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Phonology and word structure in Modern Hebrew

Bat-El, Outi, Ph.D.

University of California, Los Angeles, 1989

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UNIVERSITY OF CALIFORNIA

Los Angeles

PHONOLOGY AND WORD STRUCTURE IN MODERN HEBREW

A dissertation submitted in partial satisfaction of the requirements for the degree Doctor of Philosophy in Linguistics

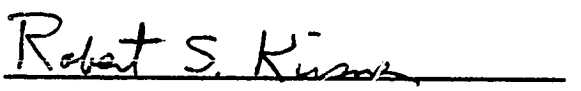
by

Outi Bat-El

1989

The dissertation of Outi Bat-El is approved.

Yona Sabar



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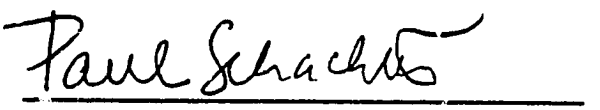

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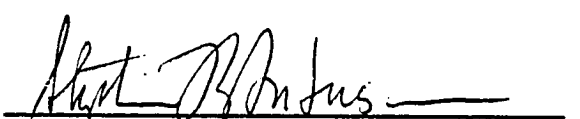
Bruce Hayes



Stephen R. Anderson, Committee Chair

University of California, Los Angeles

1989

In the memory of my father

MOSHE FURSHT

1918-1968

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NOTATIONS

σ_o - open syllable

σ_c - closed syllable

σ - any syllable

μ - mora

σ_μ - light (monomoraic) syllable

$\sigma_{\mu\mu}$ - heavy (bimoraic) syllable

C' - unsyllabified (floating) consonant

[CVCVC] - CV-skeleton

CVCVC - a sequence of segments

x<y - x precedes y

x>y - x follows y

ACKNOWLEDGMENTS

Stephen Anderson and Bruce Hayes have encouraged me to think and work independently. It is thus not surprising that they do not necessarily agree with everything written in this dissertation, and needless to say they should not be blamed if I failed to follow their advice. Yet without their contribution I could not have written anything at this level; I am obliged to them for many of the ideas presented in this work.

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Outi Bat-El

February 1989
Los Angeles, CA

VITA

February 8, 1954	Born, Tel-Aviv, Israel
October, 1982	B.A., Tel-Aviv University
March, 1986	M.A., University of California, Los Angeles

PUBLICATIONS AND PRESENTATIONS

Bat-El, Outi (1984, December) "Reduplication in Modern Hebrew". A paper presented in the annual meeting of the Linguistic Society of America, Baltimore, Maryland.

Bat-El, Outi (1985) "Locality in Morphological Derivation". In Goldberg et. al. (eds.) *Proceedings of the West Coast Conference on Formal Linguistics* 4. The Stanford Linguistics Association.

Bat-El, Outi (1988, April) "Nasalization in Kwawu-Akan". A paper presented in the annual African Linguistic conference, Boston, MA.

Bat-El, Outi (1988) "Remarks on Tier Conflation". *Linguistic Inquiry* 19.3.

Bat-El, Outi (1988) "Distinctive Nasality in Kwawu: A Prosodic Account". *Studies in African Linguistics* 19:2.

Bat-El, Outi (1988, December) "A Non-templatic Analysis of Modern Hebrew Word Structure". A paper presented in the annual meeting of the Linguistic Society of America, New Orleans, Luisiana.

ABSTRACT OF THE DISSERTATION

PHONOLOGY AND WORD STRUCTURE IN MODERN HEBREW

by

Outi Bat-El

Doctor of Philosophy in Linguistics

University of California, Los Angeles, 1989

Professor Stephen R. Anderson, Chair

This thesis examines the phonological character of Modern Hebrew word structure. It concerns with the nature of the formatives participating in word formation, the process of word formation, and the (phonological) structure of the output forms.

I claim that the formatives participating in Modern Hebrew word formation are strings of noncontinuous segmental elements only, without underlying prosodic structures. These strings are interdigitated as a by-product of rule-governed syllabification. The output forms consist of phonological structure only, segmental elements and derived syllabic structure, without morphological structure.

The approach I am taking here is that of process-based morphology, which allows morphological rules to be non-affixational, and more precisely, phonological in nature. In addition, I argue that when information about morphemic distinctions appears to be required, the rule in question is actually based on phonological form.

This is a direct consequence of the absence of morphological structure beyond word formation.

Phonological process thus appears to be based on segmental and prosodic information. Previous arguments in favor of internal morphological structure are are interpreted as phonologically-based, assuming that features are hierarchically organized. Phonological rules and constraints seem to be sensitive to the structural organization of the features.

CHAPTER 1

INTRODUCTION

This thesis is devoted to the phonology and morphology of words in Modern Hebrew (hereafter MH), where the main theoretical issue is the impact of phonology in morphological operations and structure. I will demonstrate the significant role of phonology in word formation by showing that (i) phonological rules can function as the sole process in word formation, and (ii) phonological shape is used to identify morphological elements, and therefore internal morphological structure does not exist beyond word formation.

The issue of the impact of phonology in morphological operations and structure is of particular concern when a Semitic language is involved since Semitic languages are well known for their rich and unusual morphology. The morphology of many Semitic languages is in part *NONCONCATENATIVE*. In such a system, the formatives[1] involved in stem formation are strings of *NONCONTINUOUS* segmental elements. Each stem consists of two such noncontinuous formatives, which are assembled by *INTERDIGITATION* rather then concatenation.

For example, the MH verb *gadal* 'he grew'[2] consists of two formatives, the root *(g,d,l)* and the vocalic pattern *(a,a)*. The same root, *(g,d,l)*, appears in *gidel*

[1] The term "formative" refers to any formal component of a word's shape. Thus, it can be an identifiable subset of the segments in a word (i.e. a morpheme, with or without meaning), or a phonological process (e.g. ablaut).

[2] Verbs are cited in their 3sg. Past form, which is identical to the stem. Stress is final unless otherwise specified.

'he raised', and the same vocalic pattern, *(a,a)*, appears in *katav* 'he wrote'. Beyond the stem, the more familiar concatenative morphology is employed, as in *katav+ti* 'I wrote'.

The analysis of interdigitation in MH provided in this work supports my claim that phonological rules can function as the sole process in particular word formation. This issue, with regard to concatenative languages, has been raised in Anderson's (1988a) discussion on *ITEM* vs. *PROCESS* morphology. Anderson shows that some morphological derivations are employed by phonological processes only. For example, imperatives in Danish (see Anderson (1975) and references cited there) are formed by deleting the stem final schwa; *spark* 'kick!' from *sparke* 'to kick'. Stems that end in vowels other then schwa are not affected; *gaa* 'to walk, walk!'. Vowel deletion, and in particular schwa deletion, is a common phonological rule; yet in Danish it is used as the sole process in forming the imperatives.

I am taking a similar approach here with respect to MH stem formation. I argue that the only mechanism required for interdigitation is syllabification; that is, interdigitation is a by-product of syllabification. For instance, the verb *gidel* 'he raised' is derived from *(g,d,l)* and *(i,e)* by syllabifying *g* and *d* as the onsets of *i* and *e* respectively, and *l* as the coda of *e*. Consequently, syllabification rules not only build the syllable structure but also determine the linear order of the segments within a stem. Syllabification is a phonological process required in every language; nonetheless, it has an essential function in MH morphology.

The claim that phonological shape is used to identify formatives is a novel theoretical approach. This strategy of referring to formatives is a direct consequence of Anderson's (forthcoming) approach to morphological structure. Anderson, in his

theory of A-Morphous Morphology, claims that morphological operations, with the exception of compounds and similar processes, do not create internal structure. I will argue here that when information about morphemic distinctions appears to be required, the rule in question is actually based on phonological form.

This approach to Semitic morphology is in disagreement with previous studies (in particular McCarthy (1981, 1986)) which argue for the accessibility of internal structure to subsequent rules. Morphemic distinctions, according to McCarthy, are encoded by multitiered representation, whereby distinct formatives appear on separate melodic tiers. In the verb *gidel* 'he raised', for instance, the vocalic pattern *(i,e)* and the consonantal root *(g,d,l)* appear on different melodic tiers, since they are distinct formatives.

Recent studies of the internal structure of segments, first introduced in Clements (1985a), can replace the morphologically motivated tier segregation with phonologically motivated distinction between the featural structure of vowels and consonants. Therefore, reference to the distinction between the vocalic pattern and consonantal root in Semitic languages can be based on phonological form rather than on internal morphological structure.

While feature geometry can replace the morphologically motivated tier segregation required for subsequent rules, it is not sufficient for the purpose of rules that require reference to a particular formative; e.g., reference to *-ate* in English for the purpose of truncation, as in *nomi+nate - nomi+~~nate~~+nee*. I claim, on the basis of the behavior of MH feminine suffixes, that when reference to a formative is required, phonological information is used to identify this formative. The crucial evidence in this particular case is that the identified phonological form is not identical to the phonological shape of the underlying formative. When the feminine singular

suffix *-Vt* (where *V* can be *a, i, u,* or *e*) needs to be truncated to respect some morphological constraint, only *t*, which is phonologically identified with the feminine suffix, is deleted; *rakdan+it+ot* --> *rakdaniot* (--> *rakdaniyot*) 'dancers f.'.

Reference to phonological information for morphological purposes is independently motivated for *EXTRACTION*. As demonstrated in Bat-El (1986), roots in MH can be created by extracting the consonants out of a fully specified base form. The crucial point is that the extracted material is phonological (a string of consonants) rather then morphological (a root formative). Thus, from the noun *misxar* 'trade', where *m* is a prefix (cf. *saxar* 'he traded'), the consonants *(m,s,x,r)* are extracted for the purpose of forming the verb *misxer* 'he commercialized'. Reference to the root of *misxar* would wrongly result in the extraction of *(s,x,r)*.

Some aspects of this study are in part a response to previous accounts of Semitic morphology where the following claims have been made:

a. Underlying representations include a prosodic template (CV-template or syllabic template) in addition to segmental formatives (McCarthy (1981), McCarthy and Prince (forthcoming)).
b. Association (and eventually interdigitation) of the segmental elements with the prosodic template is (i) phoneme driven (i.e., a segment is linked to a position in the prosodic template rather then a position in the prosodic template is linked to a segment), and (ii) directional and ordered (i.e., segments are linked to positions in the prosodic template from left to right in the order they are presented) (McCarthy (1981)).

c. Internal morphological structure is preserved at least through part of the derivation, such that subsequent rules can refer to morphemic distictions (McCarthy (1986)).

The analysis of MH word structure presented in this study dispenses with underlying prosodic templates. What supports the absence of underlying prosodic templates in MH is (i) the fact that they are morphologically unmotivated, and (ii) that their effect can be properly derived by syllabification rules, and thus they are phonologically redundant. Therefore I argue that the information provided for interdigitation is just the two segmental formatives, the vocalic pattern and the consonantal root.

In the absence of underlying prosodic templates, interdigitation cannot be maintained as a phoneme-driven and directional association of segmental elements with a prosodic template. As noted earlier, the alternative mode of association is governed by syllabification rules, which are independently required in the language[3].

Syllabification ensures the appropriate makeup of vowels and consonants within the stem, but this is not sufficient to derive the correct output. Syllabification rules first create syllables over the vowels, then syllabify (i.e. associate) all onsets, and at the end they syllabify the codas. The order in which the consonantal elements are syllabified does not necessarily follow the order in which they appear in the root. In the stem *dirben* 'he urged', whose root is *(d,r,b,n)*, *b*, which in the root follows *r*, is syllabified as an onset before *r* is syllabified as a coda. To ensure the correct output, *dirben*, and to exclude **dinreb* or **ridben*, I propose an obvious but as yet

[3] The abandon of association in favor of syllabification has been implied in McCarthy and Prince (forthcoming).

unstated constraint, the Order Preservation Constraint. This constraint ensures that a linear order defined in the underlying representation must be preserved throughout the morphological derivation.

In response to the previous studies I thus make the following claims:

a. Underlying specification of the prosodic templates required for nonconcatenative morphology is redundant in MH and therefore must be at most language specific.

b. Interdigitation (association) is a by-product of rule-governed syllabification, and therefore cannot be phoneme-driven or directional.[4] Output forms are subject to the Order Preservation Constraint, which ensures that the order defined in the underlying representation is maintained on the surface.

c. Internal morphological structure does not exist beyond word formation, and therefore subsequent rules may refer to phonological structure only.

From a language specific point of view this study is an attempt to account for some problems in MH phonology and morphology. The name MH refers here to the non-standard dialect of Hebrew spoken by Jewish natives of Israel in non-formal circumstances. In addition to morphologically related phenomena, which include interdigitation, reduplication, extraction, and the feminine suffixes, I discuss some phonological processes, in particular stress and stress related segmental alternations, and epenthesis.

[4] This coincides with the proposal made in McCarthy and Prince (forthcoming) to replace left to right association with syllabification.

1. LANGUAGE BACKGROUND

Two aspects of MH morphology are introduced in this section. Section 1.1. describes the morphology of words, where the term "word" refers to a stem plus affixes. I first establish the underlying representation of the vocalic patterns of verbal stems and then draw the distinction between the morphological structure of nouns and verbs. I argue that verbal stems must consist of two identifiable formatives, while this condition is not necessary for nominal stems. Nonetheless, as argued in section 1.2., even verbal forms must be fully specified in the lexicon, since there is no one-to-one correspondence between a component of structure and a component of meaning.

1.1. THE FORMATIVES

Words in MH may consist of a stem only (1a) or a stem plus an affix (1b):

(1) a. Verbs: *gadal* 'he grew' Nouns: *gódel* 'size'
sider 'he arranged' *séder* 'order'

b. Verbs: *ya+gdil* 'he will enlarge' (*ya-* '3 Future')
ne+sader 'we will arrange' (*ne-* '1pl. Future')

Nouns: *mi+gdal* 'tower' (*mi-* 'nominal prefix')
sadr+an 'attendant' (*-an* 'agent noun suffix')

A stem in MH, as in many other Semitic languages, may be further dissected into two noncontinuous formatives, a consonantal root and a vocalic pattern. For instance, in *gidel* 'he raised' the root is *(g,d,l)*, and the vocalic pattern is *(i,e)*. The same root but a different vocalic pattern appears in *higdil* 'he enlarged', where a

prefix is added. Interdigitation of two phonologically distinct sets of segmental elements, i.e., a vocalic pattern and a consonantal root, creates configurations which are identified with derivational categories.

Verbal derivational categories are traditionally termed *BINYANIM* (singular *BINYAN*) and nominal derivational categories are termed *MISHKALIM* (singular *MISHKAL*). The derivational categories have been named on the basis of their configurations, with the root *(p, ʔ, l)* as a prototype[5], including obligatory prefixes in the name (verbal patterns are designated in accordance with the 3m.sg. Past). Thus, the binyan of *gadal* is "paʔal", and that of *higdil* is "hifʔil"[6]. There are five binyanim in MH, while the number of mishkalim is much larger. Examples of configurations are given in (2), where *C*s[7] are used instead of the root *(p, ʔ, l)*.

(2)	a. Verbs:	CaCaC	Ci(C)CeC	hiCCiC
		rakad 'he danced'	*limed* 'he taught'	*higniv* 'he smuggled'
		gadal 'he grew'	*gidel* 'he raised'	*higdil* 'he enlarged'
		šalax 'he sent'	*dirben* 'he urged'	*hirbic* 'he hit'
	b. Nouns:	CaCaC	Ci(C)CuC	CaCCan
		šafan 'rabbit'	*rikud* 'dance'	*rakdan* 'dancer'
		davar 'thing'	*sipur* 'story'	*karyan* 'announcer'
		zakan 'beard'	*tirgul* 'drill'	*šakran* 'liar'

[5] This root is historically *(p, ʕ, l)*, but in MH *ʔ* and *ʕ* merged to *ʔ*.

[6] Phonological processes are also reflected in the name, as in "hifʔil", where *p* --> *f* via a rule of Spirantization.

[7] I use small cap *C* and *V* for segments, and big cap C and V in square brackets for a prosodic template; for example, *CVC* is a string of segments and [CVC] is a CV-template.

Each of the five binyanim consists of three aspect classes: Past, Future, and Participle[8]. Each aspect class has its idiosyncratic vocalic pattern, which is not derivable by independent phonological rules. Therefore, as argued below, the vocalic pattern of each class must be lexically specified. In addition, some of the binyanim have an obligatory prefix or prefixes. Throughout this work I refer to the binyanim by the numbers given below (B_n, where B stands for "binyan").

(3)

	Past	Future	Participle	
B1 pa?al	CaCaC	Ci+CCo/aC[9]	CoCeC	
	ganav	*yi+gnov*	*gonev*	'to steal'
	gadal	*yi+gdal*	*godel*	'to grow'
B2 nif?al	ni+CCaC	Ci+CaCeC	ni+CCaC	
	ni+gnav	*yi+ganev*	*ni+gnav*	'to be stolen'
	ni+lxam	*yi+laxem*	*ni+lxam*	'to fight'
B3 hif?il	hi+CCiC	Ca+CCiC	ma+CCiC	
	hi+gdil	*ya+gdil*	*ma+gdil*	'to enlarge'
	hi+rgiš	*ya+rgiš*	*ma+rgiš*	'to feel'
B4 pi?el	Ci(C)CeC	Ce+Ca(C)CeC	me+Ca(C)CeC	
	gidel	*ye+gadel*	*me+gadel*	'to raise'
	dirben	*ye+darben*	*me+darben*	'to urge'

[8] The terms Past, Future, and Participle are probably semantically inaccurate as aspect categories (not to say that I am not sure whether the term aspect is appropriate), but will suffice as indicator of the three morphological categories.

[9] In Tiberian Hebrew *o* roughly characterizes active verbs while *a* characterizes stative verbs (Blau 1976). MH does not make this semantic distinction, and therefore the vowels in B1 Future must be lexically specified for each root. Alternatively, roots which take *o* could be marked where *a* is taken as the basic vowel of the pattern (or vice versa).

B5 hitpa?el	hi+t+Ca(C)CeC	Ci+t+Ca(C)CeC	mi+t+Ca(C)CeC	
	hi+t+raxec	*yi+t+raxec*	*mi+t+raxec*	'to shower'
	hi+t+gander	*yi+t+gander*	*mi+t+gander*	'to conceit'

The prefixes deserve some discussion. The initial consonant position in the Future configuration occupies a gender-number-person marker; *yi+gdal* 'he will grow' *ni+gdal* 'we will grow' *ti+gdal* 'you m.sg. will grow, she will grow', etc. In some cases a suffix is added; *yi+gdel+u* 'they will grow', *ti+gdel+i* 'you f.sg. will grow'.[10]

Less straightforward is the underlying vowel of the prefixes mentioned above and the distribution of the binyan prefixes *h* (in B3 and B5) and *n* (in B2); these two phenomena are closely related. Bolozky (1978) assumes that the underlying vowel of the prefixes is *a*; it becomes *i* in a closed syllable (*ya+gnov* --> *yignov* (B1) 'he will steal') and *e* in an open syllable (*ya+gadel* --> *yegadel* (B4) 'he will raise'). The underlying *a* surfaces in monosyllabic stems (*yakum* 'he will stand up') and before the historical pharyngeals (*yaxšov* 'he will think' < **yaħšov*).

(4) Vowel Raising (in prefixes)

a --> i / __ CCV

--> e / __ CV

---

[10] There is no one-to-one correspondence between an affix and a morphological category like person, number, gender.

	Singular	Plural
1	*?e+gdal*	*ni+gdal*
2f.	*ti+gdel+i*	*ti+gdel+u*
2m.	*ti+gdal*	"
3f.	*ti+gdal*	*yi-gdel+u*
3m.	*yi+gdal*	"

Note that *ti-* is used for both 2pr. (sg. and pl.) and 3pr.f., while *ni-* marks not only person (1st) but also number (pl.). See Matthews (1972) and Anderson (1982) for similar phenomenon in Latin and Old English.

Following Bolozky's assumption, it is necessary to account for the appearance of *i*, rather than *e*, in an open syllable in B2 Future (*yiganev*), and the appearance of *a*, rather then *i*, in a closed syllable in B3 Future and Participle (*yagdil*, *magdil*).

Regarding B2, notice that the binyan prefix *n*, which appears in the Past and Participle forms, does not surface in the Future forms, exactly where *i*, rather than the expected *e*, appears. Bolozky suggests a minor rule that deletes the *n* in the environment V+__C. This rule has been proposed to account for the deletion of stem initial *n* in *yi+npol* --> *yipol* (B1) 'he will fall', but it is also appropriate for the deletion of the prefix *n* in *yi+n+ganev* --> *yiganev* (B2) 'it will be stolen'. Before *n* is deleted the prefix vowel *a* is in a closed syllable, and therefore it is raised to *i*. The derivation is as follows:

(5)	B2: /ya+n+ganev/	B1: /ya+npol/	
	yinganev	yinpol	Vowel Raising: *a* -->*i* / __CCV
	yiganev	yipol	*n*-Deletion: *n*-->ø / V+__C
	yiganev	*yipol*	
	'it will be stolen'	'he will fall'	

As noted by Bolozky, the number of the B1 forms with stem initial *n* which undergo *n*-Deletion is rather small; cf. *yinvax* 'he will bark', *yingos* 'he will bite', *yinšom* 'he will breathe', where the rule does not apply. Therefore, if we adopt the above analysis, *n*-Deletion must be restricted to the prefix of B2, where it applies without exceptions, and to some lexically specified forms.

In B3, the prefix *h* does not appear in the Future and Participle forms, and in these forms *a*, instead of *i*, appears in a closed syllable; *higdil* 'Past', *yagdil* 'Future', *magdil* 'Participle'. We may follow Blau's (1976) analysis of the same phenomenon in Biblical Hebrew, which proposes an *h*-Deletion rule of the form

h --> ø / V__V; *ya+ha+gdil* --> *yaagdil*. Vowel Raising applies after *h*-Deletion, and is therefore blocked, since its environment is not met.[11] In MH, the resulting form is *yagdil*, and therefore we must assume an additional rule which simplifies the vowel sequence. Notice that also Blau assumes an underlying *a* in the prefixes.

The prefix *ha-* also appears in B5 Past, but, as it is the case with B3, not in the Future and Participle forms; *hitgander* 'Past', *yitgander* 'Future', *mitgander* 'Participle'. As can be seen from the derivations below, it is impossible to account for the absence of *h* in B3 (*yagdil* 'he will enlarge') and B5 (*yitgander* 'he will conceit') in a unified way.

(6) a. *h*-Deletion before Vowel Raising

B3: /ya+ha+gdil/	B5: /ya+hat+gander/	
yaagdil	yaatgander	*h*-Deletion
---	---	Vowel Raising
yagdil	yatgander	Simplification
yagdil	**yatgander*	

b. Vowel Raising before *h*-Deletion

B3: /ya+ha+gdil/	B5: /ya+hat+gander/	
yahigdil	yahitgander	Vowel Raising[12]
yaigdil	yaitgander	*h*-Deletion
yagdil	yatgander	V --> ø / V__
yagdil	**yatgander*	
or		
yigdil	yitgander	V --> ø / __V
**yigdil*	*yitgander*	

[11] Either because the syllabification in the output is *ya.ag.dil*, or, assuming resyllabification (*ya:g.dil*), because the rule refers specifically to a short *a*.

[12] Note that it must be assumed that Vowel Raising is not iterative in order to block raising to *e* in the leftmost prefix; *ya+ha+gdil* --> **yehigdil*.

The above discussion reveals that (i) the absence of the *n* prefix in the Future of B2 must be accounted for by a specific rule, and (ii) there is no way to provide a unified account for the absence of the *h* prefix in the Future and Participle of B3 and B5. I thus suggest that the surface representation of the prefix vowels and the *h* and *n* prefixes is provided underlyingly, as described below.

Regarding the vowels of the prefixes, since in most cases *i* appears, I suggest that it is inserted by the following rule:

(7) *i*-Insertion (derived environment)
ø ---> i / #C__C

Since *i*-Insertion applies only when the initial cluster is derived by prefixation, it must be specified as a derived environment rule[13]. The prefix vowel of B3 Future and Participle, *a*, and of B4 Future and Participle, *e*, must be lexically specified along with the vocalic pattern[14].

As for the prefixes, it must be assumed that the Future and Participle prefixes are attached directly to the stem (*y+gamer* 'B2 Future') and not to a stem-plus-prefix (*y+n+gamer, ya+h+gdil*). In this way we do not have to provide deletion rules to account for the absence of *n* and *h*.

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[13] Derived environment rules apply only when the relevant environment is derived at the beginning of the cycle. This notion was first introduced in Kiparsky (1973; see also chapter 3 section 2.1.). It should be emphasized that interdigitation does not create a derived environment since, before interdigitation, neither the conosnantal root nor the vocalic pattern can be ever subject to phonological rules.

[14] This situation arises due to historical change. There are other ways to extract the exceptional cases. For example, we could say, following the history of these forms, that *i* is inserted in a closed syllable (Past of B2, B3, and B5, and Future of B1, and B5), *e* in an open syllable (Future of B4), and the exceptions are the Future of B2, where *i* appears in an open syllable instead of *e*, and Future and Praticiple of B3, where *a* appears in a closed syllable instead of *i*. For reasons of simplicity I prefer the above analysis, which requires two lexical markings (B3 and B4) and one rule (insertion of *i*), as opposed to this analysis which requires two lexical marking (B2 and B3) and two rules (insertion of *i* and insertion of *e*).

I thus assume the following underlying configurations (recall that a prefixed *C* stands for a gender-number-person marker).

(8)

	Past	Future	Participle
B1	CaCaC	C+CCo/aC	CoCeC
B2	n+CCaC	C+CaCeC	n+CCaC
B3	h+CCiC	Ca+CCiC	ma+CCiC
B4	Ci(C)CeC	Ce+Ca(C)CeC	me+Ca(C)CeC
B5	h+t+Ca(C)CeC	C+t+Ca(C)CeC	m+t+Ca(C)CeC

The only rule required to derive the surface forms is *i*-Insertion (7), which affects the prefixed forms of B1, B2, B3 Past, and B5.

Traditional accounts propose two additional binyanim, "huf?al" (*huCCaC*) as the passive counterpart of B3 (*hiCCiC*) and "pu?al" (*Cu(C)CaC*) as the passive counterpart of B4 (*Ci(C)CeC*). Following Horvath (1981) I do not consider these passive categories as independent binyanim since they can be derived by regular substitution of the pattern *(u,a)* for the vowels of B3 and B4.[15] The same cannot be said of the five binyanim in (8); while the existence of a B_n verb with a root R does not imply the existence of a B_m verb with the same root (where $n \neq m$), the above passive forms exist only if they have an active counterpart with the same root (with the exception of the Participle; see discussion on Participles in chapter 2 sections 1 and 3.2.2.).

[15] These passive forms are not used in case there is already a passive form represented by one of the basic binyanim; e.g. *kibel* (B4) 'he accepted' - *hitkabel* (B5) 'it was accepted', therefore **kubal* is not attested.

As will be suggested in chapter 2 section 1, the Passive vocalic pattern in MH behaves like that of the aspect/voice in Classical Arabic. In MH, voice is represented by an independent vocalic pattern while aspect must be specified for each binyan. It should also be noted that only a few roots appear in forms from each of the binyanim, but these gaps can potentially be filled by newly formed verbs (subject to semantic restrictions).[16]

Several properties of MH stems should be emphasized, by comparison with Classical Arabic, as analyzed in McCarthy (1981)). There is no length distinction in MH; all historically long vowels are short (**kaatav* > *katav* 'he wrote'), and all historical geminates are simple consonants (**dibber* > *diber* 'he talked')[17]. As noted above, there is no one vocalic pattern for each aspect (corresponding to the complex category of aspect/voice in Classical Arabic), with the exception of the Passive voice. Nor is there a single configuration for every binyan, as can be seen from B1 and B2 in (8). That is, a binyan (across the aspect category) cannot be identified on the basis of a single configuration, and an aspect (across the binyan category) cannot be identified on the basis of a single vocalic pattern. This point is relevant to the discussion in chapter 2 section 1, where I argue that derivational categories in MH do not have corresponding unitary prosodic templates.

The vocalic pattern in nouns is not as limited phonologically as in verbs, nor is it relevant morphologically. This is actually the main morphological difference between verbs and nouns. In verbs, the phonological shape of a Future form, i.e.

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[16] Dictionaries often list the entire derivational paradigm for a given root, but in practice only a few of the listed forms are actually used.

[17] On the surface, a long vowel may result from the deletion of a glottal stop (*ba ʔar* --> *baar* 'it flamed'), and heteromorphemic geminates may appear in careful speech (*taxán+nu* --> *taxánnu* 'we milled'; *taxánu* in casual speech).

the vocalic pattern and affixes, is determined on the basis of the corresponding Past, since a phonological shape identifies both the derivational category and aspect. Therefore, the word formation process responsible for aspect relation within a particular binyan must specify the vocalic pattern and the prefix. In the nominal system, on the other hand, only the suffixes are relevant to the morphology, while the vocalic pattern does not play a role. There is no morphological rule in the grammar that mentions the vocalic pattern of nouns; there are only rules that mention the suffixes (e.g. agreement).

This is probably the reason why every new verb entering the language must conform to one of the existing vocalic patterns, while new nouns may introduce new phonological shapes. Deviation from any inventory of nominal vocalic patterns does not affect the morphological system, since there are no rules in the grammar that refer to this pattern. But deviation from the vocalic pattern of verbs creates an anomaly, since there would be no way to express aspect relationships. Since the vocalic pattern of nouns is irrelevant, I suggest in section 1.2. below that in most nouns the vocalic pattern is not an identifiable formative.

Nominal stems are often accompanied by obligatory prefixes, where the most common are *m-* and *t-*; *mi+gdal* 'tower' (cf. *gódel* 'size'), *ma+xzor* 'cycle' (cf. *xazar* 'he returned') *ta+kdim* 'precedent' (cf. *kódem* 'earlier'). Stems may also be accompanied by suffixes, where the most common are *-a*, *-it*, *-et*, *-ut*, *-on*, and *-an*; *ti+zmór+et* 'orchestra' (cf. *zamar* 'singer'), *mi+štar+a* 'police' (cf. *šoter* 'policeman'), *yald+ut* 'childhood' (cf. *yéled* 'child'), *rakd+an* 'dancer' (cf. *rikud* 'dance').

1.2. FORMATIVE-MEANING CORRESPONDENCE

While reference to formatives is crucial to any discussion of the structural aspects of word formation, this does not imply that these formatives have any independent existence. I adopt and support the word-based view of Aronoff (1976), according to which the lexicon consists of a list of words rather then formatives. The structural aspects of words are identified on the basis of Word Formation Rules which express relationships between words. Thus, given a Word Formation Rule of the form X <---> XY, X and Y can be identified as formatives. This is the usual case, but it is also possible that Y is not a formative, as in *cranberry*, where *cran* is merely a residue (see discussion later on). In the following discussion I provide further evidence for this view.

It has been observed by Berman (1978) and Horvath (1981) that in MH there is no one-to-one correspondence between component of meaning and component of form. "Though it is possible to give a rough characterization of the 'meaning' associated with verb-classes [i.e. binyanim], the meaning of a verb of a particular class is normally not a mere composition of the 'meaning' of the root - if it is definable at all - and the 'meaning' of the verb-class. Idiomatic extensions and various other extremely idiosyncratic meaning modifications are typical of the Hebrew verb-class system" (Horvath 1981:233-4).

Within the morpheme-based view, advocated in Selkirk (1982a) and others, every formative (in MH, a root and a binyan/mishkal) has a corresponding syntactic or semantic component. This entails that, given a form which consists of a binyan B_n and a root R_x, if the binyan has the sense 'MB_n' (where M stands for meaning) and the root has the meaning 'MR_x', the meaning of the form should be

'M{B_n, R_x}'. As I will show below, MH nouns, as well as verbs, very often do not exhibit such a regularity. Since verbs and nouns behave differently with respect to some properties, I will treat them separately in the discussion to follow.

VERBS: It is commonly believed that Semitic binyanim have independent syntactic properties. For example, B2 is mostly passive (*nignav* 'it is/was stolen', *nišbar* 'it is/was broken'), B3 is usually inchoative (*hivrid* 'it became pink', *hišmin* 'he became fat') or causative (*hirdim* 'he put s.o. to sleep', *hinmix* 'he lowered'), and B5 is reflexive (*hitlabeš* 'he dressed himself', *hitraxec* 'he showered') or reciprocal (*hitkatev* 'he corresponded', *hitnašek* 'he kissed with s.o.'). B1 and B4 do not have an identifiable property, although many B4 forms are transitive. This view predicts that the combination of binyan with a root, where the latter provides the basic meaning, would result in a compositional form. Consequently, since a verb consists of binyan-plus-root, the root has been commonly believed to have an independent meaning.

A similar situation in Classical Arabic led McCarthy (1979) to argue that the consonantal root serves as a root node for a lexical entry tree, where the tree dominates related words sharing this root. McCarthy notes that not all words are derived directly from the root node; some words are derived from others. This approach combines both the morpheme-based view and a word-based view. As shown in Bat-El (1985), only words can serve as the base of other words, where the notion of root is an intermediate abstract state.

Berman (1978), who discusses this issue in some detail, points out that the properties of the binyanim cannot be identified in every verb. For example, the active verb *nixnas* 'he entered' appears in B2, which is usually passive. Similarly,

hitnakem 'he took a revenge' is neither reciprocal nor reflexive, although it appears in B5, and *hirgiš* 'he felt' is neither inchoative nor causative, although it appears in B3. Berman proposes a much more permissive list of what she regards as the salient syntactic properties of the binyanim (p.93). The insight underlying this idea is that the properties are relational rather then absolute. For instance, the properties of B3 are 'causative of B1' (*katav* (B1) 'he wrote' - *hixtiv* (B3) 'he dictated'), and 'transitive of B2' (*nixnas* (B2) 'he entered' - *hixnis* (B3) 'he put in'). This account is also not free from exceptions, however, as noted by Berman. For example, as pointed out in Horvath (1981), the verb *higniv* (B3) 'he smuggled' is neither causative of *ganav* (B1) 'he stole' nor transitive of *nignav* (B2) 'it was stolen'.

Berman's proposal is promising, however. The idea is that a property assigned to a verb is not unique to the binyan of this verb, but rather to the Word Formation Rule which expresses the relationship of this particular verb to some other verb. In order for B3 to assign the property 'causative of B1' to *higdil* 'he enlarged', there must be a related B1 verb with the same root. That is, it is not that B3, the binyan of *higdil*, has an independent property 'causative', but rather it is assigned the property 'causative' in case there is a B1 verb with the same root, i.e. *gadal*. The relation between the two verbs is expressed by a Word Formation Rule, and therefore the property is assigned by this Word Formation Rule as well. It is thus predicted that "orphan" verbs, i.e., verbs which are not related to any other verb, or "basic" verbs, i.e., verbs which are not derived from another verb, need not have the particular property usually identified with a Word Formation Rule. This is indeed the case in the orphan verb *hifgin* (B3) 'he demonstrated', which is neither causative nor inchoative, and in basic verb *nixnas* (B2) 'he entered', which is not passive.

This situation has probably misled students of Semitic languages to believe that each binyan has some absolute property. Due to the preponderance of regular relationships between B_n verbs and B_m verbs, the properties have been identified as belonging to the binyan only. My claim is that the properties are an undetachable part of Word Formation Rules, and are thus *PROPERTIES OF RELATIONS* and not of formatives.

Not only can the syntactic property of a binyan not be detached from the verb and its base, but also the meaning of the consonantal root is contingent on the meaning of the forms in which it appears. The root cannot be treated as an independent unit that carries some basic meaning, since in order to identify the meaning of the root one must refer to the set of words which contain this root, and this set is not always homogeneous. The root *(ʔ,m,d)*, for instance, which appears in *ʔamad* (B1) 'he stood', *ne ʔemad* (B2) 'he stood up', and *he ʔemid* (B3) 'he set up', might have the meaning 'an upright position', but this is not sufficient in order to understand the meaning of *ʔimed* (B4) 'he paginated', related to the noun *ʔamud* 'page, post'. The same is true for the root *(z,r,k)* in *zarak* (B1) 'he threw' and *hizrik* (B3) 'he injected', and the root *(ʔ,b,d)* in *ʔibed* (B4) 'he lost' and *hit ʔabed* (B5) 'he committed suicide'. The meaning of the root is even less coherent when nouns are considered, as can be seen from the forms *macpen* 'compass', *macpun* 'conscience', and *hicpin* 'he hid, he went north' (*cafon* 'north'), which share the root *(c,p,n)*. These examples show that the root does not always have a consistent and plain meaning, and therefore every stem must be considered individually, and this can be achieved only under the word-based view.

I believe that the heterogeneous meaning of words containing the same root arises due to the local mode of derivation and semantic change. As argued in Bat-El

(1985, 1986), words in MH are derived from words, and words, as is commonly known, often undergo semantic change. Thus, if X is closely related Y and Y is closely related to Z, the meaning relation between X and Z is indirect, as X may include some properties of Y which are not included in Z. The way speakers identify a relation between X and Z is through a path (X<-->Y<-->Z) in the lexicon, as in *ʔamad* <--> *ʔamud* <--> *ʔimed*. If Y undergoes semantic change, the relation between X and Z may become obscure. It is possible that due to a drastic semantic change of Y, or more dramatically, the loss of Y from the lexical inventory, the relation between X and Z can become completely opaque and originally identical roots may become merely homophonous.

This situation supports the claim that not every formative has a corresponding semantic component as an independent unit. It is possible to list all potential semantic properties for a given formative, but it is still impossible to predictable which property will be chosen for a given word. This state of affairs is by no means peculiar to MH derivational relationships. As shown in Anderson (1988b), Icelandic *-st* Verbs constitute a unified class formally, but syntactically they must be subgrouped, since they can reflect reciprocal relation (*bita* 'bite' - *bitast* 'bite each other'), passive relation (*heyra* 'hear' - *heyrast* 'be audible'), transitive relation (*dylja* 'hide trns.' - *dyljast* 'hide intrans.'), and others (*stand* 'stand' - *standast* 'resist'). In addition, the base forms of *-st* Verbs do not constitute a unified class, as they include nouns, adjectives, and verbs.

NOUNS: The view that derivational categories (i.e. binyanim and mishkalim) do not have independent properties is probably less controversial in the case of nouns. Ravid (1978), who does not agree with this view, provides a list of

mishkalim and their purported semantic properties. For example, the mishkal *miCCaC* characterizes place nouns (*migraš* 'lot', *miklat* 'shelter', *mirbac* 'resting place'), or collective nouns (*mimsad* 'establishment', *mimšal* 'administration', *mišpat* 'trial'). Similarly, the mishkal *CCuC(a)* characterizes collective nouns (*gdud* 'troop', *sxum* 'sum', *kvuca* 'group'). If we take these chracterizations seriously, the exceptions are too many to list (*miCCaC* - place/collective nouns: *mixtav* 'letter', *mivta?* 'pronunciation', *minhag* 'custom'; *CCuC(a)* - collective nouns: *gruš* 'cent', *zvuv* 'fly', *tluš* 'coupon', *dmut* 'image'); but this is a minor point. I claim that most of the traditional mishkalim not only lack a particular semantic property but also do not constitute formatives.

The basic assumption of this argument is that forms are not necessarily exhaustively comprised of morphological components; it is possible that a form consists of a morphologically motivated component and some unanalyzable residue. In this view, the English noun *cranberry* consists of a formative *berry* and a residue *cran*, where the latter is not a morphological unit. What made *cran* a "morpheme" in most studies is just the traditional view that every form consists exhaustively of such units, but this is not a necessary assumption.

