

Phonological approaches to word stress

Day 3/4:
Stress & foot inventory

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What we will do today

- Short repetition syllable structure
- Talk about stress / foot structure

What we will do today

- Repetition syllable structure
- Talk about stress / foot structure

Luganda – Ludikya

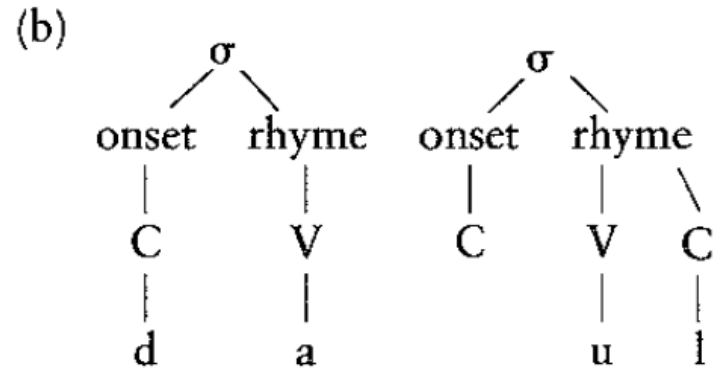
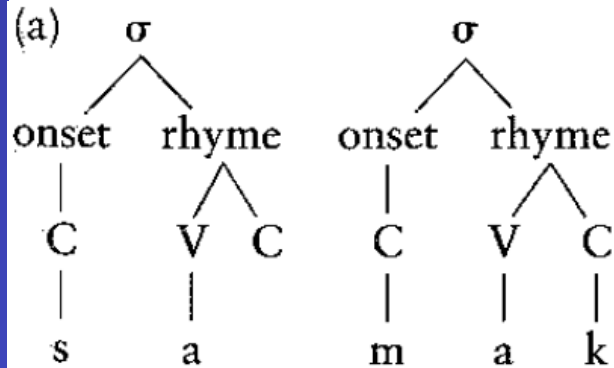
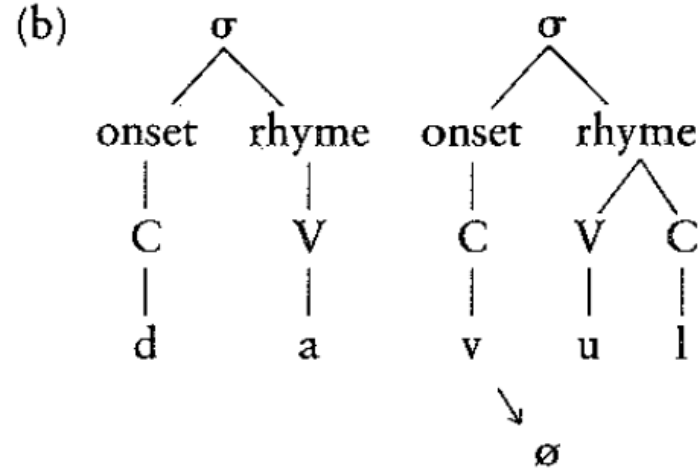
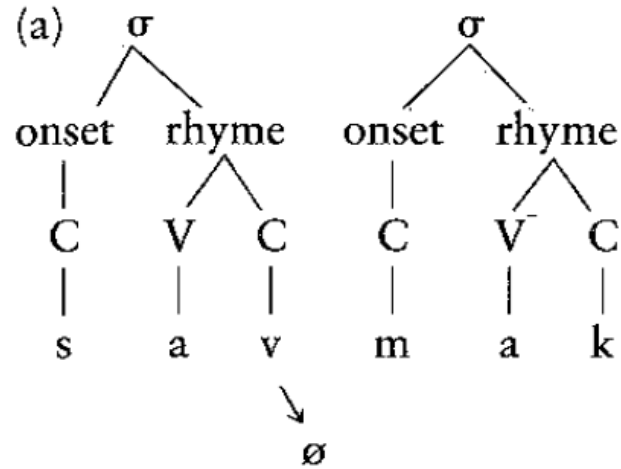
b a n a
| ^ | |
C V V C V
| v | |
n a b a

k u b a ɟ a
| | | | ^ |
C V C V C C V
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ɟ a b a k u

