

A count effect in Warlpiri vowel harmony

Margit Bowler (University of Manchester, margitbowler@gmail.com) & Jesse Zymet (UC Berkeley, jzymet@berkeley.edu)

1. Overview

Majority rules vowel harmony: a hypothetical pattern whereby the grammar assesses the number of majority and minority vowels in a word, and harmonizes the minority vowels.

- Previously advanced as a **pathological pattern** predicted by Optimality Theory to exist under certain assumptions.
- Prior investigators have yet to identify a case of majority rules harmony.

We present data on variable vowel harmony in Warlpiri suggesting it as a potential example.

- We identify a **count effect** whereby the grammar assimilates the vowel occurring the least number of times in the word, regardless of direction.
- The data are consistent with **many-to-one harmony**[†] or **majority rules harmony**.

The data lend support to a system in which directionless assimilatory constraint dominates count-based, symmetric IDENT.

2. Background on count effects in harmony patterns

Lombardi (1999): OT predicts majority rules patterns.

- E.g., if AGREE >> IDENT(lar) >> *LAR, AGREE_{DIREC}(lar) ...
- then we get /pig/ → [pikt] but /pigds/ → [pigdz], /pikdz/ → [pigdz], etc.

Lombardi (1999), Baković (2000), for example: add other constraints, potentially with some universal ranking, to rule out pattern (binary faith and constraint conjunction respectively).

Finley (2008): Experiments reveal learners prefer directional harmony to majority rules.

- Helps explain rarity/so-far-unattestedness, but should it be ruled out completely?

3. Background on Warlpiri

Warlpiri: Pama-Nyungan language spoken in Australia by around 3,000 people.

- Has **three vowels**: [i a u].
- The high vowels were previously shown to trigger progressive and regressive cross-boundary rounding harmony; [a] is not subject to harmony, and can block it (Nash 1986, Harvey & Baker 2004).

4. Introduction to the data

Data drawn from text corpus called the *Warlpiri Dictionary Project* (WDP).

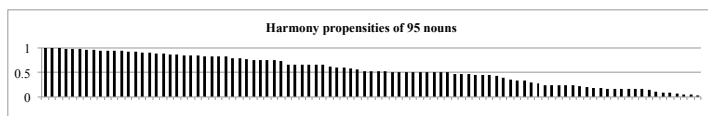
- WDP data collected by a number of linguists (primarily Ken Hale and Mary Laughren) in central Australia in the 1970s and 1980s.
- Disharmonic nouns were identified in the WDP, and their frequencies were calculated from Warlpiri sentences.

Warlpiri disharmonic nominals appear to be in a stage of regularizing to harmonic forms. Our interest is in how harmony behaves in this stage.

- Of the 355 disharmonic noun roots identified, **95** vary with a harmonic form.[†]

- (1) wirinkuru ~ wirinkiri ‘spindle’ kulkuri ~ kulkuru ‘middle’
mijipuru ~ mujupuru ‘marsupial’ juwinti ~ jiwinti ‘wild currant’

Propensity for variable noun to take a harmonic form differs by word, distributing evenly:[†]



- The following type counts here include all words displayed above.

5. Variable vowel harmony with equal numbers of disharmonic vowels

54 nouns have equal numbers of /u/'s and /i/'s.

- No dominant-recessive harmony: roughly 50% harmonizing to [u].
- They vary overwhelmingly lexically as to whether harmonic form displays progressive or regressive harmony: roughly 50% harmonizing regressively.

(2a) *Progressive*

mijura ~ mijira ‘ceremonial fat’
junjurkupi ~ junjurkupu ‘python’

(2b) *Regressive*

marluri ~ marliri ‘claypan’
mijipuru ~ mujupuru ‘marsupial’

Suggests harmony **agnostic to vowel and direction** in the aggregate—conditions we would expect to obtain in a system harmonizing to majority when disharmonic vowels are unequal.

6. Variable vowel harmony with unequal numbers of disharmonic vowels

The **41** nouns with unequal numbers of /u/'s and /i/'s display a **count effect**: **35** harmonize to majority vowel (3a), **4** harmonize to minority (3b), and **2** vary.

- (3a) *Count-based harmony*
- | | |
|------------------------------------|----------------------------------|
| kulkuri ~ kulkuru ‘middle’ | juwinti ~ jiwinti ‘wild currant’ |
| puluki ~ puluku ‘calf’ | warupini ~ waripini ‘grass seed’ |
| puruɽujinpa ~ puruɽujunpa ‘beetle’ | munijiki ~ minijiki ‘honey bee’ |

- (3b) *The four exceptions*
- | | |
|-------------------------------|-----------------------------------|
| ɽuɽijinpa ~ ɽuɽujunpa ‘child’ | kuɽiji ~ kuɽuju ‘circumcision’ |
| jinawuɽu~ jinawiɽi ‘echidna’ | kuɽijinjiji ~ kuɽujuyujuju ‘crab’ |

- All but two forms with unequal vowels have a single minority vowel—hence data are largely consistent with many-to-one harmony.[†]
- The two forms with two minority vowels follow majority rules: e.g., juɽumijimiji ~ jijimijimiji ‘decongestant plant’, karliŋkajurunpiri ~ karliŋkajirinpiri ‘fairy martin’
- Various cases of transparent [a] in variable forms.

