Class 7, 4/20/15: Grids and Quantitative Meter; Rajaz Analysis

1. Readings

Prince reading, on web site

GRIDS AND QUANTITATIVE METER

2. The grid-based theory of quantitative meter

- Unidentified (yet) work by Russ may be the first to use grids.

3. Underlying question

- Can the theory of rhythm (e.g. as worked out by Lerdahl and Jackendoff) give us help in understanding quantitative meters like Hausa?
  ➢ This is a slightly more “extended” application than application to stress-based meters.

4. Key ingredient I: moraic theory

- Heavy syllables are more than just bigger syllables; they are the theoretical equivalent of two light syllables.
- The characteristic equivalence of - with vv is part of the evidence, but phonology tells us much the same.

5. Key ingredient II: prominence alignment

- In stress systems, both WEIGHT TO STRESS and STRESS TO WEIGHT play important roles.
- These are part of the overall system of prominence alignment laid out in Prince and Smolensky (1993).
- You pick two scales, and a natural direction of alignment, and you can say stuff like
  ➢ Anything with less/more than \( x \) on Scale I must have less/more than \( y \) on Scale II.
  ➢ All values of \( x \) and \( y \) produce sensible constraints.
- Prince and Smolensky’s paradebeispiel is sonority and syllabic (in Berber)
- Stress and weight would be another example.
- The idea here is to use grid height in a Lerdahl/Jackendovian grid as the basis for prominence alignment.
6. Fleshing this out

- Label the layers of the Lerdahl/Jackendovian grid from the bottom up:
  - weak
  - strong
  - superstrong
  - hyperstrong

- Two forms of prominence alignment:
  - (SUPER/HYPER)STRONG IS LONG
  - LONG IS (SUPER/HYPER)STRONG

7. Defining ‘is strong’ more precisely

- = “is aligned with a grid column that has an x on the Strong layer”
- Meaning: anything that is Superstrong is also Strong; and anything that is Hyperstrong is also Superstrong and Strong

8. What can go into a quantitative metrical analysis under this approach?

- The spacings of each layer on the grid (2 or 3)
- Something to regular starting or stopping points
  - we need to think about this
  - This could probably be based on the bracketed domains that go with grids
  - probably integral numbers of units, with empty positions
- A set of weighted constraints from the family given in (6).

WORKING OUT A SIMPLE CASE: HAUSA MUTADARIK

9. Basics

- Recall that this is v v - / v v - / v v - / v v -, with - substitutable for v v.

10. The constraints we had before (in model evaluation lecture)

- LINES HAVE FOUR FEET
- FEET ARE TETRAPOSITIONAL
- ONE MORA PER POSITION
- LAST TWO POSITIONS OF FOOT MUST CORRESPOND TO A HEAVY
11. Being more explicit

- The grid is binary at all levels; and going upward is trochaic, then iambic (and then it doesn’t matter).¹
- See Prince (readings) for “metrical position”
  - some kind of rather low-level position, though not terminal
  - Universally, Prince suggests, the MP is trochaic.
- Labeling of grid levels is not theoretical; just a terminology for bottom-up numbering

![Diagram of grid levels]

12. Pattern constraints for the mutadarik (infinite weight)

- LINES ARE BINARY
- HEMISTICHS ARE BINARY
- FEET ARE BINARY
- METRICAL POSITIONS ARE BINARY

Prominence constraints:

\[
\text{ALIGN(head x, MP, Left)} = \text{MP’s are left-strong (universally? Prince)}
\]
\[
\text{ALIGN(head x, Foot, Right)} = \text{Feet are right-strong}
\]

can’t tell about other such constraints

13. The main quantitative constraints for mutadarik

- Two constraints to regulate moras-to-grid slots, one-to-one
  - STRETCH: *mora in two slots
  - SQUEEZE: *extra mora in a slot
- SUPERSTRONG-IS-LONG

¹ Prince (readings) believes in “labeling harmony” across levels and bravely deduces predictions therefrom; I think the generalization is just not true across metrical traditions.
14. Anything else?