Similarly, the fact that the root *(t,l,š)* can be identified in the noun *tluš* 'coupon' (as it appears in *talaš* 'he tore off') does not make the residue *CCuC* a component of any sort (morphological or semantic). Nouns of the shape *CCuC* do not share any significant morphological property and obviously no semantic one either. This, as mentioned in section 1.1. above, makes the distinction between nouns and verbs, since the phonological shape of verbs is crucial to reflecting aspect relationships. Notice that it is not the case that the semantic property of the mishkal is obscure, but rather that the mishkal itself does not exist in the first place. The

semantic properties of the noun *tluš* are unique to this noun, and not assigned by any Word Fromation Rule. The relationship between forms is based entirely on the common root and some shared semantic property, while the phonological shape itself does not play a role.

What supports this claim is that most, though not all, of the traditional mishkalim are hardly ever used for forming new nouns. Borrowed nouns, unlike verbs, tend not to adopt the shape of an existing noun, but rather to maintain (more or less)[18] the original form; *télefon* 'phone', *filosof* 'philosopher', *student* 'student', *general* 'general (officer)', *óto* 'auto', *kílo* 'kilo'. As noted above, verbs, unlike nouns, must, without exception, adopt one of the given binyanim. I thus claim that most of the traditional mishkalim do not have any function because (i) they are not used for borrowed words, and (ii) they are not morphologically or semantically relevant in the grammar of the language.

There are, however, several mishkalim that deviate from this generalization, as they provide their configuration for newly derived nouns. The most productive mishkalim are those of the verbal nouns. Every binyan has a corresponding verbal noun configuration (the verbal noun of B2 is relatively rare in MH):[19]

(9)

	Verbal Noun		Verb
B1:	CCiC+a	*šmira* 'guarding'	*šamar* 'he guarded'
B2:	h+CaCeC+ut	*hikansut* 'entering'	*nixnas* 'he entered'
B3:	ha+CCaC+a	*hatxala* 'beginning'	*hitxil* 'he started'

[18] Occasionally native suffixes are attached, as in *karpiyon* 'carp (fish)', *teatron* 'theater', *xímiya* 'chemistry', *totalitáriyut* 'totalitarianism', *diyéta* 'diet'.

[19] The stem final *e* in B2 and B5 is deleted via *e*-Deletion (see chapter 4 section 2). As in the verb system, *i* is inserted via *i*-Insertion (see section 1.1. above). Since *i*-Insertion is a derived environment rule, it does not affect *šmira* 'guarding', the verbal noun of B1.

B4:	Ci(C)CuC	*kicur* 'shortening'	*kicer* 'he shortened'
B5:	h+t+Ca(C)CeC+ut	*hitkansut* 'gathering'	*hitkanes* 'he gathered'

The relationship between a verbal noun and its corresponding verb is not consistent. Verbs of the form B_n may have a verbal noun of the form NB_m (where NB_m stands for a verbal noun of binyan m), and verbal nouns of the form of NB_n may lack a related verb. For instance, the noun *knisa* (NB1) 'entering, entrance'[20] is not related to a verb **kanas* (B1), but rather to *nixnas* (B2) 'he entered'. Similarly, the noun *kidúax* (NB4) 'drilling' is not related to a verb **kidéax* (B4) but rather to *kadax* (B1) 'he drilled'. There are nouns like *gvina* 'cheese' and *pnina* 'pearl' which are obviously not verbal nouns, but still have the same vocalic pattern as NB1. As I claimed earlier, most nouns consist of one indivisible stem, and this is also true for these nouns; the similarity in the patterns is accidental.

In addition to the verbal nouns, there are few other productive nominal shapes, which are also used for nouns derived from acronyms:[21]

(10) Ca(C)CaC: *tabax* 'cook'

ravak 'bachelor'

balam 'brake gear, buffer'

mapam 'United Labor Party' (*mifléget po ʔalim me ʔuxédet* 'party workers unified')

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[20] See Berman (1978) for the syntactic and semantic difference between the behavior of a verbal noun as a regular noun (concrete) and as a verbal noun (always abstract). As this work is concerned mainly with phonological and morphological structure, this distinction is not relevant.

[21] Deviation from these patterns in acronyms is usually due to spelling. For example, in the acronym *sakum* 'cutlery' (sakin kaf ve-mazleg 'knife, spoon, and-fork'), the *u* stands for the *v*; *v~u* alternations occur sporadically in MH (see chapter 3 section 3.2.1.). It should also be noted that the term acronym is used although it is not always the case that only the first segment of each word appears in the derived form. Yet, it should be distinguished from blendings, where the vocalic pattern remains intact (and some consonants may be deleted); *maxaze+zémer* --> *maxazémer* 'musical (play+song)', *kadur+régel* --> *kadurégel* 'football (ball+foot)', *ram+kol* --> *rámkol* 'loud-speaker (high + voice)'.

bagac 'high court of justice' (*béit-din gavóah le-cédek* 'house-law high for-justice')

mankal 'general manager' (*menahel klali* 'manager general')

CV́CeC: *gólem* 'larva'

kécer 'short circuit'

rések 'mash'

ʔéšel 'board and lodging' (*ʔaxila, štiya, lina* 'eating, drinking, sleeping')

šékem 'canteen service' (*šerut kantínot ve-miznonim* 'service canteens and-kiosks')

The suffixed patterns *Ca(C)CeCan* and *CaCV́Cet* are also quite common. The stem final *e* in *Ca(C)CeCan* is deleted when not preceded by a consonant cluster (see *e*-Deletion in chapter 4 section 2). In *CaCV́Cet*, stress is penultimate since the last syllable is not a stress-bearing element (see chapter 3 section 3.2.2.), and the stem final vowel harmonizes with the vowel of the suffix (see chapter 4 section 2).

(11) Ca(C)CeCan: *rakdan* 'dancer'

kaškešan 'prattler'

šakran 'liar'

yaxcan 'public relations officer' (*yaxasei cibur* 'relations public')

CaCV́Cet: *nayéret* 'paperwork'

kaséfet 'safe'

kalétet 'tape'

On the basis of productivity we may establish some mishkalim as functions of Word Formation Rules, as they provide the structure for forming new nouns. I

conclude, however, that most of the traditional mishkalim do not have any function, and therefore most nouns should not be considered as composed of two identifiable units, a root and a mishkal. The fact that the consonants of a noun appear in other related forms does not entail that the noun is composed of two components, just as the fact that the consonants of the English words *sing* and *feed* also appear in *song* and *food* respectively does not entail that each of these forms is composed of two components. Therefore, the fact that *gruš* 'cent', *zvuv* 'fly', *tluš* 'coupon', and *dmut* 'image' have the same pattern is as insignificant as the similar situation in English *parallax* and *cataract.*

2. OUTLINE AND PHONOLOGICAL NOTES

The rest of the thesis is organized in the following way. In chpater 2 I introduce a phonologically-based analysis of interdigitation. I claim that underlying specification of prosodic templates is morphologically unmotivated and phonologically redundant in MH. I provide a set of syllabification rules which not only build the syllabic structure, but also, and more importantly, interdigitate. My main concern in chapter 3 is word internal morphological structre. I argue that such a structure is not required at any stage beyond word formation. As evidence, I show that when reference to word internal structure seems to be required phonological information is used. In chapter 4 I deal with some phonological processes in MH. I provide an analysis of stress assignment and account for several instances of vocalic alternation, some of which are sensitive to a syllable which is not a stress-bearing element. I also propose two distinct epenthesis rules which manifest the relevance of the Obligatory Contour Principle in the language.

Before proceeding I provide some phonological information to facilitate the reading of the cited forms. Below is the phonemic system of MH consonants:

(12)

	bilabial	labio-dental	dental-alveolar	palato-alveolar	palatal	velar	uvular	glottal
Stops	p b		t d			k g		ʔ
Fricatives		f v	s z	š			x	h
Affricates			c					
Nasals	m		n					
Liquids			l				r	
Glides					y			

In addition, there are sounds that appear as phonemes only in borrowed words: the palato-alveolar affricates *č* and *ǰ* (*kveč* 'quibble', *ǰob* 'job), and the voiced palato-alveolar fricative *ž* (*garaž* 'garage').

There are five phonemic vowels in MH, *i*, *u*, *e*, *o*, and *a*. Phonetically, only *o* is tense, but this is not phonologically significant.

It should be noted that the forms cited in this work do not reflect late phonetic rules. The laryngeal sounds *ʔ* and *h* , where the latter optionally alternates with the former (the preservation of *h* is more standard), are transcribed when relevant, although they never surface when in the coda, and only optionally when in the onset of a non-initial syllable; *kanah* --> *kana* 'he bought', *kara ʔ* --> *kara* 'he read', *miher* ~ *miʔer* ~ *mier* 'he hurried'. In word initial position *ʔ* or *h* is obligatory only in isolation; *halax* ~ *ʔalax* 'he went', *hi alxa* ~ *hi ʔalxa* 'she went'. Also (optional) voicing assimilation is not transcribed, unless relevant to the discussion; *zkenim* --> *skenim* 'old m.pl.' (see chapter 4 sections 3).

The alternations *p* ~ *f*, *b* ~ *v*, and *k* ~ *x* (not every *x* and *k*), as in *šaxax* - *yišxax* 'to forget Past-Future', are transcribed. This alternations are due to

spirantization of post-vocalic non-geminated non-emphatic stops. Due to various mergers the rule became opaque in MH. For instance, MH simplified all geminates, therefore we find both stops and fricatives in postvocalic positions; *siper* 'he told' (< **sipper*), *safar* 'he counted' (< **saafar*). Another merger which caused opacity is that of the emphatic uvular stop *q* with the velar stop *k*, which also created *k* in a post-vocalic position; *xakar* 'he investigated' (< **ħaaqar*). In this last form we also find *x* in an initial position, due to the merger of the laryngeal fricative *ħ* with the velar fricative *x*. The status of spirantization in MH is not altogether clear, and I do not discuss this issue in the present work.

The insertion of *a* before word final *x* (not all *x*'s) is transcribed; *tapux* --> *tapúax* 'apple'. Stress is final unless otherwise specified (final stress is usual, and will be specified only in the discussion of stress).

CHAPTER 2

INTERDIGITATION

This chapter is the core of the thesis. It provides a formal analysis of interdigitation by means of rule-governed syllabification. Section 1 is concerned with prosodic temlates, as introduced in McCarthy's (1979, 1981) theory of Nonconcatenative Morphology and subsequent studies. I argue that in MH, underlying specification of prosodic templates is morphologically unmotivated. In section 2, where I show that underlying specification of prosodic templates in MH is also phonologically redundant, I provide an non-templatic analysis of MH stem structure. My claim is that in MH, interdigitation is a by-product of syllabification. Some apparent problems are discussed and reconciled in section 3. Section 4 is concerned with reduplication. I argue that reduplication in MH is similar to stem formation, as there is no reason to believe that a process of affixation is involved. Apart from root copying, which distinguishes between reduplicated and unreduplicated stems, reduplicated stems are subject to the same rules and constraints imposed on unreduplicated stems.

1. PROSODIC TEMPLATES

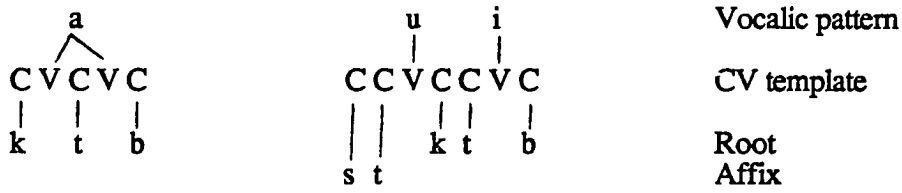
The theory of Nonconcatenative Morphology, first introduced in McCarthy (1979, 1981), has been developed in large part to account for the unusual morphology of Semitic languages. The familiar concatenating structure, as in English *næšən+əl+ɨzm̩*, has been found inadequate for Semitic languages. As

described in chapter 1 above, stems in many Semitic languages consist of two identifiable noncontinuous formatives which are interdigitated, thus creating a nonconcatenative structure. For example, in the Classical Arabic forms *katab* 'to write', *kattab* 'to cause to write', and *kaatab* 'to correspond', the vocalic pattern and the consonantal root are distinct formatives; the vocalic pattern indicates voice/aspect and the consonantal root provides the basic meaning. What distinguishes the three forms is the way the segments are organized, *CVCVC*, *CVCCVC*, and *CVVCVC* respectively.

This distinction, which signifies the difference in derivational categories (binyanim), is structurally encoded by underlyingly specified *PROSODIC TEMPLATES*. I will argue in this chapter that not every language which exhibits nonconcatenative structure requires underlying prosodic templates, as in MH, underlying prosodic templates are morphologically unmotivated and phonologically redundant.

To account for nonconcatenative structure, McCarthy proposes replacing the familiar brackets, as in *[[[næšən]əl]ɨzmɨ]*, by separating a morphologically complex form into several morphologically motivated tiers. The distinction between material belonging to one formative and that to another is structurally encoded by a multitiered representation, in which each formative appears on a separate tier. The vocalic pattern (indicating voice/aspect in Classical Arabic), the consonantal root (bearing a basic meaning), and the affixes appear on distinct segmental tiers. These segmental tiers are linked to the prosodic template (which, as noted above, corresponds to a particular derivational category), represented by the CV-skeleton. The CV-template provides the sequential order of vowels and consonants.

(1) *katab* B1 Perf. Pass. *stuktib* B10 Perf. Pass.



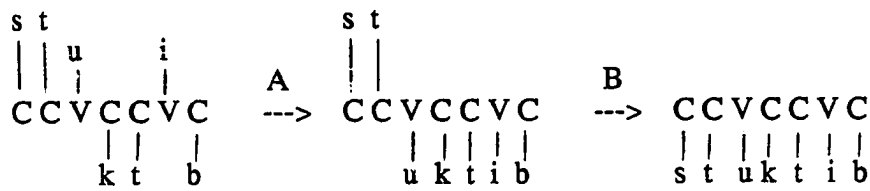
This approach to morphology has been adapted from the Autosegmental phonological theory developed in Goldsmith (1976), where features appear on distinct tiers, so as to allow long distance processes like vowel harmony and nasal spreading, and many-to-one associations among components of phonological representations, such as appear to be necessary in describing contour tones. The basic principles of this theory are that (i) the autosegmental elements are linked to their bearing units in a one-to-one fashion from left to right, and (ii) association lines do not cross.

The multitiered representation in (1) is derived by similar principles. The melodic elements are linked to the CV-skeleton one-to-one from left to right, such that the association lines do not cross. Although association is one-to-one, it is possible to derive a many-to-one association when the number of the positions on the CV-skeleton is larger than the number of the segmental elements; in this instance the last segmental element spreads to the empty slot, as it is the case with the *a* in *katab*.

The multitiered representation must, however, be eliminated at a later stage, where phonological rules refer to a single segmental tier which includes both vowels and consonants. It is thus suggested in McCarthy (1986) that a process of Tier Conflation (identified with the notion of Bracket Erasure from Lexical Phonology) linearizes the multitiered representation into a single melodic tier. As shown in (2),

Tier Conflation applies twice; first the vocalic and the consonantal tier are linearized to form a stem (A), then the affix and the stem are linearized to form a word (B).

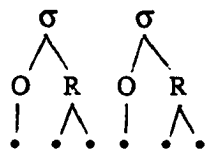
(2)



Interdigitated structure, according to McCarthy (1981, 1986), is derived by (i) association of segmental elements with prosodic units, and (ii) Tier Conflation. Contrary to McCarthy's view, I will argue in this chapter that in the absence of underlying prosodic templates, interdigitation in MH is a by-product of rule-governed syllabification.

I turn now to the issue of prosodic templates (multitiered representation will be discussed in chapter 3). As noted above, McCarthy argues that every derivational category must be specified for its prosodic template. He proposes a CV-template, which is a sequence of slots with specified syllabicity, V-slots for [+syllabic] and C-slots for [-syllabic]. Lowenstamm and Kaye (1985) in their analysis of compensatory lengthening in Tiberian Hebrew then argued that information about syllabicity should not be specified as properties of slots but rather by syllabic structure. Within this view all slots are of a uniform type, while syllabicity is encoded by the syllabic structure. The distinction between these views, the CV-theory and the X/dot-theory, is marginal to the present purposes, but let me present the geometry of the different structures.

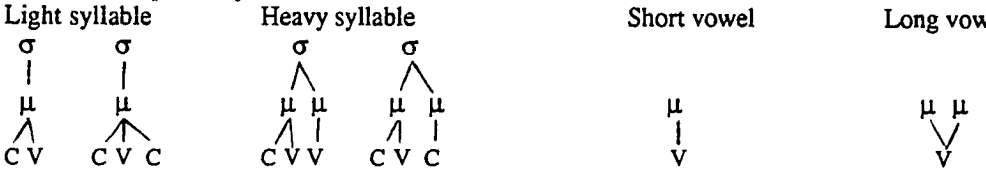
(3) CV-theory X/dot-theory



[CVCCVC]

The impact of syllabic structure in underlying representation introduced by the X/dot-theory has led McCarthy and Prince (forthcoming) to propose a more economical representation in which only the syllable structure is available. Within this theory, Templatic Morphology, a CV-template, such as [CVCVC], is replaced by the syllabic template [σ_{μ} $\sigma_{\mu\mu}$], where σ_{μ} stands for a monomoraic syllable and $\sigma_{\mu\mu}$ stands for bimoraic syllable[1]. Such a template does not specify the number of consonants to be linked to the syllable, and therefore, as noted by McCarthy and Prince, it accounts neatly for the varying number of consonants which may be linked to B4 in MH; *šiker* (three consonants) 'he lied', *dirben* (four consonants) 'he urged', and *tilgref* (five consonants) 'he telegraphed'. These three forms are represented by the same template [$\sigma\sigma_{\mu\mu}$], where the number of morae in the first syllable is not specified, and thus can be either one or two (but see next page). Since the template does not specify segmental positions, it allows for any number of consonants that are permitted in the language, as long as their distribution is compatible with the syllabic template. Thus, the information encoded by the syllabic

[1] Within the framework of the moraic theory a syllable consists of weight units, or morae. Light and heavy syllables are distinguished by having one and two morae respectively. Similarly, short and long vowels are distinguished as composed of a single segmental unit linked to one and to two morae respectively.



The distinction between mono- and bimoraic *CVC* syllable is language specific. For comprehensive discussion see Hyman (1985), McCarthy and Prince (forthcoming), and Hayes (1989).

template includes the syllable weight, and the distribution of light and heavy syllables within the stem (where the CV-template is derived from the syllable structure).

Several properties of MH morphology and phonology, when compared with those of Classical Arabic (as analyzed in McCarthy (1981)) suggest that there is no motivation for underlying prosodic templates in MH.

WEIGHT DISTINCTION: In Classical Arabic the verbal derivational categories are restricted to two possible templates, $[\sigma_{\mu}\ \sigma_{\mu\mu}]$ and $[\sigma_{\mu\mu}\ \sigma_{\mu\mu}]$, where each template can be preceded by an additional extraprosodic consonant. The last syllable is always *CVC*, while the first syllable is *(C)CVV* or *(C)CVC* when bimoraic, and *(C)CV* when monomoraic. The weight distinction is not stipulated only for the purpose of representation, as it is also relevant for stress assignment.

In MH there is no evidence for weight contrasts since there are no long vowels in the language, nor phonological rules which distinguish between light and heavy syllables[2]. In the absence of a weight distinction, both open and closed syllables in MH are monomoraic, and therefore a templatic representation of the sort employed by McCarthy and Prince cannot distinguish between *CVCVC* and *CVCCVC* stems, as both are represented by the template $[\sigma\sigma\ ]$ or $[\mu\ \mu]$ (since $\sigma = \mu$ in MH).

DERIVATIONAL CATEGORIES - PROSODIC TEMPLATES: In Classical Arabic the prosodic template of a derivational category is constant throughout the voice/aspect paradigm, within which only the vocalic pattern varies. For example, the template of B3 is $[\sigma_{\mu\mu}\ \sigma_{\mu\mu}]$, as illustrated by the following forms (prefixes are parenthesized):

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[2] What is relevant for the phonology is the distinction between open and closed syllables. This distinction seems to be necessary for a rule of *e*-Deletion (chapter 4 section 2).

(4)		Perfective	Imperfective	Participle
	Active	*kaatab*	*(u)kaatib*	*(mu)kaatib*
	Passive	*kuutib*	*(u)kaatab*	*(mu)kaatab*

Therefore, as suggested in McCarthy (1981), the prosodic template in Classical Arabic is characteristic of the derivational category. This is not the only information required to identify a derivational category, however, since there are fifteen derivational categories but only four possible syllabic templates. Some of the derivational categories are distinct on the basis of the content of the second mora of the first syllable, *CVC* vs. *CVV*; cf. *kattab* (B2) vs. *kaatab* (B3). Others are distinguished on the basis of affixes; cf. *ʔaktab* (B4) vs. *staktab* (B10).

In two out of the five verbal derivational categories in MH the prosodic template in not constant throughout the paradigm.[3]

(5)		Past	Future	Participle
	B1:	*gamar* [CVCVC[	*(yi)gmor* [CCVC]	*gomer* [CVCVC]
	B2:	*(ni)gmar* [CCVC]	*(yi)gamer* [CVCVC]	*(ni)gmar* [CCVC]

In both cases the inconsistency is found in the Future forms, though there is no obvious way to account for the syllabic alternation (if indeed it is a systematic fact, rather than a mere accident). If the B1 template is underlyingly [CVCVC] and that of B2 is [CCVC], the two processes required to derive the surface form are opposed

[3] In Classical Arabic there is one exceptional binyan, B1, in which the prosodic template varies; [CVCVC] Perfective Active but [CVVCVC] Participle Active. This, however, is not that significant in the presence of the fourteen other binyanim that follow the generalization (out of which four are not productive). In MH there are two exceptional binyanim, but here it is two out of five, and therefore there is very little generalization left to be made.

to each other. The output of one rule is just the structure that is amended by the other rule.

(6) B1: [CV+CVCVC] ---> [CV+CCVC]

B2: [CV+CCVC] ---> [CV+CVCVC]

It is thus necessary to conclude that a prosodic template cannot signify a derivational category in MH.

VOICE/ASPECT - VOCALIC PATTERN: In Classical Arabic, the vocalic pattern, which indicates voice/aspect, remains (relatively) constant throughout the paradigm, where a given voice/aspect is represented by the same vocalic pattern in all derivational categories.

(7)

	B2	B5	B7	B12
Active Participle *(u,a,i)*	*mukattib*	*mutakattib*	*munkatib*	*muktawtib*

This distribution, as clearly demonstrated in McCarthy (1981), motivates the separation of the the vocalic pattern from the prosodic template.

Here again, as can be seen from the table below, there is no such motivation in MH, since there is no one particular vocalic pattern for each aspect category.

(8)

	Past	Future	Participle
B1	CaCaC	C+CCo/aC	CoCeC
B2	n+CCaC	C+CaCeC	n+CCaC
B3	h+CCiC	Ca+CCiC	ma+CCiC
B4	Ci(C)CeC	Ce+Ca(C)CeC	me+Ca(C)CeC
B5	h+t+Ca(C)CeC	C+t+Ca(C)CeC	m+t+Ca(C)CeC

Therefore in MH the vocalic pattern does not indicate aspect (see below for voice).

The above chain of reasoning leads me to treat the vocalic pattern as representing simultaneously the derivational category and the aspect. Each binyan has to be lexically specified for the vocalic pattern of its three aspect classes, Past, Future, Participle. This is because the prosodic template does not distinguish among the derivational categories and because the vocalic pattern does not unify aspect. I therefore conclude that in MH a derivational category and an aspect category are simultaneously represented by one unit, the vocalic pattern, while the prosodic template is superfluous. The vocalic pattern is the only phonological information which contrasts between B1 *gadal* 'he grew' and B4 *gidel* 'he raised'.

This is an independent argument for the redundancy of the syllabic template in MH. It coincides with the analysis given in section 2 below, where it is argued that also from a phonological point of view the syllabic template is superfluous in the underlying representation, as the sequential order of vowels and consonants can be properly derived by syllabification rules.

One category of MH morphology which behaves in a way similar to the pattern in Classical Arabic is the passive construction. B3 and B4 have passive forms which are identified by the vocalic pattern *(u,a)*:

(9)

		Past	Future	Participle
B3:	Active:	*higdil*	*yagdil*	*magdil*
	Passive:	*hugdal*	*yugdal*	*mugdal*
B4:	Active:	*gidel*	*yegadel*	*megadel*
	Passive:	*gudal*	*yegudal*	*megudal*

I argued in chapter 1 section 1.1. above that these passive forms should not be treated as independent binyanim, since the existence of a passive form of a given root implies the existence of an active form of the same root. This is not true for the relationship among distinct binyanim, where the existence of B_n with a certain root does not imply the existence of B_m with the same root (although phonologically such a form is a potential verb); *katav* (B1) 'he wrote' but **kitev* (B4).

The *(u,a)* passive pattern behaves like that of the Classical Arabic voice/aspect formatives. It usually appears only in B3 and B4, but it can be found rarely in B5 as well. For instance, the B5 form *hitpater* 'he resigned' is active, and it has (in non-standard usage) a passive form *hitputar* 'he resigned involuntarily'.[4]

What emerges from this is that while in Classical Arabic the vocalic pattern and syllabic template (plus affixes) correspond to voice/aspect and derivational category respectively, in MH this separation has been obscured. The syllabic template is redundant, the vocalic pattern (plus affixes) corresponds both to derivational category and to aspect, while one vocalic pattern, *(u,a)* corresponds to voice. Note that although B2 is typically (though not uniformly) Passive, as in *nigmar* 'it was finished' (cf. *nixnas* 'he entered'), is certainly an independent binyan.

The difference between Classical Arabic and MH drawn above shows that the degree of prosodic specification required in the underlying representation is language-specific. Not all languages that exhibit a nonconcatenative morphological structure require underlying prosodic templates. A similar claim regarding language specific idiosyncrasies in prosodic representation has been made in Guerssel (1986).

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[4] *hitputar* (B5) 'he resigned involuntarily' is semantically different from the passive form *putar* (B4) 'he was fired'. The former includes both passive and reflexive, and thus there are two agents, one of which is also the participant (V: NP_1 & NP_2 ___ NP_1). A similar example is *hitnadev* 'he volunteered' - *hitnudav* 'he volunteered involuntarily' (cf. *nudav* (B4) 'he was volunteered').

Guerssel shows that the syllabicity of some glides and high vowels in Berber is distinctive, since some glides alternate with high vowels while others do not. He thus proposes that vowels are underlyingly linked to a rhyme while glides are free (assuming, on the basis of the alternation, that high vowels and glides have the same feature matrix). In the same spirit, Hayes (1989) argues that languages which distinguish between long and short vowels must specify long vowels by two morae, since, as argued in Steriade (1982) and Hayes (1986), true long segments are represented by one element on the segmental tier linked to two timing/weight units on the prosodic tier. Here again, languages which do not make this distinction do not require this specification. A different kind of evidence for the requirement of underlying prosodic structure is given in Bat-El (1988b), where it is argued that in the Kwawu dialect of Akan a vowel must be underlyingly linked to a mora. In Kwawu the feature [+nasal] is lexically specified on the mora, and therefore it is necessary to have the mora in the underlying representation to host this feature. The same must be true for languages with lexical stress or prelinked tone, which must be specified underlyingly, as it is necessary to have the prosodic unit to host these features. In MH, for instance, borrowed nouns bear lexical stress. We must then assume that the syllable structure of these nouns is given underlyingly, and this is indeed supported by the fact that the syllabic structure of many borrowed nouns is different from that of native nouns.

The conclusion that follows from the arguments above is that prosodic structure is available universally, but languages differ in the level at which this structure is manipulated and in the inventory of structure required in the underlying representation. Thus, although MH does not require reference to an underlying prosodic unit, the assumption that Classical Arabic requires it could still be

maintained. Even for the latter language, however, it is not a necessary assumption; a possible (though not particularly attractive) account of Classical Arabic verb structure which dispenses with underlying prosodic template is given in the appendix at the end to this chapter.

2. INTERDIGITATION AS A BY-PRODUCT OF SYLLABIFICATION

Across the languages of the world, a variety of mechanisms are involved in the derivation of words from other words. Some of these appear to be purely phonological in nature, since only a segmental or prosodic alternation is involved in the derivation. Such instances are ablaut, as in English *sing - sang*, umlaut, as in German *Mantel - Mäntel* 'coat sg. - pl.', and stress shift, as in Afar *dummú - dúmmu* 'cat f.-m.' (Bliese (1981)). A similar case is the subtraction of a phonological unit, such as rhyme subtraction in Alabama *balaaka - balka* 'lie down sg. - pl.' (Broadwell (1988) and Martin (1988)).

A more common strategy of word formation is the combination of two units, where the mode of combination can be concatenation[5] (Afar *m+akxan+inn+a* 'he did not love (neg.-love-perf.-he)') or interdigitation (MH; *(g,d,l) + (i,e) --> gidel* 'he grew'). I am concerned here with the latter type of word formation, specifically that of Semitic consonantal roots and vocalic patterns. I will argue here that in MH interdigitation is governed by syllabification rules and not mediated by independently given syllabic templates. More precisely, interdigitation is a by-product of syllabification.

[5] With McCarthy and Prince (forthcoming) I view infixation (including reduplicated infixes) as concatenation. Thus, interdigitation refers to Semitic morphology.

Two aspects of the process of interdigitation are at issue here:

a. the information which is given in the underlying representation; and

b. the mode of formative combination, i.e., association.

With respect to the first issue, I argued in section 1 above that the degree of prosodic information given in the underlying representation is determined on language-specific grounds. In MH there is no need for underlying prosodic templates (cf. McCarthy (1979, 1981) and McCarthy and Prince (forthcoming) for underlying prosodic templates).

As for the second issue, I argue in the present section that in the absence of underlying prosodic templates, the directional mode of association from left to right (cf. McCarthy (1979, 1981)) must be abandoned in favor of the Order Preservation Constraint, which requires that output representations must maintain the underlying order.

A related issue, which will be discussed in chapter 3, is the morphological structure of the output. I will argue that there is no motivation for tier segregation, where different formatives are represented on separate melodic tiers, and thus the output representation consists of a single melodic tier. This entails that structural distinctions between the phonological material belonging to distinct morphological elements do not exist once association has been accomplished (Cf. McCarthy (1979, 1981) for multitiered structure, and McCarthy (1986) for the persistence of morphemic distinctions beyond association). I will support this argument by showing that apparently morphological properties are actually identified on the basis of phonological information, and therefore the grammar can dispense with morphological structure in the representaion.

In the following discussion I present a formal analysis of interdigitation.

2.1. BASIC CONCEPTS

The mode employed by a language to assemble several formatives into a single word, and in particular the divorcing of concatenation and interdigitation, depends primarily on the lexical representation of the formatives. Both continuous and noncontinuous formatives are composed of ordered segments, formally represented here by the elements a_1, a_2, etc. A formative can then be written as an n-tuple, using parentheses to indicate that the elements are crucially ordered. There are two types of such sets. In one type, consisting of noncontinuous formatives, the elements need not be adjacent. I formally represent such a not necessarily continuous sequence of elements by separating its constituents with commas; $(a_1, a_2, \ldots, a_n)$. In the other type, that which stands for continuous formatives, the elements must be adjacent, and they are therefore not separated by commas in the formal representation; $(a_1\ a_2 \ldots a_n)$. For example, the formatives in the MH verb *gidel* 'he raised' are *(g,d,l)* and *(i,e)*, while the formatives of the Afar form *makxaninna* 'he did not love' are *(m)*, *(akxan)*, *(inn)*, and *(a)*.

There are various logical possibilities for combining the elements of a vocalic pattern (hereafter "V-set") with those of a consonantal root (hereafter "C-set"), but only one is actually attested in MH. Given a V-set (V_1,V_2) and a C-set (C_1,C_2,C_3), the shape $V_1C_1C_2V_2C_3$ never arises, since MH does not permit an onsetless syllable in the stem . Similarly, $C_1V_1C_2C_3V_2$ never arises, since non-initial syllable in the stem must be closed.[6] The only possible output is $C_1V_1C_2V_2C_3$. The question then is how best to account for the absence of other logical and phonologically possible shapes.

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[6] These restrictions are not always surface true (i.e. they may hold only at an early level of representation) due to the effect of various phonological rules, like the deletion of *h* and *ʔ* in word final position, which results in a final open syllable.

Interdigitation is not random, as the possible consonant-vowel sequences correspond exactly and in an unambiguous way to the permissible syllable structure and syllabic structure of stems. This relation has two possible theoretical interpretations; either the permissible syllabic templates are given underlyingly, as proposed in McCarthy and Prince (forthcoming), or derived by rules. With Steriade (1982), I assume rule-governed syllabification, as opposed to the principle-governed template approach proposed in Selkirk (1982) and Itô (1986). I claim that in MH the syllabic structure is not given underlyingly but rather derived by rules.

The reason for this theoretical preference is that interdigitation in MH is not ambiguous; given, for instance, three consonants and one vowel, the only possible form is *CCVC*, where *CVCC* is ruled out (see section 3.2. for the analysis of segolates, a class of nouns whose purported structure is *CVCC*). In addition, as argued in Hayes (1989), if syllabic structure is given underlyingly we would expect distinctive syllabification, such as an opposition *CVC.CV* vs. *CV.CCV* within the same language, and such cases are not found. Moreover, rule-governed syllabification is independently required for resyllabification, and therefore we wish to eliminate the redundancy of having both syllabic templates and syllabification rules.[7] Thus, since syllabification rules can do the work attributed to syllabic templates, I favor them as the sole apparatus in determining the syllabic structure.

In principle, interdigitation works as follows in MH: Given a V-set and a C-set, (V_1,V_2) and (C_1,C_2,C_3) respectively, the first stage in deriving the stem $C_1V_1C_2V_2C_3$ is to build a syllable node over each vowel. The onset of each syllable is then created by linking C_1 and C_2 to the left of V_1 and V_2 respectively. The coda of

[7] As Hayes (1989) points out, a minimal underlying syllabic structure may be required on language-specific ground to distinguish between long and short segments, or vowels and their corresponding glides (see note in section 1 above).

the last syllable is created by linking C_3 to the right of V_2. It is crucial to emphasize that association is syllable driven, and therefore we cannot impose a particular order and direction on the process of associating the elements of the C-set .

Syllabification rules are responsible for the sequential order of vowels and consonants, but they do not account for the fact that the output stem is $C_1V_1C_2V_2C_3$ and not for instance *$C_1V_1C_3V_2C_2$ or *$C_1V_2C_2V_1C_3$, where in the ill-formed shapes the relative order of some of the segments has been changed. These unattested forms are logically possible in the absence of the directional (left to right) association, which designates which segment to link to which position.

To account for the fact that the order of the segments within a set is always maintained in the output stem, I propose a constraint which is apparently trivial, but which needs to be made explicit and which will be seen below to have important consequences:

(10) The Order Preservation Constraint

If x and y are elements in a set A, and
x is α-ordered with respect to y,
then x must be α-ordered with respect to y in a stem S,
where A is a component of S.

x and y are segments in a given formative A. Order is binary; it is defined between adjacent members of a set using the predicates "precede (<)" and "follow (>)". In a set (x,y,z) the order is defined for each element (in bold) as follows: $x<y$, $y>x$ & $y<z$, and $z>y$. The order between x and z follows from transitivity (if $x<y$ and $y<z$

then $x<z$), and therefore, in principle, this is not one of the orderings that has to be respected in a derived string.[8]

To summarize the proposal, the underlying representation of MH formatives consists of ordered sets of segmental elements, where the elements of a given formative need not be adjacent in strings containing that formative; no prosodic structure is given as such. Syllabification rules are responsible for interdigitation, i.e., for deriving the sequential order of vowels and consonants, and the derived syllabic structure. The order of the elements within each set is maintained in the interdigitated string, as required by the Order Preservation Constraint.

2.2. A FORMAL ANALYSIS

The concepts of the approach advocated here must now be translated into a formal framework. I provide in this section a set of syllabification rules which account for the syllable structure and syllabic structure of MH stems. The rules are syllable driven; that is, they state which position in the syllable a given segment is to occupy. The consonants are not necessarily linked in the order they are presented, but the output is subject to the Order Preservation Constraint, which blocks any output that does not preserve the order defined underlyingly.

There is a crucial difference between syllabification rules which syllabify a continuous string and those proposed here, which syllabify two noncontinuous strings. In the former, the way one would state onset linking, for example, is "link the first consonant on the left of the vowel to ...", while in the latter the statement is

[8] This constraint makes strong predictions regarding Metathesis rules, as this is a phonological rule which involves reordering of segments. At this stage of research I limit the Order Preservation Constraint to morphology.

"link a consonant to the left of the vowel". The appropriate consonant is linked such that the output shape respects the Order Preservation Constraint.

Such a derivation, where a certain action is taken or not taken depending on whether the output will be ill-formed according to some condition, is not a new strategy in phonological analysis. McCarthy (1986) argues that in Afar a rule which deletes a vowel between two consonants is blocked if the consonants are identical. The blockage, which exhibits antigemination effect, derives from a violation of the Obligatory Contour Principle which would otherwise be created. Similarly, as argued in Itô (1986), in Lardil the final *k* in a stem such as *ŋaluk* cannot be syllabified due to a prohibition against syllable final non-coronals. Consequently *k* is deleted (by Stray Erasure), resulting in *ŋalu* 'story'. The principle is that processes can be blocked if they would create an impermissible structure. The other possibility, where impermissible structures are created and later amended by subsequent rules, is also attested, as shown in chapter 4 section 3.

2.2.1. STEM FORMATION

As noted above, interdigitated segments in MH are not randomly organized within a stem. Consider the distribution of vowels and consonants in the stems below (where a period indicates a syllable boundary):

(11)

Number of *V*s	Number of *C*s	Distribution of *V*s & *C*s	
1	2	CVC	*kam* 'he stood up'
			gan 'garden'
1	3	CCVC	*gvul* 'boarder'
			dmut 'image'

2	3	CV.CVC	*gidel* 'he raised' *davar* 'thing'
2	4	CVC.CVC	*tirgem* 'he translated' *tarmil* 'beg'
2	5	CVC.CCVC	*tilgref* 'he telegraphed'
3	5	CV.CVC.CVC	*samankal* 'assistant director'[9]

Syllablification in the above forms is based on universal as well as language specific principles. Universally, syllabification of a *CVCVC* sequence is *CV.CVC*, rather than **CVC.VC* (see Steriade (1982) and Hyman (1985), but also Anderson (1974) for counterevidence). The syllabification *CVC.CCVC* (rather than **CVCC.CVC*) is specific to MH, based on the observation that the language does not permit stem final clusters (with the exception of a few borrowed words, such as *boks* 'box (blow)' and *student* 'student'), while it does allow stem initial clusters, as in *dmut* 'image' and *gdila* 'growing'. Other evidence for the syllabification *CVC.CCVC* is drawn from epenthesis. A word initial onset which violates the sonority hierarchy[10] is simplified by an epenthetic *e* ; cf. *levana* 'white f.sg' vs. *gdola* 'big f.sg.'. Similarly, a word medial complex onset which violates the sonority hierarchy is simplified by inserting an epenthetic *e* (such instances are rare); *hit.ʔam.rken* --> *hitʔamreken* 'he became American' (cf. *til.gref* 'he telegraphed', where the second onset does not violate the sonority hierarchy).

The distribution of vowels and consonants in (11) above reflects the following restrications:

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[9] The form *samankal* is an acronym (see chapter 1 section 1.2.). Otherwise, trivocalic stems are rather rare.

