

Lowenstamm

SPIRANTIZATION MELODIES IN HEBREW

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1. Introduction.

Modern Hebrew (MH) is the commonly spoken dialect of Hebrew. Another dialect is also in use, that I will call Standard Hebrew (SH), and it stigmatizes its speakers as being teachers, radio announcers or just overly educated. Both MH and SH are different from Biblical Hebrew (BH), the departure of MH from BH being even wider than that of SH. SH is basically the form of the language when it was revived at the beginning of this century (it has been kept frozen since by prescriptivist rules), and it incorporates changes to BH that date from Mishnaic and Medieval times.

A major difference between the modern variants of Hebrew and BH is that consonant gemination no longer exists in the modern variants. One effect of this change is to make the BH spirantization rule opaque. In BH the rule accounts for the spirantization of six underlying stops: b, g, d, k, p and t in a post vocalic position, unless geminated. In SH and MH the spirants corresponding to g, d, and t do not exist any more, so only the b ~ v, k ~ x and p ~ f alternations have to be accounted for.

For example the BH spirantization rule accounts for the following alternations:

- 1.a laavaš 'wear'
 b hilbiš 'make wear'
 c hitlabbeeš 'get dressed'

The modern forms corresponding to 1.a - c are lavaš, hilbiš and hitlabeš. The b was not spirantized in 1.c because of gemination, but the corresponding MH (and SH) form hitlabeš makes the spirantization rule opaque. But not only the disappearance of gemination contributes to the opacity of the rule. Another factor is the merging of the BH q into k,

of the BH pharyngeal H into x (the spirant corresponding to k), and of the BH w into v (the spirant corresponding to b), as in the following:

- 2.a xala 'become sick' historically Haalaa
 b hixli 'make sick' heHelaa
 c hitxala 'pretend to be sick' hitHallaa
 3.a kadam 'be prior to' historically qaašam
 b hikdim 'be early' hiqdiim
 c hitkadem 'advance' hitqaddeem
 4. vered 'rose' historically wered

Still another contributor to the opacity of spirantization is heavy borrowing into MH: tilfen 'call on the phone' (from telefon), telescop, robot etc.

These three factors by no means exhaust all cases of deviations in SH and MH from the BH phonological spirantization rule, cf. the following examples (and many others listed in Ben-Horin and Bolozky (1972) and Bolozky (1980)). The examples in 5 show that the stop and spirant versions of p, k, b, are no longer in complementary distribution.

- 5.a hitxaber 'be added' ~ hitxaver 'become friends with'
 b hitkaven 'intend, ~ hitxaven 'time oneself'
 c tapsan 'climber' ~ tafsan 'catcher'

It is the aim of this paper to give a morphological account to the facts of MH spirantization that will unreveal regularities where a phonological spirantization rule lists exceptions.

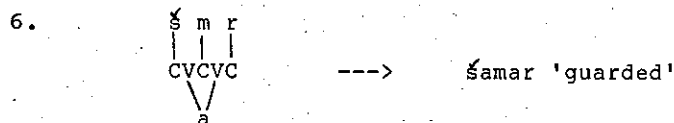
The framework for this account is McCarthy's (1979) treatment of Semitic morphology, that uses the concepts of autosegmental phonology (cf. Goldsmith (1976)). In autosegmental phonology, phonemic representations are analyzed as pairs of autonomous tiers, which are

linear sequences of units that can be effected independently by specific rules. McCarthy proposes three autonomous tiers: the syllabic skeleton (prosodic template), the consonant melody and the vowel melody. The units of each melody are linked (associated) to the units of the skeleton according to the Well-formedness Condition:

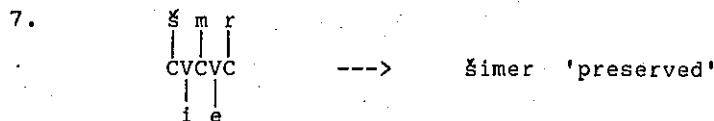
- i) Unless otherwise stipulated, segments in the melody and slots in the skeleton are linked one-one from left to right;
- ii) each slot in the skeleton must be linked with at least one segment in the melody;
- iii) linking lines must never cross."

(Halle and Vergnaud (1980) p. 86)

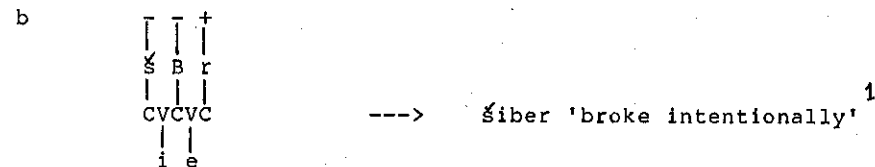
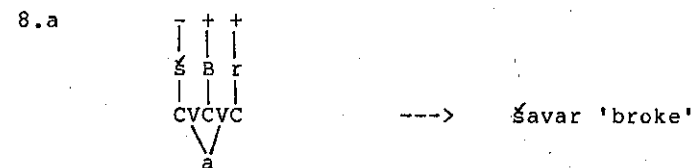
The phonemes in the consonant and vocalic melodies are unspecified for the feature [\pm syllabic], they acquire this specification by attachment to the syllabic skeleton. A phoneme attached to C in the skeleton acquires [-syllabic], whereas a phoneme attached to V acquires [+syllabic]. For example, if we assume the skeleton for the perfect of binyan paal is CVCVC and the vocalic melody is a, then given the root šmr 'guard' as a consonantal melody, we get:



If we assume that the skeleton in MH for binyan piel is the same as for paal, but that they differ in vocalic melodies, we get the MH form for šmr in piel:



My suggestion is that phonemes in the root are not necessarily specified for the feature [\pm continuant] either. A set of distinctive features that represent a consonant not specified for [\pm continuant] will be denoted by a capital letter, e.g. B, K, P. The specification for that feature will be supplied by a fourth autonomous tier: the spirantization melody. + on that tier will stand for [+continuant] and - for [-continuant]. For example, the spirantization melody for the perfect of paal is -++, (to account for bala 'swallowed' from the root B_l, lavaš 'wore' from lBš, šaxav 'lay down' from šKB), and for the perfect of piel it is --+ (to account for bišel 'cooked' from Bšl, riped 'upholstered' from rPd and kizev 'lied' from KzB).



When there are no alternations in related forms between a stop and its corresponding spirant, neither in SH nor in MH, I shall assume that the feature [\pm continuant] is specified already in the root.

This will be the case for most borrowings, but by no means not for all, for example the following alternation exists in MH: pitrel 'patrolled' ~ yefatrel 'will patrol' which shows that the root is Ptrl even though it's a borrowing.

k that is historically q will always be specified in the root as [-spirant] since it never alternate with x. x that is historically H

will be specified in the root for [+spirant], and the same for v that is historically w. For example the spirantization melody for the imperfect of piel is +--, cf. bišel 'cooked' ~ vevašel 'will cook'; but we still get the following:

9.	root	piel perfect	piel imperfect
a	kBl	kibel 'accepted'	yekabel 'will accept'
b	xBl	xibel 'damaged'	yexabel 'will damage'
c	vtr	viter 'gave up'	yevater 'will give up'

Since there are also no other forms related to 9.a, b or c that alternate stop ~ spirant in root initial position, we deduce that the roots for 9.a - c have initial k, x and v respectively, rather than being KBl for 9.a and b, and Btr for 9.c. Notice that the form kavil 'acceptable' shows that the root in 9.a is kBl rather than kbl; the form xavul 'damaged' shows that the root in 9.b is xBl rather than xbl. Notice also that there is a root KBl in Hebrew distinct from the roots in both 9.a and 9.b, as can be seen from the alternation in SH paal: kaval 'roped' ~ yixbol 'will rope'. There is also a root Btr distinct from the root in 9.c, as can be seen from the alternation: biter 'sliced' ~ yevater 'will slice' in SH and MH piel.

In section 2 I will lay out a treatment of spirantization in the verbal system, in section 3 - a treatment of spirantization in the nominal system, and in section 4 - the interaction of spirantization with reduplication.

2. Spirantization in the Verbal System

2.1 The Verbal Conjugations (Binyanim):

SH and MH have basically five binyanim: paal, nif'al, hif'il, piel and hitpael.² The last two are called 'heavy binyanim' by traditional grammarians of Hebrew, because of the historical gemination of the root's middle consonant in those binyanim. The first three are called 'light binyanim'. In 10 I list the conjugation of the root Ptr 'exempt' in all binyanim, (for the unmarked 3rd person masc. sing. so as not bring in the person, gender and number agreement suffixes of other forms):

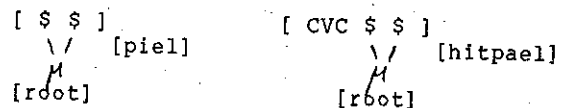
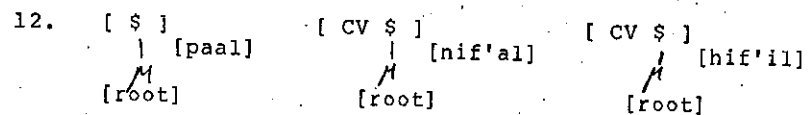
10.		perfect	imperfect	gloss
	paal	patar	yiftor	exempt
	nif'al	niftar	yipater	get rid of
	hif'il	hiftir	yaftir	speak casually
	piel	piter	yefater	fire, dismiss
	hitpael	hitpater	yitpater	resign

The skeleta corresponding to three consonantal roots in all binyanim are listed in 11. For the sake of clarity, that part of the skeleton that links to the root (which I will call the basic skeleton) is framed.

