Class 15: Metrical stress theory—the grid

To do
• Get started on Asheninca (due Thurs., Dec. 2)
• Get started on last two readings, if you want: Hayes 1985 (SQs to be posted to web soon) and Prince & Smolensky 1993

Overview: In a lot of ways, stress doesn’t look like a feature. Accordingly, a type of representation called a grid has been proposed, to which stress rules apply.

1. What is stress?
It’s hard to say, actually. Stress doesn’t have a consistent phonetic realization, although stressed syllables tend to…

• have longer duration than unstressed
• be louder than unstressed
• support a larger set of vowel contrasts (as you saw in Haiman 1972; see Crosswhite 2001 for survey)
• have longer VOT, more fortition on their consonants than unstressed (see Lavoie 1996, González 2002 for surveys)
• attract glottalization and aspiration away from unstressed
• be associated with pitch excursions (high or low)

It’s easier to define stress as an abstract prominence relation—some syllables are more prominent (stressed) than others, and this has phonetic and phonological consequences like those listed above.

2. Stress as a feature?
• Other features don’t shift from segment to segment based on distance from a word edge:

  origin original originality
  photógraph photógrapher photógraphic

• Other features don’t act at long distances (well, sometimes they do):

  Mississippi vs. Mississippi législâtors

• Languages don’t require every content word to have at least one + value of other features.
• For just about every other feature, there is some language where it assimilates.

3. The grid
Instead, stress is often represented as a grid (Liberman 1975). The rows (a.k.a. ‘layers’) represent degrees of stress; the columns are associated with stress-bearing units (syllables, in the simple cases).

1 This is what makes stress different from pitch accent. A pitch-accented syllable always gets the same tone.
Example from Hayes (1995):

```
x
x  x
x  x  x
x  x  x  x  x  x
re  con  ci  li  a  tion
```

Can you tap your finger $n$ times while saying *reconciliation*, and if so which syllables do you tap on?

1
2
3
4
5
6
7
8+

Grids are assumed to be subject to the (inviolable) Continuous Column Constraint: for every grid mark (except on the bottom layer) there must be a grid mark in the same column on the layer below.

4. **Payoff I: Locality**

English *phrasal stress rule* (a.k.a. *nuclear stress rule*): Places main stress on the last word of a phrase,\(^2\) even though this is sometimes several syllables from the end of the phrase (example from Hayes: *hypothetical imitators*, which could also perhaps be *hypothesical imitators*).

The grid allows us to state the rule very locally. It’s assumed that any amount of white space is allowed between and on either side of $x$s on the same layer when matching representations up to the structural description:

```
[ x  x ] → [ x  x ]
```

- Draw grids for *hypothetical* and *imitators* and apply this rule.

The *English rhythm rule* (Prince 1983): really an interaction between a constraint *No-Clash* and a rule *Move-X*.\(^3\)

```
No-Clash: * x  x  (if two grid marks are adjacent on their layer, the grid marks under x  x  them can’t also be adjacent on their layer)
```

---

\(^2\) This can be overridden by focus. Also, look out for compounds.

\(^3\) The rhythm rule is usually optional.
Move-X: Move one grid mark along its layer (triggered by No-Clash)

- Draw the grids for Mississippi and legislators. If you put them together, is No-Clash violated?

- Apply Move-X if necessary—where can X move to without violating the Continuous Column Constraint?

- In what way might this operation appear non-local? In what way is it actually local?

5. Payoff II: Consequences of the Continuous Column Constraint

The rich get richer: in the rhythm rule, Prince notes that the stress retracts onto the strongest preceding syllable.

- Draw grids for Sunset Park and Zoo, and then put them together and apply Move-x to resolve the clash. What would be the permissible landing sites for the moved \( x \) if the Continuous Column Constraint didn’t exist?

- Let’s use the rhythm rule to figure out the grids for totalitarian tendencies and Constantinople trains.

And the poor get poorer: Consider the cyclic derivation of a word like paréntal (from párënt). When –al is added to párënt, assume that, rather than recalculating stress entirely, the Level 2 stress rules merely add stress to the penult (pärëntal). Then assume that main stress is added to rent (pàréntal).

- Draw the grid for pàréntal. What constraint is now violated? Can Move-X help?

- Assume a rule ‘Delete (one) \( x \)’ that can be triggered by that constraint. What options do we have for applying that rule?
6. The perfect grid—describing four basic stress systems

Prince proposes that the four basic stress types of Hayes (1981) can be achieved through setting two parameters for lining up syllables with a perfect grid:

```
  x  x  x
  ...x  x  x  x  x  x  x  ...
```

(a) where to start on the grid: peak or trough
(b) where to start in the word: beginning or end

○ What are the parameter settings for each of the following four languages?

