Variation and breakdown in the saltatory interaction of Rendaku and velar nasalization

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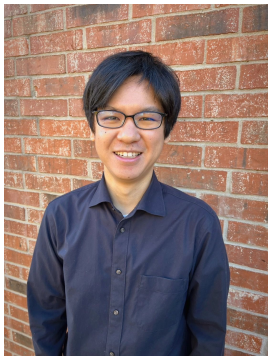
Acknowledgements

Team



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Main takeaways

- One goal of phonological analysis: understand **what patterns are representable** in a speaker's grammar
- We learn the most from cases where learning data and learned grammar **mismatch** (Becker et al. 2011)
- This talk revisits an a case of classic "rule feeding" in light of new data
- Despite classical simplicity, we find that for almost all speakers **the alternation is not generalized**.

→ Further evidence supporting a **substantively-biased theory of learning** (White 2013)

Roadmap

The basics: Japanese Rendaku, voiced nasalization, and their interaction

New data complicate the picture

Frequency-conditioned nasalization

Saltation and substantive bias

What do speakers learn?

Summary and discussion

The basics: Japanese Rendaku

A process of **initial obstruent voicing** in compound second-members

- /natsu + sora/ → [natsu**z**ora] “summer sky”
- /hi + tane/ → [hi**d**ane] “spark” (lit. “fire seed”)
- ...

HUGE literature (cf. Kawahara et al. 2016, Kawahara 2016 for an overview); for present purposes we assume a rule modeled on Otsu (1980)

- $C_{[-voice]} \rightarrow [+voice] / [_N X [_N \_ Y^*$

  *...where Y does not contain another voiced obstruent (Lyman’s Law)

The basics: Interaction of Rendaku and nasalization

Rendaku: $C_{[\text{-voice}]} \rightarrow [\text{+voice}] / [_{N}X\ [_{N}\_Y^{*}$

The basics: Japanese voiced velar nasalization

Phonologically-conservative dialects of Japanese have [ŋ] as an **allophone** of word-medial /g/ (Kindaichi 1942; Trubetskoy 1969; Labrune 2012)

- [gama] “toad” vs. [kaŋami] “mirror”

Compounds exhibit **alternations** (Itō & Mester 1996, 2003)

- /doku + ga/ ⟶ [doku-ŋa], *[doku-ga] “poison fang”;
- /ga + ʒō/ ⟶ [ga-ʒō] “main castle” (lit. “fang castle”)
- /ga/ ⟶ *[ga] “fang”

- /doku + ga/ ⟶ [doku-ga] ~ [doku-ŋa] “poison moth”
- /ga/ ⟶ [ga] “moth”

The basics: Interaction of Rendaku and nasalization

Rendaku: $C_{[-voice]} \rightarrow$ [+voice] / $[_{N}X\ [_{N}\_Y^{*}$

Nasalization: /g/ → [ŋ] / [+son] _ [+son]

The basics: Interaction of Rendaku and nasalization

Rendaku: $C_{[-voice]} \rightarrow$ [+voice] / $[_N X [_N \_ Y^*$

Nasalization: /g/ → [ŋ] / [+son] _ [+son]

Traditional view: in dialects with both processes, **Rendaku feeds nasalization**

UR	/hi + tane/ *“spark”*	/doku + ga/ *“poison fang”*	/te + kami/ *“letter”*
Rendaku	hi + dane	---	te + gami
Nasalization	---	doku + ŋa	te + ŋami
SR	[hidane]	[dokuŋa]	[teŋami]

New data complicate the picture

We investigated the variability in nasalization in a corpus (Breiss et al. 2021) and two production experiments (Breiss et al. *to appear*).

Corpus:

- 2016 NHK Pronunciation and Accent Dictionary of Yamanote Japanese (prestige dialect; the subject of (almost) all previous analyses)
- Prescriptive norm, used to train radio announcers

Experiments:

- Unfortunately, few living speakers of Yamanote dialect
- Need to look at a related dialect with the same alternation

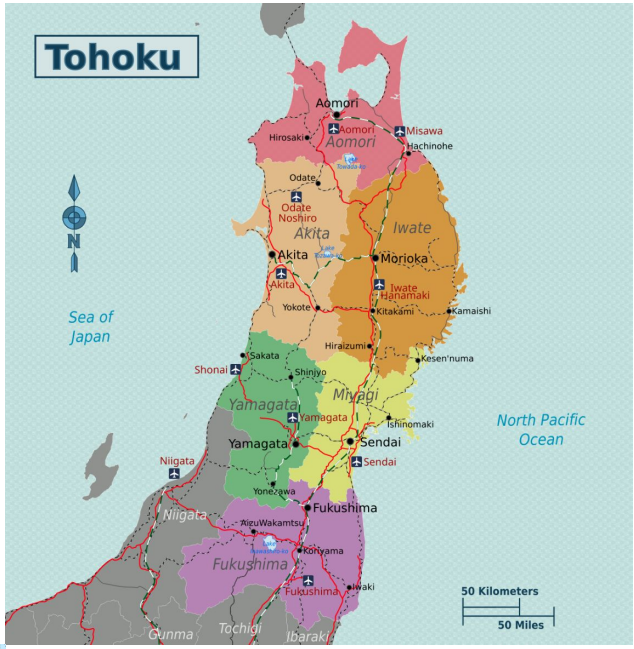
New data complicate the picture

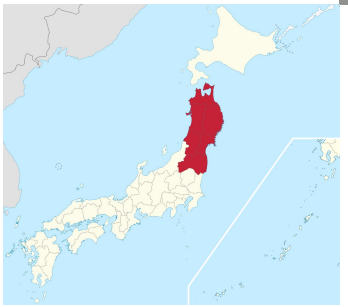
We looked at **Tōhoku Japanese**

Phonologically-conservative dialect, specifically:

- Voicing of medial voiceless stops
- Prenasalization of medial voiced stops
- **Except /g/ → [ŋ]!**

(Relatively) more accessible





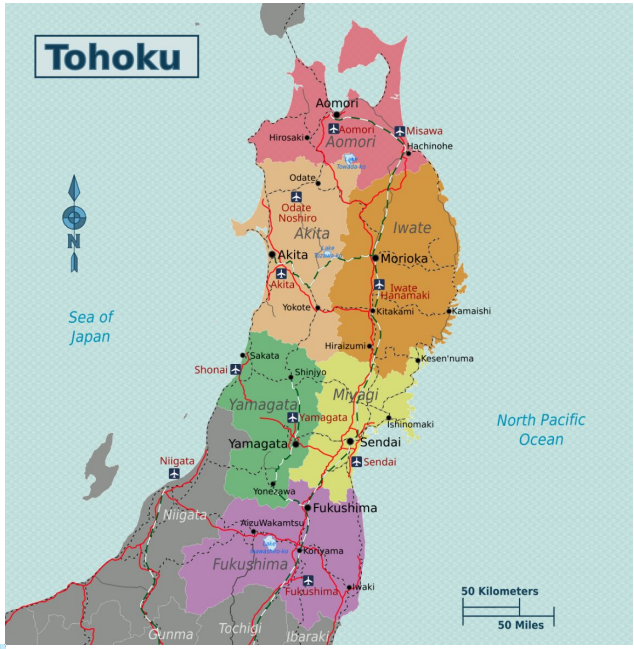
New data complicate the picture

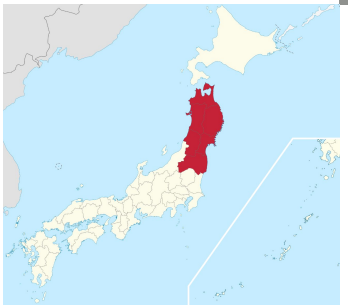
Two production experiments, containing N2s:

