The form of structure, the structure of form
Three days of linguistics for Jean Lowenstamm
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Gutturals ghosts, synchronic Sandhi and the parameters of impenetrability

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1. The Problem

- Biblical Hebrew had a set of guttural consonants [ʔ,h,ʕ,ħ]. General Modern Hebrew did not fully recover any of these sounds.
  - ✓ [ʔ,ʕ] are mostly silent, and in careful speech pronounced as [ʔ]
  - ✓ [h] is mostly silent, and in careful speech pronounced as [h] or [ʔ]
  - ✓ [ħ] is pronounced [χ].

- Modern Hebrew allows initial clusters of level sonority (1a-c). But the cluster is resolved by epenthesis of e if the first consonant is a sonorant [l,m,n,ʁ] (1d) or if the second consonant is a historical guttural [ʔ,ʕ,h] (1e).

(1) Possible initial clusters

	V	Action noun	epenthesis	
TR	a. karac	**kr**ica	no	‘wink’
sT	b. šatak	**št**ika	no	‘remain silent’
TT	c. gadal	**gd**ila	no	‘grow’
	d. takaf	**tk**ifa	no	‘attack’
RT	e. našam	**n**e**š**ima	yes	‘breathe’
RR	f. lamad	**l**e**m**ida	yes	‘learn’
sG	g. ša(ʔ)al	**š**e(**ʔ**)ila	yes	‘borrow’
TG	h. da(ʔ)ax	**d**e(**ʔ**)ixa	yes	‘fade’
RG	i. na(ʔ)al	**n**e(**ʔ**)ila	yes	‘lock’

- Epenthesis (of e) occurs within RX (1e,f) and XG (any C plus guttural) (1d). It does not occur within TR, TT.

- TR+TT vs. *RX: cross-linguistic pattern deserving more attention, occurring for example in Slovenian, Serbo-Croatian and Emilian dialects of Italy (Passino 2013).
  ==> TT count as branching onsets.
  [difference between MH and the other languages mentioned: #RR follow #RT in MH, but #TR, #TT in the other languages.]

- Epenthesis optionally disappears if the preceding word ends in a vowel, but only in case C_1 is a sonorant (2b).

- No obvious syntactic conditioning: any V-final preceding word provokes the (optional) absence of the epenthetic vowel.

(2) External Sandhi only if C_1 is a sonorant

Action noun	'the'+ action noun	
a. **kr**ica	a**kr**ica	'wink'
b. **št**ika	a**št**ika	'silence'
c. **gd**ila	a**gd**ila	'growth'
d. **tk**ifa	a**tk**ifa	'attack'
e. **n**e**š**ima	a**n**e**š**ima ~ a**nš**ima	'breath'
f. **l**e**m**ida	a**l**e**m**ida ~ a**lm**ida	'learning'
g. **š**e(**ʔ**)ila	a**š**e(**ʔ**)ila, *a**š**(**ʔ**)ila	'loan'
h. **d**e(**ʔ**)ixa	a**d**e(**ʔ**)ixa, *a**d**(**ʔ**)ixa	'fading'
i. **n**e(**ʔ**)ila	a**n**e(**ʔ**)ila, *a**n**(**ʔ**)ila	'locking'

(3) If the preceding word ends in a consonant, the epenthetic vowel is obligatory

Action noun	'against'+ action noun	
a. **n**e**š**ima	néged **n**e**š**ima, *néged **nš**ima	'breathing'
b. **l**e**m**ida	néged **l**e**m**ida, *néged **lm**ida	'learning'
c. **š**e(**ʔ**)ila	néged **š**e(**ʔ**)ila, * néged **š**(**ʔ**)ila	'loan'
d. **d**e(**ʔ**)ixa	néged **d**e(**ʔ**)ixa, *néged a**d**(**ʔ**)ixa	'fading'
e. krica	néged krica	'wink'
f. gdila	néged gdila	'gdila'

(4) This **is** external Sandhi: **all** these clusters are possible word-medially

QaTaL		iQTiL	
a. šatak	'remain silent'	i**št**ik	'silence'
b. gadal	'grow'	i**gd**il	'enlarge'
c. takaf	'attack'	i**tk**if	'attack'
d. našam	'breathe'	i**nš**im	'resuscitate'
e. ša(ʔ)al	'borrow'	i**š**(**ʔ**)il	'lend'

(5) **Take-home message**

1. Epenthesis under (1e) **n**e**š**ima and (1g) **š**e(**ʔ**)ila occurs within all and only those clusters that are not a good "branching onset" in MH: RX and XG.
2. Epenthesis is triggered by the beginning of the word.