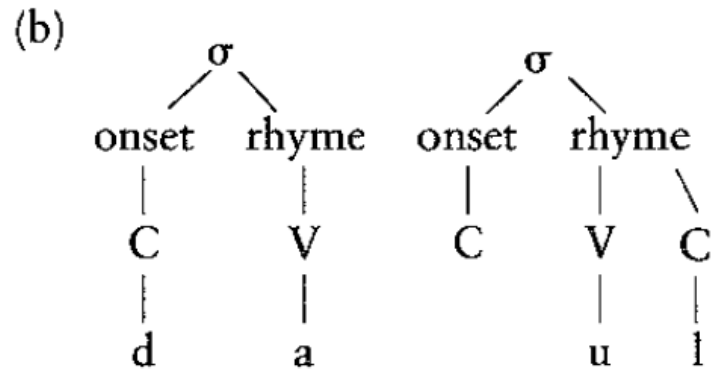
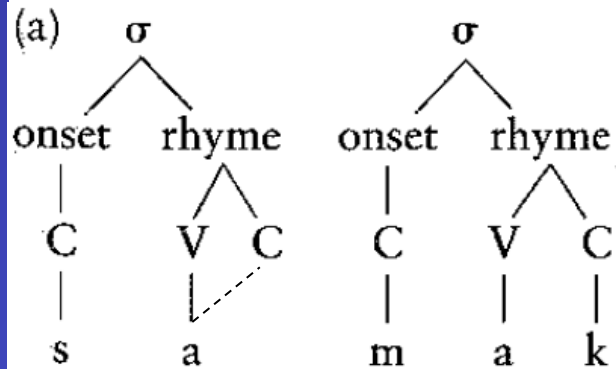
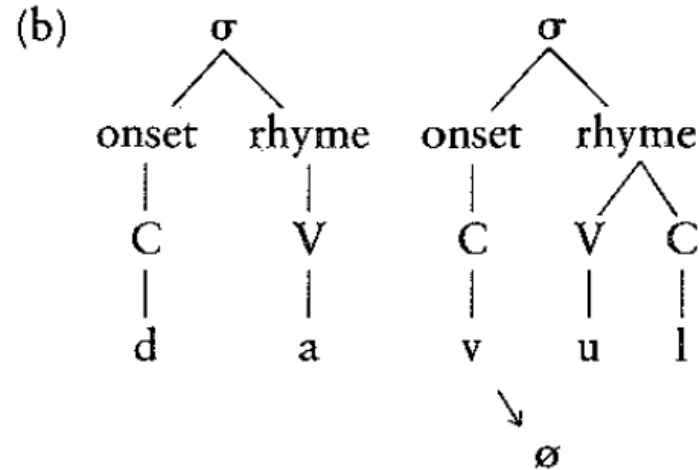
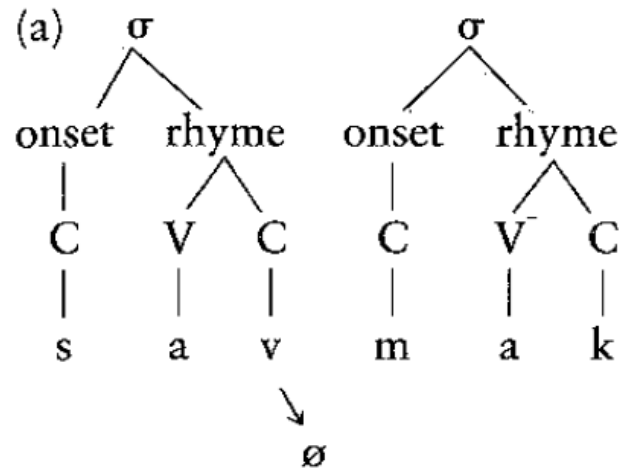
CL in Turkish (based on Sezer 1986)

- Turkish: /v/ can optionally be deleted in certain contexts
- Sometimes, the preceding vowel lengthens, sometimes not
- /sav.mak/ → [sa:mak]
- /da.vul/ → [da.ul]
- What is the generalization here?

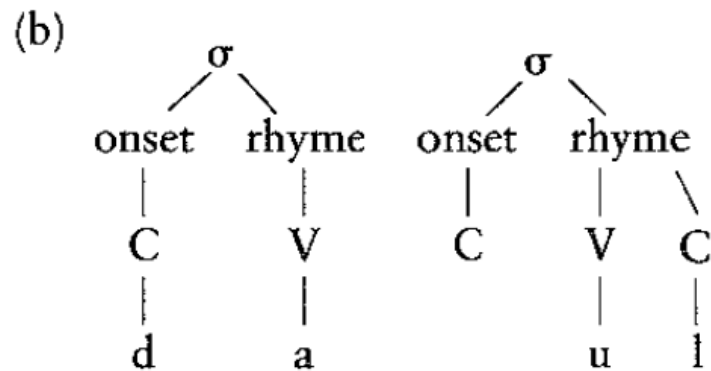
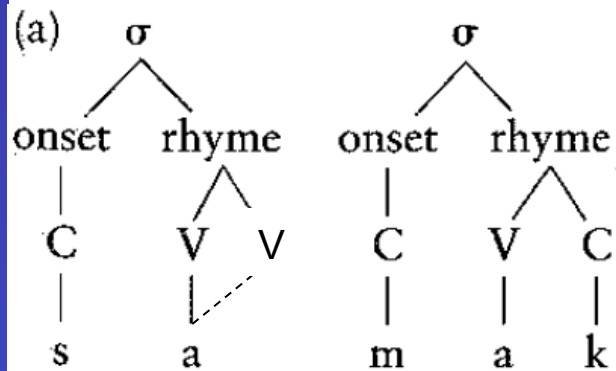
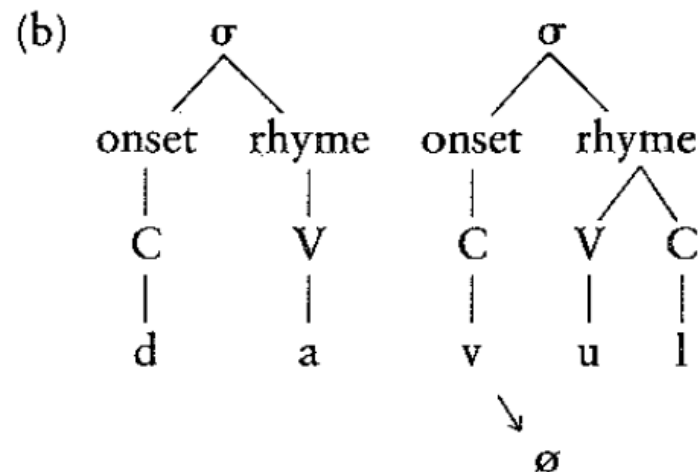
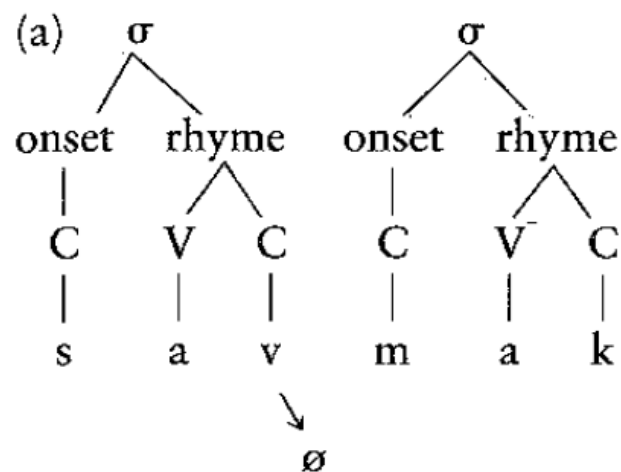
CL in Turkish (based on Sezer 1986)