- /k/-initial, novel
- /g/-initial, novel

- /k/-initial, existing
- /g/-initial existing

Recruitment hard → 20 speakers

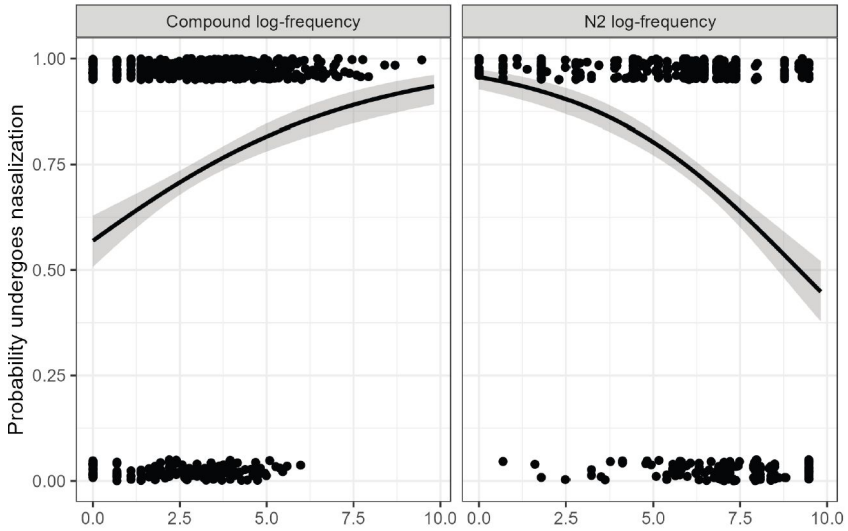




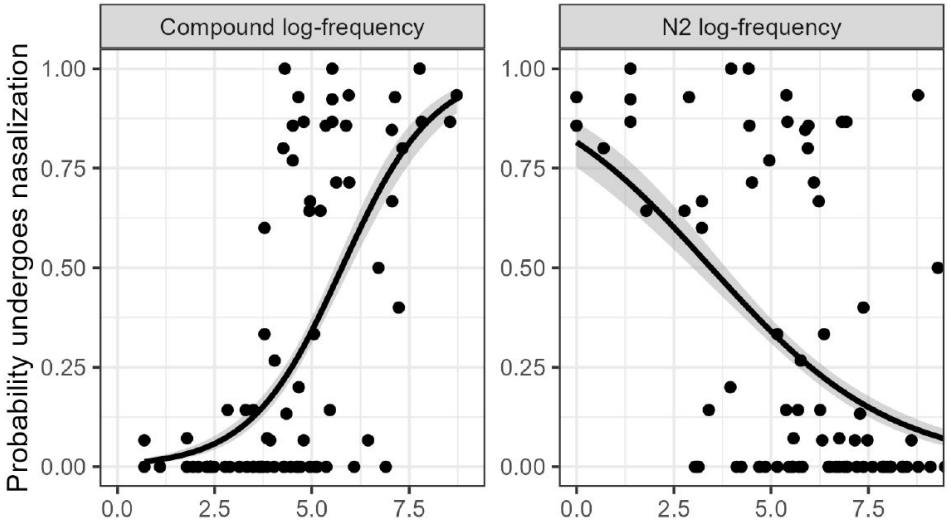
Data: Breiss et al. *to appear* in *Phonology*

