The Morphology of Nonconcatenative Languages

Data and Analysis from a Few Semitic Languages

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Overview of the Semitic Language Family

Geographical

- Semitic languages are spoken in:
  1. Northern Africa
  2. Horn of Africa
  3. Middle East
  4. Southwest Asia

Ethnographical

- More than 467 million speakers worldwide
- Named after the Hebrew word “shem" (son of Noah)
- Only languages in Afroasiatic family spoken outside of Africa
- Constitutes some of the oldest written languages on the planet

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- Proto-Afroasiatic originated in NE Africa (probably Ethiopia)
- Large language diversity and lack of many common vocabulary
- Family dispersed around the Neolithic era (!!)
- Some of the oldest writings/artifacts date back 7,000-10,000 years
- Proto-semitic established by about 4th millennium BCE
- Eastern Semitic died out by about 8th century BCE (we think)

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(Sub-)Family Overview and Subdivisions

Subdivisions Include:

Eastern Semitic (Extinct) Akkadian, Babylonian, Eblaite, ...

Central Semitic Arabic, Hebrew, Amharic, Maltese, ...

South Semitic Ge'ez, Tigré, Tigrinya, Soqotri, ...

Common Features

- Two-gender system with famous feminine marker /t/
- *Maybe* a three-way case system, preserved in Akkadian, (Qur'anic Arabic?)
- VSO and SVO word order; SVO becomming standard.
- Emphatic Consonants: variously realized as {glottalized, pharyngealized, implosive}
- Many subfamilies have possessive suffixes
- and most importantly. . .

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Root-and-Pattern Morphology, I

- Almost all the languages have Root-and-Pattern Morphology (RPM): words are formed (in part) by nonconcatenatively interleaving various morphemes
- The only non-Semitic example — Sierra Miwoq:

Table : RPM in Sierra Milwoq

Root	1	2	3	4
√kcw	kicaaq	kicaww	kiccaw	kicwa
√tyŋ	tuyaaŋ	tuyaŋŋ	tuyyaŋ	tuyŋa
√pttt	pattɨt	patɨtt	pattɨt	pattɨ

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Root-and-Pattern Morphology, II

Major Properties of RPM:

- Affixes exist, but most appear discontinuously
- Prosodic structure is very important
- Consonants and vowels play different roles
- Some prefixes and suffixes, but usually for *inflection only*

Semitic RPM Includes:

Root	Made up of 2-4 consonants
Vocalism	Affix carrying tense/aspect/voice; two vowels
Template	Pattern into which root and vocalism are placed
Other	Some prefixes and suffixes (more to come)

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An Overused Example

Table : The Ubiquitous $\sqrt{\text{ktb}}$ Example

Root	*Meaning*	*Template*
kataba	he wrote	CaCaCa
kattaba	he made someone write	CaCCaCa
nkataba	he subscribed	nCaCaCa
ktataba	he copied	CtaCaCa
kitaab	book	CiCaaC
kuttaab	Koranic school	CuCCaaC
kitaabii	written, in writing	CiCaaCa
kutayyib	booklet	CuCauuiC
maktaba	library, bookstore	maCCaCa
mukaatib	correspondant, reporter	muCaaCiC

Other Extensions of Class Topics

- Problem for Item-and-Arrangement (on the surface)
- Morphophonological rules target root, stem, word
- Discontinuous parts come from distinct syntactic heads
- Allow us to look into structure of the lexicon
- Evidence for category-netural roots (like Esperanto, except real)

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The Arabic Derivational Verbal Paradigm - CCC Roots

Table : $\sqrt{\text{fʕl}}$, "doing, action"

Number	*Verb*	*Template*
I	faʕal	$C_1VC_2VC_3$
II	faʕʕal	$C_1VC_2C_2VC_3$
III	faaʕal	$C_1VVC_2VC_3$
IV	ʔafʕal	$ʔaC_1C_2VC_3$
V	tafaʕʕal	$taC_1VC_2C_2VC_3$
VI	tafaaʕal	$taC_1VVC_2VC_3$
VII	nfaʕal	$nC_1VC_2VC_3$
VIII	ftaʕal	$C_1tVC_2VC_3$
IX	fʕall	$C_1C_2VC_3C_3$
X	stafʕal	$staC_1C_2VC_3$

What are the Morphemes Here?!

