Autosegmental Phonology: Root-and-Pattern Morphology

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Concatenative Approaches to
Nonconcatenative Morphology
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Arabic Root- & Pattern- Morphology

'write':

	Perfective Active	**Perfective Passive**
X	katab	kutib
cause to X	kattab	kuttib
X each other	kaatab	kuutib

'wug':

	Perfective Active	**Perfective Passive**
X	lagat	lugit
cause to X	laggat	luggit
X each other	laagat	luugit

Arabic Root- & Pattern- Morphology (Roots)

'write':

	Perfective Active	**Perfective Passive**
X	**k**at**a**b	**k**ut**i**b
cause to X	**k**att**a**b	**k**utt**i**b
X each other	**k**aat**a**b	**k**uut**i**b

$\Rightarrow$ write $\approx$ k . . . t . . . b

'wug':

	Perfective Active	**Perfective Passive**
X	**l**a**g**a**t**	**l**u**g**i**t**
cause to X	**l**a**gg**a**t**	**l**u**gg**i**t**
X each other	**l**aa**g**a**t**	**l**uu**g**i**t**

$\Rightarrow$ wug $\approx$ l . . . g . . . t

Arabic Root- & Pattern- Morphology (Aspect/Voice)

	'write'		'wug'	
	Perfective Active	**Perfective Passive**	**Perfective Active**	**Perfective Passive**
X	k**a**t**a**b	k**u**t**i**b	l**a**g**a**t	l**u**g**i**t
cause to X	k**a**tt**a**b	k**u**tt**i**b	l**a**gg**a**t	l**u**gg**i**t
X each other	k**aa**t**a**b	k**uu**t**i**b	l**aa**g**a**t	l**uu**g**i**t

- ▶ **Perfective Active** ≈ a … a

- ▶ **Perfective passive** ≈ u … i

Arabic Root- & Pattern- Morphology (Binyanim)

	'write'		'wug'	
	Perfective Active	**Perfective Passive**	**Perfective Active**	**Perfective Passive**
X	k**a**t**a**b	k**u**t**i**b	l**a**g**a**t	l**u**g**i**t
cause to X	k**a**tt**a**b	k**u**tt**i**b	l**a**gg**a**t	l**u**gg**i**t
X each other	k**aa**t**a**b	k**uu**t**i**b	l**aa**g**a**t	l**uu**g**i**t

- **X** ≈ C V C V C

- **cause to X** ≈ CVCCVC

- **X each other** ≈ CVVCVC

Arabic Root- & Pattern- Morphology (Binyanim)

| Binyan	Form	Gloss	Wugging
I	katab	'write'	lagat
II	kattab	'cause to write'	laggat
III	kaatab	'correspond'	laagat
IV	**?-**aktab	'cause to write'	**?-**algat
VI	**ta-**kaatab	'write to each other'	**ta-**laagat
VII	**n-**katab	'subscribe'	**n-**lagat
VIII	k**t**atab	'write, be registered'	l**t**agab
X	**st-**aktab	'write, make write'	**st-**algat
XI	ktaabab		lgaatat

Problem I: Discontinuous Morphemes
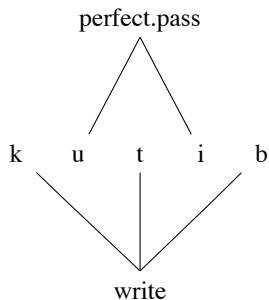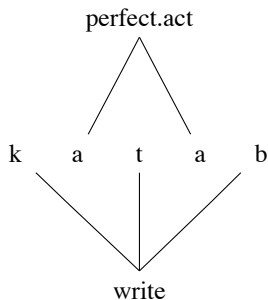
Problem II: Templatic Morphemes

Binyan III
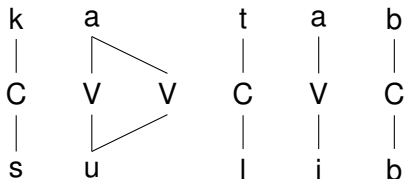
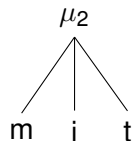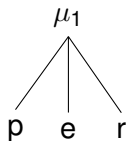# Ingredients of an Autosegmental Analysis

