

Developmental changes in the influence of acoustic & non-acoustic contributions to the perception of spoken language

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ABSTRACT

The purpose of this study was to establish an experimental paradigm to assess the developmental trajectory of audiovisual processing during speech perception. Audiovisual processing is often studied using a McGurk task, which elicits a perceptual illusion from the interaction of mismatched auditory and visual speech. Research on this task shows evidence for perception of the illusion in adults and infants but not in school-aged children. This has been interpreted as reflecting limited use of visual information during speech perception at particular developmental stages. Research has also shown an absence of the McGurk effect in children with SLI, citing auditory processing deficits as the cause. Before we can interpret findings from children with SLI, we need to determine if the findings in typical children are due to task demands. Results from typical children demonstrate that our task is sensitive to audiovisual processing. We will use this task with children with and without SLI to determine the developmental nature of audiovisual processing.

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BACKGROUND

- Audiovisual speech perception in **school-age children with SLI** is less influenced by visual speech cues than typical peers (Norrix et al. 2007)
- Weak responses to visual speech cues are also seen in **typically developing school-age children** (McGurk & MacDonald, 1976; Dupont et al., 2005)
- Sensitivity to visual speech cues is often assessed using a McGurk task (McGurk & MacDonald, 1976), where 98% of **adult** responses indicate an illusory percept.
- Interestingly, the McGurk effect is also seen in **infants** (Rosenblum et al. 1997)
- Why do infants and adults show evidence of McGurk, whereas in both school-age children with SLI and typically developing school-age children the effect is weaker?
- One possibility is how performance on McGurk tasks is assessed:
 - o *Preferential looking* - **Infants**
 - o *Verbal report* - **School-age children & Adults**
- Typical children's poor performance has been attributed to poor lip-reading skills, less experience correctly producing phonemes, or learning to read around this age which causes reorganization of phonological representational knowledge (Massaro et al., 1986; Dupont et al., 2005; Jerger et al., 2009).

PURPOSE

The purpose of this study was to develop an experimental paradigm that could be used to differentiate "clinical" poor performance on audiovisual integration tasks from developmental poor performance in typically developing school-age children and children with SLI, using a paradigm that removes the demands of verbal report methods.

METHOD

| Participants | SLI (N = 3) | | | TD (N=18) | | |
|---------------------|-------------|-----|------------|-----------|-----|-----------|
| | Mean | SD | Range | Mean | SD | Range |
| Age (years; months) | 10;1 | 2;0 | 7;11-11;11 | 9;3 | 1;5 | 7;5-11;11 |

Demographics

Children

- Normal nonverbal intelligence
- Normal hearing at time of testing
- Monolingual speaking
- No prior history of perceptual or neurological disorders