[10] The sonority hierarchy proposed in Barkai and Horvath (1978) for MH is as follows:

stops	fricatives	*v*	nasals	*y*	*r*	*l*
1	2	3	4	5	6	7

(12) a. Every vowel corresponds to a syllable

b. The permissible syllables are *CV*, *CVC*, and *CCVC*

c. Final and medial syllables must be closed[11]

On the basis of these generalizations, I propose the following ordered set of syllabification rules for MH stems:

(13) Syllabification rules

1. Link a syllable node to each element in the V-set
2. Link a consonant to the onset of each syllable
3. Link a consonant to the coda of the ultimate syllable
4. Link a consonant to the coda of the penultimate syllable
5. Link a consonant to the onset of the ultimate syllable

These rules account for all attested distributions of vowels and consonants within the stem (with the exception of borrowed nouns). Rule (13-1) reflects the absence of length distinction in the language, such that each vowel corresponds to a syllable (or a mora). Rule (13-2), which appears in Hyman (1985) as the Onset Creation rule, seems to be universal. Rule (13-3), which creates a coda in stem final position is common to some Semitic languages, where stems must end in a consonant. These first three rules are obligatory given a bivocalic V-set, and therefore in case there are only two consonants in the C-set, reduplication is triggered. Rule (13-4) satisfies the restriction that final and medial syllables must be

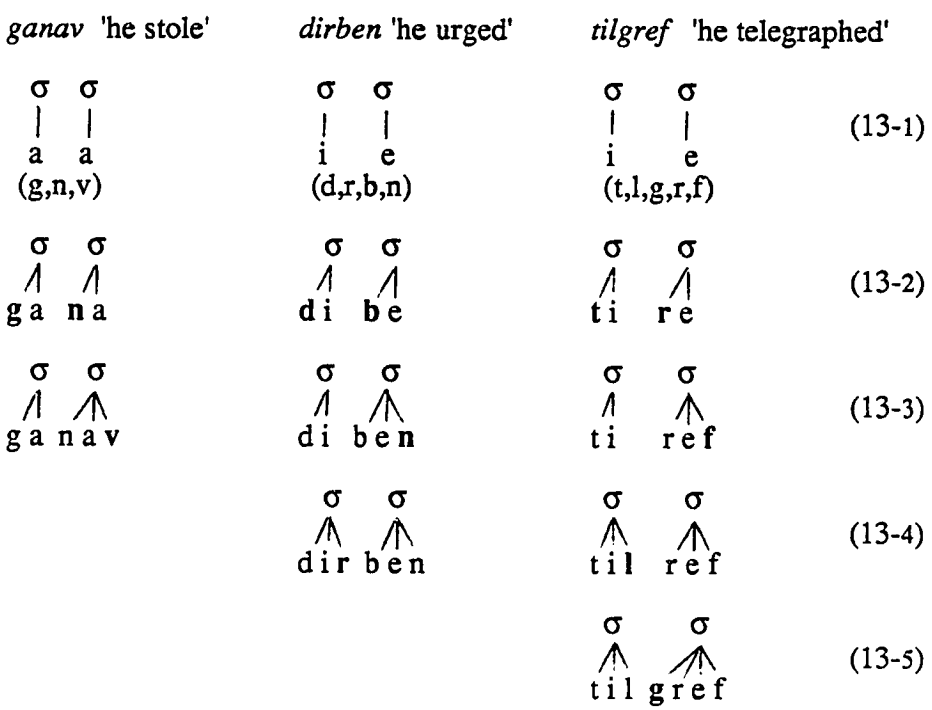
---

[11] (12c) allows the following stems: monosyllabic *CVC* (**CV*); disyllabic - *CV.CVC*, *CVC.CVC* (**CV(C).CV*); and trisyllabic - *CV.CVC.CVC*, *CVC.CVC.CVC* (**CV(C).CV.CVC*). An apparent counterexample to this generalization is the acronym *lahadam* 'nonsense' (*lo hayu dvarim me ʔolam* 'nothing ever happened'), which is explained by the fact that the bisyllabic stem **lahdam* would obscure the source of the form, given that *h* is deleted in a coda position, thus yielding **ladam*.

closed, and rule (13-5) creates a complex onset. Attention should be drawn to the similarity between the syllabification rules proposed above and those found in concatenative languages, in particular, the order of the rules, where the onset is created before the coda (see Steriade (1982) and Hyman (1985)).

The application of the rules is given in (14) below (bold face marks the consonants linked by the rule specified on the right). Note that the rules do not specify which consonant to link. This, as suggested earlier, is taken care of by the Order Preservation Constraint; there is only one way to link the consonants since all other possibilities would yield stems that violate this constraint.

(14)



In (15) below I illustrate the application of these syllabification rules in all the stems given in (11), which represent all of the possible (native) stems:

(15) a. One vowel

(i) two consonants (*kam* 'he stood up')

(13-2) [C V]

(13-3) [C V C]

(ii) three consonants (*gvul* 'border')

(13-2) [C V]

(13-3) [C V C]

(13-5) [C C V C]

b. Two vowels

(i) three consonants (*gadal* 'he grew')

(13-2) [C V] [C V]

(13-3) [C V] [C V C]

(ii) four consonants (*dirben* 'he urged')

(13-2) [C V] [C V]

(13-3) [C V] [C V C]

(13-4) [C V C] [C V C]

(iii) five consonants (*tilgref* 'he telegraphed')

(13-2) [C V] [C V]

(13-3) [C V] [C V C]

(13-4) [C V C] [C V C]

(13-5) [C V C] [C C V C]

c. Three vowels (rare)

five consonants (*samankal* 'assistant director')

(13-2) [C V] [C V] [C V]

(13-3) [C V] [C V] [C V C]

(13-4) [C V] [C V C] [C V C]

All other logical but unattested sequences of vowels and consonants are impossible as they violate the Order Preservation Constraint and/or the rules given in

(13). The form **giled*, for instance, violates the Order Preservation Constraint, given the root *(g,d,l)*. The form **gidle* violates rule (13-3), which links the onset of the last syllable.

2.2.2. AFFIXATION

Apparent violation of the restrications in (12), and consequently of some of the syllabification rules in (13), is exhibited by affixed forms. Consider the distribution of vowels and consonants in the forms below:

(16)

Number of *V*s	Number of *C*s	Distribution of *V*s & *C*s	
2	4	CCV.CVC	*gvul+ot* 'borders'
3	5	CVC.CV.CVC	*hit+xaver* 'he befriended'

These forms apparently present syllabic structures that do not coincide with those predicted by the syllabification rules in (13). The plural noun *gvulot* 'borders', should apparently have been **guvlot* (cf. *tirgem* 'he translated'), and the verb *hitxaver* 'he befriended' should have been **hitaxver* (cf. *samankal* 'assistant director').

This situation arises from the addition of affixes. The apparent problem disappears, however, if we assume that the stem is first formed on the basis of the rules given in (13), and that only then are the affixes attached. After affixation the syllabic structure of the word no longer conforms to the restriction that non-initial syllables must be closed, since this restriction is relevant for interdigitation only.

This state of affairs requires us to postulate internal structure for the phonological material identified with the derivational categories, which are each composed of a vocalic pattern together with any relevant affixes. What identifies a

verbal derivational category, as B5 in *hitxaver*, is not only the vocalic pattern *(a,e)* but also the prefix *(h,t)*. Both must therefore be specified in the lexical representation of the pattern. The syllabification rules in (13) combine the vocalic pattern with the consonantal root, while the affixes remain floating until they are attached later on. In the verbal noun *gdila* 'growing' for example, the rules in (13) derive only the stem *gdil*, while the suffix is attached at a later stage. Therefore *gdil* but not *gdila* obeys the generalizations on syllable structure and on the syllabic structure of stems.

I thus assume that derivational categories consisting of a vocalic pattern plus an affix have the internal hierarchical structure [[PREF [STEM]] SUFF], where the STEM is the head, and the PREF and the SUFF are the margins of the pattern. As in syllable structure (or alternatively in syntactic structure), the nucleus (or the head), i.e., the STEM, is obligatory in every set; that is, there is no stem that lack a vocalic pattern. The syllabification rules given in (13) apply only to the nucleus, while the margins, PREF and/or SUFF, are attached later. On the surface, the order of PREF, SUFF, and STEM with respect to each other should be preserved, as required by the Order Preservation Constraint. Within the stem, the vowels and the consonants are organized on the basis of the syllabification rules. Although the affixes are not ordered with respect to the root consonants, by transitivity, the PREF must precede them and the SUFF must follow them.

Below are the appropriate representations of the verbal derivational categories. Recall that *i* is inserted in the environment #C__C, where the first C is a prefix (see (7) in chapter 1). *i* is not inserted in Future of B3 and B4, since in these cases the prefix consonant is followed by a vowel. These vowels are specified as part of the

prefix, and must be adjacent to the prefix consonant (therefore formally not separated by a comma).

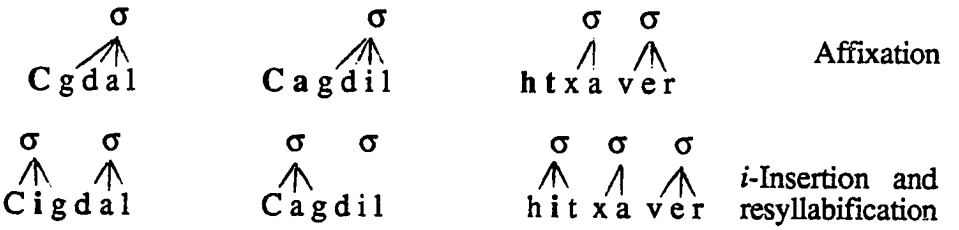
(17)

	Past	Future	Participle
B1:	(a, a)	([C, [o/a]])	(o, e)
B2:	([n, [a]])	([C, [a, e]])	([n, [a]])
B3:	([h, [i]])	([Ca, [i]])	([ma, [i]])
B4:	(i, e)	([Ce, [a, e]])	([me, [a, e]])
B5:	([h, t, [a, e]])	([C, t, [a, e]])	([m,t, [a, e]])

The syllabification rules in (13) pertain to the head of the pattern, and are thus involved directly in deriving the stem. After the stem has been constructed, the affixes are attached to the edges of the stem, preserving the order given in the underlying representation. Recall that the appropriate consonant is associated such that the output would respect the Order Preservation constraint.

(18)

yigdal (B1) 'he'll grow'	*yagdil* (B3) 'he'll enlarge'	*hitxaver* (B5) 'he befriended'	
σ | C a (g,d,l)	σ | Ca i (g,d,l)	σ σ | | h,t a e (x,v,r)	(13-1)
σ /\ C d a	σ /\ Ca d i	σ σ /\ /\ h,t x a v e	(13-2)
σ /\\ C d a l	σ /\\ Ca d i l	σ σ /\ /\\ h,t x a v e r	(13-3)
σ /\\\ C g d a l	σ /\\\ Ca g d i l		(13-5)



Some issues regarding this derivation need to be clarified. First, the value of C is determined when agreement affixes are added: *t* - 2pr. f., m., and pl., *y* - 3pr. m.sg. and pl., *ʔ* - 1pr. sg., and *n* - 1pr. pl (see table in chapter 1 fn. 10). We might as well assume that *t* is specified underlyingly, and it is substituted for the other prefixes in the appropriate syntactic environment.

The affixes are attached to the stem in the familiar manner. Later, the syllabification rules given in (13) build the appropriate syllable structure in the derived environment. As the order of the vowels and consonants is already given, the function of the rules at this stage is only to derive the syllable structure. Since the same syllabification rules are applicable, we do not expect them to derive any syllable other then the ones provided in (12b) above.

To conclude, it is important to draw the distinction between the proposal made in the present chapter and the one pursued in McCarthy's Nonconcatenative Morphological theory. McCarthy argues that

a. prosodic units are given underlyingly; and

b. the segmental elements are linked in a well defined order.

In this chapter I argued that

a. in MH, prosodic units are not given underlyingly; and

b. the order of consonant association is governed by syllabification rules (i.e., the process is syllable driven) and the output form is restricted by the Order Preservation Constraint.

Notice that my account is appropriate for MH and any other Semitic language which permits unambiguous correspondence between segmental content and syllabic inventory, like *CV*, *CVC*, and *CCVC*. An ambiguous syllabic inventory, in constrast, would include for instance both *CVCC* and *CCVC* at the same position within the stem. The view taken here is that languages may differ in the amount of information required in underlying representations (as is the case with melodic information), where in some cases this may include a (partial) prosodic structure.

3. APPARENT PROBLEMS

The analysis outlined for MH above faces two (unrelated) problems. The first is the interdigitation of consonantal roots of five or more consonants. These roots are usually extracted from loan words in the derivation of new verbs (see chapter 3 section 3.2. for Extraction), and the derived verbs tend to maintain the clusters that appear in the source form, disregarding the otherwise valid syllabification rules. I will argue in section 3.1. below that this case is not evidence against the proposed syllabification rules, providing that adjacency of consonants in the source tends to be preserved by Extraction.

The second problem is presented by the segolate forms, which have previously been analyzed as underlyingly *CVCC*. This stem shape cannot be derived by the syllabification rules given in (13), but I will argue in section 3.2. that MH segolates have the underlying shape *CVCVC*.

3.1. THE PRESERVATION OF CLUSTERS

Some forms derived by Extraction do not conform to the syllabification rules given in (13) above. As discussed in Bat-El (1986), and further below in chapter 3 section 3.2., new verbs and verbal nouns (and occasionally other nouns) are derived by extracting the consonants from a base word and interdigitating them with one of the vocalic patterns; *télefon* 'phone' - *tilfen* (B4) 'he phoned', *špric* 'squirt' - *hišpric* (B3) 'he squirted'. As observed in Bolozky (1978), there is a great tendency to preserve original clusters. One way to preserve clusters is to choose a binyan where the clusters in question exist throughout the voice/aspect paradigm, as it is the case with *hiflik - yaflik - maflik* (B3) 'to slap' derived from *flik* 'slap' (cf. the native verb *hidbik - yadbik - madbik* (B3) 'to glue'). Notice that it is not preservation of the syllabic structure but rather of the cluster, since in the base noun both *f* and *l* are onsets, while in the derived verb *f* is a coda while *l* is an onset. In the same position, where a cluster of two consonants is found in native words, it is possible to find a cluster of three consonants in borrowed words; *hišpric* (B3) 'he squirted' (from *špric* 'squirt').

Of special interest is the distinction in syllable structure between *šnirkel* 'he snorkeled' (from *šnórkel* 'snorkel') and *tilgref* 'he telegraphed' (from *télegraf* 'telegraph'). In both verbs there are five consonants and two vowels, but while in the former the distribution is *CCVC.CVC* in the latter it is *CVC.CCVC*. Since interdigitation is a by-product of syllabification, it is impossible to derive both forms by the same set of rules, assuming a root formative *(C,C,C,C,C)*. One may suggest that the syllabification rule (13-5), which associates a consonant to the onset of the ultimate vowel, can be restated such that it may associate the consonant to the onset of either of the syllables. This, however, would not reflect the tendency to preserve

the cluster of the base form since the revised version of the rule could in principle derive unexpected forms, such as **šinrkel* (rather than *šnirkel*) from *šnórkel*, and **xnitreš* (rather than *xintreš* 'he talked nonsense') from *xantariš* 'nonsense'.

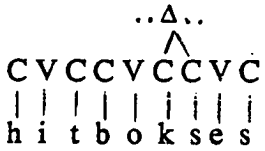
McCarthy (1984) and McCarthy and Prince (forthcoming) argue that these types of forms provides support for the requirement of syllabic templates. Unlike the CV-template, the syllabic template does not restrict the number of consonants. These authors do not, however, provide a formal account of this phenomenon. McCarthy (1984) just notes that the selection of the distribution of vowels and consonants in these forms is purely lexical, usually preserving similarity with the source.

The problem in providing a formal account for this phenomenon is that clusters are interdigitated as if they are complex segements, like affricates. Nonetheless they cannot be represented as two segmental elements linked to one prosodic unit. True complex segments are treated as a single unit by reduplication, as can be seen from *cilcel* 'he rang' (**cilsel*) and *hitpocec* 'it was bombed' (**hitpoces*), where c is a complex segment, composed of *t* and *s*. Extracted clusters are treated as two units, as can be seen from *hitbokses* 'he boxed' (**hitbokseks*), which is derived form *boks* 'box (blow)'. Our theory does not provide us any unit, such as Δ in (19b) below, which exclusively dominates the elements in an extracted cluster.[12]

[12] As matter of fact the affricate *c* needs not be represented as a complex segment in MH since the feature [continuent] distinguishes it from *s*, and the feature [strident] distinguishes it from *t* (see chart in (12) in chapter 1). But if we adopt the representation of complex segments for these type of clusters we predict, what I suspect to be a wrong prediction, that in a language which has complex segments, they would not contrast with clusters.

(19) a. Affricates

b. Clusters



The representation of formatives proposed in section 2.1. above allows us to account for this phenomenon in a formal manner. Recall the distinction between continuous and noncontinuous formatives; in the former, $(a_1\ a_2 \ldots a_n)$, the segments must be adjacent, while in the latter, $(a_1, a_2, \ldots, a_n)$, they must not. That is, adjacency is obligatory when specified, while non-adjacency is optional. I propose that extracted roots tend to preserve the adjacency relation of the base.[13]

(20)

šlúmper 'sloppy person'	--->	*(šl, mp, r)*	--->	*šlimper* (B4) 'it made sloppy'
šnórkel 'snorkel'	--->	*(šn, rk, l)*	--->	*šnirkel* (B4) 'he snorkeled'
xantariš 'nonsense'	--->	*(x, nt, r, š)*	--->	*xintreš* (B4) 'he talked nonsense'
télegraf 'telegraph'	--->	*(t, l, gr, f)*	--->	*tilgref* (B4) 'he telegraphed'
stenograf 'stenographer'	--->	*(st, n, gr, f)*	--->	*stingref* (B4) 'he took shorthand'
psanter 'piano'	--->	*(ps, nt, r)*	--->	*psinter* (B4) 'he played the piano'
flik 'slap'	--->	*(fl, k)*	--->	*hiflik* (B3) 'he slapped'
špric 'squirt'	--->	*(špr, c)*	--->	*hišpric* (B3) 'he squirted'

[13] Exception; *blof* 'bluff' --> *(bl,f)* --> *bilef / bilfef* 'he bluffed' (rather than **blifef / *bliflef* as expected).

flirt 'flirt'	--->	*(fl, rt)*	--->	*flirtet* (B4) 'he flirted'
boks 'box (blow)'	--->	*(b, ks)*	--->	*hitbokses* (B5) 'he boxed (fight)'

Adjacency in continuous strings (not separated by commas) must be preserved, while nonadjacency in noncontinuous strings need not be. Therefore in *stingref (st,n,gr,f)* 'he took shorthand' *n* comes to be adjacent to *g* although it is not represented as necessarily adjacent (cf. *(g,d,l)* in *gadal* 'he grew' and *higdil* 'he enlarged'), but *s* must be adjacent to *t*. Notice that in the last two forms in (20), only the prevocalic positions are filled, therefore reduplication is triggered (see section 4 below).

It should also be mentioned that the noun *télegraf* 'telegraph' could in principle provide the base for two alternative verbs, *tilgref* and **tligref*, as in both forms *g* and *r* are adjacent. Yet the syllabification rules provided in (13) above (see derivation in (21) below) can derive only *tilgref*.[14]

We must therefore add further conditions to the syllabification algorithm presented in (13) above. Formally, when a consonant is to be linked to a position within the syllable, the adjacent consonant is linked as well to the same position. That is, consonants which are adjacent in the root formative are interdigitated as if they are a single unit.

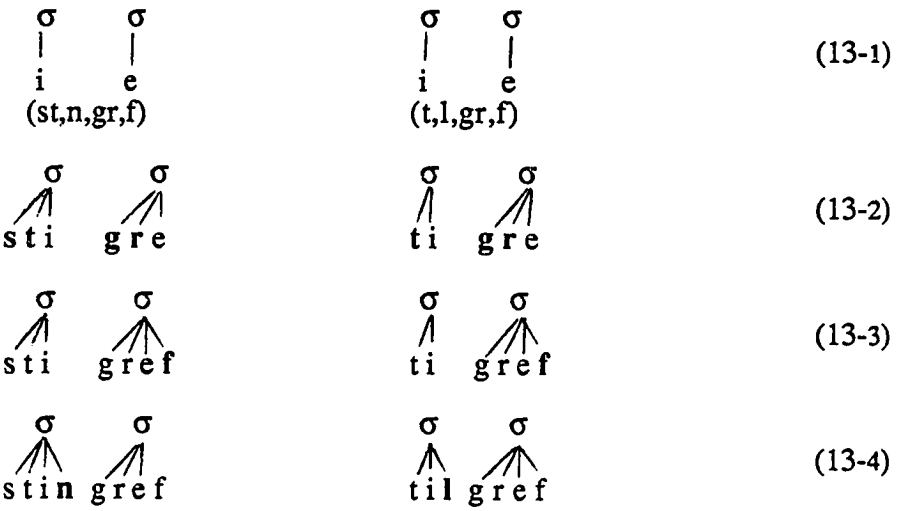
---

[14] The form *tilgref* could support Yip's (1988b) argument for End-In association (assuming a CV-skeleton):

```
C i C C C e C  --->  C i C C C e C  --->  C i C C C e C
|         |          | |   |   |          |   | | | |
t         f          t l   r   f          t   l g r f
```

But this account would wrongly predict **pisnter* from *psanter* and **šilmper* from *šlúmper*.

(21) *stingref* 'he took shorthand' *tilgref* 'he telegraphed'

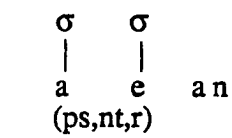


Striking support for this analysis is provided by the agent noun *psantran* 'pianist', which has been formed from *psanter* 'piano' by associating the root extracted from the noun*psanter* with the agent noun pattern *([[a,e,]an])*. The result of interdigitation is the stem *psanter* (as argued in section 2.2.2., affixes are attached after the stem has been syllabified, i.e., after interdigitation). When a vowel initial suffix is added, *e* should be deleted when preceded by an open syllable (see *e*-Deletion in chapter 4 section 2), as in *raked+an* --> *rakdan* 'dancer', but preserved when preceded by a closed syllable, as in *kaškeš+an* --> *kaškešan* 'prattler'. In *psanter+an* the *e* is deleted, resulting in *psantran*.

Interdigitation of the root *(p,s,n,t,r)* would result in the syllabic structure *psan.te.ran*, in which *e* should not be deleted since it is not preceded by an open syllable. The fact that *e* is deleted, resulting in *pasantran*, is evidence that at a certain stage of the derivation it is preceded by an open syllable. This situation can arise only if *n* and *t* are associated together as the onset of the second syllable, as required by the extracted formative *(ps,nt,r)*. Notice that Rule (13-2), which creates the

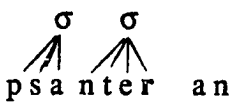
onsets, links together only the elements which must be adjacent, i.e., *p* with *s* and *n* with *t*. As can be seen from the derivation below, the stem final *e* is preceded by an open syllable before resyllabification, and this is the stage at which it is deleted.

(22) *psantran* 'pianist'

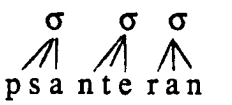


(13-1)

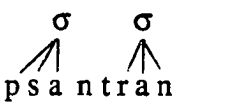
(13-2)



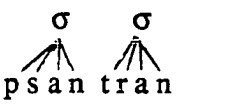
(13-3)



Suffixation and resyllabification



e-Deletion



Resyllabification

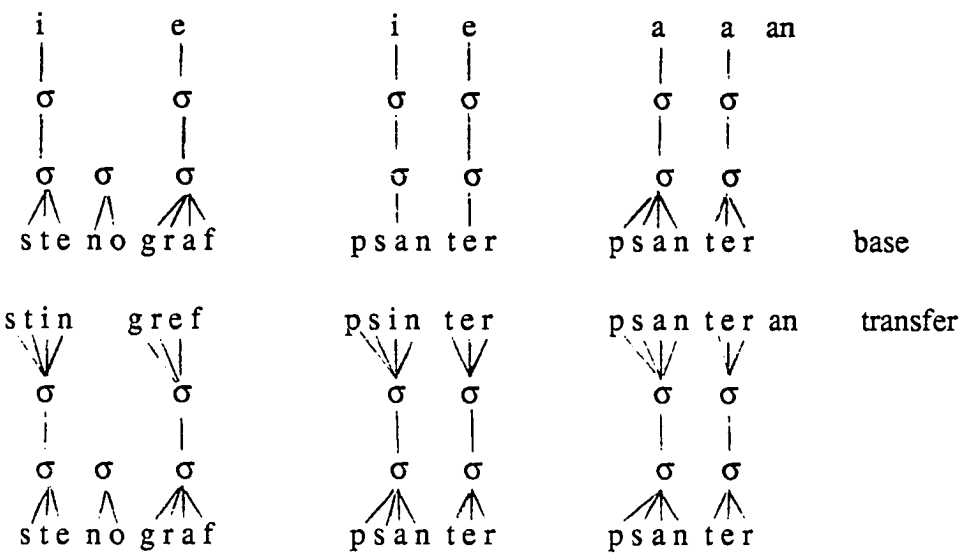
It is crucial for *e*-Deletion that the preceding syllable is open and that the rule applies before resyllabification. Notice that resyllabification must be restricted to a derived environment only. When the suffix *-an* is attached *psa.nter+an* becomes *psa.nte.ran* and after the vowel is deleted, *psa.nt.ran* becomes *psan.tran*. That is, only the newly derived structure is resyllabified.[15]

[15] Notice that we cannot assume that *-an* is attached directly to the noun *psanter* 'piano' since the syllabic structure is *psan.ter* and therefore *e*-Deletion should not apply, thus resulting in **psanteran*. If the syllabic structure of the base were *psa.nter* we should expect an epenthetic *e* to break the *nt* onset, since it violates the sonority hierarchy (see fn.10 above); cf. *netina* (**ntina*) 'giving' vs. *tnuxa* 'posture'.

Such an analysis is not available within the templatic approach of McCarthy and Prince (forthcoming) since a given syllabic template induces a proper syllabification, and therefore there is no stage in which the appropriate environment for *e*-Deletion is available.

The fact that clusters presented in the source form are preserved in the output form could also be analyzed in terms of melodic transfer. The notion of transfer is introduced in Clements (1985b) for the analysis of reduplication. According to that analysis, the segmentally impoverished prosodic material, which triggers copying, is initially placed parallel to the stem, and each element in that prosodic material is associated with a prosodic element of the stem. Then the melodic material of the stem is transferred, such that associated prosodic elements are linked to identical melodic elements. We could also adopt a similar analysis for Extraction. First the vocalic pattern linked to a syllable node is placed parallel to the syllables of the base (assuming that a medial syllable is skipped, as in *stenograf*), and then the consonants are transferred:

(23)



First, skipping the medial syllable makes this analysis unappealing. More importantly, this analysis still does not account for the fact that *e*-Deletion applies in *psanteran* yielding *psantran.* I the syllable node is placed but the syllabic structure is not copied, syllabification after transfer would not provide the appropriate structure for *e*-Deletion. Notice that in *psanter* the first syllable is closed, and so transferring the syllable structure would not do any good.

I thus conclude that cluster preservation not only does not pose serious problems to the non-templatic approach advocated here, but in fact demonstrates the advantage of this approach over the templatic theory.

3.2. SEGOLATES

This section is concerned with a group of nouns, traditionally termed "segolates", whose underlying stem has previously been assumed to have the shape *CVCC*, as evidenced by their penultimate stress, as in *dégel* 'flag' (as opposed to final stress in most native nouns). This assumption poses a problem for the approach taken here, since the syllabification rules in (13), which not only syllabify but also interdigitate, cannot derive both *CVCC* and *CCVC* stems. The rule which links the third consonants, after *CVC* has been formed, would need to be lexically specified to whether it link the consonant to the coda or to the onset. I argue in the following discussion that the underlying shape of MH segolates is *CVCVC*. The final syllable in segolate forms is not a stress-bearing element, and therefore stress is penultimate.

3.2.1. UNDERLYING REPRESENTATION

Unlike most nouns in MH, which bear final stress, segolates[16] bear penultimate stress in the singular form; cf. *dégel* 'flag' vs. *dagál* 'flagman' and *šémen* 'oil' vs. *šamén* 'fat m.sg.'. And unlike nouns with penultimate lexical stress, whose stress remains in the same position when suffixes are added, suffixed segolates bear final stress; cf. *xével - xavalím* 'rope sg.-pl.' vs. *tíras - tírasim* 'corn sg.-pl.'. As shown in chapter 4 sections 1 and 2, the vocalic alternation *e ~ a* and the stress pattern exhibited by *xével - xavalím* 'rope sg.-pl.' are closely related.

To account for the penultimate stress in MH segolates Bolozky (1978) argues that their underlying representation is *CVCC*. An epenthetic *e* is inserted to simplify the impermissible final cluster after stress has been regularly assigned to the ultimate syllable (which on the surface, after epenthesis, would be the penultimate). In the plural form, according to Bolozky, the stem has a particular template, [CCaC-]. This approach is similar to that presented in McCarthy (1979) and Hammond (1988) for broken plurals in Arabic; the root consonants are directly linked to the given template. In this way there is no need to provide rules for the deletion of the stem initial vowel and the *e ~ a* in the plural forms (*dégel - dgalím* 'flag sg.-pl.').

(24)

Singular	Plural	
(d,g,l) + CVCC	(d,g,l) + CCaC+im	Underlying representation
degl	dgalim	Association
dégl	dgalím	Stress assignment
dégel	---	Epenthesis
dégel 'flag'	*dgalím* 'flags'	

[16] The traditional term "segolate" comes from "segol", the Hebrew name for a short *e*. The name refers to the final stem vowel in segolates, which is usually *e* (recall that there is no length distinction in MH).

This view reflects the history of the segolates and follows in essence the analysis of Tiberian Hebrew segolates presented in Prince (1975) and Rappaport (1984).

Within the framework developed in this chapter the assumption that the segolate stem is *CVCC* cannot be maintained, since it has been argued that the sequential order of vowels and consonants is phonologically determined. The syllabification rules in (13) cannot derive both *CCVC* and *CVCC* stems; as formulated there, they can derive only *CCVC* stems.

The argument here against a *CVCC* stem form for MH segolates is, however, not only theory internal; further evidence can be drawn from reduplication. MH, unlike Tiberian Hebrew, permits reduplicated segolates; *mélel* 'verbosity', *rétet* 'quiver'. The absence of reduplicated segolates in Tiberian Hebrew was accounted for on the basis of a proposed *CVCC* structure in Prince (1975). Given two root consonants and a [CVCC] template, the final C-slot remains empty after association, and therefore the last consonant spreads, creating a geminate. This geminate, as in many other languages, cannot be split by epenthesis (Steriade (1982) Hayes (1986)), and is later simplified since Tiberian Hebrew does not permit word final geminates.

(25)

Association	Spreading	Epenthesis	Degemination	
C V C C	C V C C		C V C	
| | |	| | \/	---	| | |	
c e l	c e l		c e l	*cel* 'shadow'
C V C C		C V C V C		
| | | |	---	| | | | |	---		
s e f r		s e f e r		*séfer* 'book'

Also MH does not permit word final geminates, therefore the fact that there are reduplicated segolates in the language suggests that the two languages differ in the

underlying representation of these nouns. In MH, as argued above, the stem of the segolates is *CVCVC*. In case of bisyllabic root, interdigitation creates a *CVCV* stem. Since stem final syllables must be closed (see (12c) above), reduplication takes place.

(26) Interdigitation: *(m,l) + (e,e)* ---> σ σ / m e l e

Reduplication: σ σ / m e l e m l ---> σ σ / m e l e m l ---> *melel*

copying association

I thus conclude that in order to account for the reduplicated segolates stems in MH, it must be assumed that the underlying representation of this stems is bisyllabic.

It should be noted that the broken plural analysis proposed by Bolozky is also inadequate, as evidenced from segolate forms whose first consonant is *ʔ* or *x* (historically *ʔ* and *ʕ* merged to *ʔ*, and *ħ* and *x* merged to *x*). Usually, when a plural suffix is added the first stem vowel of segolates does not surface; *séfer - sfarím* 'book sg.-pl', *bóker - bkarím* 'morning sg.-pl.'. But when the stem initial consonant is *ʔ* or *x*, the stem initial vowel surfaces in the plural form: *xével - xavalím* 'rope', *xóref - xorafím* 'winter sg.-pl.', *ʔérec - ʔaracót* 'country sg.-pl.', *ʔótek - ʔotakím* 'copy sg.-pl.' (see chapter 4 section 2 for a rule of Height Harmony, which derives the stem initial *e* in the singular forms).

In order to account for the fact that the stem initial vowel surfaces in the plural form of stems which begin with *ʔ* or *x*, we must assume that the absence of the stem initial vowel in the plural form is rule-governed (see chapter 4 section 2); this rule

does not apply when the vowel is preceded by ʔ or *x*. It is impossible to preserve the vowel if we assume, as suggested by Bolozky, that the plural is formed by linking the root consonants to the template [CCaC-]. Since the stem initial vowel which surfaces in the plural form is either *o* or *a*, it is impossible to account for it by epenthesis.

3.2.2. THE STATUS OF THE FINAL SYLLABLE

As argued above, the stem of segolates is *CVCVC*. Stress in MH usually falls on the final syllable (see chapter 4 section 1). Thus, in order to account for the penultimate stress pattern of segolates it is necessary to exclude the final syllable from the domain of the stress rule.

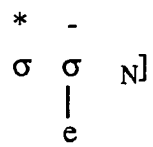
Similar phenomena in other languages have been treated by extrametricality. The notion of extrametricality was introduced in Hayes (1980) and has been widely invoked in successive phonological studies (Harris (1983), Pulleyblank (1983), Steriade (1988a), and many others). In analyzing various stress systems and developing a theory of metrical stress, Hayes has argues for the necessity of the notion of extrametricality, while admitting that it weakens the theory to a certain extent. Extrametrical elements, which are confined to the edge of a domain (the Peripherality Condition) are ignored by stress rules. Thus, given a rule which assigns stress to the rightmost syllable, a form whose last syllable is extrametrical will come to bear penultimate stress. In some languages extrametrical elements can be identified on the basis of phonological information (Ancient Greek; Steriade (1988a)), while in others extrametricality is specified as lexical information (Polish; Franks (1985)). In still others, both phonological and lexical information are relevant. The last case is found in Spanish, where, as described by Harris (1983),

there are some forms which exhibit (idiosyncratic) "marked stress", i.e., extrametricality based on lexical information, and other forms whose extrametricality is predictable by a phonological redundancy rule called by Harris "Predictable Extrametricality".

The notion of extrametricality is not appropriate for the analysis of segolates. As will be shown in chapter 4 section 2, there are phonological rules which affect only segolates. These rule apply after a suffix is attached, but they must refer to the stem final syllable of segolates, which, after suffixation, it is no longer at the edge of the domain. If we assign extrametricality to the final syllable of a segolate form we cannot preserve the Peripherality Condition, which restricts extrametricality to the edge of the domain. I thus suggest that the final syllable in segolates is not a stress-bearing unit. Similar proposal is made in Cohn (1989) with respect to epenthetic vowels in Indonesian, which are ignored by stress rules. I follow Cohn in designating such a syllable by the absence of a lvel 0 beat, assuming, as proposed in Prince (1983), that every stress-bearing element is marked (with an asterisk) for a beat on level 0 (see chapter 4 section 1).

With a few lexical exceptions, a zero-beat syllable is identified in MH mainly on the basis of phonological information. Assuming that the stem final vowel in segolates is *e* , zero-beat (marked by a dash) is assigned to nouns whose last syllable dominates *e*, as stated in (27) below:

(27) Zero-beat Assignment



It is crucial to indicate that zero-beat is assigned to nouns only, since in B4 and B5 verbs the last syllable contains *e* as well, yet it is a stress-bearing element; *dibér* (B4) 'he talked', *hitraxéc* (B5) 'he showered'.

The final stem vowel in segolates exhibits an *e* ~ *a* alternation, where *e* appears in the singular and *a* in the plural (see chapter 4 section 2 for this vocalic alternation). I have assumed that this vowel is underlyingly *e* since *CVCaC* nominal stems with final stress are very common, while *CVCeC* nominal stems with final stress are relatively rare. Thus, in proposing underlying *CVCeC* for segolates, the number of exceptions to zero-beat which must be mark is relatively minimal.

The underlying penultimate vowel in segolate stems can be *i*, *a*, *e*, or *o*, that is, the segolate stems are *CoCeC*, *CiCeC*, *CaCeC*, and *CeCeC*. As noted above, there are forms with identical shpae which are not segolates. The less problematic ones are the few *CVCeC* nouns and adjectives whose last syllable is stress-bearing, resulting in final stress; *tipéš* 'stupid', *ʔilém* 'deaf', *yaxéf* 'barefoot', *šamén* 'fat', *namér* 'tiger', *tevél* 'universe'. It seems reasonable to assume that these forms are exceptional since their number is quite small in comparison with the large number of segolates (which makes up about 25% of all nouns; the largest single nominal class according to Avinery (1976)). In addition, it does not seem that new forms of this type enter the language, while the segolate class is very productive .

The more problematic case is a large group of nouns of the shpae *CoCeC* which exhibits final stress; cf. *bokér* 'cowboy' vs. *bóker* 'morning'. This is actually the vocalic pattern of the Participle of B1; cf. *godél* 'he grows' vs. *gódel* 'size' and *šovér* 'he breaks' vs. *šéver* 'break, fraction'.

I suggest that there are two lexically distinct *CoCeC* shapes, a nominal one, that of segolates, and a non-nominal one, that of Participles. Similar homophony is

found in the shpaes *CiCeC* and *CaCaC*. *CiCeC* is a segolate pattern (*gišer* --> *géšer* 'bridge') as well as the pattern of B4 Past (*gisér* 'he bridged'). *CaCaC* is a nominal pattern (*katáv* 'reporter') as well as the pattern of B1 Past (*katáv* 'he wrote'). The idea is that the final syllable of the Participle *CoCeC* pattern is not zero-beat because Participles are not lexically treated as nouns.

The claim that participles are not lexically nominals requires a detailed discussion of Participles, a rather controversial issue which I am not prepared to take on here. For the purpose of my argument it suffices to mention some of the diverse characteristics of the participle in MH (see Berman (1978) for illustrative morphological and syntactic properties). Syntactically, Participles function as both nouns and verbs; cf. the word *šomér* as a verb in *ha-xatul šomér al ha-xalav* 'the cat guards the milk (the-cat guards on the-milk)' and as a noun in *ha-šomér ha-tov* 'the good guard (the-guard the-good)'. Also morphologically Participles combine nominal and verbal properties. With the exception of B1, Participles do not have an independent vocalic pattern. The vocalic pattern of the B2 Participle is identical to that of the corresponding Past, and the vocalic pattern of B3, B4, and B5 Participle is identical to that of the corresponding Future (see (17) above). But in terms of suffixation, Participles agree with their head nouns in number and gender only, like adjectives, while verbs agree in number gender and person.

This diverse behavior of the Participle has led Ritter (1988) to conclude that Participles are not lexically marked as either nouns or verbs until they enter a syntactic construction which determines their lexical status (a sort of underspeicifcation in lexical categories). Since Participles are not marked as nouns they are exempt from the zero-beat rule, which, as formulated in (27) above, affects nouns only. This is then the reason for the distinction in stress pattern between the

segolate *CóCeC* and the B1 Participle *CoCéC*. The fact that there are B1 participles with no corresponding verbs (*bokér* 'cowboy', *šotér* 'policeman', *soxén* 'agent') stems from the nominal characteristic of participles.

