24.964

Phonetic Realization

Does Language-Specific Detail Affect Phonological Distribution?

Syllable Weight

Readings for next week:

- Kawahara, S. (2006). A faithfulness ranking projected from a perceptibility scale
- Jun, Jongho (2002). Positional faithfulness, sympathy and inferred input
  - background: Jun (2004), Jun (1995).

Syllable Weight

- Division of syllables into heavy vs. light (or more weight categories.
  - e.g. CV light, CVV, CVC heavy
- Heavy syllables attract stress, light syllables repel stress. E.g. Yana
  - Stress the first heavy syllable (CVC, CVV)
  - else stress the first syllable.

Yana stress

a. sibúmk'ai 'sandstone'

b. suk'ó:niya:, 'name of Indian tribe', ʒáuxauya: 'Hat Creek Indians', tsiniyá: 'no'

c. p'údiwi 'women'

Excerpted from Gordon, Matthew. "A Phonetically-driven Account of Syllable Weight." *Language* 78 (200): 51-80. Also in *UCLA Working Papers in Phonology* 2.

Syllable Weight

- It has been argued that syllable weight is relevant to many other areas of phonology (including distribution of contour tones, minimal word requirements).
- A central argument of Gordon (1999, 2004) is that different phenomena often diagnose inconsistent weight criteria and exhibit different typological patterns.
  - e.g. contour tone distribution depends on sonorous rhyme duration, syllable weight depends on perceptual energy of the rhyme.
- We will only look at weight as diagnosed by stress and metrics.

Cross-linguistic variation

- Weight criteria vary across languages.
- E.g. light heavy

CV |	CVC	CVV	Yana
CV	CVC |	CVV	Khalkha
CV |	CVC |	CVV	Chickasaw

Weight Distinction	Example Language(s)
CVV heavy	Khalkha
CVX heavy	Yana
CVV, CV[+son] heavy	Kwakwala
CVXX heavy	Pulaar Fula, (Hindi)
Low V heavy	Yimas
Nonhigh V heavy	Komi Jaz'va
Diphthongs heavy	Maori
Short central V light	Javanese
Short central V in open σ light	Malay
Short central V in open σ, Short central V[-son] light	Lamang

Image by MIT OpenCourseWare. Adapted from Gordon, Matthew. "A Phonetically-Driven Account of Syllable Weight." *Language* 78 (2000): 51-80. Also in *UCLA Working Papers in Phonology* 2·

Syllable weight typology

- Is there a more differentiated typlogy of weight distinctions?
- Gordon conflates all evidence for weight distinctions that bear on stress assignment, primary or secondary.
- E.g. Chickasaw secondary stress treats CVC and CVV as heavy, whereas phrasal primary stress (nuclear accent placement) makes a ternary distinction CVV > CVC > CV (Gordon 2004 IJAL).
- Weight criteria for secondary stress seem to be much more restricted.
  - Binary, even where primary stress is sensitive to a richer weight hierarchy (Chickasaw), also Pulaar (Wiltshire 2006, based on Niang 1997): primary stress falls on heaviest of CVVC > CVV > CVC > CV, secondary stress falls on everything heavier than CV, unless it would create stress clash.
  - Primary stress can be sensitive to vowel quality, maybe onsets. Secondary stress only seems to be sensitive to ‘traditional’ weight criteria (Hayes 1995).
  - But Nanta (Crowhurst and Michael 2005) is an exception to both of these generalizations.

- Nanti secondary stress is sensitive to vowel height, diphthongization (=duration?), vowel length, nasal coda.
- CVV > CVN > Ca > Ce, Co, Cɯi > Ci (maybe more)
- CV syllables of equal height only: iambic L->R stress

C. o.gó.te.ro	(o.gó).te].ro	'she will know it'
d. no.né.he.ro	(no.né).he].ro	'I will see it'
e. i.pì.ri.ní.te	(i.pì)(ri.ní).te]	'he sits'
f. o.kò.wo.gó.te.ro	(o.kò)(wo.gó).te].ro	'she harvests it'

- Lower vowels attract stress, disrupting alternation:

a > e	à.bʲe.tsi.kái	(**à.bʲe**)(tsi.kái)]
	'we.INCL made it again'	
a > o	à.wo.te.hái.gʒi.ri	(**à.wo**)(te.hái).gʒi].ri
	'we approached him/them'	
a > i	à.tsi.to.ká.kse.ro	(**à.tsi**)(to.ká).kse].ro
	'it crushed it'	
o > i	nò.gʒi.wo.tá.kse.ro	(**nò.gʒi**)(wo.tá).kse].ro
	'I placed it (vessel) mouth down'	

Image by MIT OpenCourseWare. The tables are adapted from: Crowhurst, Megan J., and L. Michael. "Iterative Footing and Prominence Driven Stress in Nanti (Kampa)." *Language* 81, no. 1 (2005): 47-95.

Syllable weight typology

- Possible difference between rhythmic, alternating secondary stress and culminative primary stress?
- Most of data in Gordon's survey involve primary stress assignment.

Constraints on syllable weight

- Gordon (2004): syllable weight affects stress via ‘Weight-to-Stress’ constraints (cf. Prince 1990, Prince & Smolensky 1993).
  - STRESS$[XX]_R$: CVV and CVC syllables are stressed.

Input: p' udiwi	One Stress	Stress $[XX]_R$	Align (σ́, L, PrWd)
→ p' údiwi			
p' udíwi			*!

Image by MIT OpenCourseWare. Adapted from Gordon, Matthew. "Syllable Weight." In *Phonetically-Based Phonology*. Edited by Robert Kirchner, Bruce Hayes, and Donca Steriade. New York, NY: Cambridge, 2004.

