Hebrew Stress
Back to the Future

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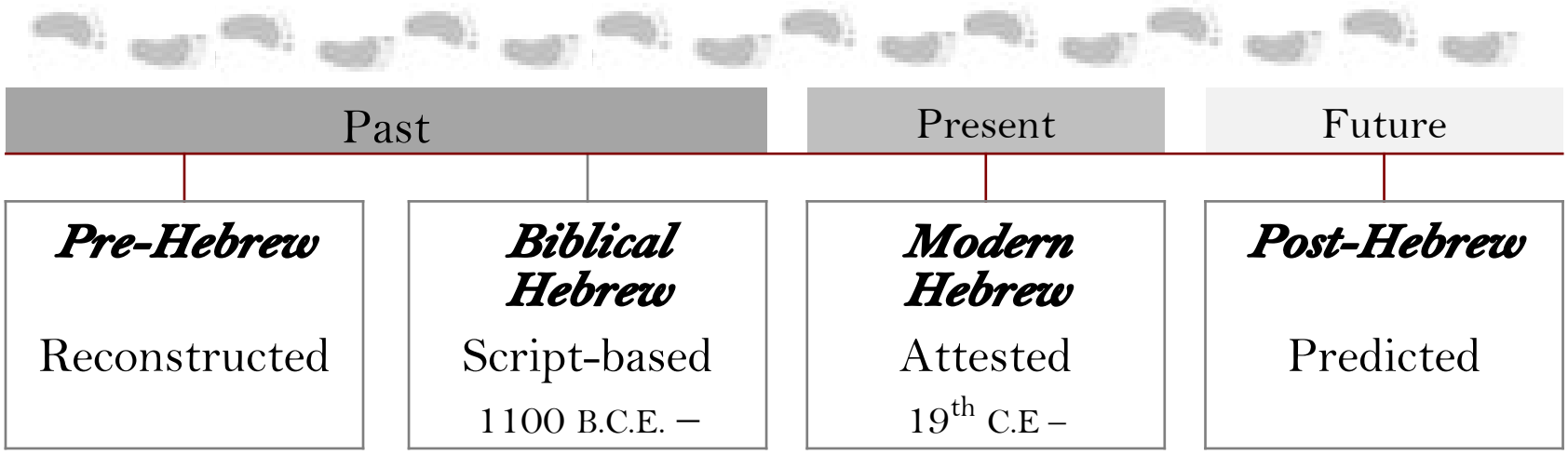
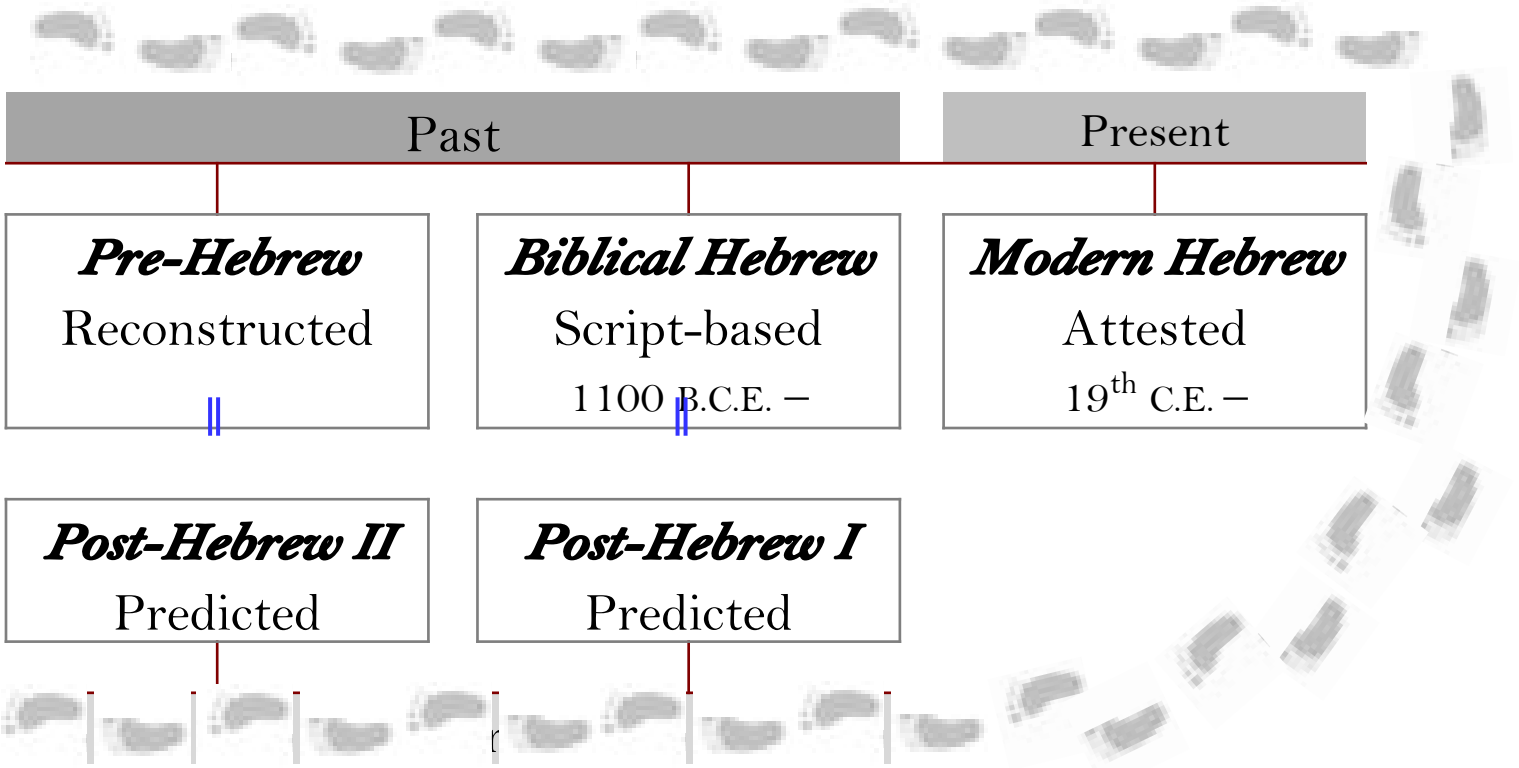
Introduction

Four landmarks in Hebrew stress



Introduction

My prediction: Post-Hebrew - ***back to the future***



Introduction The purpose of the talk

Restoration (rɛ stəˈ reɪʃ (ə)n), *n*. The reinstatement of a previous practice, right, or situation.

- Restoring the glory of **historical linguistics**.
- Restoring the glory of **universal principles**.

Introduction Chain of events

- Systematic and natural stress system □ *change in the prosodic structure* □ *change in the stress system* □ systematic but less natural stress system.

  Pre-Hebrew □ Biblical Hebrew

- □ *change in the prosodic structure* □ non-systematic and unnatural stress system.

  Biblical Hebrew □ Modern Hebrew

- □ *change in the stress system* □ systematic not so natural stress system □ systematic and natural stress system.

  Modern Hebrew □ Post-Hebrew

Introduction Chain of events

- Systematic and natural stress system □ *change in the prosodic structure* □ *change in the stress system* □ systematic but unnatural stress system

Independent events affected the stress system

- □ *change in the prosodic structure* □ non-systematic and unnatural stress system

Biblical Hebrew □ Modern Hebrew

An unnatural system becomes natural independently

- unnatural stress system □ systematic and natural stress system.

Modern Hebrew □ Post-Hebrew

Past

Pre-Hebrew (reconstructed)

- Blau (2010), Florentin (2002, 2015), Poebel (1939), among others

Past
Pre-Hebrew

Stage	'tongue'	'steam'	'is writing'	'he wrote'	'we guarded'
1	la[šó:nu]	qi:[tó:ru]	[kó:ti]bu		ša[márnu:]
2					

- ***Stage 1***: Stress the rightmost non-final heavy syllable (CV: and CVC are heavy);

Past
Pre-Hebrew

Stage	'tongue'	'steam'	'is writing'	'he wrote'	'we guarded'
1	la[šó:nu]	qi:[tó:ru]	[kó:te]bu	ka[tába]	ša[márnu:]
2					

- ***Stage 1***: Stress the right most non-final heavy syllable (CV: and CVC are heavy); in the absence of non-final heavy syllables, stress the penultimate.

Past
Pre-Hebrew

Stage	‘tongue’	‘steam’	‘is writing’	‘he wrote’	‘we guarded’
1	la[šó:nu]	qi:[tó:ru]	[kó:te]bu	ka[tába]	ša[márnu:]
2					

- ***Stage 1***: Stress the right most non-final heavy syllable (CV: and CVC are heavy); in the absence of non-final heavy syllables, stress the penultimate.

