Input or Uptake?

Statistical learning moderates the relationship between language input and vocabulary size

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BACKGROUND

- Children require high quality language inputs from their environment to learn words (Weisleder & Fernald, 2013).
- New words are also acquired in part through statistical learning (SL) abilities that encode environmental regularities (Eghbalzad et al., 2020). SL is fundamental for both word learning and vocabulary growth (Arnon, 2019; Romberg & Saffran, 2010).
- Thus, it is both the input children hear, and how they process this input, that predicts vocabulary acquisition.
- Yet, it remains unknown how these two factors interact.

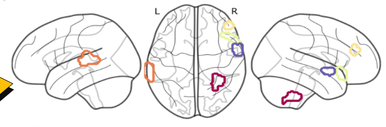
RESEARCH QUESTION

Either individually or synergistically, is it the input you hear or how you process that input that best predicts concurrent vocabulary?

ANALYSIS

- Number of Different Words (NDW) produced by the mother and total # of mother and child utterances were analyzed in SALT
- We examined functional brain activity during learning of structured versus random speech
- **Group constrained, subject specific analysis** (Scott et al., 2019; Julian et al., 2012; Fedorenko, et al., 2010):
  - Addresses intersubject variability
  - Identified 5 functional ROIs, in which there was overlap between 60% or more of subjects:

More details at C51

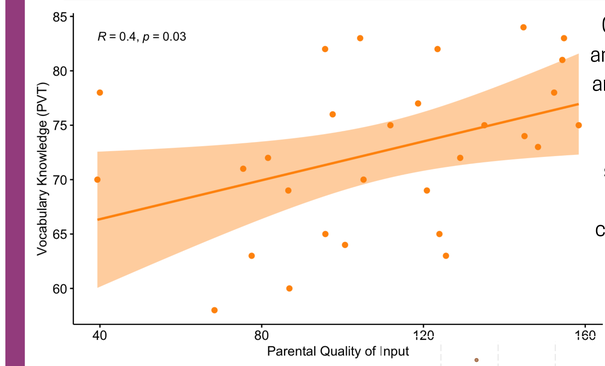


  - Within these functional ROIs, we extracted the top 10% of voxels activated for each participant within the entire ROI

RESULTS

Mean Reaction Time Across SL Exposure

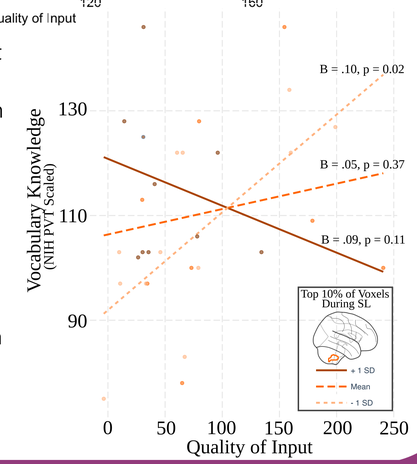
	Structured Mean (St. Dev.)	Random Mean (St. Dev.)	Statistics
Speech	180.12 (397.83)	444.68 (168.74)	t (21) = -4.5, p < 0.0001



Controlling for age, and number of parent and child utterances, the number of different words spoken by parents was positively correlated with child vocabulary (r = .40, p = .03).

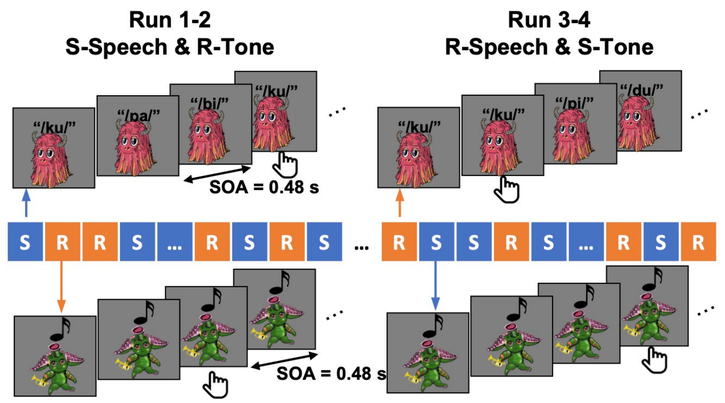
Importantly, activation in the right cerebellar cortex during SL of structured versus random speech sequences moderated this association (B = -.004, p = .02).

Children with greater activation in the right cerebellum during SL, a region particularly important for language functions (Starowicz-Filip et al., 2017), scored better on measures of vocabulary, despite hearing less diverse input (95% CI [.02,.35]).



METHODS

- Twenty-nine children ages 5-7 years (Mage = 6.44, SDage = 1.05) and their mother participated in a semi-structured play session (Hirsh-Pasek et al., 2015).
  - Maternal education: < HS diploma/GED (N = 10); some college (N = 4); College degree (N = 8), Graduate degree (N = 7)
  - Child Race/Ethnicity: Asian (N = 1), Black (N = 5), White (N = 22); Hispanic/Latinx (N = 2)
- Conversations from these play sessions were transcribed in SALT (Miller & Iglesias, 2008)
- The Picture Vocabulary Task (PVT; NIH Toolbox) was used to measure child vocabulary knowledge
- Children then completed an auditory SL fMRI task (adapted from Saffran et al., 1996; 1999; Schneider et al., 2020)



SL fMRI Task

THE BIG TAKEAWAY

High quality input promotes vocabulary knowledge*

*In a predominately white sample, from the Mid-Atlantic region of the US

Factors endogenous to the child (like SL ability) may buffer the detrimental vocabulary effects thought to be associated with low quality language input.

FUNDING

This research was funded by the NSF Directorate for Social, Behavioral & Economic Sciences under Grant 1911462

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