

## Conditional Blocking in Tutrugbu requires non-determinism: Implications for the subregular hypothesis.

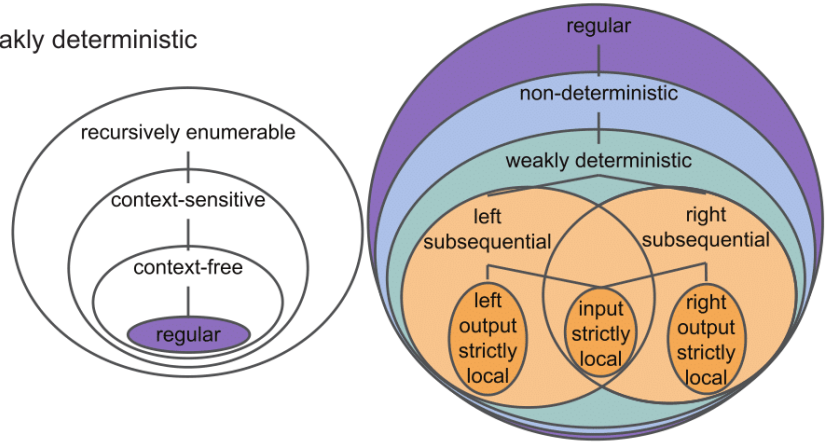
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Phonological maps = subregular (Heinz 2011 a,b; Chandlee 2014 a.o.)

Vowel harmony maps = subsequential or weakly deterministic (Heinz & Lai 2013)

Existing explanation: **formal biases**

- The learning mechanism applied to (segmental) phonology can learn only **weakly deterministic** or **subsequential** maps.
  - Most attested maps: strictly local
  - Fewer: subsequential
  - Even fewer: weakly deterministic



**The message:** Vowel harmony in Tutrugbu (McCollum & Essegbey, 2017) requires phonological maps that are non-deterministic regular functions — strictly more complex than previously thought.

**Significance/Interpretation:** The gradient empirical distribution of phonological patterns over the Subregular Hierarchy reflects relative learnability.

### ATR harmony in Tutrugbu

- Proceeds right-to-left from roots to prefixes
- [-hi] prefixes block harmony iff they are preceded by an initial [+hi] prefix (conditional blocking)

[+ATR root]			[-ATR root]		
V height	word	gloss	V height	word	gloss
hi hi √lo	i-tí-ɛē	'1S-NEG-grow'	hi hi √lo	ɪ-tí-bá	'1S-NEG-come'
hi hi √hi	ki-zi-wu	'CM.5-REP-climb'	hi hi √hi	kɪ-zɪ-wĩ	'CM.5-REP-drink'
lo lo √lo	e-be-ɛē	'3S-FUT-grow'	lo lo √lo	a-ba-bá	'3S-FUT-come'
lo lo √hi	ke-be-wu	'CM.7-VENT-climb'	lo lo √hi	ka-ba-wĩ	'CM.7-VENT-drink'
lo hi √lo	e-tí-ɛē	'3S-NEG-grow'	lo hi √lo	a-tɪ-bá	'3S-NEG-come'
lo hi √hi	ke-zi-wu	'CM.7-REP-climb'	lo hi √hi	ka-zɪ-wĩ	'CM.7-REP-drink'
hi lo √lo	ɪ-ba-ɛē	'1S-FUT-grow'	hi lo √lo	ɪ-ba-bá	'1S-FUT-come'
hi lo √hi	kɪ-ba-wu	'CM.5-VENT-climb'	hi lo √hi	kɪ-ba-wĩ	'CM.5-VENT-drink'

**ATR harmony is blocked iff a [-hi] prefix follows an initial-syllable [+hi] prefix.**

- Because the realization of a [-hi] prefix does not depend only upon the following string, but also on the height of the initial suffix, ATR harmony in Tutrugbu is not subsequential (and therefore not strictly local).

- If a [+hi] prefix occurs between a #[+hi]...[-hi] sequence and the root, this [+hi] prefix does undergo harmony
  - i-ba-di-wu (\*i-ba-di-wu) '1S-FUT-ITIVE-climb'
  - bu-ba-di-wu (\*bu-ba-di-wu) '1P-FUT-ITIVE-climb'
- The dependency between [-hi] prefixes and the height of the initial prefix may span a number of intervening vowels.

Dependency	word	gloss	translation
no #[+hi] pfx	e-tí-wu	'3S-NEG-climb'	"S/he does not climb"
no [-hi] pfx	i-tí-wu	'1S-NEG-climb'	"I do not climb"
adjacent	i-ba-wu	'1S-VENT-climb'	"I come to climb."
σ gap	i-tí-ka-wu	'1S-NEG-PFV-climb'	"I no longer climb."
σσ gap	i-tí-ka-á-wu	'1S-NEG-PFV-PROG-climb'	"I am no longer climbing"
σσσ gap	i-tí-ka-á-ba-wu	'1S-NEG-PFV-PROG-VENT-climb'	"I am no longer coming to climb"
σσσσ gap	i-tí-ka-á-ba-ba-wu	'1S-NEG-PFV-PROG-VENT-VENT-climb'	"I am no longer coming to climb (defiant)."
cf.	e-tí-ke-é-be-be-wu	'3S-NEG-PFV-PROG-VENT-VENT-climb'	"S/he is no longer coming to climb (defiant)."

- Since the pattern is not subsequential, it cannot be modeled with a single output strictly-local function.
- Instead, to model this pattern, two output strictly-local functions are necessary, as well as intermediate markup.

#### Function 1:

- scanning from R-to-L, if a [+ATR] root is encountered, markup, convert /ɪ/ to [i], but mark up the first [-hi] prefix as [ʔ] and all subsequent prefixes as [ʔ] or [ɿ], for [-hi] and [+hi] vowels, respectively.

#### Function 2:

- scanning from L-to-R, if the initial-σ prefix is [+hi], convert every following [ʔ] and [ɿ] to [a] and [ɪ], respectively.
- if the initial prefix is [-hi], convert every [ʔ] and [ɿ] to [e] and [i], respectively.

Input: /i-tɪ-ba-wu/

×	ɪ	t	ɪ	b	a	√	w	u	×
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Intermediate Output:

×	ɿ	t	ɿ	b	ʔ	√	w	u	×
---	---	---	---	---	---	---	---	---	---

Output [i-tɪ-ba-wu]:

×	ɪ	t	ɪ	b	a	√	w	u	×
---	---	---	---	---	---	---	---	---	---

Input: /a-ba-di-wu/

×	a	b	a	d	ɪ	√	w	u	×
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Intermediate Output:

×	ʔ	b	ʔ	d	i	√	w	u	×
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Output [e-be-di-wu]:

×	e	b	e	d	i	√	w	u	×
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Input: /i-ba-di-wu/

×	ɪ	b	a	d	ɪ	√	w	u	×
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Intermediate Output:

×	ɿ	b	ʔ	d	i	√	w	u	×
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Output [i-ba-di-wu]:

×	ɪ	b	a	d	i	√	w	u	×
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- Since this input-output mapping requires markup, it is non-deterministic (Heinz & Lai 2013).
- Alternatives that don't (appear to) involve markup and where they fail:
  - Spread [+ATR] to left edge of word. Then spread [-ATR] from initial [+hi] vowels.
    - This analysis can't account for [i-ti-wu]; instead predicts \*i-tɪ-wu.
  - Spread [+ATR] up to [-hi] vowel, treating it as a blocker. Then spread [+ATR] from an initial-syllable [-hi] vowel.
    - Given that the output of function 1 ≠ SR, F2 depends on intermediate information from F1 (as in our analysis), and the two functions are non-commutative, contra the schema laid out in Heinz & Lai (2013).