- ▶ Morphemic Affiliation by Autosegments

- ▶ Timing by Autosegments

- ▶ Vowels and Consonants as different Tiers

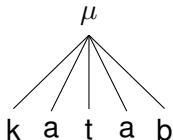# Getting rid of juncture symbols: Morphemic Affiliation

SPE   McCarthy (1981)

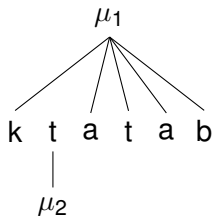μ_1 μ_2

per**+**mit   p e r   m i t

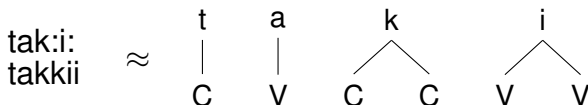# Independent Motivation: Infixation

Binyan I
'write'

Binyan VIII
'write, be registered'

Timing by Autosegments

- ▶ Timing and segmental quality
  are represented on different tiers

- ▶ Timing slots are either V (syllabic position) or C
  (non-syllabic position). This is the 'skeletal tier'

- ▶ Short segments are linked to 1 timing slot
  Long segments are linked to 2 timing slots

Independent Evidence: Geminates in Tiberian Hebrew

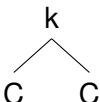**Geminates as single segments – Postvocalic Spirantization:**

katab	$\Rightarrow$	ka**θ**av	'write'
ji-pgos	$\Rightarrow$	ji**f**goʃ	'meet'
gibbor	$\Rightarrow$	gibbor	'hero'

Geminates as two segments – Vowel Reduction:

malak-im	$\Rightarrow$	m**ə**laxim	'kings'
galgal-im	$\Rightarrow$	ga**lg**alim	'wheels'
sappir-im	$\Rightarrow$	sa**pp**irim	'sapphires'

Autosegmental representation combines 1-segment and

2-segment aspects:

$$
\begin{array}{c}
\text{k} \\
\diagdown\diagup \\
\text{C} \quad \text{C}
\end{array}
$$
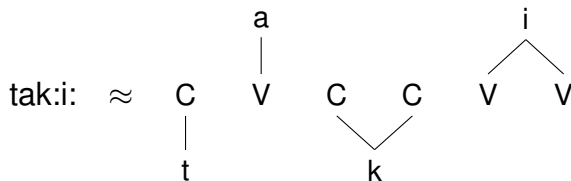
Separating Vowels and Consonants

▶ Vowels and Consonants are
   on different autosegmental tiers

▶ Their relative order is mediated via the skeletal tier

$$
\text{tak:i:} \quad \approx \quad \underset{\underset{t}{|}}{C} \quad \underset{a}{\overset{|}{V}} \quad \underset{\underset{k}{\diagdown\diagup}}{C \quad C} \quad \underset{i}{\overset{\diagup\diagdown}{V \quad V}}
$$

Independent Motivation Wolf Vowel Harmony

	+ATR			–ATR	
gən-**e**	'be better in'		x**a**m-**ɛ**	'know in'
r**e:**r-**e**	'be lost in'		d**ɛ**m-**ɛ**	'go with'
d**o:**r-**e**	'hit with'		x**ɔ**l-**ɛ**	'look with'

[+ATR]   [+ATR][+ATR]

| → | |

d**o:**r-ɛ   d**o:**r-**e**

Autosegmental Phonology: Tier Locality
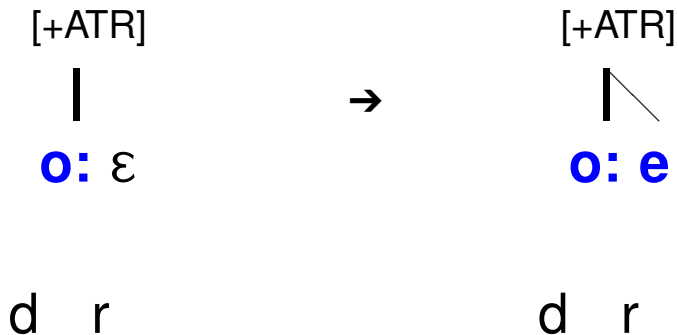
Slicing Morphological Information into Tiers (*kuutib*, Binyan III Perf., 'write')
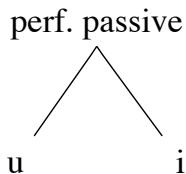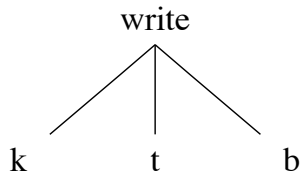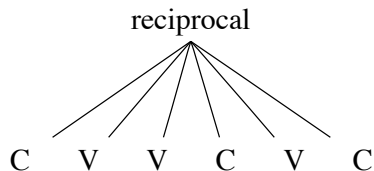
| **C V V C V C**	Binyan III, reciprocal	(kaatab,kuutib)
k t b	write,	(kattab,ktatab)
u i	Perf. Passive	(kutib,nkutib)

