Imperfect Rhymes as a Measure of Phonological Similarity

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The degree of similarity between segments is central to many domains of phonology:

- IO & BR Faithfulness (McCarthy & Prince 1995)
- OCP (e.g. Leben 1973): adjacent elements must be dissimilar
- Agreement by Correspondence (e.g. Rose & Walker 2004): harmony between segments that meet a threshold of similarity

Intuition: speakers are aware of and can measure how similar segments are. Sometimes similarity is avoided (OCP), and sometimes it is reinforced (ABC).
Measuring Similarity

- Similarity is measured with distinctive features, and all features are equal.
- Does this match speakers’ intuitions about similarity?
Measuring Similarity

- Do more featural differences = greater dissimilarity?
- Is a difference in $\pm F$ equivalent to a difference in $\pm G$?
Probing speakers’ assessments about similarity: imperfect rhymes
Imperfect Rhymes

- Imperfect rhymes: sometimes rhyming words don’t rhyme exactly:

  *This version of the world will not be here long* [læŋ]
  *It is already gone It is already gone* [ɡʌn]

  T Bone Burnett, “Palestine, Texas”

- Assuming lyricists are more likely to use similar-sounding imperfect rhymes than dissimilar ones, we can use imperfect rhymes to probe speakers’ judgments about segmental similarity.
If featural similarity matches speakers’ judgments about similarity, the frequency of consonantal pairings in imperfect rhymes should be inversely proportional to the number of features they mismatch on.
The Data

- Our study: rhymes from 117 songs from many genres of popular music; 1977–2016.
- Data collected by AK and students at the North Carolina School of Science and Mathematics.
  - Juniors in John Woodmansee & Ormand Moore’s 2016–2017 American Studies class
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- Same number of consonants: *long/gone* but not *fun/fund*
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Total: 378 pairs of mismatched consonants
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⇒ This idealized feature system provides a rough starting point: do distinctive feature systems in general have a hope of reflecting speakers’ judgments?
General Trends
Most Common Mismatched Consonants

Consonant Pairs
n > 5
Are mismatches with fewer featural differences more common?

Yes, mostly:

![Number of Consonant pair Mismatches by Number of Featural Differences](chart.png)
The Numbers & Some Examples

- One feature different: 66
- Two features different: 149
- Three features different: 73
- Four features different: 55
- Five features different: 25
- Six features different: 9
  - *smile/time* × 2; *while/time* (Colbie Caillat, “Bubbly”)
  - *whole/home; close/home* × 2; *nine/life* × 2 (Emimem, “Lose Yourself”)
  - *roof/moon* (Tom Petty, “Even the Losers”)
- Seven features different: 1
  - *whole/broke* (Emimem, “Lose Yourself”)
Place Features are to Blame.

- Low number of 1-feature differences: place features
- A multivalued [Place] feature smooths things out:

Number of Consonant pair Mismatches by Number of Featural Differences using Multivalued [place]
Multivalued Features Everywhere

Number of Consonant pair Mismatches by Number of Featural Differences using Place, Manner, and Voice

Number of Features on which Consonants Differ

Number of Occurrences
Distinctive features do a good job of modeling imperfect rhyme frequency.

Featural differences match speakers’ similarity intuitions.

Except for place features: mismatches in place mean a large number of featural differences, but this is not reflected in the frequency of pairs mismatching in place.

Fewer multivalued features perform better than many binary features.

Next step: compare specific feature systems.
A Closer Look
Not All Features are Equal

- If consonants mismatch on exactly one feature:
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![Bar chart showing frequency of mismatched features with just 1 feature difference.](chart.png)
Not All Features are Equal

- If exactly two features mismatch:

![Mismatched Features with just 2 Feature Differences](chart.png)
Some mismatch more than others.

To ensure this isn’t simply a reflection of consonantal frequency, we did the same analysis on the portion of the CMU dictionary that also occurs in CELEX (Baayen et al. 1995) to weed out low-frequency items:
- Match each final-stress word to all other words with the same final vowel and same number of consonants
- Compare coda consonants as before
Our Data vs. CMU/CELEX

- Over represented: [lab, cor]
- Under represented: nearly everything else
- Mismatches on [lab, cor] are more acceptable. Perhaps differences along these dimensions are “smaller” than differences along other dimensions.
What’s up with [lab] & [cor]?

- [m]∼[n]: 31.1% (60/193) of all [lab] mismatches; 27.8% (60/216) of [cor] mismatches.
- This accounts entirely for the prevalence of [lab] and [cor] mismatches.
- We can’t explain the high frequency of [m]∼[n] merely on the grounds that place cues for nasals are weak: why are [n]∼[ŋ] and [m]∼[ŋ] infrequent?
  - 9 tokens of [n]∼[ŋ]; 18.4% of [dor] mismatches, 4.2% of [cor] mismatches
  - 1 token of [m]∼[ŋ]; 2.0% of [dor] mismatches, .5% of [lab] mismatches
- It looks like a combination of nasal place weakness and a preference for [lab]/[cor].
Implications

What this might mean:

- Certain feature (mis)matches are more significant than others, as are certain combinations.
- E.g. labials and coronals are judged as more similar than, say, labials and dentals, stops and fricatives, etc.
Implications

In phonological systems:

- If featural asymmetries matter to grammars, they should arise in the typology of ABC/OCP systems.
  - Cooccurrence of similar consonants is disfavored in $C_1C_2C_3$ Arabic roots. Frisch et al. (2004): all combinations of non-identical place features in $C_1$ and $C_3$ are over represented, but labial/dorsal combinations are less over represented than others.
  - Not so for $C_1$ and $C_2$ though

- But maybe grammars don’t care about these asymmetries. Grammars are a step removed from phonetic detail in other ways.
Comparison with Zwicky (1976)
Most Common Consonant Pairs

Consonant Pairs
\( n > 5 \)

Consonant Pairs from Zwicky
\( n > 2 \)
Most Common Consonant Pairs

- [m]~[n] is the most common pair in both analyses, but:
  - It is 39.8% of all pairs in Zwicky
  - Only 15.9% in our data (60/378)

- [n]~[ŋ] is second most common for Zwicky (8.9%)
  - 12th on our list (2.4%; 9/378)
Zwicky’s (1976) results (for feature mismatches ≥ 10):

- [dor] 148
- [lab] 138
- [cor] 70
- [cont] 49
- [voi] 19
- [pal] 10
Conclusion
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- Generally, fewer featural differences between consonants makes them more likely to be paired in rhymes.
- Except for place features, counting features is a plausible model of speakers’ similarity judgments.
- But the particular features involved matters, too: do some they represent smaller differences?
Next Steps

- Vowels
- Differences in number of consonants
- Compare specific feature systems
- Morphology (Zwicky 1976): e.g. does past-tense /d/ behave differently from other /d/?
- Genre & year differences


Thanks to these students for their contributions to this work: