
Week 07 – The Syllable and Stress Part 1

October 21, 2008

1 The Syllable

1.1 What is a syllable?

- (1)
- (2) Is syllabification of a string something that can be contrastive in a language?
 - a. E.g. could a language contrast [mis.tik] from [mist.ik]?
 - b. Generally, it has been observed that syllabification is predictable (i.e. does not need to be specified underlyingly), and a very simple algorithm serves to syllabify a string.
- (3) Syllabification Algorithm (first approximation)
 - a. Scanning from left to right identify the vowels in the word, and project a syllable node from them.
 - b. For each syllable node, link to a consonant to the left of the vowel (if there is one).
 - c. Then, for each syllable node, link to a consonant to the right of the vowel (if there is one).
 - d. Unlinked segments are then either linked to existing syllable nodes, respecting the Sonority Sequencing Principle wherever possible, and the process is repeated with other sonorous sounds like glides and liquids now serving to project syllable nuclei.

★ Let's apply the algorithm to [nostradamΛS]

- (4) The segments which project the syllable node are called the *nucleus*. The prenucleic elements make up what is called the *onset*, and the post nucleic elements make up what is called the *coda*.
- (5) Note there aren't any known phonetic correlates to syllables. But native speakers of languages often agree on how many syllables are in a word. They are able to count them, often by 'tapping' them out.
- (6) Note also that under a theory of extrinsic rule ordering, we may expect syllabification to be ordered with respect to rules. In the Hayes textbook, syllabification is often *persistent*; i.e. it applies whenever it can (before and after many rules).

1.2 Cross-linguistic facts

- (7) These typological facts come from Blevins (1996).

	onsets	codas	possible syllables (excluding complex onsets and codas)
Arabela, Siona, Piro, Hua	required	forbidden	CV
Totonac, Klamath, Nisqually, Tunica, Sedang, Dakota, Thargari	required	allowed, but not required	CV, CVC
Pirahã, Mazateco, Fijian, Cayuvava	allowed, but not required	forbidden	V, CV
English, Gilyak, Finnish, Tamazight Berber, Cairene Arabic, Spanish, Italian, Mokilese, Cuna	allowed, but not required	allowed, but not required	V, CV, VC, CVC

- (8) These typological facts seems to suggest that:
- Onsets are preferred (may be required, never forbidden)
 - Codas are dispreferred (never required, may be forbidden)
- (9) Questions:
- Why are onsets preferred cross-linguistically?
 - Why are codas dispreferred cross-linguistically?
 - What does it mean for something to be (dis)preferred cross-linguistically?
- (10) We see a typological gap; i.e. a logically possible language type is unattested.

- a. Either this is accidental: we expect to find such languages if we look hard enough (either through fieldwork or through experimental means)
- b. Or it is not: there is a principled reason for the gap.

1.3 Allowing rules to refer to syllables simplifies rules

(11) Consider the rule: $C \rightarrow \emptyset / C \text{ ____ } \{C, \#\}$

- a. Thus: /kapt+kan/ \rightarrow [kapkan].
- b. Thus: /kapt/ \rightarrow [kap].
- c. Thus: /kapt+i/ \rightarrow [kapti].

(12) What do the environments \underline{CC} and $\underline{CC}\#$ have in common?

(13) Now consider the rule: $C \rightarrow \emptyset / \text{ ____ }]_{\sigma}$

★ Provide derivations of the the words above using the syllabification algorithm and the rule in (13).

★ Can you think of some other examples of rules that get simplified, or of rules you have seen in class that can be understood as a syllable-based process?

2 Stress Patterns Part 1

(14) Today we look at the ways in which languages in the world place stress in some domain.

(15) Questions to keep in mind:

- a. Given the stress pattern in some particular language, what kinds of representations, rules, constraints, etc. best describe the competence of the speaker?
- b. What are the logically possible stress patterns?
- c. What are the actual attested patterns?
- d. Given that the variation that exists is limited, how should this affect our theory of competence?
- e. Can we develop a theory that predicts the attested variation and nothing (or little else)?
 - (i) Towards an explanatory theory
 - (ii) Universal principles and parameters

2.1 What is stress?

(16) Answer: (Liberman and Prince 1977)

- a. Relative prominence of portions of an utterance.
 - b. Rhythmic structure that serves as an organizing framework for an utterance.
- (17) Metrical theories of stress describe stress as essentially the same as other rhythmic phenomena (verse, music).
- a. “[the description of stress] is reminiscent of the traditional picture of verse scansion, so that the theory as a whole deserves the name ‘metrical’” (Lieberman and Prince 1977)
- (18) Function of rhythm in language (Trubetzkoy 1939)
- a. Delimitative: Changes in rhythm mark the boundaries of domains.
 - b. Culminative: Beats of certain strength mark the presence of words or lexical morphemes.
 - c. Culminativity: Every (content) word must have at least one stressed syllable.
 - (i) More generally: Every domain must have a peak of prominence.
 - d. Distinctive: Differences of rhythm distinguish words or lexical categories (ex. *pérmít* vs. *perμίt*, *récord* vs. *recórd*, and many other such pairs in English).
- (19) Stress is distinct from the phonetic and phonological properties that are correlated with it:
- a. Phonetic properties correlated with stress (with cross-linguistic differences): amplitude, length, high/low pitch or pitch changes
 - (i) But: “The definition of stress is one of the perennially debated and unsolved problems of phonetics” (Hayes 1995: 5) .
 - b. Phonological properties that ‘express’ or are sensitive to stress:
 - High tone on stressed syllable in Creek; High tone before stressed syll. in Greek.
 - Low tone on stressed syllable in Chamorro, Malayalam.
 - Stressed syllables have the ability to carry more tone distinctions in Chinese dialects.
 - Stressed syllables have the ability to carry more vowel distinctions, and vowels in stressed syllables are more resistant to coarticulation, in English.

2.2 Stress as a feature?

- (20) Other features don't shift from segment to segment based on distance from a word edge (well, not usually...):

óorigin	oríorigin	orìorigin
phòtograph	photógrapher	phòtographíc

- (21) Other features don't act at long distances (well, not usually...):

Mississippi vs. Míssissippi législàtors

- (22) Languages don't require every content word to have at least one + value of other features (except maybe [syllabic]) (which, in the CV-skeleton theory, which we get to later, is not a feature any more).

- (23) For just about every other feature, there is some language where it assimilates—but I know of no rules of stress assimilation.

2.3 Detecting Stress

- (24) How do we know that a given portion of an utterance is stressed?
 a. There is no invariant physical realization of stress, even within a single language. This is true of rhythm in general, and implies that we have to use phonological diagnostics.

- (25) Some diagnostics for stress in English (Hayes 1995: Ch.1)
 a. Attraction of Nuclear Intonational Tunes: pitch accent (T*) falls on stressed syllable.
- | | |
|------------------|--------|
| declarative tune | M H* L |
| question tune | M L* H |

★For the two tunes above, on which syllable does the pitch accent fall in the words *assimilation*, *preliminary*, *pontoon*?

- (i) For more on intonational contours see (Ladd 1996).
 b. Schwas are never stressed.

**medícine* [m ε d ə s ə n]
 | | |
 M H* L

- c. Vowel reduction: {æ, a, ε, ɔ, ɪ, u, ʌ} reduce to schwa or [ɨ] when stressless.
 d. Flapping: t, d → r / [-cons] _____ [+syl, -stress]
 (i) ex. data vs. attain
 e. /t/ Insertion: ∅ → t / n _____ s[+syl, -stress]
 (i) ex. Mensa vs. insane
 f. /l/ Devoicing: l → [-voice] / s _____ [+syl, -stress]
 (i) ex. Iceland vs. Icelandic
 g. Medial Aspiration: [-son, -cont, -voice] → [+spread glottis] / [-stri] _____ ([+son])[+syl, +stress] ■
 (i) ex. append vs. campus, accost vs. chicken

- (26) Moral: When investigating stress in another language, maybe you can hear the stress but it is useful to find diagnostics such as these to verify the presence or absence of stress.

