- Stress
  - a syllable is *stressed* if it is, in some way, more prominent than another syllable
- Very hard to pin down what 'prominence' means phonetically, across languages
  - In some languages stressed syllables have higher pitch than non-stressed syllables but (roughly) the same duration
    - ex.: Lithuanian, Serbo-Croatian
    - such languages are called 'pitch accent languages'
  - In other languages stressed syllables are more loud than non-stressed syllables, but also have roughly the same duration
    - ex.: Czech, Latvian, Finnish
    - such lgs typically have a phonemic distinction between long and short vowels

- In other languages loudness, duration, and pitch are used to signal stress
  - ex.: English, Russian
- Thus, none of the three characteristics of stress is obligatory
- Yet there are some more abstract ways of distinguishing stress from other prosodic features
  - Some languages use pitch to signal stress
  - Some languages (*tone languages*) use pitch for lexical contrasts
    - Very frequent in East Asian languages and Sub-Saharan African languages

- One syllable is priviledged
  - Stress: typically one syllable has the strongest stress of the word
  - Tone: every syllable has some tone
  - Other segmental properties are more like tone than stress
- Edge-marking
  - Stress: often can be located with reference to an edge
    - see exs. in textbook
  - Tone: free to occur anywhere (because on every syllable)
  - Other segmental properties are again more like tone than stress

- Rhythm
  - Stress: often distributed evenly (every other syllable)
  - Tone: can occur on adjacent syllables
  - Again, segmental features are like tone, not stress
- Rules
  - Stress: never assimilates; sometimes dissimilates (adjacent stresses are removed)
  - Tone: often assimilates to neighbouring syllables
  - Segments are like tone, not stress

- English stress
  - mostly predictable from the word edge and the morphological structure of words
  - but the rules are very complex

	2	3	4	5	6
first	pérson	Flórida	mánageable	párodiable	párodiableness
second	admít	consénsus	calámity	Ocónomowoc	remédiableness
third		kangaróo	Arizóna	Amazónian	charismátically
fourth			Kalamazóo	imagination	potentiálity
fifth				governmentalése	califragilístic
sixth					?

Finding stressed syllables

- Minimal pairs: primary stress

  English nouns: *permit* *survey* *protest*

  English verbs: *permit* *suvey* *protest*

- Intonational melodies
  - Stressed syllables serve as 'hooks' for the tones that form the English intonational patterns
  - Declarative intonation: high tone on the stressed syllable
  - Question intonation: low tone on the stressed syllable
  - Surprise-redundancy contour: H L H* L
    - H* goes on the stressed syllable

- Try these on the following words

  assimilation

  magnanimity

  innocent

  complacent

  antelope

  kangaroo

- Other ways
  - tapping: pronounce the word several times in a row, once per word
  - soon you should settle into a pattern where the tap goes on the primary-stressed syllable
    - speed up and then slow down if you're not sure
- Try this:
  - Merlot, prelude, untie, access, shampoo, Kodak, lampoon

- Phonological evidence for stress
  - vowel quality
    - unstressed syllables may have [ə]
    - NB: this is a bit circular, since the difference between [ə] and [ʌ] is defined in terms of stress
    - But *alternations* are not ambiguous (cases where the same morpheme has different vowels in related forms)

atom	atomic
medicinal	medicine
elemental	element

- flapping
  - flapping takes place between a stressed and an unstressed syllable

    data attain

    atom atomic

    cf. Navratilova, mediterranean
- Aspiration
  - at the beginning of a stressed syllable

    capital, append, campus

- Secondary stress. Minimal pairs:

the Whíte hoùse	a whìte hoúse
bláckboàrd	a blàck boárd
blúebèrry	a blùe bérry

- Within words

áxis	áccèss	['æksɪs]	['ækˌsɛs]
ánchor	éncòre	['æŋkəɹ]	['ɑŋˌkoɹ]
maroón	ràccoón	[mə'ɹun]	[ˌɹæ'kun]

- Locating secondary stress, especially if it is to the right of primary stress, is often hard
  - Same diagnostics: vowel quality, aspiration, flapping

    agree, canoe, rescind, lampoon, typhoon, below, Merlot, baboon, return, untie, soufflé, marquee, shampoo, derive, remind

    Atlantic vs. atrocious

    motto vs. veto

    malady vs. chickadee

    reality vs. manatee

- Intonational melodies
  - Surprise-redundancy countour is H L H L
    - the second H goes on the primary-stressed syllable
    - the first L goes on the secondary-stressed syllable

      collaboration, classification, originality, Tatamagouchi, gentrification, imagination, systematize, califragilistic

      The blackboard's painted orange! vs.

