Linguistics 219
Phonological Theory III

Spring 2018
B. Hayes

Class 17, 5/30/2018: Syllable Weight II

1. Assignments

- Hand in Homework #5 (Indonesian stress).
- Read: Liberman, Mark and Janet Pierrehumbert (1984) Intonational invariance under changes in pitch range and length. In Mark Aronoff and Richard Oerhle (eds), *Language Sound Structure*. Cambridge: MIT Press, 157–233.
- Make your appointment to give a talk to me, with handout.

MORE ON SYLLABLE WEIGHT

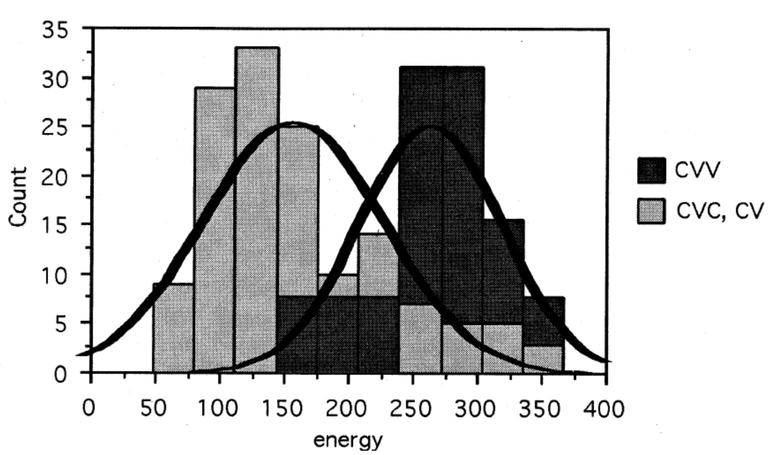
2. Reviewing Gordon's approach

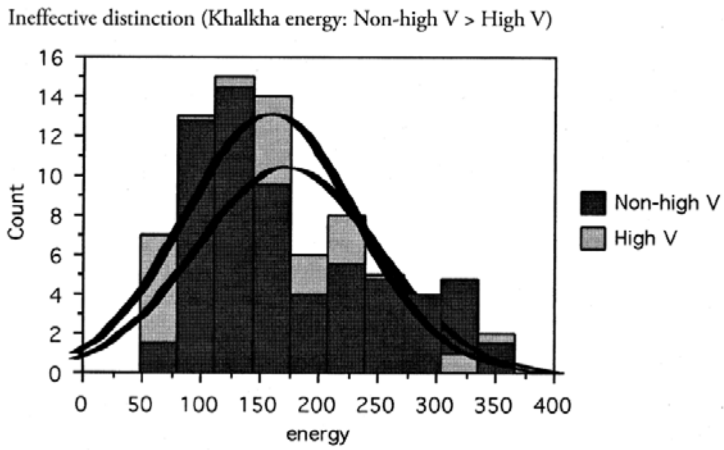
- Phonology is phonetically sensible — the right criterion of weight is one in which (for that language) heavy syllables sound more prominent.
  - ➢ We can assess sensibleness against **maps**, which express aggregate phonetic experience.
- Phonology is formally symmetrical — the criterion is simple, even in a more complex criterion would achieve better fit to the map.

3. Review: fit to map

- Sample comparison:

Effective distinction (Khalkha energy: CVV > CVC, CV)





- ➢ Gordon finds an appropriate statistic to assess this degree of fit.

4. Simplicity

- Book, p. 134: "A weight distinction is complex iff: it refers to more than one place predicate OR it makes reference to disjoint representations of the syllable.

Table 4.2. Weight distinctions and their phonological dimensions

	Predicates	Dimension	
		Non-place	Place
CVV(C) heavy	$[X]_R$ | +syllabic $[X]_R$ | +syllabic	4	0
CVV(C), CVC heavy	$[X]_R$ $[X]_R$	2	0
CVV(C), CVR heavy	-const.gl. | $[X]_R$ | +sonorant -const.gl. | $[X]_R$ | +sonorant	6	0
CVVC, CVCC heavy	$[X]_R$ $[X]_R$ $[X]_R$	3	0
Non-high V heavy	-high | $[X]_R$ | +syllabic	2	1
Low V heavy	+low | $[X]_R$ | +syllabic	2	1

5. Allowed under the complexity criterion

- vowel height cutoffs, alone
- branching rhyme

- [+syllabic] segments
- has onset, no onset

6. Not allowed

- E.g., blend of the above: "Stress the leftmost long low vowel of the word."