2.4 Examples of simple stress systems (from Kager)

- (27) Hungarian. Main stress is on the initial syllable; secondary stresses fall on all odd-numbered syllables.

bóldog	‘happy’	bóldogtálan	‘unhappy’
bóldogsà:g	‘happiness’	bóldogtálansà:g	‘unhappiness’

- (28) Weri. Main stress is on the final syllable; secondary stresses fall on preceding odd-numbered syllables counting from the word end.

ʊlòamít ‘mist’ àkʊnàtepál ‘times’

- (29) Warao. Main stress is on the penultimate syllable (penultimate = immediately before the last syllable); secondary stresses fall on all even-numbered syllables counting back from the main stress.

yà.pu.rù.ki.tà.ne.há.se ‘verily to climb’
e.nà.ho.rò.a.hà.ku.tá.i ‘one who caused him to eat’

- (30) Araucanian. Main stress is on the second syllable; secondary stresses fall on following even-numbered syllables.

e.lá.a.à.new ‘he will give me’
ki.mú.fa.lù.wu.lày ‘he pretended not to know’

3 Grid theory of Stress Patterns

3.1 Basics

- (31) (Lieberman and Prince 1977, Prince 1983)

- (32) Linguistic stress is represented by a hierarchy of grid lines, with higher columns representing greater prominence.

line 3:		x									lines can also be labelled with prosodic units:
line 2:	x			x							Prosodic Word
line 1:	x		x		x						Foot?
line 0:	x	x	x	x	x	x					Foot
	a	pa	la	chi	co	la					σ

- (33) The strong tendency toward rhythmic alternation is accounted for by mapping to the **perfect grid**:

$$\begin{array}{cccccccccccc} & & & & x & & x & & x & & x & & x & & x \\ \dots & x & & x & & x & & x & & x & & x & & x & & x & \dots \end{array}$$

- (34) Mapping to the perfect grid has two binary parameters:

- Directionality parameter: Right-to-left, Left-to-right.
- Starting parameter: Begin with peak, Begin with trough.

- (35) **End Rules** strengthen rightmost/leftmost stresses by adding one grid mark above them.

- ER(I,Wd): place a grid mark above the leftmost (initial) grid mark on the Ft level.
- ER(F,Wd): place a grid mark above the rightmost (final) grid mark on the Ft level.

- a. Formal statement of the End Rule (Prince 1983:27):

“Let p be the strongest grid position in a constituent C. There is a level (n + 1) such that (i) p is the only position in C with representation at level (n+1), and (ii) other

positions in C have representation at level n. The End Rule says: The entry for p at level n is the rightmost/leftmost entry at level n for C.”

- (36) Operation of the End Rules is (implicitly or explicitly) subject to a well-formedness condition called the **Continuous Column Constraint** (formulation after Hayes 1995):
 - a. “A grid containing a column with a mark on line n + 1 and no mark on line n is ill-formed. Phonological rules are blocked when they would create such a configuration.”
 - b. Basically, for every grid mark (except on the bottom layer) there must be a grid mark in the same column on the layer below.

3.2 Typological Predictions

★ Describe the patterns of (6) within the grid theory

	Directionality parameter	Starting parameter	End Rule
Hungarian			
Weri			
Warao			
Araucanian			

- (37) Many unattested stress system cannot be described within the grid theory, and are therefore correctly predicted not to occur.

‘Stresses pile up on the left’

‘Stresses pile up on the right’

‘Main stress in the middle, with alternation outwards in both directions’

```
x x x
x x x x x x x x
```

```

      x x x
x x x x x x x x
(cf. tones)
```

```

      x
  x x x x x x x x
cute, but unattested
```

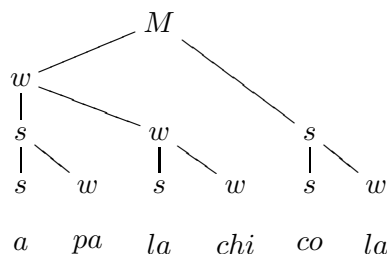
4 Alternatives to (elaborations of) the grid

- (38) Grid (Lieberman and Prince 1977, Prince 1983).