/a/ takes over empty slot

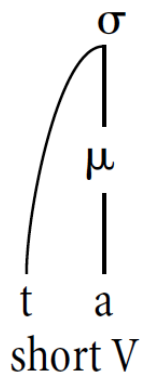


C changes to V

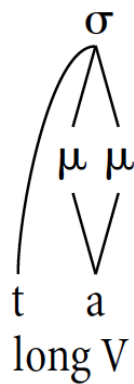


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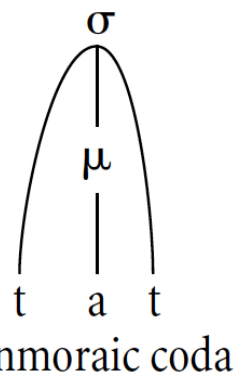
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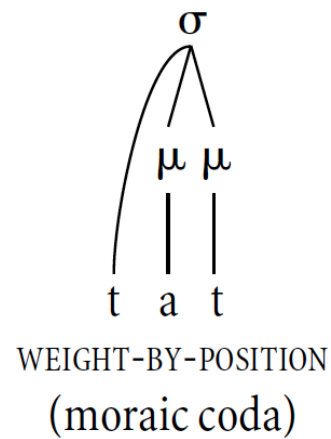
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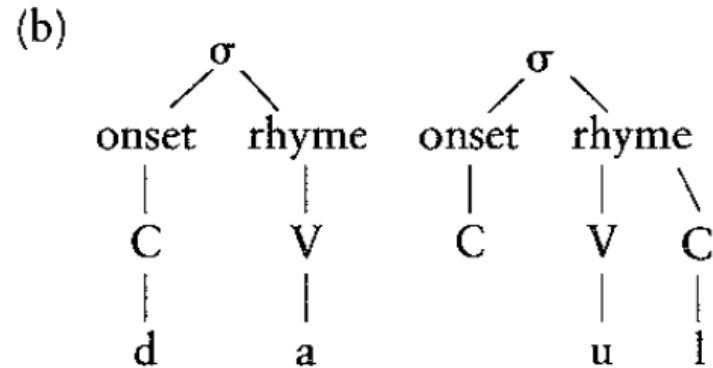
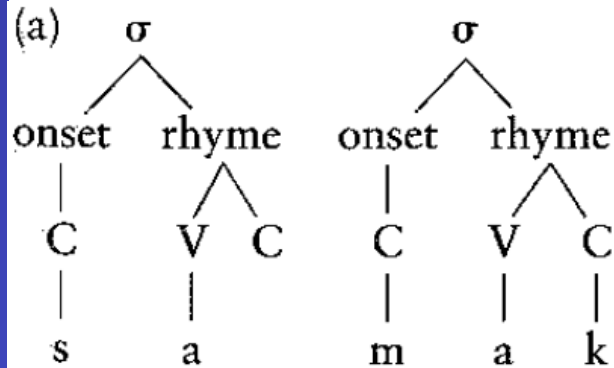
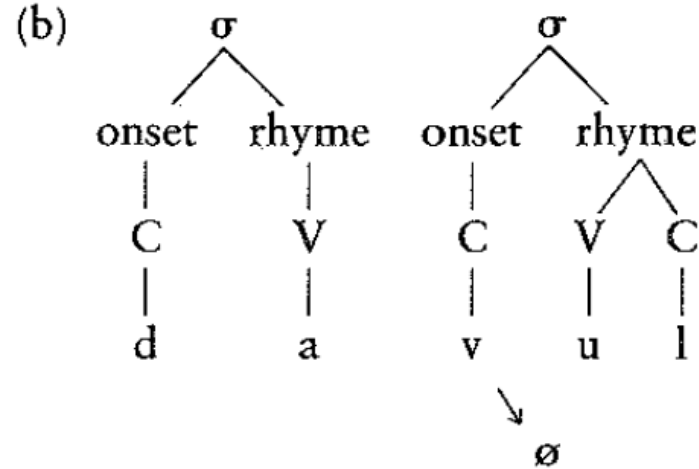
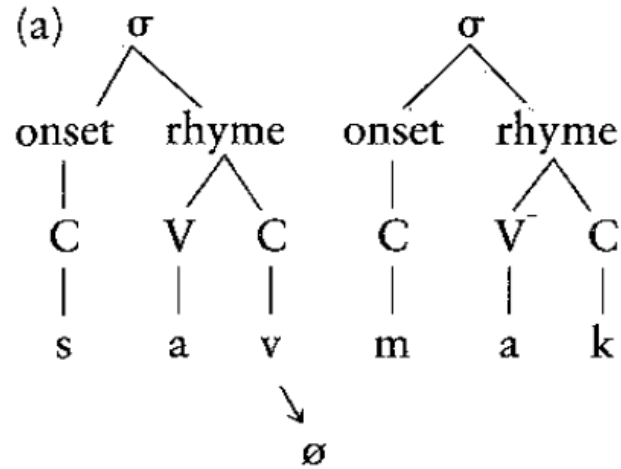
c.

