Onset weight, word weight, and the perceptual interval

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Sat., Nov. 9, 2013
1 End-weight
   - Phonological factors in end-weight
   - End-weight as weight
   - Nuclear stress

2 Generalized Weight-Mapping
   - Grid alignment
   - Strong-node alignment
   - Stress-weighted weight

3 Onset weight and the perceptual interval
   - Onset complexity
   - Onset quality
   - Perceptual motivations for onset weight
**End-weight in English**

- **Order B** more likely as \( X \) gets “heavier” (relative to \( Y \)):
  
  (Hawkins 1994, Wasow 2002, etc.)

<table>
<thead>
<tr>
<th></th>
<th>Order A</th>
<th>Order B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Particle Verbs</td>
<td>e.g. ( \text{picked } X \text{ up} )</td>
<td>( \text{picked up } X )</td>
</tr>
<tr>
<td>Coordination</td>
<td>e.g. ( X \text{ and } Y )</td>
<td>( Y \text{ and } X )</td>
</tr>
<tr>
<td>Dative Alternation</td>
<td>e.g. ( \text{gave } X \text{ to } Y )</td>
<td>( \text{gave } Y \ X )</td>
</tr>
<tr>
<td>Heavy DP Shift</td>
<td>e.g. ( \text{revealed } X \text{ to } Y )</td>
<td>( \text{revealed to } Y \ X )</td>
</tr>
<tr>
<td>Genitive Alternation</td>
<td>e.g. ( X’s \ Y )</td>
<td>( Y \text{ of } X )</td>
</tr>
<tr>
<td>Locative Alternation</td>
<td>e.g. ( \text{spray } X \text{ with } Y )</td>
<td>( \text{spray } Y \text{ on } X )</td>
</tr>
<tr>
<td>Extraposition (\textit{varia})</td>
<td>e.g. ( \text{N Rel-X V} )</td>
<td>( \text{N V Rel-X} )</td>
</tr>
<tr>
<td>Adjunct Stacking</td>
<td>e.g. ( \text{AP-X, AP-Y N} )</td>
<td>( \text{AP-Y, AP-X N} )</td>
</tr>
<tr>
<td></td>
<td>e.g. ( \text{PP-X PP-Y} )</td>
<td>( \text{PP-Y PP-X} )</td>
</tr>
</tbody>
</table>

...and many others
Non-phonological factors

- Frequency, animacy, gender, proximity, givenness, syntactic weight (complexity in words, nodes, etc.), etc.

Isolating phonology’s contribution

1. Multivariate models

2. Wug tests
   (Bolinger 1962, Pinker and Birdsong 1979, Oden and Lopes 1981, Oakeshott-Taylor 1984, Parker 2002; below)
All else (incl. word count) equal, item B tends to have:

(e.g. Cooper and Ross 1975, Pinker and Birdsong 1979, Ross 1982, Wright et al. 2005, Benor and Levy 2006)

1. More syllables
   (Pāṇini et seq.)
   e.g. kit and caboodle; trials and tribulations;
   Friends, Romans, countrymen

2. Longer vowel(s)
   (Kātyāyana et seq.)
   e.g. trick or treat; Slip & Slide; Tic Tac Toe

3. More sonorous coda(s)
   e.g. thick and thin; kith and kin; push and pull;
   big and small but short and tall
   (Pinker and Birdsong 1979, Ross 1982)

4. More complex coda(s)?
   (cf. Pāṇini 2.2.33)

5. More complex onset(s)
   e.g. fair and square; meet and greet; sea and ski

6. More obstruent onset(s)
   e.g. wear and tear, huff and puff; wheel and deal
Phonological end-weight

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Claim here: “End-weight is weight”
All of these ph. asymmetries serve to align weight with stress
Motivating end-weight: nuclear stress

- **Nuclear Stress in English** (Chomsky and Halle 1968 et seq.)

  “The most prominent syllable of the rightmost constituent in a phrase P is the most prominent syllable of P” (Selkirk 1995:562)

  \[
  \begin{array}{c}
  \text{trick} \quad \text{’r} \quad \text{treat} \\
  \times \quad \times \quad \times \\
  (a) \quad \times \quad \times \\
  \times \quad \times \quad \times \\
  \end{array}
  \begin{array}{c}
  \text{treat} \quad \text{’r} \quad \text{trick} \\
  \times \quad \times \quad \times \\
  (b) \quad \times \quad \times \\
  \times \quad \times \quad \times \\
  \end{array}
  \]

(a) better aligns stress and weight
Nuclear stress: Three conjuncts

- Nuclear Stress is cumulative (Chomsky and Halle 1968 et seq.)

(a) × × × × ×
(b) × × × × ×
(c) × × × × ×

(a) best aligns stress and weight
“End-weight is weight”

- (1–6) above, I’ll claim, all reflect nuclear stress

- While various other ph. factors affect ordering decisions —
  1. complexity
  2. edge effects
  3. eurhythmy
  4. eutaxy

  — the core properties of ph. end-weight follow from the interaction of stress and weight *per se*
(1 of 4) End-weight is weight, not (just) complexity

- Cf. syntactic “weight” via processing complexity

  - Defer complexity
  - Minimize dependency distances
  - Ease comprehension through pause adjacency
    (uniform load over time)
Ph. complexity? Segments, features, p-nodes, vel sim.

Fails to motivate weight-like properties, e.g.

- Sonorant coda (or open V:) > obstruent coda
- Obstruent onset > sonorant onset
- Clear effect of phonetic V length (Oakeshott-Taylor 1984)
- V effects stronger than C effects (Oden and Lopes 1981:677)
- In obstruent codas, voiced > voiceless (Bolinger 1962)

“Persistent euphony”
(2 of 4) End-weight is weight, not final lengthening

- **Final lengthening often mentioned**
  (e.g. Pinker and Birdsong 1979, Ross 1982, Oakeshott-Taylor 1984, Wright et al. 2005, Wolf 2008)

- **Counter-evidence**
  
  1. **FL nearly only affects final $\sigma$** (Turk and Shattuck-Hufnagel 2007)
     
     cf. *trials and tribulations*

     cf. *neeminy-nominy* (Oden and Lopes 1981:676); *rickety and ramshackle* (below)

  2. **End-weight non-pre-pausally** (Benor and Levy 2006)

     e.g. *check and discipline himself* (Brown Corpus via Benor and Levy 2006)

     e.g. *The smick, morpy, and smoocular ones over there on that side*

  3. **Beyond English**
(3 of 4) End-weight is weight, not (just) eurhythmly

- Possible lapse avoidance in $\sigma$ and $\sigma\sigma \geq \sigma\sigma$ and $\sigma$
  (Jespersen 1905, 1938, McDonald et al. 1993, Wright and Hay 2002, et seq.)

- No relevance to (2–6) above; even within (1), little coverage
  - Count effect persists when rhythm same/worse, e.g.
    (Pinker and Birdsong 1979, McDonald et al. 1993:219, my own Turk name conjunction survey)
    - $\sigma$ and $\sigma\sigma$
      e.g. Sue and Michelle
    - $\sigma$ and $\sigma\sigma\sigma$
      e.g. Sue and Amanda, kit and caboodle

    “[A]lthough it seems clear that English speakers do not shelve their appreciation of the rhythms of
    the language when creating or judging freezes, our data indicate that Panini’s Law is not simply an
    artifact of stress patterns” (Pinker and Birdsong 1979:507)

- Polynomials
- Beyond English
  e.g. French, Sanskrit (Pinker and Birdsong 1979:507)
(4 of 4) End-weight is weight, not (just) eutaxy

- Wright and Hay (2002), Wright et al. (2005): In X and Y, one might expect X to have the longer onset (cf. (5) above)
  - They find no sig. onset effect, but in every study that does, longer ⇒ later (Cooper and Ross 1975, Ross 1982, Parker 2002, Benor and Levy 2006; below)

  - A heterosyllabic sequence of two segments A.B is more harmonic the higher the sonority of A and the lower the sonority of B.” (291)
  - Wrong prediction for final sonority
  - Cf. the roshy and the toshy orrishy-roshy-toshy...
• Turk survey of five $\sigma$-buffered pairs (e.g. lemonte and leponte)
• Presented in both orders (intra- and inter-randomized)
• Fillers $\supseteq$ 12 real, non-interfering pairs (e.g. right and wrong)
• Participant counted iff all fillers correct, etc. ($n = 21$)
• 3.2x as many favored obstruent-final orders ($p<.05$) (4/5 by items)
“End-weight is weight”

- Nuclear Stress explanation
  
  e.g. *roschy-tóshy* ≻ *toshy-róshy* because *to-* outweighs *ro-*

- NS still unmentioned in most treatments of end-weight
  
  (exceptions on next slide)

  e.g. Surveys by Wright et al. (2005) and Wolf (2008) cite FL, eurhythmy, and phonotactics, but not NS
Towards Nuclear Stress

- End-weight reflects sentential prosody (not just eurhythmy)
  (Bolinger 1962, Oakeshott-Taylor 1984, Müller 1997, etc.)