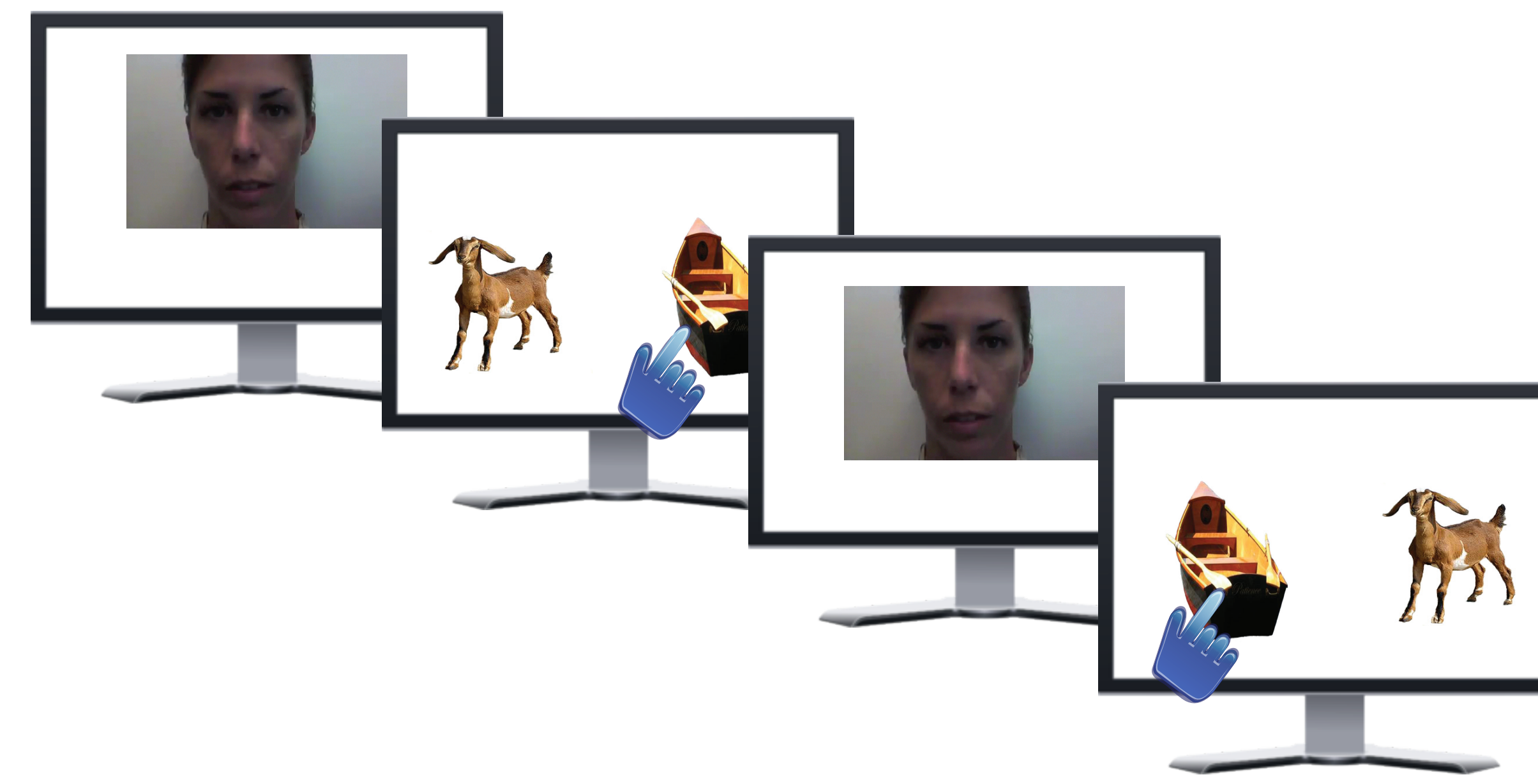
STIMULI

| Lexical Items | GOAT | BOAT | OAT |
|-------------------------|-----------------------|-----------------------|------------------------|
| Neighborhood Density | 26 | 32 | 25 |
| Imageability | 585 | 631 | 499 |
| Familiarity | 496 | 584 | 484 |
| Meaningfulness | 402 | 542 | 357 |
| Concreteness | 636 | 637 | 553 |
| Phonotactic Probability | Sum =.0066(Avg=.0033) | Sum =.0077(Avg=.0038) | Sum =.0394(Avg =.0197) |
| Word Frequency | 2.79 | 3.62 | 2 |

*Stimuli designed to be matched & age appropriate.

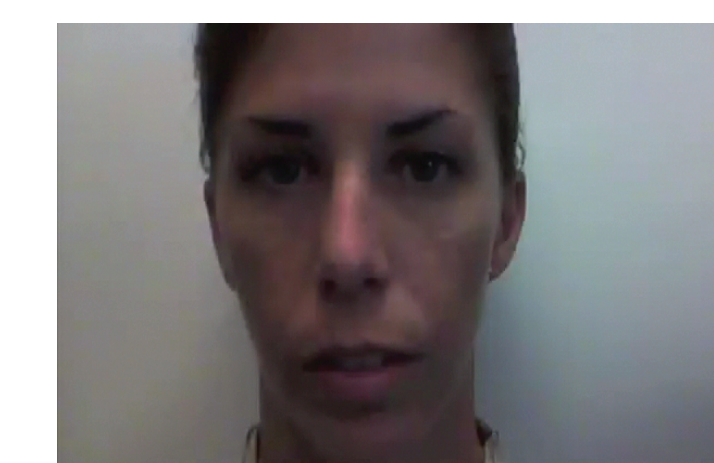
PROCEDURE

- Participants were instructed to "Touch the picture that matches the word the woman said"
- 43 Trials (3 practice trials, 40 test trials)
- Videos presented one at a time in a fixed random order on a touch screen monitor
- Counterbalanced location of pictures on screen (right, left)
- Programed on PsyScope X