(6) **Puzzle**

Epenthetic vowel is present in XG-,
but (optionally) absent in (RX-),
in an initial position that becomes non-initial position, i.e. after a V-final word.

2. More on historical gutturals

(7) Historical gutturals are real 1: emphasis

	No emphasis	Emphasis	
a.	ya**šir**	yaš**ʔir**	'he will leave'
	ya**šir**	ya**šir,** *yaš**ʔir**	'he will sing'
b.	mu**fal**	muf**ʔal**	'turned on'
	mu**far**	mu**far,** *muf**ʔal**	'violated'

(8) Historical gutturals are real 2: they trigger epenthesis

Past.3ms	Past.3pl	
a. ne(h)er**a**s	ne(h)e**rs-**u	'be destroyed'
b. nign**a**v	nign**e**v-u, *ni**gnv-**u	'be stolen'
c. nišba	nišb-u	'be made captive'
d. nišba	nišb**e**(ʔ)-u, *nišb-u	'swear'

(9) Gutturals cannot be internal codas: in case they come to stand in coda position,
1. epenthesis occurs to their right
2. the prefixal i is lowered to e (only when G is in coda position).

Active	Passive	
a. ganav	n**i-**gnav	'steal'
b. šalax	n**i-**šlax	'send'
c. (h)aras	n**e-**(h)**e**ras	'destroy'
d. (ʔ)axal	n**e-**(ʔ)**e**xal	'eat'

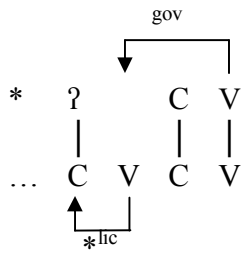
(10) **Take-home message**
1. Gutturals lower preceding /i/: (9c,d).
2. the resulting sequence e(ʔ)e is pronounced as two independent vowels (two peaks), rather than as a long vowel (one peak).

3. Analysis

3.1. Guttural effect on preceding vowel

- Why /niʔxal/ => [ne(ʔ)exal] ??
  two actions of the guttural:
  1. it causes epenthesis
  2. it lowers the preceding /i/

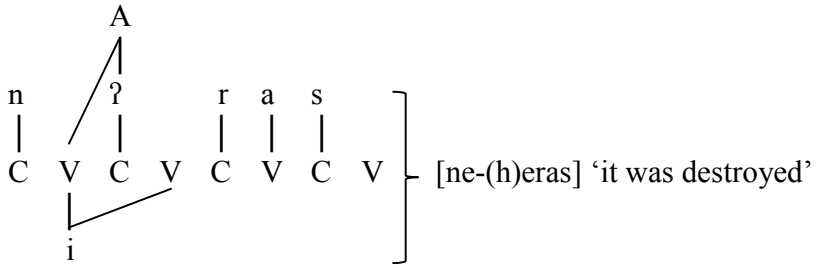
(11) Gutturals can't be codas, because they must be licensed (in the sense of Scheer 2004)



(In Tigre, gutturals always appear on the surface, but they also obey the restriction in (11): Faust (2014))

- Gutturals involve an element A, which lowers the preceding vowel and its echo in the following nucleus:

(12) │A│ element of guttural linked to preceding non-high vowel



3.2. Initial clusters

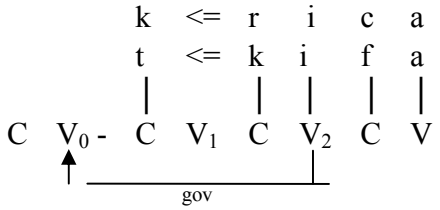
(13) Possible initial clusters (recall)

	V	Action noun		
a.	šatak	**št**ika	'remain silent'	**Not only TR!!**
b.	gadal	**gd**ila	'grow'	
c.	takaf	**tk**ifa	'attack'	
d.	našam	**n**e**š**ima	'breathe'	**Not anything goes!!**
e.	ša(ʔ)al	**š**e(**ʔ**)ila	'borrow'	

- Because not anything goes, we will assume **the initial CV** (Lowenstamm 1999, Scheer 2004, 2012).