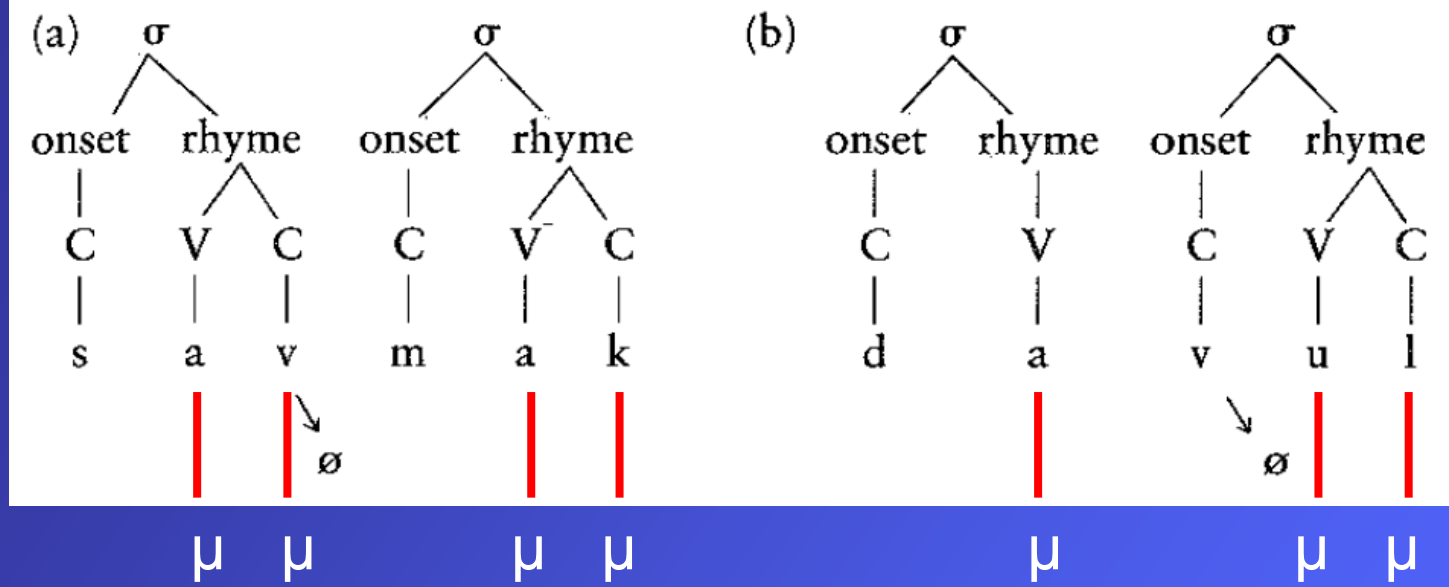


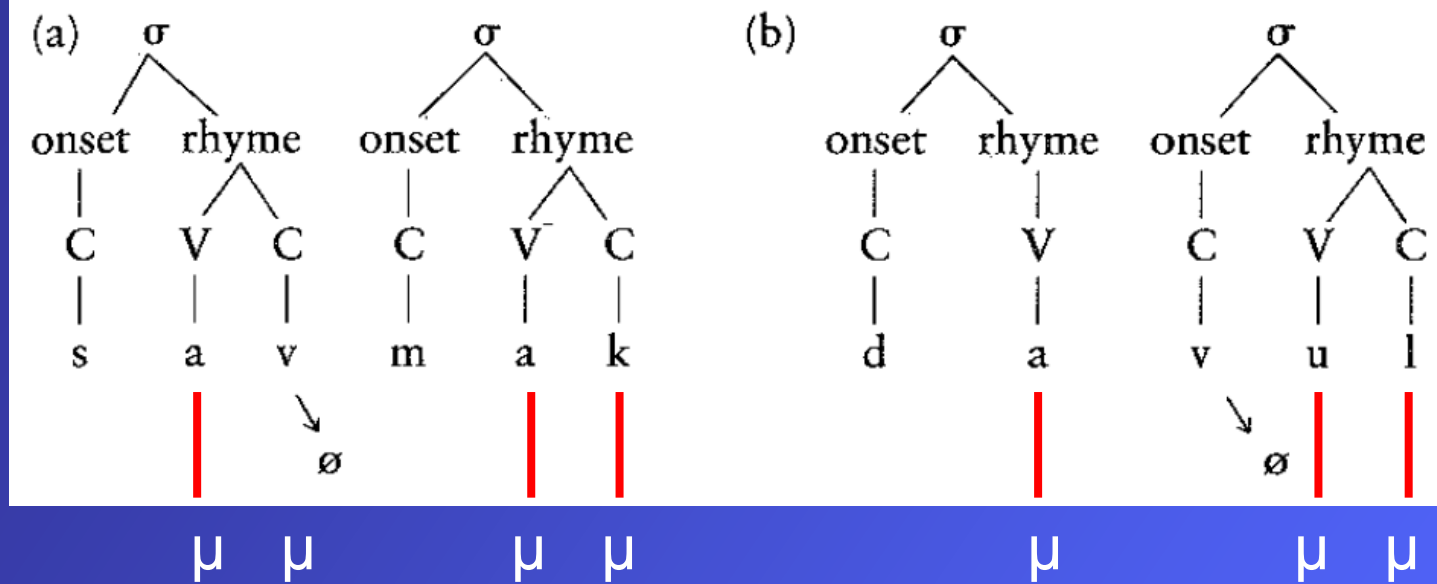
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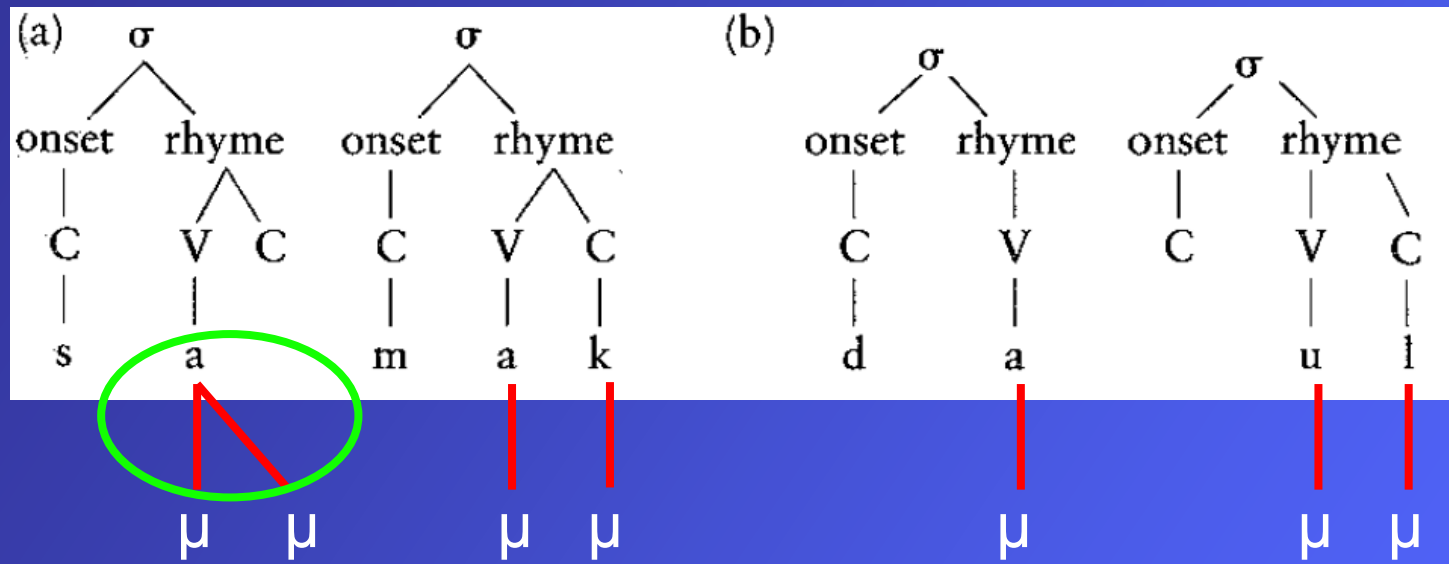
CL in Turkish (based on Sezer 1986)







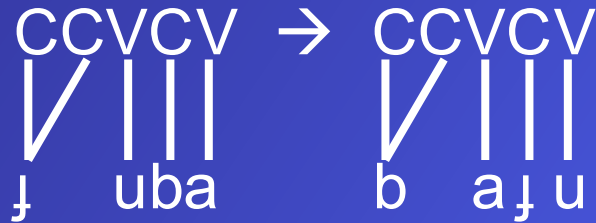
Segment deletes, μ = floating



Mora reassociates with preceding vowel

Luganda – Ludikya

- ɸuba → bbaɸu
- Fairly easy to do in CV theory:



Luganda – Ludikya

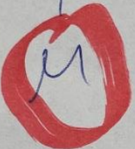
- ɟɟuba → bbaɟu
- If onsets are universally non-moraic, mora theory has no straightforward way to express geminate onsets!

Exercise 1

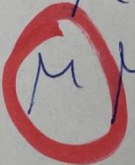
- Vowels are lengthened when the prefix vowel /o/ is changed to a glide [w].
- In mora theory, this can be expressed by stating that when the vowel loses a mora, it becomes an onset consonant; the mora reassociates with the vowel, making it long
- IN CV theory, we need to associate the V to the vowel and add a new C slot for postulate

Mora

ko-ambata

1  m m m m

2 kw a:mbata

 m m m m

CV

ko-ambata
| | | | |
CVCVCVCV

kwa mbata
| | | | |
CCVCVCV

!
new C-slot

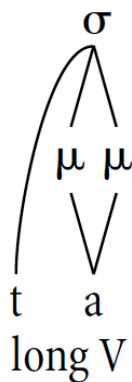
Moving towards stress

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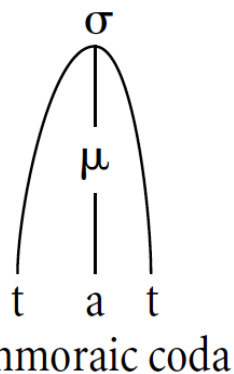
a.