Slicing + μ-Notation (*kuutib*, Binyan III Perf., 'write')

The Spatial Geometry of Different Tiers

- ▶ Different tiers are strings in a three-dimensional space

- ▶ More than two tiers connected to the same tier
  are hard to depict on (two-dimensional) paper

- ▶ Every tier is parallel to every other tier

- ▶ Tiers cannot cross or overlap
 and association lines connecting different tier pairs
  cannot cross

Slicing + μ-Notation (*kuutib*, Binyan III Perf.,'write')
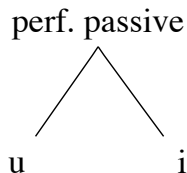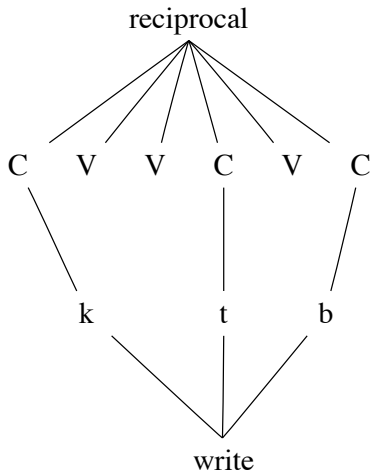
Slicing + μ-Notation (*kuutib*, Binyan III Perf., 'write')
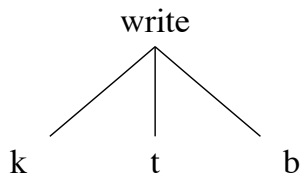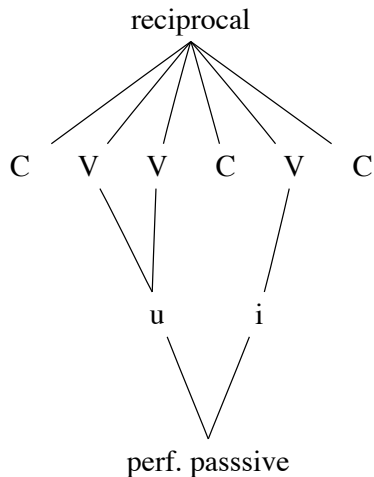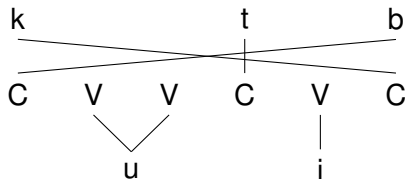
Hard Constraints

1. Association lines never cross

2. Vowels link to Vs, Consonants to Cs

3. A skeletal node cannot be linked to
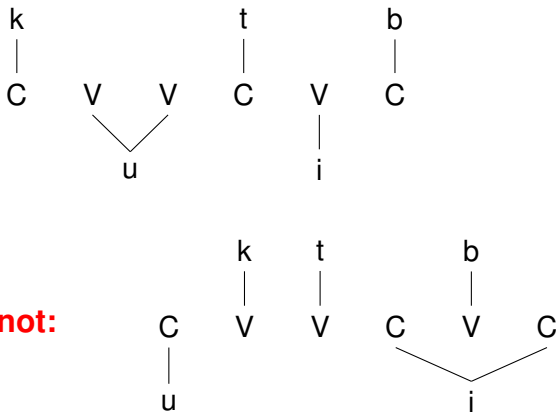   two different segments on different tiers

Hard Constraint 1: Association Lines never Cross
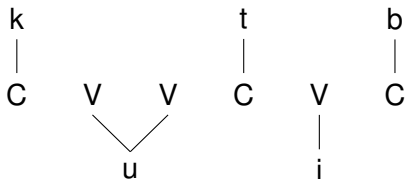
Hard Constraint 2: Vowels link to Vs, Consonants to Cs

not:

Hard Constraint 3

▶ A skeletal node cannot be linked to
two different segments on different tiers

Underlying Assumption: Different autosegmental morphemes
are always on different tiers even if they specify information of
the same type (e.g. they specify all consonantal melodies)

Intuition: "Preassociation is not altered"
(Association to one morpheme cannot be altered
by later association of another morpheme.
This is the way McCarthy actually formulates the constraint)

Hard Constraint 3: Preassociation is not altered:

C   C   V   C   V   C

     t   Binyan VIII

k   t   b   'write'

(k**ta**ta**b**)

Hard Constraint 3: Preassociation is not altered
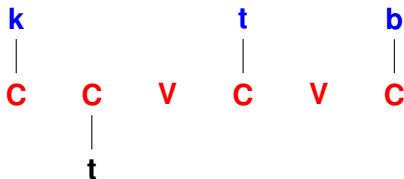
not:
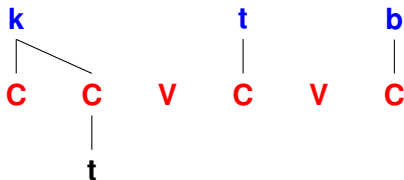
Soft Constraints

1. Every skeletal node is linked to a melodic node

2. Every melodic node is linked to a skeletal node

The Central **Preference** (Preliminary Version)

Association should be as unique as possible

i.e.

1. Every skeletal node should be associated
   to **at most** one melodic node

2. Every melodic node should be associated
   to **at most** one skeletal node

The Repair Algorithm (Preliminary Version)

1. If there are unassociated S-nodes and M-nodes:

▶ Associate S-nodes und M-nodes 1:1 from left to right
  (if possible without violating hard constraints)

2. Else: If there are unassociated S-nodes:

▶ Associate every unassociated S-node S to the M-node to
  which the S-node immediately preceding S is associated
  (if possible without violating hard constraints)

3. Else: If there are unassociated M-nodes:

▶ Associate every unassociated M-node M to the S-node to
  which the M-node immediately preceding M is associated
  (if possible without violating hard constraints)

Revision by McCarthy

▶ Preference 2 ("Every melodic node should be associated to **at most** one skeletal node") is promoted to the status of a soft constraint. **Consequently:**

▶ Repair Rule 3 is removed (it would create violations of the constraint)

▶ and replaced by a rule which delinks the previously linked melodic elements of the whole tier in case there is a violation of the soft constraint

Binyan I: katab

C V C V C   Binyan

k t b   Root

Binyan XI: ktaabab

C C V V C V C   Binyan

k t b   Root

Complication 1: Template + Affix Morphology

Binyan	Form	Wugging	Template
IV	**ʔ-**aktab	**ʔ-**algat	CVCCVC
VI	**ta-**kaatab	**ta-**laagat	CVCVVC
VII	**n-**katab	**n-**lagat	CCVCVC
X	**st-**aktab	**st-**algat	CCVCCVC

Binyan VI: **ta**-kaatab

t Binyan-μ_1

C V C V V C V C Binyan-μ_2

k t b Root

Assumption:
Binyam VI consists of two morphemes: Binyan-μ_1 & Binyan-μ_2
Binyan-μ_1 is combined with Binyan-μ_2
before the root is combined with Binyan-μ_2

Complication 2: Wrong Asociation

Binyan	Form	Wugging	Template
II	kattab	laggat	CVCCVC
VIII	ktatab	lgagab	CCVCVC

Binyan II: kattab

C V C C V C   Binyan

k t b   Root

Second-Binyan Erasure

```
CVC]              CVC]
 |                 |
 X      ⇒          X
 |                 |
[root]           [root]
```
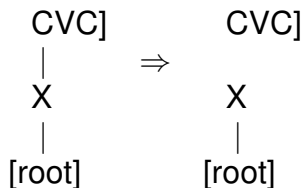
Complication 3: Infixation

Binyan	Form	Gloss	Wugging
VIII	k**t**atab	'write, be registered'	l**t**agab

Binyan VIII: k**t**atab

t   Binyan-μ_1

C C V C V C   Binyan-μ_2

k t b   Root

Eigth-Binyan Flop

```
C C           C C
 |    ⇒        |
 t            t
 |            |
[ref]        [ref]
```