**Maranungku** (data originally from Tryon 1970)
Australian language from Australia with 15 to 20 speakers in 1983.

<table>
<thead>
<tr>
<th>Maranungku</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>tí.ralk</td>
<td>‘saliva’</td>
</tr>
<tr>
<td>mé.re.pèt</td>
<td>‘beard’</td>
</tr>
<tr>
<td>yán.gar.mà.ta</td>
<td>‘the Pleiades’</td>
</tr>
<tr>
<td>lángkaråtetí</td>
<td>‘prawn’</td>
</tr>
<tr>
<td>wèlepênemànta</td>
<td>‘kind of duck’</td>
</tr>
</tbody>
</table>

**Weri** (data originally from Boxwell & Boxwell 1966)
Trans-New Guinea language from Papua New Guinea with 4,163 speakers.

<table>
<thead>
<tr>
<th>Weri</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>ṇin.típ</td>
<td>‘bee’</td>
</tr>
<tr>
<td>kù.li.pú</td>
<td>‘hair of arm’</td>
</tr>
<tr>
<td>u.lè.a.mít</td>
<td>‘mist’</td>
</tr>
<tr>
<td>à.ku.nè.te.pál</td>
<td>‘times’</td>
</tr>
</tbody>
</table>

**Warao** (data originally from Osborn 1966)
Language isolate from Venezuela, Guyana, and Suriname with 18,000 speakers.

<table>
<thead>
<tr>
<th>Warao</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>yi.wà.ra.nà.e</td>
<td>‘he finished it’</td>
</tr>
<tr>
<td>yà.pu.rù.ki. tà.ne.há.se</td>
<td>‘verily to climb’</td>
</tr>
<tr>
<td>e.nà.ho.rò.a.hà.ku.tá.i</td>
<td>‘the one who caused him to eat’</td>
</tr>
</tbody>
</table>

**Araucanian** (data originally from Echeveria and Contreras 1965)
Family consisting of two languages, Mapudunun from Chile and Argentina with 440,000 speakers, and Huilliche from Chile with several thousand speakers.

<table>
<thead>
<tr>
<th>Araucanian</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>wu.lé</td>
<td>‘tomorrow’</td>
</tr>
<tr>
<td>tì.pán.to</td>
<td>‘year’</td>
</tr>
<tr>
<td>e.lú.mu.yù</td>
<td>‘give us’</td>
</tr>
<tr>
<td>e.lú.a.e.new</td>
<td>‘he will give me’</td>
</tr>
<tr>
<td>ki.mú.ba.lù.wu.lày</td>
<td>‘he pretended not to know’</td>
</tr>
</tbody>
</table>
Additional parameter: add an extra grid mark at either the beginning or the end of the word.

- Which setting does each of the four languages above have?
- What ensures that an already-stressed syllable gets this extra grid mark?

7. **Extrametricality**

In order to analyze some languages’ stress systems, it is necessary to suppose that certain material at the beginnings or ends (usually ends) of words is ‘left out’ of the grid-mark assignment (*extrametrical*).

Hayes (1981) proposes that only constituents (segments, syllables, feet [which we’ll get to next time], phonological words, or affixes) may be made extrametrical.

*Example:* Winnebago/Hocak (data originally from Miner 1979, Hale & White Eagle 1980). Siouan language from Wisconsin, with a settlement in Nebraska; about 885 speakers total? (All the hooks under vowels—which indicate nasalization—should be going the other way.)

- What are the parameter settings for Winnebago, and what has to be extrametrical?

```
ha.ki.rú.jik.šą.ną  ‘he pulls it taut’
hi.ra.wā.haz.rà  ‘the license’
ho.ki.wá.ro.kè  ‘swing’
ho.čį.čį.nįk  ‘boy’
hi.jo.wi.re  ‘fall in’
hi.pi.rák  ‘belt’
hiš.ja.sū  ‘eye’
```

- How are these forms different? Any ideas about why?

```
wa.jé  ‘dress’
wi.júk  ‘cat’
```

⇒ Most languages require every content word to have a stress. When a word is otherwise unstressable (like a two-syllable word in Winnebago), a special rule steps in.

- Let’s try to formulate Winnebago’s rule for otherwise unstressable words.

