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

1. **Assignments**
   - Hand in Homework #5 (Indonesian stress).
   - Make your appointment to give a talk to me, with handout.

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 (Khallkha energy: CVV > CVC, CV)](image)

   - **Count**
     - 0
     - 5
     - 10
     - 15
     - 20
     - 25
     - 30
     - 35

   - **energy**
     - 0
     - 50
     - 100
     - 150
     - 200
     - 250
     - 300
     - 350
     - 400

   - **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>
<thead>
<tr>
<th>Table 4.2. Weight distinctions and their phonological dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Predicates</td>
</tr>
<tr>
<td>CVV(C) heavy</td>
</tr>
<tr>
<td>CVV(C), CVC heavy</td>
</tr>
<tr>
<td>CVV(C), CVR heavy</td>
</tr>
<tr>
<td>CVVC, CVCC heavy</td>
</tr>
<tr>
<td>Non-high V heavy</td>
</tr>
<tr>
<td>Low V heavy</td>
</tr>
</tbody>
</table>

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

- (See also his prescient work with Martin

- Basic generalization: the more consonants an English disyllable begins with, the more likely it will have initial stress.

- Corpus study (electronic lexicon):

<table>
<thead>
<tr>
<th>Number of onset consonants</th>
<th>Number trochaic</th>
<th>Number iambic</th>
<th>Proportion trochaic</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>441</td>
<td>806</td>
<td>.35</td>
</tr>
<tr>
<td>1</td>
<td>2862</td>
<td>295</td>
<td>.69</td>
</tr>
<tr>
<td>2</td>
<td>783</td>
<td>158</td>
<td>.83</td>
</tr>
<tr>
<td>3</td>
<td>40</td>
<td>1</td>
<td>.98</td>
</tr>
</tbody>
</table>

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

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

- 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*:

<table>
<thead>
<tr>
<th>No prefix</th>
<th>Prefix</th>
</tr>
</thead>
<tbody>
<tr>
<td>bel–beldop</td>
<td>colv–colvane</td>
</tr>
<tr>
<td>bolay–brolay</td>
<td>conzee–cronzee</td>
</tr>
<tr>
<td>botest–blotest</td>
<td>covact–covact</td>
</tr>
<tr>
<td>corlax–clorlax</td>
<td>formand–flormand</td>
</tr>
</tbody>
</table>
• 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)

<table>
<thead>
<tr>
<th>Prefix</th>
<th>Onset structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>CC</td>
</tr>
<tr>
<td>Present</td>
<td>0.67 0.71</td>
</tr>
<tr>
<td>Absent</td>
<td>0.60 0.80</td>
</tr>
</tbody>
</table>

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

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

11. Main reference

• 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
Some classicist terminology: L = “longum”, B = “biceps”

Example from the *Iliad* (Ryan 2011, discussed below)

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

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.

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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:

<table>
<thead>
<tr>
<th></th>
<th>VV rhyme</th>
<th>VC rhyme</th>
<th>VV : VC ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>longum</td>
<td>75,931</td>
<td>58,862</td>
<td>1.290</td>
</tr>
<tr>
<td>biceps</td>
<td>19,143</td>
<td>8,946</td>
<td>2.140</td>
</tr>
</tbody>
</table>

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:

x   x   x   x
x x x x x x x x x
| | | | |  | | | | |

- - - - - - - - -

➢ 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 / — — /

<table>
<thead>
<tr>
<th></th>
<th>VV rhyme</th>
<th>VC rhyme</th>
<th>VV:VC ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>longum</td>
<td>6,810</td>
<td>3,999</td>
<td>1.703</td>
</tr>
<tr>
<td>biceps</td>
<td>3,829</td>
<td>1,513</td>
<td>2.531</td>
</tr>
</tbody>
</table>

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.

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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 \( \sim \) 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:

\[
\text{Hasse diagram for five rhyme types}
\]

\[
\begin{align*}
\text{V[son]} & \rightarrow \text{VV} \rightarrow \text{VVC} \\
\text{V[obs]} & \rightarrow \text{VCC} \\
\end{align*}
\]

\((p = 0.02)\) \hspace{1cm} \((p = 0.05)\)

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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**

\[
\text{Hasse diagram for Finnish rhyme skeletons}
\]

\[
\begin{align*}
\text{V} & \rightarrow \text{VC} \rightarrow \text{VV} \\
\text{VC} & \rightarrow \text{VCC} \rightarrow \text{VVC} \\
\end{align*}
\]

\((p = 0.05)\)

\[
\text{Hasse diagram for Old Norse rhyme skeletons}
\]

\[
\begin{align*}
\text{V} & \rightarrow \text{VC} \rightarrow \text{VV} \rightarrow \text{VVC} \\
\text{VCC} & \rightarrow \text{VVCC} \\
\end{align*}
\]

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

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

\[
\text{Estimated weights of the rhyme types in Table IX}
\]

<table>
<thead>
<tr>
<th>V</th>
<th>āj</th>
<th>VR</th>
<th>VT</th>
<th>VN</th>
<th>VL</th>
<th>VJ</th>
<th>V:C</th>
<th>V:CC</th>
</tr>
</thead>
<tbody>
<tr>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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].

![Diagram showing estimated metrical weight vs. rhyme duration (ms)]

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)

![Diagram showing two categories of phonology and phonetics](image)

![Diagram showing three categories of phonology and phonetics](image)

26. Tamil: an almost entirely phonetic system

![Diagram showing estimated metrical weight](image)
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 \( \frac{e^{-H}}{Z} \) 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.