Neural sensitivity to local and global distributional information in speech changes as a function of development

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Background

- Detecting distributional regularities in speech is foundational for language learning (Werker et al., 2007; Maye et al., 2002)

- Both adults and children are sensitive to distributional statistics in the environment, such as frequency and variability (Aslin & Newport, 2014; Thiessen, Girard, & Erickson, 2016; Saffran et al., 1997; Raviv & Arnon, 2017)

- Yet, sensitive period has been identified for speech sound discrimination and syntactic acquisition (Werker & Tees, 2005; Weikum et al., 2013; Newport, 1990)

- The developmental trajectories of listeners' sensitivity to distributional cues in speech are poorly understood
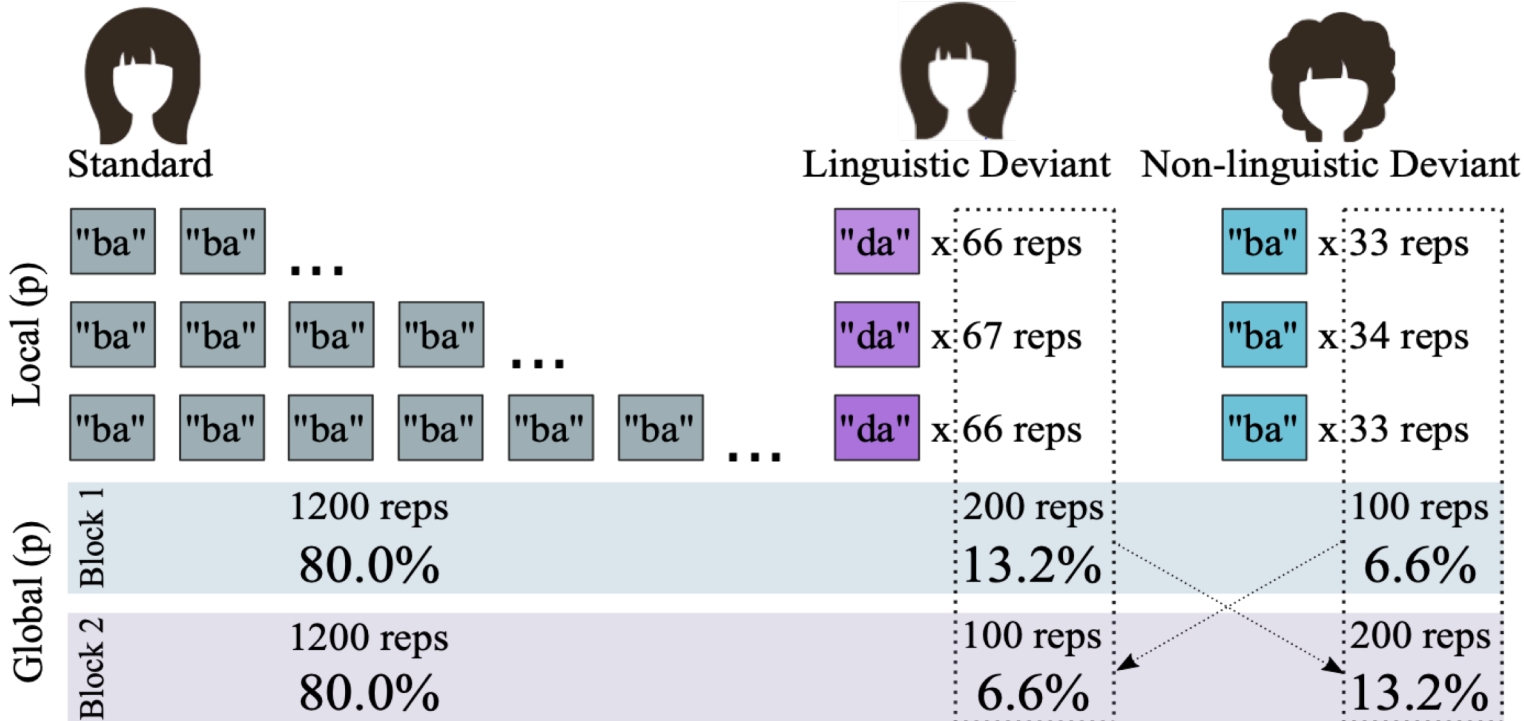
Research Questions

1. Are children more sensitive to distributional information, compared to adults?

2. How automatic do children and adults process the distributional information in speech?

Methods

Experiment 1: 45 adults (Mean = 22.76 years, SD = 3.02 years)

Experiment 2: 22 children (Mean = 10.2 years, SD = 1.99 years)

Hypotheses

1. Children might display larger ERP differences elicited by deviants with high vs. low probability, compared to adults

- Group x Frequency interaction

- Group x Frequency x Global/Local interaction

2. Children's processing might rely on an automatic mechanism, while adults might engage a more attentive process (Finn et al., 2015)

|	Automatic	Attentive
Early time window	MMR	-
Late time window	LDN	P3

Näätänen et al., 2005; Bishop, 2007; Wetzel & Schröger 2014; Wacongne et al., 2012

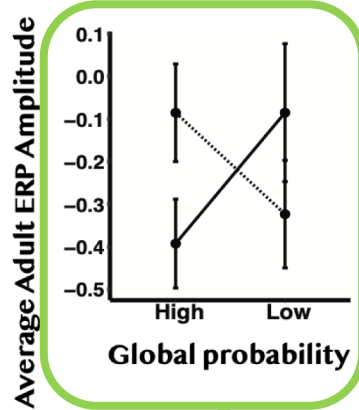# Identify ROIs (All standards versus all deviants)
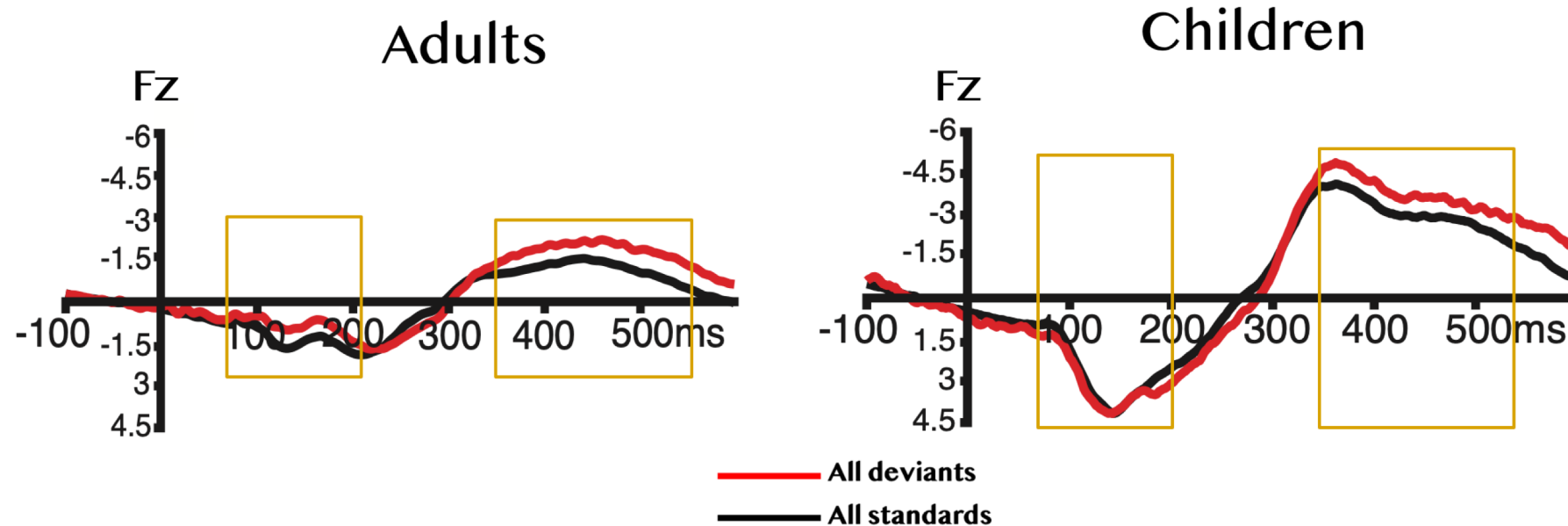
- Mass-Univariate Analysis: two significant clusters are identified in adults **(MMR window: 60-214ms and LDN window: 350-560ms)**
- Within the same time windows, children showed little evidence of MMR, but presented a robust LDN. However, two groups are not significantly different
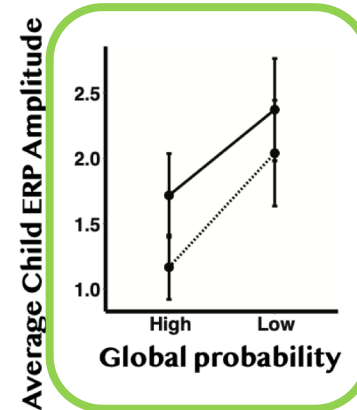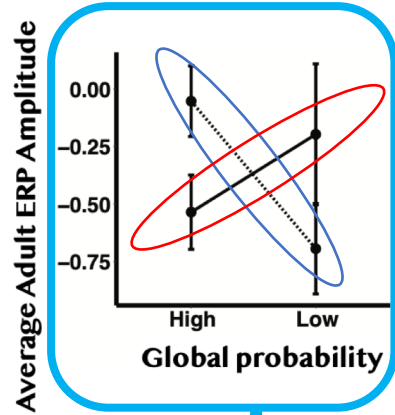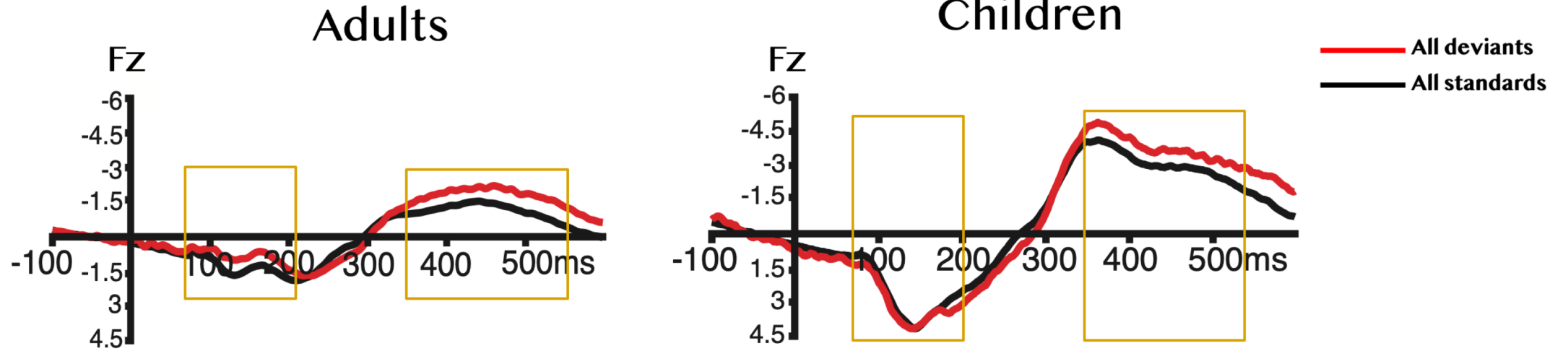
Early time window (MMR)
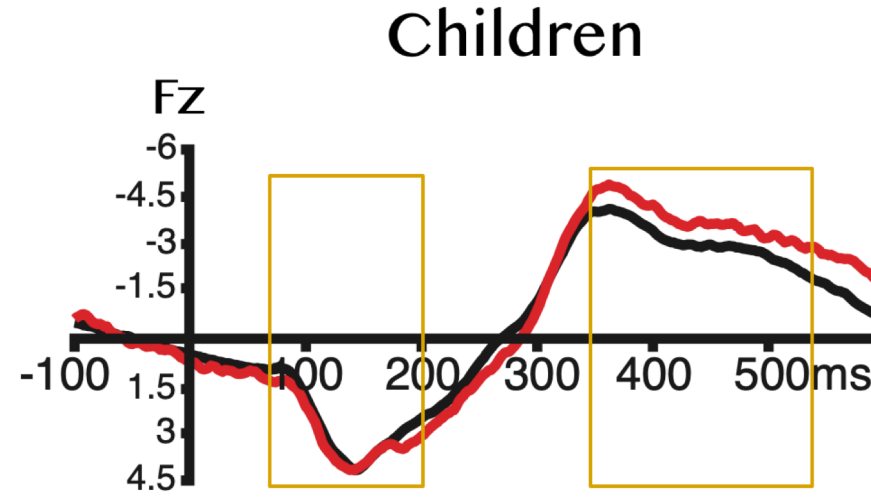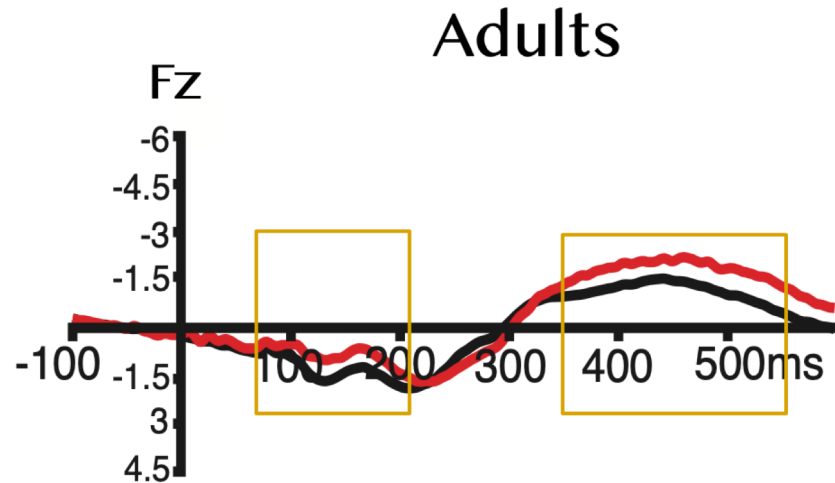
Late time window (LDN/P3)
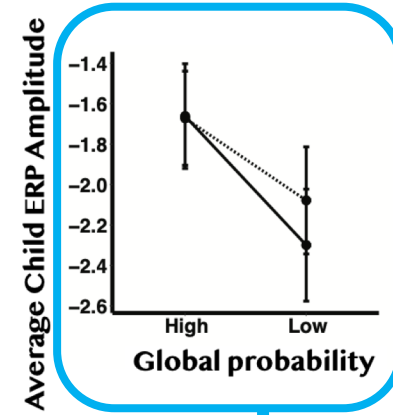
Discussion

1. **Are children more sensitive to distributional information, compared to adults?**

- Yes for the global probability!

- Children are sensitive to both global and local information, while adults' responses to global distributional information is modulated by local statistics

	Adults	Children
Local probability		P-MMR
	interaction	
Global probability		P-MMR, LDN

Discussion

2. How automatic do children and adults process the distributional information in speech?
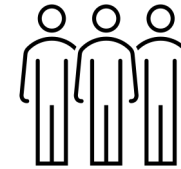
	Automatic	Attentive?
Early time window	P-MMR (local and global)	-
Late time window	LDN (global)	P3?

Acknowledgement

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