Table : (One Possible) Morphological Analysis

Number	*Root*	*Vowels*	*Other Aff.*	*CV-Template*
I	√fʕl	/a. . . a/	None	CVCVC
II	√fʕl	/a. . . a/	/μ/	CVCCVC
III	√fʕl	/a. . . a/	/μ/	CVVCVC
IV	√fʕl	/a/	/ʔa-/	CVCCVC
V	√fʕl	/a. . . a/	/ta-/	CVCVCCVC
VI	√fʕl	/a. . . a/	/ta-/	CVCVVCVC
VII	√fʕl	/a. . . a/	/n-/	CCVCVC
VIII	√fʕl	/a. . . a/	/-t-/	CCVCVC
IX	√fʕl	/a/	/μ/	CCVCC
X	√fʕl	/a/	/sta-/	CCVCCVC

What Does All This *Mean*?

(Mostly) Derivational Because. . .

- Not every root appears in every pattern (Productivity)
- Ordered *really* close to the root (Distance)
- Roots do not exist by themselves (*Optionality)
- Meanings are unpredictable (Lexicalization) *but*. . .

There are *some* Regularities. . .

IV/ʔafʕal is usually causative.

V/tafaʕʕal is usually the passive of II/faʕʕal

VI/tafaaʕal is usually the passive of III/faaʕal

VIII/ftaʕal is sometimes the passive of I/faʕal

IX/fʕall is usually denominative

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The Arabic Derivational Verbal Paradigm - CCCC Roots

Table : $\sqrt{\text{fʕll}}$, "nonce root"

Number	*Verb*	*Template*
Q1	faʕalal	$C_1VC_2VC_3VC_4$
Q2	tafaʕlal	$taC_1VC_2C_3VC_4$
Q3	fʕanlal	$C_1C_2VnC_3C_4$
Q4	fʕalall	$C_1C_2VC_3VC_4C_4$

Examples!

Table : Examples of Real-Life Arabic Verbs I

Number	*Example*	*Gloss*	*Root*
I	ʧasar	'he broke'	ʧsr
II	ʧassar	'he broke into pieces'	ʧsr
III	kaatal	'he fought with'	ktl
IV	ʔatˤlaʕ	'he brought out'	tˤlʕ
V	taʧassar	'he was broken into pieces'	ʧsr
VI	takaatal	'he fought with himself'	ktl
VII	inʧasar	'he was broken'	ʧsr
VIII	intasaf	'he was blown up'	nsf
IX	ɪswadd	'he became black'	swd
X	ɪstazɣar	'he thought of something as small'	zɣr

Examples (Redux)!

Table : Examples of Real-Life Arabic Verbs II

Q1	zarbatˤ	'he confused'	zrbtˤ
Q2	tazarbatˤ	'he was confused'	zrbtˤ
Q3	branʃaq	'he flourshed/bloomed'	brʃq
Q4	kfaharr	'to become dark/gloomy'	kfhr

The Hebrew Derivational Verbal System

Table : $\sqrt{\text{pʕl}}$, "doing, action"

Number	*Verb*	*Template*
I	paʕal	$C_1aC_2aC_3$
II	nifʕal	$niC_1C_2aC_3$
III	hifʕil	$hiC_1C_2iC_3$
IV	hufʕal	$huC_1C_2aC_3$
V	piʕel	$C_1iC_2eC_3$
VI	puʕal	$C_1uC_2aC_3$
VII	hitpaʕel	$hitC_1aC_2eC_3$

Discussion of Hebrew Verbs

Some Differences from Arabic

- Vowels are associated with particular *binyanim*
- Fewer patterns
- A bit more extra affixal material

Some Regularities

IV/huf$\S$al Generally the passive of III/hif$\S$il

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One More Example – Maltese

Table : Various Roots in Maltese

Number	*Verb*	*Template*	*Meaning*
I	zelaq	$C_1VC_2VC_3$	'he slipped'
II	daħħal	$C_1VC_2C_2VC_3$	'he introduced'
III	bierek	$C_1VVC_2VC_3$	'he blessed'
V	tfarrak	$tC_1VC_2C_2VC_3$	'he smashed into pieces'
VI	tbierek	$tC_1VVC_2VC_3$	'he was blessed'
VII	ngabar	$nC_1VC_2VC_3$	'he was gathered'
VIII	ntefaq	$C_1tVC_2VC_3$	'it was spent'
IX	ħdar	$C_1C_2VC_3$	'he turned green'
X	stkerrah	$stC_1VC_2C_2VC_3$	'he loathed'

Theoretical Considerations – Derivational Verbs

Item-and-Arrangement is Dead

- If we try to segment by morpheme: *k*+*a*+*t*+*a*+*b*
- . . . but this misses generalizations (i.e., $\sqrt{\text{ktb}}$)
- Item and process gets us a bit further. . .

