

## 24.901 Phonetics-3: syllables and prosodic (suprasegmental) features

### 1. syllable

- no agreed upon phonetic definition of syllable
- concept is inferred rather than perceived (Steriade 2000)
- syllabic writing systems are ubiquitous vs. alphabetic
- suggests that parsing speech into syllables is easier than into phonemes (e.g. Japanese hiragana)
- many verse structures built on number of syllables (French alexandrine: 12 syllables divided by a pause (caesura) between 6th and 7th; Berber 12 syllable lines with heavy syllable in 3rd, 7th, and 12th position (Dell & Elmedlaoui 2002))

### 2. internal structure: onset-rhyme (nucleus coda)

- structure preservation in spoonerisms: *our dear queen* -> *our queer dean* break at onset.rhyme
- cross-linguistically rhyme is domain for poetic rhyme; rhyme books crucial to reconstruction of Chinese;
- **open** syllable ends in a vowel and **closed** syllable ends in a consonant
- phonetic definition in terms of chest pulses (Stetson) not confirmed
- peaks of sonority: sonority is roughly the acoustic intensity of a sound with loudness being a primary auditory correlate.
- **sonority hierarchy**: vowels (low,mid,high) > glides > r > liquids > nasals > fricatives > stops (voiced > voiceless) see CIP 10.1
- correlates with degree of opening of vocal tract
- no salient peaks lead to less robust judgments of syllable number: *prism, file*
- consonantal onset and coda are frequent sites of phonotactic restrictions (syllabic licensing): in English the velar nasal [ŋ] is barred from the onset while in nonrhotic dialects [r] is banned from the coda

### [3] syllable parsing

- given VCV other things being equal, V.CV parse is preferred
- Fujimura's (1978) experiment  
starts with cluster with different points of articulation: *apta, atpa*, then shorten closure duration to that of a single stop—but formant transition cues conflict: CV transitions predominate over VC
- judgments of syllabic division are inferred rather than based on a direct phonetic percept.
- judgements based on possible word initial and word final clusters
- languages with no clusters at beginning and end of word will divide cluster: CVC.CVC (e.g. Korean). cf. English, Romance where V.CR (ál.ge.bra) but VR.CV (al.bér.ta)

- #bra is a possible word initial cluster while #rta is not
- syllabification parse here may be analogous to treating each syllable as if it were a word
- but if we get a consonant that is not permitted initially then syllabification goes against the Onset preference. Cf. Korean no velar nasal initially. V<sub>1</sub>V is parsed V<sub>1</sub>.V

tam	can	k*oŋ
tam-i	can-i	k*oŋ-i
'wall'	'cup'	'pheasant'

- cf. English *lamént* vs. *lémon*: [lɛ] not possible word-finally; thus lɛ.mon is not a good parse and [m] is perceived as ambisyllabic (straddles syllable boundary and belongs to both syllables)

[4]. **Stress**: will discuss later: phonetic correlates include greater muscular energy (subglottal pressure) with increased pitch and duration

[5]. **Length**

- long vs. short vowels: Latin, Czech, German; ratio of duration contrast is 1.3 : 1 up to 2: 1
- long (geminate) consonant: Italian 2 to 3 times longer
- both long vowels and consonants: Hungarian, Arabic, Japanese, Finnish
- inherent duration of vowels: low vowel [a] is 20-25 ms. longer than high vowel [i]
- in a CVC syllable more time is required for tongue to move from consonantal constriction to open low target in CVC syllable
- global effects:
  - the number of segments in a syllable and the number of syllables in a word can decrease the length of the individual segments
  - phrase-final lengthening
  - tempo: faster tempo compresses longer segments (vowels) more
- Many languages avoid long vowel in closed syllable
  - Italian lengthens stressed vowels of nonfinal syllable, but not when consonant in coda

fate	'do'	fat.te	'done'
177 ms.		126 ms.	D'Imperio & Rosenthal 1999

- Egyptian Arabic non-final closed-syllable shortening
 

baab	'door'	beet	'house'
bab-na	'our door'	bit-na	'our house'
- English: keep, kept

- Cf. Hungarian, which retains contrast

	V	C	
hal	151	182	duration in ms
hall	177	272	
a:l	285	172	
ne:z	287	198	
ne:zz	263	288	

#### [6] tone: pitch Fo

- gender: average of 130 Hz for adult males and 220 for females
- intrinsic F0: high vowels greater by c. 15 Hz (JND for speech is 10 Hz)
- not clear why; speaker control to enhance height contrast ?
- after voiceless obstruent F0 is 5-10 Hz greater (basis of tonogenesis); again apparently under speaker control to enhance voicing contrast

