Poetic Rhyme as a Tier-Based Strictly Local Constraint Grammar

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Problem: Rhyme, forlorn

Formal models of poetry often successfully describe prosodic templates (Jakobson 1960, Halle & Keyser 1971, Kiparsky 1977), but they largely ignore segmental content.

"Why are metrical templates always prosodic? Why are there no meters that partially fix the segmental content of lines?" (Blumenfeld 2016, p. 426)

Two words rhyme by matching their stressed nucleus and following segments (Attridge 1998).

↓↓↓

This agreement over structurally-constrained, long distances looks like phonological harmony!

Proposal: FLT + Poetics

Formal language theory can address this gap left in generative metrics. I posit the following:

- Rhyme is a segmental constraint formally distinct from meter.
- Rhyme can be modeled using parallel techniques to classic cases of segment harmony (Heinz, Rawal & Tanner 2011, Aksënova et al. 2024) and morphosyntactic agreement (Hanson 2025).
- Rhyme belongs to the class of Input-Dependent Multi-Tiered Strictly Local (I-MTSL) grammars (De Santo & Graf 2019).

Two claims to model

1. There is a universal grammar of rhyme: Agree(Feature) on a tier.
2. Frame-specific knowledge determines which segments project to the tier.

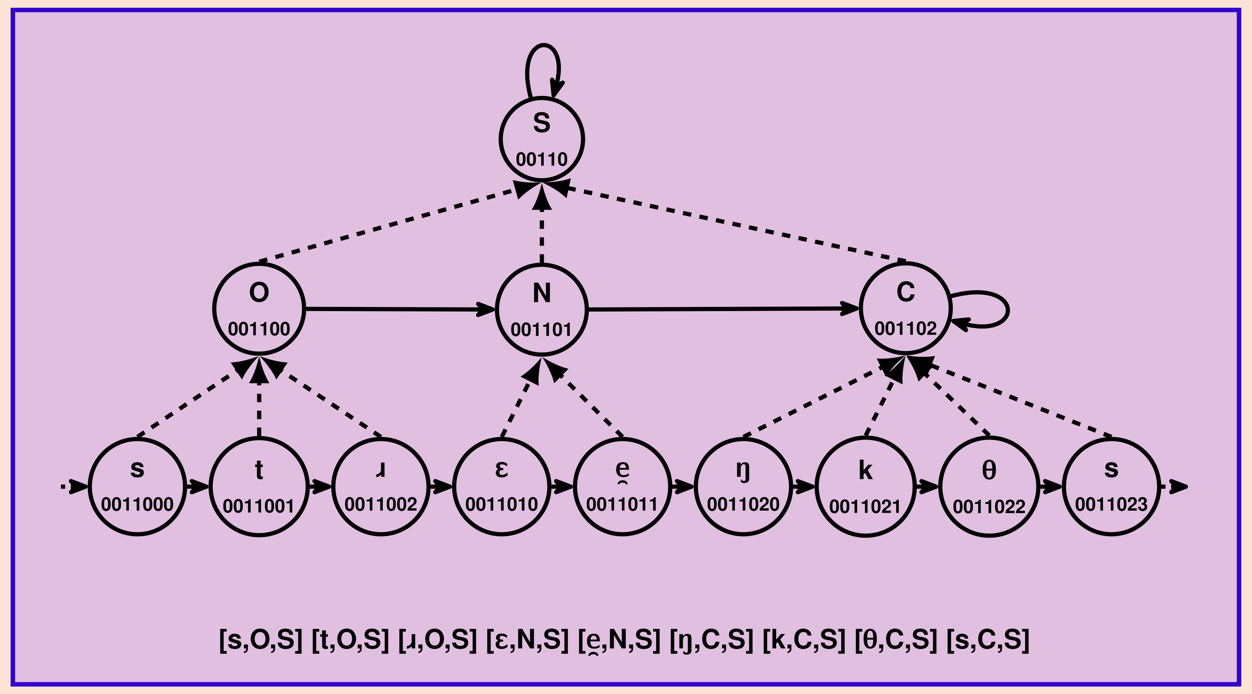

Figure 1. *Strengths* in tree structure and in flat structure

Test case: ROSES

Roses are red,	(ˈroʊ.zɪ.zɚ)(ˈrɛd.♪.♪)
Violets are blue,	(ˈvaj.lɪ.tsɚ)(ˈblu.♪.♪)
Sugar is sweet,	(ˈʃʊ.gɚ .ɪz)(ˈswit.♪.♪)
Likewise are you	(ˈlaj.kwaj.zɚ)(ˈju.♪.♪)

We assume poets have awareness of structure beyond the syllable; rhyme is a demonstration of that awareness. Rhyme, like harmony, is the agreement of features, but unlike harmony, requires identity of parallel segment nodes in a tree.

Representation

Hierarchical information as seen in a tree diagram can be compressed with no data-loss into a flat string (Figure 1). While this has been shown for syllabic structure labels (Strother-Garcia 2019), the same quantifier-free transduction can be applied to greater poetic structure.

Frame-specific projection

The feature bundles defined by segmental icons such as /s/ receive additional features encoding their parents in the tree, such as **O** for onsets. We can pick out any member in a string or tree using a shorthand Gorn address (Gorn 1967).