Wither Semantics and the Lexicon?

- What can we say about lexicalization here?
- Many forms show something like it, but. . .
- Ultimately, must list the combination ROOT+CV somewhere
- How can we do this without missing generalizations?
- What *is* the meaning of the root?
- One answer: root encodes semantic potentiality

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Inflection/Functional Morphology Overview

Inflectional Morphology

- Inflectional morphology realized as prefixes/suffixes
- Prosodic considerations change the base form (!!)
- We will read about this later in the quarter (Brame, 1974)
- Can encode {pers, num, gen}
- Subject and object marking

Functional Morphology

- Things like voice, tense, aspect
- We've already seen a lot of this
- Usually encoded in vowels or periphrastically

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Inflectional Morphology – Maltese

Table : qatel, 'he kill{ed, s}'

	Perfect	*Imperfect*
	Singular	
1	qtilt	noqtol
2	qtilt	toqtol
3.masc	qatel	joqtol
3.fem	qatlet	toqtol
	Plural	
1	qtilna	noqtlu
2	qtiltu	toqtlu
3	qatlu	joqtlu

Inflectional Morphology – Hebrew

Table : ʃamar, 'he tread'

	Singular	*Plural*
1	ʃamarti	ʃamarnu
2.masc	ʃamarta	ʃmartem
2.fem	ʃamart	ʃmarten
3.masc	ʃamar	ʃamru
3.fem	ʃamra	ʃamru

Theoretical Considerations – Inflection

Prosody and Word Formation

- The stem changes form because of prosody
- maximal word: words can be only so big
- minimal word: words must be at least so big
- Otherwise, we would have to write v. complicated VI/Form rules here

Level Ordering/Strata

- Seems like we add CCC to /V. . . V/. . .
- *then* we add inflection (concatenativity outside nonconcatenativity)
- **Question**: What does this say about the Split Morphology Hypothesis?

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Introduction to Nominals

- Evidence for two kinds of nominals in Arabic:
  1. Root-Derived: Noun is derived from $\sqrt{CCC}$ + Template
  2. Word-Derived: Noun is derived from other words by affixes.
- Noun formation isn't predictable in the same way as verb formation
- The plural system is interesting, though

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Root-Derived Nouns

Table : Some Root-Derived Nouns in Arabic

Example	*Meaning*	*Pattern*
baħr	'sea'	CVCC
badal	'substitute'	CVCVC
sukuun	'tranquility'	CVCVVC
xaasir	'loser'	CVVCVC

These Nouns. . .

- Have idiosyncratic meaning
- Appear with all different vocalisms

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The Plural System I – Regular Plurals

The Morphology

Dual Productive dual suffix /-aan/ or /-ain/ (cf., Hebrew /-ajim/)

Plural.Fem Productive suffix /-aat/(cf., Hebrew /-ot/)

Plural.Masc Productive suffix /-uun/ (cf., Hebrew /-iim/)

Examples!

Dual *safiir-aan,*"abassador-dual"

Plural.Fem *mat*ˤ*aar-aat,* "airport-pl.fem"

Plural.Masc *filist*ˤ*iiniyy-uun,* "Palestinian-pl.masc"

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The Plural System II – Broken Plurals

- These plurals formed by ablaut/pattern change
- They're almost regular, based on prosodic form
- These plurals are the most frequent

Table : Arabic 'Broken' Plurals

Singular	*Plural*	*Meaning*
raʔiis	ruʔaasaʔ	'president(s)'
sˤadiiq	asˤdiqaaʔ	'friend(s)'
kaatib	kuttab	'writer(s)'
ħaqq	ħuquuq	'right(s)'
raml	rimaal	'sand(s)'
dawla	duwal	'state(s)'
madiina	mudun	'city(ies)'

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Deverbal Nouns and Pattern Behavior I

- "Verbal nouns" are formed by augmenting the pattern of verbs:
- Notice the transparent semantics. . .