8. **Moras**

In order to look at the next example, we need to introduce the *mora*, a unit of weight (abbreviated µ). Weight is sort of an abstract version of duration. In most languages, short vowels have one mora and long vowels have two. In many languages, some or all coda consonants also get one.
9. Exercise: Cairene Arabic (data originally from Mitchell 1960)  
(i.e., the variety of Egyptian Arabic spoken in Cairo)

Building the grid on moras rather than syllables, figure out the parameter settings for Cairene and what has to be extrametrical. You can assume that secondary stressed get assigned and then wiped out by a later rule.

\[
\begin{align*}
a & \ \text{šá.ja.ra} & \text{‘tree’ (pausal)} & k & \text{?ad.wi.ja.tû.hu} & \text{‘his drugs’} \\
b & \ \text{ká.ta.ba} \\
c & \ \text{ša.ja.rá.tu.hu} & \text{‘his tree’} & l & \text{kaa.tá.ba} \\
d & \ \text{wá.lad} \\
e & \ \text{rá.ʔaa} \\
f & \ \text{ša.ja.rá.tun} & \text{‘tree’ (nonpausal)} & m & \text{ʔin.ká.sa.ra} \\
g & \ \text{ka.ta.bá.taa} \\
h & \ \text{ša.ja.ra.tu.hú.maa} & \text{‘their (dual) tree’} & n & \text{qat.tá.lat} \\
i & \ \text{šá.ja.rah} \\
j & \ \text{?ad.wi.ya.tú.hu.maa} & \text{‘their (dual) drugs’} & o & \text{mak.tá.bah} \\
k & \ \text{ʔad.wi.ja.tû.hu} \\
l & \ \text{kaa.tá.ba} \\
m & \ \text{ʔin.ká.sa.ra} \\
n & \ \text{qat.tá.lat} \\
o & \ \text{mak.tá.bah} \\
p & \ \text{mus.tást.fa}\text{a} \\
q & \ \text{mur.ta.bi.Tá.tun} \\
r & \ \text{ʔaa.báa.tun} \\
s & \ \text{ʔaʃ.máal} \\
t & \ \text{Da.rábt} \\
u & \ \text{mu.qáa.til} \\
v & \ \text{mu.ʃál.lim} \\
x & \ \text{hi.ya} \\
y & \ \text{bu.lah.ní.ja.tun}
\end{align*}
\]

- First make a guess based on (a-h).

- Modify this guess to take care of (i-j), if necessary. Make sure (k-s) are OK.

- Any ideas about how to deal with (t-v)?

- Ideas for (x)?

- (y) is one to think about. We won’t really have a way to deal with it (unless you can come up with something!) till we see feet.
10. Exercise: Italian

- Treat the following words as representing the basic primary-stress pattern of Italian. What are the parameter settings?

  a  mé.se  ‘month’
      ká.sa  ‘house’
      fjá.to  ‘breath’
      tér.ra  ‘earth’
      dʒór.no  ‘day’
      di.vi.sa  ‘uniform’
      tri.bú.na  ‘rostrum’
      kom.prá.re  ‘buy’
      kor.ní.tfē  ‘corniche’
      me.ta.fo.ní.a  ‘metaphony’

- Here are some words with a different stress pattern. There is no other systematic difference between these words and the basic words in (a), so something has to be different about their underlying representations. What could it be?

  b  ká.li.tē  ‘chalice’
      mú.si.ka  ‘music’

- What extra stipulation do we need to make to take care of these words?

  ál.be.ro  ‘poplar’
  fis.si.leg  ‘fissionable’

- Some word shapes, however, never show antepenultimate stress. This should follow from the analysis so far:

  b  spa.gét.ti  ‘spaghetti’
      a.rán.tʃo  ‘orange (color)’
      am.búr.go  ‘hamburger’
      in.tén.to  ‘intent’
      *á.bur.go  *ín.men.to

- In addition, there are no words with preantepenultimate stress: *dó.bi.ta.pi. Does that follow from the analysis so far?
There are some words with final stress. What could we say about their underlying representations? (Note: final vowels in Italian are never long on the surface: *par.ló, pár.lo; certain other vowels are long, though I haven’t marked them.)

ko.li.brí ‘hummingbird’
dʒo.ve.di ‘Thursday’
u.ni.ver.si.tá ‘university’
li.ber.tá ‘liberty’
dʒo.ven.tú ‘youth’
ko.sí ‘thus’
tʃit.tá ‘city’
per.ké ‘why’

There is a famous exception to the stress pattern laid out above, [mán.dor.la] ‘almond’ (and a small number of other words like it: [pó.lit.tás] ‘policy’, [á.ris.ta] ‘pork loin’). We would like to account for these few words without opening the door to completely free stress placement. Please speculate on how these words’ underlying representation might look.