7. Success

- The observed criteria do seem to single out what gets used; and both of them are needed.
- The theory has teeth: it is *committed* to some consistent relative patterns, which emerge from the map.
  - CVV is always heavier or equal to CVC.
  - CVC always heavier or equal to CV.
  - Onset-based distinctions will not trump rhyme ones.
  - Vowel height distinctions will not trump rhyme-length distinctions
  - No reversed vowel height distinctions.
- These implications have been extensively investigated since then by Kevin Ryan and seem to be holding up well.

8. Gordon's exterminationism with respect to moras, etc.

- Moras provide little explanatory payoff if they are not a parameter set by language.
  - Indeed, they fail to cover compensatory lengthening under onset loss, which exists; work of Kavitskaya, Loporcaro, Topintzi
- Indeed, as noted, Gordon finds process-specific tendencies in weight — exactly what we would expect if the work is done by the constraint system, not parameters.
- So Gordon is an exterminationist regarding syllable structure and segmental slots:
  - Segment slots are X's (one per "segment")
  - Vowels bear the good-old feature [+syllabic].
  - All the work goes into the constraint system, which refers to the structural properties relevant to weight.

GRADIENCE AND RYAN'S LAW

9. Ryan's Law

- Where syllable weight is treated gradiently/statistically, virtually all criteria get accessed.
- The Gordonian primordial slime does not disappear once the categorical weight criterion is extracted!
  - Stochastic phonology and metrics still can "see" gradient phonetics.

10. An early study: Kelly on English

- Source

- Michael H. Kelly (2004) Word onset patterns and lexical stress in English. *Journal of Memory and Language* 50: 231–244.

- (See also his prescient work with Martin
  - Michael H. Kelly and Susanne Martin (1994) Domain-general abilities applied to domain-specific tasks : Sensitivity to probabilities in perception, cognition, and language. *Lingua* 92: 105-140.)
- Basic generalization: the more consonants an English disyllable begins with, the more likely it will have initial stress.
- Corpus study (electronic lexicon):

Number of onset consonants	Number trochaic	Number iambic	Proportion trochaic
0	441	806	.35
1	2862	295	.69
2	783	158	.83
3	40	1	.98

- This is *superposed* on the well-known noun-verb difference (*SPE*); so in fact there is *ganging*:

Number of onset consonants	Number trochaic	Number iambic	Proportion trochaic
Nouns	2411	646	.79
0	274	102	.73
1	1689	475	.78
2	429	68	.86
3	19	1	.95
Verbs	648	1228	.35
0	43	485	.08
1	468	667	.41
2	129	76	.63
3	8	0	1.00
Adjectives	966	183	.84
0	107	90	.54
1	632	81	.89
2	214	12	.95
3	13	0	1.00

- Wug test: "how would you stress this?" Pairs with C-, CC-, splitting subjects so no one sees both in the same pair.
  - Try this out on your *Sprachgefühl*:

No prefix	Prefix
beldop–breldop	colvane–crolvane
bolay–brolay	conzee–cronzee
botest–blotest	covact–clovact
corlax–clorlax	formand–flormand

dolmak–drolmak
feslak–freslak
fonjoob–flonjoob
fontrain–flontrain
garlag–glarlag
menlee–smenlee
mernak–smernak
pinjub–plinjub
ransfoe–gransfoe
rignaz–grignaz
roncerp–troncerp
ronvoon–gronvoon
seldiz–sneldiz
torvoot–tworvoot
wispay–swispay
fornay–frornay
pernew–spernew
pernor–spernor
renell–drenell
telmate–trelmate
telpez–trelpez

- Result:

Mean Proportion of trochaic stress judgments in study 2 as a function of pseudoword onset (C or CC) and prefix on C pseudowords (present or absent)

Prefix	Onset structure	
	C	CC
Present	.67	.71
Absent	.60	.80

  - ➢ Note the rather larger effect in non-prefixed forms.