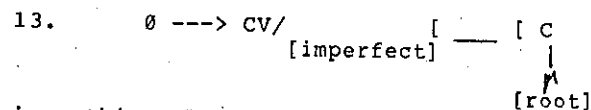
11.		perfect	imperfect
	paal	CVCVC	CV CCVC
	nif'al	CV CCVC	CV CVCVC
	hif'il	CV CCVC	CV CCVC
	piel	CVCVC	CV CVCVC
	hitpael	CVC CVCVC	CV CVCVC

It is striking that the basic skeleton is always CVCVC in the heavy binyanim, and mostly CCVC in the light binyanim. I claim that the light binyanim are basically monosyllabic, whereas the heavy binyanim are

basically bisyllabic, i.e. the basic skeleton for the light binyanim is \$, whereas for the heavy ones it is \$\$\$. From these basic skeleta we then get the final skeleta for the binyanim:

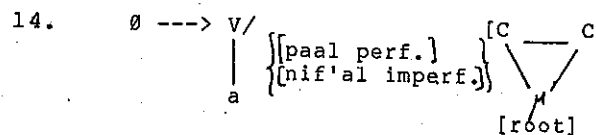


We need a rule to prefix CV to paal and piel to form the imperfect:

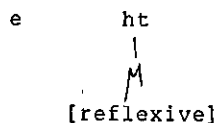
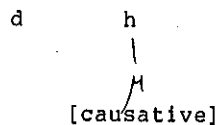
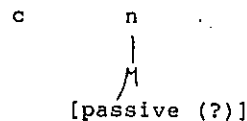
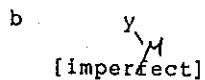
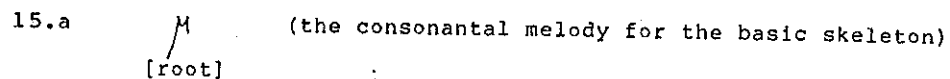


i.e. this rule prefixes CV to those binyanim that do not have previous prefixes to their basic skeleta: paal and piel.

We also need a rule to insert V attached to a in the forms for paal perfect and nif'al imperfect:



Let us consider some examples of linking the skeleta to other morphemes. The relevant morphemes are listed in 15:



f vocalism morpheme (about which I shall have nothing to say)
 Association of the various morphemes to the skeleta works in the

following way: the root morpheme is associated to the basic skeleton, and the consonantal melodies in 15.b - e are associated to the prefix. There are other melodies in SH and MH that associate together with the root to the basic skeleton:

16.a š prefixes to the root:

KtB: šixtev 'rewrite' ~ katav 'write'

Kn': šixnea 'persuade' ~ nixna 'surrender'

b t prefixes to the root:

xkr: tixker 'debrief' ~ xakar 'investigate'

Pkd: tiked 'function' ~ piked 'command'

c ' prefixes to the root:

zKr: 'izker 'commemorate' ~ zaxar 'remember'

KzB: 'ixzev 'disappoint' ~ kizev 'lie'

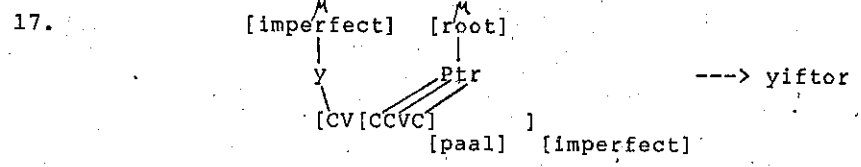
gP: 'igef 'flank' ~ gaf 'wing'

d ' suffixes to the root:

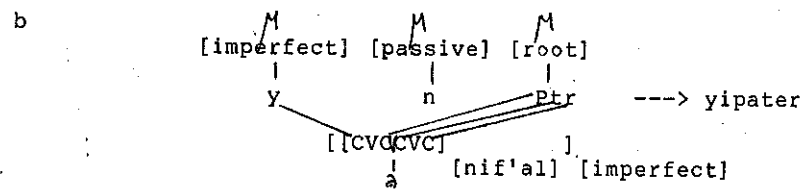
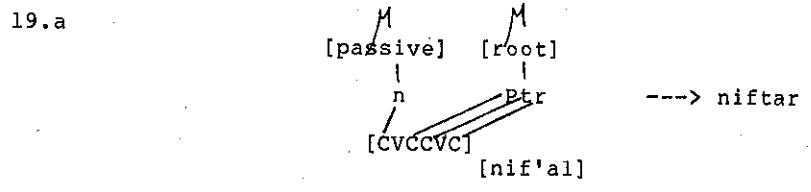
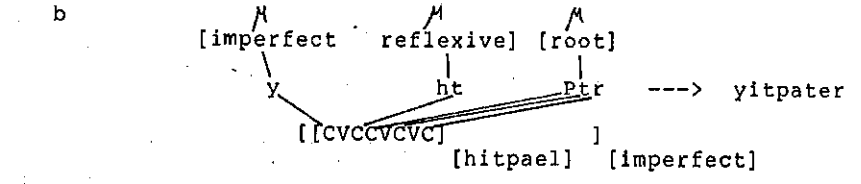
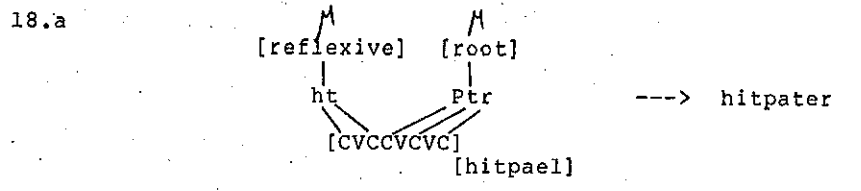
dK: dik'a 'she oppressed' ~ dixdex 'depress'

- e y suffixes to the root:
 - zK : zikita 'you acquitted'
 - zaxita 'you won' ~ zikex 'purify'³
- f y prefixes to the root:
 - cr : yacar 'create' ~ car 'form'
 - šn : yašan 'sleep(v)' ~ šena 'sleep(n)'
- g y infixes in the root:
 - cr : ciyer 'draw' ~ car 'form'
 - šf : šiyef 'smooth' ~ šifšef 'polish'

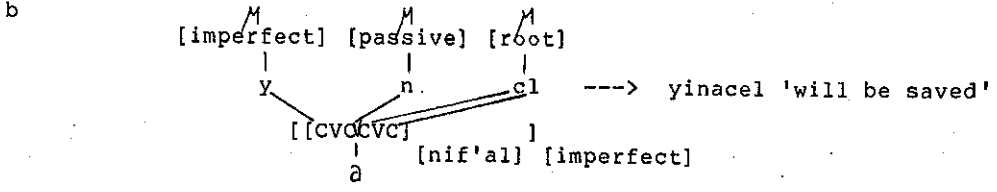
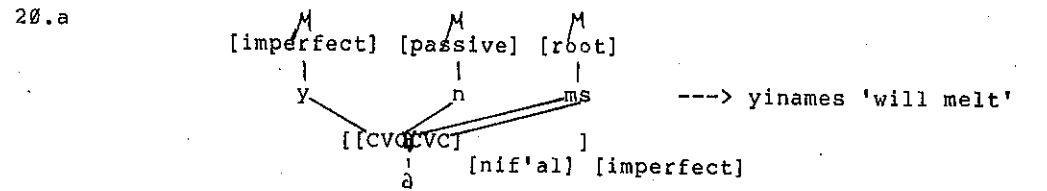
17 illustrates the association of the various morphemes to the skeleta:



As will be motivated in section 4, when two morphemes associate to the same part of the skeleton, the first is associated from left to right and the second from right to left. This explains what happens in some of the imperfect forms:



The proper account for the nif'al in BH would be to allow a CVC prefix for the imperfect, the first C associating to y and the second to n. A rule of n assimilation to the following morpheme would then apply and result in the form yippater. In SH and MH n assimilation is not longer in effect: linsoa 'to travel', linšom 'to breathe', linkom 'to take revenge', linboax or linvoax 'to bark', lintoš 'to abandon' etc. But the n morpheme is still part of the imperfect of nif'al, as can be seen in the case of some biconsonantal roots, where n associates in MH to the first C slot of the basic skeleton:



It seems to be a true generalization about Hebrew underlying syllable structure that the onset in an open syllable may include at most one consonant, the onset in a closed syllable - at most two consonants, and that the appendix may include at most one consonant. (cf. Halle and Vergnaud (1980) for the definition of onset (as pre-nucleus) and appendix (as post-nucleus).) Moreover, every stem ends in a closed syllable, and no word contains two adjacent syllables with "heavy" onsets, i.e. that contains two consonants.

These principles determine that no more than three consonants can be linked to a light binyan basic skeleton. They also determine that no less than three consonants and no more than five can be linked to a heavy binyan basic skeleton. Actually they determine that the possibilities for basic skeleta for light binyanim are exactly: CVC, CCVC and for heavy binyanim: CVCVC, CVCCVC, CCVCVC, CVCCVC. And it turns out that these are indeed all and only the atested possibilities:

21.a	basic skeleton \$	root	examples
	CVC	km	yakum 'rise', yakim 'rise (trans.)'
	CCVC	lht	yilhat 'blaze', yalhit 'make blaze'
b	basic skeleton \$\$	root	examples
	CVCVC	lht	lihet 'make blaze', hitlahet 'blaze'
	CVCCVC	trgm	tirgem 'translate'
	CCVCVC	prklt	priklet 'behave like a lawyer'
	CVCCVC	tlgrf	tilgref 'send a telegram'

This account explains why four or more consonant roots can only be conjugated in the heavy binyanim. McCarthy's account of this fact relies on the skeleton for piel in BH being CVCCVC, and on the middle consonant in three consonantal roots reduplicating. This is no longer

true in SH and MH. Moreover McCarthy does not account for the fact that two consonant roots are not conjugated in the heavy binyanim, (unless reduplicated or with an affix). In my account here both facts are results from the basic skeleton for the heavy binyanim being bisyllabic. In the light binyanim only two or three consonant roots are conjugated because the basic skeleton of the light binyanim is monosyllabic.

The advantage of inserting V in 14 rather than having this V as part of the basic skeleton is that insertion explain what happens in cases of biconsonantal roots:

22.	root	perfect	imperfect	gloss	
	paal	Bz	baz	yavuz	despise
	nif'al	Kn	naxon	yikon	be ready
	hif'il	Kn	hexin	yaxin	prepare

The forms for paal perfect and nif'al imperfect are not *baaz and *yikoan respectively, since the environment for rule 14 is not met, there are no two adjacent Cs in the basic skeleton for two consonantal roots, since it is simply CVC.

Notice that an account that starts for example with CVCVC for paal perfect even in the case of biconsonantal roots and tries to account for baz as linking to the second syllable of the skeleton, will run into problems accounting for spirantization, since the spirantization melody for biconsonantal roots corresponds to the spirantization of the first and third consonants in a three consonantal root, rather than to the second and third. But between the first and third consonants there are two vowels.

So the only alternative account to the one presented here is to postulate different skeleta and different spirantization melodies for roots with different numbers of consonants.