It should be noted that zero-beat is not confined to stems. Feminine nouns and Participles which end in the feminine suffix *-et* exhibit the same stress pattern; *zaméret* 'singer f. (*zamár* 'singer m.'), *rakévet* 'train', *tinóket* 'baby f.' (*tinók* 'baby m.') *goméret* 'she finishes' (*gomér* 'he finishes').

As I have shown, assigning zero-beat on the basis of phonological information is not free of problems. But it is certainly to be favored over the alternative solution of lexical marking for all stems whose last syllable is not a stress-bearing unit. It is not that such lexical marking does not exist; on the contrary, some languages happen to require lexical markers for idiosyncratic properties even at the syntactic level (idioms for instance). The point is that one would not expect lexical marking for such a large and productive group as the segolate nouns; lexical marking should be limited to genuine, unpredictable idiosyncrasies. It is clear that segolates are currently productive because their pattern charactierizes a vast number of nouns, many of which are basic lexical items. Therefore I believe that the phonology of the segolates has been restructured (apart from a few exceptions), such that their behavior is not longer to be treated as exceptional. Otherwise the productivity of the segolates would remain unexplained. The basic way in which they differ from other nouns is that their last vowel is *e*, and on the basis of a rule like that given in (27), such last syllable is not a stress-bearing element.

I thus conclude that segolate nouns do not pose any problem to the analysis of interdigitation proposed above. Since the segolates stems are *CVCVC*, the language

does not contrast between *CCVC* and *CVCC* stems, and therefore the syllabification rules need only derive *CCVC* stems.

An analysis of stress assignment in MH is given in chapter 4 section 1. As this approach to segolate has, to the best of my knowledge, no precedent in the literature, I present in chapter 4 section 2 a phonological account of the vocalic alternation exhibited by segolates and other forms.

4. REDUPLICATION

Major progress in understanding the nature of reduplication was made in Marantz (1982), where it was argued that the appropriate way to analyze this morphological process is by extending the notion of affixation. Reduplication, according to Marantz, is simply affixation of segmentally impoverished CV-skeletal material, followed by copying of the melodic material from the stem. The copied material is then associated with the affixed CV-skeleton in one-to-one fashion, starting from the edge of the affix towards the stem. Segmental material which fails to associate does not receive any phonetic interpretation (or alternatively, is deleted by convention). This is illustrated below by plural formation in Agta, in the derivation of *taktakki* 'legs' from *takki* 'leg':

(28)

Stem		Affixation		Copying		Association
CVCCV	--->	CVCCVCCV	--->	CVCCVCCV	--->	CVCCVCCV
| | | | |		| | | | |		| | | | |		| | | | | | | |
t a k k i		t a k k i		t a k k i		t a k t a k k i
				t a k k i		k i --> ø

Some aspects of Marantz's theory have recently been reconsidered, in Clements (1985b), McCarthy and Prince (forthcoming) and Steriade (1988b). McCarthy and Prince argue that the affixed material is not an arbitrary string of CV-

slots but rather a well defined prosodic unit (mora, syllable, etc.). Association is actually syllabification, since prosodic units do not have segmental position.

Steriade, with McCarthy and Prince, emphasizes the relevance of prosodic structures to reduplication, but provides it a different role in the process. She criticizes the affixation approach, arguing that reduplication is a matter of copying the entire stem including its prosodic structure, followed by syllable readjustment procedures, which may affect constituents like the onset. Moreover, the issue of "transfer" (Clements (1985b)), where length and syllabicity is copied, has been shown to be a natural consequence of Steriade's approach (but see Hayes (1988) for "antitransfer" in Ilokano, where glides are copied as vowels).

In the following discussion I argue that reduplication in MH is very different from that in Agta and other languages. The main distinction is that reduplicated forms in MH are basic stems, just as much so as unreduplicated forms, and not complex forms composed of stem-plus-affix. I will show that reduplicated forms obey all the restrictions independently imposed on simple stems.

4.1. PECULIARITIES OF MODERN HEBREW REDUPLICATION

The peculiarity of MH reduplication, which distinguishes it from the cases that have been dealt within the phonological liturature, stems mainly from the nonconcatenative character of the language's morphology. First, there is no affixation involved in MH reduplication. Second, the copied material is not the stem but rather the root (without any prosodic structure).

Reduplication in other languages typically has some determinate morphological function (e.g. plurality, intensity, diminutive, etc.), just as any other affixation process has. In MH, however, there is no such particular function associated with

reduplication, as it is merely one type of stem formation. Therefore the sequential order of vowels and consonants in reduplicated stems follow the generalization given in (12) above for simple stems. Consequently, reduplicated stems are derived by the same syllabification rules proposed in (13) above, which derive unreduplicated stems. The only difference between reduplicated and unreduplicated stems is in the consonantal root. In unreduplicated forms the root of a base and the root of those forms derived from it are (usually) identical (R_i --> R_i), while reduplicated forms appear to contain an additional subset of the segmental content of the base root (R_i --> R_i+R_j, where R_j is a subset of R_i). Some examples are given in (29) below; notice in particular the structural identity between reduplicated and unreduplicated forms (the latter are given in parenthesis).

(29)

caxak 'he laughed'	*cixkek* 'he giggled'	(*dirben* 'he urged')
xam 'hot'	*xamim* 'warm'	(*taʔim* 'tasty')
xad 'sharp'	*xided* 'he sharpened'	(*gidel* 'he raised')
ʔvir 'air'	*meʔavrer* 'ventilator'	(*mexamcen* 'oxydizer')
mila 'word'	*milmel* 'he humed'	(*dirben* 'he urged')
dal 'poor'	*dilel* 'to dilute'	(*gidel* 'he raised')
	dildel 'to impoverish'	(*dirben* 'he urged')
mar 'bitter'	*hitmarmer* 'he complained'	(*hitʔagref* 'he boxed')
	mirer 'he embittered trns.'	(*gidel* 'he raised')
	mirmer 'he embittered intr.'	(*dirben* 'he urged')
xameš 'five'	*xamšuš* 'freshman student'	(*yalkut* 'bag')

šaxor 'black' *š(a)xarxar* 'blackish'[17] (*samankal* 'assistant director')

The above data show that reduplicated forms in MH are stems as much as non-reduplicated forms are, and therefore there is no reason to believe that affixation is involved. This follows directly from the fact that there is no morphological function associated with reduplication.[18] MH reduplicated forms are derived by interdigitation, which is a by-product of syllabification. The process, which was illustrated in section 2 above, covers the derivation both of unreduplicated as well as reduplicated stems.

There is no morphological property associated with reduplication and there is no affixation involved, but nonetheless it is still possible to refer to it as reduplication, since there is a process of copying, where the copied material is the entire root, out of which only a defineable subset surfaces. Thus, the segmental copying advocated in Marantz (1982) and McCarthy and Prince (forthcoming), as opposed to the copying of stem plus prosodic structure as proposed in Steriade (1988b), is the appropriate approach for MH reduplication.

In some instances copying is predictable on the basis of syllabification rules. In case there are two vowels and two consonants, reduplication is required since syllabification rule (13-3), which links a consonant to the coda of the stem final syllable, is obligatory (as non-initial syllables must be closed). Thus reduplication in *šalal* 'to negate' is obligatory since **šala* would be ill-formed.

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[17] The parenthesized vowel is deleted by a rather opaque (though historically motivated) rule. The synchronic validity of the rule is clear from the form *samankal*, oreginally an acronym, where this rule does not apply.

[18] Empty morphs, i.e., affixes which do not carry any semantic or morphological load, do exist (see Anderson (1988a)), but this is obviously not the case here.

It is, however, not always predictable which portion of the root will surface. In some patterns containing two vowels which are combined with a root containing only two consonants, it may be the last consonant only, or the entire root which is reduplicated. For example, in *kided* (B4) 'he codified' (from *kod* 'code') only the last consonant of the copied root surfaces, while in *nimnem* (B4) 'he took a nap' (from *nam* 'he slept') the entire root surfaces.

The portion of the root which surfaces is predictable in case there are three vowels (in which case the root must be triconsonantal). Then the last two consonants surface, as in *xalašluš* 'weakish' (from *xalaš* 'weak'), since copying of one consonant only would result in an open medial syllable, **xalašuš* (see (12c) above).

Below are the possible reduplicated stems; the first shape in each combination is unreduplicated.

(30)

a. (V,V) & (C_i,C_j)	--->	1.	*C_iVC_jV
	--->	2.	$C_iVC_jVC_j$
	--->	3.	$C_iVC_jC_iVC_j$
b. (V,V) & (C_i,C_j,C_k)	--->	1.	$C_iVC_jVC_k$
	--->	2.	$C_iVC_jC_kVC_k$
	--->	3.	*$C_iVC_jC_kC_jVC_k$
c. (V,V,V) & (C_i,C_j,C_k)	--->	1.	*$C_iVC_jVC_kV$
	--->	2.	*$C_iVC_jVC_kVC_k$
	--->	3.	$C_iVC_jVC_kC_jVC_k$

All the stared shapes except (30b-3) are ill-formed since they violate the restriction that a non-initial syllable must be closed. (30b-3) contains a tri-consonantal cluster,

a situation which tends to be avoided. Despite these generalization, however, it is impossible to predict which shape of reduplication will occur in (30a), or that we will have reduplication at all in (30b). This information must be lexically specified. Additional evidence for the unpredictability is drawn from the existence of alternative forms like *mišeš- mišmeš* 'he felt (by touching)' and *likek - liklek* 'he licked' (where the second form in each pair is identified with non-standard register or child language). The semantically distinct forms *dilel* 'he diluted' - *dildel* 'he impoverished' and *mirer* 'he embittered tr.' - *hitmarmer* 'he became embittered' also demonstrate this point.

I thus conclude that MH reduplication has the following properties:

a. there is no particular morphological function associated with reduplication;

b. there is no affixation involved;

c. copying is often unpredictable, except on a purely lexical basis; and

e. the portion which surfaces is also unpredictable in some cases.

4.2. ON THE THREE SURFACE PATTERNS OF REDUPLICATION

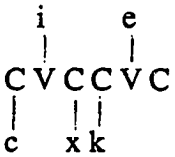
MH exhibits three surface forms of reduplicated stem, distinguished by the portion of the root that surfaces:

(31) a. $C_iC_jC_j$:	*ʔaviv* 'spring'	*bazaz* 'he looted'
	clil 'sound'	*kilel* 'he cursed'
b. $C_iC_jC_iC_j$:	*cilcul* 'ringing'	*milmel* 'he humed'
	taltal 'curl'	*gilgel* 'he roled'
c. $C_iC_jC_kC_jC_k$:	*š(a)xarxar* 'blackish'	*š(a)rafraf* 'stool'[19]
	ʔasafsuf 'crowd'	*š(a)ravrav* 'plumber'

[19] The parentesized *a* is deleted unless preceded by *ʔ* or *x*.

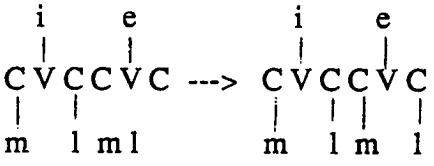
McCarthy (1979, 1981) provides an analysis of similar data from Tiberian Hebrew, where he argues that the three surface patterns of reduplication given above are derived by three different process. As illustrated in (32) below, (31a) is derived by spreading the last consonant to the empty C-slot (assuming a multitiered representation and a CV-skeleton), (31b) is derived by copying the entire root, and (31c) is derived by copying the last syllable of the surface stem.

(32) a. Spreading



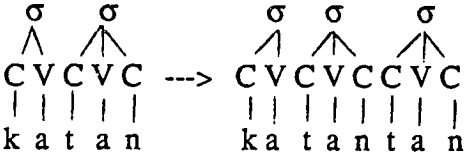
---> *cixkek* 'to giggle'

b. Root Copying



---> *milmel* 'to hum'

c. Final Syllable Copying



---> *k(a)tantan* 'very little'

There is no substantive motivation for providing three diverse accounts of reduplication, however. The three types of reduplication in McCarthy's analysis do not reflect three different morphological functions. Indeed, (31c) is commonly used for diminutives, but this property is also found in forms of type (31a); *kofif* 'little monkey' from *kof* 'monkey', *karir* 'cool' from *kar* 'cold'. Moreover, not all forms of the type (31c) are diminutives; *ʔasafsuf* 'crowd' (*ʔasaf* 'he gathered'), *šravrav*

'plumber'. Occasionally we can identify a tendency to provide the same formal shape for semantically related forms (e.g. the suffix *-on* for types of news document, and B3 for forms derived from colors; see chapter 3 section 3.2.). Nonetheless it is impossible to identify these shapes with any coherent semantic property due to the vast number of forms which do not fall into this category.

I claim that the surface distinction among the three types of reduplication arises due to the different number of vowels assembled with the root consonants. In all three cases the entire root is copied and only later some of the elements are eliminated. This coincides with Steriade's (1988b) approach to reduplication in concatenative languages, where she argues that partial reduplication starts out as complete reduplication.

Prince (1987) argues against the root copying analysis of the forms in (31c), in favor of McCarthy's analysis of final syllable copying illustrated in (32c). He claims that, as observed by McCarthy, nouns with five consonants are not primitive, but rather derived by this particular process of syllable copying. Indeed, there are no basic stems with five consonants in MH, but acronyms, which often adopt existing vocalic patterns (see chapter 1 section 1.1.), are similar on the surface to reduplicated forms; cf. *xalaklak* 'very smooth' with *samankal* 'assistant director' (*sgan* 'vice' ***menahel*** 'president' ***klali*** 'general') and *ramatkal* 'chief of general staff' (***roš*** 'head' ***mate*** 'division' ***klali*** 'general').

Prince notes, parenthetically, that in some cases vowel modification is required, as *o* --> *a* in *šaxor* 'black' - *šxarxar* 'blackish', *a* --> *u* in *xalaš* 'weak' - *xalašluš* 'weakish'. This obscure vowel modification, which cannot be accounted for by any regular phonological rules, actually turns out to be strong support for the unified analysis of root copying I advocate here.

As can be seen from the forms in (33) below, the vocalic patterns found in reduplicated forms with five consonants are found in both unreduplicated and reduplicated forms with three or four consonants. Below are examples of four nominal vocalic patterns, each linked to three, four, and five consonants. In some cases a is added at the beginning of the stem, since additional syllable is required to host all the consonants. The unreduplicated forms appear in the first line of each vocalic pattern.

(33)

	3 consonant	4 consonants	5 consonants
(a, a)	*sabal* 'porter'	*baldar* 'courier'	*samankal* 'assitant director'
	xalal 'space'	*galgal* 'wheel'	*ʔadamdam* 'reddish' (*ʔadom* 'red')
([[a, e], et])	*šaménent* 'cream'	*šalhévet* 'flame'	---
	ganénet 'kindergarten teacher'	*dafdéfet* 'paper pad' (*daf* 'paper')	*xafarféret* 'mole'
(a, u)	*tapuz* 'orange'	*yalkut* 'bag'	---
	barur 'clear'	*sarsur* 'pimp'	*ʔasafsuf* 'crowd'
	---	*xamšuš* 'freshman student' (*xameš* 'five')	---
([[a, o], et])	*bacóret* 'drought'	*malkódet* 'trap'	---
		zanzónet 'little prostitute' (*zona* 'prostitute')	*c(a)marmóret* 'shiver'

Strangely enough, there is an additional vowel in reduplicated forms and acronyms with five consonants. The vowel that appears is *a* and it comes at the beginning (and not at the end) of the form; cf. *(a,u)* in *tapuz* 'orange' vs. *(a,a,u)* in *ʔasafsuf* 'crowd' and *samankal* 'assistant director'. This is not a case of epenthesis but simply a (rather uncommon) strategy for extending the vocalic pattern, similar to the extension of the consonantal root by reduplication (or addition of a medial *y*; see chapter 3 section 3.2.1.). Such a strategy is employed at a pre-lexical stage of the grammar. The crucial evidence that the resulting trivocalic pattern is an existing pattern is that it is found in acronyms.

The forms above provide clear evidence that reduplicated forms of the type (31c) are not derived by final syllable copying but rather by regular root copying. The additional *a* (syllable) is independent of the consonants. The fact that the various vocalic patterns which appear in all types of reduplicated forms in (33) are found in unreduplicated forms is a strong support for the unified analysis of reduplication advocated here. It is thus concluded that all cases of reduplication in MH are derived by the same process.

4.3. A FORMAL ANALYSIS

Within the non-templatic approach I am advocating here, a formal analysis of MH reduplication must account for the following:

a. in the absence of underlying prosodic templates and affixation, what triggers copying?[20]; and

[20] The question is directed at the studies of Marantz (1982) and McCarthy and Prince (forthcoming), as they argue for affixation of unspecified prosodic unit which triggers copying. Steriade (1988b) does not assume any structural trigger for copying.

b. in the absence of directional association, how can we predict which portion of the root will surface?

The fact that copying is not always obligatory forces lexical specification which first triggers copying and second, indicates the portion which should surface. This requirement of lexical specification is not surprising, since, as emphasized earlier, reduplicated forms are stems, and as such they are derived like any other stems. As argued in chapter 1 section 1.2., words must be listed in the lexicon, and this obviously includes reduplicated forms. Not only the portion of the material to be copied must be lexically specified, but also the exact meaning is unpredictable, since reduplication is not linked to any particular semantic or morphological property.

Reduplication in MH is one of the strategies for extending the lexical inventory of the language, and therefore a structural trigger for copying, like the CV-affix in Agta, is not a necessary condition. Copying is utilized in order to form a new, yet related stem. This claim is different from the one made in Bat-El (1984), where, within the CV-theory, it was argued that copying is triggered by the presence of empty C-slot(s) left over after left to right association. The mechanism argued for in that work is illustrated below:

(34)

Association left to right	Copying	Association edge to stem	
C i C C e C	C i C C e C	C i C C e C	
| | |	| | |	| | | |	
c x k	c x k	c x k k	*cixkek* 'he giggled'
	c x k	c x --> ø	

The inadequacy of this position lies not only in the redundancy of positing underlying prosodic templates, argued for in section 1 above, but also in the

unmotivated distinction between [CiCeC] and [CiCCeC]. Within the CV-theory, the distinction between, e.g., *dilel* 'he diluted' and *dildel* 'he impoverished' (both (B4) forms), stems from the presence of distinct templates, [CiCeC] vs. [CiCCeC] respectively. Similarly, the fact that we have *kicec* 'he chopped' and not **kickec* must be attributed to the selection of a particular template, [CiCeC]. There is, however, no independent motivation for distinguishing between the two templates, since such a distinction is not significant for any other aspect of the grammar, and it is obviously not the case that the difference in template is itself responsible for the semantic distinction.

The templatic approach promoted in McCarthy and Prince (forthcoming) provides an adequate solution to this problem. There it is proposed that both *CiCeC* and *CiCCeC* stems have the same disyllabic template, where the initial syllable can be either open or closed[21]. In that case the distinction between *CiCeC* and *CiCCeC* stems must be lexical.

Quite a few reduplicated forms are orphans, i.e., they do not have wieghtunreduplicated counterparts. Examples include forms like *sixsex* 'he instigated', *cifcef* 'he whistled', *gimgem* 'he stammered', *xilel* 'he played the flute', *sinen* 'he filtered', *basis* 'base', and *tamrur* 'post-sign'. This situation is not surprising, as reduplication does not stand for any particular morphological category. Since there are orphan stems in the lexicon, i.e., stems which have no related form with the same root, it is to be expected that some of them would be reduplicated, as reduplicated forms are listed. In addition, there are reduplicated forms which do not have an unreduplicated counterpart but which do have another

[21] The original proposal as made by McCarthy and Prince is that the initial syllable can be either mono- or bimoraic. But since in MH there is no weight distinction (i.e. *CV* and *CVC* are both monomoraic), the interpretation here is open vs. closed syllable.

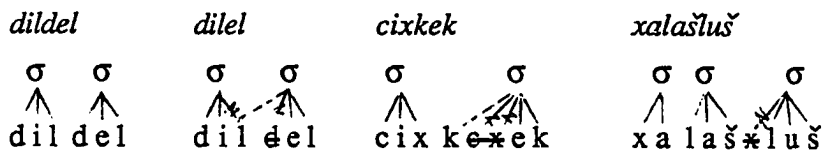
related reduplicated form; *clil* 'sound' - *cilcel* 'he rang', *blil* 'mixture' - *bilbul* 'confusion'.

It is clear that the root in *clil* and *cilcel* is *(c,l)*, but there is no independent evidence that the root in *sixsex* and *xilel* is *(s,x)* and *(x,l)* respectively, as there is no pattern alternation in the language to conform this. It seems, however, that native speakers might well identify these as reduplicated forms, since reduplication is rather common in the language. This, however, is not a necessary consequence of my analysis; the root *(x,l,l)* would indeed violates the Obligatory Contour Principle, which might suggest that it should be derived from other form, but as will be shown in chapter 3 section 1.1.1. the Obligatory Contour Principle does not hold for MH roots.

I argue below that copying precedes syllabification, as it is utilized to create new roots from existing ones. But a root, as understood in this work, is not an independent unit but rather a phonologically defined subset of a stem. It has a semantic correlate, which is contingent upon the stem(s) it appears in. Thus given a stem, the root can be extracted, as shown in chapter 3 section 3.2. below, and then reduplicated.

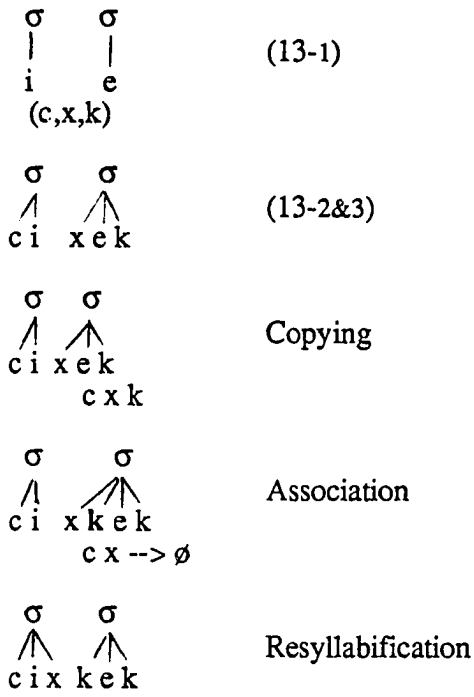
The only process particular to reduplication is root copying, since association follows the general syllabification rules in the language. Association obviously follows copying. If we assume that the entire complex root is syllabified and that then some portion of it is eliminated (i.e., first copying, second complete syllabification, and third elimination), we reach a dead end in the absence of some principled criterion for eliminating the consonants. This can be seen from the examples below (the eliminated consonants are struck through).

(35)



The mechanism of copying and syllabification of the entire complex root followed by elimination does not seem to be consistently carried out, when we observe the various outputs in (35). Also the mechanism of syllabification of the root followed by copying and syllabification of the copied material does not seem appropriate since it requires us to syllabify the copied material in strange positions (for instance between a syllabified onset and its vowel) and later resyllabify. This undesirable procedure is illustrated below:

(36) *cixkek* 'to giggle' (*caxak* 'to laugh')



I therefore propose that the first stage is actually to extend the root by completely copying it, thus providing as the input to syllabification a complex root (R_i+R_j). From this stage the syllabification rules apply, placing the consonants in the appropriate position, where the output is subject to the Order Preservation Constraint, formulated in (10) above. This reflects the identical formal status of reduplicated and unreduplicated stems. The root is idiosyncratically expanded to provide a similar but not identical root for a new word. That is, reduplication is not a predictable process since one cannot foresee which stem will have a related reduplicated stem. But it is certainly a regular process once it is invoked.

Below I illustrate the syllabification, and consequently the interdigitation, of some reduplicated roots to make it clear that this is identical to the syllabification of unreduplicated roots (see section 2.2.1. above). The impact of the Order Preservation Constraint in determining the approprite output will be discussed further below.

(37)

	xalašluš	*cixkek*	*dilel*	*dildel*	
	σ σ σ | | | a a u	σ σ | | i e	σ σ | | i e	σ σ | | i e	(13-1)
	(x,l,š,x,l,š)	(c,x,k,c,x,k)	(d,l,d,l)	(d,l,d,l)	
	σ σ σ /| /| /| x a l a l u	σ σ /| /| c i k e	σ σ /| /| d i l e	σ σ /| /| d i d e	(13-2)
	σ σ σ /| /| /\ x a l a l uš	σ σ /| /\ c i k e k	σ σ /| /\ d i l e l	σ σ /| /\ d i d e l	(13-3)
	σ σ σ /| /\ /\ x a l aš l uš	σ σ /\ /\ c i x k e k		σ σ /\ /\ d i l d e l	(13-4)

The problem which immediately emerges from the syllabification illustrated in (37) above is to provide a principled account for the portion of the root which associates. For example, why we get *cixkek* and not **cixkex* or **cicxek*. As I show below, such forms do not appear since they violate the Order Preservation Constraint, and additonal restriction to be suggested below. I do this, in (38) below, by justifying the well-formedness and ill-formedness of the four possible outputs, which correspond in Marantz's theory, to the possibilities that emerge from the combining prefixation / suffixation and left to right / right to left association. I also account for unordered association. I do not considere here reduplicated strings in which the elements are reordered, such as **(c,x,k,k,x)* as a derivative of *(c,x,k)*, as this is immediately ruled out by the Order Preservation Constraint.

Order is defined on the root for each element (in bold). Thus, in the root *(c,x,k)* the order is $c<x$, $x>c$ & $x<k$, $k>x$. Every element in the output string must conform to all the orders so defined. Therefore a reduplicated string is ill-formed in case one of the elements does not fonform to the required ordering. There is, however, one case ((38a-3) and (38b-3)) where the all defined orderes are found, yet the string is ill-formed. I will discuss this matter further below. I use the following notations: √ stands for a required ordering relation found in the output string, ° stands for a required ordering relation not found in the output string, √- stands for a required ordering relation which is non-adjacent in the output string, and * stands for an ill-formed string of consonants. L-R means left to right association, R-L means right to left association, and UO means unordered association. Subscripts are given for reference only.

(38) a. root: (g,l); order: g<l, l>g

1. *g_1 l g_2 (suffix; L-R): $\sqrt{}g_1<l$, $\sqrt{}l>g_1$, $^{\circ}g_2<l$
2. *l_1 g l_2 (prefix; R-L): $^{\circ}l_1>g$, $\sqrt{}g<l_2$, $\sqrt{}l_2>g$
3. *g_1 g_2 l (prefix; L-R): $\sqrt{}^{-}g_1<l$, $\sqrt{}g_2<l$, $\sqrt{}l>g_2$
4. g l_1 l_2 (suffix; R-L): $\sqrt{}g<l_1$, $\sqrt{}l_1>g$, $\sqrt{}^{-}l_2>g$

b. root: (c,x,k); order: c<x, x>c & x<k, k>x

1. *c_1 x k c_2 (suffix; L-R): $\sqrt{}c_1<x$, $\sqrt{}x>c_1$ & $\sqrt{}x<k$, $\sqrt{}k>x$, $^{\circ}c_2<x$
2. *k_1 c x k_2 (prefix; R-L): $^{\circ}k_1>x$, $\sqrt{}c<x$, $\sqrt{}x>c$ & $\sqrt{}x<k_2$, $\sqrt{}k_2>x$
3. *c_1 c_2 x k (prefix; L-R): $\sqrt{}^{-}c_1<x$, $\sqrt{}c_2<x$, $\sqrt{}x>c_2$ & $\sqrt{}x<k$, $\sqrt{}k>x$
4. c x k_1 k_2 (suffix; R-L): $\sqrt{}c<x$, $\sqrt{}x>c$ & $\sqrt{}x<k_1$, $\sqrt{}k_1>x$, $\sqrt{}^{-}k_2>x$
5. *c x_1 k x_2 (suffix; UO): $\sqrt{}c<x_1$, $\sqrt{}x_1>c$ & $\sqrt{}x_1<k$, $\sqrt{}k>x_1$, $^{\circ}x_2<k$
6. *x_1 c x_2 k (prefix; UO): $^{\circ}x_1>c$, $\sqrt{}x_1<k$, $\sqrt{}c<x_2$, $\sqrt{}x_2>c$ & $\sqrt{}x_2<k$, $\sqrt{}k>x_2$

As observed in Marantz (1982) the copied material is usually associated from the edge towards the stem. Within the present account, there is no need to stipulate any direction, since the Order Preservation Constraint rules out strings which could be viewed as association from the stem towards the edge. This can be seen from (38a-1&2) and (38b-1&2), where one of the required orders is not found in the reduplicated string and therefore the string is ill-formed. Similarly, the (unordered) association of the middle consonant in (38b-5&6) is ruled out by the Order Preservation Constraint due to the absence of one of the required orders.

Notice, however, that **ggl* (38a-3) and **cicxek* (38b-3) are ill-formed although the required ordering relations are respected by all the elements, just as much as in the well-formed strings *gll* (38a-4) and *cixkek* (38b-4). This distinction

is made on language specific grounds, just like the direction of affixation (prefixation vs. suffixation) in Marantz's analysis.

The distinction between (38a-3) vs. (38a-4) and (38b-3) vs. (38b-4), repeated in (39) below, is in one ordering relation (in bold) in which the elements over which the order is defined are not adjacent. In the ill-formed strings in (39a-3) and (39b-3) the non-adjacency is at the beginning of the string, and in the well-formed strings in (39a-4) and (39b-4) it is at the end of the string.

(39) a. root: (g,l); order: g<l, l>g

3. *g_1 g_2 l (prefix; L-R) - $\sqrt{}$-**g_1<l**, $\sqrt{}$$g_2$<l, $\sqrt{}$l>g_2

4. g l_1 l_2 (suffix; R-L) - $\sqrt{}$g<l_1, $\sqrt{}$$l_1$>g, $\sqrt{}$-**l_2>g**

b. root: (c,x,k); order: c<x, x>c & x<k, k>x

3. *c_1 c_2 x k (prefix L-R) - $\sqrt{}$-**c_1<x**, $\sqrt{}$$c_2$<x, $\sqrt{}$x>c_2 & $\sqrt{}$x<k, $\sqrt{}$k>x

4. c x k_1 k_2 (suffix R-L) - $\sqrt{}$c<x, $\sqrt{}$x>c & $\sqrt{}$x<k_1, $\sqrt{}$$k_1$>x, $\sqrt{}$-**k_2>x**

The ill-formed strings correspond to prefixation and left to right association in Marantz's analysis. But notice that reduplication in MH is neither prefixing nor suffixing. I argued earlier that reduplication in MH is root copying, which applies before syllabification (i.e. interdigitation). Therefore there is no sense in which the root is copied in one direction rahter than the other, since in either case the ouput is the same: R_i+R_i.

Recall that order is defined between two adjacent elements, and therefore it should be met in the output string between two adjacent elements as well. Thus, to account for the well-formedness of (39a-4) and (39b-4), and at the same time to exclude (39a-3) and (39b-3), it is necessary to allow the first element of the copied root to be non-adjacent to the element with which it is in an ordering relation.

(40) Non-adjacency Permission

Given a set A with an underlying ordering relation x α order y over n elements, and a set A' of n+m element, where every element in A' is also an element in A

If y is the n+1 element in A', than y must not be adjacent to x.

In (g,l_1,l_2) (root: (g,l), order: $g<l$, $l>g$) and in (c,x,k_1,k_2) (root: (c,x,k), order: $c<x$, $x>c$ & $x<k$, $k>x$), l_2 and k_2 respectively are the n+1 elements in the reduplicated roots, and therefore they must not be adjacent to g and x respectively. In $*(g,g,l)$ and $*(c,c,x,k)$ it is the first element in the reduplicated root which is not adjacent to the element with which it is ordered, and therefore these forms are ruled out. Thus, the Order Preservation Constraint is responsible for the appropriate ordering relations and, by definition, for adjacency, and the Non-adjacency Permition allows the n+1 element in the reduplicated root to be non-adjacent to the element with which it is ordered.

The same restrictions hold for reduplicated strings where two consonants surface in the copied portion. Reduplication of the root (x,l,k), whose order is $x<l$, $l>x$ & $l<k$, $k>l$, cannot yield $*(x_1,l,k_1,x_2,k_2)$, since k_2, which is not adjacent to l, is the n+2 element in the string rather than the n+1 element. The Non-adjacency Permission allows only the n+1 element to be non-adjacent to the element with which it is ordered. The reason $*(x_1,l_1,k,x_2,l_2)$ is ill-formed is because l_2 does not meet the required order $l<k$. Thus, the only possible reduplicated string is (x,l_1,k_1,l_2,k_2), where l_2 is the n+1 element in the string and therefore it is allowed to be non-adjacent to x.

When the entire root surfaces in the copied portion, as in (g,l,g,l), all ordering relations are met.

(41) root: (g,l); order: g<l, l>g

$g_1\ l_1\ g_2\ l_2$ - $\sqrt{g_1}<l_1, \sqrt{l_1}>g_1, \sqrt{g_2}<l_2, \sqrt{l_2}>g_2$

The n+1 element in the string, g_2, is not ordered with respect to a preceding element, and therefore the Non-adjacency Permission is not relevant here.

This approach to reduplication in MH reflects its nature as stem formation. Reduplicated stems are formed via syllabification and they obey the Order Preservation Constraint just like unreduplicated stems. Since the root of unreduplicated stems is R_n and that of reduplicated stem is R_{n+m}, the Non-adjacency Permition is relevant only for reduplicated stems as there is no n+1 element in the nonreduplicated ones.

A final note should be made with regard to some forms whose first and second consonants are identical; *mimen* 'he financed', *sisgen* 'he variegated', *nanas* 'dwarf' and *šušbin* 'best man', In Bat-El (1984), where the CV-theory was assumed, I argued that such forms result from reduplication, where the direction of root linking is exceptionally from right to left instead of from left to right. The mechanism argued for in that worked is illustrated below for the verb *mimen* 'he financed' (exceptional linking is marked with °).

(42)

Association °right to left	Copying	Association left to right
C i C e C	C i C e C	C i C e C
| |	| |	| | |
m n	m n	m m n
	mn	n-->ø

In terms of the analysis proposed above, such forms would require to allow the Non-adjacency Permission to be exceptionally stated with respect to the first

element of a string of n elements. At this state of research I do not believe that these types of forms are derived by reduplication. The basic root of *mimen* 'he financed' is *(m,m,n)*, where no reduplication is involved; this root has been extracted as it is from the noun *mamon* 'money' (see chapter 3 section 3.2.). As I will argue in chapter 3 section 1, MH roots do not respect the Obligatory Contour Principle and therefore roots like *(m,m,n)* are not ruled out.

5. CONCLUSION

I have shown in this chapter that not every nonconcatenative morphological system requires underlying specification of prosodic templates. I argued that such a specification is morphologically unmotivated and phonologically redundant in MH. Morphologically, the prosodic templates are unmotivated because (i) they do not remain constant throughout the voice/aspect paradigm (in two out of the five binyanim), and therefore they cannot signify a particular binyan, and (ii) the vocalic pattern simultaneously signifies the binyan and the aspect categories.

Phonologically, the sequential order of vowels and consonants in MH, which has been previously attributed to underlying prosodic templates, can be properly derived by syllabification rules. I proposed a set of syllabification rules which not only build syllabic strucutres but also interdigitate the vocalic pattern and the consonantal root to form a stem. Interdigitation in MH is an instance of a morphological operation which is governed by a phonological process.

In the absence of directional associatiton I propsed the Order Preservation Constraint, which ensures that an ordering relation defined in the underlying representation is maintained in the output form. I showed that reduplicated forms behave like stems with respect to this constraint. This coincides with the absence of

morphological or semantic function conveyed by reduplication, and the absence of affixation involved in the process. Reduplicated stems are just like unreduplicated ones, and therefore we expect them to obey all rules and restrictions independently required in the language.

6. APPENDIX: A NON-TEMPLATIC ANALYSIS OF ARABIC VERBS

In this section I wish to show that in principle it is at least marginally possible to eliminate morphological templates even in Classical Arabic. I do, however, leave open the question of how far one would like to push this account.

In the non-templatic analysis of stem structure developed in this chapter, I have argued that in MH underlying representations should not be specified for prosodic templates, as this information is properly derived by syllabification rules. Redundancy serves here as only a minor criterion in dispensing with prosodic templates. The more crucial argument is that the prosodic templates do not have a morphological function in MH.

McCarthy (1981) argues that binyanim in Classical Arabic are identified by their prosodic templates, in addition to affixes in some cases; "...one aspect of the specification of any given binyan in the grammar is an indication of the prosodic template..." (p.387). This statement is also supported by the fact that a given prosodic template is preserved throughout the voice/aspect paradigm (see section 1).

The syllabic template which McCarthy and Prince (forthcoming) propose as a replacement for the CV-templates, requires an additonal apparatus in some binyanim. The distinction between Classical Arabic B2 and B3, whose templates are [CVCCVC] and [CVVCVC] respectively, "is accounted for by rules of somewhat lesser generality", since the syllabic template does not distinguish

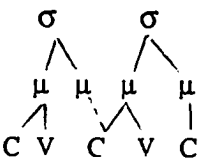
between *CVC* and *CVV* syllables, as they are both represented as bimoraic. Exactly the same distinction is found between B5 and B6, whose templates are [CV+CVCCVC] and [CV+CVVCVC] respectively.

A careful observation of the inflectional paradigm given in McCarthy (1981:385) reveals that it is possible to derive most of the binyanim by rules, as much as the distinction between B2 and B3 is derived by a rule. Verbal stems in Classical Arabic are restricted to two syllables, which within the non-templatic approach would correspond to an underlying vocalic pattern with two vowels. A disyllabic stem, *CV.CVC*, is formed by syllabification rules similar to those proposed above for MH. Recall that these syllabification rules not only derive the syllable structure but also interdigitate. Disregarding the quality of the vowels, I introduce below the rules which in principle can derive the verbal stems out of *CV.CVC* base (where *CVC* is bimoraic), assuming that a given derivational category can be specified for one or more of these rules.

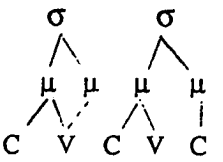
(43) a. Mora Insertion: Insert a mora between the two syllables

$$\sigma_{\mu}\ \sigma_{\mu\mu} \text{ ---> } \sigma_{\mu\mu}\ \sigma_{\mu\mu}$$

b. Consonant Spread: Link the initial consonant of the following syllables to the empty mora



c. Vowel Spread: Link the vowel to the empty mora



d. CV-Metathesis: Metathesize CV in a light syllable when preceded by an unsyllabified consonant[22]

C' (C) C V $_{\sigma}$]
1 2 3 4 ---> 1 2 4 3

e. *t*-Metathesis: Metathesize the initial *t* with the following consonant in a light syllable

t C...σ_{μ}]
1 2 ---> 2 1

f. Reduplication: Suffix a mora, copy the stem, and (re)syllabify[23]

$C_iVC_jVC_k$ ---> $C_iVC_jVC_kVC_k$

g. Vowel Deletion: Delete a vowel in a light syllable when preceded by two syllables the first of which is light

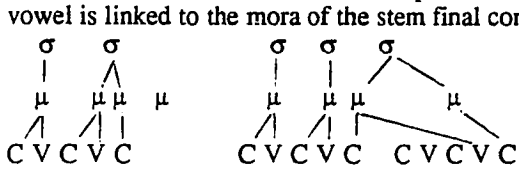
V ---> ø / σ_{μ} σ __ $_{\mu}$]

I illustrate below the application of the above rules in eleven out of fifteen binyanim. Given two vowels and three consonants, syllabification rules yield *CVCVC* (σ_{μ} $\sigma_{\mu\mu}$), which provides the phonological base for all forms.

