Imperfect Rhymes as a Measure of Phonological Similarity

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1 Similarity in Phonology

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

⇒ Do more featural differences = greater dissimilarity?

⇒ Is a difference in [±F] equivalent to a difference in [±G]?

2 Imperfect Rhymes

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

(1) *This version of the world will not be here long* [laŋ]
It is already gone It is already gone [gan]
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.

3 Our Study

3.1 The Data

- Zwicky (1976): a limited study of "rock rhyme" in 1960s–1970s rock.
- 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
- For today, 294 rhyming pairs of words meeting the following criteria:
  - "Masculine" rhymes: the stressed/rhyming syllables are final: *unfair/compare*
    - "Feminine" rhymes (*treble/rebel*): stressed syllable and all following syllables "should" match. Not sure how to handle them yet...
  - Identical vowels (analysis here focuses on consonants)
  - Same number of consonants: *long/gone* but not *fun/fund*
- Identical pairs included unless the pair is repeated in identical lines (e.g. it's in the chorus).
- Transcriptions pulled from CMU Pronouncing Dictionary
- In two words with shape $\ldots \mathrm{VC}_1\mathrm{C}_2\ldots\mathrm{C}_n$, we compared C_1 to C_1, C_2 to C_2, etc.
  - This doesn't account for cases where Word 1's C_1 matches Word 2's C_2, but it's a good first approximation.
- Total: 378 pairs of mismatched consonants

3.2 Evaluating Featural Similarity

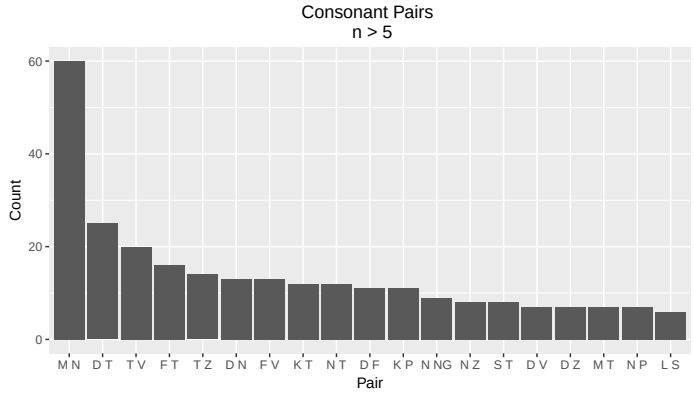
- Our feature system: an "average" of commonly accepted systems, perhaps most similar to Hayes (2009).
- Uncontroversial features: [syll, son, approx, voc (= cons), lat, nas, cont, voi]
- [delayed release] to distinguish stops from affricates (fricatives are [–d.r.], contra Hayes)
- Place features: to avoid inflation of featural differences, we used [lab, dental, cor, pal, dor] instead of [lab, cor, dor] with many dependent place features.
- This idealized feature system provides a rough starting point: do distinctive feature systems in general have a hope of reflecting speakers' judgments?

4 Results

4.1 General Trends

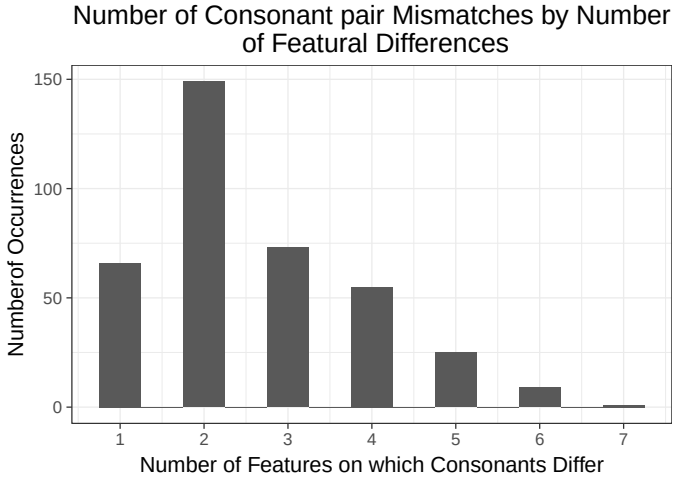
- Most common consonant pairs:

(2)



- Pairs with fewer featural differences more common, for the most part:

(3)