      The black board's painted orange!
- The last example shows that stress is *relative*
  - the primary stress of a smaller phrase (*blackboard*) counts as the weaker stress of the whole sentence

Primary: initial		Primary: second		Primary: final	
σ́ σ σ	Cánada	σ σ́ σ	Amánda	σ σ σ́	*none*
σ́ σ̀ σ	báckgàmmon	σ̀ σ́ σ	Àlbérta	σ̀ σ σ́	kàngaroó
σ́ σ σ̀	Ságinàw	σ σ́ σ̀	adúlthoòd	σ σ̀ σ́	appoìntée
σ́ σ̀ σ̀	éxcùlpàte	σ̀ σ́ σ̀	mìscóndùct	σ̀ σ̀ σ́	chìmpànzeé

σ́ σ σ̀ σ	prósecùtor	σ σ́ σ σ	calámity	σ̀ σ σ́ σ	Mànitóba
σ́ σ σ σ̀	sýstematìze	σ σ́ σ σ̀	cholésteròl	σ̀ σ σ́ σ̀	coùnterclóckwìse
σ́ σ̀ σ σ	(dúst-gàthering)	σ σ́ σ̀ σ	(canóe-lòving)	σ σ̀ σ́ σ	depàrtméntal

σ̀ σ σ σ́	Kàlamazoó
σ σ̀ σ σ́	evàcueé

Basic typology

Marunungku

σ́ σ	tíralk	'saliva'
σ́ σ σ̀	mérepèt	'beard'
σ́ σ σ̀ σ	yángarmàta	'the Pleiades'
σ́ σ σ̀ σ σ̀	lángkaràtetì	'prawn'
σ́ σ σ̀ σ σ̀ σ	wélepènemànta	'kind of duck'

Weri

σ σ́	ŋjintíp	'bee'
σ̀ σ σ́	kùlipú	'hair of arm'
σ σ̀ σ σ́	ulùamít	'mist'
σ̀ σ σ̀ σ σ́	àkunètepál	'times'

Warao

σ σ̀ σ σ́ σ	yiwàranáe	'he finished it'
σ̀ σ σ̀ σ σ̀ σ σ́ σ	yàpurùkitàneháse	'verily to climb'
σ σ̀ σ σ̀ σ σ̀ σ σ́ σ	enàhoròahàkutái	'the one who cause him to eat'