- Extra stress on item B not due to FL (Benor and Levy 2006)

- NS explicit part of formal analysis (Anttila et al. 2010)

  “STRESS-TO-STRESS: Each lexical stress occurs within the prosodic phrase that receives sentence stress” (954)

  \[
  \begin{array}{cccccc}
  & & & & x & x \\
  & x & & x & & x \\
  \end{array}
  \]

  (a) Robertson (gave critical backing) (to Bush) 3 violations

  \[
  \begin{array}{cccccc}
  & & & & x & x \\
  & x & & x & & x \\
  \end{array}
  \]

  (b) Robertson (gave Bush) (critical backing) 2 violations
Nuclear stress: Anttila et al. (2010)

- Anttila et al. highlight three new predictions of STS (955)
  1. Stressless functors = weightless
  2. Anharmonic orders improved if NS lured away
e.g. never send someone them in the mail either (ex. from Bresnan and Nikitina 2003:20)
  3. Left-shift predicted for languages with left NS (e.g. Japanese?)

- However, STS predicts none of (1–6) above, nor cumulativity
  - A more general theory that will do so...
Weight and stress can be computed for every p-node in the tree.

Their alignment is globally optimized (ceteris paribus).

STRESS-TO-STRESS (possibly also STRESS-TO-WEIGHT and WEIGHT-TO-STRESS) emerges (approximately) from this more general schema, as do arguably all core properties of ph. end-weight.
A first pass (t.b.r.): maximally align moras with grid marks

\[
\begin{array}{ccc}
\times & \times & \times \\
\times & \times & \times \\
\times & \times & \times \\
\times & \times & \times \\
\end{array}
\]

trick_\mu^* \text{ or } \mu \text{ treat}_{\mu, \mu}

Two perspectives

- Reward \( \mu \times \) coincidence
- \( \approx \) Penalize \( \mu \times \) non-coincidence
  - cf. ALIGN, but no need for gradience (with McCarthy 2003), L/R, or scope, since ALIGN(\( \mu \), \( \times \)) \( \approx \) ALIGN(\( \times \), \( \mu \)) here

Let \( \mu \times \text{reward} \) assign a reward (1) for every pair \( \langle \mu, \times \rangle \) such that \( \times \) dominates \( \mu \)

\( \approx \mu \times \text{penalty} \): Assign a penalty (-1) for every pair \( \langle \mu, \times \rangle \) such that \( \times \) does not dominate \( \mu \)
For now, pretend the moras play along

<table>
<thead>
<tr>
<th></th>
<th>μ/×_reward</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>×</td>
</tr>
<tr>
<td></td>
<td>×</td>
</tr>
<tr>
<td></td>
<td>×</td>
</tr>
<tr>
<td></td>
<td>trick_μ or_μ treat_μμ</td>
</tr>
<tr>
<td></td>
<td>1·3 + 1·1 + 2·4 = 12</td>
</tr>
<tr>
<td>b.</td>
<td>×</td>
</tr>
<tr>
<td></td>
<td>×</td>
</tr>
<tr>
<td></td>
<td>×</td>
</tr>
<tr>
<td></td>
<td>×</td>
</tr>
<tr>
<td></td>
<td>treat_μμ or_μ trick_μ</td>
</tr>
<tr>
<td></td>
<td>2·3 + 1·1 + 1·4 = 11</td>
</tr>
</tbody>
</table>