2.2 Spirantization.

The example in 10. showed spirantization alternations in the first consonant of three consonantal roots. These are basically the same in MH and SH. We now give examples of MH spirantization alternations in the third consonant, and again these are the same as in SH:

23.	root	perfect	imperfect	gloss
paal	'lB	'alav	yaalov	insult
nif'al	'lB	neelav	yealev	be offended
hif'il	'lB	heeliv	yaaliv	insult
piel	kLP	kilef	yekalef	peel
hitpael	kLP	hitkalef	yitkalef	peel oneself

Notice that the third consonants are indeed B and P and not underlying v and f, as the following related nouns show: 'elbon 'insult', klipa 'peel'.

From 10 and 23 it is clear that the appendices of all syllables of the skeleta are always [+continuant]. This is also true if the root is biconsonantal:

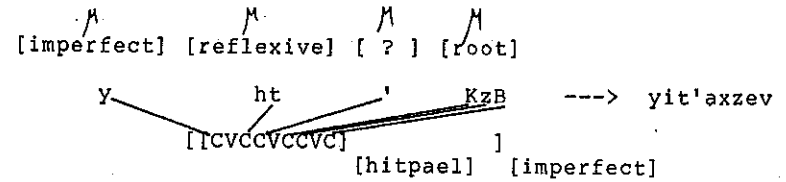
24.	root	perfect	imperfect	gloss
paal	'P	'af	yauf	fly
nif'al	sB	nasav	yisov	turn around
hif'il	'P	heif	yaif	make fly

(These are not underlying f and v: 'af'apayim 'eyelids', siba 'reason'.) and also if it is four consonants that associate with the skeleta:

25.	root	perfect	imperfect	gloss
piel	KtB	šixtev	yešaxtev	rewrite
hitpael	KzB	hit'axzev	yit'axzev	be disappointed

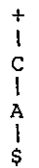
ktuba 'marriage certificate' and kizben 'lied' show that the final v are not underlying. The associations in 25. work as follows:

26.



So far one generalization is clear, every appendix (A) in the skeleton is associated with [+continuant]. Rule 27 expresses this generalization.

27. Appendix Rule:



Let us now look at what happens in the middle consonant of the three consonantal root:

28.	root	perfect	imperfect	gloss	
paal	SH	tPr	tafar	yitpor	sew
	MH			yitfor	
nif'al	SH	tPr	nitpar	yitafer	be sewed
	MH		nitfar		
hif'il	šKn	hiškin	yaškin		settle
piel	šKn	šiken	yešaken		house
hitpael	šKn	hištaken	yištaken		settle down

Another clear generalization is that the onset of the last syllable in the heavy binyanim is always linked to [-continuant]. 29 expresses this generalization.

29. Onset rule: (heavy binyanim)

-
|
C
|
O
|
\$ \$]

Notice that this generalization does not apply to hif'il, since in the case of a biconsonantal root, the consonant that constitutes the onset of the second syllable associates to +, as can be seen in 22.

The difference between SH and MH appears for most roots:

paal			nif'al		
SH	MH	gloss	SH	MH	gloss
yigbe	yigve	collect	nigba	nigva	be collected
yigba	yigva	become taller			
yigbol	yigvol	border upon			
yaxboš	yaxvoš	bandage			
yitbol	yitvol	dip	nitbal	nitval	be dipped
yigbor	yigvar	subdue			
yirbac	yirvoc	crouch			
yicbor	yicvor	accumulate			
yinbot	yinvot	bud			
% yišbor	yišvor	break			
% yikbor	yikvor	bury	nikbar	nikvar	be buried
% yišbot	yišvot	go on strike			
yinbax	yinvax	bark			
% yikba	yikva	arrange			
yitpax	yitfax	swell			
yitpos	yitfos	catch			

paal			nif'al			
	SH	MH	gloss	SH	MH	gloss
%	yišpox	yišfox	spill			
	yicpe	yicfe	foresee	nicpa	nicfa	be foreseen
%	yispor	yisfor	count	nispar	nisfar	be counted
	yidpok	yidfok	knock	nidpak	nidfak	be knocked
	yikpoc	yikfoc	jump			
%	yišpot	yišfot	judge	nišpat	nišfat	be sentenced
	yikpa	yikfa	freeze			
%	yimkor	yimxor	sell			
%	yilkod	yilxod	capture			
%	yiskor	yisxor	rent			

(We explain later the scarcity of examples involving K.)

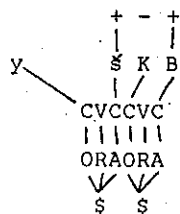
So the spirantization melodies for SH and MH that we can deduce from 10, 23, 24, 25 and 28 are:

31.		perfect	imperfect
	paal SH	- + +	+ - +
	MH	- + +	+ + +
	nif'al SH	+ - +	- + +
	MH	+ + +	- + +
	hif'il	+ - +	+ - +
	piel	- + - +	+ + - +
	hitpaal	- + - +	- + - +

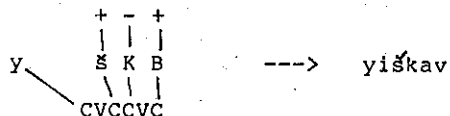
Let us consider a few examples of associations:

32. ŠKB 'lie' in paal imperfect:

a By the Appendix Rule:

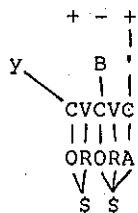


b By the Well-formedness Condition:



33. B' 'come' in paal imperfect:

a By the Appendix Rule:



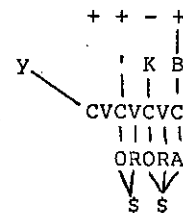
b By the Well-formedness Condition:



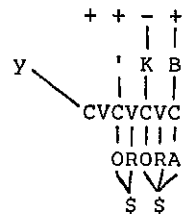
The Appendix Rule and the Well-formedness Condition get the right result in 32.b: the spirantization of the two consonant root will be like the spirantization of the first and third consonants of a three consonant root. The spirantization melodies for the heavy binyanim also give the right results for both three and four consonants:

34. 'KB 'delay' in piel imperfect:

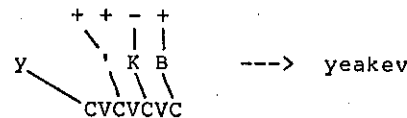
a By the Appendix Rule:



b By the Onset Rule:

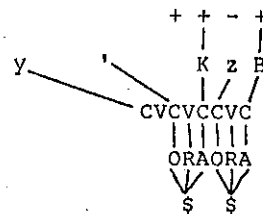


c By the Well-Formedness Condition:

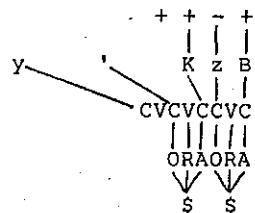


35. KzB 'lie' in piel imperfect:

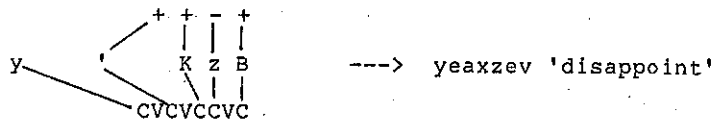
a By the Appendix Rule:



b By the Onset Rule:



c By the Well-formedness Condition:



2.3 K Dissimilation in MH:

There is an interesting special case with the spirantization of K in MH. Consider the following examples, all in the paal conjugation, where K does not spirantize even though it is in a position linked to +:

36.	root	perfect	imperfect	gloss
	KPr	kafar	yikfor	deny
	KPl	kafal	yikfol	multiply
	KP	kafaf	yikfof	bend
	Ktš	kataš	yiktoš	crush
	Krt	karat	yikrot	cut off
⊗	KBh	kava	yikve	extinguish
⊗	KBs	kavaš	yikvoš	press
⊗	KtB	katav	yiktov	write
⊗	K'B	kaav	yik'av	hurt
⊗	K's	kaas	yik'as	be angry

(Also in nif'al: nikfal 'be multiplied', nikfaf 'be bent', niktaš 'be crushed')

Notice that this is not a case of underlying k, since the corresponding relevant forms in SH are: yixbe, yixpor, yixpol, yixpof, yixboš, yixtov, yix'av, yixrot, yix'as, yixtoš. Moreover there are alternations even in MH: yexabe 'extinguish (trans.)', yexaper 'atone for', maxpela 'multiplication', kapot 'hands', maxbeš 'a press', hixtiv 'dictate', max'ov 'pain', hixrit 'destroy', hix'is 'make angry', maxteš 'mortar'.

K also fails to spirantize according to the MH spirantization melody in the following examples, instead it follows the SH spirantization melody:

37.	root	perfect	imperfect	gloss
	BK	baxa	yivke * yivxe	cry
	xKr	xaxar	yaxkor * yaxxor	lease
	xKm	xaxam	yexkam * yexxam	become wise
	šKB	šaxav	yiškav * yišxav	lie down
	rKB	raxav	yirkav * yirxav	ride
	šKx	šaxax	yiškax * yišxax	forget
	zKr	zakar	yizkor * yizxor	remember

(Also in nif'al perfect: nexkar 'be leased' * nexxar, niškav 'lie down' * nišxav, niškax 'be forgotten' * nišxax, nizkar 'be reminded' * nizxar.)

There are more unexpected examples in the heavy binyanim, where we find K spirantizing in a [-continuant] position:

38.	root	perfect	imperfect	gloss
	KBh	xiba	yexabe	extinguish
	KPr	xiper	yexaper	atone for
	KBs	xibes	yexabes	do laundry
	KBd	xibed	yexabed	respect
	Kvn	xiven	yexaven	aim
	Ksh	xisa	yexase	cover

(Also in hitpael: hitxaper 'be atoned for', hitxabes 'wash (intrans.)', hitxabed 'be treated', hitxaven 'time oneself'.)