- This only depends on whether vv - or - - is favored; some sort of silly constraint penalizing heavies, or lights, depending.
  - If vv is favored, this could be due to LONG IS STRONG.
- This didn’t test significant when we tried it on data; maxent equality worked fine.
- N.B. there is also the final - - clausula, not yet taken into account.

15. Being explicit about STRONG IS LONG

- It is violated whenever there is a strong grid mark that does not initiate an affiliation with a heavy syllable.
- We will later have to refine this when we deal with syncopation (syncopated mutadarik).

16. Where this is all going

- Following Prince (readings), trying to have some kind of principled limitation on the systems of quantitative meters.
- Update: we
  - plug into the Lerdahl/Jackendoff principles of grids
  - plug into the Prince/Smolensky system of prominence alignment.
  - abandon Prince’s untenable hypothesis of vertical labeling harmony

BACK TO THE RAJAZ

17. Generalization for Rajaz: across the board preference for v - v -

- We assume that the most frequent patterns violate the fewest and weakest constraints (Halle and Keyser 1971:xxx; Hayes Wilson and Shisko 2012:xxx).
- So v - v - somehow must reflect the simplest possibility.
- Let’s also assume that some kind of “as if” principle folds in the - - v - cases — making the pattern even more frequent (almost half of all feet)

18. Our grid for the rajaz dimeter

- If the v vs. - difference for the default foot v - is going to be due to the principles above, then the grid will have to be basically amphibrachic, as follows:

```
x       x       x
x       x       x
x       x       x       x       x       x       x       x       x       x
```

Then, the obligatory - at the end of all feet reflects SUPERSTRONG IS LONG
The heavy found in the predominant foot type v - v - reflects STRONG IS LONG.
19. What is the tree?

- Prince would have us break down the ternary amphibrachs into a right-branching structure.
- No support for this in Hausa, but no evidence against it either.
- The adherence to the Lerdahl-Jackendovian numbers two and three forces us to have higher-level structure, with hemistichs.

```
   x x x x x x x x x x x x x x x x x x x
  Hemi    Iamb  Iamb  Iamb  Iamb
     |   |    |   |
    Iamb  Iamb  Iamb  Iamb
       |   |    |   |  superstrong  strong  weak
      x x x x x x x x x x x x x x x x x x x
```

20. The data we are working with

- These were all selected by Russ as a representative sample of *rajaz*
- 11 poems by 8 poets
- 2046 lines total
- These are notated by Russ for vowel length (not spelled, argh), foot division, and juncture.

21. A Rajaz stanza

```
v  v  v  v  v  v
A yad- da rai- naa ya fi soo,
v  v  v  v  v  v
A mai- ma- kon ‘yan ka- ma- shoo,
v  v  v  v  v  v  v
Ya-bon Ma- ‘ai- kii na fi soo,
v  v  v  v  v  v  v
Na baa da kwa- zoa na fi soo,
v  v  v  v  v  v  v
Ya-bon- sa baa Ma- gaa- ji baa.
```

(Akilu Aliyu, “Kokoon Mabarata”, verse 4)

‘In the way that my life prefers,
Instead of (being) a middle man,
Praise of the profit is what I prefer,
That I be diligent is what I prefer,
In praising him, not Magaji.’
22. Descriptive generalizations involving syllable quantity

- As Russ covered last time, there seem to be five major types of feet.
- Thus:

\[
\begin{align*}
\text{v} & \quad \text{-} & \quad \text{v} & \quad \text{-} \\
\text{-} & \quad \text{-} & \quad \text{v} & \quad \text{-} \\
\text{v} & \quad \text{v} & \quad \text{-} & \quad \text{-} \\
\text{-} & \quad \text{v} & \quad \text{v} & \quad \text{-} \\
\text{-} & \quad \text{-} & \quad \text{-} & \quad \text{-} \\
\end{align*}
\]

- In addition, there is also a certain number of minor feet.
  - = feet that are rare; typically about 5% of the feet in a poem.
  - We won’t try to analyze the minor feet here.

