The Burstiness of Parents' Utterances: Classification of Vocal Temporal Structure during Parent-Child Naturalistic Interaction

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INTRODUCTION

The temporal structure of written[1] and oral[2] communication differs based on information content:

- Words and utterances of greater information content (e.g., *"Africa," "turn left"*) are more *bursty* than those of lesser information content (e.g.," *let," "no"*).

The timing of when information is given affects what is learned:

- Spacing produces better memory than massing.[3]
- Consecutive repetitions facilitate cross-situational word learning.[4]

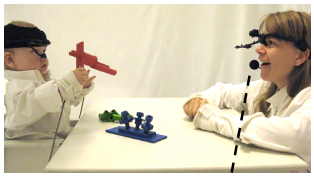
RESEARCH QUESTIONS

1. What is the temporal structure of infants' language input? Do different types of language input show different temporal distributions?
2. Does the temporal structure of parents' talk about objects relate to infants' learning of those objects' names?

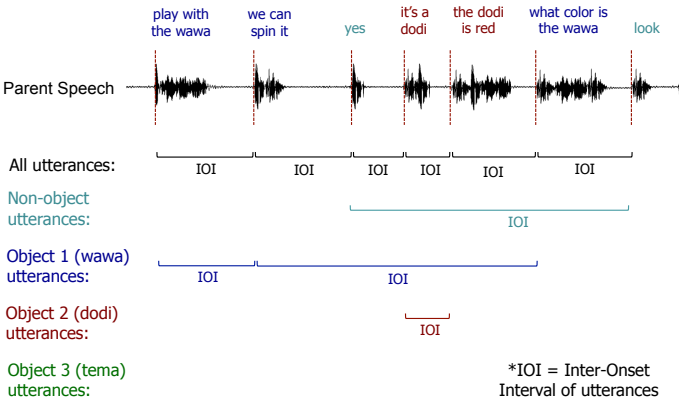
METHOD

DATA

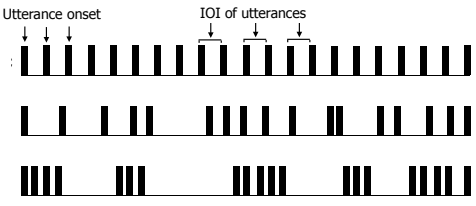
- N = 92 parent-infant dyads
- infants aged 12-27 mo. (*M*=19.5, *SD*=4.1)
- played with 2 sets of 3 novel objects
- parent speech recorded during play
- 45 infants' word learning tested after play



ASSESSING THE TEMPORAL STRUCTURE OF PARENT SPEECH



*IOI = Inter-Onset Interval of utterances



Infinite time series [5]

$$B = \frac{\sigma - \mu}{\sigma + \mu} = \frac{r - 1}{r + 1}$$

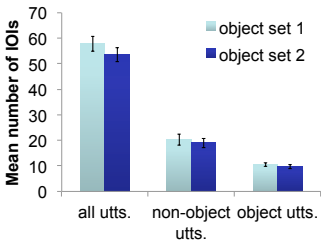
Finite time series [6]

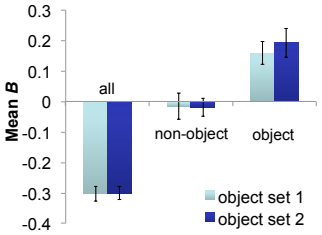
$$B = \frac{\sqrt{n+1}r - \sqrt{n-1}}{(\sqrt{n+1} - 2)r + \sqrt{n-1}}$$

RESULTS

*all error bars represent 95% CIs

1. Parents' speech to their infants has a periodic temporal structure overall, but talk about individual objects is predominantly bursty.

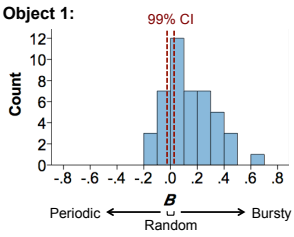




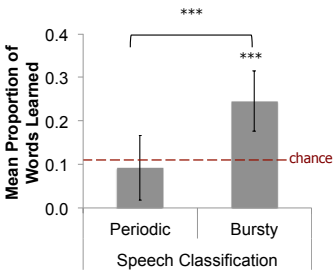
2. Objects parents talked about with bursty temporal structure were better learned than objects talked about with periodic temporal structure.

Bootstrapping procedure: classify temporal structure of talk about each object

- Generate exponential distribution of IOIs based on each objects' mean number of IOIs. Calculate *B*. Repeat 10,000 times.
- 99% CI of the mean → range of "Random" (Poisson) B values



Within subjects comparison of learning scores for the 37 (of 45 tested) infants that experienced at least 1 object talked about in a periodic way and 1 object talked about in a bursty way:



DISCUSSION

Almost all parent talk to their infant deviated from a Poisson process to at least some extent, indicating that infants' language input was structured in time.

Parents' talk about individual objects was predominantly bursty, however their overall talk was periodic, suggesting that parents engaged in short spaced discourses about alternating objects.

This spaced discourse (i.e., bursty) structure promoted better word learning than did a more regular, rhythmic speech structure.

Parents' speech is embedded within a multimodal play context such that bursty object talk may accompany short bouts of sustained infant and/or joint attention to objects, which may be the drivers of infant word learning in this study and more generally.

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Acknowledgments. We thank the parent and infant volunteers, as well as the volunteers and staff of the Computational Cognition and Learning Laboratory at Indiana University. Funding for this project was provided by NIH T32HD007475-22, NIH R01HD28675, NIH R01HD074601, NSF BCS1523982, and by Indiana University through the Emerging Area Research: Learning: Brains, Machines and Children. **Contact** laurenkslone@gmail.com with questions or for more information.