36 and 38 point in the direction of paradigm levelling, but since 37 seems to be a related phenomenon, and results in quite the opposite of paradigm levelling, we are led in the direction of a different solution. Notice that in the case of three consonantal roots, it is only in paal imperfect, nif'al perfect and piel and hitpael perfect that that a sub-melody of the form + + or - - appears. Whenever K is associated with the first + or - in such a sub-melody, it dissimilates. The rule is therefore:

39. K Dissimilation (MH):



Notice that in 37 the relevant melody is + + +, with K associating to the middle +. The generalization still is that K dissimilates from a following rather than preceding equal value of [+continuant], otherwise we would expect in the case of - - + of piel the forms: *sixen (siken 'settle'), *mixen (miken 'mechanized'), *zixa (zika 'acquitted'). The starred forms are not so because of underlying k: saxan 'dwell', mexona 'machine', zax 'pure'.

2.4 An Apparent Counterexample:

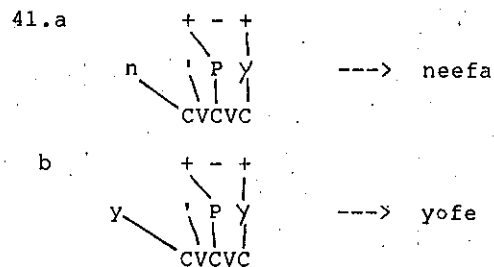
In 40 I list what looks like counterexamples to my account of spirantization. In hif'il, the second consonant of a three consonant root associates to [-spirant] in SH and MH, and also in paal perfect and nif'al imperfect in SH, but notice the following:

40.	root	binyan	form	gloss
	'Bd	hif'il	heevid	employ
		paal	yaavod	work
	'Pl	hif'il	heefil	darken
	'Br	hif'il	heevir	transfer
		paal	yaavor	cross
	'Pr	hif'il	heefir	turn grey
	'Kl	hif'il	heexil	feed
		paal	yoxal	eat
		nif'al	neexal	be eaten
	'Kr	hif'il	heexir	trouble
		paal	yaaxor	"
		nif'al	neexar	be troubled
	'Bk	nif'al	neevak	struggle
	'PK	hif'il	neefax	become
	'Py	paal	yofe	bake
		nif'al	neefa	be baked

At least not all these forms have underlying spirants: maabada 'laboratory', ipul 'blackout', maaboret 'ferryboat', afarpar 'greyish', hit'abkut 'wrestling', maapexa 'revolution'.

The skeleton for these binyanim is CVCCVC, but ' cannot appear at the appendix of a syllable, therefore the roots are reanalyzed as being

biconsonantal, i.e. link to the skeleton CVCVC, and the missing glide has an effect on the first vowel: either by lowering it and lengthening it, as in neefa, or by backing it, as in yofe. The associations in these cases would work as follows:



3. Spirantization in the Nominal System.

Syllabic skeleta for nouns are traditionally called miskalim. Since there are dozens miskalim, much of the variation being in the vocalism, we shall not be interested in distinguishing between many of them. Moreover I shall discuss only those mishkalim that display variations in their spirantization melodies.

3.1 Mishkalim with alternating last consonant.

Those mishkalim where the basic skeleton is monosyllabic exhibit an alternation in both vocalic and spirantization melodies between variants of the skeleta with and without suffixes. Consider the following alternations of SH and MH:

42. root	stem	stem+suffix
dB	dov 'bear'	dubim 'bears'
tP	tof 'drum'	tupim 'drums'
lB	lev 'heart'	liba 'core'
xK	xex 'palate'	xiki 'my palate'
rK	rax 'soft'	raka 'soft (fem.)'
dP	daf 'page'	dapim 'pages'

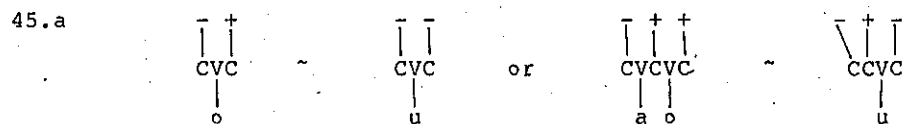
The same alternations take place when the biconsonantal root is preceded by a prefix:

43. root	stem	stem+suffix
gP	'agaf 'wing'	'agapim 'wings'
gP	magaf 'boot'	magapayim 'boots' MH
sK	masax 'screen'	masakim 'screens' SH
sK	musax 'garage'	musakim 'garages' SH

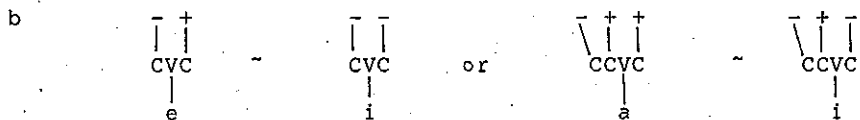
The same alternations take place in adjectives with the a o vocalism, and in a number of other nouns with three consonantal roots or more:

44. root	sing.	pl.	gloss
chB	cahov	cehubim	yellow
'rK	'arox	'arukim	long
š'B	maš'av	maš'abim	resource
xcB	SH maxcav	maxcavim	mineral
	MH mexcav	mexcabim	
sgB	misgav	SH misgabim	high place
		MH misgavim	
'sB	SH 'asav	'asabim	grass
	MH 'esev		
'cB	SH 'acav	'acabim	nerve
	MH 'ecev		
'krB	'akrav	'akrabim	scorpion
'snB	'esnav	SH 'esnabim	window
		MH 'esnavim	

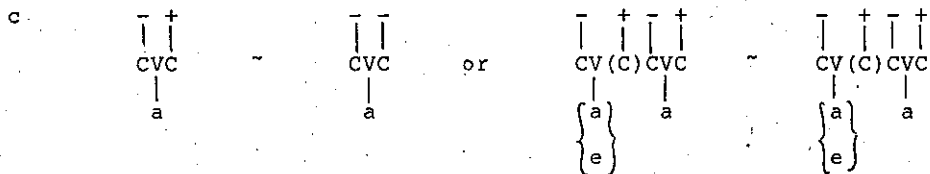
So the following alternations (or morpholexical rules in Lieber's (1980) terminology) are listed in the lexicon:



for the following roots: dB, tP, chB, 'rK, rtB...



for the roots: lB, xK, KP (kipa 'dome'), sB (siba 'reason'), k1P (klaf 'card' ~ klipa 'peel')...



for the roots: 'P, rK, dP, zK, KP, 'P, xP, ś1B, 'sB, 'cB, 'šnb...

The *sing.* forms are determined by the pseudo-input, whereas all suffixes choose the pseudo-output. But we also have to account for the following non-alternating stems:

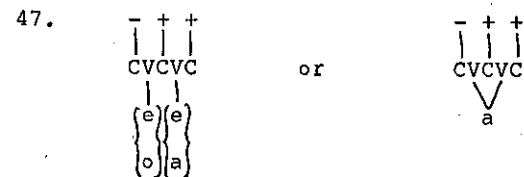
46.	root	<i>sing.</i>	stem+suffix
	xB	xov 'debt'	xovot 'debts'
	nP	nof 'view'	nofim 'views'
	tB	tov 'good'	tovim 'good (pl.)'

Notice that we could not automatically claim that the roots are really xv, nf, tv, and that the morphological rule of applies vacuously to them, because then we would get *xuvot, *nufim, *tuvim. The case really is even simpler: the roots xB, nP, tB etc. are not listed as *undergoing* the morphological rule at all. It should be noted that the list of rules that undergo morphological rules varies from SH to MH. For example the root xP 'beach' undergoes the morphological rule in MH: xof

~ xupim, but not in SH: xof ~ xofim. The root sK undergoes the morphological rule in SH (cf. 43), but not in MH: masax ~ masaxim, musax ~ musaxim.

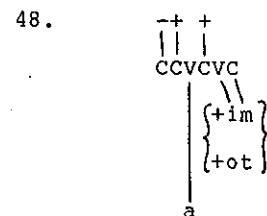
3.2 The Segolates.

The singular non-suffixed form for segolate nouns is the following:



e.g. mélex 'king', 'élef 'thousand', séfer 'book', xóref 'winter', 'óref 'neck', pétax 'opening', róxav 'width', šaxaf 'sea-gull'.

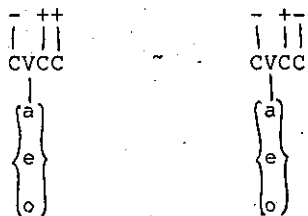
What distinguishes the segolates from other nouns with the same skeleton and sometimes even the same vocalic and spirantization melodies is that segolates are stressed penultimately, whereas other nouns in Hebrew are stressed on the last syllable: šafán 'rabbit', kanáf 'wing', 'anáf 'branch'. The plural of the segolates is the same as the plural of nouns in the šafán miskal:



e.g. kélev ~ klavim 'dogs'
délet ~ dlatót 'doors'
kazáv ~ kzavim 'lies'
zanáv ~ znavót 'tails'

But there is a morphological rule special to the segolates:

49.



Both in MH and SH the sing. possessive suffix chooses the pseudo-output, and so does the pl. possessive suffix in MH, whereas in SH it chooses the pseudo-input:

50. root	stem	gloss	+o pos. sing.	MH +ey pos. pl.	SH +ey
KLB	kélev	dog	kalbo	kalbéy	kalvéy
mLK	mélex	king	malko	malbéy	malvéy
drK	dérex	way	darko	darbéy	darvéy
'rK	'orex	length	'orko	'orbéy	'orvéy
rxB	roxav	width	roxbo	roxbéy	roxvéy
'rK	'erex	value	'erko	'erbéy	'ervéy

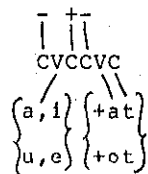
The dual suffix +ayim chooses the pseudo-output in both SH and MH: 'elef 'thousand' ~ 'alpayim 'two thousands', and the +ut suffix that forms abstract nouns chooses the pseudo-input: mélex 'king' ~ malxut 'kingdom', 'ecev 'sorrow' ~ 'acvut 'sadness', roxav 'width' ~ raxvut 'luxury', semex 'support' ~ samxut 'authority'.