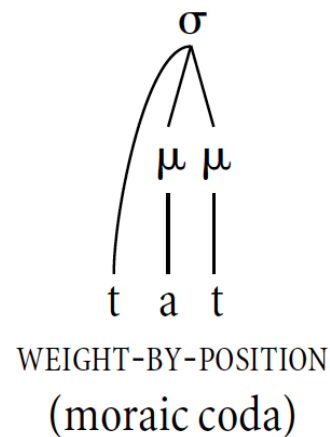
b.



c.



d.



What we will do today

- Repetition syllable structure
- Talk about stress / foot structure

Syllable weight

- In mora theory, bimoraic syllables are referred to as heavy, and monomoraic syllables as light – onsets do not count
- Heavy versus light syllables will be important for the discussion of word stress

This can be restated as follows

- Long vowel (diphthong): always heavy
- Short vowel plus coda: sometimes heavy, sometimes light
- Short vowel: always light
- General hierarchy: $VV \geq VC \geq V$
 - No weight distinction (for stress): VV, VC, V
 - Only long vowels are heavy: $VV > VC, V$
 - Long vowels and closed syllables are heavy: $VV, VC > V$

What is stress?

- Stress is the relative prominence of some syllables in comparison to others
- How do stressed syllables differ from unstressed ones phonetically?
 - More pitch movement / higher pitch
 - Louder
 - Longer
 - More peripheral vowels
 - Etc...

What is stress (phonology)?

- Stress is not just some arbitrarily distributed phenomenon
- In languages with stress...
 - every content word has at least one stressed syllable
 - in every content word there is one syllable which is stronger than the rest

What is stress (phonology)?

- Which syllable is the strongest in a word is rule-based in many languages
- In languages where words can have more than one stress, stress is rhythmically distributed (typically strong-weak, or weak-strong)

Let's look at a stress pattern:
Pintupi – Stress, Exercise 1

Pintupi data

- a. [tʰá:]
- b. [mú.ŋu]
- c. [mú:ŋu]
- d. [tʰán.pa]
- e. [ká.pa.li]
- f. [mí:lʰ.ma.nu]
- g. [ŋál.ku.nìn.pa]
- h. [pú.[iŋ.kà.la.tʰu]
- i. [tʰá.mu.lìm.pa.tʰùŋ.ku]

Pintupi

- Alternating stress pattern (strong-weak)
- First stress is the strongest
- Final syllable in words with uneven number of syllables does not receive stress

Let's look at another stress pattern:
Classical Latin (Stress, Exercise 2)

Classical Latin data (G&J: p. 217)

- | | | | |
|----|-------------------------------------|----|--|
| a. | <i>mél</i>
'honey' | b. | <i>lác</i>
'milk' |
| c. | <i>má lum</i>
'misfortune' | d. | <i>má: lum</i>
'apple' |
| e. | <i>a mí: cum</i>
l h
'friend' | f. | <i>cá me ram</i>
l l
'(bed)room' |
| g. | <i>ár bo rem</i>
h l
'tree' | h. | <i>pe dés ter</i>
l h
'on foot' |

Classical Latin

- Primary stress is on the pre-final (= penultimate) syllable if it is heavy
- Otherwise on the pre-prefinal (= antepenultimate) syllable
- Last syllable never stressed, unless the word is monosyllabic

The phonological nature of stress

- How to express stress phonologically?
- In linear phonology (sometimes called SPE), stress was assumed to be a feature
- But stress rules often looked weird and somewhat arbitrary (at best: descriptive)
- Beginning with Liberman and Prince (1977) and Halle and Vergnaud (1978), stress is now regarded as a 'structural position'

Syllables, CVs vs. moras

- All of these representations assume levels of representation in addition individual segments with their features
- This marks a difference between **linear** and **non-linear** phonology

Linear phonology

- Leading approach in earlier days of phonology
- Assumption: phonological representations are one linear string of segments, with boundary markers between words / morphemes
- No syllables / CVs / moras / (feet)

Linear phonology (Hayes, p. 71)

map ([mæp]):

−syllabic	+syllabic	−syllabic
+sonorant	+sonorant	−sonorant
+stop	−stop	+stop
+nasal	−nasal	−nasal
+labial	+low	+labial
+voice	−back	−voice
	+front	
	−round	
	+stress	