	Input: suk' o:niya:	One Stress	Stress $[XX]_R$	Align (σ́, L, PrWd)
→ (a)	suk' ó:niya:		*	*
(b)	suk' o:níya:		**!	**
(c)	suk' o:niya:	*!	**	
(d)	suk' ó:niyá:	*!		****
(e)	suk' o:niyá:		*	***!
(f)	súk' o:niya:		**!	

Image by MIT OpenCourseWare. Adapted from Gordon, Matthew. "Syllable Weight." In *Phonetically-Based Phonology*. Edited by Robert Kirchner, Bruce Hayes, and Donca Steriade. New York, NY: Cambridge, 2004.

Constraints on syllable weight

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  - STRESS$[XX]_R$: CVV and CVC syllables are stressed.
- Presumably also:
  - STRESS$[VV]_R$: CVV syllables are stressed.
  - STRESS$[V[+son]]_R$: CV[+son] syllables are stressed (CVV, CVN, etc).
  - STRESS$[V_{+low}]$: Ca syllables are stressed.
    - or should this be formulated to form a stringency hierarchy?
  - etc for all 'simple' weight criteria.
- Weight criterion depends on ranking of these constraints relative to edge alignment, rhythmic constraints etc.
  - CVC heavy: STRESS[VV]R, STRESS$[XX]_R$ >> ALIGN-L
  - CVC light: STRESS$[VV]_R$ >> ALIGN-L >> STRESS$[XX]_R$
- Ranking of Weight constraints depends on the 'phonetic effectiveness' of the associated weight distinction *in that language*.

Phonetic effectiveness

- Ternary etc weight distinctions are analyzed in terms of multiple binary weight distinctions.
  - CVV > CVC > CV = CVV > CV(C) and CVX > CV
  - STRESS[VV]$_R$ >> 'MC' >> STRESS[XX]$_R$ >> 'MC'
- Weight corresponds to perceptual loudness of the syllable rhyme.
- An effective weight distinction separates syllables into groups that are maximally distinct in loudness.
  - 'distinctions based on larger phonetic differences are easier to perceive and thus to learn...' (p.57)
  - quantified as the difference in mean loudness between the groups, averaging over all the syllable types in each group.

Phonetic effectiveness

- Graphically:

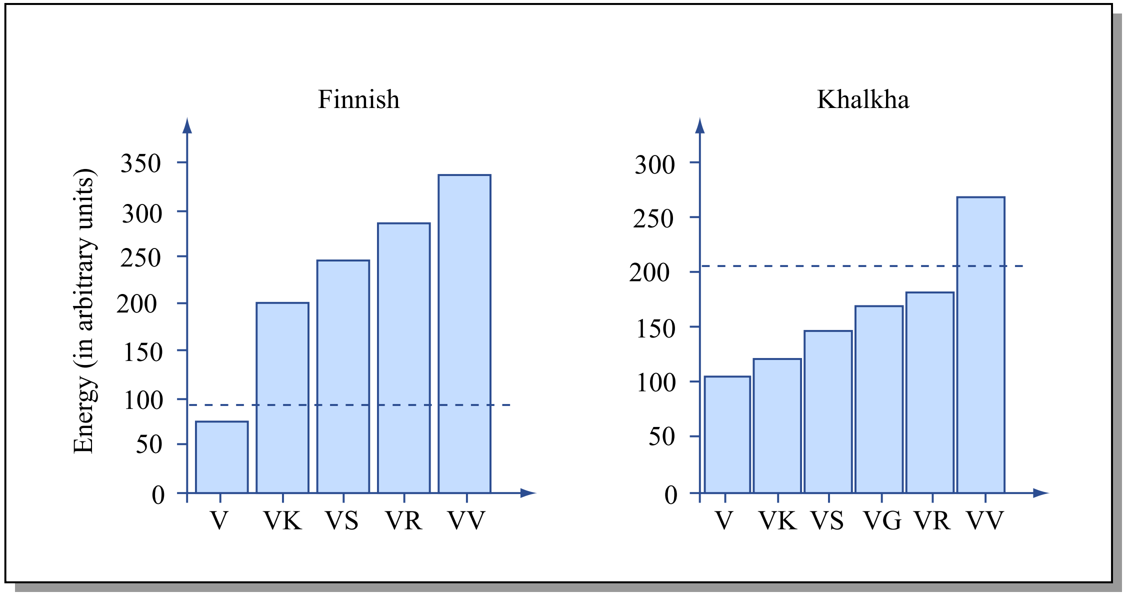
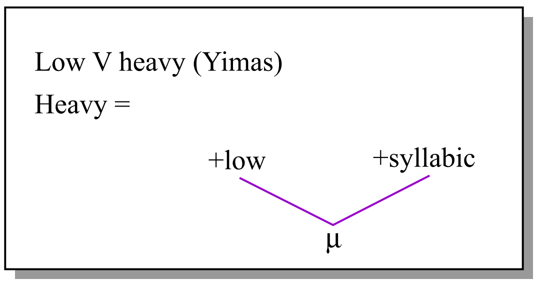


Image by MIT OpenCourseWare. Adapted from Gordon, Matthew. "Weight-by-Positon Adjunction and Syllable Structure." *Lingua* 112 (2002): 901-931.

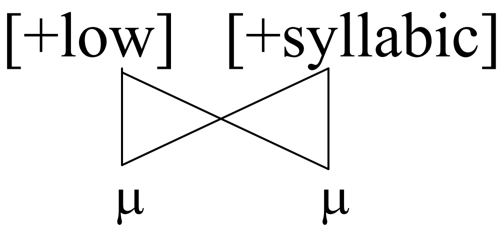
- Problem: sometimes the most effective weight distinction turns out to be (a) wrong and (b) unattested in any language.
  - e.g. Ca: & Cu: heavy and everything else light (Ci:, CVC, CV)
- Solution: impose a condition of 'structural simplicity' on weight criteria to eliminate the aberrant distinctions.