Notice now the following alternations:

51. root	fem. sing.	gloss	pl. +ot
mLK	malka	queen	mloxot
			MH malkot
KLB	kalba	bitch	klavot
			MH kalbot
lšK	liška	office	lešaxot
			MH liskot
rcP	ricpa	floor	recafot
			MH ricpot
šKv	šixva	layer	šxavot
			MH šixvot
nkB	nikba	tunnel	nekavot
	MH nikva		nikvot
kcB	kicba	allowance	kcavot, kicbaot
	MH kicva		kicvaot
xrB	xurba	ruin	xoravot
	MH xurva		xurvot
pnK	pinka	plate	pnaxot
	MH pinxa		pinxot
'cB	'ucba	detachment	'ucbot
	MH 'ucva		'ucvot
xrP	xerpa	shame	xarafot
	MH xerpa		xerpot

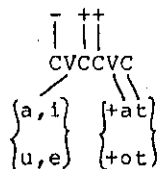
In SH the fem. suffix +at chooses the pseudo-output in 47, and the plural is formed according to 48. In MH both +at and +ot suffix to the same stem, but there are two variants of the stem:

52.a



roots: mlK, KlB, lšK, rcP, xrp

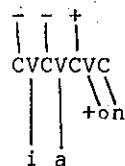
b



roots: nkB, kcB, xrB, pnK, 'cB

3.3 The +on suffix.The +on suffix attaches in 53 mostly to create abstract nouns.

53.



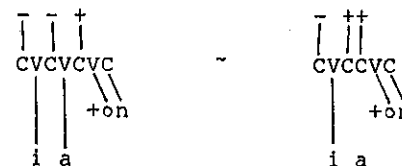
Notice the following alternations:

54.	root	stem	gloss	plural
	zKr	zikaron	memory	zixronot
	'Pr	'iparon	pencil	'efronot
	šKr	šikaron	drunkenness	sixronot
	šBt	šabaton	holiday	sabtonim
	dK'	dikaon	depression	SH dix'onot MH dik'onot
	zKy	zikayon	concession	SH zixyonot MH zikyonot
	kB'	kiba'on	fixation	SH kiv'onot MH kib'onot

(None of the roots have underlying stops or spirants in middle consonant position: šavat 'rested', dixdux 'depression', zaxa 'won', kava 'fixed'.)

There seem to be two different morphological rules, with different roots listed for them in SH and MH:

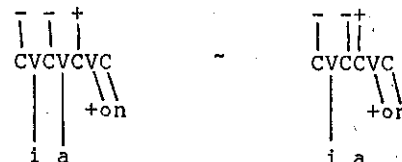
55.



SH: zKr, 'Pr, šKr, dK', zKy, kB'

MH: zKr, 'Pr, šKr

56.



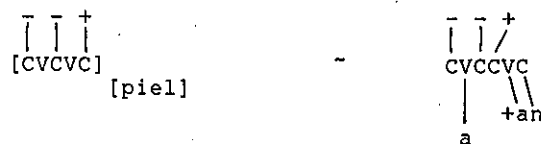
SH: šBt

MH: šBt, dK', zKy, kB'

3.4 The suffix +an

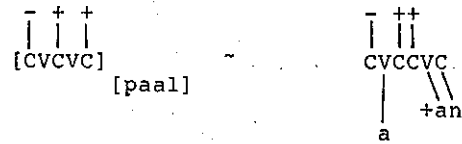
The suffix +an forms agentive nouns from verbs or nouns, e.g. tipes 'climbed' ~ tapsan 'climber'; refet 'cow-shed' ~ raftan 'dairy farmer'. In SH, the spirantization melody of the stem suffixed with +an varies according to the spirantization melody of the related verb or noun:

57.



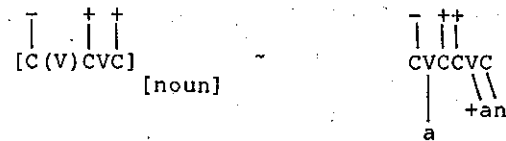
root	piel	agentive
tPs	tipes 'climb'	tapsan 'climber'
xBl	xibel 'destroy'	xablan 'saboteur'
kBc	kibec 'collect'	kabcan 'beggar'
kBl	kibel 'receive'	kablan 'contractor'
dBr	diber 'talk'	dabran 'talkative'

58.



root	paal	agentive
crK	carax 'consume'	carxan 'consumer'
sKx	saxax 'forget'	saxexan 'forgetful'
KtB	katav 'write'	katvan 'typist'
sKB	šaxav 'lie'	šaxvan 'sexually active'
dxP	daxaf 'push'	daxfan 'pusher'
tkP	takaf 'attack'	tokfan 'aggressor'
'sP	'asaf 'collect'	'asfan 'collector'
xSP	xasaf 'uncover'	xasfan 'stripper'

59.



root	noun	agentive
xlB	xalav 'milk'	xalvan 'milkman'
clB	clav 'cross'	calvan 'crusader'
klB	kelev 'dog'	kalvan 'dog-trainer'
srB	seruv 'refusal'	sarvan 'objector'
xnP	xonef 'flattery'	xanfan 'flatterer'
klP	klaf 'card'	kalfan 'gambler at cards'
xlP	xelef 'in exchange'	xalfan 'money-changer'
tK	txax(im) 'intrigue(s)'	taxexan 'intriguer'
sPr	sefer 'book'	safran 'librarian'

In MH the picture is similar, but we get: *xalvan, *calvan, *kalvan.

In addition there is a new morpholexical rule:

60.



roots: xlB, clB, klB, srB, crK, tkP, xcP, krB.

So that we get the following agentives in MH: xalban 'milkman', calban 'crusader', kalban 'dog trainer', sarban 'objector', carkan 'consumer', tokpan 'aggressor', xucpan 'insolent', korban 'victim'.

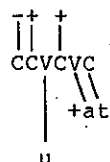
3.5 The p'ula mishkal

This is an interesting example of two BH mishkalim that have collapsed to one: p'uulaa and p'ullaa. SH still preserves the distinction in spirantization between the two: the last root consonant is a spirant in those forms that are historically p'uulaa, and a stop in those forms that are historically p'ullaa. In MH the distinction is blurred:

61.	root	p'ula	gloss
	mIK	mluxa	kingdom
	'zB	'azuva	desolation
	šB	tšuva	answer
	KtB	ktuba	marriage certificate
	xnP	xanupa	flattery
	xnK	xanuka	inauguration
	xCB	SH xacuva	tripod
		MH xacuba	
	'sP	SH 'asupa	collection
		MH 'asufa	
	'rB	SH 'aruba	guarantee
		MH 'aruva	
	'kB	SH 'akuba (mi-dam)	bloody
		MH 'akuva	

The synchronic account is that both SH and MH have two possible stems that +at (and +ot) can suffix to in the p'ula mishkal, but they have different roots associated to them:

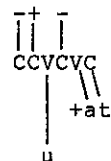
62.a



roots: SH: mIK, 'zB, šB, xCB

MH: mIK, 'zB, šB, 'sP, 'rB, 'kB

b



roots: SH: ktB, xnP, xnK, 'sP, 'rB, 'kB

MH: ktB, xnP, xnK, xCB

The same treatment would account for the related mishkal pa'ul, derived historically from paa'uul and pa''uul, where the middle consonant of the root is stop (in forms derived from pa''uul) or spirant (in forms derived from paa'uul). But in this case MH diverges only slightly from SH:

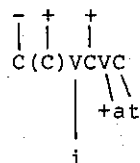
63.	root	paul	gloss
	cPn	cafun	hidden
	sBr	savur	broken
	tPx	tapuax	apple
	xBš	xabuš	quince
		MH xavuš	

A similar phenomenon can be observed in the pail and p'ila mishkalim: the root 'Bk 'pipe' surfaces as both 'abik and 'avik; the root kIP surfaces as klipa 'peel' whereas clB surfaces as cliva 'crucification'.

3.5 Deverbal mishkalim

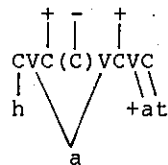
Nominalizations get their spirantization melodies from the verb binyan they are derived from. I will now list some of those:

64. paal nominalization:



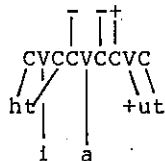
e.g. dIP: dalaf 'leak (v)' ~ delifa 'leak (n)'
 šBt: šavat 'rest' ~ švita 'strike'
 šB : šav 'return (v)' ~ šiva 'return (n)'

65. hif'il nominalization:



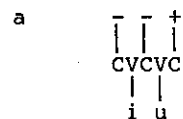
e.g. dIP: hidlif 'leak information' ~ hadlafa 'information leak'
 šBt: hišbit 'stop' ~ hašbata 'stopping'
 šB : hešiv 'return (v.t.)' ~ hašava 'returning'

66. hitpael nominalization:

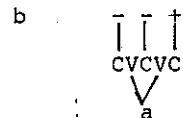


e.g. xšB: hitxašev 'consider' ~ hitxašvut 'consideration'
 lBt: hitlabet 'be perplexed' ~ hitlabtut 'perplexion'
 Bit: hitbalet 'be prominent' ~ hitbaltut 'prominence'

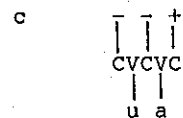
67. piel nominalizations:



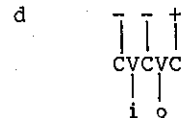
e.g. sPr: siper 'tell' ~ sipur 'story'



e.g. zKy: zika 'acquit' ~ zakay 'innocent'
 nPx: nipax 'blow' ~ napax 'blacksmith'



e.g. 'Br: iber 'impregnate' ~ ubar 'fetus'



e.g. šKr: šiker 'make drunk' ~ šikor 'drunkard'



e.g. pKx: pikax 'make sober' ~ pikeax 'sober'

4. Reduplication.

Marantz's (1980) account of reduplication explains only some very marginal phenomena of Hebrew reduplication. His account views reduplication as a word formation process (in the sense of Aronoff (1976)), that consists of affixation of a skeletal morpheme to a stem. And indeed one can find in Hebrew a few examples of reduplication that consist of prefixing or suffixing a skeletal morpheme to an existing word.

First there are various examples of whole word reduplication. Many adjectives and adverbs can be reduplicated, the meaning being intensification, e.g. leat 'slowly' : leat leat 'very slowly'; gadol 'big' : gadol gadol 'very big'. Nouns can be reduplicated, the meaning being the same as the result of applying universal quantification: 'is 'man' : 'is 'is 'each man'. All of those are 'syntactic' reduplications in that they are not viewed by speakers as words in the language. Dictionaries of Hebrew, such as Even-Sošan, do not list them. Other word reduplications, where the meanings are unpredictable, e.g. sof 'end' : sofsof 'finally', yom 'day' : yomyom 'daily' are listed in the dictionary. But all of those are not interesting from a morphological point of view, though they show that Hebrew has ample recourse to reduplication.