Past
Pre-Hebrew

All possible syllabic patterns

L HL	la[šó:.nu]	
H HL	qi:[tó:.ru]	
L HH	ša[már.nu:]	
H HH	hix[nás.nu:]	
L LL	ka[tá.ba]	
H LL	[kó:.te]bu	the only one with antepenult.
L LH	ša[má.ru:] □ šam.rú:	

Past
Pre-Hebrew

Stage	'tongue'	'steam'	'is writing'	'he wrote'	'we guarded'
1	la[šó:nu]	qi:[tó:ru]	[kó:te]bu	ka[tába]	ša[márnu:]
2			ko:[tébu]		

- ***Stage 1***: Stress the rightmost non-final heavy syllable (CV: and CVC are heavy); in the absence of heavy syllables, stress the penultimate.
- ***Stage 2:*** Penultimate across the board.
- The change from stage 1 to stage 2 could be attributed to
  the **high frequency** of penultimate stress (Blau 2010).

Past
Pre-Hebrew

	‘tongue’	‘steam’	‘is writing’	‘he wrote’	‘we guarded’
1	la[šó:nu]	qi:[tó:ru]	[kó:te]bu	ka[tába]	ša[márnu:]
	TROCHEE				

	‘tongue’	‘steam’	‘is writing’	‘he wrote’	‘we guarded’
2	la[šó:nu]	qi:[tó:ru]	ko:[tébu]	ka[tába]	ša[márnu:]
	TROCHEE				

Past
Pre-Hebrew

	‘tongue’	‘steam’	‘is writing’	‘he wrote’	‘we guarded’
1	la[šó:nu]	qi:[tó:ru]	[kó:te]bu	ka[tába]	ša[márnu:]
	TROCHEE	WEIGHT-TO-STRESS » ALIGNR(FT, PRWD)			

	‘tongue’	‘steam’	‘is writing’	‘he wrote’	‘we guarded’
2	la[šó:nu]	qi:[tó:ru]	ko:[tébu]	ka[tába]	ša[márnu:]
	TROCHEE				

Past
Pre-Hebrew

	‘tongue’	‘steam’	‘is writing’	‘he wrote’	‘we guarded’
1	la[šó:nu]	qi:[tó:ru]	[kó:te]bu	ka[tába]	ša[márnu:]

TROCHEE | WEIGHT-TO-STRESS » ALIGNR(FT, PRWD)

	‘tongue’	‘steam’	‘is writing’	‘he wrote’	‘we guarded’
2	la[šó:nu]	qi:[tó:ru]	ko:[tébu]	ka[tába]	ša[márnu:]

TROCHEE | ALIGNR(FT, PRWD) » WEIGHT-TO-STRESS

Past
Pre-Hebrew

1	Trochee		Weight-to-Stress » AlignR(Ft, PrWd)

Weight-to-Stress » AlignR(Ft, PrWd)

2	Trochee		AlignR(Ft, PrWd) » Weight-to-Stress

Past
Pre-Hebrew

	‘tongue’	‘steam’	‘is writing’	‘he wrote’	‘we guarded’
1	la[šó:nu]	qi:[tó:ru]	[kó:te]bu	ka[tába]	ša[márnu:]
	TROCHEE		WEIGHT-TO-STRESS » ALIGNR(FT, PRWD)		

	‘tongue’	‘steam’	‘is writing’	‘he wrote’	‘we guarded’
2	la[šó:nu]	qi:[tó:ru]	ko:[tébu]	ka[tába]	**ša[márnu:]**
	TROCHEE		ALIGNR(FT, PRWD) » WEIGHT-TO-STRESS		

syllabic trochee » moraic trochee

Foot-σ » Foot-μ

*šmar[nú:]

Foot units

Past

Pre-Hebrew □ Biblical Hebrew

Loss of word final short vowels

	‘tongue’	‘steam’	‘is writing’	‘he wrote’	‘we guarded’
Pre-Hebrew	lašó:nu	qi:tó:ru	ko:tébu	katába	šamárnu:

Past

Pre-Hebrew □ Biblical Hebrew

Loss of word final short vowels

	‘tongue’	‘steam’	‘is writing’	‘he wrote’	‘we guarded’
Pre-Hebrew	lašó:nu	qi:tó:ru	ko:tébu	katába	šamárnu:
Bib-Hebrew	lašó:n	qi:tó:r	ko:téb	katáb	šamárnu:

Word-final stress

Past
Pre-Hebrew □ Biblical Hebrew

	Pre-Hebrew	*Biblical Hebrew*	
a.	…CV́.CV]$_{\omega}$	…CV́C]$_{\omega}$	Loss of word final short vowel
	…CV́:.CV]$_{\omega}$	…CV́:C]$_{\omega}$	**C-final words – final stress**
	…CV́C.CV]$_{\omega}$	…CV́CC]$_{\omega}$	
b.	…CV́.CV:]$_{\omega}$	…CV́.CV:]$_{\omega}$	No change
	…CV́:.CV:]$_{\omega}$	…CV́:.CV:]$_{\omega}$	**V-final – penultimate stress**
	…CV́C.CV:]$_{\omega}$	…CV́C.CV:]$_{\omega}$	
c.	…CV́.CVC]$_{\omega}$	A small group of forms – vanished	
	…CV́:.CVC]$_{\omega}$		

Past
Pre-Hebrew □ Biblical Hebrew

	Pre-Hebrew	*Biblical Hebrew*	
a.	…CV́.CV]$_{\omega}$	…CV́C]$_{\omega}$	Loss of word final short vowel
	…CV́:.CV]$_{\omega}$	…CV́:C]$_{\omega}$	**C-final words – final stress**
	…CV́C.CV]$_{\omega}$	…CV́CC]$_{\omega}$	
b.	…CV́.CV:]$_{\omega}$	…CV́.CV:]$_{\omega}$	No change
	…CV́:.CV:]$_{\omega}$	…CV́:.CV:]$_{\omega}$	**V-final – penultimate stress**
	…CV́C.CV:]$_{\omega}$	…CV́C.CV:]$_{\omega}$	
c.	…CV́.CVC]$_{\omega}$	A small group of forms – vanished	
	…CV́:.CVC]$_{\omega}$		

Past
Biblical Hebrew

Biblical Hebrew

a.

…CV́C]$_{\omega}$

…CV́:C]$_{\omega}$

…CV́CVC]$_{\omega}$

C-final words – final stress

b.

…CV́.CV:]$_{\omega}$

…CV́:.CV:]$_{\omega}$

…CV́C.CV:]$_{\omega}$

V-final – penultimate stress

Simplification of complex codas via vowel epenthesis
(debatable whether it is synchronic or diachronic)

Past
Biblical Hebrew

Biblical Hebrew

a.

1 …CV́C]$_{\omega}$

2 …CV́:C]$_{\omega}$

3 …CV́C**V**C]$_{\omega}$

C-final words – final stress

b.

4 …CV́.CV:]$_{\omega}$

5 …CV́:.CV:]$_{\omega}$

6 …CV́C.CV:]$_{\omega}$

V-final – penultimate stress

Long vowel

Contradicting weight hierarchy for stress (Gordon 2006):
VV > VC > V

Past
Pre-Hebrew □ Biblical Hebrew

	‘tongue’	‘steam’	‘is writing’	‘he wrote’	‘we guarded’
Pre-Hebrew	lašó:nu	qi:tó:ru	ko:tébu	katába	šamárnu:
Bib-Hebrew 1	lašó:n	qi:tó:r	ko:téb	katáb	šamárnu:

Past
Biblical Hebrew Loss of V-length contrast

	‘tongue’	‘steam’	‘is writing’	‘he wrote’	‘we guarded’
Pre-Hebrew	lašó:nu	qi:tó:ru	ko:tébu	katába	šamárnu:
Bib-Hebrew 1	lašó:n	qi:tó:r	ko:téb	katáb	šamárnu:
Bib-Hebrew 2	lašón	qitór	kotéb	katáb	šamárnu

Past Biblical Hebrew Loss of V-length contrast

	‘tongue’	‘steam’	‘is writing’	‘he wrote’	‘we guarded’
Pre-Hebrew	lašó:nu	qi:tó:ru	ko:tíbu	katába	šamárnu:
Bib-Hebrew 1	lašó:n	qi:tó:r	ko:tíb	kataːb	šamárnu:
Bib-Hebrew 2	lašón	qitór	kotíb	kataːb	šamárnu
PR	[laʃóːn]	[qiːtóːr]	[koːtíb]	[kaːtáːb]	[ʃaːmáːrnuː]

The environment of ***Phonetic*** long vowels (Khan 2013b)

