Types of statistical learning in the acquisition of alternations:
insights from artificial grammar learning

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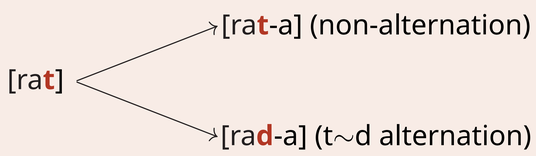
Background

- How do speakers learn alternations?



- Factors involved in alternation learning:
  - **Frequency-matching**: match the rate of alternation found in lexicon (e.g. Ernestus and Baayen, 2003; Hayes et al., 2009).
  - **Phonotactics**: probabilistic knowledge of how phonemes can combine in stems (e.g. Pater and Tessier, 2005; Chong, 2021)
- Phonotactics and alternations…
  - Often **line up**
    e.g. /fɪʃ+z/ → [fɪʃɨz] (cf. *[fɪʃz])
  - But can also **mismatch** (Paster, 2009; Gouskova, 2018)
- **Methodological challenges**
  - Hard to isolate effects of frequency and phonotactics

Research Questions

- How does **phonotactics** interact with **frequency-matching**?
- When do speakers use phonotactics to aid in alternation learning?

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Experiment

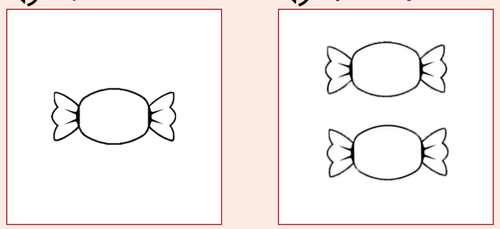
Participants
- N=150 English speakers (Prolific)

Stimuli
- Final **[p]** may alternate with **[k]**
- Suffixes: /-a/ 'dual', /-**l**a/, /-**w**a/
  - /-**l**a/ and /-**w**a/ mean 'bigger' or 'many'
- CV.'CV**CC**, obeys English phonotactics

Procedure
- **Training**: 30 p-final + 30 fillers
  - p-final items always given with /-a/.
  - /-wa/ and /-la/ shown with filler items.
- **Testing**: 16 p-final
  - 2AFC: non-alternating vs. p∼k alternation

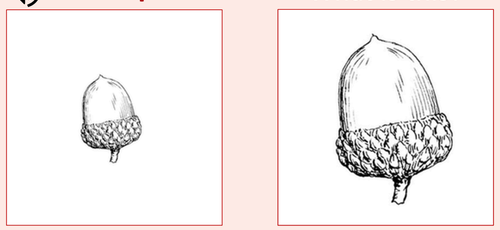
Example stimuli: training phase

panas**k** panas**pa**



Example stimuli: testing phase

chiris**p** What is this?

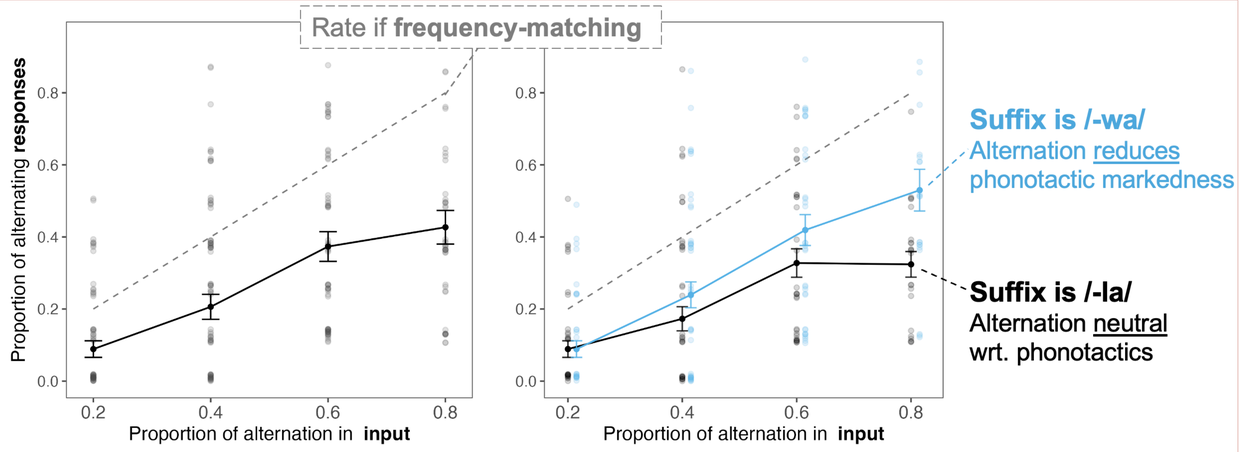


chiris**pl**a chiris**kl**a

Conditions
- **Rate of alternation** in training data: 20%, 40%, 60%, 80%
- **Phonotactic markedness** of alternating form, based on English judgments (Hammond, 1999)

SG	**/-wa/**	**Pattern**	**Phonotactics**	
chihas**p**	chihas.**p**wa	non-alt	**marked onset *pw**	Suffix is /-wa/: non-alternation results in bad onset *pw
ganas**p**	ganas.**k**wa	p∼k	unmarked onset kw	
SG	**/-la/**			
ganar**p**	ganar.**p**la	non-alt	unmarked onset pl	Suffix is /-la/: neutral wrt. phonotactics
pener**p**	pener.**k**la	p∼k	unmarked onset kl	

Results



- **Figure A**. Effects of **frequency-matching** and a **preference for non-alternation**
- **Figure B**. **Effect of phonotactics** *only* at higher alternation rates.

Discussion

Preference for **non-alternation**
- Paradigm uniformity (Benua, 1995; Kenstowicz, 1997; Steriade, 2000)
- Underlearning of alternation pattern

Effect of phonotactics **depends on alternation rates**, surfacing when…
- Uncertainty in choice of alternant.
- Extending high rates of alternation.

Leakage (Martin, 2011): use phonotactics…
- even when alternation is *not* phonotactically motivated in training.
- potentially shaping lexicon over time.

Implications for **modeling**
- Phonotactics & alternations are separate…
- but interact with e/o

Takeaway

Speakers utilize phonotactics when extending alternations, in a way that is **sensitive to paradigm-internal frequencies**.

Future directions

- Test the reverse pattern (alternation increases phonotactic violations).
- **Degrees** of phonotactic violations.
- Effect of **individual** phonotactic judgments
- Effect of **input size**
- Replication with **in-person study**.

Link to poster

www.kuojennifer.com/files/2024_wccfl.pdf

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