23. All foot types in corpus sorted by descending frequency

<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>v - v -</td>
<td>1362</td>
<td>- v - -</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- - -</td>
<td>871</td>
<td>- v v v</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- v v -</td>
<td>687</td>
<td>v v - v -</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- - v -</td>
<td>600</td>
<td>-----</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>v v -</td>
<td>417</td>
<td>v v - v</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>v - v v</td>
<td>35</td>
<td>- v - v -</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>v v v -</td>
<td>24</td>
<td>- v v - -</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>v -</td>
<td>19</td>
<td>- v v v v</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>v v v v -</td>
<td>19</td>
<td>v v -</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>v - -</td>
<td>16</td>
<td>v v v - -</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- v -</td>
<td>10</td>
<td>v v v v -</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- - v v</td>
<td>6</td>
<td>v v v v v</td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

24. Qualitative characterizations of the distributions of the five major foot types

- v - v -
  1. It is welcome everywhere, prevalent except in poems where some other foot type grabs all the cases.
  2. Where v - v - doesn’t win, it usually comes in second.

- - v -
  3. It is always despised as Foot 2 of any line.
  4. It is “tied to” v - v -: where - - v - is common, so is v - v -.

v v - -
  5. Always despised as Foot 1
  6. In some poems frequent or even dominant as Foot 2
  7. Tied to - - -: where v v - - is common, so is - - -, usually more so.
8. Seldom actually despised (at worst, shares equally with other nondominant types)
9. In a few poems favored as Foot 2

10. In some poems despised as Foot 1
11. In several poems highly favored as Foot 2

25. Looking ahead

We need constraints that have these properties:

- Across the board preference
  - Fundamentally favor v - v - across the board (see 1-2 above)

- The “tied-to” phenomenon
  - Favor - - v - , but only in contexts that also favor v - v - (see 4 above)
  - Favor v v - - only where - - - is also favored (7 above)

- Contextual preferences:
  - Disfavor v v - - in Foot 1 (5 above)
  - Disfavor - - v - in Foot 2 (3 above)
  - Mildly disfavor - - - in Foot 1 (10 above)
  - Boost for any of - v v -, v v - -, - - - in Foot 2 (6, 9, and 11 above)

26. The special status of stanza-final lines: “boosting”

- We think stanza-final lines are like regular lines, except that two foot types can be “boosted” when they are the very last foot of the stanza: v - v - and - - -
27. Looking the cases of “boosting” I: boosting to $v - v -$

- One diagram per poem
- Dotted = final foot of non-stanza-final lines
- Solid = final foot of stanza-final lines
- Degree of boosting varies from slight to overwhelming
28. Looking the cases of “boosting” II: boosting to - - -

29. Looking ahead to the analysis

- Boosting, particularly partial boosting, can be regarded as the effect of constraint interaction, with an added constraint applicable only in stanza-final position.

30. Desiderata for an analysis

- Get the qualitative generalizations in (22).
- Where possible, root the constraints in principles of metrics that have some typological validity.
- Put it all together to get good frequency matches to the observed counts in all 11 poems.

AS IF” PRINCIPLES

31. What they are

- “Fictional” treatment of quantities as other than they are phonologically

32. Anceps

- Treat line final syllables as heavy no matter what.

33. Motivation for Anceps

- It seems to be a universal, or near-universal, of quantitative metrics.
  - Persian, Arabic, Sanskrit, Latin, Greek, other verse forms of Hausa never regulate the quantity of the last syllable of a line.
• It perhaps could be related to “interval theory” of Steriade (xxx ref.): no following CV transition to provide sharp timing cue.
• We don’t know why the neutralized quantity is treated generally as heavy.

34. Initial squeezing

• You (may not/may/prefer to) treat an initial syllable as light.

35. An analog for Initial Squeezing

• Persian meter (Elwell-Sutton 1973:128) allows, indeed more or less prefers this:
  
  \[-v--/vv--/vv--/vv-\]

  for basic

  \[vv--/vv--/vv--/vv--/vv--\]

  and similarly for other meters starting \[vv-\]

• Hausa “false mutadarik” is quite similar

36. The main result of initial squeezing in the Hausa Rajaz

• \[-v-\] (the only heptamoraic foot), gets allowed in, since it is honorarily \[v-v-\]