Table : Some Arabic Verbal Nouns

Verb	*Meaning*	*VN*	*Meaning*
daʕam	'to support'	daʕm	'support'
karrar	'to repeat'	takraar	'repetition'
ħaawar	'to converse'	ħiwaar	'conversation'
ʔarsal	'to send'	ʔirsaal	'sending'
tanaffas	'to breathe'	tanaffus	'breathing'

Deverbal Nouns and Pattern Behavior I

- "Verbal nouns" are formed by augmenting the pattern of verbs:
- Notice the transparent semantics. . .

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Deverbal Nouns and Pattern Behavior II

Some Preface

- Other nouns are formed by affixation or ablaut + affixation
- These include participles, nouns of place, agentive nouns, etc.
- A lot also include the affix /ma-/ or /mu-/, common in Semitic

Examples!

Noun of Place *maktab,* 'office' (→ *katab,* 'he wrote')

Passive Participle *mubaarak,* 'blessed' (→ *baarak,* 'to bless')

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Theoretical Considerations – Nouns

Targets of Rules

- Noun formation rules can target root *or* stem (verb)
- Thus we (maybe?) need both these concepts
- Rules also can make reference to prosody (take phono II!)

Level Ordering/Split Morphology

- Again we seem to need level ordering!
- Verbs → Nouns (or vice versa, as before)
- This gives us the semantic facts pretty elegantly...
- **Question**: Again, what about the SMH?

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Do We Even Need a Root?

Pretheoretical Question

- Seems descriptively like we might need a root
- But do we need it *theoretically*?
- **Question**: could we just get away with an augmented definition of stem?

Evidence to Consider

- Phonological processes bounded by the root (≠ stem)
- Phonological processes triggered/targeting the root
- Generalizations we can't state w/o the root
- Semantics contributed by the root

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Meaning Similarity Across Derived Forms

- We saw this one before:
- 33/35 words from $\sqrt{\text{ktb}}$ mean "writing, books"

Table : The Ubiquitous $\sqrt{\text{ktb}}$ Example

Root	*Meaning*	*Template*
kataba	he wrote	CaCaCa
kattaba	he made someone write	CaCCaCa
nkataba	he subscribed	nCaCaCa
ktataba	he copied	CtaCaCa
kitaab	book	CiCaaC
kitaabii	written, in writing	CiCaaCa
kutayyib	booklet	CuCauuiC
maktaba	library, bookstore	maCCaCa
mukaatib	correspondant, reporter	muCaaCiC

Greenbergian Restrictions on Root Consonants

Greenberg (1950)

- Fact: An asymmetry in root-consonant place distribution:
  - $C_1C_2C_2$ is common ($\sqrt{\text{ħbb}}$, $\sqrt{\text{ʃtt}}$, . . .)
  - *$C_1C_1C_2$ – it is *never* seen.
- This is the Obligatory Contour Principle at work!

Pierrehumbert (1993)

- This OCP effect is even stronger:
- Roots of the form $C_1C_2C_1$ are statistically rare
- . . . and speakers don't like nonce roots of this form

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Psycholinguistics I

Productive OCP?!

- The OCP is also synchronically active
- Hebrew speakers given $C_1C_1C_2$ have a harder time:
- With word-recognition
- With deciding phonotactic plausibility

Priming Studies

- Data from priming studies and Hebrew morphology:

Roots	Roots prime other roots
Templates	Templates do *not* prime templates
Vocalism	Somewhat inconclusive. . .

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Psycholinguistics II – Aphasia

French Speech & Background

- French/Arabic bilingual; stroke caused deep aphasia
- Aphasia surfaces as metathesis in speech:
- French:
  - *naval*, 'naval' → *vanal*
  - *pedalo*, 'pedal boat' → *palode*

Arabic Speech

- But his Arabic errors metathesis *only* root consonants!
  - *ʔuʃb*, 'grass' → *ʃuʔb*
  - *kuʔuus* 'glasses' → *kusuuʔ*
  - *ta-waqquf*, 'stopping' → *ta-qawwuf*
  - *s-t-aqaam*, 'he stood straight' → *waʔiim*

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A Bedouin Hijazi Language Game + Nickname Formation

Bedouin Game

- Bedouins sometimes play a language game (cf., Pig Latin) which switches root consonants.
- Outputs for word *difaʕna,* "we pushed" ($\sqrt{\text{dfʕ}}$):
  - daʕafna
  - fidaʕna
  - faʕadna
  - *nafaʕda

