

# Visual Emotion Processing During an n-back Working Memory Task in Adolescents with Specific Language Impairment



Deanna M. Hughes  
San Diego State University

Julia L. Evans  
San Diego State University

Seth D. Pollak  
University of Wisconsin-Madison

## Abstract

The purpose of this experiment was to investigate visual processing of facial affect in pre-adolescents with SLI. Accuracy and reaction time data were investigated in group (SLI, CA), load (1-2-back) and valence (neutral, emotion - happy, angry, sad) conditions for 10 adolescents with SLI and 10 CA peers (11;9-14;10). Behavioral accuracy showed a main effect for valence with both groups performing significantly worse in the emotion condition which is hypothesized to represent a higher processing load. A group by valence interaction was observed with the SLI group performing significantly worse than the CA group in the processing of emotions. The RT's demonstrated a group by load interaction with the SLI group being significantly slower processing visual information in the 2-back condition. The data from this study indicate that pre-adolescents with SLI are slower and less accurate in processing visual emotional information as processing demands increase.

## References

- Creusere, M., Alt, M., & Plante, E. (2004). Recognition of vocal and facial cues to affect in language-impaired and normally-developing preschoolers. *J Commun Disord*, 37(1), 5-20.
- Ellis Weismer, S. E., Plante, E., Jones, M., & Tomblin, J. B. (2005). A functional magnetic resonance imaging investigation of verbal working memory in adolescents with specific language impairment. *J Speech Lang Hear Res*, 48(2), 405-425.
- Nowicki, S., Jr., & Mitchell, J. (1998). Accuracy in identifying affect in child and adult faces and voices and social competence in preschool children. *Genet Soc Gen Psychol Monogr*, 124(1), 39-59.
- Ekman, P., & Frieson, W.V. (1976). Pictures of facial affect. Palo Alto, CA: Consulting Psychologist.
- This research was supported by grants from the NIDCD to Julia Evans, (R01DC005650) and from the NIMH to Seth Pollak, (MH61285, MH68858) and the Waisman Center.

## Purpose

The purpose of this study was to investigate visual processing of facial affect in pre-adolescents with SLI using an n-back working memory task.

## Introduction

- Ability to process emotional facial affect is vulnerable to increased processing demands in children with SLI.
- Previous work showed children with SLI were significantly impaired in processing facial affect when required to simultaneously process auditory paralinguistic cues in conjunction with the visual emotion cues.
- It is unknown if the breakdown in emotion processing in children with SLI is secondary to the dual modality demands, or if emotion processing is vulnerable to increased demands in a visual modality alone.
- Emotional processing is correlated with peer ratings and popularity. Thus, if visual emotion processing in SLI is vulnerable to increases in processing demands, this puts them at risk for social and academic failure above and beyond their current risk associated with language impairment alone.

## Problem

Previous studies of emotion processing of facial affect in individuals with SLI have shown deficits across auditory and visual modalities making it hard to determine performance in a single modality when processing demands are increased.

## Methods

### Participants

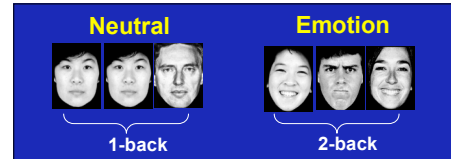
10 SLI and 10 CA controls (11;9 - 14;10). On the CELF-R, standard scores for the SLI group were one SD or more below the mean and within age level expectations for the CA group.

### Task

A 2 x 2, (valence; neutral & emotion) x (load; 1- & 2-back) n-back working memory task cofactoring for IQ. Participants had to decide whether a visually presented stimulus (neutral or emotion faces) matched one n-trials back

- Continuous memory task
- Processing demands independent of storage demands
- Active storage load is varied systematically
- Emotions were happy, angry, and sad

## Visual Stimulus (Ekman & Frieson, 1976)

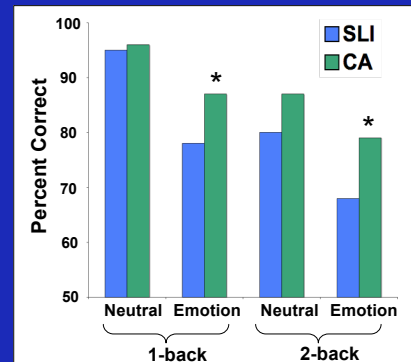


## Predictions

- Reduced accuracy for matching emotions in the SLI group when load is increased in the 2-back condition
- Slower response latencies for matching neutral and emotion stimulus in both 1- and 2-back conditions in the SLI group

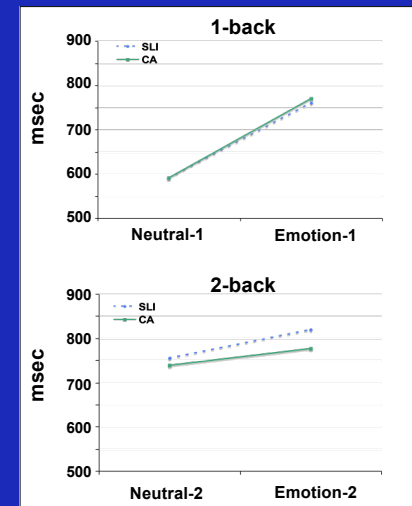
## Results

### Accuracy for Neutral and Emotion 1 and 2-Back Conditions



- The addition of emotion, regardless of load, resulted in reduced accuracy in both groups. A main effect of emotion  $F(1,17) = 6.92, p < .05, \text{partial } \eta^2 = .28, \text{power} = .69$
- Accuracy had a disproportional reduction in the SLI group. Interaction effect of emotion x group  $F(1,17) = 11.13, p < .01, \text{partial } \eta^2 = .39, \text{power} = .88$
- No main effect of load alone
- There was a trend for reduced accuracy especially in the 2-back condition for the SLI group. Interaction effect of load x group approaching significance  $F(1,17) = 4.02, p = .06$
- NO main effect for group  $F(1,17) = .007, p = \text{ns}$
- The SLI group did not have overall poorer performance

### Reaction Times for Neutral and Emotion 1- and 2-Back Conditions



- Reaction times were slower in the 2-back condition for both groups. A main effect of load  $F(1,17) = 7.41, p < .05, \text{partial } \eta^2 = .30, \text{power} = .72$
- Participants in the SLI group had significantly slower reaction times in the 2-back condition compared to the 1-back condition,  $p = 0.007$ . Interaction effect of load x group  $F(1,17) = 6.3, p < .05, \text{partial } \eta^2 = .27, \text{power} = .66$
- No main effect of group participants in the SLI group were not significantly slower than CA peers overall

## Conclusions

These results suggest that adolescents with SLI have more difficulty processing visual emotion stimuli compared to CA peers. They were also significantly slower than CA peers when processing demands were increased in the 2-back condition. This suggests that dual task processing in a visual modality alone is difficult for pre-adolescents with SLI compared to peers.