Markedness effects in paradigm reanalysis: Malagasy consonant alternations

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1 Overview

- How do learners reconstruct a neutralized form?

['bʌrəɹ] → /bʌtəɹ/, /bʌdəɹ/

- Possible factors:
  - distributional information (Ernestus and Baayen, 2003; Albright, 2002)
  - innate biases (Moreton, 2008)
- **Paradigm reanalysis** as window into phonological learning (Kiparsky, 1965)
- **Case study**: Malagasy (iso:mdg) consonant alternations
- **Results**: effects of **markedness bias**
  - not predicted by existing models (e.g. Albright, 2002; Nosofsky, 2011)

2 Background: Malagasy

- (C)V syllables, mostly penult stress.
- **Weak stems:** antepenult stress (if long enough) and end in "weak syllable" (-ka, -na, tra [ʈʂa])
- Weak syllable's consonant may alternate under suffixation:

pattern		stem	passive (-ana)
na ∼	n	andrávina	andravánana
	m	anándrana	andrámana
ka ∼	h	angátaka	angatáhana
	f	anáhaka	anaháfana
tra ∼	r	iánatra	ianárana
	t	anándratra	anandrátana
	f	andrákutra	andrakúfana

- Historically consonant-final (Dahl, 1951; Adelaar, 2012)
  1. Final consonant neutralization
  2. Vowel epenthesis to resolve codas
- Development of tra∼r alternation:

*bukiD	*bukiD-ən	Historical
* wúkit	–	(*-D > *-t)
–	*wukírən	(*D > *r)
*wúhitr	–	(*-t > *-tr)
*wúhitra	*wuhírəna	(Epenthesis)
vúhitra	**vuhírina**	**Modern**

Possible reanalyses for [pákutra]

Direction	passive (stem+ana)
t → r	pakut-ana→pakur-ana
r → t	pakur-ana→pakut-ana

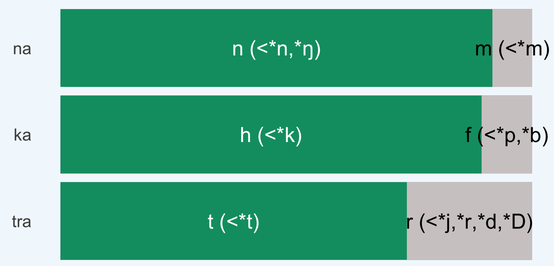
3 Reanalysis in weak stems

Method: Compare historical and modern Malagasy
- Historical: Austronesian Comparative Dictionary (ACD; Blust and Trussel, 2010)
- Modern: Malagasy Dictionary & Encyclopedia of Madagascar (de La Beaujardière, 2004)

Predicted reanalyses:

- Distributional models: reanalysis towards more likely alternant
- Expected distribution of alternants + predicted reanalyses, based on historical Malagasy (PMP; Proto-Malayo-Polynesian):

(1) Expected distribution of alternants:



(2) Effect of r-dissimilation

	does stem have [r]?	
Exp. alt	yes	no
t	8	39
r	0	17

▷ Alternant never [r] when stem has preceding [r].

Observed reanalyses:

Type	Direction	Count
na (n=70)	m→n	3
	n→m	0
ka (n=60)	h→f	0
	f→h	4
tra (n=81)	**t→r**	**33 ⇐Not Predicted**
	r→t	1

Reanalysis of tra-final stems follows r-dissimilation, as seen by tra-stems:

has r?	Direction	Count
no (n=65)	t→r	33
	r→t	0
yes (n=16)	t→r	0
	r→t	1

For tra-final stems, reanalysis is t→r, not predicted by distributions

4 Markedness bias

Markedness bias against intervocalic stops explains t→r reanalysis

- Constraint: ***V[-cont]V**
- Historically, intervocalic lenition in Malagasy (*b>v, *p>f, *d>r, *k, *g>h)
- Typologically common (Kirchner, 1998; Kaplan, 2010; Katz, 2016)
- Active as phonotactic tendency

5 Model Implementation

Goal: Show effect of markedness bias through modeling

Model components:

- **Iterative:** Predictions of one iteration is input to next iteration.
- **MaxEnt Harmonic Grammar** (Goldwater and Johnson, 2003) to capture gradient alternations.
- **Bias** implemented as a Gaussian prior (Wilson, 2006; White, 2013).

Model constraints:

- Constraints enforcing alternation in weak stems: *tr]V, *k]V, *h]V
- Faithfulness constraints: *MAP (Zuraw, 2010, 2013)
  - Useful for implementing perceptual similarity bias
- *r...r enforces r-dissimilation
- ***V[-cont]V** penalizes tra∼t alternation.

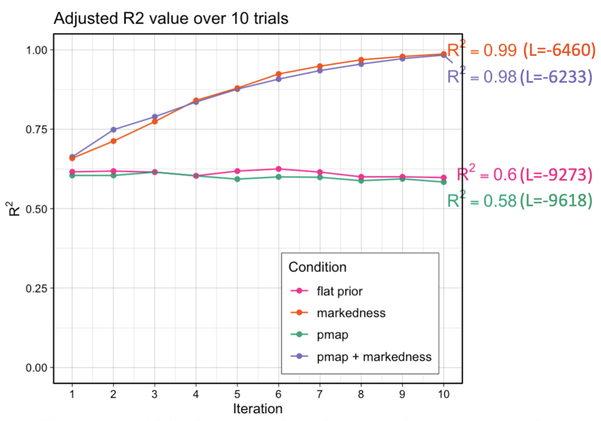
Model evaluation:

- Compare models with markedness bias against controls with no bias.
- See Section 5

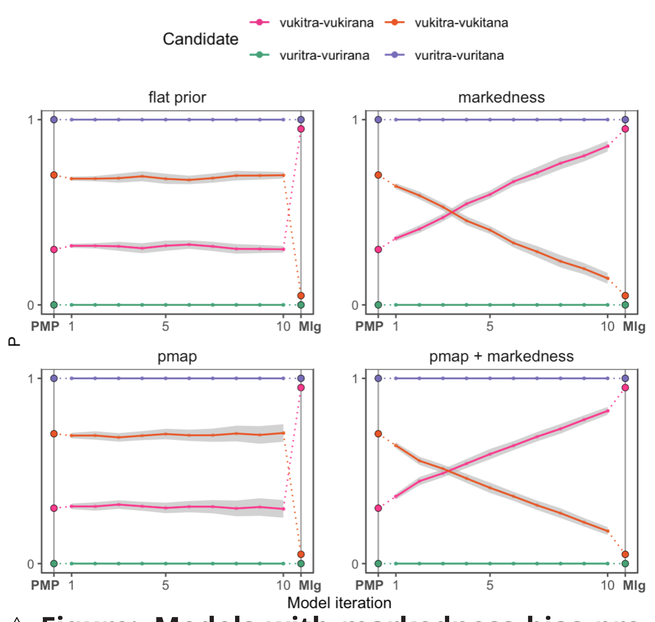
6 Model Results

Result: Reanalysis in Malagasy explained by successive generations of learning modulated by markedness bias

Bias terms: (μ ≈preferred weight)
- **Flat prior (control)**: uniform μ
- **P-map (control)**: For *MAP, perceptually similar mappings get lower μ
- **Markedness:** μ(*V[-cont]V) > μ(Faith)
- **Markedness + P-map**



△ **Figure: With markedness bias, model fit improves over iterations**



△ **Figure: Models with markedness bias predict more tra∼r alternation.** (Change in P of tra-final candidates over 10 iterations; PMP='old' Malagasy, Mlg='new' Malagasy)

References

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