIIIth GLOW meeting in Paris, to the effect that "prosodic structure must be interpreted phonetically". Incidentally, if Vergnaud is correct, we have a very strong indication that the thesis of the non-autonomy of the skeleton, which we defend here, is correct, too.

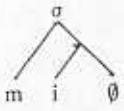
27. Our position on this question is radically different from Ingria (1980), for Ingria sees vowel lengthening as the unmarked strategy to solve a similar problem.

28. For valuable discussion of related processes in Italian, see Chierchia (1981).

29. Aoun (to appear) contains proposals which are close in spirit to our approach, although his ideas are expressed in the form of a theory of binding, rather than a theory of government. For further discussion of the theory of government, as we understand it, see Lowenstamm (forthcoming) and Kaye & Lowenstamm (in preparation b.c).

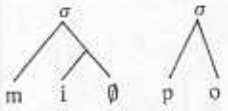
30. Our analysis of the strong binyanim involves an empty position at the level of the terminal nodes of the prosodic structure. This analysis extends to the clitic elements discussed in section 2. Historically, *ha* 'the' and *mi* 'from' come from *han* and *min* respectively. Cf. Bauer & Leander (1922). A natural interpretation of the diachronic developments is that the *n* was lost over a period of time, without corresponding pruning of the structure. Accordingly, the lexical representations of these items are as in (i) and (ii).

(i) 

(ii) 

These forms determine, with the items to which they attach, configurations such as (iii) and (iv), thus providing inputs to Gemination (or compensatory lengthening)

(iii) 

(iv) 

A similar proposal concerning the representation of these items can be found in Rappaport (1981).

31. It is necessary in this case to return to Arabic, as Hebrew does not provide us with the relevant crucial examples.

32. The *n* of ktanbab is an infix and is represented as an autosegment on a separate tier; it does not interfer with the normal process of association of the melody /ktb/. See McCarthy (1981) on this question.

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Chapter 6

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