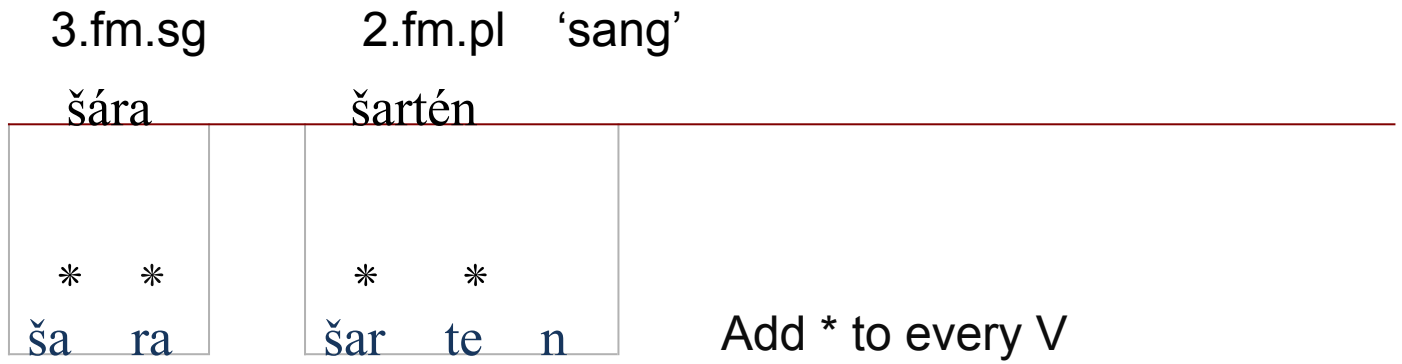
- Stressed vowels
- Vowels in open syllables

Past
Biblical Hebrew Primary stress system

- Generalization
  - C-final words – final stress
  - V-final words – penultimate stress

Past Biblical Hebrew Primary stress system

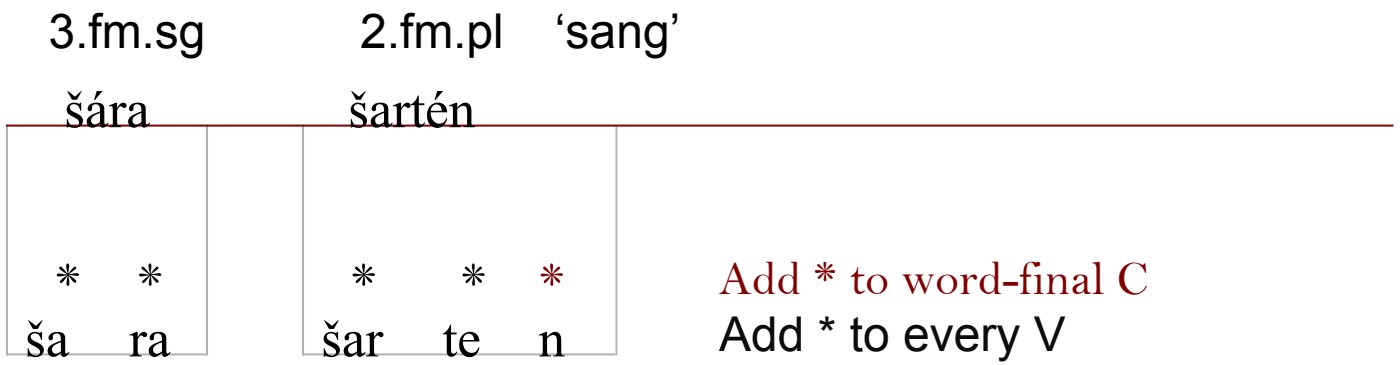
- Generalization
  - C-final words – final stress
  - V-final words – penultimate stress
- Previous accounts within the Metrical Grid Theory ·



• Churchyard (1999), Halle and Vergnaud (1987), Hayes (1980/1, 1995), McCarthy (1985), Rappaport (1984), Prince (1975).

Past Biblical Hebrew Primary stress system

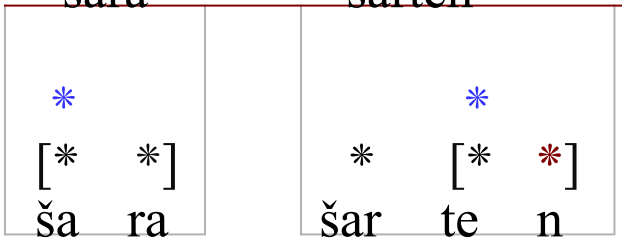
- Generalization
  - C-final words – final stress
  - V-final words – penultimate stress
- Previous accounts



Past Biblical Hebrew Primary stress system

- Generalization
  - C-final words – final stress
  - V-final words – penultimate stress
- Previous accounts

3.fm.sg	2.fm.pl	‘sang’
šára	šartén	

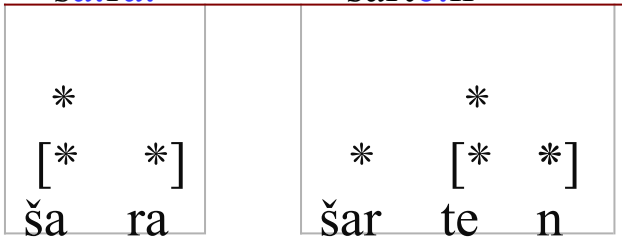


Construct a left-headed tree
at the right edge of the word
Add * to word-final C
Add * to every V

Past Biblical Hebrew Primary stress system

Stress assignment must ignore phonetic vowel length, otherwise CVC would be ‘heavier’ than CV:, contrary to the universal weight hierarchy CV: > CVC.

3.fm.sg	2.fm.pl	‘sang’
šá:ra:	šarté:n	



Construct a left-headed tree
at the right edge of the word
Add * to word final C
Add * to every V

Past
Pre-Hebrew Foot units

‘tongue’	‘steam’	‘is writing’	‘he wrote’	‘we guarded’
la[šó:nu]	qi:[tó:ru]	ko:[tébu]	ka[tába]	ša[márnu:]

Trochee | AlignR(Ft, PrWd) » Weight-to-Stress

Foot-σ » Foot-μ

*šmar[nú:]

Foot units

Past
Pre-Hebrew □ Biblical Hebrew Foot units

Foot-σ » Foot-μ

Pre-Hebrew	la[šó:nu]	qi:[tó:ru]	ko:[tébu]	ka[tába]	ša[márnu:]
	‘tongue’	‘steam’	‘is writing’	‘he wrote’	‘we guarded’

Past Pre-Hebrew □ Biblical Hebrew Foot's units

Foot-σ » Foot-μ

Pre-Hebrew	la[šó:nu]	qi:[tó:ru]	ko:[tébu]	ka[tába]	ša[márnu:]
	'tongue'	'steam'	'is writing'	'he wrote'	'we guarded'
Bib-Hebrew	la[šón] σ	*[qítor]	*[kóteb]	ka[táb] *[kátab]	ša[márnu]

Foot-μ » Foot-σ

Past Pre-Hebrew □ Biblical Hebrew Foot's units

Foot-σ » Foot-μ

Pre-Hebrew	la[šó:nu]	qi:[tó:ru]	ko:[tébu]	ka[tába]	ša[márnu:]
	'tongue'	'steam'	'is writing'	'he wrote'	'we guarded'
Bib-Hebrew	la[šón]			ka[táb]	**ša[márnu]**

Foot-μ » Foot-σ

šmar[tém]
'you ms.pl. guarded'

Past Pre-Hebrew □ Biblical Hebrew

Constraint reranking

Pre-Hebrew 1	*Pre-Hebrew 2*
Trochee	Trochee
Weight-by-position » Depm	Weight-by-position » Depm
Weight-to-Stress » AlignR(Ft, PrWd)	AlignR(Ft, PrWd) » Weight-to-Stress
Foot-Σ » Foot-M	Foot-Σ » Foot-M

Pre-Hebrew 2	*Biblical Hebrew*
Trochee	Trochee
Weight-by-position » Depm	Weight-by-position » Depm
AlignR(Ft, PrWd) » Weight-to-Stress	AlignR(Ft, PrWd) » Weight-to-Stress
Foot-Σ » Foot-M	Foot-M » Foot-Σ

Past

Pre-Hebrew □ Biblical Hebrew

Pre-Hebrew 1	*Pre-Hebrew 2*
Trochee	**Trochee**
Weight-by-Position » Depm	Weight-by-Position » Depm
Weight-to-Stress » AlignR(Ft, PrWd)	AlignR(Ft, PrWd) » Weight-to-Stress
Foot-Σ » Foot-M	Foot-Σ » Foot-M

Pre-Hebrew 2	*Biblical Hebrew*
Trochee	**Trochee**
Weight-by-Position » Depm	Weight-by-Position » Depm
AlignR(Ft, PrWd) » Weight-to-Stress	AlignR(Ft, PrWd) » Weight-to-Stress
Foot-Σ » Foot-M	Foot-M » Foot-Σ

Past

Pre-Hebrew □ Biblical Hebrew

Pre-Hebrew 1	*Pre-Hebrew 2*
Trochee	**Trochee**
Weight-by-Position	**Weight-by-Position**
Weight-to-Stress » AlignR(Ft, PrWd)	AlignR(Ft, PrWd) » Weight-to-Stress
Foot-Σ » Foot-M	Foot-Σ » Foot-M

Pre-Hebrew 2	*Biblical Hebrew*
Trochee	**Trochee**
Weight-by-Position	**Weight-by-Position**
AlignR(Ft, PrWd) » Weight-to-Stress	AlignR(Ft, PrWd) » Weight-to-Stress
Foot-Σ » Foot-M	Foot-M » Foot-Σ

Biblical Hebrew □ Modern Hebrew Disclosure

Hebrew is attested since ca. 1100 B.C.E. (Biblical Hebrew).