<table>
<thead>
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</tr>
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<td>a.</td>
<td>×</td>
</tr>
<tr>
<td></td>
<td>×</td>
</tr>
<tr>
<td></td>
<td>×</td>
</tr>
<tr>
<td></td>
<td>trick_μ or_μ treat_μμ</td>
</tr>
<tr>
<td></td>
<td>1·5 + 1·7 + 2·4 = -20</td>
</tr>
<tr>
<td>b.</td>
<td>×</td>
</tr>
<tr>
<td></td>
<td>×</td>
</tr>
<tr>
<td></td>
<td>×</td>
</tr>
<tr>
<td></td>
<td>×</td>
</tr>
<tr>
<td></td>
<td>treat_μμ or_μ trick_μ</td>
</tr>
<tr>
<td></td>
<td>2·5 + 1·7 + 1·4 = -21</td>
</tr>
</tbody>
</table>
Captures cumulativity (insofar as moras play along)

<table>
<thead>
<tr>
<th></th>
<th>µ \times \text{penalty}</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>tic_\mu\mu</td>
</tr>
<tr>
<td></td>
<td>tac_\mu\mu</td>
</tr>
<tr>
<td></td>
<td>toe_\mu\mu\mu</td>
</tr>
<tr>
<td>b.</td>
<td>tac_\mu\mu\mu</td>
</tr>
<tr>
<td></td>
<td>tic_\mu</td>
</tr>
<tr>
<td></td>
<td>toe_\mu\mu\mu</td>
</tr>
<tr>
<td>c.</td>
<td>toe_\mu\mu\mu\mu</td>
</tr>
<tr>
<td></td>
<td>tic_\mu</td>
</tr>
<tr>
<td></td>
<td>tac_\mu</td>
</tr>
</tbody>
</table>
Two problems with $\mu/\times$

1. No $\sigma$-count effect

2. $\mu$-count insufficient
Problem (1 of 2): No $\sigma$-count effect

- NS affects only the tallest bar of each conjunct

<table>
<thead>
<tr>
<th></th>
<th>$\mu/\times$ penalty</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>a.</strong> $\mathcal{S}$</td>
<td>[Table with filled cells]</td>
</tr>
<tr>
<td>friends$_{\mu\mu}$</td>
<td>$\times$</td>
</tr>
<tr>
<td>Ro$_{\mu\mu}$</td>
<td>$\times$</td>
</tr>
<tr>
<td>mans$_{\mu\mu}$</td>
<td>$\times$</td>
</tr>
<tr>
<td>coun$_{\mu\mu}$</td>
<td>$\times$</td>
</tr>
<tr>
<td>try$_{\mu\mu}$</td>
<td>$\times$</td>
</tr>
<tr>
<td>men$_{\mu}$</td>
<td>$\times$</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>b.</strong></td>
<td>[Table with filled cells]</td>
</tr>
<tr>
<td>coun$_{\mu\mu}$</td>
<td>$\times$</td>
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<td>$\times$</td>
</tr>
<tr>
<td>friends$_{\mu\mu}$</td>
<td>$\times$</td>
</tr>
</tbody>
</table>
Some working assumptions for the prosody

- **Strict binarity with headedness** (Liberman 1975 et seq.)
- **Recursion** (e.g. Ladd 1986, Wagner 2005, Itô and Mester 2009, Selkirk 2011)
- **MATCH family can be undominated here** (Selkirk 2011)

English coordination: right-branching

Prosody:  Syntax, e.g.  

![Prosody Tree](image)

![Syntax Tree](image)  

(Munn 1993 inter alios)
**Prosody:**

\[
\begin{array}{c}
\phi_s \\
\phi \\
X
\end{array}
\begin{array}{c}
\phi_s \\
\phi \\
Y
\end{array}
\begin{array}{c}
\& \\
Z
\end{array}
\]

**Syntax:**

\[
\begin{array}{c}
XP \\
XP \\
XP
\end{array}
\begin{array}{c}
& P \\
& XP
\end{array}
\]

- Rising NS reflects accumulating s-nodes
  - Wagner (2005): Degree of final lengthening in each conjunct reflects # of \( \phi \)-boundaries

\[\phi \textit{s} \]
Remedied constraint

- Replace $\times$ with $s$

- Let $\mu/s_{\text{reward}}$: reward (1) every pair $<\mu, s>$ s.t. $s$ dominates $\mu$

  $\approx \mu/s_{\text{penalty}}$: penalize (-1) every pair $<\mu, s>$ s.t. $s$ doesn’t dominate $\mu$
Two monosyllables work as before

\[
\begin{array}{|c|c|c|}
\hline
\mu/s_{\text{reward}} & a. 1.4 + 1.2 + 2.5 & b. 2.4 + 1.2 + 1.5 \\
& = 16 & = 15 \\
\hline
\end{array}
\]
But now $\sigma$-count effect also captured

<table>
<thead>
<tr>
<th>$\mu/s_{\text{reward}}$</th>
<th>a.</th>
<th>b.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\phi_s \sigma_s \omega_s \sigma_s \omega_s \sigma_s \sigma_s$</td>
<td>$\phi_s \sigma_s \omega_s \sigma_s \omega_s \sigma_s \sigma_s$</td>
</tr>
<tr>
<td></td>
<td>Sue$_{\mu\mu}$</td>
<td>man$_{\mu\mu}$</td>
</tr>
<tr>
<td></td>
<td>da$_{\mu}$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(2·4) + 1·2 + (1·3 + 2·5 + 1·4)</td>
<td>(1·2 + 2·4 + 1·3) + 1·2 + (2·5)</td>
</tr>
<tr>
<td></td>
<td>= 27</td>
<td>= 23</td>
</tr>
</tbody>
</table>
Prediction (1 of 2): Stressed $\sigma$s count for more

- Not simple $\mu$ (or whatever) addition, but stress-weighted

- $\dot{\sigma}_\mu \ddot{\sigma}_\mu \dot{\sigma}_\mu \ddot{\sigma}_\mu$ outweighs $\dot{\sigma}_\mu \ddot{\sigma}_\mu \dot{\sigma}_\mu \ddot{\sigma}_\mu$

- $\dot{\sigma}_\mu \mu \# \dot{\sigma}_\mu \mu$ outweighs $\ddot{\sigma}_\mu \mu \# \dot{\sigma}_\mu \mu$
NB. $\bar{\sigma}$s tend to be under fewer $s$-nodes (esp. if clitic)

$\phi_s$

$\sigma$

$\omega_s$

the$_{\mu}$

$f_s$

$\sigma_s$

$\phi_s$

$\omega_s$

$\phi_s$

$\omega_s$

Ma-$_{\mu}$

$f_s$

$\sigma_s$

$\sigma_s$

$	ext{cow}_{\mu\mu}$

$	ext{-cao}_{\mu\mu}$

small$_{\mu\mu}$

$\text{cow}_{\mu\mu}$

1

8

= 9

2

8

= 10

6

8

= 14
Anttila et al. (2010): Functors = weightless (955)

Here: functors nearly weightless, esp. around multiple ω-stresses (cf. Weber’s law)

Non-sig. for Switchboard dative alternation corpus (but note trends): (Anttila et al. 2010:974)

<table>
<thead>
<tr>
<th></th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>Wald Z</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>0.8608</td>
<td>0.1624</td>
<td>5.30</td>
<td>0.0000</td>
</tr>
<tr>
<td>Log length of recipient in words</td>
<td>-0.3294</td>
<td>0.3161</td>
<td>-1.04</td>
<td>0.2972</td>
</tr>
<tr>
<td>Log length of theme in words</td>
<td>0.3237</td>
<td>0.2152</td>
<td>1.50</td>
<td>0.1325</td>
</tr>
<tr>
<td>Log number of primary stresses in theme</td>
<td>-4.2955</td>
<td>0.3083</td>
<td>-13.93</td>
<td>0.0000</td>
</tr>
<tr>
<td>Log number of primary stresses in recipient</td>
<td>3.6864</td>
<td>0.3165</td>
<td>11.65</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

But σ-count effect is clear elsewhere, and we still need to analyze intra-σ effects and cumulativity, which STS doesn’t touch
Prediction (2 of 2): Stressed $\mu$s count for more

- Also new here: contribution per $\mu$ predicted to scale with stress

```
\omega_s
/  \   /  \\
| f   | f_s |
\sigma_s \sigma \sigma_s \sigma

\text{car}_{\mu\mu} \quad \text{to}_\mu \quad \text{gra}_\mu \quad \text{phic}_\mu

4 \quad 1 \quad 3 \quad 2
= 10
```

```
\omega_s
/  \   /  \\
| f   | f_s |
\sigma_s \sigma \sigma_s \sigma

\text{ca}_\mu \quad \text{ta}_\mu \quad \text{lec}_{\mu\mu} \quad \text{tic}_\mu

2 \quad 1 \quad 6 \quad 2
= 11
```