Arabic Hypocoristics (Nicknames)

- Arabic nickname formation is truncation
- But it *always* preserves root consonants!
- Thus *muħammɛd* → *ħammuud* (**maħħam*)

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Form VIII Semivowel Assimilation

Form VIII/*ftaʕal* Pattern in Arabic Weak Verbs

- Weak Verbs: verbs in Arabic with semivowels the root
- In form VIII, the semivowel disappears:
  - ttijah, "to head (for)" ($\sqrt{\text{wjh}}$; *utijah, *wtijah)
  - ttiqan, "to master, know well" ($\sqrt{\text{yqn}}$, *itiqan, *ytiqan)
  - ttixað, "to take, adopt" ($\sqrt{\text{ʔxð}}$, *ʔtixað)

No Assimilation Elsewhere

- Crucially, this does not happen elsewhere:
  - mawwtooni, "they would have killed me"
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Form VIII Infix Assimilates to [α voice]

- The infix also has progressive assimilation for [± voice]:
  - ddiʕa, "to claim" (*dtiʕa)
  - zdiʒam, "to be crowded" (*ztiʒam)

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- But normally, voicing assimilation is regressive:
  - ʔaðgalˤ, "heavier" (*ʔaθgal)
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A Prosodic Theory of Nonconcatenative Morphology

- McCarthy (1981): first systematic attempt to explain RPM
- Takes roots, vocalisms, and templates as real
- Association governed by the tenets of Autosegmental Phonology
- After association, tier conflation applies, linearizing the string
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Templatic Inventory

Table : McCarthy (1981)'s Inventory of Templates for Arabic

CVCVC	CVCVCCVC
CVCCVC	CVCVVCVC
CVVCVC	CCVCCVC
CCVCVC	CCVVCVC

- Or by rule:
  1. $[(\left\{ \begin{matrix} C \\ CV \end{matrix} \right\})CV([+seg])CVC]$
  2. $V \rightarrow \emptyset$ / [CVC__CVC]

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Vocalic Inventory

- Recall that vowels encode {voice, aspect, tense, . . . }
- Often in Arabic, it's the same vowel in both
- Don't need to go through them all, but. . .
  1. /a/ = [perfective, active]
  2. /u/ = [perfective, passive]
  3. /u. . . a/ = [participle, active]
  4. /u. . . a. . . i/ = [participle, passive]

Applying All These Things. . .

- From here, things associate according to the following conventions:
  1. If there are several unassociated melodic elements and several unassociated melody-bearing elements, the former are associated one-to-one from *left to right* with latter.
  2. If, after application of the first convention, there remain one unassociated melodic element and one or more unassociated melody-bearing elements, the former is associated with *all* of the latter.
  3. If all melodic elements are associated and if there are one or more unassociated melody-bearing elements, all of the latter are assigned the melody associated with the melody-bearing element on their immediate left, if possible.
  4. All tier activity is *tier internal*.
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The Arabic Derivational Verbal Paradigm - McCarthy-Style!

Table : $\sqrt{\text{fʕl}}$, "doing, action"

Number	*Verb*	*Template*
I	faʕal	$C_1VC_2VC_3$
II	faʕʕal	$C_1VC_2C_2VC_3$
III	faaʕal	$C_1VVC_2VC_3$
IV	ʔafʕal	ʔa$C_1C_2VC_3$
V	tafaʕʕal	ta$C_1VC_2C_2VC_3$
VI	tafaaʕal	ta$C_1VVC_2VC_3$
VII	nfaʕal	n$C_1VC_2VC_3$
VIII	ftaʕal	C_1tVC_2VC_3
IX	fʕall	$C_1C_2VC_3C_3$
X	stafʕal	sta$C_1C_2VC_3$

The Good

- McCarthy's analysis gets us a few things nicely:
  1. OCP-Effects: combined with L→R spreading, this comes for free by stating OCP over the root
  2. RPM: this is built into the very architecture of the system
  3. Semantics: since the roots and vowels are morphemes, we can give them semantics
  4. Item/Arrangement: technically, this is like an I+A model of RPM (sorta?)
- . . . and, hey, at least now we have a story!

The Bad and the Ugly

- However, there are some problems, too:
  1. Cyclicity: we have no intrinsic account of (Brame's) cyclicity facts
  2. Templates: recall that templates don't prime. . .
  3. Templates: also, we've really just stipulated template inventory
  4. Typology: the formal grammar of RPM is *really* weird from the standpoint of other languages
  5. OO-Effects: remember we had some evidence that some things actually *do* derive from words. . .