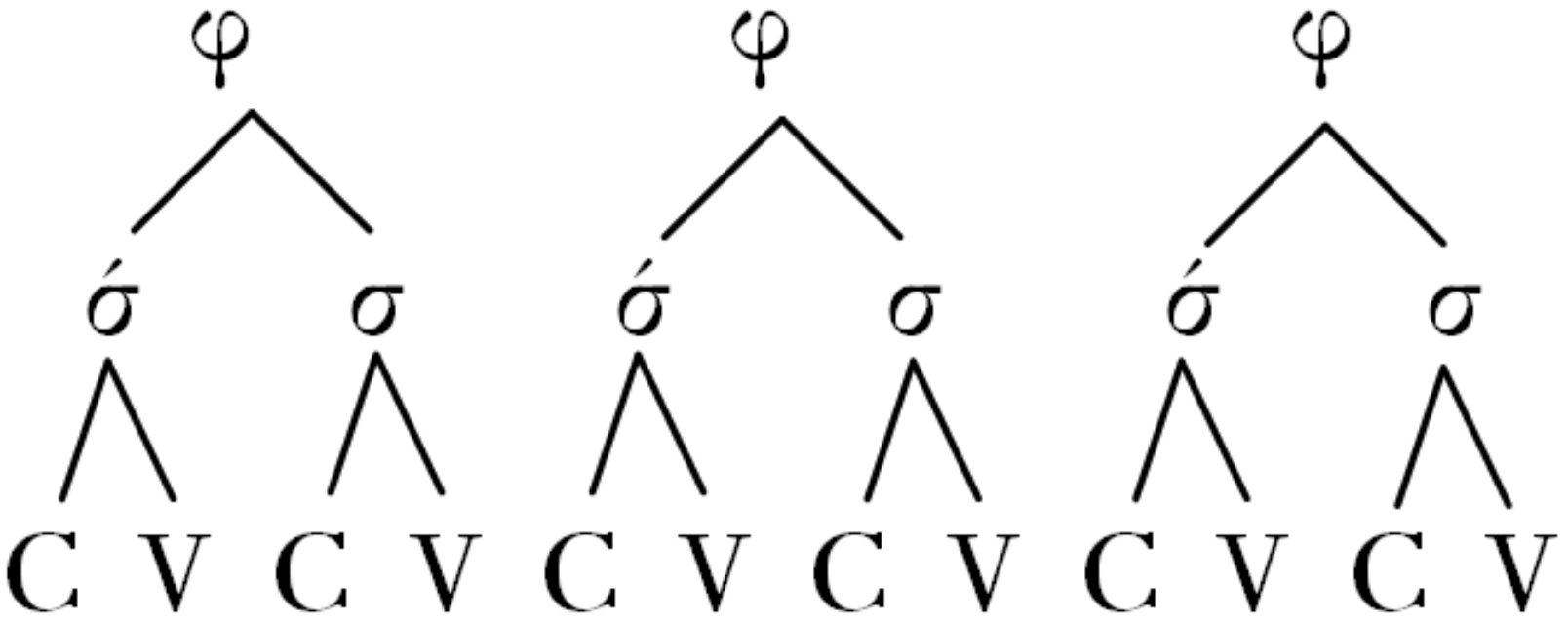
Araucanian

σ σ́	wulé	'tomorrow'
σ σ́ σ	tipánto	'year'
σ σ́ σ σ̀	elúmuyù	'give us'
σ σ́ σ σ̀ σ	elúaènew	'he will give me'
σ σ́ σ σ̀ σ σ̀	kimúbalùwulày	'he pretended not to know'

- What's in common between all these?
  - stressed and unstressed syllables alternate
    - there are never adjacent stressed syllables (*clashes*), and never adjacent unstressed syllables (*lapses*)
  - either the first or the last of the stressed syllables bears primary stress; all others have secondary stress
- What's different between these languages?
  - Some start the binary count at right edge, some at left edge
  - Some start from the first/last syllable, some from the second/second-to-last syllable

- Stress represents the grouping of syllables into higher constituents, called (*metrical*) *feet*
- Feet have heads (unfortunately). The heads are the stressed syllables
- Ways to represent feet graphically:
  - With brackets: (*tapa*)(*tapa*)
  - With trees

The prosodic hierarchy



- Feet in languages we've seen so far are at most binary: they consist of no more than two syllables, of which one is the head.
- There are special terms for left-headed and right-headed feet:

(σ́ σ)	a TROCHAIC foot, a TROCHEE
(σ σ́)	an IAMBIC foot, an IAMB

- Back to the typology: The 4 languages differ in several parameters
  - Are feet assigned left-to-right or right-to-left?
  - Are the feet iambs (right-headed) or trochees (left-headed)?

Marumungku

(σ́ σ)	tíralk	'saliva'
(σ́ σ) (σ̀)	mérepèt	'beard'
(σ́ σ) (σ̀ σ)	yángarmàta	'the Pleiades'
(σ́ σ) (σ̀ σ) (σ̀)	lángkaràtetì	'prawn'
(σ́ σ) (σ̀ σ) (σ̀ σ)	wélepènemànta	'kind of duck'

Weri

(σ σ́)	ŋjintíp	'bee'
(σ̀) (σ σ́)	kùlipú	'hair of arm'
(σ σ̀) (σ σ́)	ulùamít	'mist'
(σ̀) (σ σ̀) (σ σ́)	àkunètepál	'times'