37. Initial squeezing manifests itself differently in the Hausa Rajaz than in Persian

• In Hausa Rajaz, if you squeeze \[-v--\], it counts as \[vv--\], which is rare in any event in line-initial position.
• From which it follows that \[-v--\] is also rare.
  ➢ See (23): only 6/2000 lines

CONSTRAINT VIOLATIONS

38. Violations of LONG IS STRONG and STRONG IS LONG in the five basic types

\[
\begin{array}{ccc}
\times & \times & \times \\
\times & \times & \times & \times & \times \\
\mid & \checkmark & \checkmark \\
v & \_ & v & \_ & 0 & 0
\end{array}
\]
39. **Empirical consequences of prominence alignment**

- Every major foot ends in `-`; due to **SUPERSTRONG IS LONG**.
- The across-the-board preference for `- v -` and its Foot1 “as if” partner `- v -`.
- In an enhanced version of **STRONG IS LONG** for stanza-final feet, the “boosting” of `- v -` seen in (27).
- Note that `- - -` is disfavored by **LONG IS STRONG**
  - It is the only foot that has a bias in both Foot1 (bad) and Foot 2 (good); see below.

40. **Accounting for the overall limitation to five foot types**

- ***STRETCH** and ***SQUEEZE** force hexamonic feet, excepting in initial position with “as if” squeezing.
- **SUPERSTRONG IS LONG** forces `-` at the end of a foot.
- This reduces the logical possibilities to:

\[
\begin{array}{c|c|c}
\text{Unsquoze} & \text{Squoze} \\
\hline
v v - - & - - v - \\
- v - v & - v - - \\
- v v - & - v v v - \\
- - - & - - - \\
v v v v - & v v v v - \\
\end{array}
\]
• Of these, v v v - occurs occasionally (0.5% of all feet in corpus)
  ➢ We penalize it with a ban on *v v v, common in quantitative systems.
• - v - - is rare (0.1%) since you could only get it by squeezing initial -, which runs you
  afoul of the ban on initial vv.
• - v v v - has both problems and is unattested.

THE QUANTITATIVE CLAUSULA IN THE RAJAZ

41. Lines like to end in lots of -

• Persian ramal (Elwell Sutton 1976): v v realized as -, sometimes

  v v - - v v - - v v - - v v - - v v -
  0 3 3.5 35%

• Perhaps also Hausa mutadarik

42. There are perhaps degrees

Whatever violates

DON’T NOT END IN - - -

also violates

DON’T NOT END IN - -.

• Hence, v v - - weakly echos the distribution of - - - at the end of lines (item 7 in (24)
  above).

ANALYSIS IV: STUPID ARBITRARY STUFF WE CAN’T EXPLAIN

43. *Initial vv

• This is weird typologically and indeed Hausa has other meters that happily start with vv.

44. Preference in some poems for final - v v -

• See tendency 9 under (24) above.

SETTING UP THE GRAMMAR

45. GEN

• We included
all feet of 2, 3, 4, and 5 syllables with all possible quantities
- the two hexamoraic 6 syllable feet (v v v v v v, - v v v v v with initial squeezing)
- This is 62 candidates
- And we do this four times (two foot positions in line, stanza final/nonfinal)

46. The final constraint set

- Note that some constraints have positional clones, reflecting Kiparskyan “beginnings free, endings strict”.

<table>
<thead>
<tr>
<th>Constraint</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>*STRETCHED</td>
<td>Don’t map a mora to two grid positions</td>
</tr>
<tr>
<td>*SQUEEZED</td>
<td>Don’t assign more than one mora to grid position.</td>
</tr>
<tr>
<td>SQUEEZED LONG LINE INITIAL</td>
<td>Don’t use the “as if” clause for initial</td>
</tr>
<tr>
<td>SQUEEZED LONG LINE INITIAL — STANZA-FINAL LINES</td>
<td>ditto, but in stanza-final lines (needed?)</td>
</tr>
<tr>
<td>SUPERSTRONG IS LONG</td>
<td>see above</td>
</tr>
<tr>
<td>STRONG IS LONG</td>
<td>see above</td>
</tr>
<tr>
<td>LONG IS STRONG</td>
<td>see above</td>
</tr>
<tr>
<td>STRONG IS LONG - LAST FOOT OF STANZA</td>
<td>for v - v - “boosting”</td>
</tr>
<tr>
<td>DON’T NOT END IN - -</td>
<td>end a line in at least 3 -</td>
</tr>
<tr>
<td>DON’T NOT END IN - - -, STANZA FINAL</td>
<td>ditto, but in stanza-final line — “boosting”</td>
</tr>
<tr>
<td>FAVOR LINE-FINAL /v v -/</td>
<td>stupid arbitrary constraint</td>
</tr>
<tr>
<td>DISFAVOR LINE-INITIAL /v v/</td>
<td>stupid arbitrary constraint</td>
</tr>
<tr>
<td>*THREE LIGHTS</td>
<td>see above</td>
</tr>
</tbody>
</table>

