Linguistics 251 Hayes/Schuh
Metrics Spring 2015

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

- Origin: Prince (1989), though he uses SW trees rather than grids.
- 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 syllabicity (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

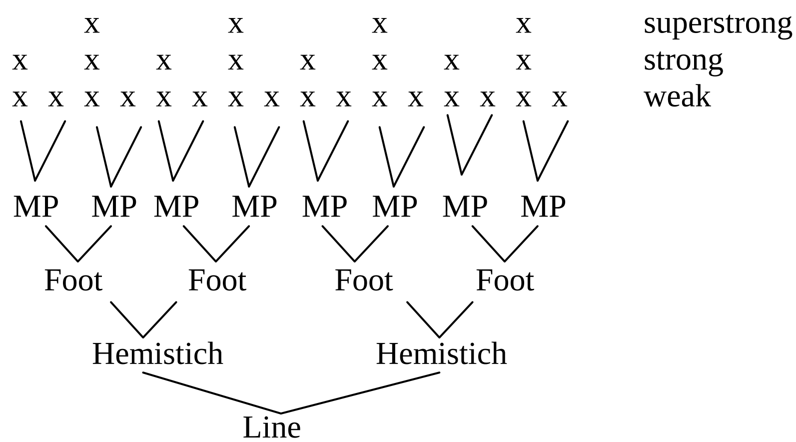
- Recall that this is v v - / v v - / v v - / v v -, with - substitutable for v v.

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



12. Pattern constraints for the mutadarik (infinite weight)

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

Prominence constraints:

ALIGN(head x, MP, Left) = MP's are left-strong (universally? Prince)
ALIGN(head x, Foot, Right) = 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 v v 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

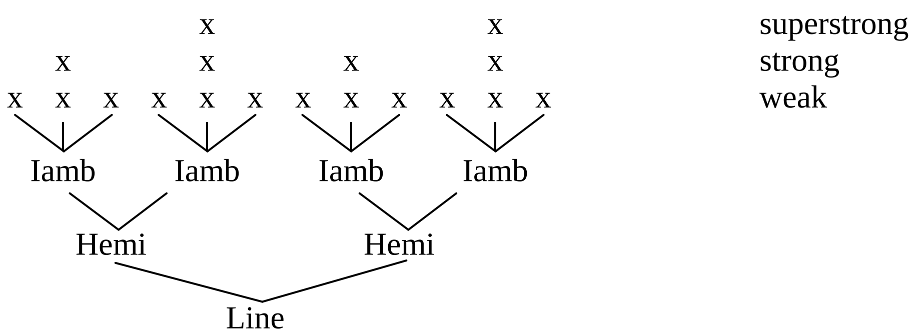
- If the v vs. - difference for the default foot v - is going to be due to the principles above, then the grid will have to be basically amphibrachic, as follows:

```
            x                 x               superstrong
   x        x        x        x               strong
x  x  x  x  x  x  x  x  x  x  x  x            weak
```

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.



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

—	= heavy syllable
v	= light syllable

(Aƙilu Aliyu, "Koƙon 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:

v — v —
— — v —
v v — —
— v v —
— — —

- 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

v - v -	1362	- v - -	6
- - -	871	- v v v	5
- v v -	687	v v - v -	5
- - v -	600	- - - -	2
v v - -	417	v v - v	2
v - v v	35	- v - v -	1
v v v -	24	- v v - -	1
v - -	19	- v v v v	1
v v v v -	19	v v -	1
v - - -	16	v v v - -	1
- v -	10	v v v v -	1
- - v v	6	v v v v v	1

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.

- **- v v -**
  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)