It died out as a spoken language in the 3rd century C. E., but retained for liturgical and literary purposes.

There were no native speakers during this period.

Hebrew became a spoken language (Modern Hebrew) in the late 19th and early 20th century (Rendsburg 2007).

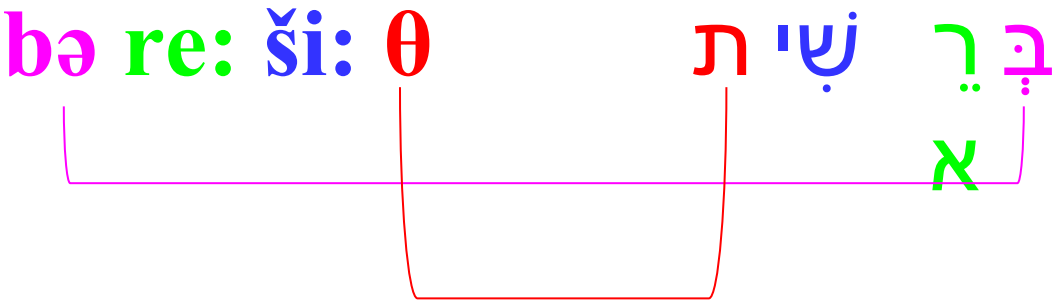
There is a debate as to whether Biblical Hebrew is the genetic ancestor of Modern Hebrew (Horvath & Wexler 1994). Regardless of one's view on the matter, researchers agree that Modern Hebrew's paradigms

Biblical Hebrew data are script-based (Tiberian script)

Segmental information

(In the beginning God created the heavens and the earth (Genesis 1.1

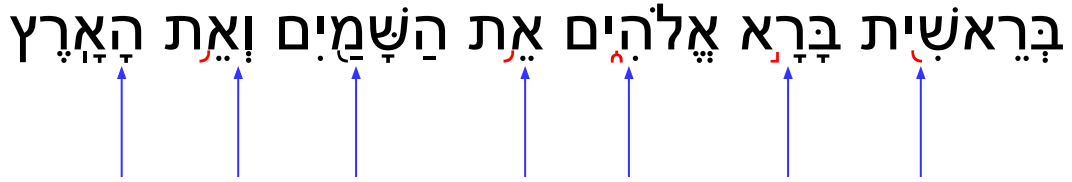
בְּרֵאשִׁית, בָּרָא אֱלֹהִים, אֵת הַשָּׁמַיִם, וְאֵת הָאָרֶץ.



Biblical Hebrew data are script-based (Tiberian script)

Prosodic information

(In the beginning God created the heavens and the earth (Genesis 1.1



Phrasal prosody markers are placed on the stressed syllable

Biblical Hebrew □ Modern Hebrew
Loss of word final glottals

Glottal-final words (phonemic)		Vowel final words
Biblical Hebrew	□	Modern Hebrew

			Biblical Hebrew			*Modern Hebrew (UR=PR)*	
Nouns:	Final	V-final	/ʦavá?/	□	ʦavá	ʦavá	'army'
		C-final			šavác	šavác	'stroke'
	Penult	V-final	/péle?/	□	péle	péle	'miracle'
	·	C-final			péreq	pérek	'chapter'
Verbs:	Final	V-final	/qafá?/	□	qafá	kafá	'froze'
		C-final			kafár	kafár	'atoned'

Biblical Hebrew □ Modern Hebrew
Loss of word final glottals

Glottal-final words (phonemic)		Vowel final words	
Biblical Hebrew	□	Modern Hebrew	

			Biblical Hebrew			*Modern Hebrew (UR=PR)*	
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	·	C-final			péreq	pérek	'chapter'
Verbs:	Final	V-final	/qafá?/	□	**qafá**	kafá	'froze'
		C-final	**qaf?-ú**		kafár	kafár	'atoned'

Biblical Hebrew □ Modern Hebrew
Loss of word final glottals

Glottal-final words (phonemic)		Vowel final words
Biblical Hebrew	□	Modern Hebrew

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Nouns:	Final	V-final	/ʦavá?/	□	ʦavá	ʦavá	'army'
		C-final			šavác	šavác	'stroke'
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	·	C-final			péreq	pérek	'chapter'
Verbs:	Final	V-final	/qafá?/	□	qafá	kafá	'froze'
		C-final				kafár	'atoned'

- Contrastive stress in Modern Hebrew nouns

Biblical Hebrew Modern Hebrew

- Loss of certain final consonants (and other changes)

Biblical Hebrew □ Modern Hebrew

- Loss of certain final consonants (and other changes)
- Contrastive stress

Biblical Hebrew □ Modern Hebrew

- Loss of certain final consonants (and other changes)
- Contrastive stress
- The mora is [illegible] of moraic consonants.

Modern Hebrew lost weight

Biblical Hebrew □ Modern Hebrew

How does the language handle this change?

- Verbs – recuperate
- Nouns – chaos

Biblical Hebrew □ Modern Hebrew

Verb paradigm - recuperating

Biblical Hebrew

	Stem	ša[már]	
s	suffixe -CV	ša[már-ti]	
	-V	ša[már-a] □ šamr-á	V-deletion in a derived CV
	-CV**C**	šamar-[te**m**] □ šmar-tém	Ante-pretonic V-deletion

Moraic coda – final stress

Biblical Hebrew Modern Hebrew

Verb paradigm – recuperating

Biblical Hebrew

	Stem	ša[már]	
s	suffixe -CV	ša[már-ti]	
s	suffixe -V	ša[már-a] šamr-á	V-deletion in a derived CV
s	suffixe -CV**C**	šamar-[te**m**] šmar-tém	Ante-pretonic V-deletion

Moraic coda – final stress

Modern Hebrew

	Stem	šamár	(footing is controversial here)
s	suffixe -CV	ša[már-ti]	
s	suffixe -V	ša[már-a] šamr-á	V-deletion in a derived CV
	-CVC	ša[már-tem]	

Non-moraic coda – penultimate stress

Biblical Hebrew □ Modern Hebrew Verbs

Verb paradigm - recuperating

Biblical Hebrew

	Stem	ša[már]
s	suffixe -CV	ša[már-ti]
s	suffixe -V	ša[már-a] □ šamr-á
	-CVC	šamar-[tem] □ šmar-tém

V-**final** vs. C-**final** suffixes

Modern Hebrew

	Stem	šamár
s	suffixe -CV	ša[már-ti]
s	suffixe -V	ša[már-a] □ šamr-á
	-CVC	ša[már-tem]

V-**initial** vs. C-**initial** suffixes

Biblical Hebrew □ Modern Hebrew Verbs

Verb paradigm - recuperating

	Final	*Penultimate*		*Final*
	Stem	V-final suffixes		C-final
Bib-Hebrew	šamár	šamr-á	šamár-ti	šmar-tém
Mod-Hebrew	šamár	šamr-á	šamár-ti	šamár-tem
	Stem	V-initial	C-initial suffixes	
	Final		*Penultimate*	

Verb paradigm - recuperating

	Final	*Penultimate*		*Final*
	Stem	V-final suffixes		C-final
Bib-Hebrew	šamár	šamr-á	šamár-ti	šmar-tém
Mod-Hebrew	šamár	šamr-á	šamár-ti	šamár-tem

	Stem	V-initial	C-initial suffixes
	šamár-a šamr-á		
	Final	*Penultimate*	

*LL (two-sided open syllable)

Biblical Hebrew □ Modern Hebrew Verbs

Verb paradigm - recuperating

	Final	*Penultimate*		*Final*
	Stem	V-final suffixes		C-final
Bib-Hebrew	šamár	šamr-á	šamár-ti	šmar-tém
Mod-Hebrew	šamár	šamr-á	šamár-ti	šamár-tem
	Stem	V-initial	C-initial suffixes	
	Final		*Penultimate*	

Verb paradigm - recuperating

	Final	*Penultimate*		*Final*
	Stem	V-final suffixes		C-final
Bib-Hebrew	šamár	šamr-á	šamár-ti	šmar-tém
Mod-Hebrew	šamár	šamr-á	šamár-ti	šamár-tem
	Stem	V-initial	C-initial suffixes	
	Final	?	*Penultimate*	

Present Modern Hebrew Verbs

Verb paradigm – stress is stem final

		Elsewhere	Monosyll. stems	Stems with final V[+high]
Past	3.ms.sg.	**šamár**	**kám**	**hitxíl**
	3.fm.sg.	šamár-a □ šamr-á	kám-a	hitxíl-a
	1.sg.	šamár-ti	kám-ti	hitxál-ti
	2.pl.	šamár-tem	kám-tem	hitxál-tem
Future	2.ms.sg.	ti-šmór	ta-kúm	ta-taxíl
	2.fm.sg.	ti-šmór-i □ ti-šmer-í	ta-kúm-i	ta-txíl-i
		‘to guard’	‘to get up’	‘to start’

Present Modern Hebrew Verbs

Verb paradigm – stress is stem final

		Elsewhere	Monosyll. stems	Stems with final V[+high]
Past	3.ms.sg.	**šamár**	**kám**	**hitxíl**
	3.fm.sg.	šamár-a ~ šamr-á	kám-a	hitxíl-a
	1.sg.	šamár-ti	kám-ti	hitxál-ti
	2.pl.	šamár-tem	kám-tem	hitxál-tem
Future	2.ms.sg.	ti-šmór	ta-kúm	ta-taxíl
	2.fm.sg.	ti-šmór-i ~ ti-šmer-í	ta-kúm-i	ta-txíl-i

If we take care of stress shift in these cases, we could say that **stress in Hebrew verbs is stem final** (Graf and Ussishkin 2003).

