Explaining Sour Grapes Harmony's Unattestedness with Agent-based Modeling

Brandon Prickett ♦ bprickett@umass.edu ♦ brandon-prickett.com

41st West Coast Conference on Formal Linguistics

1. Introduction

- Sour Grapes is an unattested harmony pattern that is predicted by several constraint-based theories of assimilation (Bakovic 2000).
- Typically, explanations for why Sour Grapes is unattested propose that it is categorically unrepresentable (e.g., Wilson 2006; Heinz 2018).
  - But artificial language learning experiments have struggled to find evidence for such a limitation in humans (e.g., Lin & Myers 2010; Prickett 2023).
- Here I explore an alternative: that the learnability of Sour Grapes causes it to be less diachronically stable (for more discussion of learnability explaining typology, see, e.g., Staubs 2014; Stanton 2016).
  - This diachronic instability could then lead to the pattern's typological absence.

2. Sour Grapes

- Attested harmony patterns spread a **feature's value** from one edge of a phonological domain to the other, with spreading sometimes being stopped by **blocker** segments (Rose & Walker 2011).

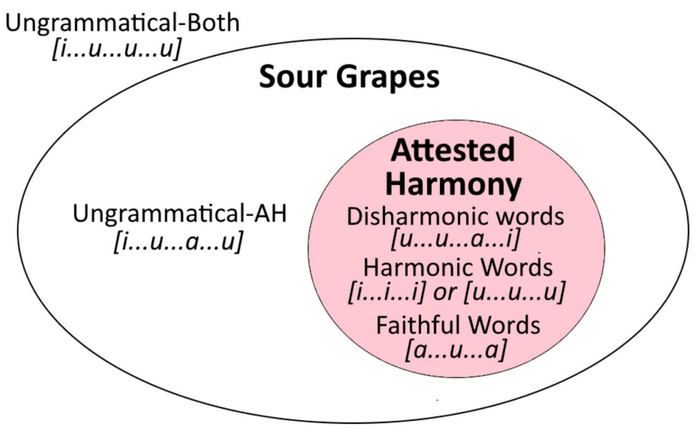
/p**i**tukutʃu/ → [p**i**t**i**k**i**t**i**ʃ**i**] /p**i**tuk**a**tʃu/ → [p**i**t**i**k**a**tʃu]

- In Sour Grapes, blocker segments block ***any*** spreading from occurring, with harmony otherwise acting normally (Bakovic 2000; Wilson 2006):

/p**i**tukutʃu/ → [p**i**t**i**k**i**t**i**ʃ**i**] /p**i**tuk**a**tʃu/ → [p**i**tuk**a**tʃu]

3. Artificial Harmony Patterns

- I created two minimally different artificial harmony patterns: **attested harmony (AH)** and **sour grapes (SG)**.
- Each language had:
  - A vowel inventory of [i], [u], and [a]
  - A CV syllable structure
  - Left-to-right backness harmony with [a] as a blocker
- There were five crucial word categories:

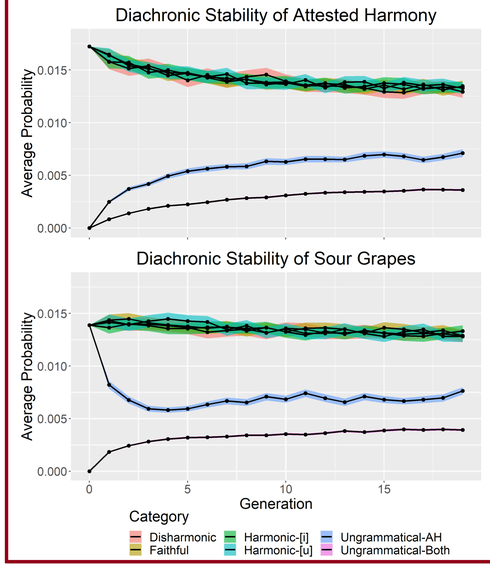


4. Agent-based Modeling

- Agent-based modeling has been shown to be useful for explaining facts about phonological typology (e.g., Hughto 2018; Beguš 2020; O'Hara 2021).
- I simulated language change over series of generations, with each generation attempting to acquire the language created by the output of the previous one.
- For learning, I used the maximum entropy phonotactic learner presented in Prickett (2023), which can represent SG *and* attested harmony with its constraints.

5. Results

- The figures below show average probabilities for each word category across 20 generations.
- When the model is initially trained on an attested harmony language, it's diachronically stable.



- However, when initially trained on Sour Grapes, the model falls into a pattern that's closer to AH (with significantly less probability being given to *Ungrammatical-AH words*).

6. Conclusions

- The instability of Sour Grapes is likely due to the subset-superset relationship between these two possible harmony patterns.
- This suggests a learning-based explanation for Sour Grapes' typological absence: it could be absent because it is less diachronically stable.
- This also suggests that attempts to categorically limit the phonological grammar from representing Sour Grapes may not be necessary.