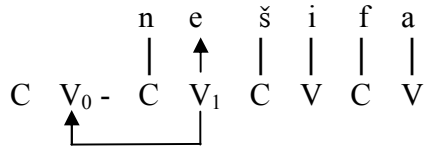
- TT languages
  As was mentioned, TT languages are an understudied pattern. The observation is that word-initial TTs in these languages behave solidarily just like branching onsets. We thus treat them as branching onsets, although of course the reason why they are solidary must be different (they don't qualify for branching onset status given their sonority slope), leaving the analysis of the TT pattern an open question.
  ==> for our purposes, thus, just like TRs, TTs in MH enclose an empty nucleus that does not call for government.

(16) Solidary initial clusters: TR, TT.
V_1 empty for another reason, hence does not call for government from V_2, which can therefore govern V_0

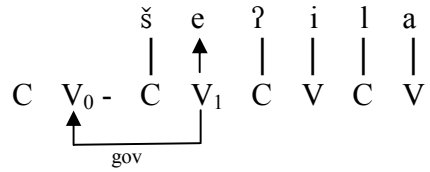


(17) Non-solidary initial clusters: RX, XG.
V_1 realized because if unrealizedV_0 would remain ungoverned

a.

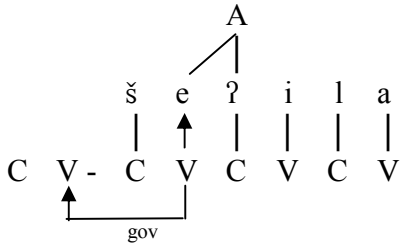


b.



- Recall: │A│ element of guttural linked to preceding non-high vowel.

(18) A more precise representation of [še(ʔ)ila]



3.3. External Sandhi

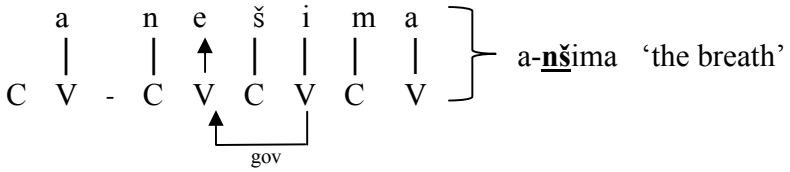
(19) External Sandhi only if C_1 is a sonorant

Action noun	'the'+ action noun	
a. **št**ika	a**št**ika	'silence'
b. **n**e**š**ima	a**n**e**š**ima ~ a**nš**ima	'breath'
c. **š**e(**ʔ**)ila	a**š**e(**ʔ**)ila, *a**š**(**ʔ**)ila	'loan'

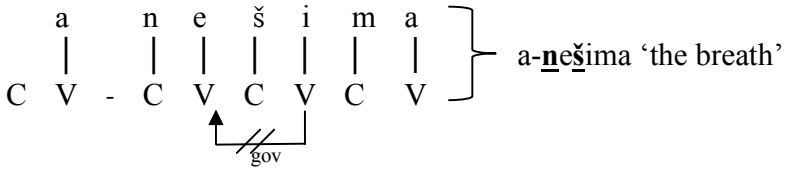
- Assume that once the computation of a word like [nešima] is complete, the initial CV drops. Then phonological computation spans over the word boundary (external sandhi): the first nucleus of the word "sees" the last nucleus of the preceding word.