B1: CVCVC		(no rules required)
B2: CVCCVC	(43a)	Mora Insertion: ---> CV $^{\mu}$CVC
	(43b)	Consonant Spread: ---> CVCCVC
B3: CVVCVC	(43a)	Mora Insertion: ---> CV $^{\mu}$CVC
	(43c)	Vowel Spread: ---> CVVCVC

[22] This rule applies in B4, since *ʔ* cannot be the first element in a complex onset, and in B10, since an onset containing three or more consonants is impermissible.

[23] The final consonant in the copied material is linked to the new mora, and the preceding vowel is linked to the mora of the stem final conosonant.



B4: ʔVCCVC Prefixation: *ʔ-* : ---> ʔCVCVC

(43d) CV-Metathesis: ---> ʔVCCVC

B5: tVCVCCVC Prefixation: *tV-* : ---> tVCVCVC

(43a) Mora Insertion: ---> tVCV $^{\mu}$CVC

(43b) Consonant Spread: ---> tVCVCCVC

B6: tVCVCCVC Prefixation: *tV-* : ---> tVCVCVC

(43a) Mora Insertion: --->tVCV $^{\mu}$ CVC

(43c) Vowel Spread: ---> tVCVVCVC

B7: nCVCVC Prefixation: *n-* : ---> nCVCVC

(no rules required)

B8: CtVCVC: Prefixation: *t-* : ---> tCVCVC

(43e) *t*-Metathesis: ---> CtVCVC

B9: $C_iC_jVC_kVC_k$ (43f) Reduplication: ---> $C_iVC_jVC_kVC_k$

(43g) Vowel Deletion ---> $C_i\emptyset C_jVC_kVC_k$

B10: stVCCVC Prefixation: *st-* : ---> stCVCVC

(43d) CV-Metathesis: ---> stVCCVC

B11: $CCVVC_iVC_i$ (43f) Reduplication: ---> $C_iVC_jVC_kVC_k$

(43g) Vowel Deletion: ---> $C_i\emptyset C_jVC_kVC_k$

(43a) Mora Insertion: ---> $C_iC_jV\ ^{\mu}C_kVC_k$

(43c) Vowel Spread: ---> $C_iC_jVVC_kVC_k$

This is a possible account, and I do not intend to pursue this line, as the point has been made; the verbal system of Classical Arabic is workable without underlying prosodic structure. Nonetheless, it is not that obvious that this account

is really any different from giving the prosodic template directly, as every binyan needs to be specified for a set of rules. Notice that in order to eliminate underlying prosodic structures it is necessary to provide rules that alter the syllabic structures. The cost is in the following rules: Mora Insertion (43a)[24], CV-Metathesis (43d), and Vowel Deletion (43g). Although some of these rules are independently motivated (e.g. Vowel Deletion), or phonologically motivated (e.g. CV-Metathesis), the templatic analysis does not require them. Thus it seems that reducing the complexity of underlying representation can be done only at the cost of a complex rule system. The rest of the rules, Consonant Spread (43b), Vowel Spread (43c), *t*-Metathesis (43e), and Reduplication (43f), are required in the templatic account as well.

The last four binaynim, CC_iVwC_iVC (B12), CCVwwVC (B13), $CCVnC_iVC_i$ (B13), and CCVnCVy (B15) cannot be derived by these rules due to the infixes. Forms in these binyanim are rarely found, however, and it is questionable whether they should be considered as productive derivational categories. Wright (1959) provides rules which account for the affixes and the syllabic structure of all the binyanim, but when the last four binyanim are under consideration, only examples are listed.

As for the voice/aspect relation within each binyan, it is not necessary to start form the first step. The notion of transfer (see section 3.1.) introduced in Clements (1985b), which is independently required in the language, as shown in Hammond (1987) in the analysis of broken plurals, can derive the Imperfective and Participle from the Perfect. In Clements' analysis the reduplicated affix, which consists of prosodic elements, is placed parallel to the stem, and then it is linked to the prosodic

[24] Our grammar should allow a rule like Mora Insertion as it seems to be necessary to form the exactive number in Ivatan (Hidalgo and Hidalgo (1971), a Philippine langauge spoken in Batanes; *chitu* 'dog' - *chitu:* 'only one dog', *atep* 'roof' - *ate:p* 'only one roof', *kavahayan* 'town' - *kavahaya:n* 'only one town'.

unit of the stem. The segmental elements are then transfered to the affix, where a segment linked to a certain prosodic element in the stem (x---C_{stem}) must be linked in the affix to the associated prosodic element (*x*---C_{stem}---C_{affix}---*x*).

In deriving voice/aspect relations in Classical Arabic we must assume that the prosodic strucutre is transfered as well, as in (44a) below. Then the vocalic pattern of the required derivational category is linked to the syllables in the copied material (44b). At the end the segmental material is copied, preserving the order given in the base (44c).

(44) a. Transfering prosodic structure

```
C V C V C C V C
| | | | | | | |
C V C V C C V C
| | | | \/ | |
t a k a t a b
```

b. Linking the vocalic pattern

```
  u   u     i
  |   |     |
C V C V C C V C
| | | | | | | |
C V C V C C V C
| | | | \/ | |
t a k a t a b
```

c. Transfering the segmental material

```
t u k u t i b        tukuttib 'B5 Perfective Passive'
| | | | /\ | |
C V C V C C V C
| | | | | | | |
C V C V C C V C
| | | | \/ | |
t a k a t a b        takattib 'B5 Perfective Active'
```

As in Clements' analysis of reduplication, the relation in syllabicity is preserved in the transferred material. Thus, since *t* is doubly-linked in the base form, it must be doubly-linked in the derived form as well.

CHAPTER 3

ON THE NONEXISTENCE OF MORPHOLOGICAL STRUCTURE

In this chapter I argue that morphological rules do not create word internal structure, and therefore only phonological strucutre is available for subsequent processes. This view disagrees with previous studies in phonology and morphology.

Within the classical generative model of phonology developed in Chomsky and Halle (1968), there is no direct interaction between morphological and phonological processes. There are two separate ordered blocks, the morphology and the phonology. The morphological rules, which apply first, create structure, some of which (those which are relevant for the phonology) are characterized by various types of junctures (boundary elements; =, +, #) which can be referred to and even manipulated by subsequent phonological rules.

The theory of Lexical Phonology, developed in Kiparsky (1982) and Mohanan (1982), eliminates the proliferation of different boundaries, in favor of one type of morphological bracket, assigned by application of each morphological rule. The brackets must be removed at a certain stage of the derivation (by Bracket Erasure), but rules which apply before the brackets are removed can refer to the morphological structure encoded by brackets. In section 2 I evaluate this approach, arguing that with the appropriate basic assumptions the theory can dispense with brackets.

The multitiered representation advocated in McCarthy's (1981, 1986) work on Semitic morphology is an alternative version of these brackets. Each formative is

associated on a distinct melodic tier, and therefore the multitiered representation encodes internal morphological structure. Here again, word internal structure is eliminated at a certain stage by conflating the segmental tiers (Tier Conflation), but rules which apply before the tiers are conflated have access to word internal structure. In section 1 I review the arguments in favor of the morphologically multitiered representation, and propose an alternative phonological account.

Following Anderson's (forthcoming) theory of A-Morphous Morphology, I argue that word internal structure does not exist beyond word formation. Brackets are erased or tiers are conflated in the course of derivation, such that subsequent processes cannot refer to internal morphological structure.

The crucial evidence is drawn from the analysis of feminine suffixation in MH, as presented in section 3.1. I show that when information about word internal structure seems to be necessary, phonological form is used. This is obvious in this particular case since the unit identified on the basis of phonological information is not identical to the shape of the underlying morphological form.

Additional support for the use of phonological information to identify, or in this case create, a morphological unit is drawn from the process of Extraction, discussed in section 3.2. I argue that in order to create a consonantal root out of a fully specified form a string of phonological elements is extracted, i.e., the consonants, and not a morphological unit, i.e. a root.

Compelling evidence for the absence of morphological structure has been introduced in Cohn (1989), who shows that in Indonesian there is no correspondence between morphological structure and the structure referred to by phoonological rules. Cohn proposes a "rebracketing" process, but under the view

advocated here it is simply "bracketing", since there are no moprhological brackets to "rebracket".

The use of phonological shape to identify morphological components can thus be extended to other cases, where the phonological and the morphological forms are identical. The fact that in many cases the phonological and the morphological forms are identical has led to the belief that the word internal structure is available. But at the moment there is positive evidence that phonological information is used to identify morphological form, word internal structure is superfluous.

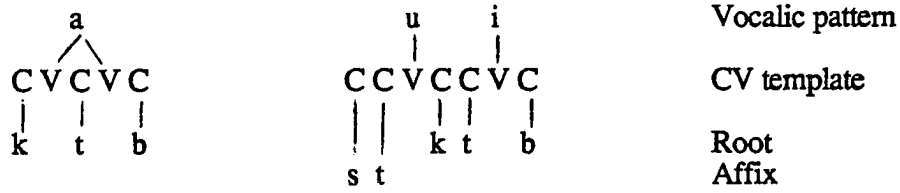
1. TIER SEGREGATION (Nonconcatenative Morphology)

In this section I review some of McCarthy's (1981, 1986) arguments for morphologically motivated tier segregation, with an emphasis on the Semitic consonant co-occurrence restrictions discussed in Greenberg (195). I suggest that research in the feature geometry may reveal that there is no need for morphologically motivated tier segregation, as the same effect can be achieved by the structural organization of features.

1.1. MORPHOLOGICALLY MOTIVATED TIER SEGREGATION

As introduced in chapter 2, McCarthy (1981, 1986) argues that the distinction between material belonging to one formative and that belonging to another is structurally encoded by multitiered representation, in which each formative appears on a separate tier. The vocalic pattern (indicating voice/aspect), the consonantal root (bearing a basic meaning), and the affixes appear on distinct segmental tiers, which are all linked to the CV-template.

(1) *katab* B1 Perf. Pass. *stuktib* B10 Perf. Pass.



This approach to morphology has been adapted from the Autosegmental phonological theory developed in Goldsmith (1976), where features appear on distinct tiers, so as to allow long distance processes like vowel harmony and nasal spreading, and many-to-one associations among components of phonological representations, such as appear to be necessary to describe contour tones. The basic principles of this theory are that (i) the autosegmental elements are linked to their bearing units in a one-to-one fashion from left to right, and (ii) association lines do not cross.

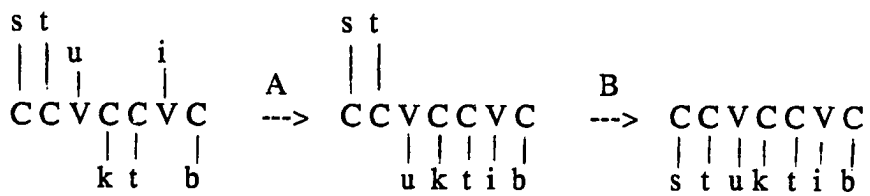
The multitiered representation in (1) is derived by the same principles. The melodic elements are linked to the CV-skeleton one-to-one from left to right, such that the association lines do not cross. Although association is one-to-one, it is possible to derive many-to-one association in case the number of the positions on the CV-skeleton is larger than the number of the segmental elements; in this case the last segmental element spreads to the empty slot, as it is the case with the *a* in *katab*.

The major difference between the Autosegmental phonological theory and the Nonconcatenative morphological theory is that the former has phonological motivation for the multitiered representation, while the latter is based on morphological motivation. In a language with vowel harmony vowels and consonants may appear on distinct melodic tiers such that the consonants will not block spreading, while in Semitic languages vowels and consonants appear on

distinct tiers primarily because they are distinct morphological units. Vowels and consonants of the same formative, for instance those of the MH suffix *-ti* in *halaxti* 'I went', appear on the same segmental tier.

The multitiered representation must, however, be eliminated at a later stage, where phonological rules refer to a single segmental tier which includes both vowels and consonants. It is thus suggested in McCarthy (1986) that a process of Tier Conflation linearizes the multitiered representation into a single melodic tier. As show in (2) below, Tier Conflation applies twice; first the vocalic and the consonantal tier are linearized to form a stem (A), and then the affix and the stem are linearized to form a word (B).

(2)



Crucial to the present discussion is that tier segregation encodes word internal structure, and therefore subsequent rules which apply beofre Tier Conflation can refer to morphological structure. When Tier Conflation applies morphemic distinctions are removed.

1.1.1. GREENBERG'S CO-OCCURENCE RESTRICTIONS

One of McCarthy's arguments to support the morphologically motivated tier segregation is based on the co-occurrence restrictions on Semitic root consonants. Greenberg (1950) provides a typology of the possible consonants which may co-occur within a Semitic root, and proposed that the following restrictions hold:

(3) In a $C_1C_2C_3$ root

a. C_1 and C_2 cannot be (i) identical *(m,m,n)

or (ii) homorganic *(t,d,r)

b. C_2 and C_3 can be (i) identical (g,r,r)

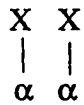
but not (ii) homorganic *(ʔ,t,d)

c. C_1 and C_3 are rarely identical ?(š,r,š)

Out of these restrictions, only (3ai) and (3bi) received theoretical interpretation in McCarthy (1981). The absence of non-final adjacent identical consonants (3ai) is accounted for by the Obligatory Contour Principle. The apparent violation of the Obligatory Contour Principle in final position (3bi), is interpreted as spreading.

The Obligatory Contour Principle, as first proposed in Leben (1973) for tonal phonology, prohibits sequences of adjacent identical tones. McCarthy (1981, 1986) extends this constraint to segmental phonology, where it corresponds to a prohibition against adjacent identical (auto)segments. The structure in (4b) below violates the Obligatory Contour Principle, and is thus ruled out, while the structure in (4a) is permissible.[1]

(4) a.

b. 

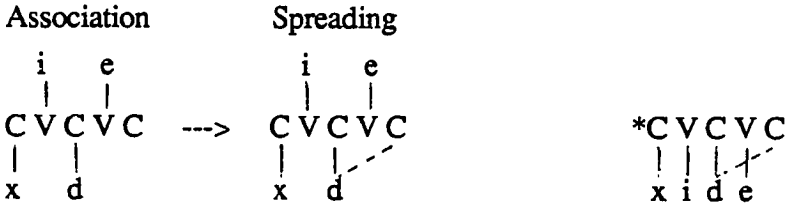
The restriction in (3ai), which forbids adjacent identical segments (in non-final position), has been argued by McCarthy to be due to the Obligatory Contour

[1] In the face of evidence that it can be violated (see Odden (1986) and discussion in chapter 4 section 3 below), the Obligatory Contour Principle cannot be said to hold as a universal constraint. I thus follow Hayes' (1986) assumption that the Obligatory Contour Principle is a statement of markedness. (4b) is often found across boundaries, and it is commonly referred to as "fake" geminate, as opposed to the "true" geminate in (4a).

Principle. But if vowels and consonants appear on the same tier, the root consonants cannot be adjacent, as they are obstructed by vowels. Therefore, the fact that the Obligatory Contour Principle is respected by the root consonants has led McCarthy to argue that at the stage it is in force, vowels and consonants appear on separate melodic tiers, such that the root consonants are adjacent.

Two adjacent identical consonants are, however, possible in stem final position (3bi). This is accounted for by spreading, where the last root consonant spreads to the empty C-slot left after one-to-one association has proceeded as far as it can. The process is illustrated below for the MH word *xided* 'he sharpened':

(5)



Here again, the last two C-slots, which are linked to the same segment, are not adjacent, as they are obstructed by a V-slot. Yet, the consonant can spread without creating crossing lines since, as argued by McCarthy, vowels and consonants appear on separate tiers. Notice that the output of spreading in (5) respects the Obligatory Contour Principle, as there is only one *d*, which is doubly-linked.

McCarthy thus concludes that morphologically motivated tier segregation is essential to account for reduplication and the co-occurrence restrictions found in Semitic languages. It is important to note, however, that as stated, the Obligatory Contour Principle does not account for the absence of adjacent homorganic consonants. For example, as observed by Greenberg, there is only one consonantal root with adjacent *b* and *m*; otherwise labials cannot co-occur next to each other.

Similarly, there are only three cases of adjacent *t* and *d*, and no single instance of adjacent *θ* and *ð*. Thus, it seems that McCarthy's account for Greenberg's co-occurrence restrictions is only partial.

Greenberg's co-occurrence restrictions given in (3) do not hold in MH. Indeed, the number of forms which violate these restrictions is rather small, but the fact that many of these forms are recent innovations suggests that in MH the root does not respect the Obligatory Contour Principle. Below are examples of verbs and nouns whose root violate the restrictions.

(6) a. Non-final identical adjacent consonants (restriction (3ai))

sisgen 'he variegated' (cf. *sasgoni* 'variegated')

mimen 'he financed' (cf. *mamon* 'money')

mimeš 'he materialized' (cf. *mamaš* 'substance')

mamzer 'bastard'

nanas 'dwarf'

šušbin 'best man'

xacocra 'trumpet'

šfoféret 'tube'

b. Homorganic adjacent consonant (restrictions (3aii) and (3bii))

fibrek 'he fabricated'

mipah 'he mapped' (cf. *mapah* 'map')

tidlek 'he refueled'

tadir 'frequent'

kixev 'he stared' (cf. *koxav* 'star')

hitʔated 'he intended' (cf. *ʔatid* 'future')

Many of the verbs above are derived via Extraction (see section 3.2. below) from native and non-native words. The data above suggest that the co-occurrence restrictions in (3) are no longer absolute in MH. The nouns in (6) above are potential sources for newly derived verbs. For example, *hitnanes* (B5), from *nanas* 'dwarf', is a possible verb, and most speakers are likely to understand this form immeditately as 'he became a dwarf/small'. What impossible, however, is a verb such as **hinnis* (B3), where the two identical consonants are adjacent (see chapter 4 section 3).

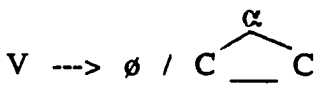
The data above reveal that the Obligatory Contour Principle does not hold within the consonantal root in MH, and therefore cannot establish an argument for tier segregation. Reduplication in MH, as shown in chapter 2 section 4, is not a spreading process, but rather a copying process, and therefore does not provide an argument for tier segregation either. I thus conclude that there is no argument for tier segregation in MH from the Obligatory Contour Principle.

1.1.2. RULES WHICH REQUIRE MULTITIERED STRUCTURE

I turn now to the phonological evidence provided in McCarthy (1981, 1986) to support morphological tier segregation. McCarthy claims that some phonological rules must refer to the multitiered structure manipulated by the morphology, and this implies that internal morphological structure is relevant for phonological rules.

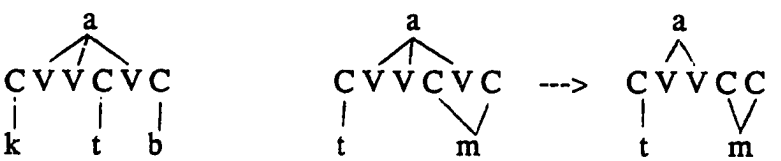
The rule of Geminate Verb Deletion in Tiberian Hebrew (McCarthy (1986)) deletes a vowel when flanked by identical consonants. The structural description of the rule specifies a doubly-linked consonant, which can be represented without crossing lines only if vowels and consonants appear on distinct tiers.

(7) Geminate Verb Deletion (Tiberian Hebrew)



As can be seen from the representation of *kaatab* 'to write' and *taamam* 'to finish' in (8) below, it is only in the latter that the structural description of the rule is met, thus yielding *taamm* .

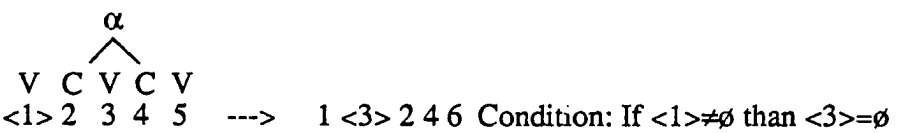
(8)



The geminate surfaces only in non-final position (*taammuu* 'they finish') while simplified in final position (*tam* 'it finished'). As noted in Hoberman (1988) Geminate Verb Deletion is optional in some cases, lexically governed in others, and occasionally determined by syntactic and semantic factors.

Additional evidence for tier segregation is drawn from Identical Consonant Metathesis rule in Classical Arabic (McCarthy 1981, 1986). A vowel flanked by identical consonants metathesizes with the consonant to its left (and, as specified by the condition, subsequently deleted if the consonant on the left is preceded by a vowel).

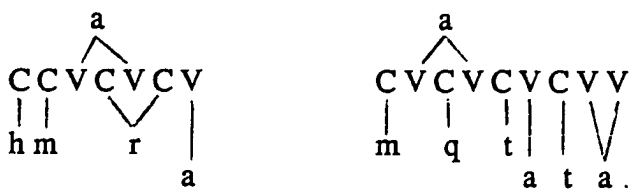
(9) Identical Consonant Metathesis (Classical Arabic)



Here again, in order to provide a structural motivation for Metathesis, vowels and consonants must appear on distinct tier to allow the doubly-linked representation.

The crucial fact is that Metathesis does not apply if the identical consonants are heteromorphemic. Thus, *hmarar+a* 'he reddened' becomes *hmarra*, but *maqat+ataa* 'they f. Dual detested' does not become **maqattaa*. Following the claim that distinct formatives are represented on separate tiers, heteromorphemic identical consonants cannot obey the doubly-linked representation specified in the rule, and therefore Metathesis does not apply.

(10)



Metathesis supports McCarthy's claim that reduplication is a spreading process, because there is an obvious distinction between the doubly-linked consonant in *hmarara* , which results from reduplication, and singly-linked identical consonants in *maqat+ataa*, which result from concatenation. This distinction may be obtained only when consonants and vowels appear on separate tiers, as in (10) above, otherwise Tier Conflation would split the doubly-linked structure in *hmarara*.

There is, however, an undesirable implication in this analysis, concerning the stage in which Tier Conflation takes place. Of particular interest is the fact that the stem has not yet been conflated at the stage where the inflectional suffixes are attached. The last vowel in (9), which is a crucial factor in the structural description of the rule, is provided by inflectional suffixes. Since Metathesis is conditioned by inflectional suffixes, and since Metathesis applies before the stem has been

conflated, the stem must be conflated after the inflectional suffixes are attached. This outcome does not coincide with the analysis of Tiberian Hebrew Schwa Deletion (see discussion below), where McCarthy supports the late application of the rule, after Tier Conflation, by the fact that it is conditioned by the vowel of the inflectional suffixes.

Assuming, for the sake of this argument, that stems are formed in level 1 and inflectional suffixes are attached in level 2, the following models of the lexical phonological must be assumed for Classical Arabic and Tiberian Hebrew (see discussion on Lexical Phonology in section 2 below)):

(11)	a. Classical Arabic:	Level 1:	Stem formation	---
		Level 2:	Inflectional suffixes	Metathesis
				Tier Conflation
	b. Tiberian Hebrew:	Level 1:	Stem formation	Tier Conflation
		Level 2:	Inflectional suffixes	Vowel Deletion
				Tier Conflation

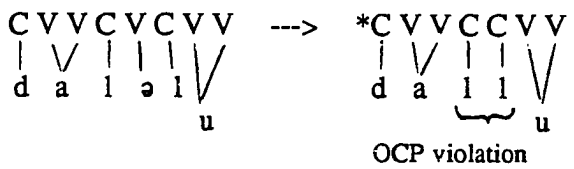
If we translate tier segregation into brackets and Tier Conflation into Bracket Erasure it turns out that in Classical Arabic Bracket Erasure applies at the end of the lexicon, while Tiberian Hebrew at the end of the level. This result is thus incompatible with a universally valid account of Bracket Erasure.

The issue of the Obligatory Contour Principle arises also after Tier Conflation. At this stage the Obligatory Contour Principle has a blocking effect, or as referred to in McCarthy (1986), "antigemination" effect; a rule whose output violates the Obligatory Contour Principle is blocked.

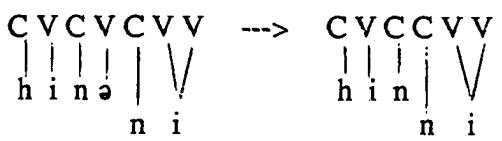
Such an instance is exhibited by Tiberian Hebrew Schwa Deletion, which applies in the environment of VC__CV. The rule fails to apply when the schwa is flanked by identical consonants, as in *daaləluu* 'they hung' (cf. *zaaxəruu* --> *zaaxruu* 'they recalled'). It is thus argued that Schwa Deletion applies after the first stage of Tier Conflation (A in (2) above), where the elements of the vocalic pattern and the consonantal root are on the same segmental tier. If the consonants flanking the schwa are identical, the output representation of Schwa Deletion would be two adjacent identical consonant, ((4b) above), exactly what disfavored by the Obligatory Contour Principle. Therefore Vowel Deletion is blocked.

If, however, the identical consonants flanking the vowel are heteromorphemic, the rule applies freely, as in *hin+ənii* --> *hinnii* 'behold me'. It is thus claimed by McCarthy that Schwa Deletion applies before Tier Conflation linearizes the stem/affix representation (B in (2) above), therefore when schwa is deleted the identical heteromorphemic consonants are on separate tier, thus Obligatory Contour Principle violation does not arise.

(12) a.



b.



Another rule which, according to McCarthy, applies after Tier Conflation, in this case after both stages (A and B in (2) above), is Tiberian Hebrew Spirantization, whereby a stop becomes a fricative when preceded by a vowel.

Spirantization does not affect geminates (as well as emphatic consonants), not even heteromorphemic geminates; *kaapal* --> *kaafal* 'he folded, doubled' but *kabbir* 'great, mighty' (**kaββir*, **kaββir*) and *kaarat+ti* --> *kaaratti* 'I cut off, make a covenant' (**kaaraθti*, **kaaraθθi*). It is thus claimed by McCarthy that Tier Conflation has a fusion effect, changing a fake geminate (a structure of two identical adjacent segment, as in (4a)) created by morpheme concatenation, into a true geminate (a doubly-linked structure, as in (4b)). Since Spirantization applies after Tier Conflation it treats hetero- and tautomorphemic geminates alike.

1.2. PHONOLOGICALLY MOTIVATED TIER SEGREGATION

In this section I propose that the feature hierarchy is a phonological alternative to the morphologically motivated tier segregation. I do not conduct here a study of the feature hierarchy but rather emphasize, following suggestions in Steriade (1987) and Odden (1988), that a research in this direction with respect to the co-occurrence restrictions in Semitic languages is may lead to the conclusion that the morphologically motivated tier segregation is superfluous.

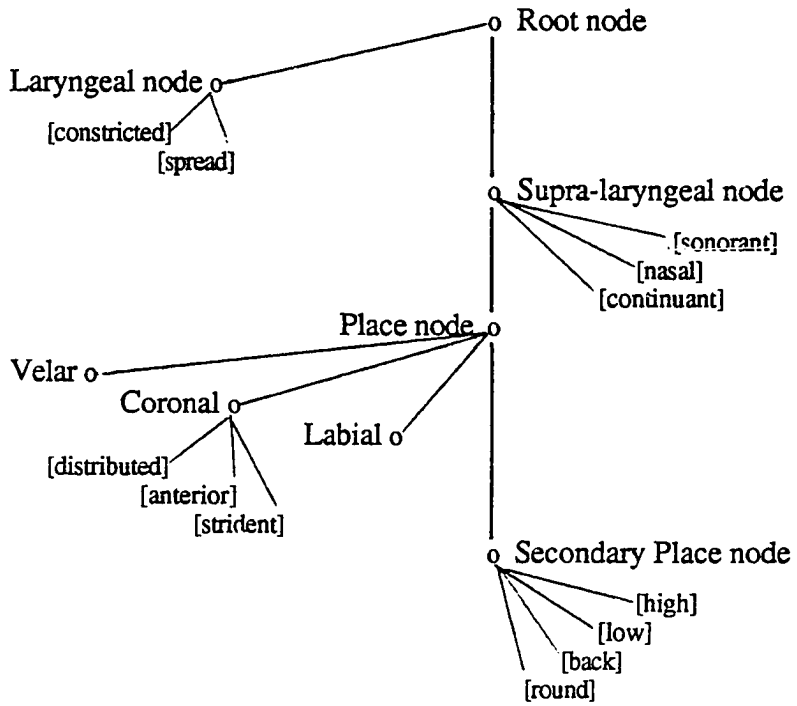
A number of recent studies have drawn attention to the internal structure of segments. The first step towards this direction of research was made in Goldsmith (1976), where it was shown that features have independent status. Phonological rules may affect the entire segment leaving one feature intact (e.g., tone stability in Igbo) or spread one feature over a large span of segments (e.g., nasal spreading in Guarani).

In establishing the independence of features, the subsequent question, first addressed in Clements (1985a), was that of the nature of the organization of features within a segment. It has been observed that phonological rules which refer to more

than one feature do not choose arbitrary sets of features, but rather seem to be consistent in the sets of features they refer to. The feature geometry proposed in Clements (1985a) and subsequent studies, such as Sagey (1986, 1987), Archangeli (1987), and others, aims to capture this generalization by postulating that features which group together in rules are dominated by the same node. For example, the wide spread rule of assimilation in place of articulation has motivated a single Place node which dominates Labial, Coronal, and Velar nodes.

Although some details in the segment structure are still in dispute, the general idea is that features are hierarchically related. The featural content of a segment is organized into hierarchically organized nodes, each of which may dominate other non-terminal nodes or terminal features. Each node and each feature constitutes a distinct tier. The feature geometry given in (13) below, follows in essence (but not in every detail) Archangeli (1987) and Sagey (1987).

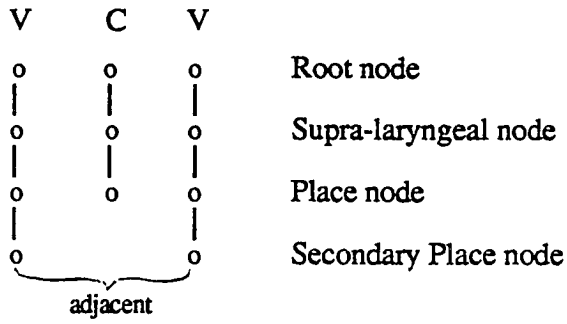
(13)



The overlap between the feature hierarchy and the morphologically motivated tier segregation is now apparent. At the moment we allow the notion of adjacency to be valid at each tier of the feature hierarchy, we gain tremendous (though hopefully not excessive) flexibility in adjacency relations. Recall from section 1.1.1. above that morphologically motivated tier segregation in Semitic languages has been supported by (i) the adjacency of the root consonants for the purpose of the Obligatory Contour Principle, and (ii) the uninterrupted spreading of the last consonant of the root to a non-adjacent C-slot.

The feature hierarchy in (13) allows the two vowels in a sequence *VCV* to be adjacent, where adjacency, in this case, is defined on the tier of the Secondary Place node.

(14)

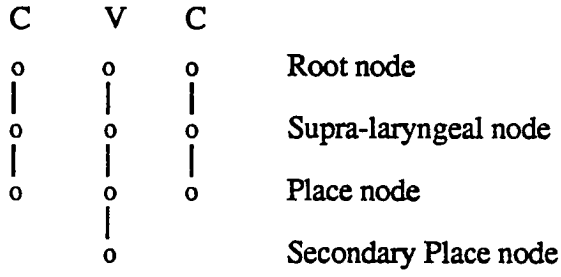


Since consonants (without secondary articulation) do not have a Secondary Place node, two vowels, which are obstructed by a consonant on the tier of the Root node, are adjacent on the tier of the Secondary Place node.

The problem with the above feature hierarchy is that it does not allow adjacency between two consonants in a sequence *CVC*, which is necessary in order to eliminate the morphologically motivated tier segregation suggested for Semitic

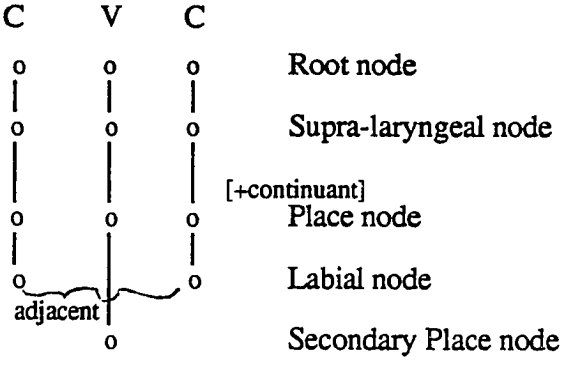
languages. All major nodes found in consonants are also found in vowels, and therefore there is no single tier in which the two consonants can be adjacent.

(15)



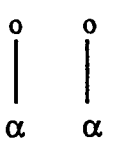
Adjacency between consonants in a *CVC* sequence can, however, be obtained in Semitic languages if we limit adjacency, in this case, to the tier of the nodes dominated by Place node. Thus, the sequence *baf* is impermissible since there are two adjacent Labial nodes, as illustrated below:

(16)

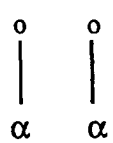


Thus, following McCarthy (1981), Greenberg's co-occurrence restrictions can be interpreted as preservation of the Obligatory Contour Principle, which prohibits adjacent identical (auto)segments. The domain of the principle is, however, language specific. In Semitic languages which follow Greenberg's restrictions the nodes relevant for the Obligatory Contour Principle are those dominated by the Place node. This account not only excludes adjacent identical consonants in the

consonantal root (restriction (3ai)) but also adjacent homorganic consonants (restrictions (3aii) and (3bii)). Greenberg's co-occurrence restrictions can be thus represented by the following constraint:[2]

(17)  Place node

As stated, the restriction in (17) is language specific, as it does not hold for MH. As shown in section 1.1.1. above, MH permits identical consnants obstracted by a vowel, as in *mimen* 'he financed'. But, as will be shown in chapter 4 section 3, MH does not permit strictly adjacent tatomorphemic identical or homorganic consonants; cf. *xidedu* (**xiddu*) 'they sharpened' vs. *gidlu* 'they raised' and *hitʔatedu* (**hitʔatdu*) 'they intended' vs. *hitkablu* 'they were accepted'. Since at the Root level *t* and *d* are not identical and so should not yield a violation of the Obligatory Contour Principle, I propose the in MH, the tier relevant for the Obligatory Contour Principle is that of the Supra-laryngeal node. Two adjacent Supra-laryngeal nodes which dominate the same featural structure and specification are impermissible.

(18)  Supra-laryngeal node

---

[2] This constraint also predicts that the first and the third root consonants cannot be identical or homorganic if the medial consonant is laryngeal, as laryngeals do not have Place node. Indeed, Greenberg notes that identical or homorganic first and third cnsonants are relatively rare, and I believe that it has to do with the featural structure of the medial consonant which allows the first and the last consonants to be adjacent. For a complete analysis of the feature geometry which emerges from Greenberg's co-occurrence restrictions, it is necessary to carefully study permissible and impemissble combinations of consonants.

Both restrictions, (17) and (18), are actually instantiations of the Obligatory Contour Principle, but they differ in their reference node.[3] In MH, the restriction applies on the Supra-laryngeal tier. Since vowels dominate a Supra-laryngeal node, identical or homorganic consonants obstructed by vowels are not considered adjacent by the restriction in (18), and therefore the sequence C_iVC_i is permissible. In some other Semitic languages the intervening vowel is not relevant since vowels do not have any of the nodes dominated by the Place node of consonants, and therefore identical or homorganic consonants which are obstructed by vowels are considered adjacent by the restriction in (17)

Evidence for the distinction between (17) and (18) is provided by the treatment of adjacent homorganic stops and fricatives. According to Greenberg's co-occurrence restrictions, homorganic stops and fricatives cannot co-occur. Thus, roots with adjacent *b* and *f* or *k* and *x* are impossible. In MH, adjacent homorganic stops and fricatives are permissible, as can be seen from the form *hikxil* 'it became blue'. Assuming that the Supra-laryngeal node dominates the feature [continuant] the featural specification dominated by the Supra-laryngeal node of stops and fricatives is not identical. Therefore the restriction in (18) does not exclude adjacent homorganic stops and fricatives. But on the featural structure of the Place node homorganic stops and fricatives are identical, and therefore the restriction in (17) considers such a sequence as identical.

Obviously, further study is required in order to provide an accurate account for the co-occurrence restrictions found in Semitic languages (see Selkirk (1988) for an interesting proposal). What crucial to the present study is that adjacency relations

[3] Similar instantiations of the Obligatory Contour Principle are found in Cantonese (Yip (1988a)) and Palauan (Lewis (1975)), where the relevant tier is that of the Labial node.

required for the Obligatory Contour Principle and reduplication are not sufficient to postulate morphologically motivated tier segregation, as there is a possible phonological account.

I now return to the evidence for tier segregation provided in section (1.1.2.) above. Long distance doubly-linked structure, $C^{\alpha}\!\!\_\!\!\_C$, which seems to be necessary for Geminate Verb Deletion in Tiberian Hebrew (7) and Identical Consonant Metathesis in Classical Arabic (9), can be maintained, assuming that α is not the Root node but rather the featural structure dominated by the Place node.

In order to maintain the single melodic tier hypothesis we must assume, as suggested in Bat-El (1984) for MH, that reduplication is a copying process. Spreading of the Root node of the consonant across an intervening vowel is blocked by the Root node of that vowel.[4]

(19)

Association		Copying		Linking
C V V C V C	--->	C V V C V C	--->	C V V C V C
| \/ | |		| \/ | |		| | | | ⋮
t a m a		t a m a t m		t a m a m

The output forms violates the restriction in (17), which prohibits (long-distance) adjacency between consonants which share the same featural structure dominated by the Place node. To amend the impermissible structure I assume a rule which collapse the identical nodes dominated by the Place node.

(20)

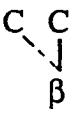
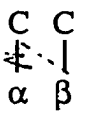
o o	--->	o o	Place node
| |		\/	
α α		α	

[4] It is not particularly relevant here whether the entire stem or just the consonants are copied as there is only one position left for the copied material to be associated with.

That is, the constraint in (17) not only states the possible representations but also functions as a rule trigger. Recall that intervening vowels are allowed since their Place node dominates different featural structure and specifications. This rule creates a structure which meets the structural description of both Geminate Verb Deletion and Identical Consonant Metathesis. The node merger process applies only within the stem, i.e. prior to affixation, and therefore heteromorphemic identical consonants, as in *maqat+attaa*, are not affected by Identical Consonant Metathesis in Classical Arabic.

Spirantization in Tiberain Hebrew, which treats hetero- and tautomorphemic geminates alike, is a different matter. Here the two consonants are not obstructed by a vowel. Tautomorphemic geminates are created by spreading of a segment to an adjacent segmental position (see Lowenstamm and Kaye (1985)), while heteromorphemic geminates are created by assimilation, a rather common rule in Semitic languages; *xad+t* --> *xatt* 'I took', *xaṛag+t* --> *xaṛakt* 'I went out' in Egyptian Arabic (Abdel-Massih (1975)). Both processes create a doubly-linked structure.

(21)

Gemination	Assimilation
	

As argued in Steriade (1982) "true" geminates, which exhibit doubly-linked structure (as opposed to "fake" geminates, where two identical segments are linked to two segmental positions), can be created by partial or total assimilation. They are treated alike by epenthesis rules, which are blocked by true geminates, and as argued above also by Spirantization in Tiberain Hebrew.

Thus, is not necessary to attribute the doubly-linked structure of the heteromorphemic geminates to a fusion effect of Tier Conflation, as suggested in McCarthy (1986). Independently motivated rules in the language may derive this representation. This predicts that heteromorphemic identical (auto)segments are not necessarily doubly-linked, as it is indeed the case with tone in Shona, and segments (but not tones) in Tangale (Odden (1986)). The fusion effect of Tier Conflation predicts that in all languages tautomorphemic (auto)segments are doubly-linked, and this is obviously the wrong prediction.

