

# An eye gaze study of late talkers' receptive verb vocabularies

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## Introduction

**Purpose of the study:** To compare late talkers' (LTs) and typically developing children's (TDs) receptive verb vocabularies and processing

- **Late Talkers**
  - Atypically small expressive vocabularies, given otherwise typical development (Desmarais et al., 2008; Rescorla, 1989)
  - Variable receptive skills (e.g., Dale et al., 2003; Rescorla et al., 2001)
- **Verbs:**
  - Receptive verb knowledge better predicts grammatical outcomes than does noun knowledge (Hadley, Rispoli, & Hsu, 2016)
  - Critical for development of grammar

### Approach

- **Eye gaze**
  - Can be used to measure both accuracy and individual differences in lexical processing (e.g., Fernald & Marchman, 2012; Fernald, Perfors, & Marchman, 2006; Horvath, Valteau, & Arunachalam, 2017)
  - Fernald & Marchman (2012): Considering nouns, 18-month old LTs have smaller vocabularies and are slower processors as compared to TDs
- **Dynamic Scenes:**
  - Better depictions of target verbs, because actions unfold over time
  - Prior research has successfully used dynamic scenes to assess receptive verb vocabulary in ID 2-year olds (Valteau et al., under review) and toddlers with ASD (Horvath & Arunachalam, in preparation; Horvath, Valteau, & Arunachalam, 2017).

## Participants

LTs identified by scores at or below 15th percentile on MacArthur-Bates Communicative Development Inventories (MCDI-2) (Fenson et al., 2007)

Measure	LTs	TDs	Statistics
<b>N</b> (proportion male)	9 ( $p = 0.77$ )	30 ( $p = 0.60$ )	$z = 0.97$
<b>Age</b>	$M = 28.1$ ( $SD = 3.6$ )	$M = 28.3$ ( $SD = 2.6$ )	$t = -0.18$ $p = 0.86$
<b>MCDI-2</b> Raw score	$M = 27.1$ ( $SD = 16.7$ )	$M = 80.0$ ( $SD = 17.2$ )	$t = -8.28$ $p < 0.001^{***}$
<b>MSEL-VR</b> T score	$M = 41.0$ ( $SD = 10.5$ )	$M = 56.6$ ( $SD = 9.3$ )	$t = -4.0$ $p = 0.002^*$
<b>MSEL-VR</b> Raw score and age equivalent	$M = 26.0$ ( $SD = 3.4$ ); 24 mo.	$M = 31.7$ ( $SD = 4.3$ ); 31 mo.	$t = -4.14$ $p < 0.001^{***}$
<b>PLS5-AC</b> Standard Score	$M = 85.8$ ( $SD = 16.1$ )	$M = 112.8$ ( $SD = 12.2$ )	$t = -4.7$ $p < 0.001^{***}$
<b>PLS5-AC</b> Raw score and age equivalent	$M = 26.1$ ( $SD = 4.6$ ); 23 mo.	$M = 35.5$ ( $SD = 4.9$ ); 35 mo.	$t = -5.2$ $p < 0.001^{***}$
<b>PLS5-EC</b> Standard score	$M = 85.8$ ( $SD = 10.3$ )	$M = 111.8$ ( $SD = 12.8$ )	$t = -6.3$ $p < 0.001^{***}$
<b>PLS5-EC</b> Raw score and age equivalent	$M = 25.8$ ( $SD = 4.1$ ); 21 mo.	$M = 34.9$ ( $SD = 5.1$ ); 34 mo.	$t = -5.5$ $p < 0.001^{***}$

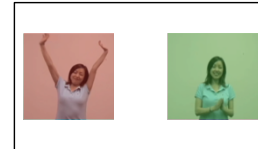
## Methods

	Inspection Phase			Prompt	Test
Visual				★	
Auditory			Do you see?	Where is she clapping?	Do you see clapping? Find clapping!
Time	4 seconds	4 seconds	6 seconds	4 seconds	6 seconds

An example of one trial. Visual stimuli were initially developed by Konishi et al. (2016). Participants saw 10 dynamic scene verbal trials.

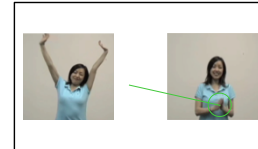
### Accuracy

- Proportion of looking time to the target over the distractor image
- Window of analysis: first 300-1800 msec of test phase (see Fernald et al., 2006)



### Latency

- The time (msec) to first look on the target image



## Results

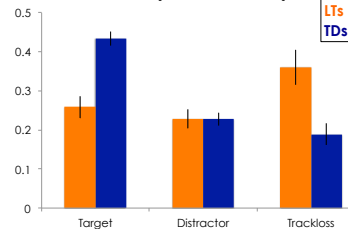
### Accuracy

- **LTs:**  $M(\text{accuracy}) = 21\%$  of target verbs ( $SD = 0.14$ , range = 0 – 0.43).
- **TDs:**  $M(\text{accuracy}) = 38\%$  of target verbs ( $SD = 0.20$ , range = 0.1 – 1.0).
- Significant group difference ( $t = -2.82$ ,  $p = 0.01$ ).

### Latency

- **LTs:**  $M(\text{latency}) = 2183$  msec ( $SD = 743$  msec).
- **TDs:**  $M(\text{latency}) = 1552$  msec ( $SD = 489$  msec).
- Significant group difference ( $t = 2.4$ ,  $p = 0.04$ ).

Proportion looking to each scene during target window (300 – 1800 msec)



As compared to TDs,

- LTs looked less to the target scene during the target window ( $t = -5.21$ ,  $p < 0.001^{***}$ )
- LTs demonstrated no group differences in looks to the distractor scene ( $t = 0.02$ ,  $p = 0.98$ , *n.s.*).
- LTs spent more time engaging in non-looking behaviors ( $t = 3.26$ ,  $p = 0.005^*$ )

## Conclusions

- As compared to TDs, LTs know fewer verbs and are slower lexical processors
- Also, LTs engage in more off-task looking, indicating behavioral differences
- Processing deficits, in particular, may be a reason why LTs struggle with language, and may indicate which LTs are at risk for language disorder
- Future directions: Does processing predict performance on a novel verb-learning task?

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## Acknowledgements

The authors have no conflicts of interest to report. This work was funded by NIH K01DC01306 to Sudha Arunachalam, an American Speech-Language-Hearing Foundation New Century Scholars Research Grant to Sudha Arunachalam, and an American Speech-Language-Hearing Foundation Student Research Grant in Early Childhood Language Development (supported by the Noel and Arlene Marlin Memorial Fund) to Sabrina Horvath. Thank you to Konishi et al. for their use of the stimuli.