(20) After V-final words, epenthetic e is optionally dropped if C2 is not a guttural.

a. epenthesis undone: epenthetic e drops

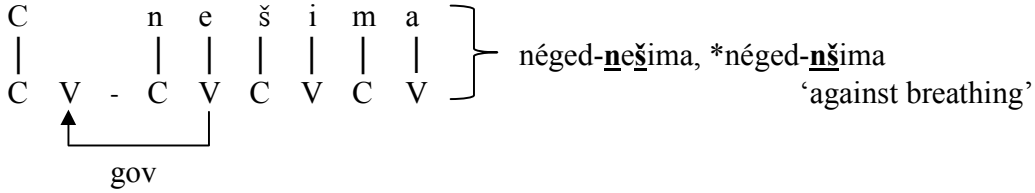


b. epenthesis not undone: epenthetic e persists



- Locus of variation: the epenthetic [e] is either governable (absence) or not (presence). Analysis of this variation below: the word-phase is optionally endowed with a PIC.

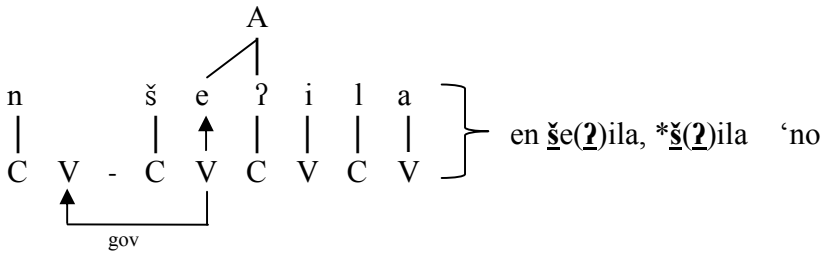
(21) After C-final words, epenthetic e is obligatory: it must govern the FEN of the preceding word and therefore cannot be governed itself.



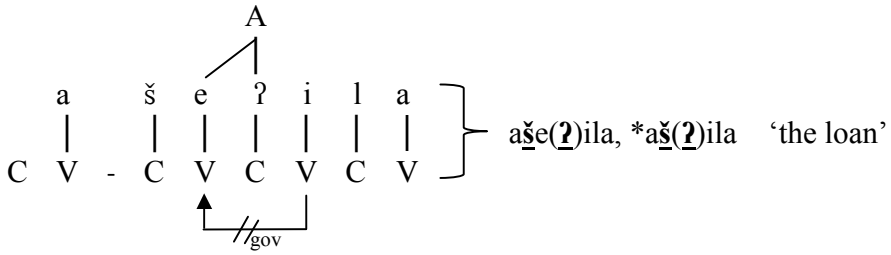
- No variation possible for phonological reasons: the FEN needs to be governed no matter what the status of the epenthetic [e] (governable or not). Even in case it is governable, it cannot be governed because it needs to govern itself.

(22) If C_2=gutt, the behavior is exactly like after C-final words, even if the preceding word is V-final: the epenthetic vowel cannot be dropped.

a. after C-final words: FEN needs to be governed (as before)



b. after V-final words: the epenthetic e is governable, but cannot be governed because after computation of the word-phase it branches on a neighbouring consonant. Vowels that alternate with zero are always simplex.



(23) Sharing makes us stronger (Honeybone 2005)

1. Generalization: pieces of melody that branch (on several constituents) resist lenition and more generally do not undergo phonological processes.
2. Canonical example: geminate integrity

(24) Apulian dialects of Italian (Bucci 2013): unstressed vowels (except a) reduce to schwa (23a), unless adjacent to a consonant with same place of articulation.

a. rótə - rət-éddə		'wheel, dim.'
b. o,u +lab	lúme - lum-íne	'lamp, dim.'
+vel	kúrve - kurv-óne	'curve, big curve'
c. i,e +pal	néʌə - neʌ-úsə	'fog, big fog'

- Analysis of Apulian
  a. vowels and adjacent consonants that share place share a melodic prime. Therefore these vowels are branching structures and escape reduction.
  b. Therefore, tonic vowels must also be branching structures: in fact they are long vowels.
  c. The surface contrast between full vowels and schwa is in fact a contrast between long and short vowels: the latter are spelled out as schwa.