Present Modern Hebrew

The results of the loss of moraic codas

Verbs ☺	**CV]$_\omega$**		**CVC]$_\omega$**	
Penultimate	gadál-ta		gadál-tem	
	‘grew 2.ms.sg’		‘grew 2.ms.pl’	
Final	daxá		daxáf	
(stems)	‘rejected 3.ms.sg’		‘pushed 3.ms.sg’	
Nouns ☹	**CV]$_\omega$**		**CVC]$_\omega$**	
Penultimate	péle	‘miracle’	pérek	‘chapter’
	Minimal	iation	**Lexical**	ovecote’
Final	pará	‘cow’	paráš	‘horseback rider’
	barí	‘healthy’	parix	‘crunchy’

A question for further study

Why do some systems recuperate after a change and others do not?

- Biblical Hebrew Modern Hebrew
  - The verb system accommodates the changes and stays systematic.
  - The noun system collapses, ending up with sheer chaos.
- Classical Arabic Spoken Arabic (quite a few dialects)
  - The stress system does not change after the loss of word final short vowels.

An answer for further study

Immune system

- A ‘strong’ system, with little or no exceptions, does not change or at least recuperates.
- A ‘weak’ system takes longer to recuperate.
- Of course, the notions ‘strong’ and ‘weak’ have to be defined (what are the units of strength) and quantified (probably on a scale).

Present Modern Hebrew Frequency of stress patterns

Final stress is by far the more frequent pattern

Corpus - Nouns	Types	Tokens
Dictionary ·	75% (n=11,920)	
3 hours recording of CDS ··	73% (n=386)	71% (n=983)
CDS of disyllabic nouns ···	72.2%	75.5%

71-75% final stress

· Bolozky and Becker (2006)

·· Adam and Bat-El (2011)

··· Segal, Nir-Sagiv, Kishon-Rabin and Ravid (2009)

Present Modern Hebrew Frequency of stress patterns

- 99% of the **verb** stems take **final stress**.*
- 76% (13/17) of the cells in the paradigm host forms with **final stress** (shaded).

		Past	Future	Infinitive
sg.	1	xipás-ti	je-xapés	lexapés
	2 fm.	xipás-t	te-xaps-í	
	2 ms.	xipás-ta	te-xapés	
	3 fm.	xips-á	te-xapés	
	3 ms.	xipés	je-xapés	
pl.	1	xipás-nu	ne-xapés	
	2	xipás-tem	te-xaps-ú	

Present Modern Hebrew Frequency of stress patterns

- 99% of the **verb** stems take **final stress**.*
- 76% (13/17) of the cells in the paradigm host forms with **final stress** (shaded).

		Past	Future	Infinitive
sg.	1	xipás-ti	je-xapés	lexapés
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	2 ms.	xipás-ta	te-xapés	
	3 fm.	xips-á	te-xapés	
	3 ms.	xipés	je-xapés	
pl.	1	xipás-nu	ne-xapés	
	2	xipás-tem	te-xaps-ú	

*Verb stems with **penultimate stress** end in $V_1V_2(C)$, where V_2=[a]; jegal**éa**x 'will shave 3.ms. sg.' jašm**ía** 'will sound 3. ms.sg.'

- Given
  - the contrastive stress in nouns, and
  - the high frequency of final stress;
- The frequency-based prediction is that final stress will eventually take over.

Present
Modern Hebrew Seeds of future

There is evidence suggesting that **penultimate stress** will take over.

Present Modern Hebrew Seeds of future

- **Acronym words** (AWs) prefer penultimate stress more than native words (Bat-El 1994, Zadok 2002)
- Note that AWs look exactly like native words – same prosodic structure and vocalic pattern

Acronym Words		*Native Words*	
alám	'colonel'	agám	'lake'
mankál	'CEO'	rakdán	'dancer ms.sg'
báhad	'training base'	láhag	'dialect'
tába	'city planning'	sába	'grandfather'
ráši	'a name'	ráfi	'a name'

Present
Modern Hebrew Seeds of future

AWs belong to the periphery of the lexicon (Ito & Mester 1995), where the **effect of universal principles may emerge (Bat-El 2000, Zadok 2002).**

For example, although Hebrew allows complex onsets (e.g. *bgadím* *'clothes'), there are no AWs with complex onsets (the emergence of *COMPLEX).

Present Modern Hebrew Seeds of future

- Also hypocoristics belong to the periphery of the lexicon.
- Stress in hypocoristics is penultimate; e.g. *smádi*, *tíki*, *mórdi* (Bat-El 2005).
- The emergence of other unmarked onset: The **weaker** the initial onset of the base the grater the chance for mis-anchoring (Bat-El 2014).

	Base name	*Left-anchored*	*Mis-anchored*
Obstruents:	smádi	smádi	
Nasals:	matitjáu	máti	
Liquids:	raxel	róxi	xéli
Glides:	jaron		róni

Present Modern Hebrew Seeds of future

Acronym words experiment

- 19 monolingual Hebrew speakers (mean age 23) read from a screen unfamiliar AWs and their base.
- Note that the Hebrew script allows recognizing AWs:

Acronym Word		*Native Word*	
báhad	בה"ד	láhag	להג
ráši	רש"י	ráfi	רפי

Present
Modern Hebrew Seeds of future

Acronym word experiment

Results:

	Penultimate		*Final*	
	44.4%	(191/430)	55.6%	(239/430)

p=<0.0001 (FET); expectation 70% final stress

Present
Modern Hebrew Seeds of future

Nonce-word experiment (Fainleib 2008)

- 12 native Hebrew speakers (mean age 23) were asked to read nonce-words within a sentence frame.
- Stimuli were controlled for similarity to real words, on the basis of their vocalic pattern (e.g. there are no words in Hebrew with two high back vowels (**butuk*).

Present
Modern Hebrew Seeds of future

Nonce-words experiment

Results	*Penultimate*	*Final*
High frequency patterns (p<0.0001; χ2)	45.6% (392/859)	54.4% (467/859)

Present
Modern Hebrew Seeds of future

Nonce-words experiment

Results	*Penultimate*	*Final*
High frequency patterns (p<0.0001; χ2)	45.6% (392/859)	54.4% (467/859)
Acronym word experiment	44.4%	56.6%

Present
Modern Hebrew Seeds of future

Nonce-words experiment

Results	*Penultimate*	*Final*
High frequency patterns (p<0.0001; χ2)	45.6% (392/859)	54.4% (467/859)
Acronym word experiment	44.4%	56.6%
Nouns in the dictionary	27%	73%

Present
Modern Hebrew Seeds of future

Nonce-words experiment

Results	*Penultimate*	*Final*
High frequency patterns (p<0.0001; χ2)	45.6% (392/859)	54.4% (467/859)
Low frequency patterns (p=0.0105; χ2)	**57.5%** **(495/861)**	**42.5%** **(366/861)**
Acronym word experiment	44.4%	56.6%
Nouns in the dictionary	27%	73%