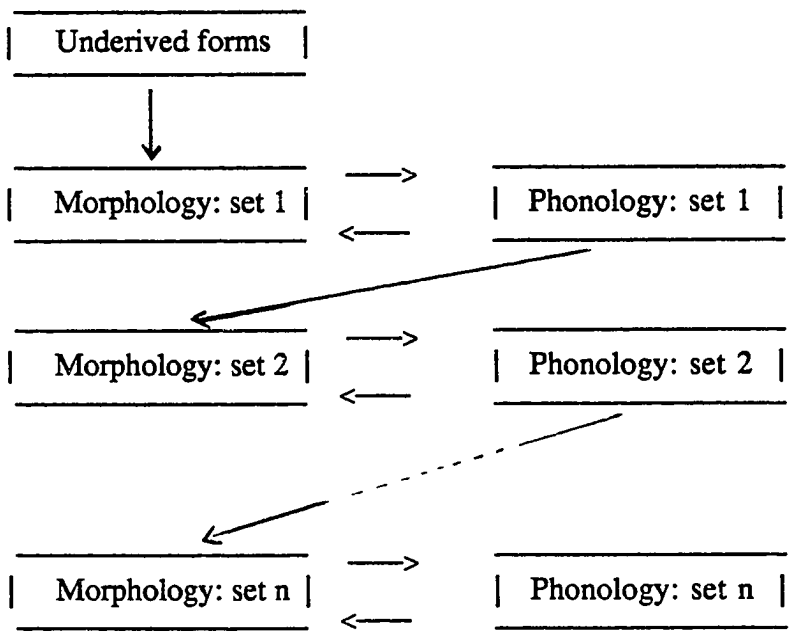
I thus conclude that tier segregation, which seems to be required for some Semitic languages, can be achieved by the phonologically motivated feature hierarchy. It is not necessary to stipulate internal morphological structure, and therefore we may maintain the claim that only phonological structure is available beyond word formation rules.

2. BRACKETS (Lexical Phonology)

Another version of internal morphological structure is that of the theory of Lexical Phonology, whereby word structure is designated by brackets. The essence of Lexical Phonology is the notion that phonological rules are intermixed with morphological operations. The morphological component consists of sets of morphological rules each of which may have a corresponding set of phonological rules. After the operation of a morphological rule of set M_n the form is subject to the application of the corresponding phonological rules from set P_n, after which it can be sent forward to a set of morphological rules M_{n+1}, or it may undergo more morphological operations from the set M_n. The sets of morphological rules are organized into an ordered sequence of levels, and consequently the corresponding

sets of phonological rules are ordered as well. The application of each morphological rule within a level creates a cycle. The model of Lexical Phonology is diagrammed in (22) below:

(22)



Notice that Chomsky and Halle (1968) stipulated several different types of boundaries, corresponding (according to Siegel (1974) and Kiparsky (1982)), to the different levels of structure in such an organization. This distinction in boundary types was necessary in their theory because they assumed that the entire morphology precedes the phonology. Since some phonological rules apply only when certain affixes are attached, these affixes would need to be marked by a specific boundary, which must then also be referred to explicitly in the structural description of the rule. Such a device in not required in the Lexical Phonology framework, as it is replaced by the interaction of phonological and morphological rules, and where furthermore

exactly those phonological rules applicable to a given class of affixes M_i appear in the phonological set P_i associated with M_i.

2.1. ABANDONING BRACKETS

The program for organizing the lexicon outlined above can dispense with distinctions of type among boundaries, since the appropriate set of phonological rules will apply after each application of any morphological rule. Thus, just those rules which refer to a particular boundary type apply right after the addition of the affixes with which this boundary would be associated, and therefore there is no need to specify this boundary as an element that might persist into arbitrarily later stages of the derivation. On this theory too, however, a morphological structure, demarcated by brackets, is assumed. Such structure will thus be present up to the point in a derivation where these brackets are erased, after which only purely phonological structure will remain. Within Lexical Phonology, then, the question of how much morphological structure is visiable to which phonological rules becomes the issue of where in a derivation Braket Erasure takes place. If Bracket Erasure applies at the end of an entire lexical level, all phonological rules applying at this particular level may refer to any morphemic distinction introduced earlier on the same level. This, however, is by no means the only possibility. I list below the uses to which brackets have been put, and argue that in each case they can be dispensed with.

DERIVED ENVIRONMENT: As demonstrated in Kiparsky (1973) certain phonological rules are restricted to application in derived environments. A phonological rule P is a "derived environment rule" if its application on a given cycle

C_i, introduced by a morphological rule M_i, is only possible when the conditions for P are newly established by M_i itself, or by some subsequent phonological processes applying to the output of M_i. The derived environment condition can be expressed as one that determines the applicability of a rule on a cycle C_i by comparing the form which is input to C_i with the form to which the rule is postentially applicable. If the environment of the rule is met in the input form, i.e., the applicability of the rule is due entirely to morphological rules of a previous set, or to conditions present in the underived form, the rule does not apply.

In this way Kiparsky (1973) accounts for the conditions on a Finnish Assibilation rule, whereby *t* becomes *s* when followed by *i*. The rule applies in forms like *halut+i* --> *halusi* 'wanted', and in *vete* --> *veti* (*e* --> *i* / __#) --> *vesi* 'water Nominative', but not in *neiti* (**neisi*) 'Miss'. Finnish Assibilation is a derived environment rule, and therefore it applies to forms which are derived morphologically (by suffixing *-i*) or phonologically (by *e* --> *i* / __#), but not to underived forms such as *neiti*.

Finnish Assibilation not only shows the necessity of the notion of derived environment but also that this notion cannot be formally interpreted as the presence of brackets. The derived environment relevant for Finnish Assibilation may be satisfied not only by morphological operations (the attachment of *-i*), but also by phonological changes (*e* --> *i* / __#).

Obviously, not all phonological rules are conditioned by a derived environment. It is thus necessary to postulate a way of characterizing the class of derived environment rules (e.g., all lexical rules are sensitive derived environment; see discussion in Kaisse and Shaw (1985)), which does not appear as a term in the structural description of the rule, yet allows us to determine which rules are sensitive

to the derived environment condition. That is, brackets are not approprite (since they are not sufficient) to indicate a derived environment.

EDGE OF DOMAIN: As noted in Hargus (1985), brackets are required for rules like Russian Final Devoicing, which refer to the edge of a domain. This is hardly a motivation for brackets per se, however, since the notion of edge of a domain is not necessarily a morphological information; it might equally be a phonological one. One can allow phonological rules to refer to the fact that no material follows (or precedes) a given position (within the current domain) without invoking the presence of a bracket element.

DIRECT REFERENCE TO BRACKETS: In his argument in favor of Bracket Erasure at the end of each level, Kiparsky (1982) points out the distinction in English between nouns derived in level 1 and nouns derived in level 2, with respect to the possiblity of serving the base to zero-derived verbs. Level 1 nouns, like *commission*, can undergo N-to-V zero-derivation, which applies in level 2, so a verb like *commission* is possible. Nouns formed in level 2, like *singer*, however, cannot undergo N-to-V zero-derivation, and therefore a verb like **singer* is ill-formed. Kiparsky accounts for these facts by postulating the condition "*] X Ø]" on N-to-V zero-derivation, which states that the rule cannot apply when internal brackets are present. Thus in order to distinguish between the nouns *commission* and *singer* in level 2, the brackets of *singer* (derived in level 2) must be preserved, while the brackets of *commission* (derived in level 1) must be erased, as predicted by Bracket Erasure at the end of each level.

An alternative solution, not requiring reference to brackets, would be to order (at least some of) the morphological rules within each level, such that N-to-V zero-

derivation applies before *singer* is formed. Indeed, the theory of Lexical Phonology does not assume any extrinsic order among the rules of a single morphological level, but rather attributes restrictions on affix sequences to the structural descriptions of the rules involved. The alternative of describing affix ordering by an ordering among some of the morphological rules does not seem to lead to a notably weaker theory, and seems consistent with the fact that at least some phonological rules must apparently be ordered with respect to each other. If this alternative allows us to eliminate reference to morphological brackets from the grammar, it clearly constitutes a net gain.

Assuming (at least some) explicit ordering of rules within morphological levels, then, N-to-V zero-derivation may be restricted to precede *-er* affixation. Therefore *singer* cannot be an input to N-to-V zero-derivation, as it has not yet been formed at the stage where the latter rule applies.

EXCEPTIONS TO BRACKET ERASURE: Another case which appears to pose a problem for the structure-less notion of morphology advocated here (as well as for the Bracket Erasure Convention) is drawn from Sekani, a northern Athabaskan language spoken in British Colombia. Hargus (1985) in her analysis of the lexical phonology of Sekani, has argued that the Bracket Erasure cannot be exceptionless. The evidence comes from a rule called Conjugation ə Deletion, which refers to the left most edge of a level 1 suffix, although it applies in level 3. She thus suggests that the bracket associated with affixes attached at level 1 is not removed by Bracket Erasure if the form is to undergo Conjugation ə Deletion in level 3. These particular brackets obviously need to be marked in order to persist in this way.

This phenomenon can be accounted for in another way, however, if we further modify the revised model of Lexical Phonology proposed in Halle and Mohanan (1985), and Kiparsky (1985). In this model phonological rules are not organized into levels, but rather every phonological rule is assigned to a morphological level. A phonological rule can be assigned to two or more morphological levels, as long as these levels are in continuous sequence. By abandoning the restriction on continuity of levels, the problem of Sekani is solved, as Conjugation ə Deletion can be assigned to both level 1 and level 3. That is, Hargus' example can be seen as counterevidence to the restriction that a rule applies to a continuous set of levels, rather than as evidence that brackets must be introduced and then (exceptionally) allowed to persist. Indeed, the theoretical apparatus needed to allow for this seems much too strong.

Another problem has been discussed in Bat-El (1986). I showed there that *-on* nouns which are derived from verbs take the feminine plural suffix *-ot* (e.g., *raca* 'he wished' - *racon* - *reconot* 'wish/will sg.-pl.', *šataf* 'he rinsed' - *šitafon* - *šitfonot* 'flood sg.-pl.'), while *-on* nouns which are derived from nouns take the masculine plural suffix *-im* (*ʔet* 'time' - *ʔiton* - *ʔitonim* 'newspaper sg.-pl.', *mila* 'word' - *milon* - *milonim* 'dictionary sg.-pl.'). This suggests hat the rule of plural formation refers to the inner brackets (which is possible if *-on*, *-im*, and *-ot* are all attached on the same level, and Bracket Erasure applied at the end of the level), and that these brackets are labeled: $[[X]_V$ *on*] --> $[[[X]_V$ *on*] *ot*], $[[X]_N$ *on*] --> $[[[X]_N$ *on*] *im*].

The plural suffix does not change the gender of the noun, as can be seen from the phrase *reconot tovim* 'good wills', where the adjective agrees with the (masculine) grammatical gender of the noun, and not with the (feminine) gender of the plural suffix. Other such cases (without *-on*) are *kirot levanim* 'white walls',

ʔavanim ktanot 'little stones'. This common discrepancy has been presented as counterevidence to the claim made in Williams (1981) and Selkirk (1982a) that the (last) suffix is the head of the word, and thus must contribute its features to the form.

To save the notion of head and to account for the behavior of *-on* nouns, Ritter (1986) suggests that MH distinguishes among four lexical noun classes but only two grammatical genders, where lexical class is the property of nouns and grammatical gender is assigned to verbs and adjectives by agreement rules.

(23)

	Lexical class (nouns)	Grammatical gender (verbs and adjectives)	
-im	[-feminine]	[-feminine]	*-im*
-ot	[+masculine]		
-ot	[+feminine]	[+feminine]	*-ot*
-im	[-masculine]		

The redundancy rule [αfeminine] --> [-αmasculine] adds the values for [masculine] to the category of grammatical gender. Thus *kir* 'wall' (pl. *kirot*) is lexically [+masculine], and therefore [-feminine] grammatically (*kirot levanim* 'white walls'); while *ʔéven* 'stone' (pl. *ʔavanim*) is lexically [-masculine], therefore [+feminine] grammatically (*ʔavanim ktanot* 'little stones').

Since the lexical specification of gender is independently required in the language, *-on* nouns derived from verbs, as well as many underived nouns, are specified for [+masculine], while *-on* nouns derived from nouns, as well as many underived nouns are specified for [-feminine]. The correspondence between the feature [+masculine] and *-on* nouns derived from verbs vs. the feature [-feminine]

and *-on* nouns derived from nouns is thus an accidental one under this account; and indeed I doubt that it is productive at the current stage of the language. I conclude that the independently motivated assumption that MH has four lexical noun classes eliminates the requirement of internal labeled brackets in this case.

The modifications suggested above in the theory in the theory of Lexical Phonology allow us to apply Bracket Erasure/Tier Conflation at the beginning of the cycle, thus removing morphemic distinctions for subsequent processes. Obviously, if brackets are immediately removed in this fashion, an equivalent theory would be one on which they were never introduced in the first place. This has been at the cost of (i) some indication of which rules are derived environment rules, which has been independently motivated for Finnish and many other languages (ii) ordering some of the morphological rules within a lexical level, and (iii) allowing individual phonological rules to be assigned to two (or more) noncontinuous levels.

The issue of continuity of levels arises with respect to another proposal, Mohanan's (1982) notion of the "loop". Although not directly relevant to the present issue of the absence of internal morphological strucutre, I wish to discuss this issue briefly in order to point out that continuity of levels is merely a stipulation, rather than a principle that is deeply embedded in the conceptual foundations of Lexical Phonology.

2.2. THE LOOP

The level ordering hypothesis in its original form is apparently too restrictive to account for compounding in Malayalam, a Dravidian language spoken in India. In Malayalam, there are two types of compounds, co-compounds and sub-

compounds. As reflected by the phonology, sub-compounds are derived on level 2 and co-compounds on level 3. The problem is, however, that co-compounds, which are formed in level 3, can themselves serve as the input of the formation of sub-compounds on level 2. This situation led Mohanan (1982), to propose the "loop", which allows recursiveness in the levels. According to this picture, forms derived in level n can return to the preceding level for further morphological and phonological rules, but only to level n-1, i.e., to the adjacent preceding level.

A more dramatic version of the loop is apparently exhibited by Piro (Matteson (1965)), an Arawakan language spoken in Peru, which seems to require a multiple loop. It was first pointed out in Kenstowicz and Kisseberth (1977, 1979) that a rule of Vowel Deletion in Piro, of the form V--->Ø / VC__+CV, refers to boundaries in a rather peculiar way. Some suffixes, like *-ta* 'Potential Theme Closure', undergo the rule (*yono+ta+na+wa* --> *yonotnawa* 'to paint o.s.') but fail to condition it (*hata+ta* --> *hatata* 'he illuminate'; cf. *hata+nu* --> *hatnu* 'light'). Other suffixes, like *-kaka* 'Causative', both condition the rule (*čokoruha+kaka* --> *čokoruhkaka* 'to cause to harpoon') and undergo it (*salwa+kaka+lu* --> *salwakaklu* 'to cause him to visit')[5]. The third type of suffixes, like *-wa* 'still, yet', fails to condition the rule (*heta+wa* --> *hetawa* 'to still see'; cf. *heta+lu* --> *hetlu* 'to see it') and also fails to undergo it (*heta+wa+lu* --> *hetawalu* 'to see him yet'). In contrast with the exceptional suffixes, all stems undergo Vowel Deletion when followed by a suffix which conditions the rule. To extract the relevant facts, there are three types of suffixes: (i) [-trigger +target] (*-ta* 'Potential Theme Closure'), (ii) [+trigger +target] (*-kaka* 'Causative'), and (iii) [-trigger -target] (*-wa* 'still, yet').

[5] The final stem vowel in salwa+kaka+lu is not deleted since it is preceded by a consonant cluster, thus the environment of the rule, VC__CV, is not met.

On the basis of Vowel Deletion it is possible to postulate three levels in the lexical phonology of Piro:

(24)		Morphology	Phonology
	level 1	[-trigger +target]	---
	level 2	[+trigger +target]	Vowel Deletion
	level 3	[-trigger -target]	---

Vowel Deletion applies on level 2, and it must be a derived environment rule, such that only level 2 suffixes can be [+trigger], while both level 1 and level 2 suffixes can be [+target]. Level 3 suffixes are attached after the application of Vowel Deletion, therefore cannot trigger the rule nor be affected by it.

This, however, does not coincide with the order of the suffixes within a given word. In the form *yoxi+xpa+hima+na+ta+ka+na+na* --> *yoxixpahimanatkanna* 'it is said they were then unfortunately mashed to a paste',

-hima 'it is said Postpositive' is [+trigger +target] - level 2,

-na 'Temporal' is [-trigger +target] - level 1,

-ta 'Potential Theme Closure' is [-trigger +target] - level 1,

-ka 'Passive' is [+trigger +target] - level 2 ,

-na 'Detrimental Effect' is [-trigger +target] - level 1, and

-na 'they' is [+trigger +target] - level 2.[6]

---

[6] The values for [trigger] and [target] are given on the basis of the following cues: Matteson (1965) in her description of Piro grammar, distinguished between [-trigger] and [+trigger] suffixes; [-trigger] suffixes are preceded by V (*-Vta* 'Potential Theme'), while [+trigger] suffixes are not (*-ka* 'Passive'). [-target] suffixes are identified when they appear before [+trigger] suffixes. The form *hiyaho+hima+ni* --> *hiyahhimni* 'therefore it is said' (--> *hiyaahimni* by compensatory lengthening) shows that *-hima* is [+trigger +target]. Therefore *-na* 'Temporal' in the form above is [-trigger], as indeed marked by Matteson. In other cases, where no cues are available the value is assigned on the basis of the model in (24).

It goes without saying that the multiple loop which seems to be required for Piro looks even less attractive than that proposed for Malayalam. Piro does not provide evidence for recursiveness in non-adjacent levels, but I believe that the reason has to do with the limited number of [-trigger -target] suffixes, which are attached at level 3. I do not see any principled reason for the adjacency restriction, beyond the desire to preserve the original principles of the theory of Lexical Phonology. I believe that a more permissive program is required, as proposed in the ensuing section.

2.3. THE INDEPENDENT LEVEL ORDERING HYPOTHESIS

I will refer to the original Lexical Phonology model proposed in previous studies as the *STRICT LEVEL ORDERING HYPOTHESIS*. While this model was initially proposed primarily to account for English morphology, it has sometimes been found inadequate with respect to other languages. Therefore various amendments has been proposed thus far, the such as loop (Mohanan (1982) and the one-level phonology where phonological rules are associated with particular morphological levels (Halle and Mohanan (1985) and Kiparsky (1985)). These modifications concern the independence of the phonological component. The morphological levels have been stipulated primarily on the basis of phonological rules, by an argument of the following form: suppose that a phonological rule R applies when suffixes A, B, and C are attached but not when X, Y, Z are attached. This must imply that A, B, and C are attached on level i, where R applies, and X, Y, Z are attached at level j (where $i \neq j$), where R does not apply. In English, this stipulation usually coincides with the order of the suffixes; A, B, and C always precede X, Y, and Z. This led to the conclusion that there is a direct correlation

between the order of the phonology and the order in the morphology, referred to as the Affix Ordering Generalization (Siegel (1979)). But this is not necessarily the case.

As suggested by Anderson (p.c.), it is at least logically possible to permit independent ordering in the phonological and the morphological components. Morphological rules are ordered on the basis of the order of the affixes within the words, where the inner most affixes are attached earlier. If two affixes may appear in either order, then there is no order assigned to the morphological rules which attach them. Independently of the morphological component, phonological rules can be ordered in the familiar fashion, where noncrucial ordering is left unrestricted here as well. Each phonological rule can be assigned to one or more morphological levels, and each morphological level can be assigned one or more phonological rules. There is no restriction on the continuity of two or more morphological levels which are assigned the same rule, nor on the continuity of two phonological rules assigned to the same level.

This rather permissive model can be more narrowly constrained on language specific grounds. In English there is a correspondence between the ordering in the morphology and the ordering in phonology. In Malayalam, co-compounding and sub-compounding are unordered with respect to each other, thus allowing a co-compound to undergo sub-compounding and a sub-compound to undergo co-co-compounding. The phonological rules that distinguish these processes are not assigned to any particular level but rather to the morphological process. And as suggested in Christdas (1987), sub-compounding and co-compounding are formed in the same level, where phonological rules assigned to one type and not to the other are conditioned by some diacritic, which is independently motivated in the language.

In Piro the morphological rules are ordered according to the sequential order of the suffixes, where Vowel Deletion is assigned to some of the rules (those introducing [+trigger] suffixes) and not others. Vowel Deletion applies immediately after the suffix is attached, and so there is no need for brackets since the rule is restricted to derived environments (i.e., the environment VC__CV will not be satisfied as a derived one before the suffix has been attached). I believe that the evidence which appears to favor a loop, by which a form can go from M_n to P_n and then back to M_{n-1}, is actually to be interpreted as showing that both M_n and M_{n-1} are part of a single lexical level.

3. ON THE INVISIBILITY OF MORPHEMIC DISTINCTIONS

I have repeatedly argued in this work that morphemic distinctions are not available beyond morphological rules. In this section I provide positive evidence from MH in support of this claim, showing that when reference to morphological structure is apparently required phonological information is used. In section 3.1. I discuss the truncation (deletion) of the feminine singular suffixes when a plural suffix is added, and in section 3.2. I provide an analysis of creation a consonantal root out of a fully specified base form. Both cases exhibit a morphological process which requires reference to a formative; nonetheless, I claim that the processes refers to segmental elements, as it evidence from the mismatch between the phonological shape of the underlying formative and the shape of the element(s) to which the process refers.

3.1. THE FEMININE SUFFIXES

Evidence for the absence of morphemic distinctions is drawn from the behavior of the feminine suffixes in MH. There are four singular nominal suffixes which are grammatically feminine: *-it*, *-at* (which surfaces as-*a* in word final position), *-et*, and *-ut*, where the latter derives abstract nouns. In addition, there is a plural feminine suffix *-ot*, attached to all forms that end in one of the singular suffixes above, as well as to other nouns (see discussion in 2.1. above). The feminine singular and the feminine plural suffix cannot co-occur .

(25)

		Feminine Singular	Feminine Plural	Masculine Singular	
a.	*-a(t)*:	*gamada(t)*	*gamadot*	*gamad*	'dwarf'
		susa(t)	*susot*	*sus*	'horse'
		tikva(t)	*tikvot*	---	'hope'
b.	*-et*:	*zaméret*	*zamarot*	*zamar*	'singer'
		tinóket	*tinokot*	*tinok*	'baby'
		rakévet	*rakavot*	---	'train'
c.	*-ut*:	*xaverut*	*xaveruyot*	---	'friendship'
		yaldut	*yalduyot*	---	'childhood'
		tarbut	*tarbuyot*	---	'culture'
d.	*-it*:	*rakdanit*	*rakdaniyot*	*rakdan*	'dancer'
		tabaxit	*tabaxiyot*	*tabax*	'cook'
		tavnit	*tavniyot*	---	'pattern'

Apparently, the feminine plural is formed by removing the feminine singular suffix and replacing it with the plural suffix *-ot*. It is thus expected that the rule responsible for this morphological process has to be able to identify the portion of the form that corresponds to the singular suffix, contrary to the claim made here that rules cannot see morphemic structure. I will show that reference to internal morphological structure is empirically the wrong approach in this particular case. The crucial evidence are given in (25c and d), where the vowel of the singular suffix *-Vt* surfaces in the plural form. That is, whatever has been removed to form the plural does not corresponds to the phonological shape of the singular suffix.

I propose the following analysis. The plural suffix *-ot* is attached to a stem-plus-suffix; *sus+at+ot*, *rakdan+it+ot*. The *t* of the singular suffix is then deleted by the following rule:

(26) *t*-Deletion

t ---> ø / __ V t $_{N[+f.]}$

Rule (26) creates a vowel sequence; *susatot* --> *susaot*, *rakdanait* --> *rakdaniot*. In case the first vowel is high, *y* is inserted by the following rules:

(27) *y*-Insertion

$$\text{ø} \text{ ---> } y \text{ / } \underset{[+high]}{V} \_\_ V$$

Otherwise, the vocalic sequence is simplified by deleting the first vowel:

(28) Two-Vowel Deletion

V ---> ø / ___ V

A sample derivation is given below:[7]

(29)

gamad	zamar	tabax	xaver	
gamadat	zamaret	tabaxit	xaverut	
/gamadatot/	/zamaretot/	/tabaxitot/	/xaverutot/	
gamadaot	zamareot	tabaxiot	xaveruot	*t*-Deletion
---	---	tabaxiyot	xaveruyot	*y*-Insertion
gamadot	zamarot	---	---	2V-Deletion
gamadot	*zamarot*	*tabaxiyot*	*xaveruyot*	
'dwarf f.pl.'	'singer f.pl.'	'cook f.pl.'	'friendship pl.'	

The phonological process illustrated above is triggered by some restriction in MH which prohibits a feminine plural suffix from immediately following a form that looks like it ends with a feminine singular suffix.

(30) * [X [+f.+sg.]] + [Y [+f.+pl.]]

Given such a restriction one may expect a morphological process of truncation. As defined in Aronoff (1976), truncation is the deletion of the outermost affix when another affix is attached; *nomin+ate+ee* --> *nomin+ee*, *lubric+ate+ant* --> *lubric+ant*. If this is the case in MH feminine suffixes we must assume the brackets are available when truncation applies, which would contradict the proposal that morphemic distinctions are not available beyond word formation. The behavior of the singular suffixes whose vowel is high (25c and d) is, however, strong evidence for the absence of internal morphological structure. If it was merely truncation of the singular suffix we should expect *rakdan+it+ot* --> **rakdanot* instead of *rakdaniyot* 'dancers f.'.

[7] The second form in (29) has penultimate stress in the singular form; *zaméret* 'singer f.sg.', and is thus identified as a segolate noun, where the last syllable of the noun is not stress-bearing since it containes *e*; *zamáret* --> *zaméret* (by Hight Harmony; see chapter 4 section 2).

My claim is that it is not a feminine suffix per se that is truncated, but rather the material which can be identified on the basis of phonological information: a voiceless alveolar stop. The restriction in (30) prohibits a feminine plural suffix to immediately follow a feminine singular suffix.[8] Since two adjacent feminine singular suffixes are permitted (e.g. *yald+ut+it* --> *yaldutit* 'childish f.') this constraint cannot be a prohibition against two *t*s in successive suffix syllables. To respect this restriction the innermost suffix might be deleted. But since there is no morphological information available to truncate the singular suffix, the phonological cue instead appears to be used as the basis of the restriction. The material thus deleted is not in fact a morphological unit, but its elimination makes the form appears not be marked any longer as feminine singular. Such a process would make sense only in the absence of morphological information in complex word froms.

This is decisive evidence for the absence of internal morphological structure. Obviously, this phenomenon is due to the fact that there are four different feminine suffixes in the language, all sharing the voiceless alveolar stop. Nonetheless, we would expect truncation of the entire suffix if the internal morphological strucutre was available. I suggest that since the strategy of identifying a morphological element on the basis of phonological shape is available in the grammar, all other instances which appear on the surface as reference to a morphological unit are actually based on phonological information. In many cases the identified phonological shape is identical to the actual shape of the morphological unit, but the cases where they are not identical, such as the one presented here, are the crucial evidence.

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[8] Notice that this is the only case where gender in a singular noun has a clearly identifiable formal correlate in the form of the word.

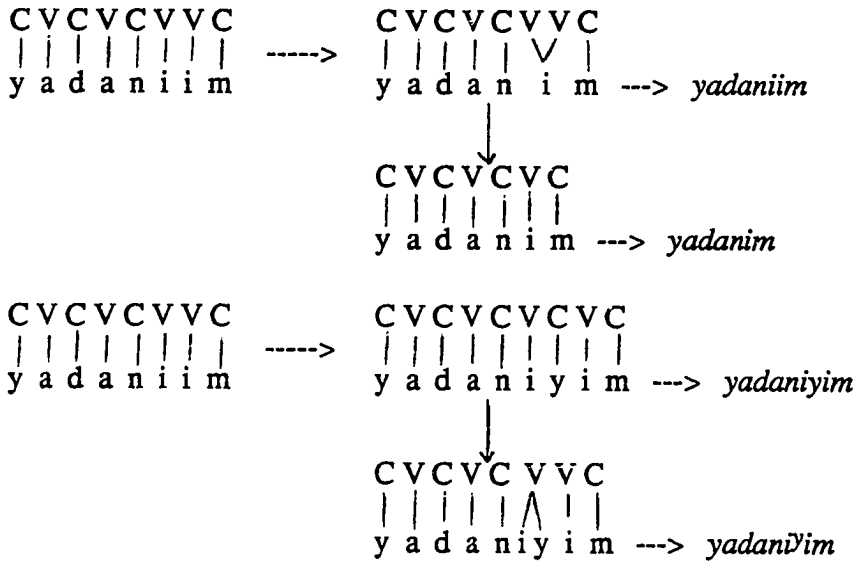
Further notes should be made with respect to the proposed rules. *t*-Deletion is conditioned in part by the number of syllables; the output of *t*-Deletion should be composed of two or more syllables, otherwise the rule is blocked. Therefore in *dalet+ot*, which undergoes Vowel Lowering and Segolate Deletion (see chapter 4 section 2) yielding *dlatot* 'doors', *t* is not deleted, for otherwise, after Two-Vowel Deletion, we would get **dlot*. Similarly, the plural form of *ʔot* 'symbol' is *ʔotot* rather then * *ʔot* (<-- *ʔoot* <-- *ʔot+ot*), and that of *dat* 'religion' is *datot* and not **dot* (<-- *daot* <-- *dat+ot*).

y-Insertion is not restricted to these particular cases in which the feminine plural suffix is added. When a singular feminine suffix is attached to adjectives ending in the suffix *-i*, *y*-Insertion applies as well; *šlišî+a(t)* --> *šlišîya* 'triplet' (*šalošˇ* 'three', *šlišî* 'third'), *ʔenošî+ut* --> *ʔenošîyut* 'humaneness' (*ʔenošˇ* 'human being', *ʔenošî* 'human'; cf. *ʔenošˇ+ut* --> *ʔenošˇut* 'humanity'), *yalduti+ut* --> *yaldutiyut* 'childishness' (*yéled* 'child', *yaldut* 'childhood', *yalduti* 'childish'). Therefore there is no need to assume that the morphological structure of the singular suffix is available to the rule introducing the plural suffix.

One remaining problem with this analysis is that *y*-Insertion need not apply when the two vowels are [+high -back]. When the plural suffix *-im* is attached to an adjective ending in *-i*, there is a free variation; *yadani+im* --> *yadaniim* ~ *yadanim* ~ *yadaniʸim* 'manual pl. Adjective'.

I assume an optional rule which turns two adjacent identical segments into a doubly-linked structure. If the rule applies we get *yadaniim*, which may optionall turn to *yadanim* in casual speech. If the rule does not apply *y* is inserted. Due to the segmental identity of *i* and *y*, [+high -back], *y* is phonetically realized as an off-glide.

(31)



It should be also emphasized that the case of feminine suffixes in MH is not an instance of morphological haplology, where an affix does not surface when it is to be attached to identical phonological material; e.g. English possessive *boys'* (**boys's*). Stemberger (1981), in his account of morphological haplology analyzes such cases as vacuous affixation, where the outmost affix fails to be attached phonologically, and the morphological brackets refered to in the rule are formed by the operation of the earlier morphological rule. It is clear that is inadequate for the MH feminine suffixes, since it is the innermost suffix which loses its *t*. It cannot be analyzed as phonological haplology either, where a whole syllable is lost in a sequence involving phonologically (nearly) identical syllables, as in English *interpretative --> interpretive* and Latin *sti:pipendium --> sti:pendium*. In our case only one segment is lost, as shown by the evidence from *-it* and *-ut* suffixation, as in *rakdanit - rakdaniyot* 'dancer f. sg.-pl.'. And as mentioned earlier, it is not simply a phonological restriction on two voiceless alveolar stops intervened by a vowel, since such a case is found in *yaldutit* 'childish f.'.

In sum, the behavior of the feminine suffixes in MH provides positive evidence for the position advocated in this work. Word internal structure is not available in the results of word formation, and whenever morphological distinction is apparently required, what is identified is actually determined of the basis of phonological cues alone.

3.2. EXTRACTION

In this section I argue that phonological cues are used in order to create what appears to be a morphological unit. Evidence is drawn from a strategy for forming new words, termed Extraction in Bat-El (1986). Given a fully specified base word, one may derive a new word by extracting the consonants from the base word and interdigitating them with a given vocalic pattern (in the manner describe in chapter 2 section 2). The source words are usually nouns, either native or borrowed, and the output forms are mostly verbs or verbal nouns.[9] In this way the forms on the right column in (32) were derived (at a certain point of the history of the language):

(32)	B1:	*xrop* 'nap'	--->	*xarap* 'he took a nap'
	B3:	*varod* 'pink'	--->	*hivrid* 'it became pink'
		darom 'south'	--->	*hidrim* 'he went south'
		me ʔat 'few'	--->	*himʔit* 'he lessened'
		flik 'blow'	--->	*hiflik* 'he gave a blow'

[9] This is due to the distinct morphological system of verbs and nouns. As noted in chapter 1 section 1, nouns can be derived by mere affixation; or in case of loan words, they may retain the shape of the source. Verbs, on the other hand, must appear in one of the given derivational categories in order to be properly inflected.

B4:	*koxav* 'star'	--->	*kixev* 'he starred'
	mamon 'money'	--->	*mimen* 'he financed'
	kaftor 'button'	--->	*kifter* 'he buttoned'
	sabon 'soap'	--->	*siben* 'he soaped'
	télefon 'phone'	--->	*tilfen* ' he phoned'
B5:	*yadid* 'friend'	--->	*hityaded* 'he befriended'
	xašmal 'electricity'	--->	*hitxašmel* 'he electrified'
	pánčer 'mishap'	--->	*hitpaněr* 'he had a mishap'

It is often not clear which binyan will be chosen for the new word. Bolozky (1978), who attempts to account for this problem, suggests a hierarchy of criteria. One of the criteria is pronounceability. When there are more than three consonants extracted, B5 is used for inchoative, reflexive, and reciprocal verbs, and B4 for transitive and intransitive. Neither B3 nor B1 can be chosen in this case in order to avoid clusters (when possible), and therefore **hikftir* (B3 Past) and **yikftor* (B1 Future) 'he buttoned' (from *kaftor* 'button') are impossible forms. When there are three consonants extracted and pronounceability does not play a role B3 is used for inchoative meaning (*hivrid* 'he became pink' from *varod* 'pink', and *hišmin* 'he became fat' from *šamen* 'fat'), B5 for reflexive, inchoative, and reciprocal (*hitmarken* 'he became a American' from *amerikáni* 'American', *hityaded* 'he befriended' from *yadid* 'friend') and B4 for other verbs (*bilef* 'he bluffed' from *blof* 'bluff', *kixev* 'he stared' from *koxav* 'star').

It seems, however, that the only consistently applied criterion is pronounceability. The fact that all color denominative verbs appear in the same binyan (B3) (*hivrid* 'he became pink', *hišxir* 'he became black', *hichiv* 'he became

yellow', *hilbin* 'he became white'), for instance, does not have to do with the binyan itself, but rather with the semantics of the verbs.

This is similar to the fact that the suffix *-on* is attached to all nouns which denote some sort of news document; *bita ʔon* 'organ (newspaper)', *yarxon* 'monthly magazine', *šavu ʔon* 'weekly magazine', *ʔiton* 'newspaper', *ʔalon* 'bulletin'. This does not entail that the shared meaning is related to the suffix *-on*, as there are many other forms which do not carry this meaning; *ša ʔon* 'watch', *malon* 'hotel', *milon* 'dictionary'. There may well be a tendency to provide a formal similarity to words belonging to the same semantic field, but the attempt to assign this semantic property to the suffix would result in a long and fuzzy list of properties for each suffix.

In general, it seems that most denominal verbs appear in B4, as this binyan is phonologically regular; it does not exhibit any consonantal or vocalic alternation found in the other binyanim[10]. B3 is often used as well, but much less than B4. As this work is concerned with morphological structures, I will not explore these semantic issues, which deserve a thesis by themselves.

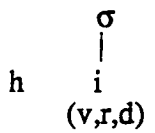
Returning to the structural description of Extraction, the full process of forming new words involves two steps, as shown in (33) below:

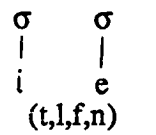
(33) a. Extraction: Extract the consonants from the base

varod 'pink' ---> *(v,r,d)* *télefon* 'phone' ---> *(t,l,f,n)*

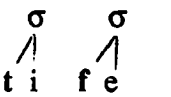
[10] It has been often noted that B4 is commonly used for extracted roots because of its historical medial geminate, which permits a consonant cluster. This explanation is not valid synchronically, and the only plausible explanation for its common use is thus its phonological regularity. B5 is also phonologically regular, but it has an obligatory prefix, and is thus morphologically more complex.

b. Syllabification/Interdigitation (see (13) in chapter 2)





(13-1)



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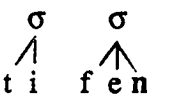

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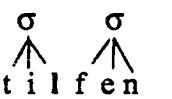
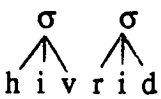


(13-4)

(13-5)



Affixation, *i*-Insertion, & resyllabification

As argued in section 2.2.1. below, the extracted material is not the root formative itself, but rather the consonantal elements of the word, which may include affixed material. In some cases, as will be shown in section 2.2.2., affixes may resist extraction. The reason is that in case there are too many extracted consonants, those which commonly correspond to affixes in the language are excluded.

3.2.1. ROOT EXTRACTION OR CONSONANT EXTRACTION

The question to be addressed next is that of which entity is extracted: a morphological one, i.e., the root, or a phonological one, i.e., a sequence of consonants. If it is the root which is extracted, we would have to admit that morphological structure is available at the word level. The problem with this view

in this particular case is that many nouns do not have a morphological structure, as their stem is indivisible. One may argue that the root in a noun is considered a unit as a result of a Word Formation rule which relates this noun to a corresponding verb with the same root. But prior to the stage of forming the new verb, many of the base forms are either native words which do not have related verbs or borrowed words. Thus, in this case it is clear that a list of consonants, and not a root, is extracted, since there is no such unit available. To support the claim that the extracted material is a purely phonological entity, I provide below instances where the effect of phonological rules applying to the source word are reflected in the form derived by Extraction.

Newly derived forms preserve the effect of phonological rules on their base. One clear example is the preservation of metathesized consonants. Metathesis applies when the *t* of B5, *([h, t, [a, e]])*, is followed by a sibilant, as in *hit+sader* --> *histader* 'he got organized'. Metathesized forms are often used as bases for deriving agent nouns[11]:

(34)

		Metathesis		Extraction		Interdigitation
hit+sagel	--->	*histagel* 'he adopted himself'	--->	*(st,g,l)*	--->	*staglan* 'opportunist'
hit+šadel	--->	*hištadel* 'he endeavored'	--->	*(št,d,l)*	--->	*štadlan* 'pleader'
hit+sakel	--->	*histakel* 'he observed'	--->	*(st,k,l)*	--->	*staklan* 'observer'

[11] The agent noun pattern is actually *([[a,e],an])*, and therefore the syllabification rules should derive **satkelan*. The fact that we get *staklan* has been discussed in chapter 2 section 3.1., where it is shown that clusters are often preserved by Extraction. It should also be noted that *-an* appears as an independent agent suffix attached to nouns (*meltaxan* 'wardrobe attendant' from *meltaxa* 'wardrobe'), as well as to Participles (*mistaklan* 'one who tends 'he observes' from *mistakel* (B5) 'to observe Participle', *matkifan* 'one who tends to attack' from *matkif* (B3) 'he attacks Participle').