THE PRIMARY TESTING GROUND FOR RYAN'S LAW: CLASSICAL METER

11. Main reference

- Kevin M. Ryan (2011) Gradient syllable weight and weight universals in quantitative metrics. *Phonology* 28:413–454.
- This is the journal-distillation of part of his UCLA dissertation:
  - ➢ *Gradient Weight in Phonology*, UCLA diss., 2011

12. Some meters

- Greco-Latin dactylic hexameter

1		2		3		4		5		6	
L	B	L	B	L	B	L	B	L	B	L	
–	{–, ⏑⏑}	–	{–, ⏑⏑}	–	{–, ⏑⏑}	–	{–, ⏑⏑}	–	{–, ⏑⏑}	–	{–, ⏑}

- Some classicist terminology: L = "longum", B = "biceps"[1]
- Example from the *Iliad* (Ryan 2011, discussed below)

a. τριπλῇ τετραπλῇ τ᾽ ἀποτείσομεν, αἴ κέ ποθι Ζεὺς 1.128
trip.lɛːj]$_1$ tet.rap]$_2$lɛːj • t' a.po]$_3$tej.so.me]$_4$n aj .ke .po]$_5$t^{h}i z.dews]$_6$
– –]$_1$ – –]$_2$ – • ⏑ ⏑]$_3$ – ⏑ ⏑]$_4$ – ⏑ ⏑]$_5$ – –]$_6$

b. εἴ ταρ ὅ γ᾽ εὐχωλῆς ἐπιμέμφεται ἠδ᾽ ἑκατόμβης 1.065
ej .ta.r ^{h}o]$_1$ g' ew.k^{h}ɔː]$_2$lɛː • s e.pi]$_3$mem.p^{h}e.ta]$_4$j ɛː.d'
^{h}e.ka]$_5$tom.bɛːs]$_6$
– ⏑ ⏑]$_1$ – –]$_2$ – • ⏑ ⏑]$_3$ – ⏑ ⏑]$_4$ – ⏑ ⏑]$_5$ – –]$_6$

- Persian meters (tradition flourished ca. 600-1900; best ref. is Elwell-Sutton 1976; analysis in Hayes 1979)

a. ⏑ — — — ⏑ — — — ⏑ — — — ⏑ — — —
b. — ⏑ — — — ⏑ — — — ⏑ — — — ⏑ —
c. ⏑ – ⏑ – / {⏑ ⏑, –} – – / ⏑ – ⏑ – / {⏑ ⏑, –} –
d. — — ⏑ ⏑ — — ⏑ ⏑ — — ⏑ ⏑ —
e. — — ⏑ ⏑ — —⏑ — — ⏑ ⏑ —

- Hausa (Hayes and Schuh under revision)

{⏑ ⏑, —} — {⏑ ⏑, —} — {⏑ ⏑, —} — ⏑ —

13. Typology of quantitative verse

- Quantitative meter is a lot like stress-based meter in that it is usually
  - periodic (sequence of parallel constituents)
  - based on hierarchy — e.g. tetrameters are favored
  - prone to leaving out stuff at the end (catalexis)
  - It tends to require stricter adherence to the template at the end of the line.

[1] "Biceps" has a truly delightful plural, *bicipitia*.

- Quantity is "swamped" by stress, and so quantitative meter is largely found in stress-free, or weak-stress languages.

- Yet stress languages can nevertheless use quantity in verse — typically, they regulate only (or principally) the quantity of stressed syllables.
  - Old Norse, discussed by Ryan
  - Finnish, discussed by Ryan
  - The English quantitative verse of Gerard Manley Hopkins (Hayes and Moore-Cantwell, *Phonology* 2011)

- Unlike stress-based meter, quantity is sometime deployed in quite baffling, aperiodic meters
  - Greek lyric verse, also Sanskrit
  - Perhaps these anchored their irregular quantity patterns to a sung melody.

14. Early literature

- Earlier students (traditional classics scholars, and even the ancients themselves) had a sense that Ryan's Law is applicable in certain cases.
- But they didn't have statistical testing to prove their point.

15. Longum vs. biceps in Homer

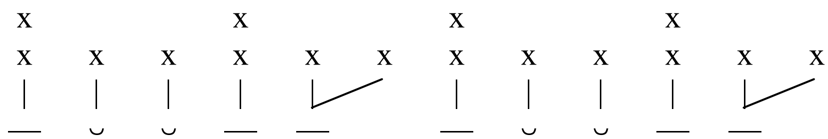
- Ryan downloaded and autoscanned the *Iliad* and *Odyssey*.
- He compared what *sort of* heavies occur in
  - longum (obligatory —) position
  - biceps (varies with ◡ ◡)
- Here is a simple result:

	VV rhyme	VC rhyme	VV : VC ratio
longum	75,931	58,862	1·290
biceps	19,143	8,946	2·140

16. Excursus: Why should *biceps* be the "stronger" position?

- Everyone always recited the dactylic hexameter as "DUM duh-duh DUM duh-duh DUM duh-duh DUM duh-duh DUM duh-duh DUM dum", right?
- This is not just an amateur intuition:
  - In a living tradition (work of Russ Schuh), Hausa musicians tend to sing heavy syllables on the strong beat.