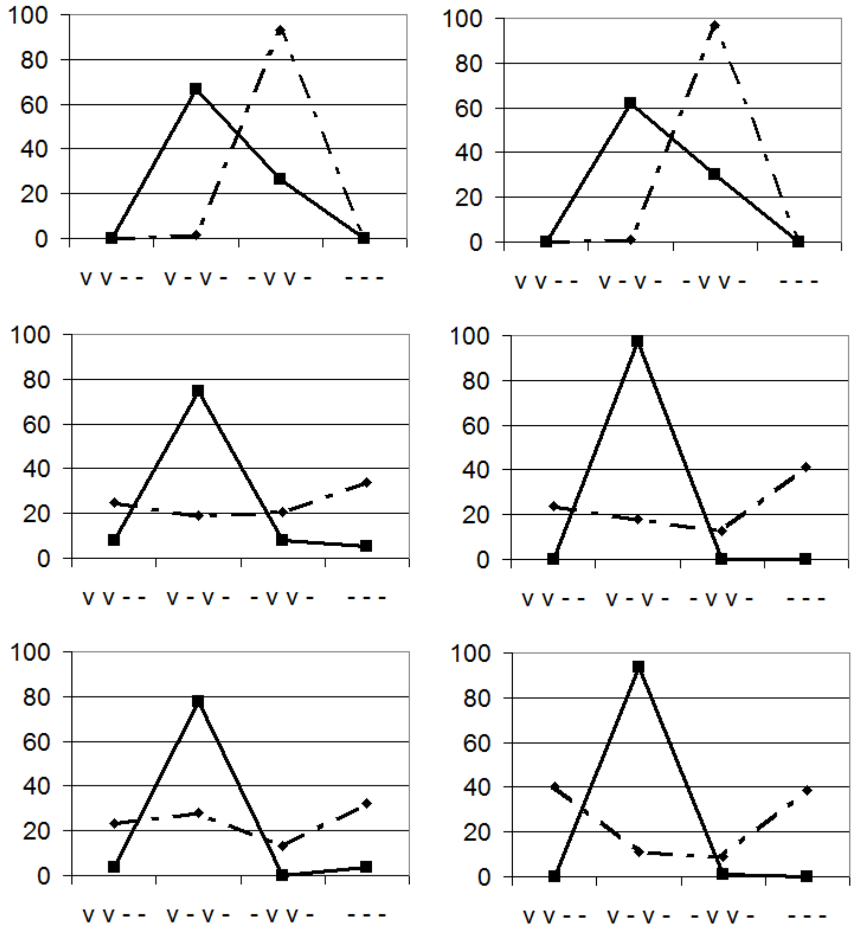
- Contextual preferences:
  - ➢ Disfavor v v - - in Foot 1 (5 above)
  - ➢ Disfavor - - v - in Foot 2 (3 above)
  - ➢ Mildly disfavor - - - in Foot 1 (10 above)
  - ➢ Boost for any of - v v -, v v - -, - - - in Foot 2 (6, 9, and 11 above)

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

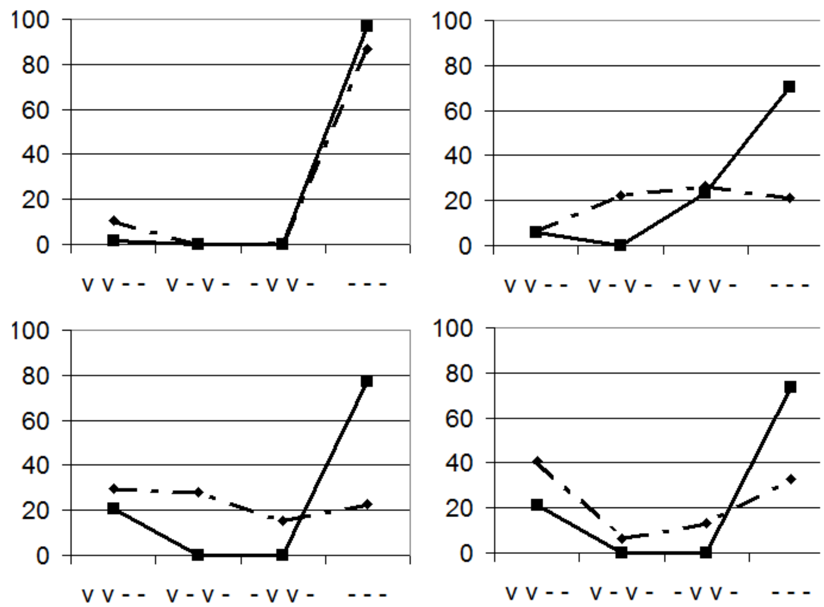
- We think stanza-final lines are like regular lines, except that two foot types can be “boosted” when they are the very last foot of the stanza: v - v - and - - -

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 - - / v v - - / v v - - / v v -

  for basic

  v v - - / v v - - / v v - - / v v -

  and similarly for other meters starting v v -

- 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 v v - -, 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

```
                x
      x         x
  x   x   x  x  x   x
  |   |/     |  |/
  v   —      v  —
```

	LONG IS STRONG	STRONG IS LONG
v — v —	0	0

```
                x
    x           x
x   x   x   x   x   x
|   |/      |   |/
—   —       v   —              0 (“as if”)        0
```

```
                x
    x           x
x   x   x   x   x   x
|   |   |/      |/
v   v   —       —              1                  1
```

```
                x
    x           x
x   x   x   x   x   x
|/      |   |   |/
—       v   v   —              1                  1
```

```
                x
    x           x
x   x   x   x   x   x
|/      |/      |/
—       —       —              2                  1
```

39. Empirical consequences of prominence alignment

- Every major foot ends in -; due to SUPERSTRONG IS LONG.
- The across-the-board preference for v - v - and its Foot1 “as if” partner - - v -.
- In an enhanced version of STRONG IS LONG for stanza-final feet, the “boosting”of v - 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 hexamoraic feet, excepting in initial position with “as if” squeezing.
- SUPERSTRONG IS LONG forces a - at the end of a foot.
- This reduces the logical possibilities to:

Unsquoze	*Squoze*
v v - -	- - v -
- v - v	- v - -
- v v -	- v v v -
- - -	
v v v v -	

- Of these, v 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 -
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".