(25) **Take-home message**
Three different reasons for the persistence of the epenthetic [e] in external sandhi:
1. It is preserved by a(n optional) PIC applying to the word-phase: a-**n**e**š**ima (in free variation with a-**nš**ima).
2. It needs to govern the FEN of the preceding word (which is C-final): C-**n**e**š**ima.
3. It branches on a following guttural: a-**š**e(**ʔ**)ila.

4. Phases and initial CVs

4.1. The initial CV produces epenthesis in #CCs

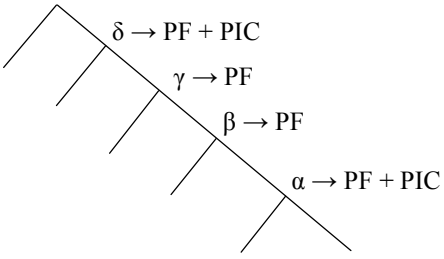
(26) What the initial CV is initial of
Scheer (2009, 2012: §307)
  a. Two cases documented
     1. word-initial
     2. utterance-initial
  b. ==> the initial CV is phase-initial
     i.e. heads domains of phonological computation.
  c. Phases may or may not be endowed with an initial CV
  d. Presence of the initial CV
     1. the empty CV unit is the exponent of a phase
     2. hence it is only present when the phase it heads is computed
     3. when the resulting string is further computed, the CV unit is absent because the phase it is the exponent of is absent.
  d. Computation of [A [B]]
     whereby both phases are endowed with an initial CV
     1. CV-B
     2. CV-AB

(27) MH
a. The word is a phase
b. It is headed by an empty CV unit
c. External sandhi: [word 1 [word 2]]
d. Computation:
1. CV-word 2
2. CV-word 1 - word 2
e. Hence
for every word there is a derivational stage where it is computed preceded by an initial CV.
f. This is why epenthesis is produced in initial clusters
/CV-nšima/ → nešima
/CV-šʔila/ → še(ʔ)ila

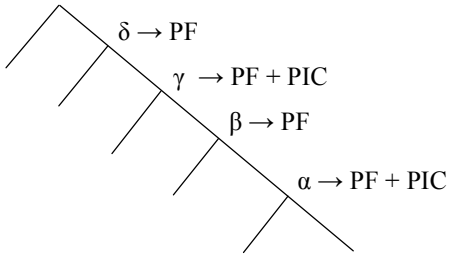
4.2. The PIC produces variation in external sandhi (a-nešima ~ a-nšima)

(28) Modular PIC
Selective footprints in phonology
Scheer (2011: §§778, 794, 2012: §307), D'Alessandro & Scheer (2013, to appear)
a. Spell-Out and the PIC are independent: a PIC may or may not hook on a phase. When Spell-Out occurs without being endowed with a PIC, there is no PIC effect at PF, i.e. the domain boundary is invisible at PF.
b. PIC is also module-specific:
a given phase head may be endowed with a PIC in one module (e.g. syntax), but not in another (e.g. phonology)
==> a given domain boundary may leave a footprint in syntax but not in phonology, or vice-versa, or in both modules, or in none. All four logically possible configurations are documented.

(29) Language A
a. Phase heads α and δ are endowed with a PIC at PF
b. Phase heads β and γ trigger vacuous spell-out at PF



Language B
a. Phase heads α and γ are endowed with a PIC at PF
b. Phase heads β and δ trigger vacuous spell-out at PF



(30) A locus of variation
  a. As under (29)
  b. Since a PIC may or may not be present at any given Spell-Out operation,
     ==> it may also be optional, i.e. present or absent in free variation
  c. Given two phases A and B,
     1. PIC present at PF: content of A frozen, boundary visible [B [$_{PIC}$A]]
     2. PIC absent at PF: content of A accessible, boundary invisible [B [A]]

(31) In MH the word phase is optionally endowed with a PIC
  a. a-**n**e**š**ima
     pronunciation with a PIC on word 2: [word 1 [$_{PIC}$word 2]]
     ==> the [e] cannot be governed on the outer cycle because the association to its nucleus is frozen by the PIC at the inner cycle.
  b. a-**nš**ima
     pronunciation without a PIC on word 2: [word 1 [word 2]]
     ==> the e can be governed on the outer cycle because it was not frozen upon previous computation.