Structural complexity

- Weight criteria are constrained to be structurally simple (not complex).
- ‘A weight distinction is complex
  - if it refers to >1 association between place predicates and weight units
  - or if it makes reference to disjoint representations of the syllable.
- ‘place predicates’ = place features (inc. vowel features).
- OK:



Not OK: long low V heavy



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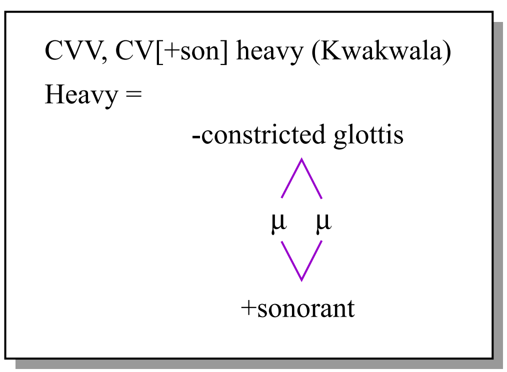
- OK:



Not OK: long V and CVL heavy

- V, L don’t form a natural class

Image by MIT OpenCourseWare. Adapted from Gordon, Matthew. *Syllable Weight: Phonetics, Phonology, and Typology*. Ph.D. dissertation, UCLA, 1999. New York, NY: Routledge, 2006.

Structural complexity

- The definition of complexity looks post hoc.
- Main roles seem to be:
  - excluding many weight distinctions based on vowel quality (could measure of loudness be wrong?)
  - letting CVT be heavy by virtue of being grouped with CVC (?).
- Not clear it's empirically correct. Nanti again: primary stress falls on the heaviest syllable in the word.
  - Ca: > Coi, etc implies a binary split: Ca: vs. everything else

Quant > Qual: Vowel quality determines choice between CVV syllables		
aa > oi	ja.máa.ta.kòi.ga.nà.kse	(ja.máa)(ta.kòi)(ga.nà).kse]
	'they.MASC floated [it] away'	
aa > ii	i.tìŋ.ka.ráa.ʃii.gʒi	(i.tìŋ)(ka.ráa).ʃii.gʒi]

Image by MIT OpenCourseWare. Adapted from Gordon, Matthew. *Syllable Weight: Phonetics, Phonology, and Typology*. Ph.D. dissertation, UCLA, 1999. New York, NY: Routledge, 2006.

Perceptual energy

- Approximate measure of perceptual loudness
- Basic idea: integrate intensity over the duration of the rhyme.
  - reflects intensity and duration, widely cited correlates of stress.
  - for a fixed intensity, longer sounds are perceived as louder, up to a certain duration (200-300 ms) - i.e. the hearing system integrates acoustic energy over some window.
- Calculated average intensity of each rhyme segment in dB.
- Convert each to perceived loudness relative to a reference vowel in the same word, using perceived loudness scale for pure tones.
- Multiply relative loudness value of each segment by its duration and sum.

Predicting weight criteria

- The goal is to predict weight criteria from the language-specific distribution of perceptual energy measures across syllable types.
  - E.g. predict whether CVC is heavy or light.
- Hypothesis: a language uses the most effective weight distinction(s) from among the structurally simple distinctions.
  - Can't predict whether a language is quantity sensitive or how many distinctions it will make.
- Or: the ranking of weight-to-stress constraints follows the phonetic effectiveness of the associated weight distinction.
- Test: study of six languages with diverse weight criteria.

Study

Language	Weight Distinction
Chickasaw	CVV > CVC > CV
Telugu	CVV > CVC > CV
Khalkha	CVV > CVC, CV
Japanese	CVX > CV
Finnish	CVX > CV
Javanese	Short central V light

Image by MIT OpenCourseWare. Adapted from Gordon, Matthew. "A Phonetically-Driven Account of Syllable Weight." *Language* 78 (2002): 51-80.

Study

- 1 speaker per language
- Measured syllables from a sample of two-syllable words.
- Included vowels /i, u, a/ where available, and a selection of coda consonants (stops, fricatives, sonorants if possible).
  – no long Vs in closed syllables.
- E.g. Finnish

la	li	nu	na:	li:	nu:
lam	lim	lum			
mal	mil	mul			
mar	mir	mur			
las	nis	mus			
mat	mit	mut			

- Is this a representative sample for estimating the average loudness of syllable types?
- Not a full set. Evidence in Gordon (2002, Lingua) that the full set of possible codas plays a role in determining the weight of CVC.

Results - Chickasaw

SIMPLE				COMPLEX			
DISTINCTION	DIFF	W-λ	P-VAL	DISTINCTION	DIFF	W-λ	P-VAL
				/a:/heavy	100	.657425	.0000
				/a:,u:/ heavy	100	.657425	.0000
VV heavy	**80.6**	**.603375**	**.0000**				
				/a:,i:/ heavy	80.6	.603375	.0000
				VV, a[+ son] heavy	73.3	.581391	.0000
				VV, a[+ nas] heavy	72.5	.612845	.0000
				V, hi V [+ dor] light	71.6	.796293	.0000
VX heavy	**71.5**	**.862489**	**.0000**				
VXX heavy	67.8	.799441	.0000				
VV, V[+ son] heavy	64.8	.661233	.0000				
VV, V[+ voi] heavy	56.3	.760122	.0000				
VV, V[+ cont] heavy	55.9	.747150	.0000				
VV, V[- nas] heavy	31.7	.934154	.0006				
+ low V heavy	17.7	.974586	.0351				

Image by MIT OpenCourseWare. Adapted from Gordon, Matthew. "A Phonetically-Driven Account of Syllable Weight." *Language* 78 (2002): 51-80.

- Best two simple criteria are the actual criteria.
- Complexity excludes best criterion: /a:/ heavy.

Results - Chickasaw

- More results - see appendix.

Telugu

SIMPLE				COMPLEX			
HEAVY	DIFF	W-λ	P-VAL	HEAVY	DIFF	W-λ	P-VAL
				/a:,i:/ heavy	100	.677287	.0000
				/a:/ heavy	89.0	.866058	.0000
				hiV in open σ light	85.4	.764897	.0000
VX heavy	**79.5**	**.709650**	**.0000**				
VV heavy	**72.3**	**.760039**	**.0000**				
VV, V[+ voi] heavy	66.1	.613276	.0000				
VV, V[- nas] heavy	47.7	.823348	.0000				
VV, V[+ son] heavy	47.1	.780127	.0000				
VV, V[+ cont] heavy	36.7	.866472	.0000				
- back V heavy	30.5	.916773	.0007				
+ low V heavy	16.9	.974847	.0662				

Image by MIT OpenCourseWare. Adapted from Gordon, Matthew. "A Phonetically-Driven Account of Syllable Weight." *Language* 78 (2002): 51-80.

- CVV > CVC > CV
- complexity excludes V height distinctions.

Khalkha

SIMPLE				COMPLEX			
DISTINCTION	DIFF	W-λ	P-VAL	DISTINCTION	DIFF	W-λ	P-VAL
				VV, a[+ nas] heavy	100	.634865	.0000
				VV, a[+ lab] heavy	99.1	.707726	.0000
VV heavy	**89.7**	**.832069**	**.0000**				
VX heavy	48.1	.948532	.0047				
VV, V[+ son] heavy	43.9	.878960	.0000				
VV, V[+ voi] heavy	38.8	.905707	.0001				
VV, V[+ cont] heavy	13.9	.988034	.1769				
VV, V[- nas] heavy	13.5	.990921	.2398				
+ low V heavy	11.9	.991083	.2441				
VV, V[- son] heavy	2.9	.999471	.7770				

Image by MIT OpenCourseWare. Adapted from Gordon, Matthew. *Syllable Weight: Phonetics, Phonology, and Typology*. PhD. dissertation, UCLA, 1999. New York, NY: Routledge, 2006.

- CVV heavy
- complexity excludes V height/coda distinctions (‘disjunct’)
  - only labial coda in sample is [m].

Japanese

SIMPLE				COMPLEX			
DISTINCTION	DIFF	W-λ	P-VAL	DISTINCTION	DIFF	W-λ	P-VAL
VX heavy	**100**	**.435783**	**.0000**				
VV, V[+ son] heavy	100	.435783	.0000				
VV, V[+ voi] heavy	100	.435783	.0000				
VV, V[+ nas] heavy	100	.435783	.0000				
				V, hiV[- nas] light	100	.435783	.0000
				V, hiV[+ cont] light	100	.435783	.0000
				V, hiV[- son] light	100	.435783	.0000
				V, hiV[- voi] light	100	.435783	.0000
				V, hiV[+ dor] light	100	.435783	.0000
				VV, V[- dor] heavy	100	.435783	.0000
				VV, V[- cont] heavy	100	.435783	.0000
VV heavy	17.5	.982682	.1767				
VV, V[+ cont] heavy	17.5	.982682	.1767				
VV, V[- nas] heavy	17.5	.982682	.1767				
				VV, V[- voi] heavy	17.5	.982682	.1767
				VV, V[- son] heavy	17.5	.982682	.1767
+ low V heavy	11.3	.991636	.3488				
- back V heavy	5.6	.997915	.6405				

Image by MIT OpenCourseWare. Adapted from Gordon, Matthew. "A Phonetically-Driven Account of Syllable Weight." *Language* 78 (2002): 51-80.

- CVV, CVC heavy in poetry
- questionable because obstruent codas were excluded.

Finnish

SIMPLE				COMPLEX			
HEAVY	DIFF	W-λ	P-VAL	HEAVY	DIFF	W-λ	P-VAL
VX heavy	100	**.431361**	**.0000**				
				V, hiV[+ dor] light	100	.431361	.0000
				V, V[+ dor] light	100	.431361	.0000
				VV, V[- dor] heavy	100	.431361	.0000
				hiV in open σ light	99.5	.603583	.0000
VV, V[+ son] heavy	62.6	.554805	.0000				
VV, V[+ voi] heavy	62.6	.554805	.0000				
VV, V[+ cont] heavy	57.2	.628306	.0000				
VV heavy	53.8	.835684	.0000				
VV, V[- nas] heavy	52.8	.735541	.0000				
- back V heavy	12.0	.985190	.1161				
+ low V heavy	1.1	.999879	.8872				

Image by MIT OpenCourseWare. Adapted from Gordon, Matthew. "A Phonetically-Driven Account of Syllable Weight." *Language* 78 (2002): 51-80.

- CVV, CVC heavy
- Complexity excludes height/coda place distinctions.

Javanese

HEAVY	DIFF	W λ	P-VAL
Short central V in open σ light	100	.828389	.0000
Short central V light	**65.5**	**.721594**	**.0000**
V[+ cont] heavy	55.9	.740907	.0000
VX heavy	53.3	.864457	.0001
V[- dor] heavy	53.3	.864457	.0001
V[- lab] heavy	53.3	.864457	.0001
V[+ cor] heavy	53.3	.864457	.0001

Image by MIT OpenCourseWare. Adapted from Gordon, Matthew. "A Phonetically-Driven Account of Syllable Weight." *Language* 78 (2002): 51-80.

- Short central V light
- incorrect prediction.

The role of structural complexity

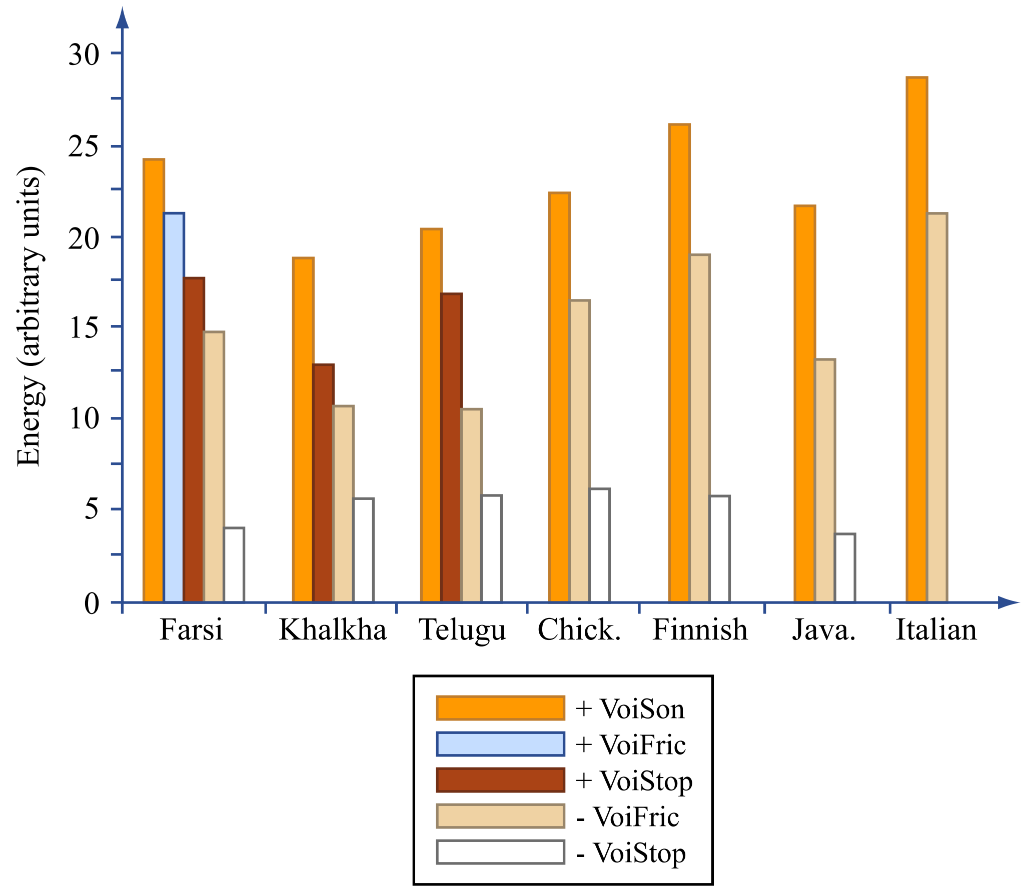
- Complexity restriction eliminates incorrect predictions of the phonetic effectiveness criterion.
- But perceptual energy measure is rather approximate, and only a subset of syllable types is examined in each language, so could the measure itself be at fault?
- In particular, could it overestimate loudness differences due to vowel height?
- Lehiste and Peterson (1959) found some evidence that listeners compensate for differences in ‘inherent’ intensity of vowels in making loudness judgements:
  - subject produced vowels at a normal level, then with equal intensity.
  - listeners judged relative loudness of pairs of vowels.
  - almost always picked higher effort vowel even if intensity was lower.
- However this kind of loudness measure might have trouble accounting for sonority-sensitive stress.

The role of structural complexity - heavy CVT

- Voiceless stops should have near zero intensity and therefore should contribute little to the perceptual energy of a CVT syllable.
- A few languages only count CV[+son] as heavy (e.g. Kwakwala), but in most cases, if CVC counts as heavy that includes syllables with coda voiceless stops.
- Do these syllables only get to be heavy by virtue of being grouped with other CVCs by the complexity condition?
- Gordon does not consider ‘CVC with syllables other than (voiceless) stops’
- CVV, CV[+voi] generally does significantly worse than CVV, CVC.

Heavy CVT

- Gordon 2002 *Lingua*

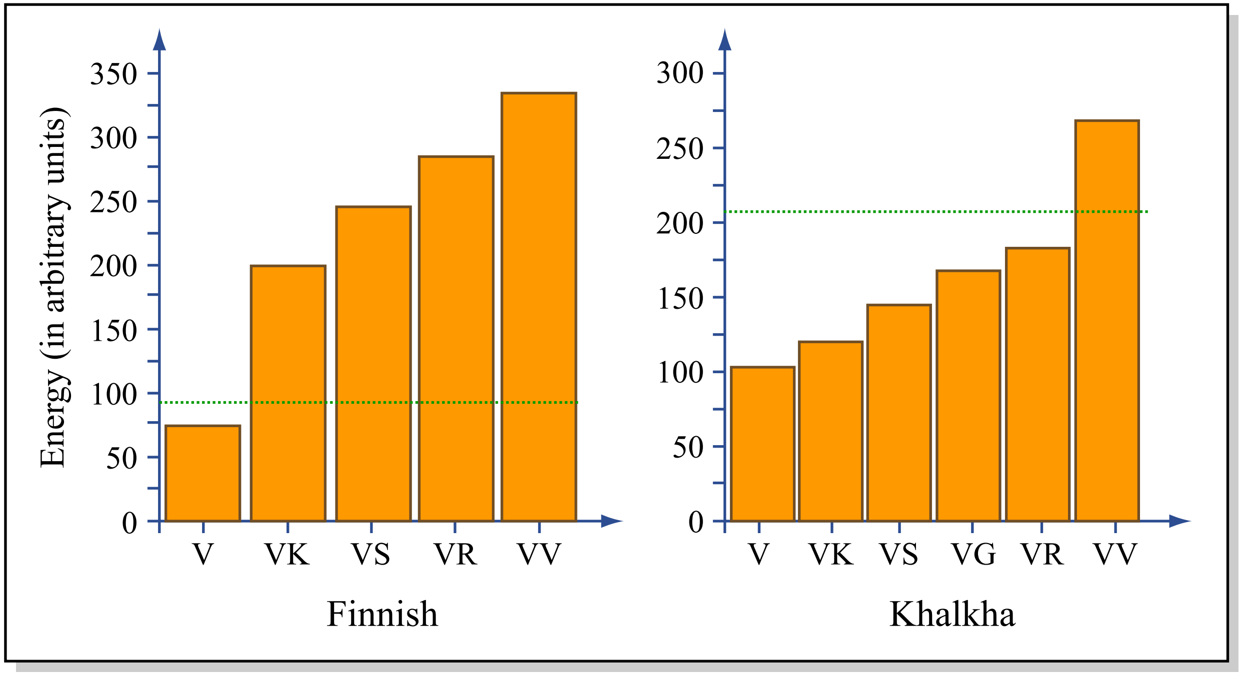


Energy values for various codas in seven languages

Image by MIT OpenCourseWare. Adpated from Gordon, Matthew. "Weight-by-Positon Adjunction and Syllable Structure." *Lingua* 112 (2002): 901-931.

Heavy CVT

- Gordon 2002 *Lingua*



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Heavy CVT

- Certainly Gordon (2002 Lingua) shows that a language is more likely to count CVC as heavy if a greater proportion of permitted codas are voiced/sonorant.
- Interpretation:
  - average energy of CVC as a class will be greater if more members of that class contain high energy codas.
  - if average energy of CVC is higher, a CVC/CVV vs. CV weight division is likely to better separated than CVV vs. CVC/CV.
  - So CVT may not be heavy by virtue of being loud - it may be heavy by virtue of being a member of a class that is loud on average.
- Note that CVX is the most effective weight distinction based on rhyme duration in all languages except Javanese (where it is 2nd).

Is there evidence for effects of language-specific phonetics on syllable weight?

- The average energy of a given class of syllables varies across languages, but this could be due to differences in the members of the class.
- Gordon (2002 Lingua) shows that it is possible to predict quite accurately whether CVC is heavy or light from the variety of consonants that are permitted in coda.
  - higher voiced/voiceless ratio -> CVC more likely to be heavy
  - higher sonorant/obstruent ratio -> CVC more likely to be heavy.
- Language-specific durational effects such as closed syllable shortening/lengthening or coda lengthening after short vowels should affect phonetic effectiveness.
  - There is some evidence that these effects play a role in the differences between Khalkha and Finnish

Khalkha vs. Finnish

- Finnish CVC heavy

Khalka CVC light

SIMPLE			
HEAVY	DIFF	W-λ	P-VAL
VX heavy	**100**	**.431361**	**.0000**
VV,V[+ son] heavy	62.6	.554805	.0000
VV,V[+ voi] heavy	62.6	.554805	.0000
VV,V[+ cont] heavy	57.2	.628306	.0000
VX heavy	53.8	.835684	.0000

Image by MIT OpenCourseWare. dapted from Gordon, M. "Weight-by-Positon Adjunction and Syllable Structure." *Lingua* 112 (2002): 901-931.

SIMPLE			
DISTINCTION	DIFF	W-λ	P-VAL
VV heavy	**89.7**	**.832069**	**.0000**
VX heavy	48.1	.948532	.0047

Image by MIT OpenCourseWare. dapted from Gordon, M. "Weight-by-Positon Adjunction and Syllable Structure." *Lingua* 112 (2002): 901-931.

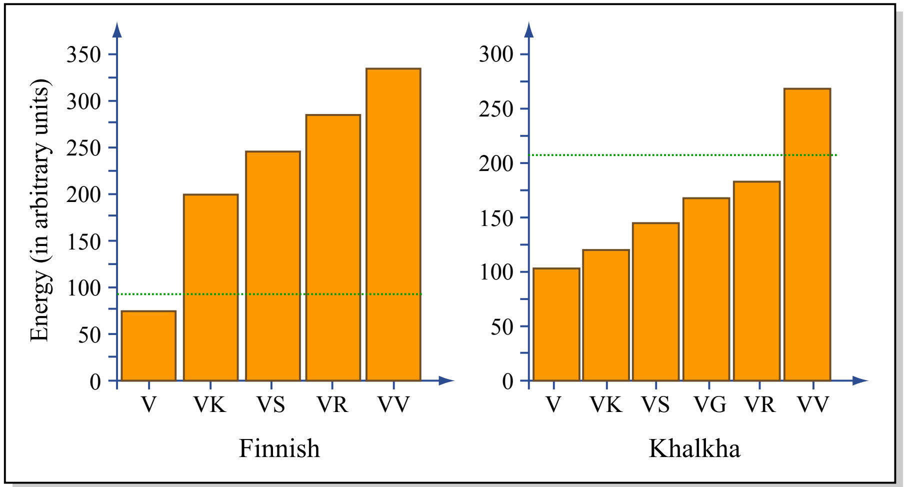


Image by MIT OpenCourseWare. Adapted from Gordon, Matthew. "Weight-by-Positon Adjunction and Syllable Structure." *Lingua* 112 (2002): 901-931.

Khalkha vs. Finnish

- Finnish CVC heavy Khalka CVC light
- The Finnish speaker has substantial closed syllable V lengthening in Khalkha V duration is uniform across open/closed syllables.
  - Gordon cites Leskinen & Lehtonen for CSL in S.Finnish, but not observed in Isei-Jaakkola (2004) (3 speakers) or Lehtonen (1970) for Helsinki Finnish. Isei-Jaakkols observes CSS for long Vs.

Duration (in ms) of short /a, u/ in open syllables and syllables closed by /m, r, l, s/.