The examples in 68 consist of VC suffixing (where V is preattached to i, c.f. Marantz's (1980) condition C on copying):

68.a kof 'monkey' : kofif 'little monkey'

kof	kof kof
CVC	CVC+ VC
	i

b	koc 'thorn'	:	kocic 'small thorn'
c	guš 'lump'	:	gušiš 'small lump'
d	guf 'body'	:	gufif 'small body'
e	xam 'hot'	:	xamim 'warm'
f	tam 'pure'	:	tamim 'naive'

Notice that these corroborate Marantz's prediction in condition D that reduplication suffixes hook up with their melody from right to left. The example in 69 is from MH, and consists of CVC prefixing. As predicted by Marantz the linking goes from left to right:⁸

69. tipa 'a little' : tiptipa 'very little'

		+at			
tiP	tiP		tiP+at	tiP+at	
CVCVC	CVCVC		CVC +	CVCVC	CVCVC

Notice that not only the phonemic melody reduplicated, but also the spirantization melody. As we shall see later this is a characteristic of MH reduplication.

The examples in 68 and 69 are marginal, and the bulk of Hebrew reduplication cannot be explained by Marantz's account. First, that account is made less attractive by the fact that in most cases in Hebrew, what would be the stems for reduplication are not themselves words:

70.a 'akalkal 'bent', related to 'ikul 'bend', but * 'akal

b šrafrac 'stool' but * šraf⁹

Second, in Marantz's account, the reduplication morpheme is a CV skeleton. In Hebrew the Cs and Vs would have to be treated separately. Even so there would be no way to account for their behaviour in Marantz's terms. Consider the following examples:

- 71.a šafan 'rabbit' : šfanfan 'small rabbit'
- b xatul 'cat' : xataltul 'small cat'
- c xazir 'pig' : xazarzir 'small pig'

In order to preserve the idea of a reduplication morpheme, one would have to say that there is here an infixation of CVC with a preattached to V:

- 72.a

š	a	š	f	a	n	f	a	n	---->	š	f	a	n	f	a	n	
CV	+	CVC	+	CVC													
													a				
- b

x	a	x	a	t	u	l	t	u	l	---->	x	a	t	a	l	t	u	l
CV	+	CVC	+	CVC														
													a					
- c

x	a	x	a	z	i	r	z	i	r	---->	x	a	z	a	r	z	i	r
CV	+	CVC	+	CVC														
													a					

The problem that faces this approach is that in most forms parallel to those in 72, the last vowel of the stem becomes a too:

- 73.a kelev 'dog' : klavlav 'small dog'
- b šaxor 'black' : šxarxar 'black haired person'
- c xamuc 'sour' : xamacmac 'slightly sour'

One can then say that it is not the words kelev, šaxor, xamuc that are the stems for reduplication, but rather klav, šxar, xamac (or kelav, šaxar, xamac). This would be positing new forms totally ad-hoc, since these forms never appear anywhere else.

Another possibility would be to say that the preattached vowel spreads somehow to the stem. This amounts to saying that in the reduplicated form the vowels do not participate in the reduplication at all: not only do the original vowels not appear in the reduplication

morpheme, they do not even appear in the stem. In other words, only the consonant melody is relevant in reduplication.

Another step is needed here, otherwise it would seem to be an accident that there are words in the language unrelated to reduplication that have exactly the same CV skeleton and vowel melody as the reduplicated forms in 73:

- 74.a gvartan 'manly'
- b štaltan 'domineering'
- c šmartaf 'baby-sitter'
- d 'amarkal 'administrator'
- e 'amargan 'impresario'
- f 'agartal 'vase'

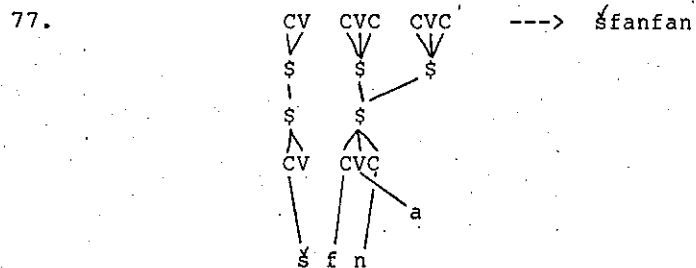
I will take this step by making the following claim about the nature of MH reduplication: what it does is "fill up" skeletal that exist independently in the language. In that respect my approach is reminiscent of McCarthy's (1979) treatment of gemination. In McCarthy's account of Semitic verb morphology, the gemination that takes place in Biblical Hebrew piel is due to the "spreading" of one of the consonants in three consonantal roots to "fill up" the given CVCCVC skeleton, e.g.:



This account does not generalize to a case like 71.a, since we would get crossing of the association lines:



McCarthy suggests to solve this problem by suffixing CVC to a CVCVC skeleton and then reduplicating the last syllable of the stem (c.f. McCarthy (1979) p. 275). His solution for 76. would look as follows:

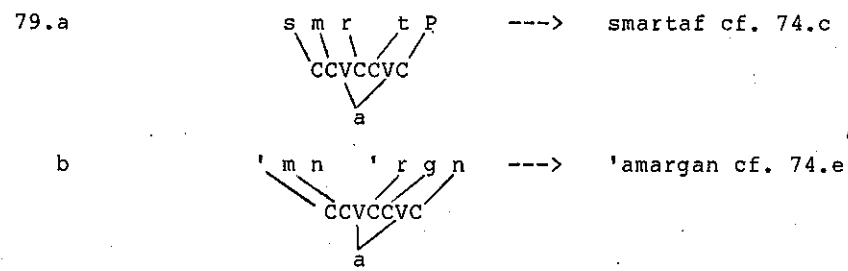


We have already seen forms such as 71.b,c and 73. that discourage such a solution, since there it is clearly not a syllable that is being reduplicated in those examples.

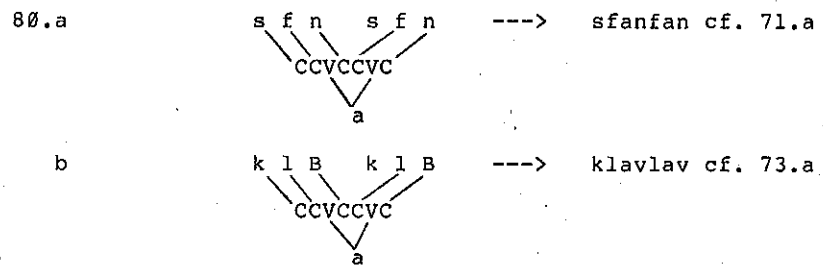
My account, that accomodates also the forms in 74, is that a skeleton CCVCVC is available independently in the language. Given the vocalic melody a we get the following association:



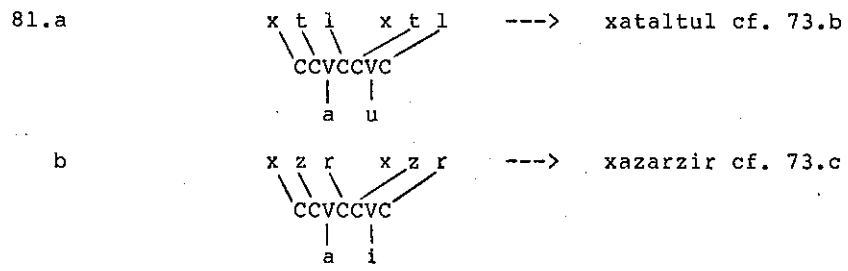
The root 'mrkl gets associated from left to right to give 74.d. The root gBr 'man' gets associated from left to right, followed by the suffixes t and n to give 74.a. I want to claim that whenever two roots are combined to hook to one skeleton, not only in cases of reduplication, the first root is associated from left to right, and the second root from right to left. This prediction is neither corroborated nor falsified by 74.c, where the root smr 'guard' is followed by the root tP 'children'; but it is corroborated in 74.e, where the root 'mn 'art' is followed by 'rgn 'organize':



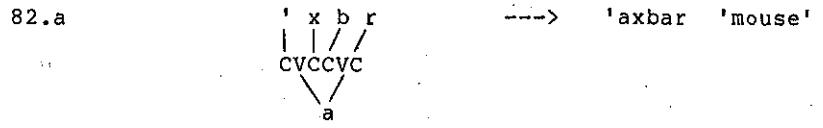
How much of each root is allowed to hook may depend on the particular case, but in reduplication it seems to always be the case that the first instance of the root is allowed to hook fully.

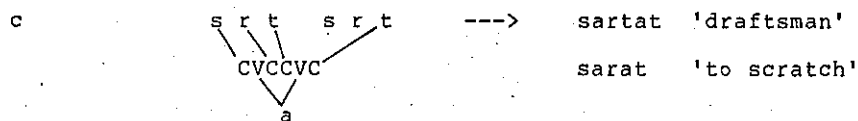
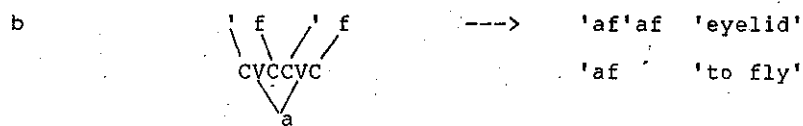


The other examples in 73 also share the same CV skeleton:



Less fancy CV skeletons, for examples some that have only four C slots, will have more forms associated with them, either from quadrilateral roots or from reduplication:

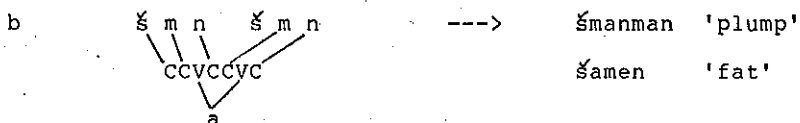




Note that 82c can also be analysed as in 83:

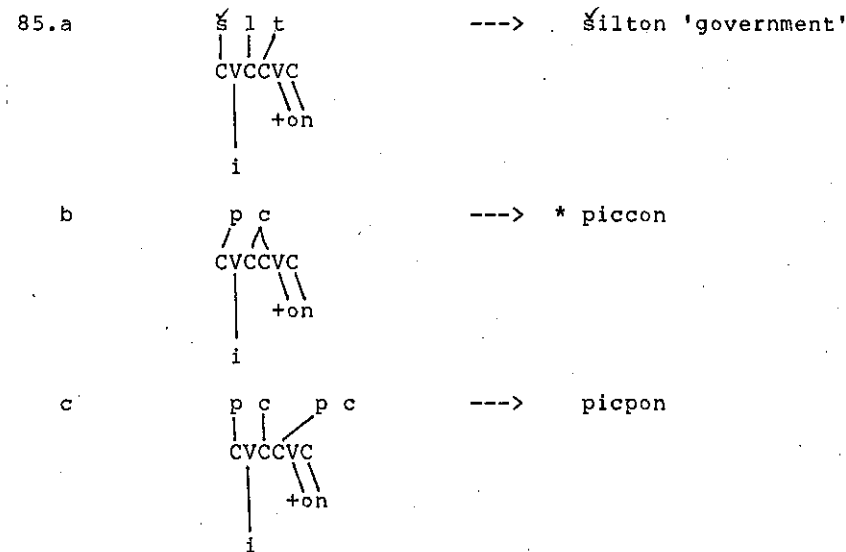


I have not been able to find any empirical differences between these two analyses. There is at least some indirect evidence that the strategy in 82c is available also for reduplicating a single consonant. Consider the following forms:



There are other forms in free variation with these: ktanton, šmanmon. The suffix +on denotes the diminutive, as in: kelev 'dog' : kalbon 'little dog'. In ktanton and šmanmon, reduplication denotes the diminutive too. So if these forms have been reanalyzed as having the

suffix +on, as the change of vowel seems to be pointing at, it is only the second to last consonant of the root that is being reduplicated. Since there is no mechanism for such kind of reduplication in general, it has not spread into three consonantal roots. But for a bi-consonantal root it should be possible. And indeed the word pic 'small' (borrowed from Yiddish), that appears to undergo the reduplication process exemplified in 69 to give picpicon 'very tiny', also undergoes reduplication that results in picpon 'tiny' (* piccon). As 85.a shows, the skeleton+vocalic melody are available in the language. 85.b shows that spreading such as in 83 gives the wrong result. 85.c shows that reduplication such as in 82.c gives the right result if we allow for the marked kind of association for the second morpheme:



Here are some more examples of reduplication within a CVCCVC skeleton:

- 86.a $\begin{array}{c} y \quad l \quad k \quad t \\ | \quad | \quad | \quad | \\ CVCCVC \\ | \quad | \\ a \quad u \end{array}$ ----> yalkut 'bag'
- b $\begin{array}{c} s \quad r \quad s \quad r \\ | \quad | \quad | \quad | \\ CVCCVC \\ | \quad | \\ a \quad u \end{array}$ ----> sarsur 'middle-man'
sar 'come'
- c $\begin{array}{c} g \quad B \quad n \quad g \quad B \quad n \\ | \quad | \quad | \quad | \quad | \quad | \\ CVCCVC \\ | \quad | \\ a \quad u \end{array}$ ----> gavnun 'hump'
giben 'hunch-back'
- 87.a $\begin{array}{c} \check{s} \quad r \quad v \quad t \\ | \quad | \quad | \quad | \\ CVCCVC \\ | \quad | \\ a \quad i \end{array}$ ----> šarvit 'sceptre'
- b $\begin{array}{c} n \quad k \quad n \quad k \\ | \quad | \quad | \quad | \\ CVCCVC \\ | \quad | \\ a \quad i \end{array}$ ----> naknik 'sausage'
- c $\begin{array}{c} \check{s} \quad B \quad r \quad \check{s} \quad B \quad r \\ | \quad | \quad | \quad | \quad | \quad | \\ CVCCVC \\ | \quad | \\ a \quad i \end{array}$ ----> šavrir 'splint'
šavar 'to break'

We have not dealt yet at all with the spirantization melodies. In many cases they are irrelevant. For example we have $\check{s}fn$ and not $*\check{s}Pn$, as can be seen from its conjugation in the hitpa'el binyan:

- 88.a $\begin{array}{c} - \quad - \quad + \\ | \quad | \quad | \\ \check{s} \quad P \quad n \\ | \quad | \quad | \\ CVCCVCVC \\ | \quad | \\ h \quad t \end{array}$ ----> *hištapen

- b $\begin{array}{c} - \quad - \quad + \\ | \quad | \quad | \\ \check{s} \quad f \quad n \\ | \quad | \quad | \\ CVCCVCVC \\ | \quad | \\ h \quad t \end{array}$ ----> hištafen¹² 'behaved like a coward (a rabbit)'

So it is not surprising that we get no p in sfanfan. The same is probably true of sfm, *sPm and txl, *tKl since the reduplicated form are sfamfam 'little moustache' (from safam 'moustache') and txalxal 'bluish' (from taxol 'azure'). The forms *sfampam and *txalkal sound terrible even in SH, though that's how the Even-SoSan dictionary lists them, to keep in line with the BH spirantization rule.

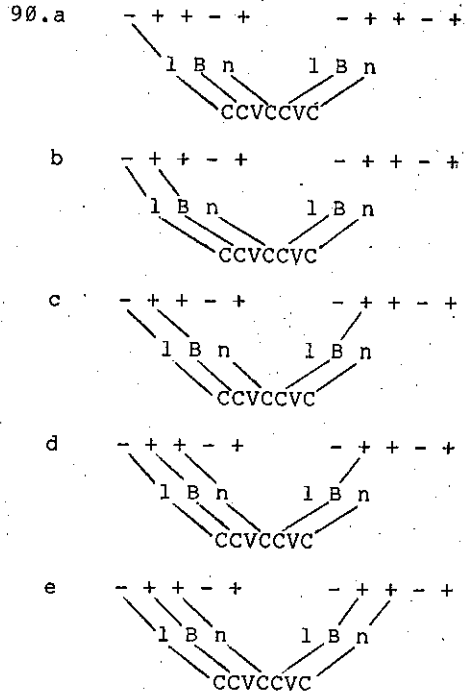
But there are roots like lBn, since we have the alternation: lavan 'white': hilbin 'became white'. And indeed speakers of SH say levanban 'whitish' whereas speakers of MH say levanvan. If we assume as given the skeleton CVCCVCVC and lBn, a, - + + - + as the consonantal, vocalic and spirantization melodies respectively, we get two possibilities:

A. The spirantization melody does not reduplicate. The Well-formedness condition associates it to the two copies of the root:

89. $\begin{array}{c} - \quad + \quad + \quad - \quad + \\ | \quad | \quad | \quad | \quad | \\ l \quad B \quad n \quad l \quad B \quad n \\ | \quad | \quad | \quad | \quad | \\ CVCCVCVC \end{array}$ ----> levanban

This gives us the right result for the SH speaker.

B. The spirantization melody reduplicates as well as the consonantal melody. The reduplication works as follows: The rules of association (in this case the Well-formedness Condition) start associating a copy of the root to a copy of the spirantization melody. A Copying Convention is then activated: Each link created on one pair of copies transfers to the second pair of copies.

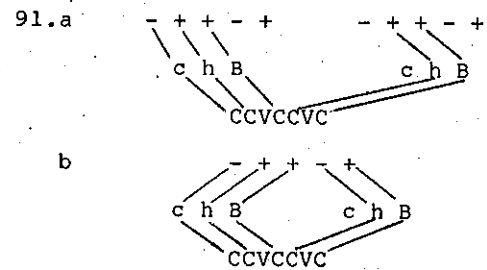


----> levanvan

This gives us the right result for the MH speaker.

Both approaches result in cehavhav 'yellowish' from the root chB:

cahov 'yellow':



----> cehavhav

----> cehavhav

Consider another example: 'af'af 'eyelid'. Notice that under phonological accounts of spirantization we run into a reduplication paradox, for we get the following alternations between singular and plural:

92.	root	singular	plural
	chB	cahov	cehubim
		cehavhav	cehavhavim
	'p	'af'af	'af'apayim

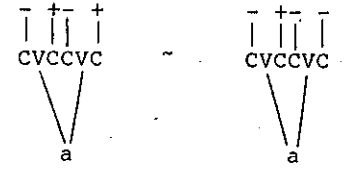
If spirantization is a phonological rule that turns stops into spirants word finally (among other environments), as suggested in Bolozky (1980), then the roots in question are chB and 'p. Since we get cehavhav and 'af'af and not *cehabhav and *'ap'af, spirantization applies before reduplication. (This is already a problem since we get a phonological rule preceding a morphological rule.) So far this is consistent with the form cehavhavim, (and the form 'afifon 'kite' from 'P) but the problem lies in the form 'af'apayim: if spirantization applies before reduplication, where does the stem 'af'ap derive from?

If on the contrary we claim that reduplication applies first to give the forms *cehabhab and *'ap'ap, and then spirantization applies syllable finally to give cehavhav and 'af'af, we account for 'af'apayim, (p is syllable initial and does not spirantize), but spirantization then over-applies in cehavhavim. (And we still have no explanation for 'afifon.)

Another basic problem to this approach is that if the root in 'af'af is 'p, the alternation 'of 'bird' ~ 'ofot 'birds' remains unexplained, since we would expect 'of ~ *'upot.

The morphological account of spirantization disentangles this paradox elegantly. We repeat here for convenience the relevant part of the morpholexical rule 45:

94.



roots: 'P, ...

Non suffixed forms choose the pseudo-input, which explains 'af'af, and every suffix chooses the pseudo-output, which explains 'afapayim. Notice that nothing can reduplicate here but the root, since the links between the skeleton and the spirantization melody are given by the morphological rule.

On the other hand there is no morphological rule involving CCVCCVC, that is why the spirantization melody -+++ is free to reduplicate to yield either levanvan or levanban, but in neither case does it yield *cehavhabim. Also since the root 'P is not listed in rule 45.a, it is clear why we do not get the alternation 'of ~ *'upot; and since it is not listed in rule 45.b, we do not get *'afipon.