Frequency-conditioned nasalization

Yamanote corpus,
existing compounds



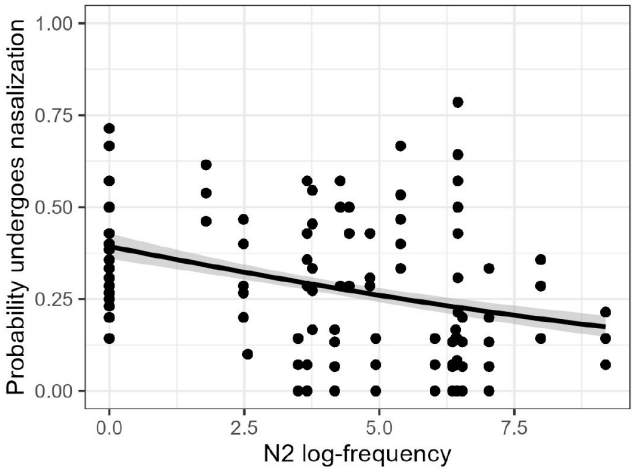
Tōhoku speakers,
existing compounds



Data: Breiss et al.
2021, *Proc. PLC*

Frequency-conditioned nasalization

Tōhoku speakers,
novel compounds



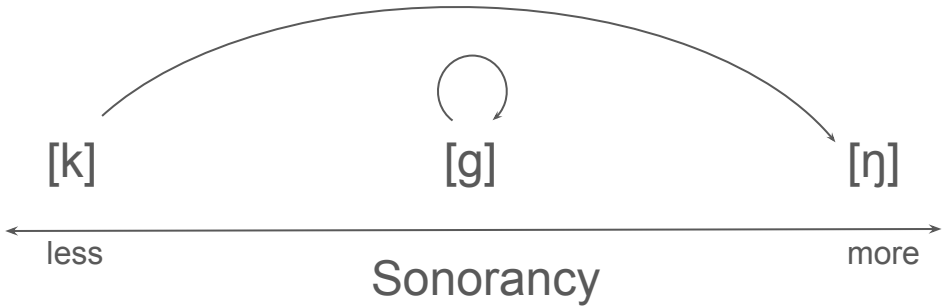
Nasalization, rendaku, and saltation

A new view of the feeding relation:

Nasalization, rendaku, and saltation

A ***saltatory*** alternation is one where where two phonemes that lie on a phonetic continuum alternate, “jumping” over a non-alternating phonetically medial phoneme (Hayes & White 2015)

Hard to learn, and to be **vulnerable to breakdown** / re-analysis over time (White 2014, White & Sundara 2014, Smolek & Kapatsinski 2018, Liang, Mateu, & Hayes 2025)



Saltation and substantive grounding

Formally, the outcome of the /k/-initial and /g/-initial forms are **unrelated**.

/k/→ [ŋ] only becomes saltatory by **comparing across alternations** within a language

Out come of /g/ → [ŋ ~ g] mapping affects the status of the /k/ → [ŋ] mapping

The difference is in phonetic/perceptual consistency **of the system**:

- Non-saltatory pattern (/k/ → [ŋ], /g/ → [ŋ]) is compatible with an "across-the-board" generalization grounded in phonetic/perceptual substance.
- Saltatory pattern /k/ → [ŋ], /g/ → [g]) is incoherent on these grounds.

"Consistency" → Perceptual Map (P-Map) (Steriade 2003)