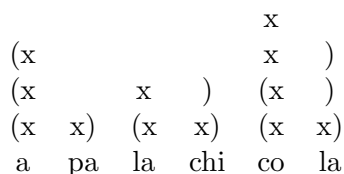
```

                                x
                                x
                                x
x      x      x      x      x      x
a  pa  la  chi  co  la
```

- (39) Stress represented by a hierarchical tree of strong and weak nodes (Lieberman and Prince 1977).



(40) Bracketed grid (contemporary theory): grids grouped into feet and words (Hayes 1995).

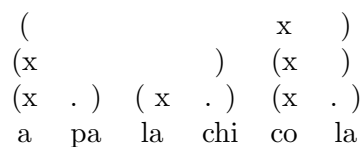


(41) Details of bracketing

- a. On line 1 (i.e., just above the syllable line), bracketings represent prosodic constituents called **feet**. We will focus on bracketings on this line (as does the literature).

(42) Some more notation

- a. Hayes (1995) alters the notation for brevity as follows.
 b. Line 0 is removed and the brackets are ‘pushed up’ a level.
 c. Each bracketing now contains only one ‘x’ mark. ‘x’ stands for a syllable that receives some degree of stress
 ‘.’ stands for a syllable that receives no stress.



4.1 More Parameters

(43) Quantity-sensitivity

- a. Light syllables (1 mora, monomoraic) are represented by [x], heavy syllables (> 1 mora) are represented by [x x]. We will discuss how moraicity is determined next week.

(44) Extrametricality

- a. Some stress patterns appear to group the last three elements together. Since this only occurs at the right edge, instead of allowing ternary feet, binary feet are maintained with the last unit (syllable, mora or foot) being **extrametrical** (outside the grid so to speak, denoted with < >).

(45) Example: Latin (C)V syllables are light, everything else is heavy.

- a. In words at least three syllables in length, stress the penult if it is heavy, otherwise stress the antepenult. In shorter words, stress the initial syllable (Jacobs 1989, Mester 1992, Hayes 1995).

a.	a.mí:kus	L H́ H	‘friend, kind’
b.	gu.ber.ná:bunt	L H H́ H	‘they will reign’
c.	i.ni.mi:kì.ti.a	L L H Ĺ L L	‘hostility’
d.	do.més.ti.kus	L H́ L H	‘belonging to the house’
e.	mán.da:	H́ H	‘entrust (2sg.imp)’
f.	ká.nis	Ĺ H	‘dog’
g.	hé.ri	Ĺ L	‘yesterday’

- b. Also note that the examples (e-f) show that stress falls initially in disyllabic words.

★ Show the grid for *guberna:bunt* and *domestikus*.

★ Do we need an additional parameter to describe the lack of secondary stress?

(46) Goals for next time

- Review arguments for bracketing of the grid: in particular, for metrical foot structure.
- Present and motivate the limited foot inventory proposed by Hayes (1995).
- Study other aspects of prosodic theory, especially extrametricality.
- Begin to discuss the motivation for constraint-based stress theory.

References

- Hayes, Bruce. 1995. *Metrical Stress Theory*. Chicago University Press.
- Jacobs, Haike. 1989. Nonlinear Studies in The Historical Phonology of French. Ph.D. thesis, Katholiek Universiteit te Nijmegen.
- Ladd, Robert. 1996. *Intonational Phonology*. Cambridge University Press.
- Liberman, Mark and Alan Prince. 1977. On Stress and Linguistic Rhythm. *Linguistic Inquiry* 8:249–336.
- Mester, Armin. 1992. The quantitative trochee in Latin. *Natural Language and Linguistics Theory* 12(1):1–61.
- Prince, Alan. 1983. Relating to the Grid. *Linguistic Inquiry* 14(1).