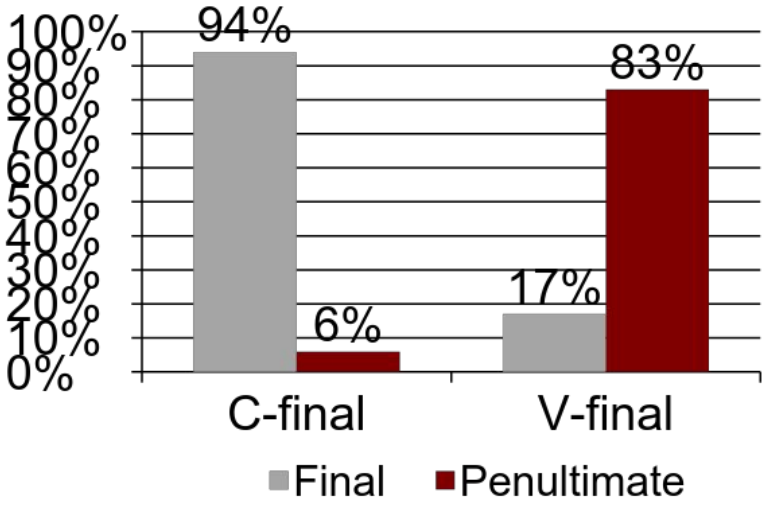
Present
Modern Hebrew Seeds of future

- The experiments suggest that Hebrew is going **back to the future** – to penultimate stress.
- Recall the two stress systems in the past:
  - **Biblical Hebrew**: Final stress in C-final words and penultimate stress in V-final words.
  - **Pre-Hebrew**: Penultimate stress across the board.
- **Is Post-Hebrew going to be like Biblical Hebrew or Pre-Hebrew?**

Present Modern Hebrew Seeds of future

Acronym word experiment

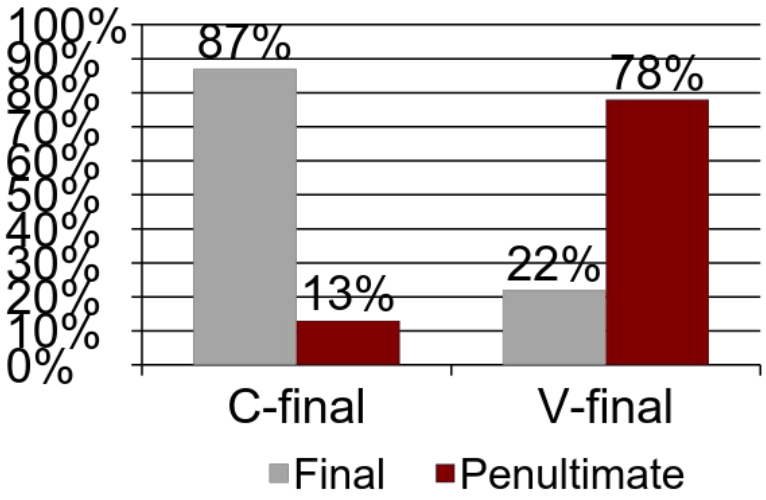
C-final vs. V-final words



V-final – penultimate
C-final – final
(p<.001; FET)

C-final vs. V-final words

Nonce words: similarity to ***high*** *frequency* patterns



V-final – penultimate
C-final – final
(p<.0001; $\chi 2$)

Future
Post-Hebrew

- **Q1:** Is Post-Hebrew going to be similar to Biblical Hebrew or Pre-Hebrew?
- **P1**: Biblical Hebrew

(P = Prediction)

Future
Post-Hebrew

- **Q2:** Is it going to comfortably dock on this new BH-like system and stay there for ever (theoretically)?
- **P2**: Quite unlikely: The new BH-like stress system will probably be systematic (eventually), but **not typologically natural**.

Biblical Hebrew Typologically not super-natural

- **Weight hierarchy**
  - **Universal**: CV: > CVC
  - **Biblical Hebrew**: CVC is heavy, but there is no phonemic vowel length contrast.
- **Compensatory Lengthening**
  - **Universal:** Compensatory lengthening arises in languages with independently motivated length contrast (De Chene and Anderson 1979, Hayes 1989).
  - **Biblical Hebrew:** Compensatory lengthening applies without vowel length contrast.

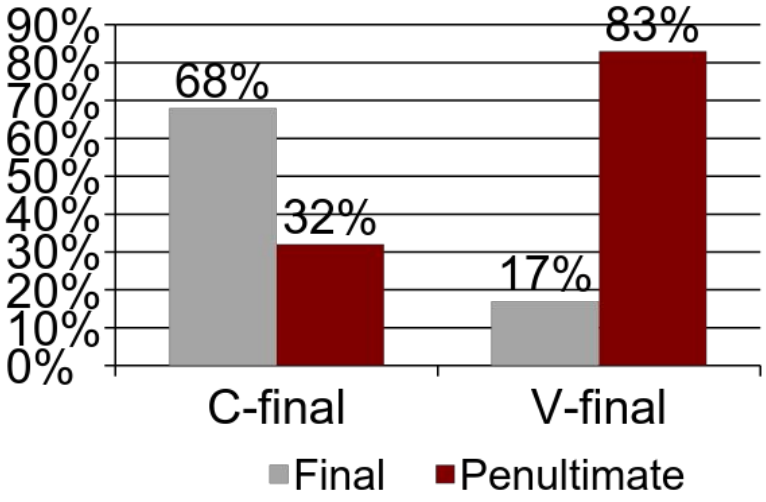
Post-Hebrew Typologically more natural than Biblical Hebrew, but still …

- **Weight hierarchy**
  - **Universal**: CV: > CVC (Gordon 2006)
  - **Biblical Hebrew**: CVC is heavy, but there is no phonemic vowel length contrast.
  - **Post-Hebrew** (=BH): CVC heavy without long vowels ☹
- **Compensatory Lengthening**
  - **Universal:** Compensatory lengthening arises in languages with independently motivated length contrast (De Chene and Anderson 1979, Hayes 1989)
  - **Biblical Hebrew:** Compensatory lengthening

Future
Post-Hebrew

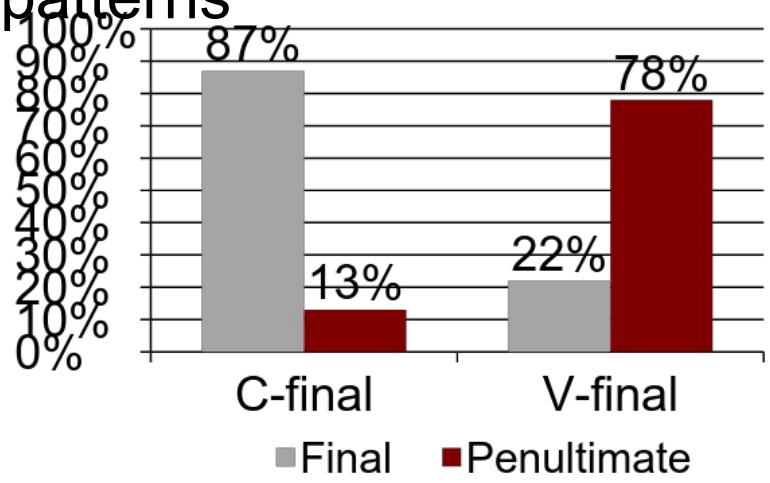
C-final vs. V-final words

Low *frequency* patterns



Evidence for Post-Hebrew 2

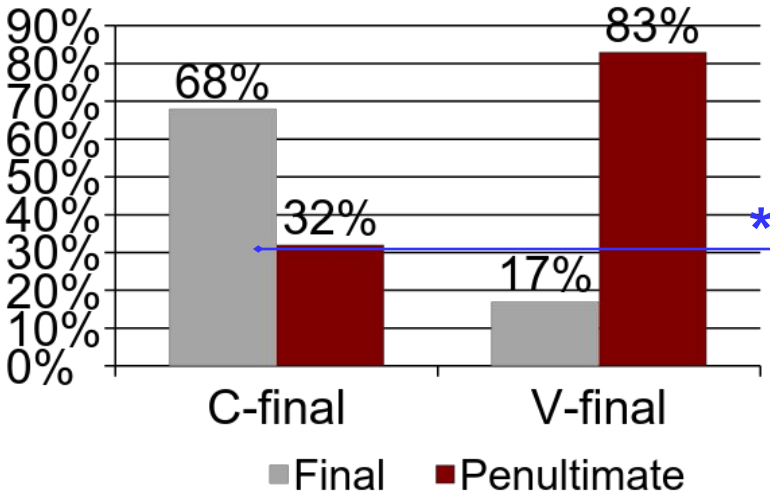
High *frequency* patterns



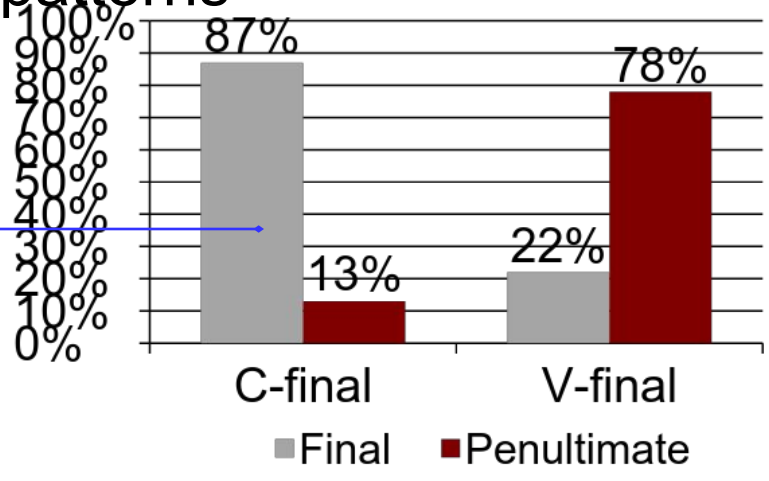
Future
Post-Hebrew

Low frequency patterns – better indicators for the far future

***Low** frequency* patterns



***High** frequency* patterns



Future
Post-Hebrew

- **Post-Hebrew 1 (~ Biblical Hebrew)**
  - Final stress in C-final words, penultimate in V-final words
  - Trochaic moraic feet (no vowel length contrast)
- **Post Hebrew 2 (~ Pre-Hebrew)**
  - Penultimate stress across the board
  - Trochaic syllabic feet (no weight contrast)