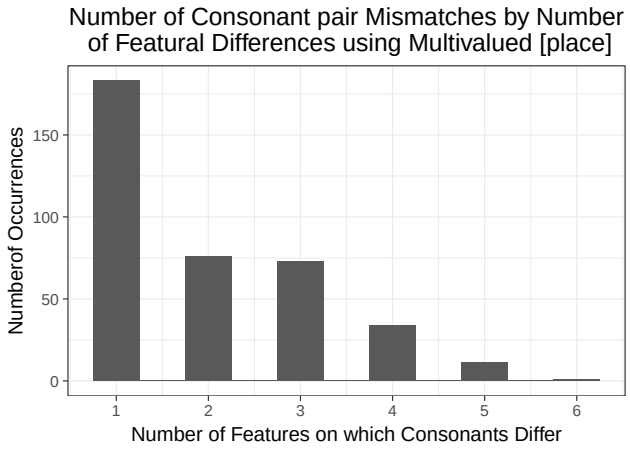


(4) **The numbers:**

- •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")

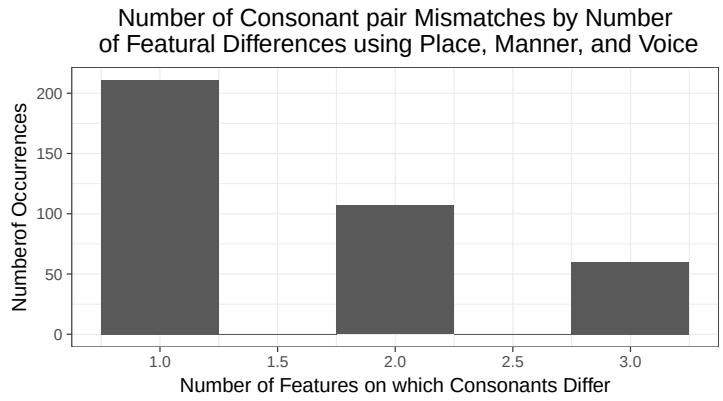
- Low number of 1-feature differences: caused by place features
- A multivalued [Place] feature smooths things out:

(5)



- And with just 3 features:

(6)



- These simplifications suggest that features and speakers' judgments are related.

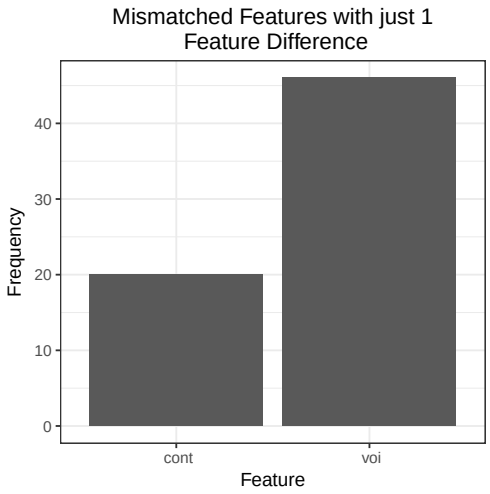
- Interim Summary
  - Distinctive features do a decent job of modeling imperfect rhyme frequency.

  ⇒ 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.
  - For the future: compare specific feature systems.

4.2 Not All Features are Equal

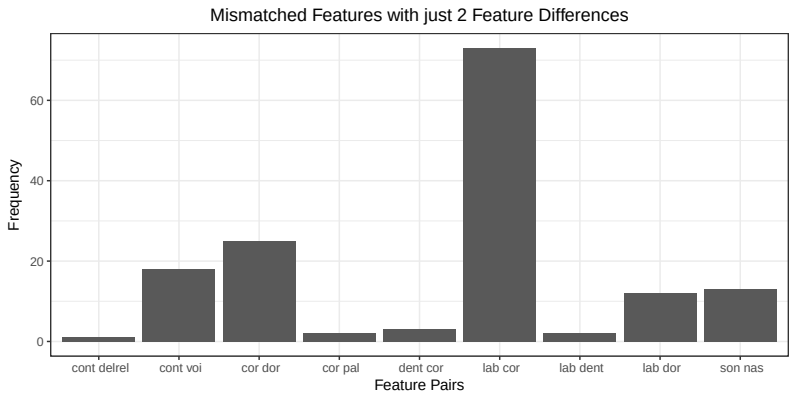
- If exactly one feature mismatches:

(7)



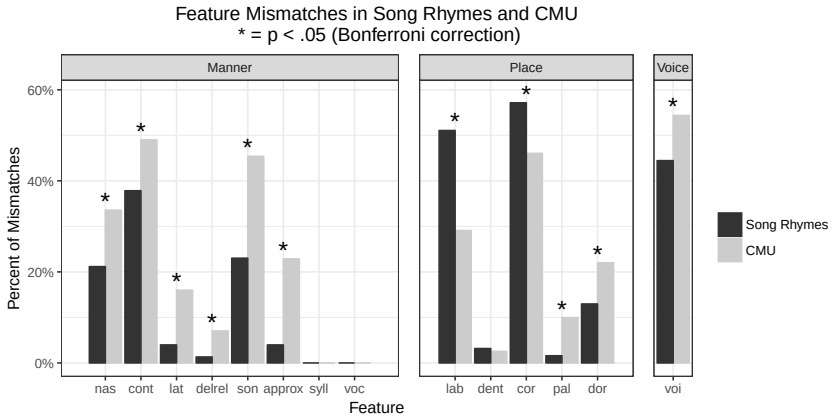
- If exactly two features mismatch:

(8)



- 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

(9)

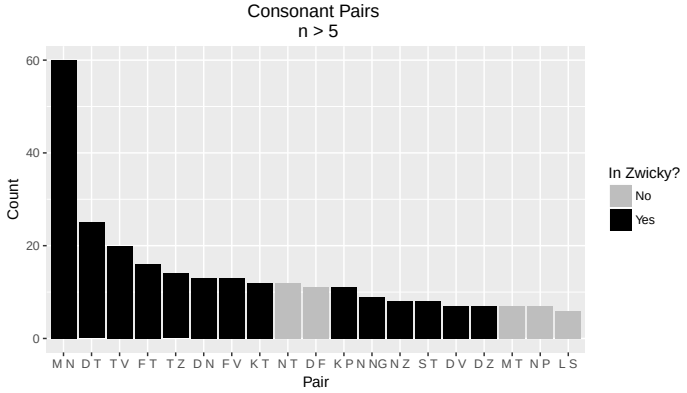


- Over represented: [lab, cor]
- Under represented: nearly everything else
- Mismatches on [lab, cor] are more acceptable. Perhaps differences along these dimensions are "smaller" than differences along other dimensions.
- What's up with [lab] & [cor]?
  - [m]∼[n]: 31.1% (60/193) of all [lab] mismatches; 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 [m]∼[ŋ] and [n]∼[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].
- 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.
  - 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.

5 Comparison with Zwicky (1976)

- Most Common Consonant Pairs

(10) a.



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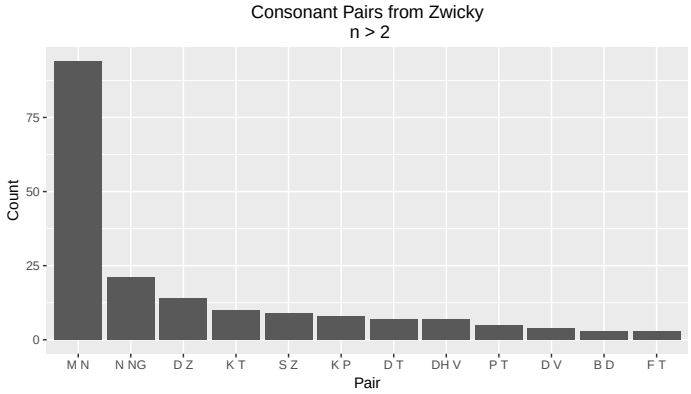
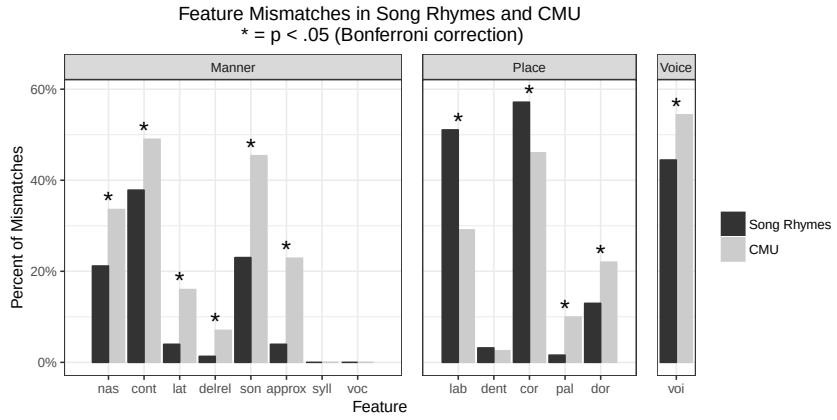


- [m]∼[n] is the most common pair in both analyses, but:
  - It is 39.8% of all pairs in Zwicky
  - Only 15.9% in our data (60/378)

- [n]∼[ŋ] is second most common for Zwicky (8.9%)
  - 12th on our list (2.4%; 9/378)

(11)



- Zwicky's (1976) results (for feature mismatches ≥ 10):
  - [dor] 148
  - [lab] 138
  - [cor] 70
  - [cont] 49
  - [voi] 19
  - [pal] 10

6 Conclusion

- 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

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