- One option for Hausa singer/poets is to sing "longum" as a single *strong* beat, "biceps" as two weak beats:



  - ➢ If Homer sang thus, it would justify making the "weak" biceps longer than the "strong" longum.

17. A methodological factor that always plagues inferences about meter

- How do we factor out patterns, especially quantitative ones, that might be "inevitable", given the phonology and lexicon of the language?
- There arose a whole school of metrists, the "Russian school", that devoted thought to overcoming this difficulty.[2]

18. A very simple way to control in the case of Homer: just examine second syllables of words with the shape / — — /

	VV rhyme	VC rhyme	VV:VC ratio
longum	6,810	3,999	1·703
biceps	3,829	1,513	2·531

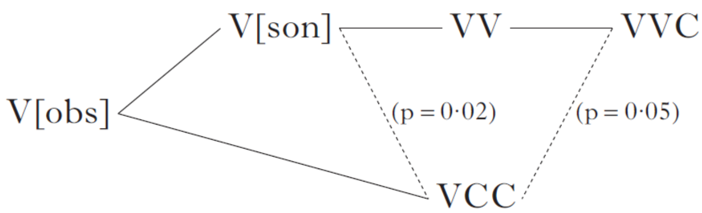
19. Doing it more carefully with modern statistics

- **Mixed-effects regression models** have fully taken over the world of statistical testing for experimental work, at least in linguistics.
  - ➢ You can factor out unwanted "noisy" effects from the behavior of individual subjects and test items — these are treated as **random effects**, whereas the general, meaningful things we are interested in are treated as **fixed effects**.
  - ➢ The testing returns not just a p-value,[3] but a baby theory, much like maxent, of how the domain under study works.
  - ➢ See Ryan p. 419 for references covering these models.
- Jesse Zymet is suggesting we may be headed this way for ordinary phonology — phonological processes may be more sensitive to particular lexical items than we have previously thought; these are his random effect.

[2] See my "Milton, maxent, and the Russian method", on my web site, for a frustrating attempt to apply the Russian method, with counterintuitive results.
[3] Indeed, p-values themselves have become quite controversial, and some scientific journals even forbid them.

- Ryan applies the method to his Greek data: the random effect here is "word context".
  - e.g., "I am a syllable preceded by ⏑ and followed by one single — in my word"
- The payoff is rigorous statistical testing, which ends up justifying an **extensive hierarchy** of weight criteria, which is quite sensible from a Gordonian point of view:

Hasse diagram for five rhyme types

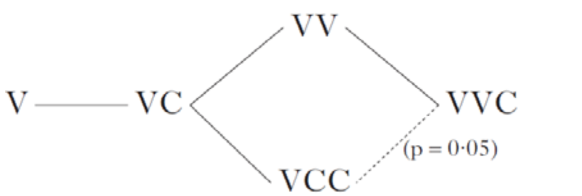


20. What about onsets?

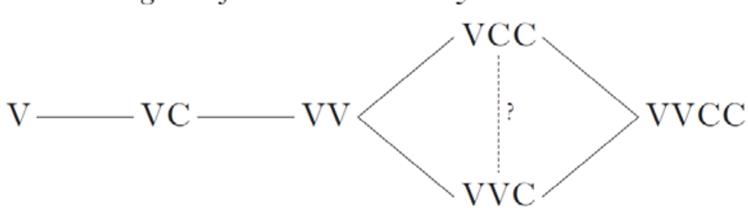
- These appear only in the dissertation, not the paper, but the result is the same:
  - with statistical significance, onset CC makes greater weight than onset C than onset null.