LANGUAGE	WEIGHT DISTINCTION	OPEN SYLL.	STD.DEV.	CLOSED SYLL.	STD.DEV.
Khalkha	CVV > CV(C)	**70.3**	8.9	**70.2**	12.6
Finnish	CVX > CV	**73.0**	15.2	**99.3**	10.5

Image by MIT OpenCourseWare. Adapted from Gordon, Matthew. "A Phonetically-Driven Account of Syllable Weight." *Language* 78 (2002): 51-80.

- Japanese (CVC) heavy also has a relatively general pattern of closed syllable lengthening.

Khalkha vs. Finnish

- Broselow et al (1997) postulate a connection between closed syllable shortening and weight of CVC on the basis of comparisons between Hindi (CVC heavy) and Malayalam (CVC light):

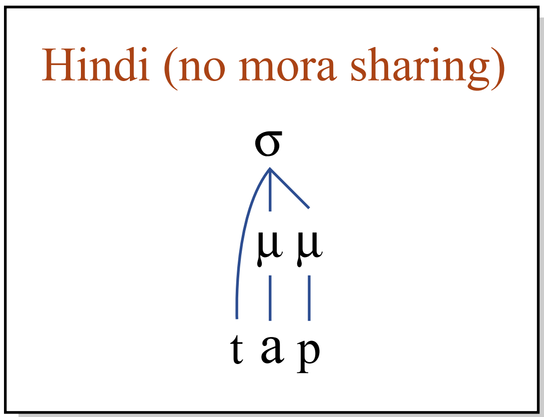


Image by MIT OpenCourseWare. Adapted from Gordon, Matthew. "A Phonetically -Driven Account of Syllable Weight." *Language* 78 (2002): 51-80. Referencing Broselow, E., S. Chen, and M. Huffman. "Syllable Weight: Convergence of Phonology and Phonetics." *Phonology* 14 (1997): 47-82.

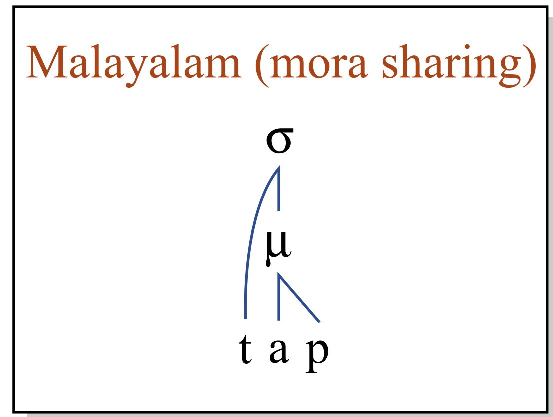
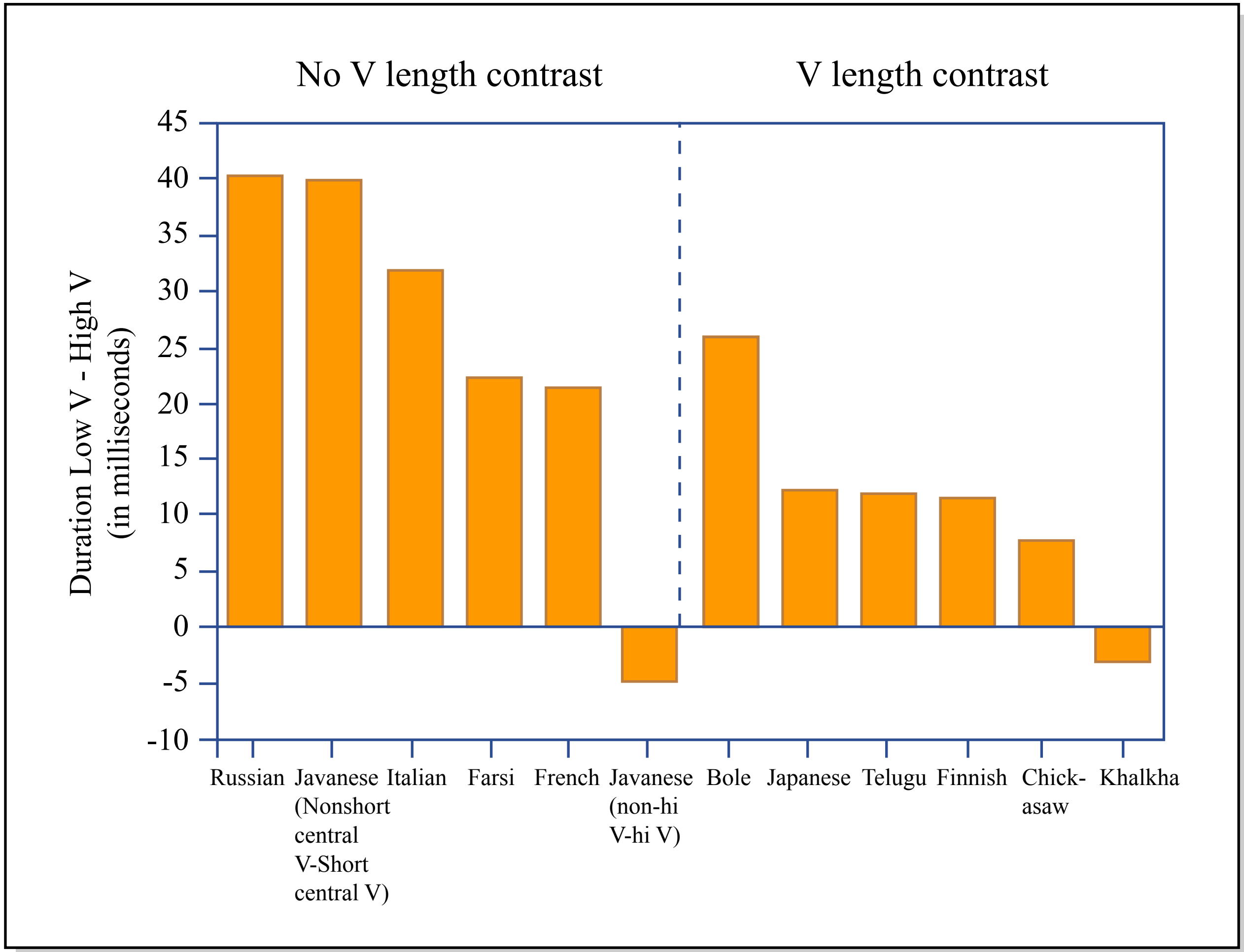