Pre-Hebrew Biblical Hebrew

Pre-Hebrew 1	*Pre-Hebrew 2*
Trochee	Trochee
Weight-by-position » Depm	Weight-by-position » Depm
Weight-to-Stress » AlignR(Ft, PrWd)	AlignR(Ft, PrWd) » Weight-to-Stress
Foot-Σ » Foot-M	Foot-Σ » Foot-M

Pre-Hebrew 2	*Biblical Hebrew*
Trochee	Trochee
Weight-by-position » Depm	Weight-by-position » Depm
AlignR(Ft, PrWd) » Weight-to-Stress	AlignR(Ft, PrWd) » Weight-to-Stress
Foot-Σ » Foot-M	Foot-M » Foot-Σ

Pre-Hebrew □ Biblical Hebrew

Biblical Hebrew	*Modern Hebrew*
Trochee	Trochee & Iamb (???)
Weight-by-position » Depm	Depm » Weight-by-position
AlignR(Ft, PrWd) » Weight-to-Stress	AlignR(Ft, PrWd) » Weight-to-Stress
Foot-M » Foot-Σ	Foot-M » **Foot-Σ**

No moraic codas and in the absence of vowel length contrast the mora does not play a role.

Since σ = μ, feet are inevitably syllabic, regardless of this ranking.

Biblical Hebrew □ Modern Hebrew

Biblical Hebrew	*Modern Hebrew*
Trochee	Trochee & Iamb
Weight-by-position » Depm	Depm » Weight-by-position
AlignR(Ft, PrWd) » Weight-to-Stress	AlignR(Ft, PrWd) » Weight-to-Stress
Foot-M » Foot-Σ	Foot-M » Foot-Σ

??

?

Present Modern Hebrew Foot structure

Are feet in the current system trochaic or iambic?

	Trochaic˙	Mixed¨	
	Trochee » FtBin	FtBin » Trochee	
Penult.	ba[nána]	ba[nána] trochaic	‘banana’
	[tútim] trochaic	[tútim]	‘strawberries'
Final	mata[ná]	ma[taná] iambic	‘present’
	xu[tím]	[xutím]	‘strings’

Either way stress is lexically specified

- Becker (2002), Graf (1999)
- Graf and Ussishkin (2003), Bat-El (2005)

Future
Post-Hebrew

Biblical Hebrew	*Modern Hebrew*
Trochee	Trochee & Iamb
Weight-by-position » Depm	Depm » Weight-by-position
AlignR(Ft, PrWd) » Weight-to-Stress	AlignR(Ft, PrWd) » Weight-to-Stress
Foot-M » Foot-Σ	Foot-M » Foot-Σ

Post-Hebrew
Trochee
Weight-by-position » Depm
AlignR(Ft, PrWd) » Weight-to-Stress
Foot-M » **Foot-Σ**

Final in C-final words
Penult. in V-final words

Future
Post-Hebrew 1 & 2

Post-Hebrew 1	*Modern Hebrew*
Trochee	Trochee & Iamb
Weight-by-position » Depm	Depm » Weight-by-position
AlignR(Ft, PrWd) » Weight-to-Stress	AlignR(Ft, PrWd) » Weight-to-Stress
Foot-M » Foot-Σ	Foot-M » Foot-Σ

Final in C-final words
Penult. In V-final words

Future
Post-Hebrew 1 & 2

Post-Hebrew 1	*Modern Hebrew*
Trochee	Trochee & Iamb
Weight-by-position » Depm	Depm » Weight-by-position
AlignR(Ft, PrWd) » Weight-to-Stress	AlignR(Ft, PrWd) » Weight-to-Stress
Foot-M	Foot-M » Foot-Σ
Foot-Σ	

Final in C-final words
Penult. In V-final words

Post-Hebrew 2
Trochee
Depm » Weight-by-position
AlignR(Ft, PrWd) » Weight-to-Stress
Foot-M » Foot-Σ

Penult. across the board

Future
Post-Hebrew 1 & 2

Post-Hebrew 1	*Modern Hebrew*
Trochee	Trochee & Iamb
Weight-by-position » Depm	Depm » Weight-by-position
AlignR(Ft, PrWd) » Weight-to-Stress	AlignR(Ft, PrWd) » Weight-to-Stress
Foot-M	Foot-Σ	Foot-M » Foot-Σ

Final in C-final words
Penult. In V-final words

Post-Hebrew 2
Trochee
Depm » Weight-by-position
AlignR(Ft, PrWd) » Weight-to-Stress
Foot-M » Foot-Σ

Penult. across the board

Not relevant

Future
Post-Hebrew 1 & 2

Post-Hebrew 1	*Modern Hebrew*
Trochee	Trochee & Iamb
Weight-by-position » Depm	Depm » Weight-by-position
AlignR(Ft, PrWd) » Weight-to-Stress	AlignR(Ft, PrWd) » Weight-to-Stress
Foot-M	Foot-M » Foot-Σ
Foot-Σ	

Mostly ***final***

Final in C-final words
Penult. In V-final words

Post-Hebrew 2
Trochee
Depm » Weight-by-position
AlignR(Ft, PrWd) » Weight-to-Stress
Foot-M » Foot-Σ

Penult. *across the board*

Universal principles

Despite of the high frequency of final stress, the change is going towards penultimate stress. WHY?

Universal principles

Trochee is the natural selection

- Trochee is common in languages with or without weight contrast, while iamb is more common in languages with weight contrast (Hayes 1995)
- “The syllabic trochee is the basic mechanism available for quantity-insensitive alternation” (Hayes

Also children support trochee

Children prefer penultimate stress

- There is quantitative preference for penultimate stress in early productions (types and tokens) as well as attempted targets.
- There are three strategies to avoid final stress (iambic feet).

Stress shift – Child I (YI age 2;0)
Shifted final stress backwards, but kept penultimate stress in its target position (Ben-David and Bat-El to appear).

target	*child*	
t͡saóv	sáov	'yellow'
xipuš ít	búžit	'beetle'
lišón	jíson	'to sleep'

target	*child*	
lekal éf	kájef	'to peel'
gviná	ína	'cheese'
karn áf	ánaf	'rhino'

Epenthesis – Child II (RI age 1;11)

Added a vowel at the end of words with final stress, but not at the end of words with penultimate stress (Ben-David and Bat-El to appear).

target	*child*		*target*	*child*	
arnáv	náva	'rabbit'	adóm	dóma	'red'
kaxól	óla	'blue'	xatúl	otúla	'cat'
kadúr	dúra	'ball'	kadúr	kadóra	'ball'

Truncation – Child III (SR age 1;2-1;7)
Produced disyllabic words for targets with penultimate stress and monosyllabic words for targets with final stress (Adam & Bat-El 2009).

Penultimate			***Final***		
target	*child*		*target*	*child*	
sáfta	táta	'grandma'	todá	da	'thanks'
glída	díla	'ice cream'	kivsá	sa	'sheep'
tapúax	púax	'apple'	agás	ga	'pear'

One goal – 3 strategies

	kadúr 'ball'	FAITHσ^{S}	ANCHORR	MAXσ
YI	• [kádur]	*		
RI	• ka [dúra]		*	
SR	• [dúr]			*

Stress shift
Unfaithful to target stressed syllable

V addition
Unfaithful to the right edge of the target

Truncation
Unfaithful to target syllables

One goal – 3 strategies

	kadúr 'ball'		Trochee	Faithσ^{s}	AnchorR	Maxσ
YI	• [kádur]	Stress shift	√	*		
RI	• ka [dúra]	V addition	√		*	
SR	• [dúr]	Truncation	√			*

We all want trochee!!!

or … we don't want iamb!!!