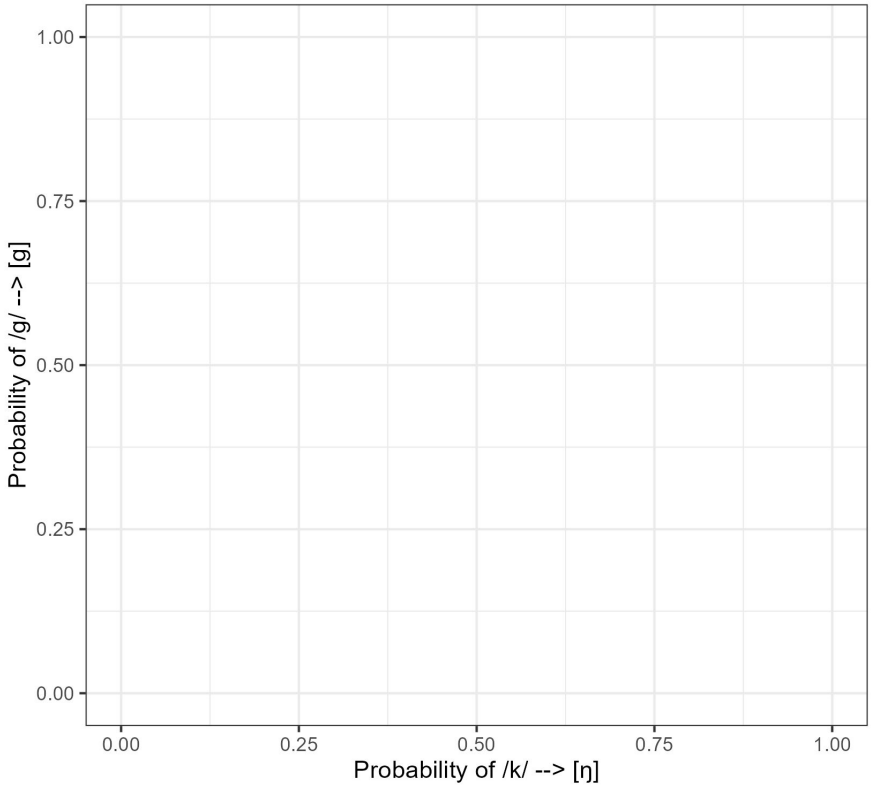
Nasalization, rendaku, and saltation

Low-freq N2s:

High-freq N2s:

What distribution do speakers learn from?

The learning data



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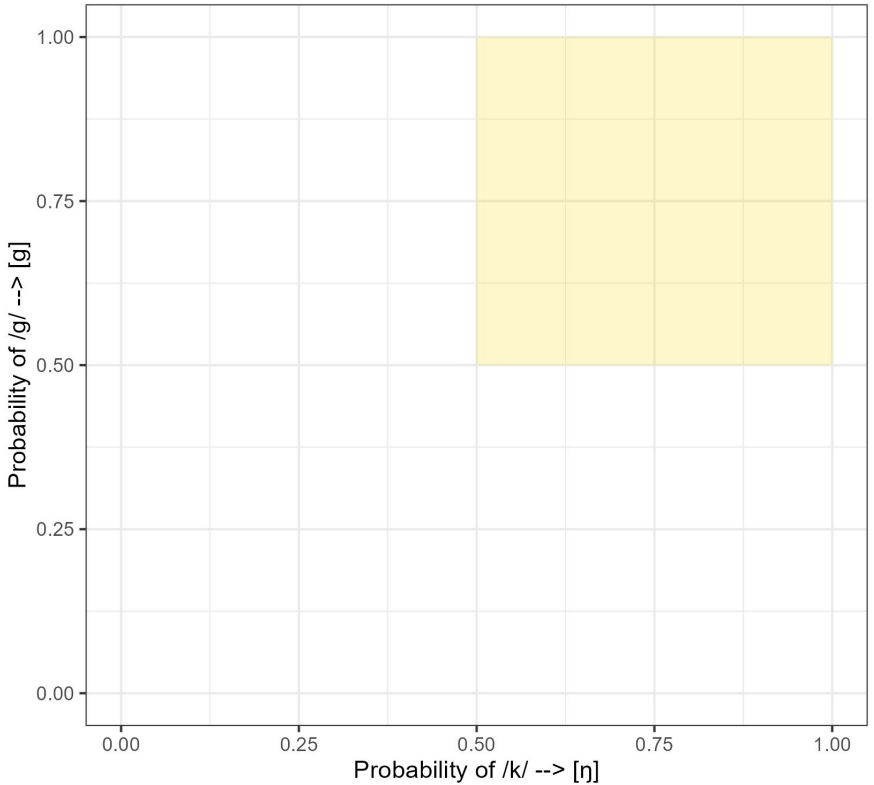