Warao

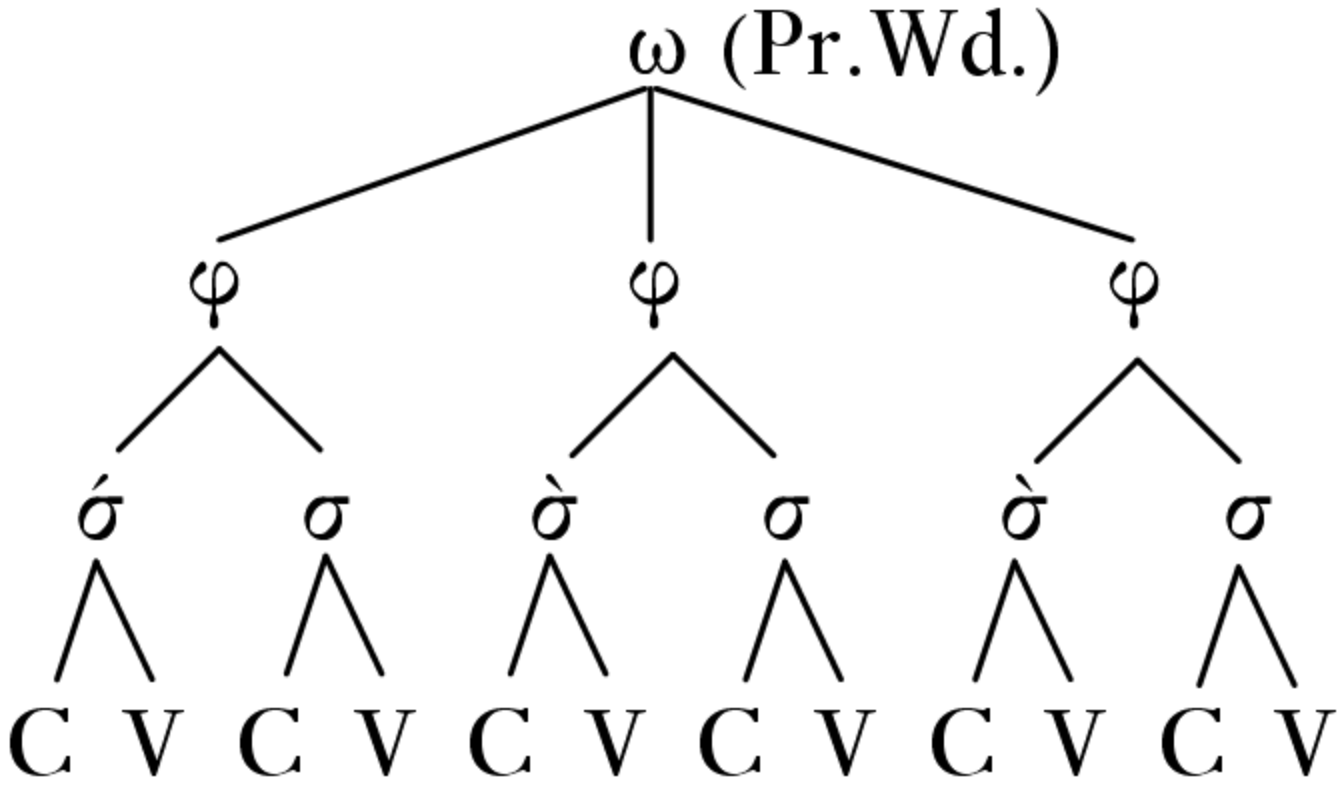
σ (σ̀ σ) (σ́ σ)	yiwàranáe	'he finished it'
(σ̀ σ) (σ̀ σ) (σ̀ σ) (σ́ σ)	yàpurùkitàneháse	'verily to climb'
σ (σ̀ σ) (σ̀ σ) (σ̀ σ) (σ́ σ)	enàhoròahàkutái	'the one who cause him to eat'

Araucanian

(σ σ́)	wulé	'tomorrow'
(σ σ́) σ	tipánto	'year'
(σ σ́) (σ σ̀)	elúmuyù	'give us'
(σ σ́) (σ σ̀) σ	elúaènew	'he will give me'
(σ σ́) (σ σ̀) (σ σ̀)	kimúbalùwulày	'he pretended not to know'

	TROCHEES	IAMBS
LEFT-TO-RIGHT	Marunungku	Araucanian
RIGHT-TO-LEFT	Warao	Weri

- Primary vs. secondary stress:
  - Feet are themselves organized into a high constituent called the Prosodic Word
  - This constituent, too, has a head. The head bears primary stress.