*STRETCHED	Don't map a mora to two grid positions
*SQUEEZED	Don't assign more than one mora to grid position.
SQUEEZED LONG LINE INITIAL	Don't[2] use the "as if" clause for initial
SQUEEZED LONG LINE INITIAL — STANZA-FINAL LINES	ditto, but in stanza-final lines (needed?)
SUPERSTRONG IS LONG	see above
STRONG IS LONG	see above
LONG IS STRONG	see above
STRONG IS LONG - LAST FOOT OF STANZA	for v - v - "boosting"
DON'T NOT END IN - -	end a line in at least 3 -
DON'T NOT END IN - - -, STANZA FINAL	ditto, but in stanza-final line — "boosting"
DON'T NOT END IN - - -	end a line in at least 3 -
FAVOR LINE-FINAL /V V -/	stupid arbitrary constraint
DISFAVOR LINE-INITIAL /V V/	stupid arbitrary constraint
*THREE LIGHTS	see above

CRUNCHING IT ALL OUT

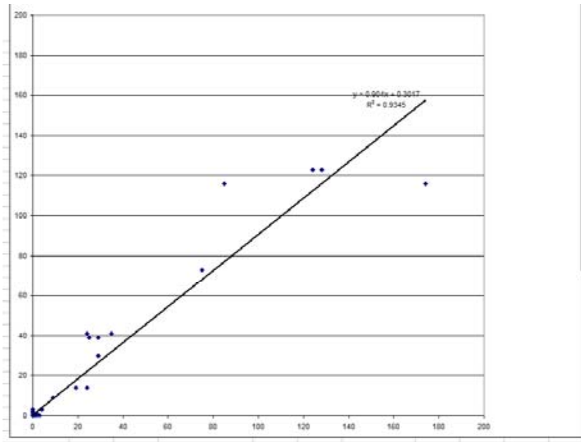
47. Setting the weights

- We used the "Solver".

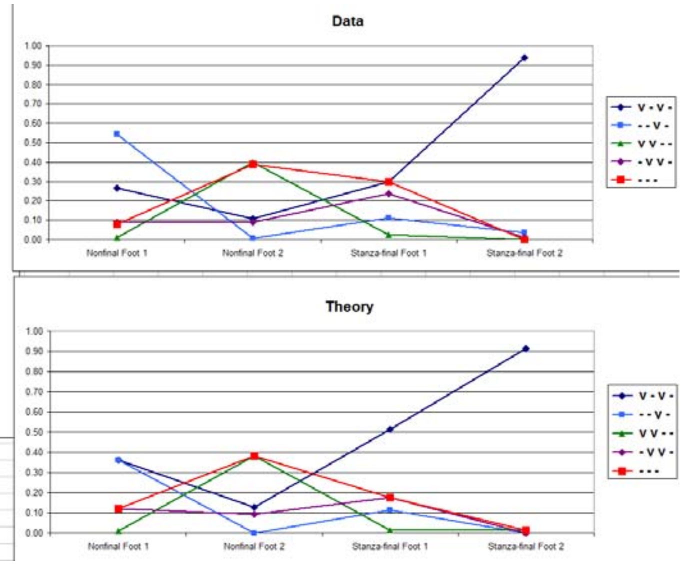
48. Results

- 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:

[2] Or "do", in some poems — unlike all the others we let this one go negative.



correl:	0.967	Stretched mora non-line	6.03	SIL - last foot of sta	5.50
odd feet:	16	Honorary line-final heav	14.09	- - - clausula	0.00
total feet	800	Squeezed long line initi	0.00	- - - clausula, stanza	0.00
pct. odd	2.0	Squeezed long line initi	1.57	Short -- clausula	2.19
		Superstrong is long	3.65	Line-final /v v -/ clau	0.77
		Long is strong	0.00	Line-initial v v	2.59
		Strong is long	1.10	*Three lights	1.61



- 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 #1  Output #2  Output #3  Output #4
Foot 1     v - v -    v - v -    v - v -    v - v -
Foot 2     - - -      - - -      v v - -    v v - -
SF Foot 1  v - v -    v - v -    v - v -    v - v -
SF Foot 2  v - v -    - - -      v - v -    v v - -
```

```
             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?

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

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.