Image by MIT OpenCourseWare. Adapted from Gordon, Matthew. "A Phonetically -Driven Account of Syllable Weight." *Language* 78 (2002): 51-80. Referencing Broselow, E., S. Chen, and M. Huffman. "Syllable Weight: Convergence of Phonology and Phonetics." *Phonology* 14 (1997): 47-82.

- Gordon shows that correlation does not hold up in general (witness Khalkha - CVC light, no CSS; CSL in Finnish, Japanese unexplained), but CSS would reduce energy of CVC whereas CSL raises it.

Low vowel duration and height-sensitive weight

- There are no studies of languages in which syllable weight depends on vowel height (e.g. non-high vowels are heavy).
- This criterion does not fare well in the languages above. It does emerge as the best criterion in French, a quantity insensitive language (Gordon 1999).
- Gordon hypothesizes that a phonological factor (vowel length contrast) affects the length of low vowels, which in turn affects the effectiveness of V height as a weight criterion. (Phonology->Phonetics->Phonology).
- Observation: Languages that have vowel height as their only weight criterion do not have vowel length contrasts.
- Hypothesis: low vowel lengthening is restricted in languages with length contrasts to maintain the distinctiveness of length.
- A smaller duration difference between high and low makes height less effective as a weight criterion since energy depends on duration.



- French shows a relatively large low/non-low difference and this is the only language in which this distinction emerges as effective.
- Most languages with vowel length show a smaller duration difference based on vowel height.

Image by MIT OpenCourseWare. Adapted from Gordon, Matthew. "A Phonetically-Driven Account of Syllable Weight." *Language* 78 (2002): 51-80.

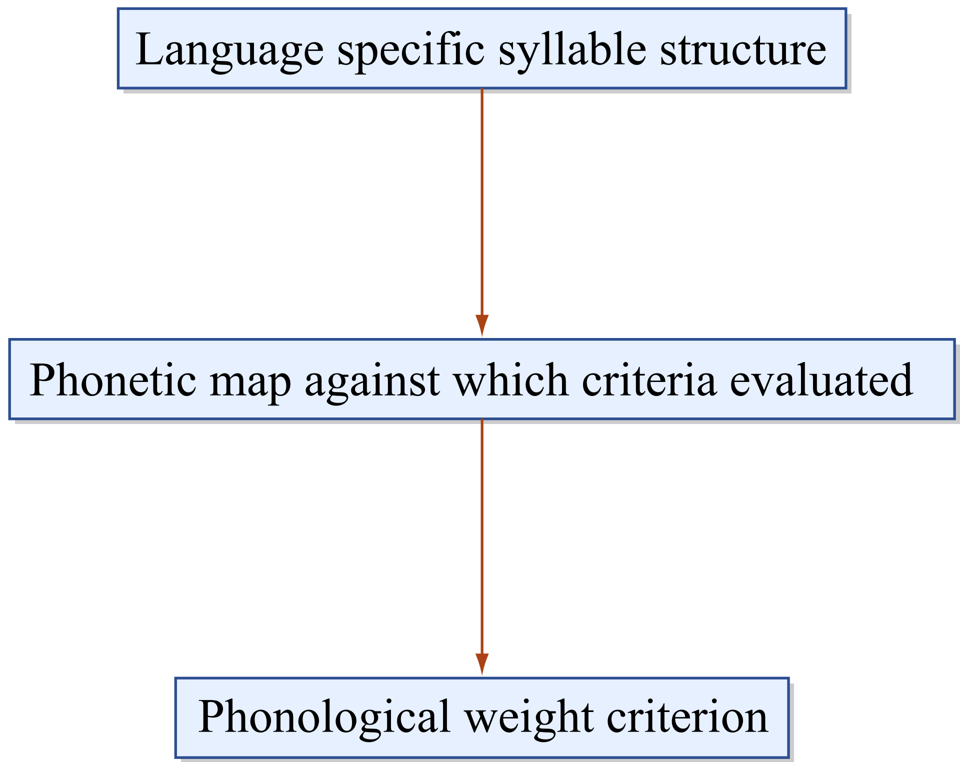
Low vowel duration and height-sensitive weight

- Only low and high vowels were studied - mid vowels could complicate matters.
  - low vs. mid+high / high vs. mid+low are likely to be less effective.
  - Some languages make low > mid > high weight distinctions
- Languages like Nanti and Asheninca with contrastive length and V height contributing to weight could be problematic - the evidence is that low vs. non-low is ineffective in languages with long vowels.

Is there evidence for effects of language-specific phonetics on syllable weight?

- The model predicts the existence of such effects, but direct evidence is rather limited.
- Gordon argues that many of the relevant language-specific phonetic differences are actually predictable from phonological properties of the languages (coda inventories, vowel length contrasts). But the effects of these factors can only be understood via their effects on details of phonetic duration.
- The phonetic property that the model appeals is not observable in individual forms: average perceptual energy of a class of syllables.

Gordon's model of phonetics-phonology interaction



The proposed model of syllable weight

- Suggests that weight criterion may also affect phonetic realization (Lingua, 2002).

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