Examining the effects of phonetic naturalness and cognitive-linguistic ability in the statistical learning patterns of typically-developing children

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Introduction

There are many theoretical accounts of the underlying deficits in child language impairment (LI), including the idea that observed "grammatical" deficits may emerge from low-level acoustic deficits or from a general deficit in procedural memory. Acoustic deficits: Children with LI have robust deficits in discriminating some of the features that correlate with linguistic structure, including amplitude rise time and duration (Corriveau et al., 2007) and aspects of pitch perception and stress (Cunningham et al., 2013). These studies suggest that higher-level deficits in LI may emerge from low-level perception of prosodic cues, which underpin all levels of linguistic processing (Frazier et al., 2006).

Methods & Procedures (continued)

Cross-linguistically common phonological pattern

- Voided stops word initially, continuants word medially between two vowels

- […βɑɡɑθuβɑɡɑθu…]

- Language 2: anti-spirantization

- Unattested in natural languages

- Opposite pattern: continuants word initially, stops medially

- [...yβɑɡiβɑɡi…]

Analysis

- Logit mixed-effects modeling of sensitivity to 'words' vs. nonwords

- How likely are subjects to respond 'word' to a word vs. a nonword?

- Confirm whether children can do task

- Compare performance to college students

- Examine correlations between standardized tests and word segmentation

- What types of abilities predict success on this task?

Results

Adults perform reasonably well, and show a small trend in the expected direction with regard to the phonetic manipulation

- Difference between conditions: β = 0.35, z = 0.62

- Performance deteriorates significantly on second session: β = -1.96, z = 5.65

- Suggests persistence of learning from first session over ≥ 1 month

- Children have great trouble with this task

- About 40% of subjects perform below chance

- Logit mixed-effects regression suggests the sample performs above chance -pooling across conditions

- […βɑɡɑθuβɑɡɑθu…]

- Overall picture: some subset of the children are able to do the task, but a large proportion of them are guessing randomly

Illustrating the non-systematicity of the children's performance: correlation between performance in the two conditions is almost exactly 0.0

D prime on trials with a & + chance

The top-left and bottom-right quadrants here (indicating above-chance performance in one condition and below-chance in the other) are more heavily populated than the other two (indicating qualitatively similar performance in the two conditions).

Conclusion

• Children showed very limited evidence of learning

• Adults performed better, and there was a small difference between conditions, consistent with previous research on spatiotemporal (Katz & Fricke 2018) and other phonetic patterns in this paradigm (e.g., Kim, 2004; Saffran et al., 1996)

• Effect is dwarfed by cross-session interference over ≥ 1 month

• Scores on cognitive-linguistic tests were not significant predictors of learning for children; this probably indicates that a large number performed more or less randomly

• Findings suggest that phonetic and cognitive-linguistic learning in children may differ from adult-like patterns of performance

• Future work could explore alternative explanations by varying protocol design

References & Acknowledgements

Selected References


- West Virginia University, Morgantown, WV

Acknowledgments

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Disclosures statement. Author #1, Jonah Katz: No conflict of interest; Author #2, Michelle Moore: No conflict of interest.

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