21. Other quantitative systems studied

Hasse diagram for Finnish rhyme skeletons



Hasse diagram for Old Norse rhyme skeletons



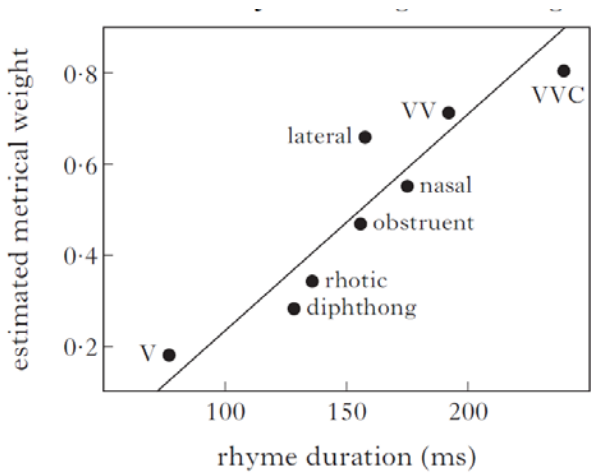
22. Tamil (poetry of Kamban, ca. 1200)

- This is by far the messiest, but nevertheless has a gradient orderliness:

Estimated weights of the rhyme types in Table IX

23. Tamil and phonetics

- Tamil is highly diglossic (acrolect, basilects).
- The acrolectal variety is phonologically very conservative.
- Amazingly, modern prestige speech, when measured by Ryan, provides syllable durations that match Kamban's scansions rather well.
- These rationalize the otherwise-baffling behavior of coda [j] and [r].

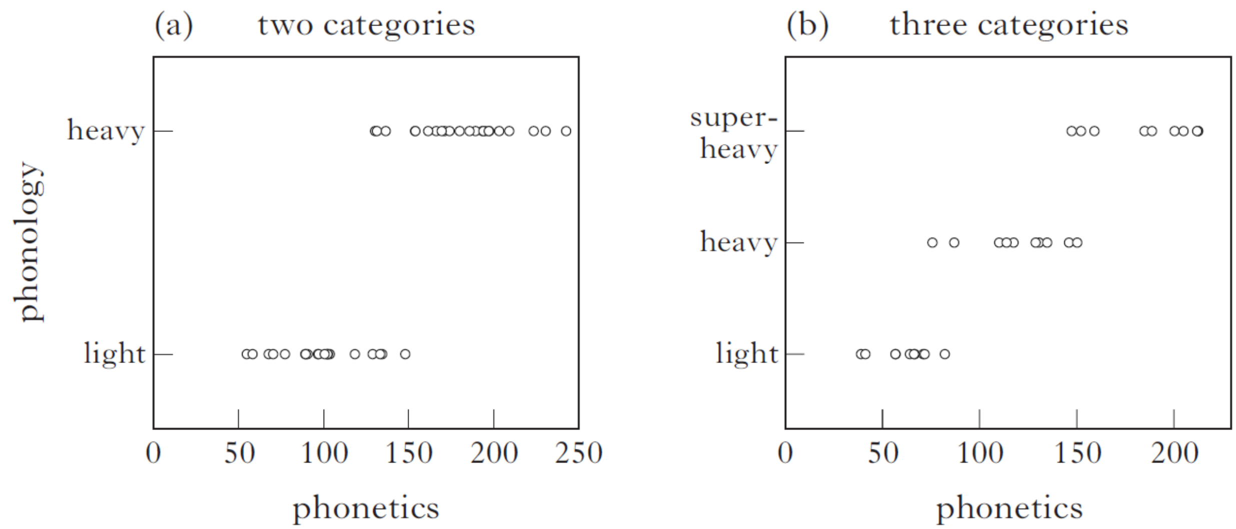


RYAN'S GRANDER CONCEPTION: THE GRADIENT CLOUD COEXISTS IN THE GRAMMAR WITH THE CRISP STRUCTURAL CONSTRAINTS

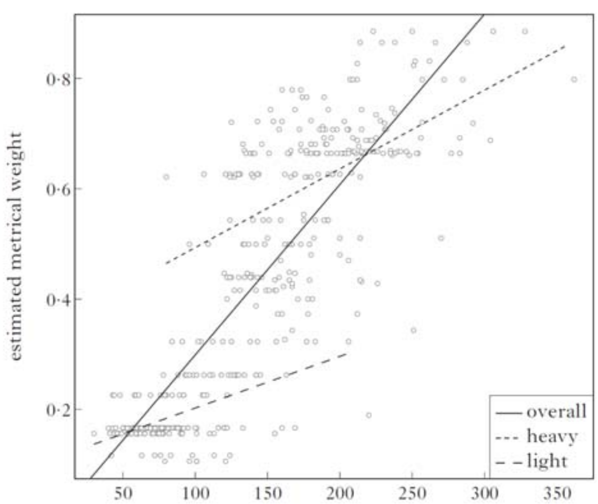
24. Scheme

- Suppose we place both structure-based and phonetics-based constraints in the same grammar.
  - ➢ Example of structure-based: Longum must be occupied by a bimoraic syllable.
  - ➢ Phonetics-based: penalize a syllable in Biceps to the extent that it falls short of the maximum in its normal range.
- The relative weights of these will be reflected in the distributions of syllable types.