Introducing Fixed-Prosody

- We could take another tack in explaining RPM
- So what if there's a lot of evidence for the root? Maybe it's an accident. . .
- We already know that at least some of the time the input is a word
- **Idea**: Prosody is primary: it stays fixed once it's set
- This theory developed right here at UCSC!

Consonant Cluster Transfer in Hebrew

Where did All These Consonants Come from?!

- Bat-El (1994): sometimes consonant clusters exist which shoudn't
- Always in *denominal* verbs
- The corresponding noun *always* has the cluster

Examples!

- priklet, "to practice law" (from base *praklit*, "lawyer")
- ʃrivrev, "to plumb" (from base *ʃravrav*, "plumber")
- striptez, "to perform a strip tease" (from base *streptiz*, "striptease")
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Imperative Truncation in Colloquial Hebrew

- In Colloquial Hebrew, one can form imperatives by truncation
- . . . but this truncation doesn't really follow any templatic form
- However, it is predictible from the 2nd person future form

Table : Patterns of Truncating Imperatives in Modern Hebrew

Base	*Imperative*	*Truncation*	*Pattern*	*Meaning*
telamed	tlamed	V	CCVCVC	"to teach"
tiʃava	tʃava	V	CCVCVC	"to swear"
tiftax	ftax	CV	CCVC	"to open"
takum	kum	CV	CVC	"to get up"

Vowels in Hebrew Deverbal Nouns

Converting V → N in Hebrew

- Sometimes, one can only predict the deverbal noun from the noun:
  1. If a noun has /a/ as its vowel, its DV is formed by doubling.
  2. If a noun has /i, u/ as its vowel, its DV is in the [j]-form.
  3. If a noun has /o, u/ as its vowel, its DV is in the [v]-form.

Hebrew Denominal Verb Examples

- cided, "to side" (from base *cad*, "side")
- tijek, "to file" (from base *tik*, "to file")
- ʃivek, "to market" (from base *ʃuk*, "market")

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Semantics and Compositionality

Regularities in Hebrew

IV/hufʕal	Generally the passive of III/hifʕil
VI/puʕal	Generally the passive of V/piʕel
VII/hitpaʕel	A passive of III/hifʕil or a “middle"

Regularities in Arabic

IV/ʔafʕal	is usually causative.
V/tafaʕʕal	is usually the passive of II/faʕʕal
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VIII/ftaʕal	is sometimes the passive of I/faʕal
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A Brief Outline of Fixed-Prosody and Melodic Overwriting

- Fixed Prosody proceeds by noticing that word prosody is highly valued in Semitic
- **Idea**: When deciding what to do about affixes, the grammar:
  1. The stem (i.e., base word) must be ANCHORED to the edges of the word
  2. So the affixes must be *infixes*
  3. But they can't change the shape of the word (w/o altering prosody)
  4. And constraints ensure they don't alter consonants (MAX-C)
  5. So the affixes (vowels) OVERWRITE the base vowels

The Good

- OO-Effects: We get all the word-word correspondence effects for free
- Prosody: Templates are *less* stipulative (but we need to derive the base)
- Typology: Semitic languages are *more* like other languages
- Templates: No templates (maybe) so they don't prime

The Bad and the Ugly

- OO-Effects: Sometimes, the base (form I) doesn't exist
- Cyclicity: Still no account for (Brame's) cyclicity
- Semantics: What does the root contribute here?
- OCP Effects: No root, so how can this domain exist?
- Semivowels: Semivowel assimilation is problematic (see Tucker, in prep.)

Conclusions I

What Should One Make of All This?

- The evidence points to a hybrid model that countenances:
  1. The root as base
  2. Output words as bases
- Need to ensure that the template is not a primitive
- Syntactic structure might help with cyclicity

Future Research

- More psycholing work – nonce roots?
- Need tests to determine root- from word-derived words
- Why is there no Arabic', with vowels as roots?
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Conclusions II

- RPM languages are cool!
- Languages have strongly *nonconcatenative* morphologies
- They implicate a lot of the theory we've discussed in class
- They are not very well understood at present (at least not as well as English, . . .)
- They implicate the smallest units of morphemic combination (roots) on the surface