Exploring the role of rhythm in iterative-infixing language game learning

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Introduction

- Present results of a language game learning experiment on iterative-infixing games

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- This may suggest that the rhythmic pattern is a strategy for reducing the cognitive burden of processing disguised words, or even that the provides a frame outside of which iterative infixation can't be processed

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Infix is applied **iteratively** within a single source word, usually once per source syllable

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Löfflisch - an iterative-infixing language game based on German[1]

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In Löfflisch, source syllables correspond to surface anapests:

[bɛ.'zuχ]→[bɛ.lə.ˌvɛ.zu.lə.'vuχ]

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Yu further notes that iterative infixation in language games appears to correlate with a reduction of phonological complexity, and that iterative-infixing language game outputs often carry less contrastive information than their source counterparts.

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It may be the case that iterative infixation is only possible with the support of a rhythmic frame; perhaps iterative infixation patterns that cannot be given a rhythmic analysis are not learnable.

Question

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Why are there no iterative-infixing language games that lack iterative rhythm? That is, why do we only see games where iterative infixation can be given a rhythmic analysis, instead of, e.g., a game where the infix appears every 5th syllable? (Pound 1964, Yu 2007, 2008)

Hypotheses

Epiphenomenal rhythm: Iterative rhythm is a coincidental factor of the pathways of language game creation.

Grammar-external factors: Games with iterative rhythm are easier to learn and use and so are more robust diachronically.

Experiment

Experimental question:

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If so, grammar-external factors must play a role in determining the ease of learning.

Experiment

- Language game learning experiment
- Subjects learned one of two language games, one with iterative rhythm and one without

Experiment

Predictions:

Rhythm type	**Epiphenomenal**	**Grammar-external**
Rhythmic	Equal difficulty	Easier
Arrhythmic	Equal difficulty	Harder

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Condition 1: Rhythmic

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Rhythmic game features constant 1:3 source:game syllable correspondence
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ə-epenthesis in Rhythmic game intended to control for difficulty of vowel-height based alternation in Arrhythmic game without compromising iterative rhythm

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Training phase: source item played, immediately followed by corresponding language game item

Test phase: source item played, followed by possible language game item; subjects classified second item as correct or incorrect game version of first item

Experiment

Stimuli:

- Composed of recordings of CV syllables
- Recorded by male and female speakers; speaker gender randomized across items
- Normalized for pitch, intensity, and vowel duration; falling intonation added to word-final syllables
- Syllables spliced together on demand by Psychopy software
- Source words consisted of one, two, or three syllables
- All possible combinations of mid/high source vowels represented

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"Correctness" category was randomized by item, except that "wrong game" could not be assigned to a word with all mid vowels because the two games have identical outputs.

Experiment

Participants:

- 18 native English speakers (12 male, 6 female)
- Mean age: 22.7 (min. 18, max. 29, SD=3.4)
- Participated for course credit or received $10 for completing this and four other short tasks
- 2 subjects (1 male, 1 female) excluded from analysis for failing to learn a preliminary sample game. 1 subject (female) was excluded from analysis for inattentiveness.
- Analysis includes 8 subjects in the Arrhythmic condition and 7 subjects in the Rhythmic condition.