7. Implications for phonological theory

The data lend support to:

- a directionless assimilatory constraint along the lines of Lombardi (1999);
- a system in which such constraint dominates a count-based, symmetric IDENT, with IDENT dominating directional constraints;
- no interference from count-avoiding constraints (Lombardi’s or Baković’s approaches, for example).
- We provide below tableaux of a Harmonic Grammar analysis of these forms (Legendre, Miyata & Smolensky 1990).

/jukuri/	H	AGREE(rd) w = 1	IDENT(rd) w = 1	/juwinti/	H	AGREE(rd) w = 1	IDENT(rd) w = 1
ɽjukuri	1	*		ɽjuwinti	1	*	
ɽjukuru	1		*	ɽjiwinti	1		*
jiki	2		**	juwuntu	2		**

8. Future directions: a wug test with long words

Does the count effect scale up to multiple minority vowels? Need lots of long words:

- For example, if we have two vowels *X* and three vowels *Y*, do speakers tend to harmonize in favor of *Y*? What about three vowels *X* and four vowels *Y*?

Future directions: present native Warlpiri speakers with a long disharmonic nonce form, and ask them which optional variant they prefer.

“This is a [murukijinj], also called a...” “This is a [kirintipijunuku], also called a...”

- A. [mirikijinj] A. [kuruntupujunuku]
B. [murukujunju] B. [kirintipijinjiki]

If the count effect were to scale up to higher numbers of minority vowels, then that would suggest majority rules unambiguously. Some implications for present discussion:

- Would constitute a pattern lying outside of regular complexity class of patterns (Kaplan & Kay 1994, Heinz & Lai 2013)—cf. Hayes (2018) on Balinese aggressive reduplication.
- Seemingly raises issues for serial phonological frameworks such as SPE and HS, at least traditionally posed (Chomsky & Halle 1968, McCarthy 2000).

9. Conclusion

Count effect in Warlpiri vowel harmony: seems at least to be a many-to-one pattern, possibly even majority-rules pattern.

- Supports constraints/ranking laid out by Lombardi to predict the count effect.
- Might be best to find other explanations for rarity other than expanding CON—e.g., a simplicity bias in learning (Moreton & Pater 2012, McCollum et al. 2019).
- Adds to cases in which a pattern predicted to be pathological turns out to exist (Hayes 2018).

10. Acknowledgments

[†] We thank Andrew Lamont for generous help with data gathering and count early on in the project, and for raising the possibility of the many-to-one interpretation (p.c.). For his views on the data, see Lamont (2019). We also thank Bruce Hayes for early discussion of these data.

References

- Baković, Eric (2000). *Harmony, Dominance and Control*. Dissertation, Rutgers. Chomsky, Noam & Halle, Morris (1968). *The Sound Pattern of English*. Harper & Row. Finley, Sara (2008). *Formal and Cognitive Restrictions on Vowel Harmony*. Dissertation, Johns Hopkins. Harvey, Mark & Brett Baker (2004). Vowel harmony, directionality and morpheme structure constraints in Warlpiri. *Lingua*. Hayes, Bruce (2018). Some remarks on MaxEnt grammars. Talk at Stanford University. Heinz, Jeffrey & Regine Lai (2013). Vowel Harmony and Subsequentiality. *MoL13 Proceedings*. Kaplan, Ronald & Martin Kay (1994). Regular models of phonological rule systems. *Computational Linguistics*. Lamont, Andrew (2019). The case against Majority Rule in Warlpiri. Ms., University of Massachusetts, Amherst. Legendre, Geraldine, Yoshiro Miyata & Paul Smolensky (1990). *Harmonic Grammar: A formal multi-level connectionist theory of linguistic well-formedness: Theoretical foundations*. Report CU-CS-465-90. Lombardi, Linda (1999). Positional faithfulness and voicing assimilation in Optimality Theory. *NLLT*. McCarthy, John (2000). Harmonic serialism and parallelism. *NELS Proceedings*. McCollum, Adam G., Eric Baković, Anna Mai, & Eric Meinhardt (2019). The expressivity of segmental phonology and the definition of weak determinism. Ms., UC San Diego. Moreton, Elliott & Joe Pater (2012). Structure and substance in artificial-phonology learning: structure. *Language and Linguistics Compass*. Nash, David (1986). *Topics in Warlpiri Grammar*. Garland Publishing, Inc.