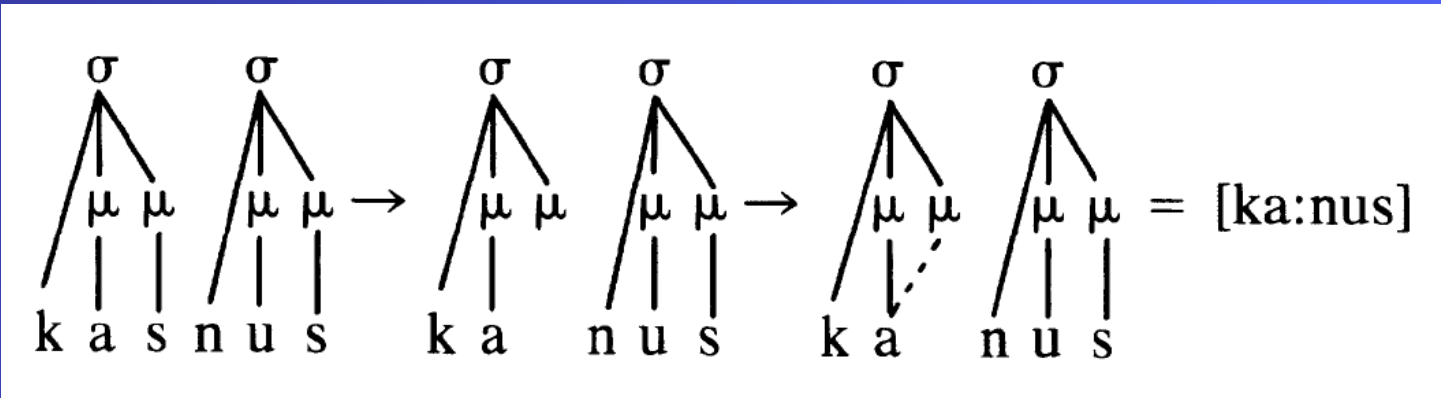
Stress rules for Classical Latin

$$\begin{array}{lll} V \rightarrow [+ \text{stress}] & / & \text{--- } C_0 \check{V} C_1 V C_0 \# \\ V \rightarrow [+ \text{stress}] & / & \text{--- } C_0 V C_0 \# \\ V \rightarrow [+ \text{stress}] & / & \text{--- } C_0 \# \end{array}$$

Non-linear phonology

- Assumption: phonology is more than a linear order of segments
- There is a hierarchical organization of different levels
- Levels assumed include syllables / CVs or moras / (feet), etc.

Non-linear phonology



Stress as a structural position in non-linear phonology

- The structural position corresponding to stress is **the foot**
- Typically, feet are characterized by one strong and one weak syllable

Stress as a structural position: the foot

- One of the feet in a word is the strong foot, and its strong syllable (its **head**) will typically be more prominent than the strong syllables of other feet:
primary stress (= main stress) vs. secondary stress
- Where feet are located within a word varies between languages

Note: feet in poetry

- The notion of the foot used within metrical theory is similar, but not identical, to the foot known from metrical poetry
- Both group syllables into constituents
- However, in poetry, feet are used for esthetic purposes – in metrical theory, they represent the rhythmic structure of the word

What's the rhythm here?

E. A. Poe – The Raven

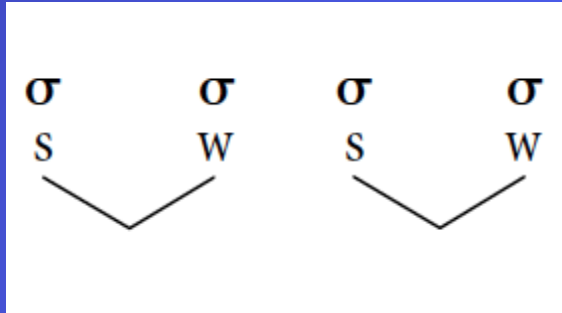
“And the Raven, never flitting, still is sitting, still is sitting
On the pallid bust of Pallas just above my chamber door;
And his eyes have all the seeming of a demon's that is dreaming,
And the lamp-light o'er him streaming throws his shadow on the floor;
And my soul from out that shadow that lies floating on the floor
Shall be lifted—nevermore!”

Stress in nonlinear phonology

- Hayes (1981) proposed a theory of stress that is an improvement upon the linear account in two ways:
 - Stress is no longer a feature but a strength relation between syllables
 - Parameters account for the different stress patterns in natural languages

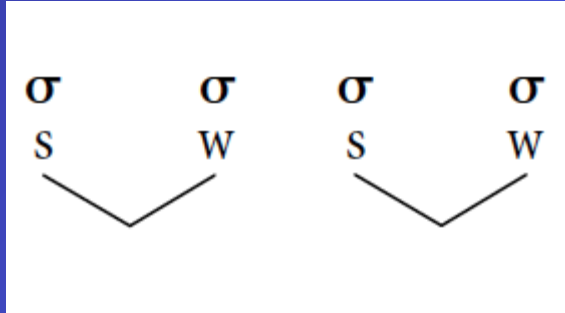
Strength relation between syllables

- Stress is formally represented by using binary branching tree structures
- These nodes are often labeled **S(trong)** and **W(eak)**



Strength relation between syllables

- Alternative notation: brackets
- $(\sigma' . \sigma) (\sigma' . \sigma)$



Different stress patterns in natural languages

- Claim: Predictable stress patterns in languages follow a handful of principles
- These principles can be handled differently across languages
- These principles have been called ‘parameters’

Different stress patterns in natural languages

- The parameters in Hayes (1981):
 - Right-dominant vs left-dominant
 - Left to right vs Right to left
 - Quantity-sensitive vs quantity-insensitive
 - Degenerate feet
 - Extrametricality

Right-dominant vs left-dominant

- Languages vary in whether the right node or the left node of the binary tree structure is dominant
 - Left-dominant: (SW)
 - Right-dominant: (WS)

Left to right vs right to left

- Languages with bounded stress systems may differ in whether foot construction starts at the **right edge** or the **left edge** of the word
- There can be asymmetries (e.g. first, primary stress can be assigned on one edge, the other feet from the other edge)