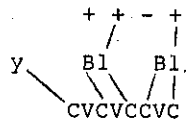
We now turn to explain some phenomena related to reduplication in the verbal system. Notice the following:

95.	root	piel perfect	piel imperfect	gloss
	B1	bilbel	SH yevalbel MH yebalbel	confuse
	Bz	bizbez	SH yevazbez MH yebazbez	waste
	Bc	bicbex	SH yevacbec MH yebacbec	sprout
	Br	birber	SH yeparber MH yeparber	talk much

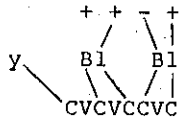
root	piel perfect	piel imperfect	gloss
Pt	pitpet	SH yefatpet MH yepatpet	chatter
Pr	pirper	SH yefarper MH yeparper	jerk
Pk	pikpek	SH yefakpek MH yepakpek	doubt
Pm	pimpem	SH yefampem MH yepampem	pump
Ps	pišpeš	SH yefašpeš MH yepašpeš	search
Ps	pispes	SH yefaspes MH yepaspes	stripe
Pc	picpec	SH yefacpec MH yepacpec	crash
Ks	kiškeš	SH yexaškeš MH yekaškeš	wag
Prns	pirnes	yefarnes * yeparnes	support
P'nx	SH pianax MH pieneax	yefaanax yefaaneax * yepaan(e)ax	decipher
Prsm	pirsem	yefarsem * yeparsem	advertise

As we saw in section 2, the spirantization melody for the imperfect of pi'el is ++-. So that for speakers of SH we again see the approach to reduplication already observed in 89: the spirantization melody does not reduplicate. For example the associations for the first root in 95 will be as follows:

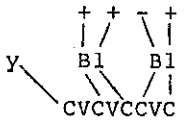
96.a By the Appendix Rule:



b By the Onset Rule:



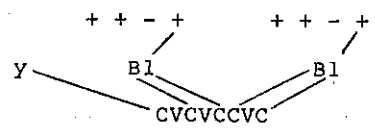
c By the Well-formedness Condition:



---> yevalbel

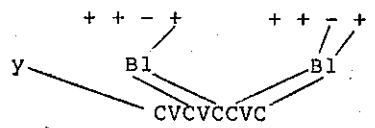
Let us now consider what happens in MH, where the spirantization melody reduplicates with the root:

97.a By the Appendix Rule:

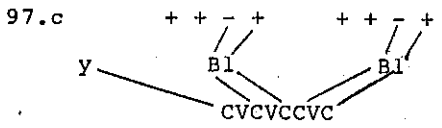


The effect of the Copying Convention is void.

97.b By the Onset Rule:



The Copying Convention produces 97.c:



---> yebalbel

This is the right result for MH.

It should now be clear why we get yefarnes but *yeparnes (cf.95): There is no reduplication involved, so the spirantization melody is as expected, i.e. + + - +. On the other hand we do get in MH the form yekadrer 'play the ball' from the root Kdr, since the spirantization melody being + + - + triggers the rule of K Dissimilation discussed in 39.

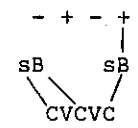
Notice now the following alternations between SH and MH in the case of last consonant reduplication in pi'el:

98.	root	SH	MH	gloss
	sB	sibev	sivev	turn
	xB	xibev	xivev	like
	'rB	'irbev	'irvev	mix
	'nB	'inpef	'infef	nasalize

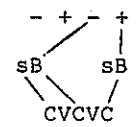
Here again the explanation lies in the different strategies of reduplication in SH and MH: In SH only the root reduplicates, in MH the root + the spirantization melody reduplicate. ¹³

In 99 and 100 we show the relevant reduplications in SH:

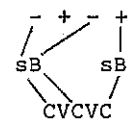
99.a By the Appendix Rule:



b By the Onset Rule:

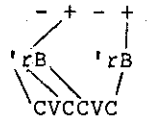


c By the Well-formedness Condition:

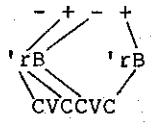


---> sibev

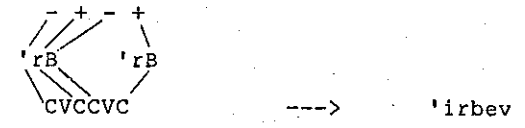
100.a By the Appendix Rule:



b By the Onset Rule:

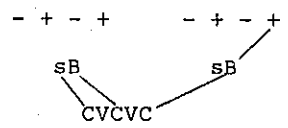


c By the Well-formedness condition:

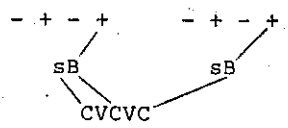


In 101 and 102 we show the reduplication for MH:

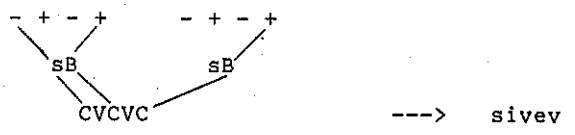
101.a By the Appendix Rule:



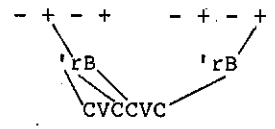
b By the Copying Convention:



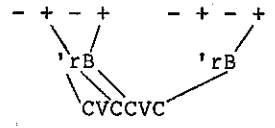
c By the Well-formedness Condition:



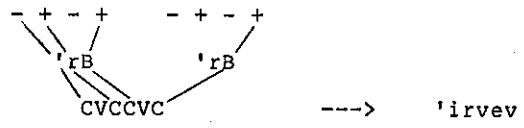
102.a By the Appendix Rule:



b By the Copying Convention:



c By the Well-formedness condition

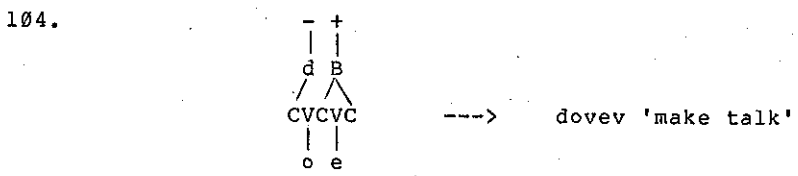


Notice the following:

103.	root	pi'el		gloss
	zK	zikex	*zixex	purify
	sK	sikex	*sixex	calm
	rK	rikex	*rixex	soften

This is explained by the rule of K Dissimilation applying to the outcome of 101, with the relevant roots.

Notice finally that Hebrew has a special binyan, polel, that may replace pi'el for biconsonantal roots. It is different from pi'el in both its vocalic melody and its spirantization melody (the latter having only two segments, which ensures that no three consonantal roots conjugates in polel). An example is shown in 104:



Conclusion

This paper outlines the regularities of Modern Hebrew spirantization. In section 1 the general approach was outlined, of treating spirantization not as a phonological rule turning underlying stops into spirants in phonologically determined environments, but as part of the morphology. An autonomous tier was proposed that consists of the specifications for the feature [+continuant] for those segments of the root that do not have this specification at the base.

In section 2 the verbal system was examined. The rules were discussed that govern the association of the different spirantization melodies to the different binyanim. It was revealed that the inner structure of the syllable is relevant to the formulation of these rules, thus confirming the point made in Halle and Vergnaud (1980) about the autonomy of the different constituents of the syllable. The account presented of spirantization in the verbal system gives a neat framework for formulating the historical changes that have taken place between SH and MH.

In section 3 the nominal system was examined. It was shown that morpholexical rules à la Lieber (1980) capture the generalizations about spirantization in the various mishkalim, that no phonological rules can account for.

In section 4 it was shown that Marantz's (1980) account of reduplication does not capture the bulk of phenomena in Hebrew reduplication. Reduplication in Hebrew does not consist of affixation but of reduplication of roots to "fill in" skeleta existing independently in the language. The differences in association of reduplicated roots with the spirantization melodies between SH and MH were explored. It was concluded that in SH only the root reduplicates, whereas in MH the root reduplicates together with its associations to the spirantization melody.

The success of the principles of autosegmental phonology to bring some order into the messy facts of Hebrew spirantization surprisingly enlarges the domain in which the autosegmental approach has been fruitful.

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Notes

1. I shall adopt the notational convention that spirantization melodies associate to the consonantal melodies. But since association is transitive, this convention has the same effect as of associating the spirantization melodies directly to the skeleta.

2. *hof'al* and *pual* that serve as passives to *hif'il* and *piel* respectively, are not commonly in use in Modern Hebrew, but all that is said in the text about *hif'il* and *piel* is true of them as well.

3. The effect of the *y* in these forms is to turn the vowel preceding the suffix *+ta* from *a* to *i*. The *y* shows up explicitly in nominalizations: *zikita* ~ *zikayon* 'right'; *zaxita* ~ *zxiya* 'winning'.

4. The \$ mentioned from now on are not \$ of the basic skeleta, but rather \$ (syllables) of the skeleta.

5. % denotes forms that are found only in colloquial speech.

6. The pseudo-input is the stem on the left of ~, and the pseudo-output is the stem on the right.

7. The *t* of *+at* deletes word finally.

8. This example can also be analysed as CVC infixation, with reduplication of *tiP*.

9. The first vowel in *šaraf* would delete in the reduplicated form, because of the stress moving one syllable further away. But if this vowel follows *!* or *h* or *x*, another vowel is reintroduced, usually a copy of the following vowel. If deletion of the first vowel creates a prohibited cluster, the vowel *e* is introduced, cf. *levanvan* in 89. The first vowel deletes only in open syllables.

10. The stem *klav* actually appears in the plural of the segolates, but *sxar* and *xamac* are totally ad-hoc.

11. This process is very productive in MH: *micpor* 'high view point' = *micpe* 'view point' + *cipor* 'bird'; *bankomat* = *bank* + *'otomat*; *tnuof* 'tnuva's brand chicken' = *tnuva* + *'of* 'chicken'.

12. There is a metathesis of \$ and t.

13. Since the spirantization melody could have been associated directly to the skeleton (cf. note 1) we can also give a treatment where the second consonant "spreads", rather than the whole root reduplicating:

i. SH: $\begin{array}{c} - + - + \\ \diagdown \quad \diagup \\ \text{CVCVC} \\ \diagup \quad \diagdown \\ \text{sB} \end{array} \quad \text{--->} \quad \text{sibev}$

ii. MH: $\begin{array}{c} - + - + \\ \diagdown \quad \diagup \\ \text{sB} \\ \diagup \quad \diagdown \\ \text{CVCVC} \end{array} \quad \text{--->} \quad \text{sivev}$

14. Associating *r* with the second + would result in a violation of the Well-formedness Condition, since the slot in the skeleton that links to *B* would end up having no link to the spirantization melody.