As can be seen from the output forms in (34), the extracted material consists of the consonants of the base, which include the *t* of the prefix (see section 3.2.2. below for the absence of *h* in the output). Had it been the root that was extracted, we would not expect to find this *t* in the output form. The pattern with which the consonants are associated is that of the agent noun *([[a,e]an])*, where the *e* is deleted via the rule of *e*-Deletion rule (see chapter 4 section 2).

An alternative analysis might invoke truncation of the prefix *hi-* (recall that *hit-* is based on *h-* and *-t-*, where *i* is inserted by *i*-Insertion (see chapter 1 section 1.1.)) and suffixation of *-an*; *hit+sagel* 'he adopted himself' --> (Metathesis) *histagel* --> (Truncation) *stagel* --> (Suffixation) *stagelan* --> (*e* -Deletion) *staglan* 'opportunist'. This process, although it yields the correct result, is unlikely to provide an adequate account, since there are alternative forms where *-an* is attached to the Participle form, and the prefix is retained; *mistagel+an* --> *mistaglan*, *mistaklel+an* --> *mistaklan* (here also *e* is deleted by *e*-Deletion). These latter forms are often associated with lower registers or child language, and their semantic effect is 'one who tends to do Verb' while the meaning of the output forms in (34) is 'one who usually/professionally) does Verb'.

In addition, if the correct rule involved truncation of *hi-*, we should expect the same process to apply in B3, thus yielding **zminan* from *hizmin* 'he invited'. Such forms, where *hi-* is truncated form B3, are not available. The possible agent nouns are either *mazminan* , where *-an* is attached to the participle form, or *zamnan*, where the root *(z,m,n)* is associated with *([[a,e]an])*.[12]

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[12] Another argument in favour of consonant extraction might be drawn from Spirantization. For example the verb *hitxaver* 'he befriended' is derived from *xaver* 'friend', where in the latter the *v* is derived from *b* via Spirantization. This verb is distinct from *hitxaber* 'he joined with', which has been derived from *xiber* 'he joined'. Similarly, the verb *kixev* 'he starred' is derived from *koxav*

Additional support for consonant extraction is provided by morphologically complex words, where an affixed consonant is extracted along with the stem consonants. Some examples are given below:

(35)

dugm+an 'modeler'	--->	*digmen* 'he modeled'	
		(cf. *hidgim* 'he demonstrated')	
kamc+an 'stingy'	--->	*hitkamcen* 'he was stingy'[13]	
		(cf. *hitkamec* 'he was stingy')	
xešb+on 'calculation'	--->	*xišben* 'he calculated'[13]	
		(cf. *xišev* 'he calculated')	
kic+on+i 'extreme'	--->	*hikcin* 'he brought to extremity'	
		(cf. *kace* 'edge')	
ta+mc+it 'summary'	--->	*timcet* 'he summarized'	
		(cf. *mica* 'he exhausted')	
ta+xkir[14] 'brief'	--->	*tixker* 'he briefed'	
		(cf. *xakar* 'he investigated')	
ta+vlit 'relief'	--->	*tivlet* 'he embossed'	
		(cf. *balat* 'he sticked out')	
ta+xbula 'trick'	--->	*tixbel* 'he devised a plot'	
		(cf. *xibel* 'he sabotaged'	
ta+xzuka 'maintenance'	--->	*tixzek* 'he maintained'	
		(cf. *hixzik* 'he held')	

'star', where *x* is derived from *k* via spirantization. At this stage of the language I do not think this example is valid, since Spirantization in MH is opaque.

[13] The forms *hitkamcen* and *xišben* are less formal than their respective counterparts *hitkamec* and *xišev*.

[14] As noted in Orman (1975) translators in search for native Hebrew words often add the consonant of a nominal prefix to a verb root, although there is no related noun. In this way the form *tiskel* 'he frustrated' (cf. *sexel* 'mind') has been formed, although there is no noun **taskil*. Occasionally a consonant is added to a root on the basis of analogy. For example, the noun *yevu* 'import' (cf. *ba* 'he came in') has been formed on the basis of *yecu* 'export' (cf. *yaca* 'he went out').

ta+ ʔasiya 'industry'	--->	*ti ʔes* 'he industrialized'	
		(cf. *ʔasa* 'he did')	
ʔa+vxana 'diagnosis'	--->	*ʔivxen* 'he diagnosed'	
		(cf. *hivxin* 'he noticed'	
mi+sxar 'trade'	--->	*misxer* 'he commercialized'	
		(cf. *saxar* 'he traded')	
mi+spar 'number'	--->	*misper* 'he denumerated'	
		(cf. *safar* 'he counted')	
ma+kom 'place'	--->	*mikem* 'he placed'	
		(cf. *kam* 'he stood up')	
ma+xaze 'play, view'	--->	*himxiz* 'he dramatized'	
		(cf. *xaza* 'he observed')	

The fact that affixes are extracted along with the stem consonants suggests that it is not the root which is subject to extraction but rather the consonants of the surface base form of the source word.

In Bat-El (1985, 1986) I supported the opposing view that the root is extracted, on the basis of cases where the surface forms provide the base for two words. The forms below constitute (to the best of my knowledge) an exhaustive list of such instances:

(36)	*toxn+it* 'plan'	-->	a. *tixnet* 'he programed'
		-->	b. *tixnen* 'he planned'
	ʔivr+it 'Hebrew'	-->	a. *ʔivret* 'he hebraized'
		-->	b. *ʔivrer* 'he hebraized'
	pizm+on 'chanson'	-->	a. *pizmen* 'he wrote a song'
		-->	b. *pizem* 'he hummed a song'

The fact that in the b. forms in (36) only the stem consonants are extracted, while in the a. forms the stem plus the suffix consonants are extracted, might suggest that Extraction is sensitive to morphological structure, and that it distinguishes between an affix and a stem.

It is possible, however, that verbs in a. and b. in (36) are not derived from the same base, although the semantic relation is not always obvious at this stage of the language.

(37)

tóxen 'content'	--->	*toxnit* 'plan'	---> *tixnet* 'he programed (computer)'
	--->	*toxna* 'program (computer)'	
	--->	*tixnen* 'he planned'	
/ʔivr/	--->	*ʔivr+it* 'Hebrew (lg.) f. Adj.'	---> *ʔivret* 'he hebraized'
	--->	*ʔivri* 'Hebrew m. Adj.'	---> *ʔivrer* 'he hebraized'
pizem 'he hummed a song'	--->	*pizmon* 'chanson'	---> *pizmen* 'he wrote a song'

Whether or not this is the accurate historical derivation, the forms in (36) are much too rare to provide strong support for the notion of root extraction, and their appearance can probably be accounted for by diachronic means. Of greater interest here is the behavior of the far more general types of extraction.

Another case which might be taken to support the view of root extraction is that in which the base has both a prefix and a suffix but only the prefix is extracted, as in the forms below:

(38)

mi+sgér+et 'frame'	--->	*misger* 'he framed'	
	(cf.	*sagar* 'he closed')	
ma+lkód+et 'trap'	--->	*milked* 'he trapped'	
	(cf.	*laxad* 'he caught')	
ti+zmór+et 'orchestra'	--->	*tizmer* 'he orchestrated'	
	(cf.	*zémer* 'song')	
ta+xmóš+et 'munitions'	--->	*tixmeš* 'he armed'	
	(cf.	*ximeš* 'he armed')	

In the above forms the final *-t*, which happens to be a suffix, does not surface in the derived verb. The absence of the final *t* in the derived forms in (38) need not be attributed to the presence of morphemic distinctions, however, which would allow rules to identify affixes and optionally to exclude them. Notice that if the final *t* is included in the set of extracted consonants there would be five consonants in the derived form. Forms with five consonants do exist, but they are rather rare and tend to be avoided if possible. Therefore, I claim that a consonant which is commonly associated with an affix (and there are plenty of affixes with *t* in MH) is ignored (or alternatively deleted after Extraction).[15]

The question then is why it is the last *t* that is ignored rather that the first *t*. A similar case in Classical Arabic has been attributed in McCarthy (1981) to directional left to right association. Since there are more consonants than consonantal positions, the rightmost consonant (which fails to be associated since the association is from left to right) remains floating thus does not receive a phonetic interpretation. Therefore the form derived from *maǧnatiiš* 'magnet' is *maǧnat* 'to magnetize' (cf. MH *magnet* 'magnet' *mignet* 'he magnetized'). As I will show in the following

[15] It is generally the case that within a given language affixes are drawn from a rather limited number of consonants. In MH, for instance, *m*, *n*, and *t* appear in most of the affixes.

section, it is not always the last consonant which is ignored. In the case of the forms in (38) exclusion of the word initial *t* or *m* would result in the root *(CC,C,C)*, and since clusters are preserved (see chapter 2 section 3.1.) the resulting form would be *CCiCeC*. Such forms are rare, and they are avoided when possible.

The conclusion is that the few cases which look like root extraction can be accounted for either by indirect derivation (37), or by the existence of purely phonological reasons for excluding affix-like consonants (38). Therefore it is possible to maintain the view that morphemic distinctions are not available to later morphological processes and phonological cues are used to derive roots.

Extraction from reduplicated forms provides further support for consonant (as opposed to root) extraction. The forms derived from reduplicated forms preserve the reduplicated consonants. Thus, the verb derived from *yadid* 'friend' is *hityaded* 'he befriended' and not **hityadyed*, which would be possible if the root *(y,d)* were extracted. This is even more obvious when a root has two surface forms of reduplication, CC_iC_i and $C_iC_jC_iC_j$. For example, *nad* 'he moved' provides the base for *nadad* 'he wandered' - *noded* 'wanderer' as well as *hitnadned* 'he swung, shook' - *nadneda* 'swing'. Notice that the same sequence of consonants appears in the closely related words, and any direct relation between *nadneda* and *noded* is unexpected. Similarly, the agent noun from *likek* 'he licked' would be *lakekan* 'one who likes to lick', and that of the alternative (non-standard) form *liklek* would be *laklekan*. We do not expect *laklekan* to be the agent noun of *likek*.

In the discussion above I have dealt with cases where the number of consonants in the derived forms is identical to or smaller than that in the base. There are also cases where the number of the consonants in the derived form is greater

than in the base. One such case is due to reduplication, as in (39a) below, which is not problematic, as it follows the regular process (discussed in chapter 2 section 4). A more serious problem for Extraction is exhibited by the forms in (39b and c), where a consonant which does not appear in the base surfaces in the derived form.

(38) a. *kod* 'code' ---> *kided* 'he coded'
xam 'hot' ---> *ximem* 'he heated'
cad 'side' ---> *cided* 'he sided with'
ʔot 'sign' ---> *ʔotet* 'he signaled'

b. *kis* 'pocket' ---> *kiyes* 'he pickpocketed'
sid 'plaster' ---> *siyed* 'he plastered'
tik 'file' ---> *tiyek* 'he filed'
ʔiš 'man' ---> *ʔiyeš* 'he maned'
min 'sort' ---> *miyen* 'he sorted'
bul 'stamp' ---> *biyel* 'he stamped'
xuga 'dial' ---> *xiyeg* 'he dialed'
ʔot 'symbol' ---> *ʔiyet* 'he spelled'
ger 'convert' ---> *giyer* 'he converted'
kef 'fun' ---> *kiyef* 'he had fun'
bama 'stage' ---> *biyem* 'he staged'

c. *šuk* 'market' ---> *šivek* 'he marketed'
zug 'pair' ---> *ziveg* 'he paired'
duax 'report' ---> *divéax* 'he reported'

The base forms of all the derived verbs in (39) biconsonantal. The derived forms show a tendency to have a regular triconsonantal form, similar to most verbs in MH. This tendency is in fact predicted by the syllabification rules given in (13) in chapter 2. Given two vowels in a pattern, the syllabification rules in (13) which link the onsets of both syllables and the coda of the last syllable, must apply. Therefore, at least three consonants must surface in the derived form.

There are two ways to derive a triconsonantal verb from a biconsonantal base: either by reduplication, as in (39a), or by adding a front glide (there are no back glides in MH) between the two consonants (39b). Both strategies conform with relations already exist in the language. The *y* - ø relation is relatively rare in non-extracted forms; *din* 'judgment' - *dayan* 'judge', *dag* 'fish, he fished' - *dayag* 'fisherman'. Strangely enough, although reduplication is much more common than these alternations, the number of biconsonantal base forms in which *y* is added to the derived form is much larger. The *v* - ø alternation in (39c) is marginal. *šivek* has been formed on the basis of the (standard) plural form *švakim*, reflecting a historical *u* - *w* alternation, where *w* changed to *v* in medial position. *dúax* 'report' is an acronym for *din ve-xšbon* 'judgment and calculation', and the *v* is included in *divéax* in order to preserve the original initial sounds of the base of the acronym. The shape of an acronym is often affected by spelling (see fn. 20 in chapter 1).

It should be noted that the addition of a medial glide does not necessarily reflect the presence of an underlying medial root consonant in the base, either synchronically or diachronically, as some of the base forms are borrowed words (*kef* 'fun', *kod* 'code'), and other are historically biconsonantal words (*ger* 'convert').

The discussion above reveals that consonants extracted from a base form may undergo slight modification, by ignoring an affix-like consonant in case there are too many extracted consonants, or by adding a front glide if there too few extracted consonants, in addition to the regular process of reduplication. In neither case there is any argument for root extraction. I thus conclude that what is extracted from a base for the purpose of forming a new stem is phonological in nature (i.e., a list of consonants), rather than morphological (i.e., the root). Therefore there is no need to maintain morphemic distinctions for the purpose of Extraction, as is indeed to be expected, since the base form is always a surface form.

3.2.2. CONSONANTS WHICH RESIST EXTRACTION

Extraction was adduced in Bat-El (1986) as evidence for the distinction between inflection and derivation. It has been shown that not all affixes are subject to Extraction. Those which fail to be extracted are often the ones which correspond to inflectional affixes. Following Anderson (1982, 1988c), inflectional affixes are taken to be those which are relevant for or assigned by the syntax, or alternatively following Borer (1985), inflectional affixes are those which obey the projection principle in the syntax. Obviously person-number-gender affixes are never extracted, since the uninflected stem is always the base.

There is one case, however, where it can be argued that the base form has both inflectional and derivational affixes, and this is the B5 forms. In *hi+t+gaber* 'he strengthened himself', the *h* might be an inflectional prefix, as it is not retained throughout the inflectional paradigm; *hitgaber* 'Past', *yitgaber* 'Future', *mitgaber* 'Participle'. As argued in chapter 1 section 1.1. the prefixes of the Future and Participle are not attached to the Past form, which includes the *h-* prefix, but rather

directly to the stem. The derivational affix *t*, on the other hand, surfaces in all forms. The fact that in the metathesized forms in (34) above only the *t* surfaces in the derived form, but not the *h*-, might suggest that Extraction distinguishes between inflectional and derivational affixes, where only derivational affixes can be extracted. This conclusion contradicts the theme of this chapter, that morphemic distinctions are not available.

The claim made in Bat-El (1986), that *h* is not extracted because it is an inflectional affix, is not the only possible explanation for the exclusion of *h* but not of *t* in the derived form. It might as well be the case that, as claimed in section 3.2.1. above, consonants which participate as affixes in the language are excluded in the derived form in case there are more than four consonants extracted. Now it is clear that it must not be the last consonant which is excluded as in Classical Arabic. In addition, *h* and *ʔ* are often excluded. They are always ignored when they are in final position, where they never surface phonetically, and this is true regardless of the number of the extracted consonants; *bamah* 'stage' (phonetically *bama*) --> *biyem* 'he staged'. In initial position *ʔ* is excluded in *hitmarken* 'he became American', derived from *ʔamerikani* 'American', where *hit ʔamreken* is rarely used.

Another case of the exclusion of an affix or an affix like consonant in the derived form is exhibited by the verb *hictavreax* (B5) 'he got into a bad mood' (*tc* --> *ct* via Metathesis). The original base of this verb is the compound *macav-ruax* 'mood (state-soul)'. An intermediate stage is provided by the adjective *mecuvrax* 'he is in a bad mood', whose shape is that of B4 Passive Participle, *([me,[u,a]])*. Notice that while *m* is part of the base word, the compound, and there is an *m* in the prefix of the Participle pattern, there is only one *m* in the derived adjective *mecuvrax*. Whatever the source of the *m* is, it does not surface in the verb

hictavreax derived from the adjective *mecuvrax*. Here again, we could say that *m* resists Extraction since it is an inflectional prefix, as argued in Bat-El (1986). But it might equally be the case that *m* is not included in the derived verb since there would be six consonants extracted, which would be far too many, and *m* is a common prefix.

The two possible explanations for the exclusion of affixes or affix-like consonants from the derived form are theoretically diverse. If we take it to be an affix that is excluded we must assume that morphological structure persists beyond word formation, or alternatively to order inflection after extraction, as suggested in Bat-El (1986). The second possibility, however, where consonants which correspond to affixes in the language are ignored, conforms with the argument made in this work that only phonological structure is available after word formation.

4. CONCLUSION

Two compitable theories, Nonconcatenative Morphology and Lexical Phonology, advocate the existence of internal morphological structure at least through part of the derivation. Subsequent rules may then refer to morphemic distinctions demarcated by this structure. I claimed in this chapter that only phonological structue is available after Word Formation. I provided alternative solutions, many of which have been presented before, to various instances which support the above theories. But more importantly, I gave positive evidence for an available phonological strategy to refer to morphological units. I demonstrated that the feminine suffix in MH is identified on the basis of phonological information (a voiceless alveolar stop), and not on the basis of morphological structure. Finally, I showed that Extraction refers to phonological elements (i.e., consonants) rather than

to a morphological unit (i.e., a root). Since such a strategy seems to be available, the grammar can dispense with internal morphological structure.

CHAPTER 4

PHONOLOGY

This chapter is concerned with phonological processes in MH that bear on some issues raised in the previous chapters. I showed (in chapter 2 section 3.2.) that segolates, which are commonly believed to have a final consonant cluster, do not pose any problem to the non-templatic analysis advocated in this work. I argued that segolates are underlyingly *CVCVC*, where the last syllable is not a stress-bearing element, and therefore stress in segolates is penultimate. As I show in section 1 below, few other assumptions, such as inherent accent and prestressing and destressing suffixes, are necessary in order to account for the stress system in MH. Otherwise stress in MH is fairly straightforward: stress the rightmost (accented) syllable. The syllables which are not stress-bearing units seem to be relevant for segmental alternation as well. In section 2 I discuss a few rules of vocalic alternation, in particular those which mention the syllable which is not a stress-bearing unit. I show that such syllables cannot be considered as extrametrical since they are not confined to the edge of the domain.

I argued (mainly in chapter 3) that there is no morphological structure beyond word formation. I showed that the fact that consonantal roots in Semitic languages respect the Obligatory Contour Principle can be accounted for by the featural structure of segments. In MH, the Obligatory Contour Principle is not respected by the root consonants, but, as I show in section 3 below, there are two instances

where the Obligatory Contour Principle is relevant. Violation of the constraint is amended by epenthesis, nonetheless it is not sufficient to state the constraint and attribute the process to it, as two independent rules of epenthesis need to be formulated.

1. STRESS ASSIGNMENT

The basic rule of stress in MH is stress the rightmost (accented) stress-bearing unit. That it, stress falls on the rightmost accented stress-bearing unit, and in the absence of such a unit, stress is final.[1] Before providing examples, let me clarify the notions "stress-bearing unit" and "accent".

As noted in Bolozky (1982), stress assignment in MH does not distinguish between open and closed syllables. With respect to weight, there is only one type of syllables in MH, and therefore the stress-bearing unit is the syllable (= mora = vowel). Nonetheless, not every syllable is a stress-bearing elements. I proposed in chapter 2 section 3.2.2. that the last syllable in segolate forms is not a stress-bearing unit, and therefore stress is penultimate. In *dégel* 'flag' the final syllable is not stress-bearing, and therefore stress is penultimate. In the plural form *dgalím* stress is ultimate since the final syllable, that of the suffix, is stress-bearing. Segolates should be distinguished from plain nouns, where stress is always final; *dagál* 'flag-man' - *dagalím* 'flag-men'.

Stems and suffixes with lexical stress are inherently accented. Borrowed words and suffixes as well as some native words bear lexical stress. Lexical stress remains in the same position when a plural suffix is attached. For example, the word *salát* 'salad' bears lexical stress as its plural form is *salátim*. The word *gamád*

[1] I do not consider here (personal and place) names and numerals; see Bolozky (1982).

'dwarf', however, does not bear lexical stress as its plural form is *gamadím*. Nouns with inherent penultimate accent should be distinguished from segolate nouns, as in the latter stress is final when a suffix is added; cf. *stíker - stíkerim* 'sticker sg.-pl.' vs. *dégel - dgalím* 'flag sg.-pl.'.

It turns out that there are three major types of alternations in stress pattern between stems and their corresponding suffixed forms (though as will be shown later, not in all suffixed forms). The relevant data are provided in (1) below:

(1) a. Plain stress: ultimate in stem and suffixed form

kfár - kfarím 'village sg.-pl.'

gamád - gamadá 'dwarf m.-f.'

zabán - zabaním 'salesman sg.-pl'

taklít - taklitím 'record sg.-pl.'

xatúl - xatulá 'cat m.-f.'

cipór - ciporím 'bird sg.-pl.

b. Segolate stress: penultimate in stem and ultimate in suffixed form

géšer - gšarím 'bridge sg.-pl.'

délet - dlatót 'door sg.-pl.'

bóker - bkarím 'morning sg.-pl.'

néxed - nexadím 'grandson sg.-pl.

xóref - xorafím 'winter sg.-pl.'

c. Lexical stress: remains in the same position when a suffix is added

kláf - kláfim 'card sg.-pl.'

salát - salátim 'salad sg.-pl.'

marák - marákim 'soup sg.-pl.

sabón - sabónit 'nerd m.-f.'

tíras - tírasim 'corn sg.-pl.'

tráktor - tráktorim 'tractor sg.-pl.'

profésor - profésorit 'professor m.-f.'

It is thus necessary to account for the following stress patterns: (i) ultimate vs. penultimate stress in non-suffixed forms and (ii) stress that shifts to the suffix vs. stress that does not shift to the suffix.

(2)

stem	+stress shifts	-stress shift
ultimate	regular stress σσ́ - σσ+σ́	lexical stress σσ́ - σσ́+σ
penultimate	segolate stress σ́σ - σσ+σ́	lexical stress σ́σ - σ́σ+σ

It should be noted that although forms with lexical stress require an underlying specification of the inherent accent, they seem to be more productive. Borrowed nouns which do not adopt one of the few native mishkalim (see chapter 1 section 1.1.) are very likely to be inherently accented.

Recent studies of stress, such as Liberman and Prince (1977), Hayes (1981), Prince (1983), and Halle and Vergnaud (1987), have demonstrated the autosegmental property of stress; stress is not a feature of a single segment but rather of a prosodic unit, such as a syllable or a mora. In addition, stress is a relative property, as it expresses relative prominence among stress-bearing elements.

In the following analysis I adopt the grid only theory proposed in Prince (1983). As an autosegmental property, stress is represented on an independent tier.

Each stress-bearing element is marked for a beat / grid position (represented by an asterisk) on the lowest level, level 0. The prominent syllable, which bears the main stress, is represented on the next level up by an additional beat.

(3)

zabán 'salesman'	*zabanít* 'saleswoman'	
*	*	level 1 (by rule)
* *	* * *	level 0
z a b a n	z a b a n i t	

Accented syllables, as suggested in Steriade (1988) for Greek, are lexically represented by an additional beat on level 1. Thus, while the level 1 beat in (3) above is assigned by a stress rule (to be formulated below), the level 1 beat in (4) below is lexically specified.[2]

(4)

salát 'salad'	*tíras* 'corn'	
*	*	level 1 (lexical)
* *	* *	level 0
s a l a t	t i r a s	

The concept relevant to the present discussion is the Left/Right-End rule proposed in Prince (1983). This rule determines the relative prominence by assigning a beat on level n+1 to the leftmost/rightmost entry at level n. Following the generalization stated at the beginning of the section, I propose the following stress rule for MH:

(5) The R(ight)-End rule
Add a beat to the rightmost grid position on the highest level

[2] I assume that level 0 beats and inherent accent are underlyingly given. A level 0 beat is erased by Zero-beat Assignment (see (27) in chapter 2).

The R-End rule adds a level 1 beat to the ultimate syllable in (6a, b, and d) below, but to the penultimate syllable in (6c), since in the latter the ultimate syllable is not a stress-bearing element, and as such it lacks a level 0 beats (marked with a dash). I return to this issue in section 2 below.

(6) a. *zabán* 'salesman' b. *zabanít* 'saleswoman' (plain stem)

* *	* * *	level 0 - Lexical rep.
z a b a n	z a b a n i t	
*	*	level 1 - R-End rule
* *	* * *	level 0
z a b a n	z a b a n i t	

c. *xóref* 'winter' d. *xorafím* 'winters' (segolate stem)

* -	* - *	level 0 - Lexical rep.
x o r e f	x o r a f i m	
*	*	level 1 - R-End rule
* -	* - *	level 0
x o r e f	x o r a f i m	

Accented syllables are lexically marked for an additional beat on level 1. The R-End rule adds a level 2 beat to the highest level, which falls on the accented syllable. Following Halle and Vergnaud (1987) I assume that two levels are conflated when one of them does not contribute to the relative prominance.

(7) *salát* 'salad' *tírasim* 'corn'

*	*	level 1 - Lexical rep.
* *	* * *	level 0
s a l a t	t i r a s i m	
*	*	level 2 - R-End rule
*	*	level 1
* *	* * *	level 0
s a l a t	t i r a s i m	

*	*	level 1 - Conflation
* *	* * *	level 0
salat	tirasim	

Although the R-End rule determines relative prominence within a word it must add a beat in monosyllabic forms in order to distinguish stressed monosyllabic words (nouns, verbs) from unstressed monosyllabic words (prepositions). Monosyllabic forms may be accented as well, as in *kláf - kláfim* 'card sg.-pl.'. In addition, as will be noted at the end of the section, when a monosyllabic word is the first element in a compound, it bears secondary stress. In compounds, primary and secondary stress fall on the syllables that bear primary stress when the words are in isolation. The first element in the compound bears secondary stress.

1.1. ACCENTED, PRESTRESSING, AND DESTRESSING SUFFIXES

ACCENTED SUFFIXES: Inherent accent characterizes some borrowed suffixes as well. These suffixes receive the stress when attached to stems that contain an accented syllable (and obviously when attached to plain stems). Compare the forms with accented suffixes in (8a) with those with plain suffixes in (8b).

(8)	a. *milyonér* 'millionaire'	b. *milyónim* 'millions'	(*milyón* 'million')
	traktoríst 'tractor driver'	*tráktorim* 'tractors'	(*tráktor* 'tractor')
	tankíst 'tank driver'	*tánkim* 'tanks'	(*tánk* 'tank')

When plain suffixes are attached to the forms in (8a) the stress remains in the same position as expected.

(9)	*milyonérit* 'millionaire f.'	*milyonériyot* 'millionaires f.'
	traktorístit 'tractor driver f.'	*traktorístiyot* 'tractor drivers f.'

tankístit 'tank driver f.' *tankístiyot* 'tank drivers f.'

No independent mechanism is required to account for forms with inherently accented syllables. Given two accented syllables, i.e. two beats on level 1, the R-End rule, as stated in (5) above, adds a level 2 beat to the rightmost beat on the highest level, level 1.

(10) *milyonér* 'millionaire' *traktoríst* 'tractor driver'

```
    *  *          *     *        Level 1 - Lexical rep
  *  *  *         *   * *        Level 0
milyo ner        trak torist
milyo n          trak tor

       *                *        Level 2 - R-End rule
    *  *          *     *        Level 1
  *  *  *         *   * *        Level 0
milyo ner        trak torist

       *                *        Level 1 - Conflation
  *  *  *         *   * *        Level 0
milyo ner        trak torist
```

milyonérim 'millionaires' *traktorístim* 'tractor drivers'

```
    *  *          *     *        Level 1 - Lexical rep
  *  *  * *       *   * * *      Level 0
milyo nerim      trak toristim
milyo ner        trak torist
milyo n          trak tor

       *                *        Level 2 - R-End rule
    *  *          *     *        Level 1
  *  *  * *       *   * * *      Level 0
milyo nerim      trak toristim

       *                *        Level 1 - Conflation
  *  *  * *       *   * * *      Level 0
milyo nerim      trak toristim
```

I thus conclude that the only property associated with lexical stress is the inherent accent, formally represented by a beat on level 1. The surface stress pattern of these forms is a direct consequence of the general analysis of stress assignment in the language.

DESTRESSING SUFFIXES: Further distinction is required to account for destressing suffixes. Suffixes such as the diminutive *-on* or the agent *-an* are always stressed, even when attached to forms with lexical stress.

(11) *salát* 'salad' *salatón* 'little salad' (cf. *salátim* 'salads')
tráktor 'tractor' *traktorón* 'little tractor' (cf. *tráktorim* 'tractors')
traktorán 'tractor driver'[3]

I propose that suffixes such as *-on* and *-an* are associated with a rule which removes the level 1 beats.

(12) Destressing

```
... * ... -----> ø
... * ... *
... σ ... σds
```

(σ_{ds} is the syllable of the destressing suffix)

After level 1 is erased by rule (12) the R-End rule applies, adding a beat to the rightmost entry at level 0.

(13)

```
salatón 'little salad'      traktorán 'tractor driver'
    *                           *                   level 1 - Lexical
  * * *                       *   * *               level 0
salaton                     trak toran
salat                       trak tor
```

[3] *traktorán* is a possible (though rather standard) alternative to *traktorist*.

		Destressing
* * *	* * *	level 0
s a l a t o n	t r a k t o r a n	
*	*	level 1 - R-End rule
* * *	* * *	level 0
s a l a t o n	t r a k t o r a n	

It should be emphasized that the destressing suffixes cannot be treated as accented since they are not stressed when a plain suffix is attached; *salatón - salatoním* 'little salad sg.-pl.', *traktorán - traktoraním* 'tractor driver sg.-pl.' (cf. the suffixed forms in (9) above). Both destressing suffixes (*-on* ,*-an*) and accented suffixes (*-er, -ist*) receive stress, and thus eliminate/destress any previously assigned level 1 beat. But since they behave differently when a plain suffix is attached, they must be lexically distinct. Destressing by accented suffixes is a direct consequence of the inherent accent and the R-End rule, while destressing by destressing suffixes require a specific rule associated with these suffixes.

PRESTRESSING SUFFIXES: As observed by Podolsky (1986), there are a couple of borrowed suffixes, such as *-nik*, which require main stress on the syllable that precedes them. Stress remains in the same position when plain suffixes are added.

(14) *kibúcnik* 'a person m. from a kibbutz'
kibúcnikit 'a person f. from a kibbutz'
kibúcnikiyot 'persons f. from a kibbutz'

The final syllable in *kibúc* 'kibbutz' is not accented as the plural form *kibucím* rather than **kibúcim.*

I thus propose that suffixes such as *-nik* are associated with a Prestressing rule which adds a beat to the preceding syllable.

(15) Prestressing

```
... *  <----- ø
... *  *
... σ  σps          (σps is the syllable of the prestressing suffix)
```

Then the R-End rule adds a beat to the highest level, and at the end level 1 and level 2 are conflated.[4]

(16)

```
     *                    level 1 - Prestressing
  *  *    *  *  *         level 0
kibucnikiyot
kibucnikit
kibucnik
kibuc

     *                    level 2 - R-End rule
     *                    level 1
  *  *    *  *  *         level 0
kibucnikiyot

     *                    level 1 - Conflation
  *  *    *  *  *         level 0
kibucnikiyot
```

To summarize this section, I proposed above the following properties which affect the stress pattern: (i) inherent accent (stems and suffixes), (ii) zero-beat units (stems and suffixes), (iii) destressing (suffixes), (iv) prestressing (suffixes), and (v) non of the above (stems and suffixes).

[4] See chapter 3 section 3.1. for the segmental alternation of the form in (16).

1.2. PERFECT GRID

Thus far I have considered forms with lexical stress whose accented syllable is either ultimate or penultimate, showing that stress does not shift when suffixes are added (unless it is a destressing suffix). Forms whose accent is antepenultimate often do not preserve their stress in the same position when a plain suffix is added[5].

(17)

télefon 'phone'	*telefónim* 'phones'
ʔótobus 'bus'	*ʔotobúsim* 'buses'
ʔálkohol 'alcohol'	*ʔalkohólit* 'alcoholic f.'
ʔámbulans 'ambulance'	*ʔambulánsim* 'ambulances'

To account for this type of alternation I adopt Prince's (1983) Perfect Grid, which provides a maximal organization of a grid, as illustrated below:

(18)

```
*     *     *        level 1 (Perfect Grid)
* * * * * *          level 0
σ σ σ σ σ σ
```

Perfect Grid reflects the tendency for alternating grid found in many languages.

Prince proposes two parameters to determine the starting point of Perfect Grid: left or right and peak or trough. Perfect Grid in MH goes from right to left, trough first. The R-End rule then applies, deriving the correct output.[6]

---

[5] Similar stress shift is found in the disyllabic stem *dólar* 'dollar'. When a plural suffix is added, stress unexpectedly shifts to the penultimate syllable; *dolárim*. But the expected form, *dólarim* (cf. *tíras - tírasim* 'corn sg.-pl.') is still much better than **dolarím*.

[6] For some speakers the Perfect Grid is subject to lexical specification. The first form in each pair below has undergone the Perfect Grid.

(i) *ʔálkohol* 'alcohol' *ʔalkohólit* - actual form 'alcoholic f.'
ʔálkoholit - impossible

(19)

Lexical rep.	Perfect Grid	R-End rule	Conflation
*	* *	* *	*
* * * *	* * * *	* * * *	* * * *
telefonim	telefonim	telefonim	telefonim
telefon			*telefónim* 'phones'

Since the purpose of Perfect Grid is to create alternating grid, it does not apply in di- and trisyllabic words.

(20)

		Perfect Grid
*	*	
* * *	* *	
s a m an k a l **samánkal*	g a m a d **gámad*	
samankál 'assistant director'	*gamád* 'dwarf'	

Perfect Grid should not create a clash. A clash is defined in Prince (1983) as two adjacent beats on level n with no intervening beat on level n-1. Below are two instances of clash (underlined).

(21)

* * *	* *
* * * *	* * * *
σ σ σ σ	σ σ σ σ

Since Perfect Grid in MH starts at the trough point and is clash-avoiding, it cannot apply in trisyllabic words whose first syllable is accented.

(22)

Lexical rep.	Perfect Grid
*	* *
* * *	* * *
tirasim	tirasim

(ii) *ʔámbulans* 'ambulance' — *ʔambulánsim* - actual form 'ambulances'; *ʔámbulansim* - acceptable

(iii) *télefon* 'phone' — *telefónim* - actual from 'phones'; *télefonim* - marginally acceptable

Consequently, Perfect Grid in MH is applicable in words with four or more syllables. It is thus predicted that in words with four unaccented syllables (which are very rare), stress will always be penultimate; *samankálim* 'assistant director' (sg. *samankál*). The result is that in such a case it is impossible to determine whether stress is lexical or regularly assigned by Perfect Grid and the R-End rule.

(23)

Lexical stress	No lexical stress	
`  *`		Lexical rep.
`* * * *`	`* * * *`	
`s a m a n k a l i m`	`s a m a n k a l i m`	
`*  *`	`*  *`	Perfect Grid
`* * * *`	`* * * *`	
`s a m a n k a l i m`	`s a m a n k a l i m`	
`  *`	`  *`	R-End rule
`*  *`	`*  *`	
`* * * *`	`* * * *`	
`s a m a n k a l i m`	`s a m a n k a l i m`	
`  *`	`  *`	Conflation
`* * * *`	`* * * *`	
`s a m a n k a l i m`	`s a m a n k a l i m`	

One problem with this analysis is that it seems that the Perfect Grid does not apply when there are two or more suffixes in the word. In the form *léymex* 'nerd' the first syllable is accented (cf. the plural form *léymexim*). When two suffixes are attached, as in *léymex+it+ot*, we get *léymexiyot* 'nerds f.' instead of **leymexíyot* (see chapter 3 section 3.1. for the segmental alternation). This is indeed strange, as stress assignment in MH is not cyclic, and therefore we do not expect such a reference to the morphology. The most I can say at this stage of research is that it is necessary to stipulate that Perfect Grid applies right after the first suffix is attached; if it cannot apply at this stage it does not try again.

A final note should be made regarding compounds and inflected verbs. Compounds undergo the R-End rule but only after it has applied to each element of the compound, as the main stress of the first element in the compound becomes secondary; *kélev* 'dog' + *rexóv* 'street' --> *kèlev rexóv* 'street dog', *koxáv* 'star' + *caméret* 'top' --> *koxàv caméret* 'superstar', *gán* 'garden' + *šošaním* 'roses' --> *gàn šošaním* 'rose garden' (recall that the R-End rule applies to monosyllabic words).

(24) *kèlev rexóv* 'street dog'

```
                  *        level 2  (R-End rule; compounds)
  *               *        level 1  (R-End rule)
  * -         *   *        level 0
kelev      rexov
```

gàn šošaním 'rose garden'

```
                  *        level 2  (R-End rule; compounds)
  *               *        level 1  (R-End rule)
  *         * * *          level 0
gan      šošanim
```

Notice that the R-End rule is not cyclic in any instance but compounds. If the R-End rule was not applying cyclically in compounds, we would have expect **gan šòšaním*, where the secondary stress is two syllables away from the main stress.

Secondary stress, as demonstrated in Bolozky (1982), appears on every other syllable away from the main stress; *gàmadón* - *gamàdoním* 'little dwarf sg.-pl.'. I do not discuss this issue here since the domain of secondary stress assignment is larger than the lexical word; *vekšèhamèvašélet* 'and when the cook f.sg.', *vèkšemèvašélet* 'and when a cook f. sg.'. But the distinction in secondary stress between the compound *gàn šošaním* 'rose garden' and the lexical word *gamàdoním* 'little dwarfs' or the phonological word *vexàmorím* 'and donkeys' is sufficient to

demonstrate that only in compounds is secondary stress conditioned by the primary stress assigned in the earlier cycle.

Notice also that in case there are two accented syllables in a lexical word, the leftmost one does not bear secondary stress (unless it happens to be two syllables away from the main stress). In *milyonér* 'millionaire' the last two syllables are accented, yet secondary stress is on the antepenultimate syllable rather than on the penultimate. Thus, we must assume that at the end of the derivation secondary stress is erased by conflation.

Compounds are formed in a different component or stratum than affixed words. The R-End rule applies at this stratum, but level 1 and level 2 are not conflated, such that secondary stress (the level 1 beats in (25)) is preserved. In forms other than compounds, secondary stress is assigned at a later stage of the derivation (after the syntax), thus not affecting compounds, which already bear secondary stress.

The same is true for verbs inflected for agreement. As I show in section 2 below, stress in suffixed verbs is stem final (*gamár+tem* 'you pl. finished', *gamár+nu* 'we finished') unless shifted due to a rule which deletes the stress syllable (*gamár+u* -->*gamrú* 'they finished'). Since the agreement suffixes are not accented or destressing, stress remains on the stem. Here again, if the agreement suffixes were attached before the R-End rule applies, we would expect final stress in suffixed forms (**gamartém*).