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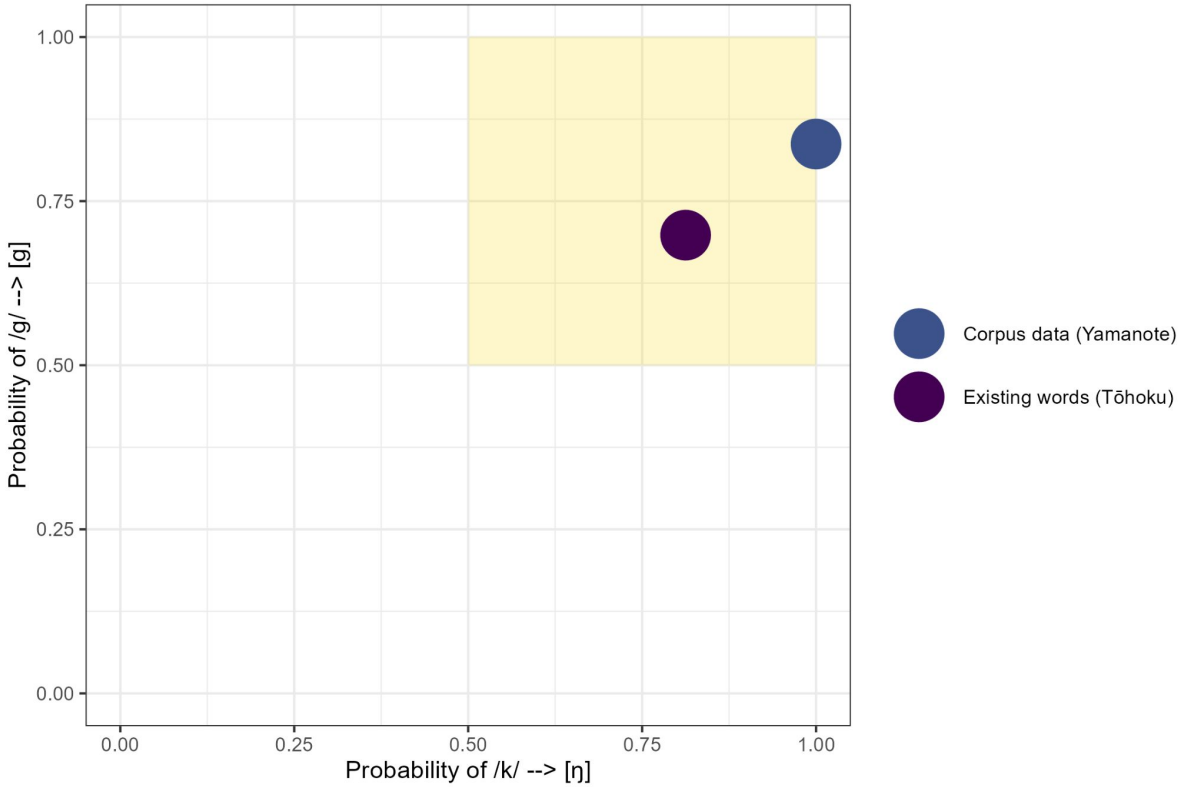