CRUNCHING IT ALL OUT

47. Setting the weights

- We used the “Solver”.

48. Results

- Analysis matches the data (all 11 poems) rather closely.
  - It darn well better, because the model has a lot of parameters!
- Frequencies: correlation of predicted and observed is never less than \( r = .967 \) and in some cases near \( r = .99 \).
- Here are graphs for the worst case:

\[ \text{Or “do”, in some poems — unlike all the others we let this one go negative.} \]
- Good old generative success: no point on the axes other than at the origin.
- Frequency-matching success: all the points are near the $y = x$ symmetry line.
- We aren’t crowing since the constraint set is so large relative to the data.

49. How do the constraint weights vary?

- Very roughly:
  - The “constitutive” constraints like *STRETCH and *SQUEEZE and SUPERSTRONG IS LONG are weighted high in every poem.
  - Little detail constraints, like those favoring a particular foot in a particular location, vary a lot in their weight.
  - It’s not as clean as this implies, for some constraints are partially isofunctional, leading to relatively arbitrary assignments of the descriptive burden.

50. Is the analysis restrictive?

- Hard to tell.
- At least as a preliminary step, we can compute the factorial typology of the constraints in OT, which often behaves like “first choice” maxent.
- To keep things simple, let’s treat - - v - simply as a variant of v - v -
- SF = stanza final
Output #5   Output #6   Output #7   Output #8
Foot 1     v - v -     v - v -     v - v -     v - v -
Foot 2     v v - -     v - v -     v - v -     - v v -
SF Foot 1  v - v -     v - v -     v - v -     v - v -
SF Foot 2  - - -       v - v -     - - -       v - v -

Output #9   Output #10
Foot 1     v - v -     v - v -
Foot 2     - v v -     - v v -
SF Foot 1  v - v -     v - v -
SF Foot 2  - v v -     - - -

51. What is attested in the empirical “highest frequency candidate” typology?

<table>
<thead>
<tr>
<th>#</th>
<th>Poet/Poem</th>
<th>Factorial typology number</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.</td>
<td>AYG karuwa</td>
<td>1</td>
</tr>
<tr>
<td>7.</td>
<td>IYM Rokon Ubangji</td>
<td>1</td>
</tr>
<tr>
<td>9.</td>
<td>MHa tutocin shehu</td>
<td>1</td>
</tr>
<tr>
<td>11.</td>
<td>TTU Kanari</td>
<td>1</td>
</tr>
<tr>
<td>3.</td>
<td>AAA cuta wa mutawa ba</td>
<td>2</td>
</tr>
<tr>
<td>6.</td>
<td>IYM Harshen Hausa</td>
<td>5</td>
</tr>
<tr>
<td>8.</td>
<td>HGU gidan audu bako zu</td>
<td>5</td>
</tr>
<tr>
<td>10.</td>
<td>TTU Harshen Hausa</td>
<td>5</td>
</tr>
<tr>
<td>1.</td>
<td>AAA jihar kano</td>
<td>8</td>
</tr>
<tr>
<td>2.</td>
<td>AAA kokon mabarata</td>
<td>8</td>
</tr>
<tr>
<td>5.</td>
<td>ADS tabarkoko wads</td>
<td>10</td>
</tr>
</tbody>
</table>

52. This could be done better

- We need to do a Harmonic Grammar factorial typology
- There is software for this at UMass but we need to climb that learning curve.