- Are weight percepts more sensitive to the internal structures of $\sigma$s than they are to those of $\bar{\sigma}$s?
Preliminary evidence to the affirmative

- Turk survey of eight pairs s.t. $\acute{o}s$ and $\check{o}s$ disagree (e.g. `climmo` [ˈkʌɪmʊ] and `clamma` [ˈkʌmə])
- Iff percept stress-weighted, `clamma` heavier/second
- Most show greater sensitivity to $\acute{o}s$ (p<.05)

(13 usable participants; 7 > 50%, 5 = 50%, 1 < 50%; 7/8 by items)
Problem (2 of 2): Moras

- E.g. phonetic length effect

For Afrikaans, Oakeshott-Taylor (230) finds $\rho = .87$ for 12 Vs

- V effects stronger than C effects (Oden and Lopes 1981:677)
- Open long V $\succ$ sonorant coda $\succ$ obstruent coda
- Onset complexity; onset sonority; etc.
Two solutions to the mora problem

(1) Enrich CON: Replace $\mu$ with feature matrix (plus $\sigma$ context), e.g., *i/s, *ɛ/s, *[+son]$_{\sigma}$/s, etc.

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<tr>
<td></td>
<td>$\phi_s$</td>
<td>$\phi_s$</td>
</tr>
<tr>
<td></td>
<td>$\phi$</td>
<td>$\phi$</td>
</tr>
<tr>
<td></td>
<td>$\omega_s$</td>
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<td>*i/s</td>
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Weight constraints to fit variation rates (maxent tableau)

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</tbody>
</table>

blick | bleck | bleck | blick

| *I/S | $w = 2$ | -4 | -5 |
| *€/S | $w = 1$ | -5 | -4 |

weighted sum: -13 | -14
proportion generated: 73% | 27%
Issues with enriched CON approach

- Explosion of parameters, all doing the same thing — rewarding energy under s-nodes
- Weights phonetically determined; no permutation typology
  - Stringency (as in de Lacy 2004) won’t solve this problem
- Unlike p-map (Steriade 2009), no need to interleave other constraints
Solution 2: Enriched interface

(2) Replace $\mu$ with $t$, where $t = \text{total energy}$ (Gordon 2002)

- $t/s$: $\forall < t, s >$ augment reward by $t$

- Stress-weighting predictions carry over

- Gradient violations in HG, e.g.
  - Flemming (2001) (e.g. $\sigma$-DURATION; 35)
  - Ryan (2011a) for metrics; (to appear) for stress
  - Pater (2012) for sonority (albeit treated as whole-, not real-, valued)
Addendum to NS-driven end-weight

- The binomials and compounds treated in previous studies are typically NS-stressed (incl. Parker 2002). But some end-weight-like properties (esp. i→ɪ vocalism) are frequently found also in non-NS-stressed compounds
  
e.g. rifraff, Kit-Kat, Tic-Tac, flip-flop

- Etymological/analogical confounds
  
e.g. rifraff < OF rif et raf

- Synchronic variation
  
e.g. tip-top

- Unclear whether this extends beyond vocalism
  
e.g. mít-a-kit or kít-a-mít? (in progress)
Onset effects in word order

- Greater complexity ⇒ greater end-weight

- Greater obstruency ⇒ greater end-weight
  “Why should elements that start less obstruently sound firster?
  [...] I hereby throw up my hands” (Ross 1982:281)

- Claim: both follow from weight-mapping
  Cross-systemically, onsets contribute to $\sigma$ weight in English
Onset complexity in word order

- Turk wug test, as above (e.g. pim and plim)
- 16 items (incl. Ø vs. C; C vs. CC; CC vs. CCC; always nested); 19 usable participants
- Sig. both by-item and by-participant \( (p < .0001) \)

Not just visual — half of items orthographically balanced

(e.g. keph and kleff, temm and trem; for this subset, both \( p < .01 \))
Onset complexity in English stress

- E.g. simplex disyllables in CELEX (Baayen et al. 1993)
- Longer onset ⇒ greater incidence of primary stress (with Kelly 2004)
End-weight
Generalized Weight-Mapping
Onset weight and the perceptual interval