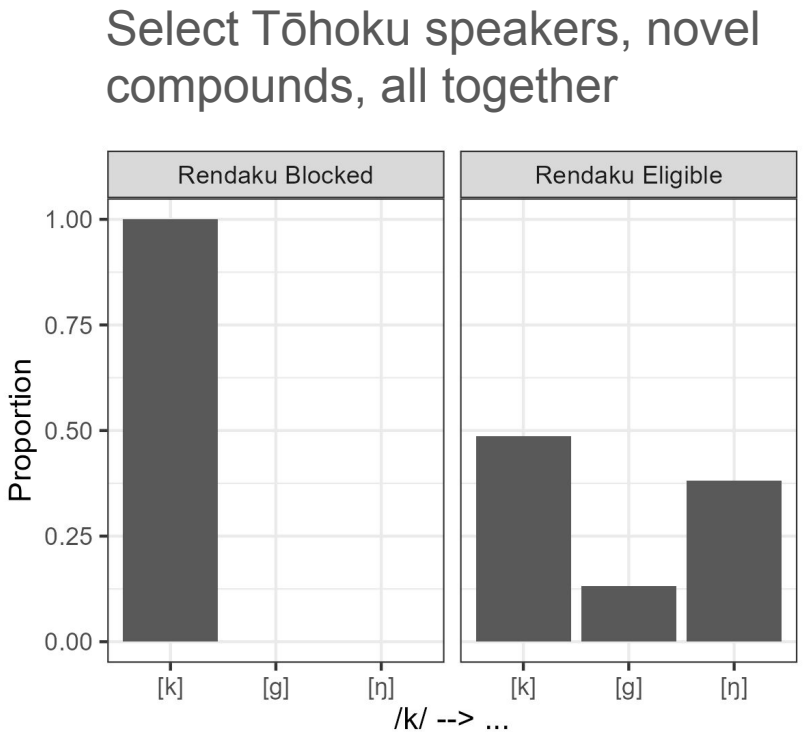
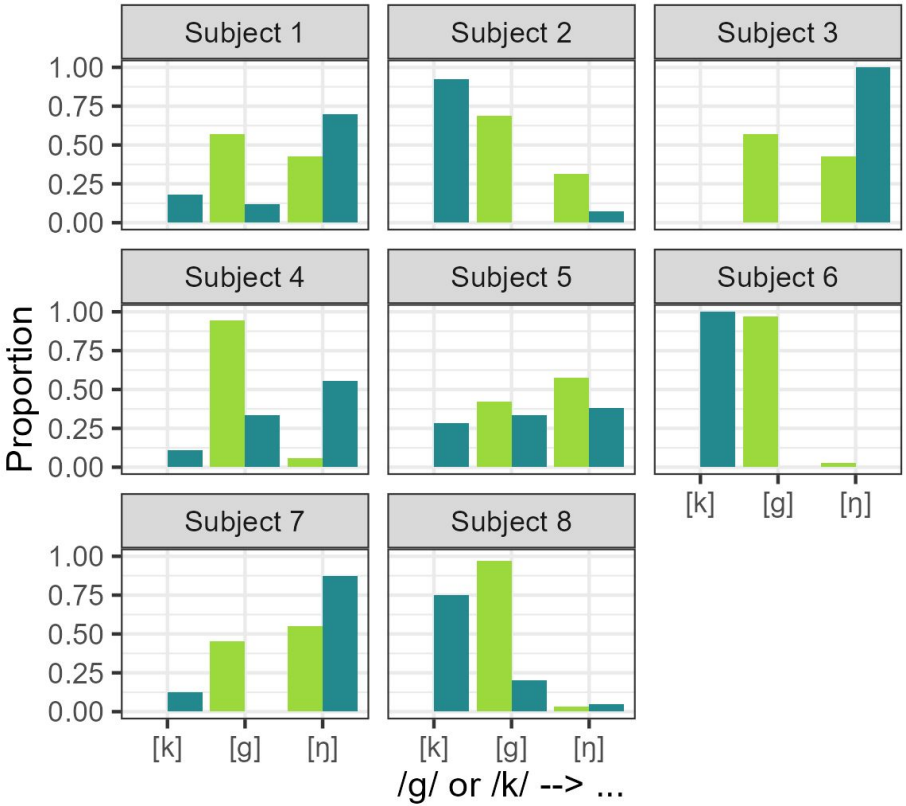