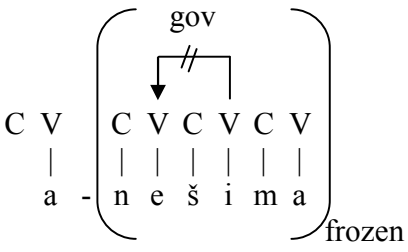
4.3. Complete derivations: initial CVs and PICs

(32) Structure and parameters
  a. Structure
     [word 1 [word 2]]
  b. Parameters
     1. word phases bear an initial CV
     2. word phases optionally bear a PIC

(33) Derivation of #RT words
  Inner cycle: epenthesis because of the initial CV
  Outer cycle shown

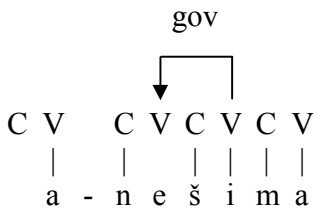
  a. Word 1 is V-final

pronunciation w2 with a PIC
[e] present because frozen



a-nešima

pronunciation w2 without PIC
[e] absent because available to gov

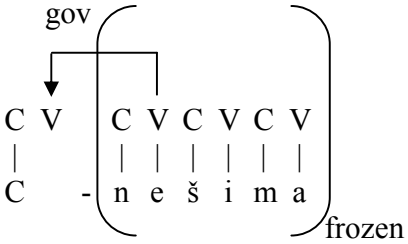


a-nšima

(33) Derivation of #RT words
Inner cycle: epenthesis because of the initial CV
Outer cycle shown

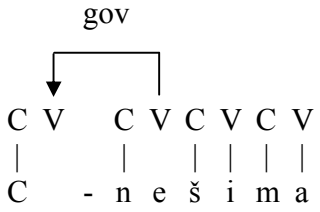
b. Word 1 is C-final

pronunciation w2 with a PIC
[e] present because frozen
(and because it must govern the FEN)



C-nešima

pronunciation w2 without PIC
[e] present because it must govern the FEN

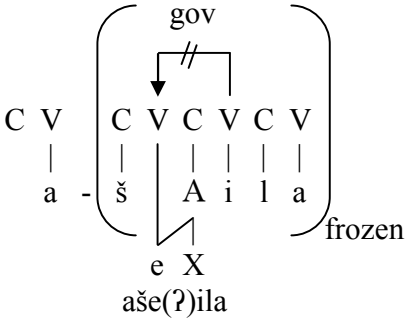


C-nešima

(34) Derivation of #XG words
Inner cycle:
1. epenthesis because of the initial CV
2. the guttural branches on the epenthetic vowel
outer cycle shown

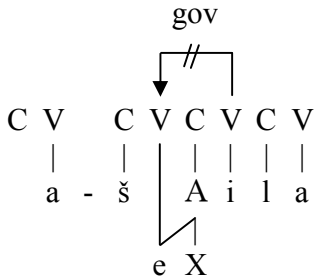
a. Word 1 is V-final

pronunciation w2 with a PIC
e present because frozen



aše(ʔ)ila

pronunciation w2 without PIC
e present because branching structures cannot be governed

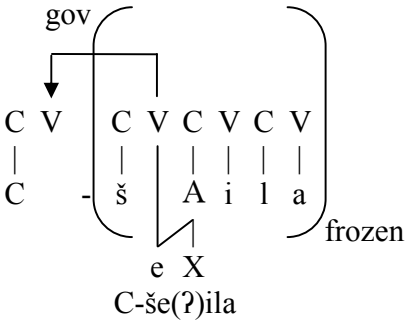


aše(ʔ)ila

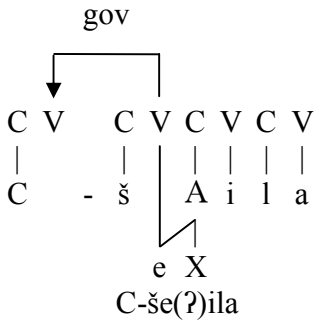
(34) Derivation of #XG words
Inner cycle:
1. epenthesis because of the initial CV
2. the guttural branches on the epenthetic vowel
outer cycle shown

b. Word 1 is C-final

pronunciation w2 with a PIC
e present because frozen
(and because it is a branching structure)
(and because it must govern the FEN)



pronunciation w2 without PIC
e present because it must govern the FEN
(and because it is a branching structure)