#### [7] tonogenesis

- in many Asian languages tones derive historically from the phonemicization of redundant F0 differences that accompany voiced vs. voiceless obstruents in syllable onset
- F0 is typically 5-10 Hz higher after a voiceless obstruent as opposed to a voiced one
- in tonogenesis the F0 difference is increased while the voicing contrast on the consonant is decreased and eventually lost resulting in a tonal contrast
- prevalent in East Asian languages
- example from Beijing Mandarin
- tone 1 [55] High and tone 2 [35] Rise both go back to the same level pitch category (*ping*) in Middle Chinese
- the category split as a function of the voicing of the onset consonant

	<u>Middle Chinese</u>	<u>Beijing Mandarin</u>	
voiceless (yin)	si	sī	[55] 'poetry'
	po	pō	[55] 'hillside'
voiced (yang)	zi	zí	[35] 'time'
	bo	pó	[35] 'old woman'

Punjabi tones (Bhatia 1975)	<u>Hindhi</u>	<u>Punjabi</u>	
	ghor-a	kōra	'horse'
	dhol	tòl	'drum'

- voiced aspirates devoice and deaspirate but with a low tone

#### [8] lexical tonal distinctions

- level tones

- two-way contrast: Lingala (Bantu Congo)

mo-tó	'head'	lo-lémo	'tongue'
mo-to	'person'	mo-ásí	'woman'
		mo-sisá	'vein'
		li-kolo	'leg'

- three-way contrast: Buli (Gur Ghana)

syúk	'path'
syūk	'navel'
syùk	'fish'

- contour tones

rise vs. fall	Thai	[Ladefoged CIP 10.4]			
high	ná:	'aunt'	rise	nâ:	'thick'
mid	nā:	'field'	fall	nâ:	'face'
low	nà:	'nickname'			

[9] register

- splits pitch space into an upper and lower region

Cantonese	[Ladefoged CIP Chapter 10 exercise G]
high	si 55 'poem'
mid	si 33 'to try'
low	si 22 'matter'
extra low	si 11 'time'
mid rise	si 35 'to cause'
low rise	si 13 'city'
high fall	si 53 'silk' [for many current speakers merges with 55]

- just as a vowel length contrast is often supplemented with a vowel quality contrast (e.g. Arabic) so a tonal height contrast is often accompanied by a laryngeal (voice quality) contrast so that breathy voice goes with lower tone

[9] F0 used for intonation contours in English

- declaratives have falling contour
- yes-no have rise
- rise also signals continuation, as in a list
- but these are just cross-linguistic tendencies; e.g. in Hungarian yes-no question ends in a fall

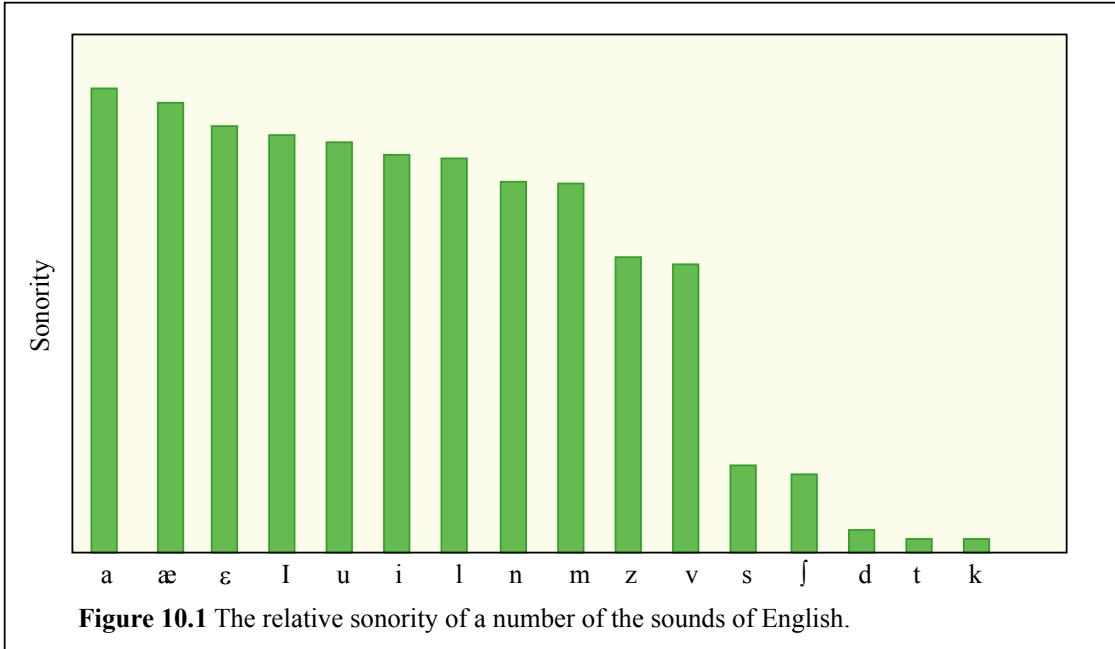


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