ω (Pr.Wd.)
φ
φ
φ
σ́
σ
σ̀
σ
σ̀
σ
C V C V C V C V C V C V

- Parametric stress theory
  - A limited set of representations: binary feet, prosodic words, etc.
  - A limited set of rules of foot assignment
    - Headedness: iambs, trochees
    - Directionality: L-to-R, R-to-L
    - Word head: L, R
  - The parameters are independent of each other

Malakmalak (no data available)

σ́ σ

σ σ́ σ

σ́ σ σ̀ σ

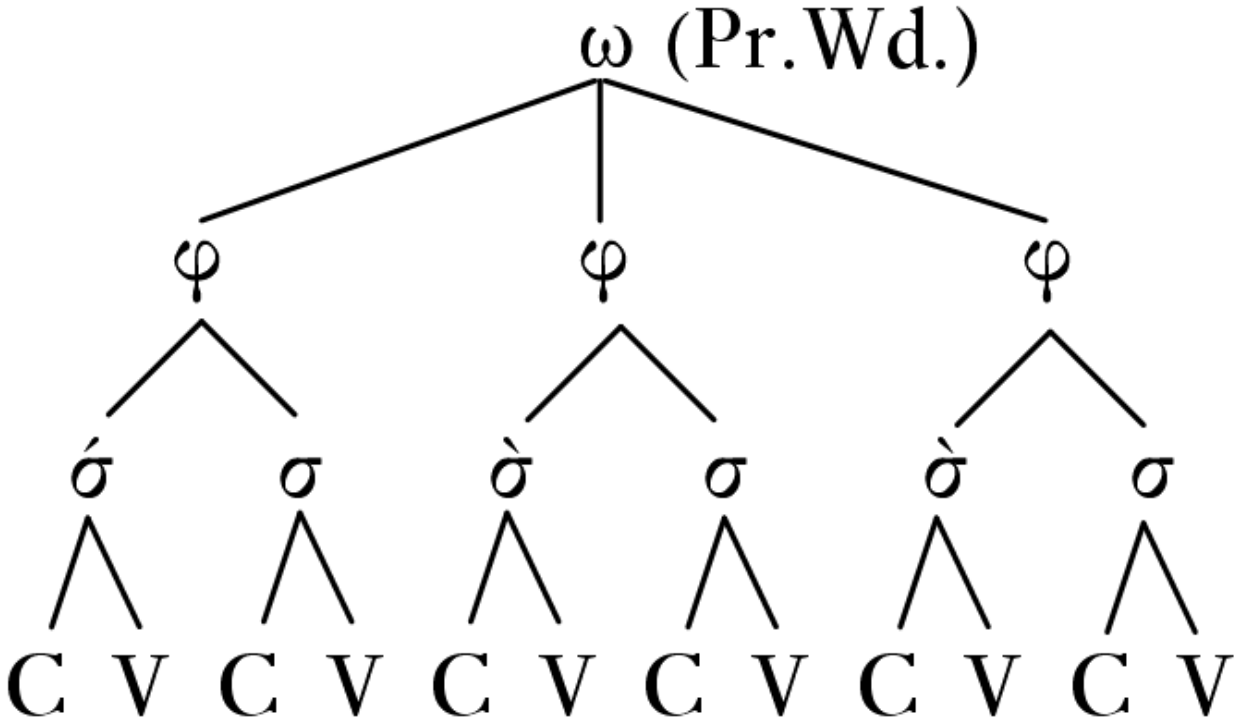
σ σ́ σ σ̀ σ

σ́ σ σ̀ σ σ̀ σ

σ σ́ σ σ̀ σ σ̀ σ

Summary of stress theory so far

- The prosodic hierarchy



- Syllables are organized into metrical feet
  - the heads of metrical feet are by definition the stressed syllables
- Feet are organized into prosodic words
  - the heads of prosodic words are by definition the primary-stressed syllables
- Parametric theory
  - Limited set of available representations
  - Limited options of applying rules (parameters)

- Goal: develop a theory where stress systems in languages can be unambiguously described by listing the value of a few parameters
- Two tasks for the theory
  - describe any observed stress system, and be able to distinguish between any two systems that are different
  - not predict any systems that are not attested

Stress parameters so far

- Foot type
  - trochee (left-headed feet)
  - iamb (right-headed feet)
- Directionality
  - are feet assigned left-to-right or right-to-left?
- Degenerate feet
  - are feet consisting of a single syllable allowed?
    - i.e. what happens to the left-over syllable in words with an odd number of syllables
- Word-head (primary stress)
  - which of the feet is the head of the prosodic word?

Finnish

tálo	‘house’
tálossa	‘in the house’
tálossansa	‘in his house’
tálossansakaan	‘not in his house either’
tálossansakaanko	‘not in his house either?’
tálotta	‘without a house’
tálottomuus	‘state of being houseless’
tálottomuudestansakaanko	‘not from his state of being houseless either?’