5. Another way of managing vowel-zero alternations in external sandhi: Belarusian

(35) Belarusian: structure and parameters
a. Structure
[word 1 [word 2]]
b. Parameters
1. word phases are not endowed with an initial CV (unlike MH)
2. word phases are not endowed with a PIC (unlike MH)
3. the utterance phase is endowed with an initial CV (like MH)
==> multi-word string computed without any extra-phonological restriction
c. and: alternating vowels never branch (on a neighbouring constituent)

(36) i-prothesis before CVC roots that occur in zero grade
Scheer (2009, 2012: §293)
Diagnostics
a. Utterance-initial and word pronounced in isolation:
==> initial CV present, provokes prothesis

context	example	gloss
## CVC	lev	lion NOMsg
## CøC-V	i-lv-a	lion GENsg

(36) i-prothesis before CVC roots that occur in zero grade
Scheer (2009, 2012: §293)
Diagnostics

b. After C-final words: prothesis
==> Belarusian repairs the first, MH the second of two empty nuclei in a row

…C # __CøC-V	brat i-lv-a	the brother of the lion

c. After V-final words: no prothesis

…V # __CøC-V	śastra lv-a	the sister of the lion

d. ==> word not protected by a PIC
1. unlike in MH, epenthesis is never carried over to the outer cycle when not motivated by the situation on this cycle:
2. compare

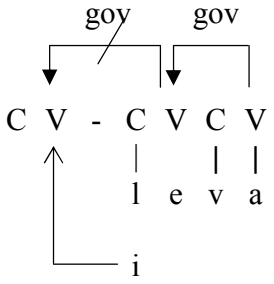
śastra lv-a	*śastra **i**-lv-a	Belarusian
a-n**e**šima		MH

e. Other evidence for words being endowed with an initial CV
In MH, two such pieces of evidence:
1. impossibility of initial RR clusters
2. no external sandhi if C2=gutt.

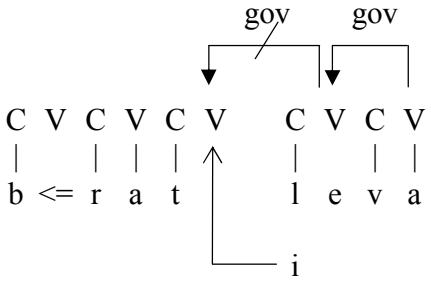
In Belarusian: only clean phonology rules on the outer cycle.

(37) Epenthesis into the leftmost of two empty nuclei in a row

a. Epenthesis into the (utterance-) initial CV



b. Epenthesis into the final empty nucleus of the preceding word



6. Conclusion

- Gutturals were never reestablished into Modern Hebrew. Nevertheless, many guttural effects have become regular processes.

- One such effect: gutturals in C_2 of an initial cluster /CC/ block the syncope of the epenthetic vowel in external sandhi.

- The guttural was shown independently to lower preceding vowels. This was represented as branching onto the preceding nucleus. The blocking of syncope follows from this branching.

- Languages differ 1) in the ways the initial CV is used to indicate phase boundaries, and 2) in selecting those processes that are frozen by phase boundaries:
  - In MH, the word-phase is endowed with an initial CV, but this CV is absent upon further computation because the phase it is the exponent of is absent.
  - In MH, some PIC: realized empty nuclei may syncopate due to new conditions.
  - In Belorussian, the word-phase is not endowed with an initial CV.
  - In Belorussian, no PIC: syncopated nuclei may not reemerge due to new conditions.

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