Quantity-sensitive vs. quantity-insensitive

- In one group of languages, the fact that a syllable is heavy or light does not influence the construction of feet. They are **quantity-insensitive**
- In another group of languages, the internal structure of the syllable is taken into account: here, a weak node may not dominate a heavy syllable; they are **quantity-sensitive**

Degenerate feet

- Feet that are not 'binary' are referred to as degenerate feet
- In quantity-insensitive languages, two syllables form a regular foot
- In quantity-sensitive languages, a heavy syllable counts as a regular foot
- Some languages allow degenerate feet, others don't

Extrametricality

- A particular phonological unit can be ignored during computation
- This element is usually at the right edge of a word
- For our purposes, we can restrict this to word-final syllables

Some examples

- Pintupi (again, exercise sheet)
- Araucanian (exercise sheet)
- Latin (again, exercise sheet)

Stress in Pintupi

- a. [tʰá:]
- b. [mú.ŋu]
- c. [mú:ŋu]
- d. [tʰán.pa]
- e. [ká.pa.li]
- f. [mí:lʰ.ma.nu]
- g. [ŋál.ku.nìn.pa]
- h. [pú.[iŋ.kà.la.tʰu]
- i. [tʰá.mu.lìm.pa.tʰùŋ.ku]

Pintupi

Overt forms

a. [tʰá:]

b. [mú.ŋu]

c. [mú:ŋu]

d. [tʰán.pa]

e. [ká.pa.li]

f. [mí:lʲ.ma.nu]

g. [ŋál.ku.nìn.pa]

h. [pú.[iŋ.kà.la.tʰu]

i. [tʰá.mu.lìm.pa.tʰùŋ.ku]

Surface forms

/(cʷv)/

/(cʷ.cv)/

/(cʷv.cv)/

/(cʷc.cv)/

/(cʷ.cv) cv/

/(cʷv .cv)cv/

/(cʷc.cv)(cʷc.cv)/

/(cʷ.cvc)(cʷ.cv) cv/

/(cʷ.cv)(cʷc.cv)(cʷc.cv)/

More, optional stuff

Trochaic versus Iambic

- Languages vary in whether the right node or the left node of the binary tree structure is dominant
 - Left-dominant: (SW)
 - Right-dominant: (WS)

Trochaic and iambic rhythm

- Not of all of the abovementioned foot types are equally common
- QI right-dominant feet are rare
- QS feet are mostly right-dominant
- Hayes 1995 connects these facts to results of perception experiments

Perception tests (as summarized in Hayes 1995)

- Listeners group sequences of even duration in a binary fashion with initial prominence
- Listeners group sequences of uneven duration in a binary fashion with final prominence

From Hyde (2011)

Intensity contrasts: Left-prominent groupings

... [O o][O o][O o][O o][O o][O o][O o][O o] ...

Duration contrasts: Right-prominent groupings

... [- —][- —][- —][- —][- —][- —][- —][- —] ...

Trochees and iambs

- Based on these results, Hayes defines two kinds of alternating rhythm
- **Trochaic rhythm** (initial prominence, even duration)
- **Iambic rhythm** (final prominence, uneven duration)

Foot inventory (Hayes 1995)

Syllabic Trochee	(x .)		
	σ σ		
Moraic Trochee	(x .)		(x)
	υ υ	or	—
Iamb	(. x)		(x)
	υ σ	or	—

υ = light syllable (μ) / — = heavy syllable (μμ)

x = stressed / . = unstressed

(15) Foot inventory in quantity-sensitive languages:

Trochee: (L L) or (H)

Iamb: (L L) or (H) or (L H)

Uneven trochees

- Hayes approach forbids uneven trochees (= trimoraic trochees) in quantity-sensitive systems
- $*(\mu\mu.\mu)$
- $*(\mu.\mu\mu)$

Foot inventory (Hayes 1995)

- Hayes argues that this foot inventory is exhaustive
- There is no anapest, dactyls, etc.
- There are no moraic iambs

Stress in Cahuilla (from Hyde 2011)

- Heavy syllables are of two types
 - Long vowel
 - Short vowel plus glottal stop
 - (All other syllables are light)

Stress in Cahuilla

(from Hyde 2011)

('taxmu)(,ʔat)

'song'

('taka)(,litfem)

'one-eyed ones'

('paʔ)(,li)

'the water (OBJ)'

('qaː)(,nitfem)

'palo verde (PL)'

('su)(,kaʔ)(,ti)

'the deer (OBJ)'

(,nesun) ('ka)(,viː)(,tʃi-wen)

'I was surprised'

Stress in Cahuilla

(Hyde 2011)

('LL)(,L)	('taxmu)(,ʔat)	'song'
('LL)(,LL)	('taka)(,litfem)	'one-eyed ones'
('H)(,L)	('paʔ)(,li)	'the water (OBJ)'
('H)(,LL)	('qaː)(,nitfem)	'palo verde (PL)'
('L)(,H)(,L)	('su)(,kaʔ)(,ti)	'the deer (OBJ)'
('L)(,H)(,LL)	(,nesun) ('ka)(,viː)(,tʃi-wen)	'I was surprised'

Stress in Cahuilla

- Crucial: disyllabic feet with H in it are avoided, even if this creates a degenerate foot at the right edge of the word
- → Moraic trochees prefer even duration (i.e., bimoraic feet)