Turkish

odá	‘room’
odalár	‘rooms’
tanɨ́	‘know’
tanɨdɨ́k	‘acquaintance’
tanɨdɨklár	‘acquaintances’
tanɨdɨklarɨ́m	‘my acquaintances’
tanɨdɨklarɨmɨ́z	‘our acquaintances’
koalisjón	‘coalition’
koalisjonumúz	‘our coalition’
koalisjonumuzdá	‘in our coalition’

- New parameter:
  - *iterativity* (yes/no):
    - iterative systems assign as many feet as possible
    - non-iterative systems assign only one foot
- Finnish:
  - trochee, L-to-R, non-iterative
- Turkish
  - iamb, R-to-L, non-iterative
- Lgs with non-iterative footing have no secondary stress
- The value word-head parameter in such languages is unknown
  - No way to tell which stress is primary if there is only one stress

- Macedonian

vodéničar	'miller'
vodeníčari	'millers'
vodeničárite	'the millers'

- Regular *antepenultimate* stress (third syllable from the end)
- Cannot account for this system with the current parameters and representation

- New parameter:
  - Extrametricality: the final syllable may be ignored for the purposes of stress
- If Macedonian has extrametricality, then the other parameters are straightforward
  - directionality: R-to-L
  - foot type: trochee
  - iterativity: no

vo(déni)⟨čar⟩
vode(níča)⟨ri⟩
vodeni(čári)⟨te⟩

Spanish

bravo	civil
drama	formal
pomada	holgazan
pistola	convoy
formalismo	mandarin
profe	profesor
alemana	aleman
señorita	señor

- Generalization:
  - if the final syllable of the word ends in a consonant, it must bear stress
- Analysis (first attempt):
  - words that end in vowels have trochees
  - words that end in consonants have iambs
- Works for this data set, but is uninsightful
  - languages in general don't allow inconsistent footing
  - why should the split go this way instead of the opposite way? why not 'iambs in V-final words, trochees elsewhere'?

- Let us call syllables that have codas *heavy*, and syllables without codas *light*
  - heavy syllables have more material and are more prominent (longer, louder) than light syllables
- Spanish generalization: stress final syllable if it is heavy, penultimate syllable otherwise

- New stress parameter: *quanitity sensitivity*
  - quantity-sensitive languages: heavy syllables cannot be in the weak branch of a foot
  - quantity-insensitive languages: heavy syllables and light syllables behave alike
- Spanish sets this parameter to 'yes'
  - The other languages we've seen so far are not quantity-sensitive

- Other parameters in Spanish:
  - foot type: trochees
  - directionality: R-to-L
  - iterativity: no
    - let's assume there's no secondary stress

(brá.vo)	ci.(víl)	*(cí.vil)
(drá.ma)	for.(mál)	*(fór.mal)
po.(má.da)	hol.ga.(zán)	*hol.(gá.zan)
pis.(tó.la)	con.(vóy)	etc.
for.ma.(lís.mo)	man.da.(rín)	
(pró.fe)	pro.fe.(sór)	
a.le.(má.na)	a.le.(mán)	
se.ño.(rí.ta)	se.(ñór)	

- Some Spanish words have exceptional antepenultimate stress

sábana	'bedsheet'	*cámara*	'chamber'
teléfono	'telephone'		

- These really are exceptions
  - no way to predict from the shape of the word that it should be *teléfono* rather than **telefóno*
- Analysis: some Spanish words have extrametrical final syllables (and this information is in the UF)

(sába)⟨na⟩ (cáma)⟨ra⟩ te(léfo)⟨no⟩

- But there are no exceptions like this:
  - **te.lé.fos.no* **te.lé.for.no* **te.lé.fam.bo*
- If the penultimate syllable is closed and therefore heavy, it cannot be in the weak branch of a foot
  - this follows from quantity-sensitivity, which we independently need for the stress of words like *civil*

*te(léfos)⟨no⟩ *te(léfor)⟨no⟩ *te(léfam)⟨bo⟩

- Quantity sensitivity allows us to make a connection between two seemingly unrelated facts about Spanish
  - obligatory stress on final heavy syllables
  - obligatory stress on penultimate heavy syllables

Latin

fá.ci.lis	ho.nés.tus
cá.pi.mus	per.féc.tum
ī.tá.li.a	au.gús.tus
dḗ.di.tus	ca.tél.la
cé.le.brō	ex.cép.tō