- **Target**: final nucleus of each couplet
- **Projection function**: if node *x* is a nucleus and its parent syllable is final in its dactyl and that dactyl is final in its line and that line is final in its couplet → project *x*

digit position - value (interpretation)
0 - 0 (member of first quatrain)
1 - 0 (first couplet), 1 (second couplet)
2 - 0 (first line), 1 (second line)
3 - 0 (first dactyl), 1 (second dactyl)
4 - 0 (first syllable), 1 (second syllable), 2 (third syllable)
5 - 0 (onset), 1 (nucleus), 2 (coda)
6 - 0 (first in cluster), 1 (second in cluster), 2 (third in cluster), 3 (fourth in cluster)

Figure 2. ROSES address interpretations

Universal evaluation of the localized tier-string

Tree: $N(p(x)) \wedge \texttt{fin}(p(p(x))) \wedge \texttt{fin}(p(p(p(x)))) \wedge \texttt{fin}(p(p(p(p(x)))))$

String: $N(x) \wedge \texttt{fin/syl}(x) \wedge \texttt{fin/dact}(x) \wedge \texttt{fin/line}(x)$

Gorn: $\mathfrak{G}^0_6(x) \wedge \mathfrak{G}^1_5(x) \wedge \mathfrak{G}^0_4(x) \wedge \mathfrak{G}^1_3(x) \wedge \mathfrak{G}^1_2(x)$

Once a tier has been projected, long-distance things are adjacent. This is similar to projecting vowels to a tier and agreeing feature [round], but in rhyme, *all* features must agree for a string to be grammatical.

TSLocality uses a function to project segments relevant to a phonotactic constraint. In poetry, the frame determines what projects, i.e., what must rhyme.

$Tier_{ROSES}$: /uu/
Constraint: *[αF][−αF]
Rhyme accepted!

Extension of the model

Some rhyme schemes require more than just nucleus agreement. Consider a version of ROSES with a nucleus and coda:

Roses are red,
One pigeon /kuz/,
Two pigeons dance,
Three sing the /bluz/

This requires multiple tiers, which is easy to implement by adjusting the exact parent functions.

- Nucleus tier: /uu/
- Coda tier: /zz/

Conclusions and future directions

Rhyme is formally similar to long-distance agreement modeled with TSL grammar.

We've shown this for the narrow definition of rhyme, but there are other patterns of phonological agreement, e.g., assonance, slant rhyme, *rime riche,* alliteration, etc.

Figure 3. Quatrain of dactylic dimeter, the ROSES template