Learning data is variable, but largely saltatory

Rendaku in novel /k/-initial compounds - group



Rendaku in novel /k/-initial compounds - individuals



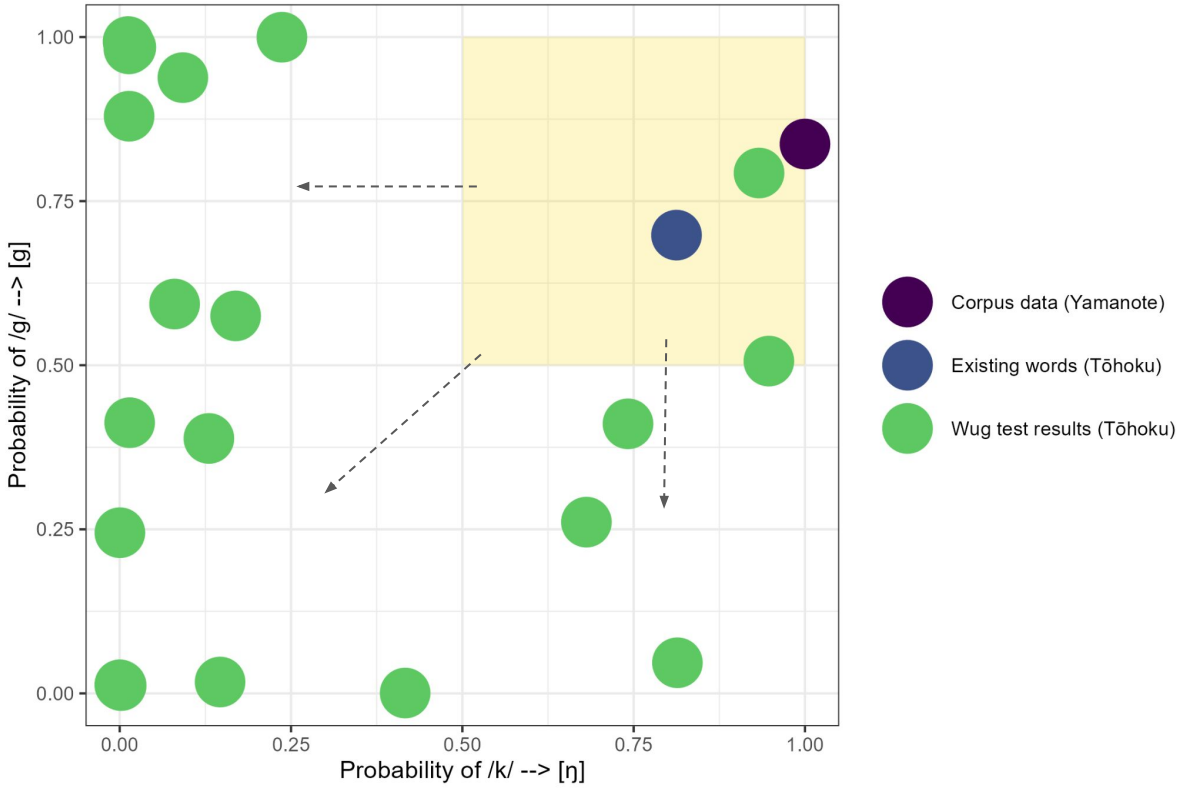
Select Tōhoku speakers, novel compounds, individuals

Source

Novel compounds with /g/-initial N2s

Novel compounds with /k/-initial N2s

The generalizations



When generalizing, **speakers shift away** from saltatory outcomes.

Summary and conclusion

- Revisit a **classical feeding rule** interaction, in light of new data
- Afflicted by “interference” from compounds with frequent N2s, rendering it **mostly saltatory**

→ Despite learning from data that instantiate a saltatory pattern, the speakers largely generalize the pattern transparently in favor of a non-saltatory grammar.

- Novel case of a traditional feeding relation being “spoiled” by a functionally-driven constraints, **leading to breakdown**
- Further evidence for a **substantively-biased theory of phonological learning**

Open questions

Previous work on substantive bias:

- Formalizable in the *Map-cum-Perceptual-Map framework (Hayes & White 2015, White 2017, Zuraw 2013, Steriade 2003)
- Argued to be a weak-to-moderate force biasing learning (White 2017)

However, the most important questions **remain unanswered**:

- Is the P-Map innate (and arbitrary) → UG?
- Is innate and grounded in perception, production, or a combination of both?
- Perhaps not innate, but rather learned as part of early development?

Where in learning does substantive bias intervene?

- Failure to represent the pattern accurately from the start?
- Dispreference for generalizing in a bias-conflicting way?

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Thanks for your attention!

Thanks also to:

- Our participants!
- *Many* past audiences
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- ...

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