- Stress penult if it is heavy, antepenult otherwise
- So far Latin is like Spanish + extrametricality
  - foot type: trochee
  - directionality: R-to-L
  - quantity-sensitivity yes
  - iterativity no
  - extrametricality yes

(fá.ci).⟨lis⟩

(cá.pi).⟨mus⟩

ī.(tá.li).⟨a⟩

(dḗ.di).⟨tus⟩

(cé.le).⟨brō⟩

ho.(nés).⟨tus⟩

per.(féc).⟨tum⟩

au.(gús).⟨tus⟩

ca.(tél).⟨la⟩

ex.(cép).⟨tō⟩

- More data

a.mī́.cus

a.mā́.mus

rō.mā́.nus

re.fḗ.cit

ek.sem.plā́.ris

- Unlike Spanish, Latin has a vowel length contrast
- Syllables with long vowels but no codas count as heavy

English

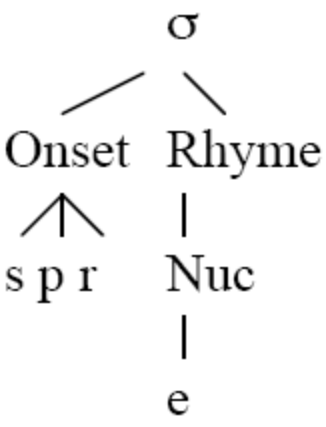
América
cínema
aspáragus
metrópolis

aróma
hiátus
horízon
coróna

veránda
agénda
consénsus
synópsis

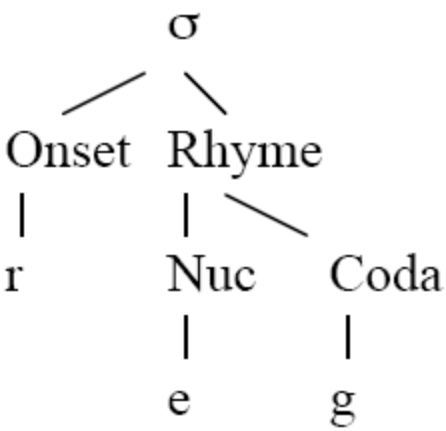
- The stress system of English nouns is very similar to the Latin system
  - stress penult if heavy, antepenult otherwise
- Closed syllables and syllables with tense vowels count as heavy
- Syllables with lax vowels count as light
- A representational idea (developed next time):
  - one long vowel = two short vowels

Light syllable

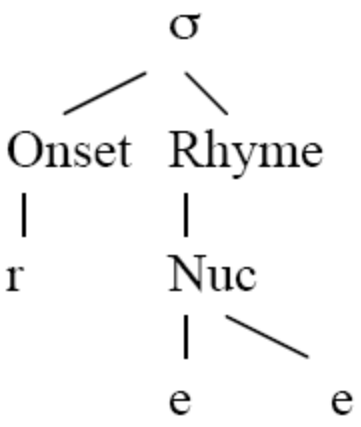


[spre]

Heavy syllables



[reg]



[ree] = [re:]

English

- Verbs
  - assume final consonants are extrametrical (don't count)

I	II	III
develop	maintain	torment
astonish	appear	usurp
surrender	erase	expect
demolish	reveal	collapse
embarrass	allow	molest
illicit	supreme	absurd
common	obscure	overt
implicit	remote	complex

- English parameters
  - foot type — trochee
  - directionality — R-to-L
  - quantity-sensitivity — yes
  - extrametricality — yes (Ns), no (Vbs)
    - verbs have final consonant extrametricality
- English stress presents many other complexities

	2	3	4	5	6
first	pérson	Flórida	mánageable	párodiable	párodiableness
second	admít	consénsus	calámity	Ocónomowoc	remédiableness
third		kangaróo	Arizóna	Amazónian	charismátically
fourth			Kalamazóo	imaginátion	potentiálity
fifth				governmentalése	califragilístic
sixth					?

- Evidence for English metrical foot: resolution in meter

There are more things in heaven and Earth, Horatio w s w s w s w s w s w	heaven = ($\breve{\sigma}$ $\breve{\sigma}$)
*There are more things on Neptune and Earth, Horatio	Neptune = ($\bar{\sigma}$)($\bar{\sigma}$)
And spends his prodigal wits in bootless rhyme w s w s w s w s w s	prodi = ($\breve{\sigma}$ $\breve{\sigma}$)
*And spends his important wits in bootless rhyme	impor = ($\bar{\sigma}$)($\bar{\sigma}$)