Pattern Structure Modulates Learning of Lexically Conditioned Morphology

Cerys Hughes
Gaja Jarosz
UMass Amherst
AMLaP 2024

Learning from Inconsistent Data

- Language patterns can have exceptions, e.g. English past tense: **Most stems**: + /d/ (rave/raved) |**But**: ring/rang, sleep/slept
- Artificial grammar learning (AGL) can manipulate patterns and test how learners generalize to novel items

Training language: 75% examples take -fi suffix, 25% -ku

Types of Inconsistency

Lexical Conditioning
75% stems always -fi
25% stems always -ku

Free Variation
All stems: occur 75% with -fi
25% with -ku

Types of Responses on Novel Items

Frequency match
Reproduce rates:
75% -fi, 25% -ku

Regularize
Over-extend most frequent, e.g.
90% -fi, 10% -ku

- Almost all AGL studies with lexical conditioning, in kids and adults, have found frequency matching (Wonnacott 2011, Austin et al. 2021, Keogh et al. 2024) except for Schumacher & Pierrehumbert (2021) **(SP21)**

SP21: Reversal and Singular Marking

What makes SP21's exception patterns different from other AGL?

- Example: wiben (sg.) wiben**yl** (pl.) vs. demil**yl** (sg.) demil (pl.)

Reversal: same suffix, different number

Singular marking: suffix for singulars

- Both typologically rare and absent in participants' L1

Hypotheses

Learners regularize more when a lexically conditioned pattern involves...

Hyp. 1: reversal **Hyp. 2**: singular-marking exceptions

Conditions

Identical artificial languages except for pattern structure:

	Regulars: 18/24 stems	Exceptions: 6/24 stems
Allomorphy : × singular-marking × reversal	Singular: stem + ø Plural: stem + fi krakle kraklefi	Singular: stem + ø Plural: stem + ku drokra drokraku
Reversal: ✓singular-marking ✓reversal	Singular: stem + ø Plural: stem + fi krakle kraklefi	Singular: stem + fi Plural: stem + ø drokrafi drokra
Dominant: ✓singular-marking × reversal	Singular: stem + ø Plural: stem + fi krakle kraklefi	Singular: stem + ku Plural: stem + ø drokraku drokra

Predictions

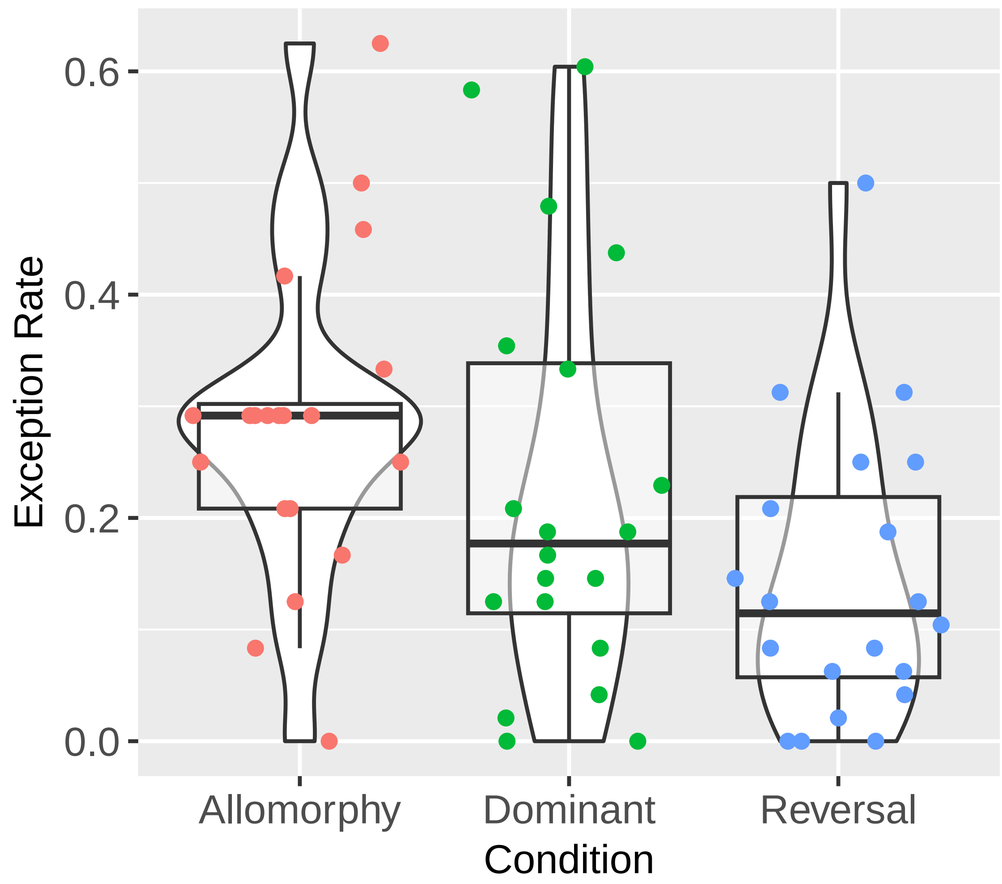
Relative amounts of regularization predicted by

- **Hypothesis 1:** More reg. in Reversal than Allomorphy and Dominant
- **Hypothesis 2:** More reg. in Dominant than Allomorphy

Method

- 20 English-speaking Prolific participants per condition, 288 training trials (24 stems x 2 x 6 randomized blocks), tested on 24 novel stems
- More regularization = fewer exceptional responses on novel stems

Results



- As predicted by **Hypothesis 1**, significantly more regularization in Reversal than Allomorphy and Dominant
- No significant difference between Allomorphy and Dominant ⇒ effect is from reversal, not just avoidance of singular marking

Exception ~ Cond + (1 |Subject) + (1 + Cond |Stem) + (1 + Cond |Set)
(Cond is Reverse Helmert Coded: Cond1 Dominant vs Allomorphy, Cond2 Reversal vs all)

	Estimate	SE	z	P(>|z|)
Intercept	-1.51	0.16	-9.35	<2e-16 ***
Cond1	-0.33	0.42	-0.78	0.44
Cond2	-0.72	0.33	-2.20	0.03 *

Conclusion

- Pattern structure manipulations yield both regularization and frequency matching with adult learners and lexically conditioned inconsistency
- This suggests a cognitive bias against reversal, above and beyond bias against singular marking
- What is the nature of this cognitive bias?
  - Bias against generalization of reversal to novel items
  - Further work: universal vs. L1

ceryshughes@umass.edu