To summarize, I distinguished among the following characteristics of stems and suffixes:in MH.

a. inherently accented (borrowed/native stems and borrowed suffixes)

b. zero-beat stress-bearing element (native stems and suffixes)

c. destressing (native suffixes)

d. prestressing (borrowed suffixes)

e. non of the above (native stems and suffixes)

Destressing and Prestressing suffixes trigger rules, which together with the Perfect Grid and the R-End rule appear in the following order:

(25) Lexical Words: Perfect Grid

Prestressing / Destressing

R-End rule

Conflation

Compounds: R-End rule

I believe that after the syntax Perfect Grid assigns secondary stress, where the starting point is the syllable which bears the main stress.

2. VOCALIC ALTERNATION

This section is concerned with a few instances of vocalic alternation exhibited mostly by segolate nouns. Segolates differ from other nouns not only in their stress pattern but also in their peculiar vocalic alternation. It was necessary to postulate that the final syllable is not a stress-bearing element in order to account for the penultimate stress in the singular segolate forms. I adopted Cohn's (1989) treatment of epenthetic vowels in Indonesian, which are ignored by the stress rules. Formally, such elements are represented by the absence of level 0 beat.

Since some segmental rules affect only segolates, I suggest that the zero-beat syllables remain as such after suffixes are attache, and therefore they can be accessible to subsequent rules which mention this property. It should be

emphasized that extrametrical elements, which are also ignored by stress rules, are distinct from zero-beat elements in their peripherality restriction. Extrametrical elements are confined to the edge of a domain; when affixes are attached they are no longer extrametrical as they are not at the edge of the domain. Zero-beat elements are not confined to the edge of the domain (e.g. epenthetic vowels in Indonesian), and therefore they are not affected by the addition of segmental material even when they happen to be at the edge of a domain.

This, indeed, is a risky strategy since it predicts that zero-beat elements are never counted by stress rules. Take for instance a language where secondary stress is assigned to every other syllable away from the main stress (as in MH). In a trisyllabic form whose ultimate syllable is not a stress-bearing element, stress is penultimate. When a suffix is added stress is final, since the syllable of the suffix is a stress-bearing element. Yet, secondary stress should be assigned to the first syllable since the penultimate syllable does not count.

(26)

```
        *
*       *
* * - *
σ σ σ σ
```

This is the wrong prediction for MH, where secondary stress in segolates is antepenultimate; *xóref - xòrafím* 'winter sg.-pl.'. I thus assume for MH that level 0 grid is filled in for the purpose of secondary stress assignment. This is independently required for epenthetic vowels whose syllable is counted as any other stress bearing-syllable. For instance, in *rècinút* 'ernestness', the first vowel is inserted to break the *rc* onset, which violate the sonority hierarchy (cf. *cridút* 'huskiness'), yet, the epenthetic vowel bears secondary stress.

In isolation, the ultimate stem vowel in segolates is *e*, and the penultimate is either *e* or *o*.[7] When suffixes are attached, both the ultimate and penultimate vowels alternate, conditioned by the type of the suffix. In section 2.1. I present a rule which affects segolate stems followed by non-plural suffixes. The same rule applies in other instances as well. In section 2.2. I deal with forms ending with plural suffixes, and in section 2.3. I account for non-suffixed segolate stems.

2.1. *E*-DELETION

When suffixes such as *-on* (diminutive), *-a(t)* (feminine), and *-i* (adjective) are added to segolate stems, the underlying penultimate vowel surfaces, while the ultimate vowel is deleted.

(27) a. *-on* *dégel* 'flag' - *diglón* 'little flag'
yéled 'boy' - *yaldón* 'little boy'
šóreš 'root' - *šoršón* 'little root'

b. *-i* *séxel* 'intellect' - *sixlí* 'intellectual'
géver 'man' - *gavrí* 'manly'
xófeš 'freedom' - *xofší* 'free'

c. *-a* *néxed* 'grandson' - *nexdá* 'granddaughter'
yéled 'boy' - *yaldá* 'girl'

---

[7] A different vocalic pattern is found when the second or the third consonant is *ʔ* or *x*; *ná ʔar* 'youngster', *náxal* 'river'; *séla ʔ* 'rock', *pétax* 'doorway'. Only *ʔ* and *x* which are derived from the historical *ʕ* and *ħ* respectively trigger this different pattern; cf. *péle ʔ* 'miracle', *dérex* 'path', *néxed* 'grandson'. I will not discuss these cases as they require a great amount of lexical marking (that resulted from historical mergers), which does not contribute much to the generalization to be made here. I should note, however, that a synchronic analysis concerning these segments, which is beyond the scope of this work, is an interesting issue regarding abstractness of representation.

The same alternation is found when clitics are added; *yaldám* 'their boy', *digló* 'his flag', *šoršá* 'her root', *nexdí* 'my grandson'. This construction is relatively standard and not often used in everyday speech, but most native speakers can provide grammaticality judgments regarding these forms.

To account for the deletion of the stem final *e* I propose the following rule:

(28) *e*-Deletion

$$e \text{ ---> } \emptyset \ / \ \sigma_0 \ \underset{\underset{\text{[+stress]}}{|}}{\sigma_0} \ (...) \ \sigma$$
$$\underline{\quad}$$

This rule applies when the syllable of *e* and the preceding syllable are open, and the (not necessarily immediately) following syllable is stressed.

Rule (28) is not peculiar to segolate forms. Non-segolates with final *e* (those which are lexically marked as exceptions to Zero-beat Assignment) also undergo *e*-Deletion; *tipéš* 'stupid person m.' - *tipšá* 'stupid person f.' - *tipšī* 'stupid' - *tipšón* 'little stupid person'. Participles with stem final *e*, and agent nouns of the pattern *([[a,e]an])* also undergo this rule; *xolém* 'he dreams' - *xolmím* 'they dream', *rakedán* --> *rakdán* 'dancer' (but *kaškešán* 'prattler', where *e* is preceded by a closed syllable). In *télefon* 'phone' the penultimate *e* is not deleted since it is not followed by a stressed syllable. In *makeloním* --> *makloním* 'little sticks' the antepenultimate *e* is deleted as the ultimate syllable is stressed.

It should be noted that the environment specified in the rule does not correspond to VC__CV since, as shown in chapter 2 section 3.1. above, *e* is deleted in *psanteran* --> *psantran* 'pianist', where *nt* is the onset of the second syllable at the stage the rule applies.

e-Deletion does not apply when the stem initial vowel is deleted; *šamén* 'fat m.sg.' - *šmením* 'fat m.pl.' - *šmená* 'fat f.sg.'. Deletion of the stem initial vowel is opaque in the current stage of the language. It used to be deletion of a long vowel, but since MH does not have a length distinction this minor rule must be specified for some forms only (cf. *gamád* - *gamadím* 'dwarf sg.-pl.' vs. *gamál* - *gmalím* 'camel sg.-pl.').[8] This rule must apply before *e*-Deletion; after the stem initial vowel is deleted (*šamen+im* --> *šmením*) the environment of *e*-Deletion is not met.

2.2. SEGOLATE DELETION AND VOWEL LOWERING

When a plural suffix (*-ot* or *-im*) is added to a segolate stem, the ultimate stem vowel *e* becomes *a*, and the penultimate vowel is deleted.

(29)

délet - *dlatót* 'door sg.-pl.'	*dégel* - *dgalím* 'flag sg.-pl.'
séfer - *sfarím* 'book sg.-pl.'	*bóker* - *bkarím* 'morning sg.-pl.'
gódel - *gdalím* 'size sg.-pl.'	*góren* - *granót* 'barn sg.-pl.'

The rules which account for these vocalic alternations are rather regular, but very restricted. They affect only segolate forms, and they apply only when a plural suffixes is attached. To account for the fact that these types of vocalic alternations are found only in segolate forms I propose that the rules refer to the zero-beat syllable, which, as suggested above, lacks the level 0 beat. And to account for the fact that they apply only when the plural suffixes are attached, I suggest that these rules are associated with the plural suffixes. The latter device has been discussed in chapter 3 section 2.3.

---

[8] Notice also that we cannot assume that the underlying shape of the alternating stems (*gamál* - *gmalím*) is *CCVC*, while that of segolates is *CVCVC*, since there are many non-alternating *CCVC* stems, such as *kfár* - *kfarím* 'village sg.-pl.'.

A stem initial vowel is deleted when followed by two syllables, where the first one lacks a level 0 beat (marked with a dash). This environment is found only in segolate forms.[9]

(30) Segolate Deletion[10]

$$V \text{ ---> } \emptyset \ / \ C\underline{\quad}\overset{*}{C}\overset{-}{V}C\overset{*}{V}$$

Segolate Deletion should not be confused with the minor rule which deletes the stem initial vowel in form like *gamál - gmalím* 'camel sg.-pl.'. As mentioned earlier, this rule is opaque in MH due to the loss of length, and thus there are many lexical items, such as *zabán - zabaním* 'salesman sg.-pl.', where the rule does not apply. Segolate Deletion, on the other hand, is fairly regular[11].

The *e ~ a* alternation of the ultimate stem vowel in the plural forms is also sensitive to the absence of a level 0 beat. As formulated below, the rule lowers a vowel in a non-final syllable that lacks a level 0 beat.

(31) Vowel Lowering

$$\begin{bmatrix}\text{-round}\\ \text{-high}\end{bmatrix} \text{ ---> } [+\text{low}] \ / \ \underset{|}{\sigma_0}\ \overset{-}{\sigma}\ \overset{*}{\ }$$

$$\underline{\quad}$$

[9] The stem initial *e* in *nexadím* 'grandsons' (sg. *néxed*) is inserted later since the *nx* onset, which results from Segolate Deletion, violates the sonority hierarchy.

[10] Segolate Deletion is blocked when the target vowel is preceded by *x* or *ʔ*; *xóref - xorafím* 'winter sg.-pl.', *ʔérec - ʔaracót* 'land sg.-pl.' (see also fn. 7).

[11] Two exception should be mentioned. The plural form of *bóten* 'peanut' is *botním*, where Segolate Deletion fails to apply, and *e*-Deletion applies. The explanation could be that the expected plural form *btaním* is actually the plural of béten 'belly'. Also in *ciporním*, the plural form of *cipóren* 'carnation', Segolate Deletion does not apply, and *e*-Deletion does. It is possible that Segolate Deletion is restricted to word initial position, but there is only one form to support this restriction.

2.3. HEIGHT HARMONY

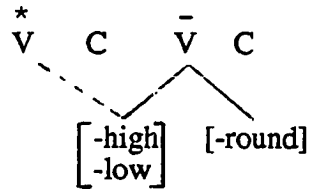
On the basis of the vocalic alternation in (27) above I assume the following segolate stems: *CiCeC*, *CoCeC*, *CaCeC* and *CeCeC*. In isolation, the penultimate vowel becomes mid (vacuously in case of underlying *o* and *e*), in agreement with the ultimate *e*; *digel* --> *dégel* 'flag', *kalev* --> *kélev* 'dog'.

There are two possible ways to specify the environment relevant for this Height Harmony rule. Either it is the main stress on the target vowel (CV́CVC), or the absence of level 0 beat on the trigger vowel (CV*CV-C). The first possibility, according to which a stressed vowel harmonizes with the following vowel, would require ordering Height Harmony after the R-End rule, as the former rule does not apply in *xivér* 'pail' (**xevér*). Under this analysis Height Harmony would be the only segmental rule that follows stress assignment. In addition, it would require limiting Height Harmony to derived stress, since the rule does not affect forms with an accented penultimate syllable; *stíker* (**stéker*) 'sticker' (cf. *dígel* --> *dégel* 'flag'). The second possibility, according to which a vowel harmonizes with the following vowel if the latter lacks a level 0 beat, is much more conceivable, as there are two other rules which affect only segolates (Segolate Deletion and Vowel Lowering) and refer to the same zero-beat syllable. This solution does not require specifying Height Harmony as a derived environment rule nor ordering it after stress assignment.

Adopting the second possibility, a vowel harmonizes in height with the following vowel, if the latter lacks a level 0 beat. If we assume a feature geometry where height features ([high] and [low]) are separated from posterior features ([back] and [front]), we may account for this process by spreading the node which

dominates height features (see chapter 3 section 1.2. above for feature geometry). Since consonants in MH do not require height features, there is no blockage effect.

(32) Height Harmony



A sample derivation is given below. I assume that level 0 grid given in the underlying representation remains throughout the derivation.

(32)

* - /digel/	* - * /digel+im/	* - * /digel+on/	
---	digalim	---	Vowel Lowering (31)
---	dgalim	---	Segolate Deletion (30)
---	---	diglon	*e*-Deletion (28)
degel	---	---	Height Harmony (32)
dégel	dgalím	diglón	R-End rule (5)
dégel 'flag'	*dgalím* 'flags'	*diglón* 'little flag'	

Recall that Vowel Lowering and Segolate Deletion are associated with the plural suffixes. *e*-Deletion is crucially ordered after Vowel Lowering, since otherwise we would get **diglim* from *digel+im*. *e*-Deletion is also crucially ordered after Segolate Deletion, since otherwise we would get **diglim* from *digel+im*. *e*-Deletion is crucially ordered before Height Harmony, since otherwise we would get **deglon* from *digel+on*.

A final note should be made regarding the feminine segolate nouns; *rakévet - rakavót* 'train sg.-pl.', *zaméret - zamarót* 'singer f. sg.-pl.', *tinóket - tinokót* 'baby

f. sg.-pl.'. The final syllable in these forms is not a stress-bearing element, and therefore stress is penultimate. As can be seen from the alternating vowel in *zamár - zaméret* 'singer m.-f.', the singular feminine form undergoes Height Harmony (32) as expected. Segolate Deletion (30) does not delete the stressed vowel in the feminine singular form since only one syllable follows the stressed syllable. Vowel Lowering (31) does not apply in the singular form since the zero-beat syllable is final.

As for the feminine plural forms, recall the following process from chapter 3 section 3.1.:

(34) zamar
zamaret
/zamaretot/
zamareot *t*-Deletion
zamarot Two-vowel Deletion
zamarót 'singers f.'

The two rules applying in (34), which are crucially ordered, precede Segolate Deletion and Vowel Lowering. Two-vowel Deletion deletes the zero-beat syllable, and therefore Segolate Deletion and Vowel Lowering are not applicable.

3. EPENTHESIS AND THE OBLIGATORY CONTOUR PRINCIPLE

As argued in chapter 3 section 1.2. the Obligatory Contour Principle in MH refers to the tier of the Supra-laryngeal node. Two identical or homorganic consonants with an intervening vowel are permissible, since a vowel has a Supra-laryngeal node as well, and therefore the two consonants are not adjacent on that tier. In this section I discuss the instances in which the Obligatory Contour Principle is relevant in MH. When a sequence of two adjacent or homorganic

consonants arises due to vowel deletion, a violation of the Obligatory Contour Principle is encountered, and therefore an *e* is inserted to satisfy the constraint. It is not sufficient, however, to state the constraint and to expect that every instance which violates it would automatically be amended by epenthesis. This claim is supported by the requirement for two distinct epenthesis rules in MH which amend violations of the Obligatory Contour Principle.

3.1. VOWEL DELETION IN VERBS

When a vowel initial suffix is added to a verb the final stem vowel disappears and the stress is shifted to the final syllable; *gadál+a* --> *gadlá* 'she grew', *gidél+u* --> *gidlú* 'they raised', *yigamér+u* --> *yigamrú* 'they will be finished'. If the last two stem consonants are identical, *e* appears in the deletion position though the stem final stress is shifted; *xagág+a* --> *xagegá* 'she celebrated', *xidéd+u* --> *xidedú* 'they sharpened'. The vowel *e* also appears when the stem final vowel is preceded by a consonant cluster; *yixtóv+u* --> *yixtevú* 'they will write', *tirgém+a* --> *tirgemá* 'she translated'.

Similar phenomena in Afar and Tiberian Hebrew have been treated in McCarthy (1986) as "antigemination" effects (see chapter 2 section 1.1.2.). Vowel deletion applies in these languages in the environment VC__CV (this environment excludes cases where the vowel is preceded by an open syllable, as in *yigmór+u* --> *yigmerú* 'they will finish'). The vowel is not deleted when flanked by identical consonants since the output form would violate the Obligatory Contour Principle. Such an account is inadequate for MH, as can be seen from the interaction of the vocalic alternation and stress shift.

Stress in MH verbs is stem final, as exemplified in (35a) below. When a vowel initial suffix (a gender-number-person suffix) is added, a stem final non-high vowel (i.e. the stressed vowel) disappears and stress is shifted to the new final syllable (i.e. to the suffix), as shown in (35b). Stress shift occurs also when *e* appears in the deletion environment, as shown in (35c), but it does not take place when the stem final vowel is high (and thus not deleted), as in (35d).

(35) a. *gadál* 'he grew'

tirgém 'he translated'

gadál+tem ---> *gadáltem* 'you pl. grew'

dibér+ta ---> *dibárta* 'you m.sg. talked'

b. *gadál+a* ---> *gadlá* 'she grew'

dibér+u ---> *dibrú* 'they talked'

yekabél+u ---> *yekablú* 'they will receive'

c. *xagág+u* ---> *xagegú* 'they celebrated'

xidéd+a ---> *xidedá* 'she sharpened'

titlonén+i ---> *titlonení* 'you f.sg. will complain'

tixtóv+u ---> *tixtevú* 'you pl. will write'

tirgém+a ---> *tirgemá* 'she translated'

d. *hitxíl+a* ---> *hitxíla* 'she started'

yagdíl+u ---> *yagdílu* 'they will enlarge'

yagíd+u ---> *yagídu* 'they will say'

There are two possible ways to approach the data above. The alternations exhibited in (35) might be the result either of a stress shift rule which triggers vowel deletion, or of a vowel deletion rule which triggers stress shift.

The major argument against the first proposal (vowel deletion triggered by stress shift) is that we must assume that stress shift is sensitive to vowel quality, as it does not apply when the final stem vowel is high, as in (35d). Stress rules are often sensitive to prosodic quantity (weight) but very rarely to segmental quality, and therefore this approach is universally implausible. Notice the distinction between *higdíl+u* --> *higdílu* 'they enlarged' and *yigdál+u* --> *yigdelú* 'they will grow'. In both forms the syllabic structure is identical, but only in the latter is stress shifted (as the stem final vowel is not high) and the stem final vowel becomes *e*. This would require an additional rule which changes to *e* a vowel which loses its stress. The *e* is then deleted in the environment $VC_i\_\_C_jV$, as proposed by McCarthy for Afar and Tiberian Hebrew. In cliticized forms there is also stress shift (probably because clitics are destressing suffixes) but the vowel which lost its stress is not deleted; *xamór+o* --> *xamoró* 'his donkey', *zabán+am* --> *zabanám* 'their salesman'. I thus argue for the alternative solution, where stress shift is triggered by vowel deletion and not vice versa. Deletion rules, unlike stress rules, are often sensitive to segmental quality.

From the alternations in (35b) it seems that stress shift is triggered by vowel deletion. Following Al-Mozainy et al. (1985) and Halle and Vergnaud (1987), I assume that deletion of a syllabic nucleus triggers the deletion of its associated syllable node, but not stress. Stress is represented on an autonomous tier, which is linked to the syllable node, and therefore when the syllable node is deleted stress

remains floating. To find a new host, the floating stress docks onto the syllable on the right.

A similar phenomena, concerning the related notion of tone stability, is discussed in Goldsmith (1976). In Lomongo, a vowel is deleted but its tone surfaces on the first vowel to the right; *bàlóngó+bǎkáé* --> *bàlóngā́káé* 'his book'. In case of tone, it is impossible to predict whether the floating tone would surface on the left or the right syllable. As for stress, it has been show in Al-Mozainy et al. (1985) that the floating stress shifts within the metrical foot.[12]

Since stress shift also occurs in the forms in (35c), where there is an *e* in the deletion environment, it must be assumed that the stem vowel is deleted and then an *e* is inserted. There is no other way to account for stress shift in these forms.[13] Notice in (35d) that there is no stress shift when the stem final vowel is high, and thus fails to be deleted.

I therefore propose a Vowel Deletion rule which deletes a non-high stressed vowel when its closed syllable becomes open, i.e. in a derived open syllable. This rule must be restricted to non-initial syllables, as it does not affect monosyllabic stems; *gár+u* --> *gáru* 'they lived'.

(36) Vowel Deletion (derived environment)

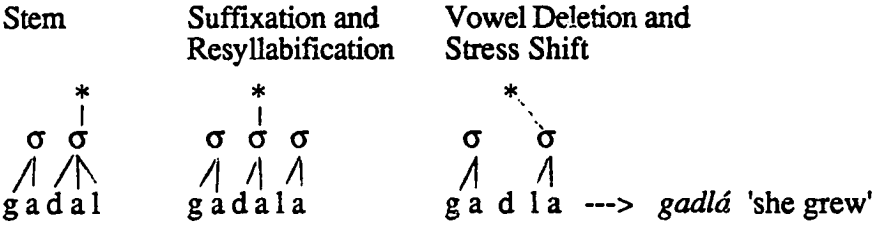
$$\underset{[\text{-high}]}{V} \text{ ---> } \emptyset \ / \ \sigma\,[C\_\_\ \sigma]\,\sigma$$

[12] In the analysis of MH stress provided above I have not used metrical feet. Further research is required to verify whether metrical feet are necessary for MH, and also whether all syllables are exhaustively parsed (as proposed in Halle and Vergnaud (1987)).

[13] As a matter of fact we could postulate a vowel reduction rule instead of a vowel deletion rule. Stress shift occurs because a reduced vowel cannot bear stress. A reduced vowel which fails to be deleted is then changed to *e*. This analysis requires postulating an abstract reduced vowel which is not found in the phonemic representation nor in the phonetic (except from casual speech). A theory which allows postulating an abstract segment, letting it do the work, and then getting rid of it, is too permissive.

Deletion of the syllabic nucleus triggers the deletion of the entire syllable node, but not of stress. Since stress remains without a host it docks onto the syllable on the right.

(37)



I wish to emphasize the distinction between *e*-Deletion (28) and Vowel Deletion (36). Unlike *e*-Deletion, Vowel Deletion affects any non-high stem final vowel. Vowel Deletion deletes a stressed vowel, while *e*-Deletion requires that the following syllable be stressed.

Of major interest is the distinction between the Past and Participle forms of B2. Their stems are homophonous; *nixnás* 'he entered, he enters'. When a vowel initial suffix is added only the Past form undergoes Vowel Deletion (followed by epenthesis); *nixnás+u* --> *nixnesú* 'they entered' but *nixnás+im* --> *nixnasím* 'they enter'. Participles behave like nouns in this respect (see chapter 2 section 3.2.2.). Their suffix is a nominal suffix and it is attached in the lexicon. *e*-Deletion is not applicable in *nixnasím* 'they enter', as the stem final vowel is *a* (but it applies in the Participle form of B1, *godél+im* --> *godlím* 'they grow'). The suffix attached to the Past form is an agreement suffix, and I therefore assume that it is post-lexical (following Anderson's (1982, 1988c) argument that post-lexical affixes are those which are relevant to the syntax). Vowel Deletion must then be a post-lexical rule.[14]

[14] According to the theory of Lexical Phonology agreement suffixes are attached on a distinct level in the lexicon. One may also suggest that Vowel Deletion is limited to verbs, but I prefer to eliminate such a specification when possible.

Vowel Deletion applies in a derived syllabic environment, when a closed syllable becomes open. Since Vowel Deletion is a post-lexical rule, the change in the syllabic environment must occur in the post-lexical component as well. The change in the syllabic structure in the Participle form *nixnas+im* occurs in the lexicon, as *-im* is attached in the lexicon, and therefore the form is not affected by Vowel Deletion.

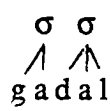
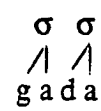
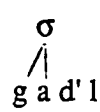
Similarly, agent nouns derived by affixing the agent marker *-an* to a nominal stem undergo *e*-Deletion, rather then Vowel Deletion. Thus the outputs for *mišpat+an* and *ʔegrof+an* are not **mišpetan* and * *ʔegrefan*, as expected if Vowel Deletion applies, but rather *mišpatan* 'legislator' (*mišpat* 'trail') and *ʔegrofan* 'boxer' (*ʔegrof* 'fist'). When *-an* is attached to Participles to derive agent nouns *e*-Deletion applies; *mistakel+an* --> *mistaklan* 'one who tends to observe'.

3.2. IDENTITY EPENTHESIS

As noted above, I assume that deletion of a syllabic nucleus triggers the deletion of the entire syllable node, but not of stress. Since stress remains without a host it docks onto the syllable on the right.

Vowel Deletion, which triggers the deletion of the entire syllable, results in a floating (unsyllabified) consonant (C'), as illustrated below:

(38)

Stem	Derived syllabic structure	Deletion	Output
a. *gadál+u* --> *gadlú* 'they grew'			
			

b. *xidéd+u* --> *xidedú* 'they sharpened'

c. *yixtóv+u* --> *yixtevú* 'they will write'

In (38a) the floating consonant is resyllabified as the coda of the preceding syllable. In (38b) the output of Vowel Deletion violates the Obligatory Contour Principle, therefore *e* is inserted to satisfy the constraint. *e* is also inserted in (38c), where the floating consonant that resulted form Vowel Deletion is preceded by a closed syllable.

It is thus necessary to posit two epenthesis rules, one to account for (38b) and the other for (38c). Identity Epenthesis, as formulated in (39a) below, inserts an *e* after an unsyllabified consonant followed by an identical/homorganic consonant. Syllabic Epenthesis, as formulated in (39b), inserts an *e* after an unsyllabified consonant preceded by a closed syllable.

(39) a. Identity Epenthesis

$\emptyset$ ---> e / C'_i ___ C_i (identical or homorganic consonants)

b. Syllabic Epenthesis

$\emptyset$ ---> e / σ_c C' ___

It should be emphasized that resyllabification cannot apply automatically, right after Vowel Deletion. If this was the case we would not expect Syllabic Epenthesis to affect *yixt'vu* (--> *yextevú*) since the floating *t* could be syllabified as the onset of the following syllable. Complex onsets are permissible in MH, as long as they do

not violate the sonority hierarchy[15]. In word initial position we find complex onsets in *dli* 'bucket', *tvuna* 'wisdom', *štút* 'nonsense', etc. In word medial position we find complex onsets in *til.gref* 'he telegraphed', *hit.ʔaš.knez* 'he became Ashkenaz', *san.dlar* 'shoemaker', *xin.treš* 'he talked nonsense', etc. Therefore the epenthetic *e* in a form like *yinterú* 'they will guard' (<-- *yin.t'.ru* <-- *yin.tó.ru* <-- *yin.tór+u*) cannot be explained by the failure of the *t* to be properly syllabified, as the same *ntr* sequence, or *tr* onset, is found in *xintreš* 'he talked nonsense' (derived by Extraction from *xantariš* 'nonsense'). Therefore Syllabic Epenthesis must precede resyllabification and specify the floating consonant, such that the rule would not affect forms like *tilgref* (**tilgeref*) 'he telegraphed' and *xintreš* (**xintereš*) 'he talked nonsense'.

As argued in chapter 2 section 1.2., the Obligatory Contour Principle in MH refers to the tier of the Supra-laryngeal node. Thus, as predicted, Identity Epenthesis applies in (*hit ʔatéd+u* -->) *hit ʔat'dú* yielding *hit ʔatedú* 'they intended'. *t* and *d* are identical on the Supra-laryngeal node, since the feature [voice] is dominated by the Laryngeal node, and therefore *t* and *d* are considered identical by the Obligatory Contour Principle. Thus, in an environment such as C_i ___ C_i the subscript indicates identity of the featural structure dominated by the Supra-laryngeal node.

Identity Epenthesis does not apply in (*lakáx+u* -->) *lakxú* (**lakexú*) 'they took', under the assumption that the feature [continuant] is dominated by Supra-laryngeal node and therefore *k* and *x* are not considered identical. Similarly, Identity

---

[15] The sonority hierarchy proposed in Barkai and Horvath (1978) for MH is as follows:

stops	fricatives	*v*	nasals	*y*	*r*	*l*
1	2	3	4	5	6	7

In case a complex onset violates the sonority hierarchy, an *e* is inserted. Cf. *cridut* 'huskiness' vs. *recinut* 'earnestness' (but *bircinut* 'seriously', where the *r* is syllabified with the preceding syllable).

Epenthesis does not apply in (*natán+a* -->) *natná* (**natená*) 'she gave', as the feature [sonorant] is dominated by the Supra-laryngeal node and therefore *t* and *n* are not considered identical.

It should be noted that in non-derived environments lexically idiosyncratic strategies prevent violations of the Obligatory Contour Principle. Extracting the consonants *(x,c,c,r)* from the noun *xacocra* 'trumpet' and associating them with the vocalic pattern *(i,e)* yield the form **xiccer* . This form violates the Obligatory Contour Principle, and therefore *e* may be inserted, resulting in *xicecer* 'he played the trumpet'. This form, however, is not commonly used. The preferred form is *xicrec*, where violation of the Obligatory Contour Principle has been prevented by metathesizing the third and the fourth consonants. Not that there is a rule of metathesis in this instance, but rather the root is altered (resulting in some sort of ablaut relation between the noun and the verb). Similarly in *hikxil* 'it became blue', Spirantization of *k* in post-vocalic position would yield **hixxil* (cf. *hiktiv* --> *hixtiv* 'he dictated). In order to prevent violation of the Obligatory Contour Principle *e* can be inserted, thus yielding *hixexil*. This form is hardly ever used; the preferred form is *hikxil*, where Spirantization does not apply.

Indeed, as formulated, Identity Epenthesis (39a) cannot derive the rare forms *xicecer* and *hixexil* since it requires an unsyllabified consonant. Notice also that the heteromorphemic cluster of identical consonants in *hit+tamem* or of homorganic consonants in *hit+daber* does not undergo Identity Epenthesis since there is no unsyllabified consonant available; the attested forms are *hittamem* (**hitetamem*) 'he pretended honesty' and *hitdaber* (**hitedaber*) 'he negotiated'. In casual speech regressive Voicing Assimilation (see (41) below) may apply, yielding *hiddaber*, and the geminate is then simplified, yielding *hitamem* and *hidaber*.

3.3. OBSTRUENT EPENTHESIS

Two adjacent identical or homorganic consonants may arise via concatenation; *rakád+ti* 'I danced', *karát+ti* 'I cut off'. This representation is amended by an epenthetic *e* (but see below for another option of voicing assimilation). Thus *rakád+ti* becomes *rakádeti* 'I danced' and *karát+ti* becomes *karáteti* 'I cut off'.

This instance of epenthesis cannot be accounted bu Identity Epenthesis. First, Identity Epenthesis requires an unsyllabified consonants; but this is a minor problem. The main problem is that this instance of epenthesis applies only between obstruents. Two adjacent coronal nasals do not undergo epenthesis in the same environment; *taxan+nu* --> *taxannu* (--> *taxanu*, in casual speech) 'we milled' (**taxanenu*). It is not the case that nasals are somehow exempt from the Obligatory Contour Principle, as Identity Epenthesis applies *rinenú* 'they sang' (**rinnú*). In addition, as noted above, the heteromorphemic cluster of identical consonants in *hit+tamem* does not undergo epenthesis, as the attested form is *hittamem* 'he pretended honesty' (--> *hitamem*, in casual speech) and not **hitetamem*. That is, not only that there are two distinct rules which refer to identity, they also must be somehow ordered.

It is therefore necessary to propose an independent rule which inserts an *e* between two homorganic or identical obstruents.[16]

(40) Obstruent Epenthesis

$$\emptyset \text{ ---> } e \;/\; C_i \underset{[-son]}{} \_\_\_\_ C_i \underset{[-son]}{} \qquad \text{(identical or homorganic consonants)}$$

[16] Since all suffix initial consonants and prefix final consonants are coronals it is impossible to determine whether the rule affects any obstruent or just coronals. But in the absence of evidence to the contrary I provide the most general rule.

Obstruent Epenthesis does not apply in *taxan+nu* (*taxannu* --> *taxanu*) since, as formulated, it is restricted to obstruents. In order to block the application of Obstruent Epenthesis in *hit+tamem*, it must be assumed that the rule is sensitive to a derived environment. The prefix in *hit+tamem* is lexical, as it is a binyan prefix, while the suffix in *rakad+ti* is post-lexical, since it is an agreement suffix. Obstruent Epenthesis must then be a post-lexical rule (under some views).

It should be emphasized that although Obstruent Epenthesis cannot be a direct consequence of violation of the Obligatory Contour Principle, as it does not apply between two identical nasals, identity is defined here as well on the Supra-laryngeal node. This is a rather suspicious situation, and it may suggest, in the spirit of Odden (1986), that the Obligatory Contour Principles is not a universal constraint, but rather a principle expressing a condition that is natural but not obligatory. As further argued in Odden (1988), we must allow rules to be sensitive to identity, "which requires a powerful system of segment subscription and checking" (p. 461). Given this device, we should expect rules to be sensitive to both environments C_i __ C_i (as it is the case with Identity Epenthesis and Obstruent Epenthesis) and C_i __ C_j. The latter instance is found Afar (Bliese (1981)); *matáru -matré* 'to overtake', *kubúcak - kubcé* 'to swell' but *calulé* (**callé*) 'it soured', *gonaná* (**gonná*) 'he searched for'.

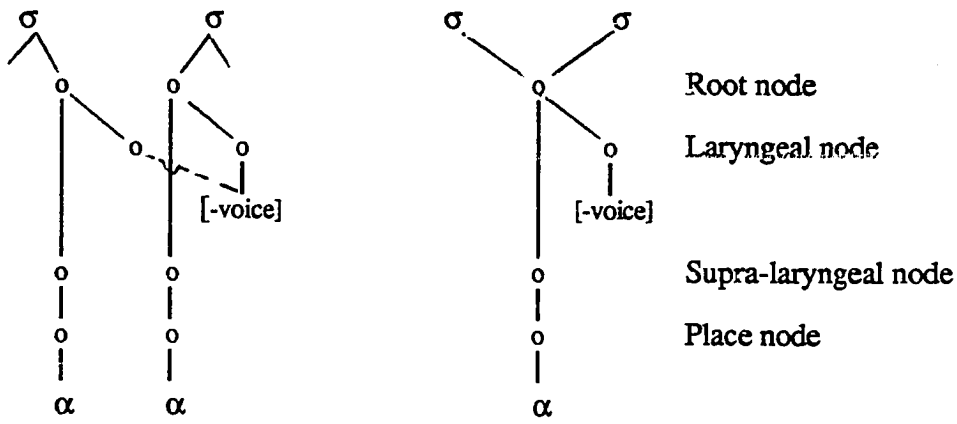
Obstruent Epenthesis can be blocked by the optional rule of Voicing Assimilation.

(41) Voicing Assimilation (optional)

$$C \;\text{---}> [\alpha\text{voice}] \;/\; \underline{\quad} \; C \quad \text{where } C = [-\text{son}] \text{ and } C = \begin{bmatrix}\alpha\text{voice}\\ -\text{son}\end{bmatrix}$$

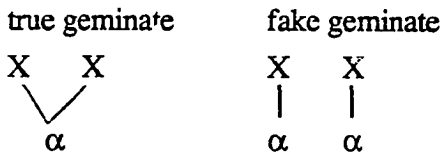
If Voicing Assimilation applies (vacuously in *karat+ti*), the resulting structure is one segment linked to two prosodic positions. This is predicted by Steriade's (1982) Shared Features Convention; when two segments come to share features via a spreading rule (in our case spreading of the feature [-voice]), all other identical features are merged. This is illustrated below for the Voicing Assimilation rule.

(42)



Steriade (1982) distinguishes between a structure of a doubly-linked segment, termed "true geminate", and a structure of two identical adjacent segments, often termed "fake geminate" (see further elaboration in Hayes (1986) and Schein and Steriade (1986)):

(43)



True geminates cannot be split by epenthesis, since otherwise there would be crossing association lines. Therefore, if Voicing Assimilation applies, Obstruent Epenthesis is blocked. Then, the true geminate is simplified in casual speech. Since

Voicing Assimilation is optional, both forms, *rakáti* and *rakádeti* 'I danced', are possible.

(44)

/rakad+ti/		
rakatti	---	Voicing Assimilation
---	rakadeti	Obstruent Epenthesis
rakati	---	Degemination
rakáti	*rakádeti*	

Voicing Assimilation must follow Identity Epenthesis (39a) and Syllabic Epenthesis (39b), as **hit ʔadu* (<-- *hit ʔaddu* <-- *hit ʔatdu* <-- *hit ʔatedu* <-- *hit ʔated+u*) is not an alternative form to *hit ʔatedu* 'they intended'.

I thus conclude that two independent Epenthesis rules which refer to identity are required in MH, Identity Epenthesis and Obstruent Epenthesis. Both rules reflect the effect of the Obligatory Contour Principle. Yet it is not sufficient to state the principle and to show that epenthesis is a direct consequence of this principle, since, as argued above, the rules must be stated independently.

4. LIST OF PHONOLOGICAL RULES

To conclude this chapter I provide a list of the phonological rules presented in this work.

LEXICAL
Segmental rules

i-Insertion (derived environment) <(7) in chapter 1>

ø ---> i / #C__C

t-Deletion <(26) in chapter 3>

t ---> ø / __ V t $_{N[+f.]}$

y-Insertion <(27) in chapter 3>

$$\emptyset \text{ ---> } y \;/\; \underset{[+high]}{V} \_\_\_ V$$

Two-Vowel Deletion <(28) in chapter 3>

$$V \text{ ---> } \emptyset \;/\; \_\_\_ V$$

Segolate Deletion <(30) in chapter 4>

$$V \text{ ---> } \emptyset \;/\; C \overset{*}{\_\_\_} C \bar{V} C V^{*}$$

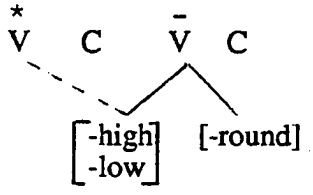
Vowel Lowering <(31) in chapter 4>

$$\begin{bmatrix}\text{-round}\\ \text{-high}\end{bmatrix} \text{ ---> } [+low] \;/\; \underset{|}{\overset{-}{\sigma_0}} \; \overset{*}{\sigma}$$

e-Deletion <(28) in chapter 4>

$$e \text{ ---> } \emptyset \;/\; \underset{|}{\sigma_0} \; \sigma_0 \; (\ldots) \; \underset{[+stress]}{\sigma}$$

Height Harmony <(32) in chapter 4>



Stress rules (follow all segmental rules)

Destressing <(12) in chapter 4>

... * ... ---> ∅
... * ... *
... σ ... σ_{ds} (σ_{ds} is the syllable of the destressing suffix)

Prestressing <(15) in chapter 4>

... * <--- ø

... * *

... σ σ_{ps} (σ_{ps} is the syllable of the prestressing suffix)

The R(ight)-End rule <(5) in chapter 4>

Add a beat to the rightmost grid position on the highest level

POST-LEXICAL

Vowel Deletion (derived environment) <(36) in chapter 4>

$$\underset{[-high]}{V} \rightarrow \emptyset \;/\; \sigma\,[C\_\_\,\sigma]\,\sigma$$

Identity Epenthesis <(39a) in chapter 4>

$$\emptyset \rightarrow e \;/\; C'_i \_\_\_ C_i$$

Syllabic Epenthesis <(39b) in chapter 4>

$$\emptyset \rightarrow e \;/\; \sigma_c\, C' \_\_\_$$

Voicing Assimilation (optional) <(41) in chapter 4>

$$\underset{[-son]}{C} \rightarrow [\alpha voice] \;/\; \_\_\_\; C \begin{bmatrix} \alpha voice \\ -son \end{bmatrix}$$

Obstruent Epenthesis <(40) in chapter 4>

$$\emptyset \rightarrow e \;/\; \underset{[-son]}{C_i} \_\_\_ \underset{[-son]}{C_i}$$

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