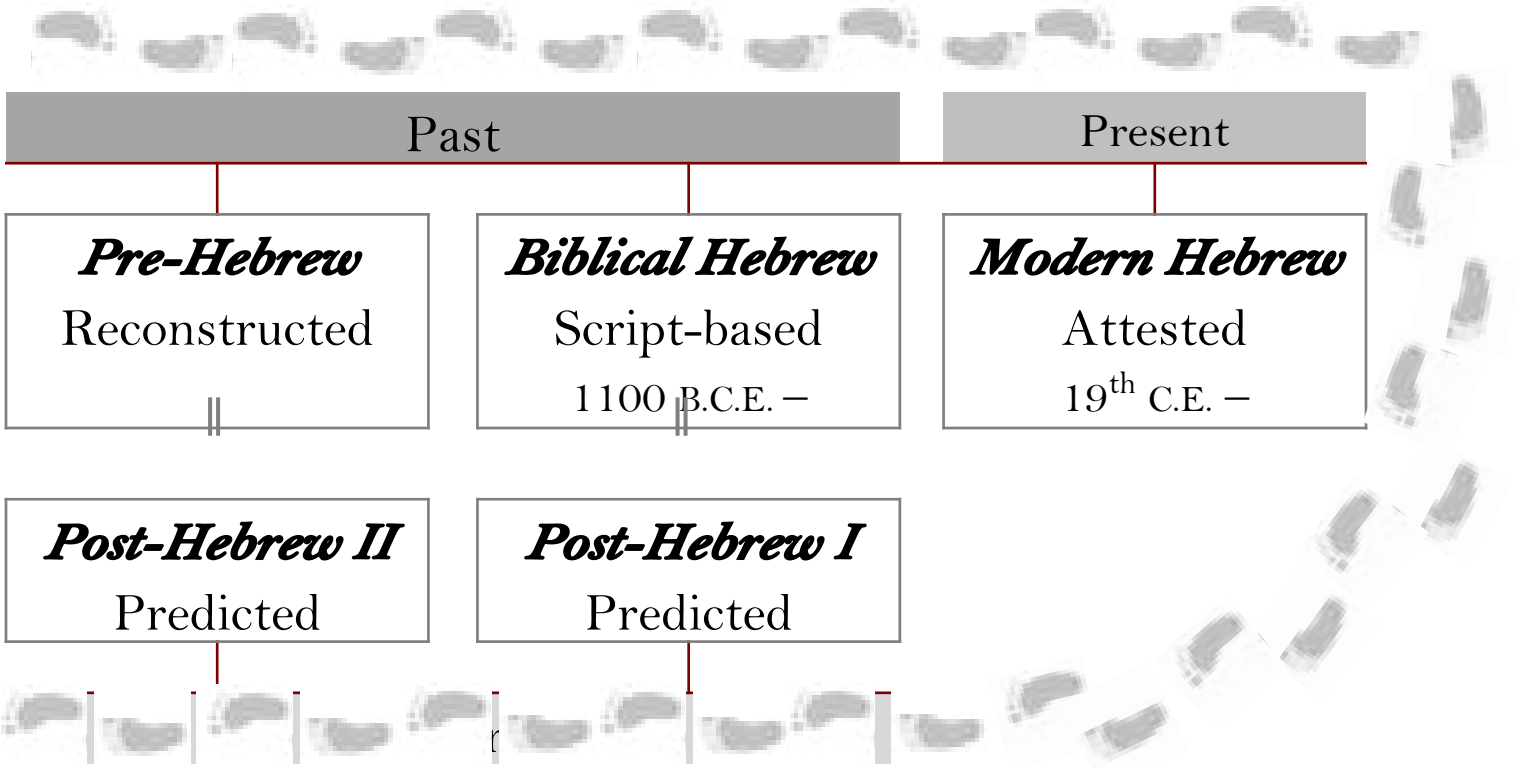
Conclusion

The purpose of the talk was restoration

- of the glory of **historical linguistics**
- of the glory of **universal principles**

Conclusion Back to the future

Historical linguistics



Conclusion Back to universal principles

Universal principles

- A frequency-based approach should have led Hebrew towards final stress - an iambic system.
- However, there are data suggesting that Hebrew stress system is going towards penultimate stress – a trochaic system, **as predicted by universal principles**.

Conclusion Further questions

- **The question to be asked is NOT**
  - Is it frequency OR universal principles?
  - Because both are relevant.
- **The questions to be asked are**
  - How do frequency and universal principles interact?
  - What are the conditions allowing the effect of frequency /universal principles to emerge?

OCP Budapest

Thank You

Adam, G. & O. Bat-El. 2009. When do universal preferences emerge in language development? The acquisition of Hebrew stress. *BAALL* 1:1-28.

Bat-El, O. 1994. The optimal acronym word in Hebrew. Koskinen (ed.) *Toronto Working Papers in Linguistics*, 23-37.

Bat-El, O. 2000. The grammaticality of "extragrammatical" morphology. In Doleschal and Thornton (eds) *Extragrammatical and Marginal Morphology* 61-84. Munich: Lincom Europa.

Bat-El, O. 2005. The emergence of the trochaic foot in Hebrew hypocoristics. *Phonology* 22:1-29.

Bat-El, Outi. 2014. Staying away from the weak left edge: A strengthening strategy. In S. Bendjaballah, N. Faust, M. Lahrouchi, & N. Lampitelli (eds) *The Form and Structure, the Structure of Form: Essays in Honor of Jean Lowenstamm*. John Benjamins.

Ben-David, A. and O. Bat-El. to appear. Paths and stages in the acquisition of Hebrew phonological word. In R. Berman (ed.), *Acquisition and Development of Hebrew: From Infancy to Adolescence*.

Blau, J. 2010. *The Phonology and Morphology of Biblical Hebrew*. Jerusalem: The Academy of the Hebrew Language. (in Hebrew)

Becker, M. 2002. *Hebrew stress: Can't you hear those trochees*? M.A. thesis, Tel-Aviv University.

Bolozky, S. & M. Becker. 2006. Living Lexicon of Hebrew Nouns. Ms., University of Massachusetts Amherst. Available at http://becker.phonologist.org/LLHN.

de Chene, B. & S. Anderson. 1979. Compensatory Lengthening. *Language* 55:505-535.

Churchyard, H. 1999. *Topics in Tiberian Biblical Hebrew Metrical Phonology and Phonetics*. Ph. D. dissertation, The University of Texas at Austin.

Fainleib, L. 2008. *Default Stress in Unpredictable Stress Languages: Evidence from Russian and Hebrew*. M.A. thesis, Tel-Aviv University.

Florentin, M. 2002. The Hebrew stress curve and what can we learn from it and from Samaritan Hebrew on stress in the Mishna. *Leshonenu* 64:221-230. (in Hebrew)

Florentin, M. 2015. Pre-Tiberian Hebrew and the heavy syllable law: A different approach for explaining the conditions of vowel reduction and lengthening during the pre-Tiberian stage of the language. *Leshonenu* 77:161-176 (in Hebrew).

Halle, M. and J-R. Vergnaud. 1987. *An Essay on Stress*. Cambridge, MA: The MIT press.

Hayes, B. 1979. Compensatory lengthening in moraic theory. *LI* 20:253-306.

Hayes, B. 1995. *Metrical Stress Theory: Principles and Case Studies*, Chicago: The University of Chicago Press.

Horvath, J. & P. Wexler. 1994. Unspoken languages and the issue of genetic classification: The case of Hebrew. *Linguistics* 32:241-269.

Ito, J. and A. Mester. 1995. The core-periphery structure of the lexicon and constraints on reranking. In J. Beckman, S. Urbanczyk and L. Walsh (eds) *Papers in Optimality Theory*, 181-210. Amherst: GLSA.

Khan, G. 2013a. Stress: Biblical Hebrew. *Encyclopedia of Hebrew Language and Linguistics*. Geoffrey Khan (ed.). Brill Online.

Khan, G. 2013b. Vowel Length: Biblical Hebrew. *Encyclopedia of Hebrew Language and Linguistics*. Geoffrey Khan (ed.). Brill Online.

McCarthy, J. 1985. *Formal Problems in Semitic Phonology and Morphology*. New York: Garland.

Poebel, A. 1939. The antepenult stressing of Old Hebrew and its influence on the shaping of the vowels. *American Journal of Semitic Languages and Literature* 56:225-230.

Prince, A. 1975. *The Morphology and Phonology of Tiberian Hebrew.* Ph.D. dissertation, MIT.

Rappaport, M. 1984. *Issues in the Phonology of Tiberian Hebrew*. Ph.D. dissertation, MIT.

Rendsburg, G. 2007. Ancient Hebrew Morphology. In Alan Kaye (ed.) *Morphologies of Asia and Africa* (v1), 85-105. Winona Lake, IN: Eisenbrauns.

Segal, O., B. Nir-Sagiv, L. Kishon-Rabin & D. Ravid. 2009. Prosodic patterns in Hebrew child directed speech. *Journal of Child Language* 36:629-656.

Zadok, G. 2002. Abbreviations: *A Unified Analysis of Acronym Words, Clippings, Clipped Compounds and Hypocoristics*. M.A. thesis, Tel-Aviv University.