Onset complexity
Onset quality
Perceptual motivations for onset weight

20
40
60
80
100

noun
adjective
verb

% initially stressed
20
40
60
80
100

low frequency
middle frequency
high frequency

consonants in initial onset

V rime
VC rime
VV rime

(Ryan to appear)
Onset complexity and English stress

- Full model (with several controls) in the paper
- Wug tests (orthographic and auditory) support productivity (e.g. bontoon vs. brontoon; Kelly 2004, Ryan 2011b; to appear)
- Wug results can’t be explained by analogy (ibid.)
Onset size and weight in English

- Longer onsets behave as heavier in both stress and word order
- And in several other English systems as well
  - **Meter** (e.g. Kelly 2004; Ryan 2011b for several other languages)
  - **Text-setting** (Ryan 2011b)
  - **Compensatory lengthening** (cf. Browman and Goldstein 1988, Katz 2010, Ryan to appear)

- **P-center alignment** (Villing 2010, Ryan to appear for reviews)
Onset size and weight in English

- Not merely stress licensing marked structure, e.g.
  - $\sigma[V$ both more marked and more stress-rejecting than $\sigma[CV$
  - Likewise for $\sigma[DV$ and $\sigma[TV$ (etc.; Ryan to appear)
  - Even insofar as weight and markedness do correlate, the same holds of “canonical” criteria as well

- Directionality of causation ($\text{Weight} \Rightarrow$ or $\Leftarrow \text{Stress}$?) is moot under Generalized Weight-Mapping
Obstruency in word order

- Several supporting lexical and wug studies for word order (supra)
- Not phonotactically driven (supra)
- Typologically, stress systems treat less sonorant onsets as (if anything) heavier; English trends this way as well (infra)
Stress criteria referring to onset quality

\[ T = \text{voiceless obstruent}, \; D = \text{voiced obstruent}, \; R = \text{sonorant} \]

- **Pirahã**: \{R,D\}V < TV < VV < \{R,D\}VV < TVV
  (Everett and Everett 1984, Everett 1988, Gordon 2005)

- **Arabela**: RV < TV
  (Payne and Rich 1988, Topintzi 2010:83)

- **Tümpisa Shoshone**: \{R,D\}V \(<_{\text{optional}}\) TV < CVV
  (Dayley 1989, Gordon 2005:601)

- **Karo**: DV < \{R,T\}V < C\(\tilde{V}\) < C\(\acute{V}\)

- **English -ative words**: RV < \{D,T\}V
  (Nanni 1977)

- \{R,D\} < T as a statistical propensity in English
  (Ryan to appear)
Onset quality in meter

- D < T in meter as well (Ryan to appear)
Proposal: P-center theory of weight

- Domain over which weight percept is assessed begins with the perceptual center of the syllable

- Near beginning of rime, but perturbed by onset structure
First speaker in Harvard-Haskins Database of Regularly Timed Speech (Patel et al. 1999)
As onset size increases, p-centers increasingly anticipate the rime, but by only a fraction of the onset’s duration; T also has more negative offset than D
P-center theory of weight

- **Onset/coda asymmetry**
  - The p-center parses only a fraction of the onset into the domain (while rime segments are parsed in their entirety)

- **In one study of English**, (Ryan to appear)
  - p-centers predict each onset C to contribute avg. 35% as much as each coda C to the weight percept
  - onset coefficient for stress model 46% of coda coefficient
P-center theory of weight

- Stress & meter are rhythmic phenomena
  - Timing/isochrony studies consistently suggest linguistic rhythm is not anchored to subsyllabic structure (e.g. supra)

- Auditory recovery (Gordon 2005) unlikely to be whole story for onset voicing effects (but not mutually exclusive with p-center account)
  - Ceiling $\sim 40$ ms (Delgutte 1982:135), whereas events well outside of this window affect stress attraction (e.g. ba vs. spa above)
  - Null onset problem (Gordon 2005)
  - Geminate onset problem (Topintzi 2010:243)
Conclusion

- Arguably all of the core properties of end-weight reflect optimization of stress/weight alignment at the phrasal level.

- Generalized Weight-Mapping is a cross-level theory of this interface — perhaps the simplest one imaginable ($t/s$).

- But it also makes non-trivial, testable predictions, e.g.
  - The weight of $x$ is not merely the sum of the weights of $x$’s parts.

- Onsets augment weight not just in end-weight but also stress, etc.
  - $t$ can be defined by the p-center interval rather than rime.


References III