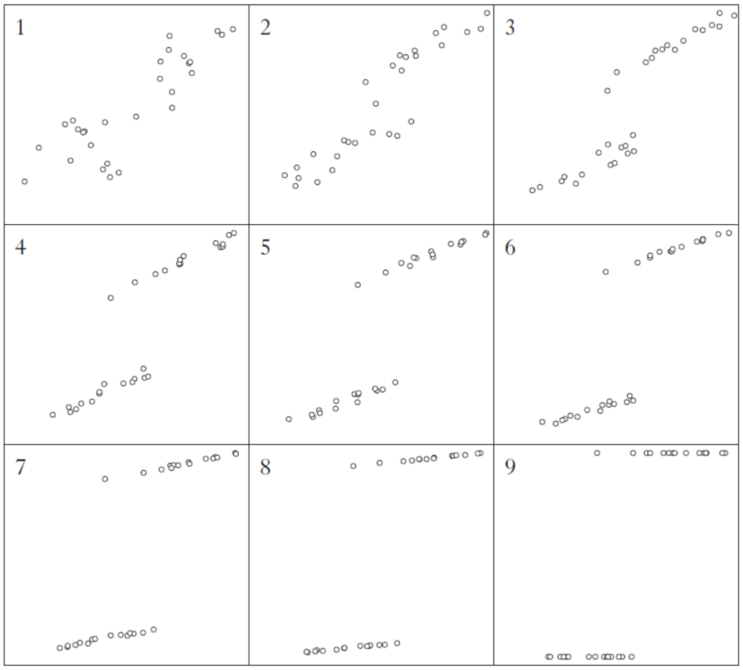
25. Example: systems with pure structure (hypothetical)



26. Tamil: an almost entirely phonetic system



27. The typology, based on degree of importance of structure/phonetic factors

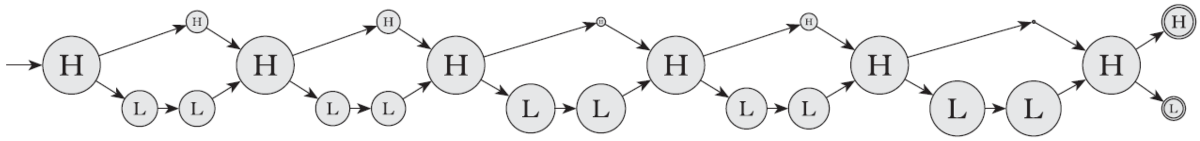


28. This addresses ancient questions

- Does phonology depend on phonetics?
- Is this dependency direct, or mediated in the formation of structural categories?
- Are structural categories arbitrary or do they too have a basis in phonetics?
  - ➢ Answer: look at the universal implications of weight that emerge from both Gordon and Ryan's work.

29. Thinking about gradience more generally

- Output gradience: outputs are generated with different frequency, or preferred gradiently in a rating task.
- Input gradience: reference to gradient phonetic properties on the map.
- There are four logically possible combinations, and in maxent only one is impossible: non-gradient outputs from gradient inputs.
  - ➢ This is because the maxent probability function is continuous (e^{-H})/Z and doesn't impose thresholds.
- What is Ryan finding in his work?
  - ➢ Nongradient outputs from non-gradient inputs: heavy syllables (in the general sense) in longum; this is exceptionless.
  - ➢ Gradient outputs from gradient inputs: the preference for phonetically heavier syllables in biceps than in longum.
  - ➢ Gradient outputs from non-gradient inputs: perhaps, the differing choices for manifesting the biceps position across the line in Homer:



30. What we've never been checking

- Most current stochastic phonology derives gradient outputs from structural (non-gradient) inputs.
- But perhaps this work sits atop an iceberg of unknown patterns; we typically don't check related phonetic factors in doing this work.

31. One more form of gradience to come

- Ryan predicts categorical outcomes (scansions) from gradient inputs (durations).
- In the last week, we will predict physically-gradient outcomes (F0, durations) from categorical inputs (phonemes, tones, syllables, phrasing).
- This is generative phonetics.