Results

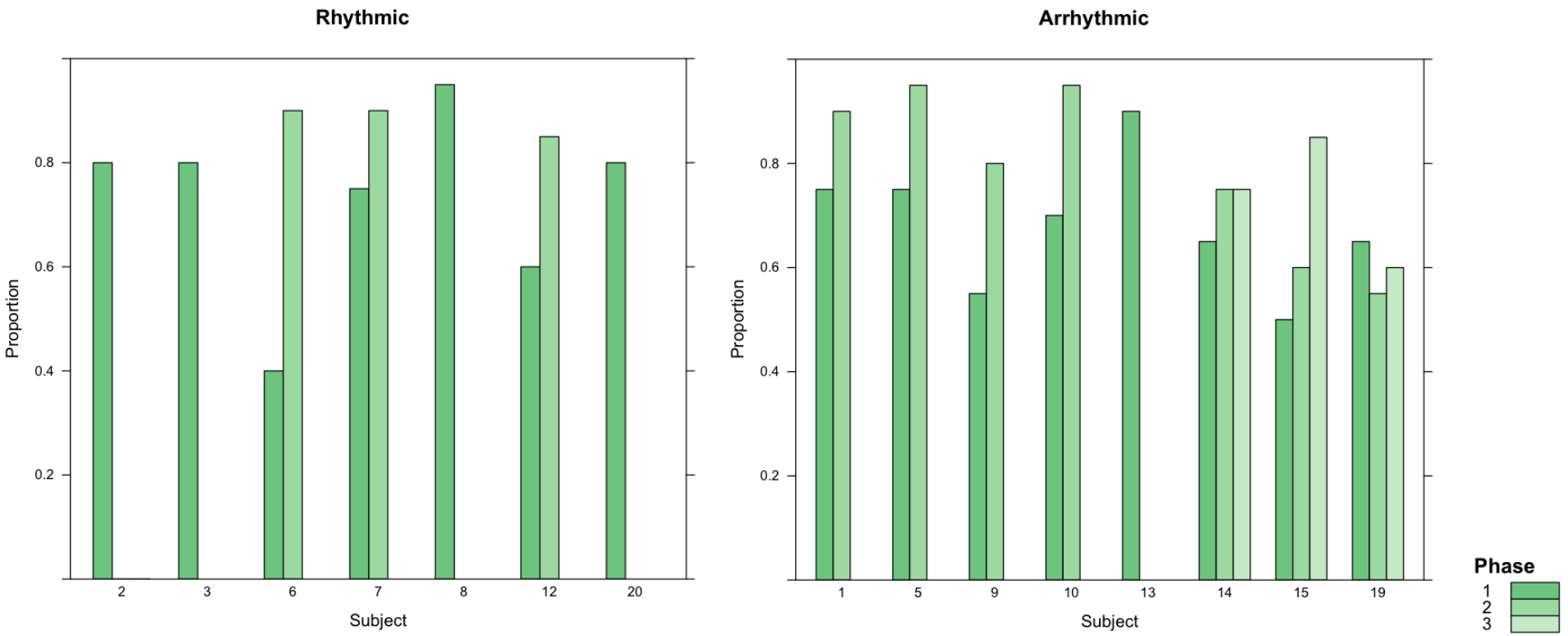

Figure 1 : Accuracy by subject, by condition and phase

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Upshot: Qualitatively, it looks like it takes more practice to learn the Arrhythmic game.

Analysis

Logistic mixed effects regression model

- Interaction: condition, training
- Main effects: condition, training, gender
- Random effects: subject, item

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- Main effects: condition, training, gender
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Summary:

Fixed effects:	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	0.68278	0.55846	1.223	0.2215
ConditionRhythmic	-0.89830	0.77295	-1.162	0.2452
Training	0.02752	0.01366	2.015	0.0439 *
SexMale	-0.21259	0.42650	-0.498	0.6182
CondRhyth:Training	0.06788	0.03359	2.021	0.0433 *

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Significant main effect of training ($p=0.0439<0.05$): unsurprising that training helps subjects perform better.

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Significant main effect of training ($p=0.0439<0.05$): unsurprising that training helps subjects perform better.

Significant interaction between training and condition ($p=0.0433<0.05$): amount that training affects performance depends on condition.

Analysis

Visualizing the significant interaction:

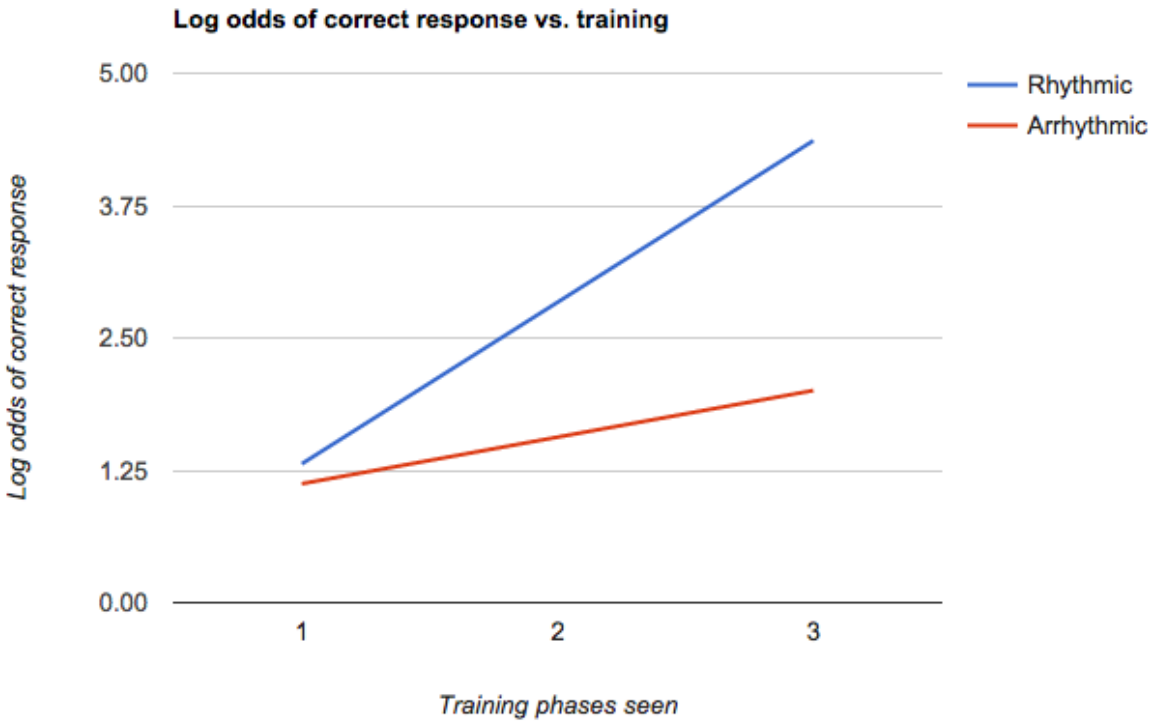

Figure 2 : Predicted log odds of correct response vs. training, by condition

Discussion

The direction of the significant interaction suggests that the Rhythmic game is more readily learned than the Arrhythmic game.

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This constitutes preliminary evidence that iterative-infixing language games with iterative rhythm are easier to learn than those without.

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The results support the **grammar-external factors** hypotheses, which suggests that performance factors play a role in the diachronic proliferation of games with iterative rhythm.

Conclusion

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This would suggest that the typological skew in favor of iterative rhythm is due at least in part to a grammar-external bias toward iterative rhythm - maybe to the extent iterative infixation without an iterative rhythmic frame can't be learned.

Of course, there might still be grammar-internal factors that also make iterative-infixing language games more likely to arise in the first place.

Future work

Confirmation of effect: Can the current findings be replicated?

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Production: Do subjects learn to correctly produce forms in a rhythmic game faster than in an arrhythmic game?

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Production: Do subjects learn to correctly produce forms in a rhythmic game faster than in an arrhythmic game?

Perception of real words: Is it actually the case that iterative rhythm makes it easier to recover source segments from a stream of disguised speech?

References

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