MOVIE STIMULI

| | Match | Match | Mismatch | Mismatch | Control |
|-------|-------|-------|----------|----------|---------|
| | Boat | Goat | Boat | Goat | Oat |
| Audio | | | | | |
| Video | | | | | |

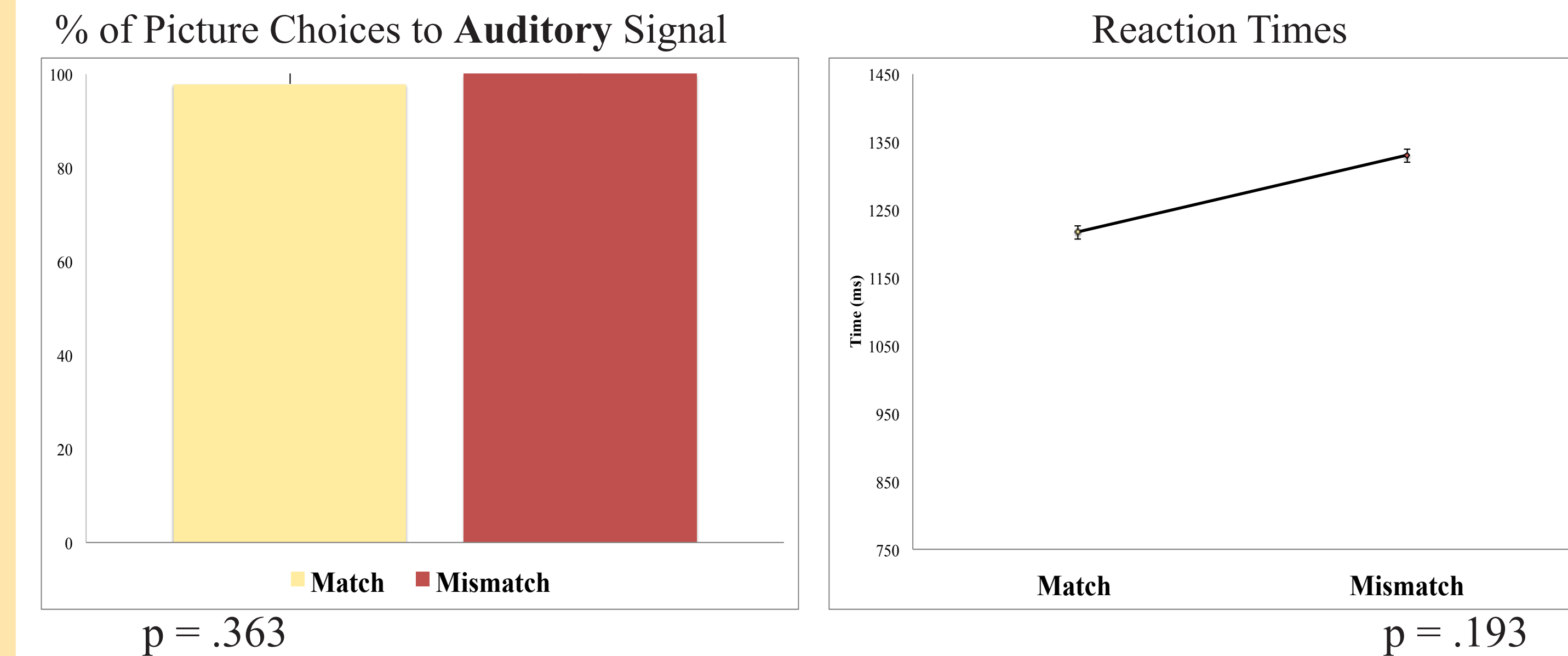


RESPONSE PICTURES

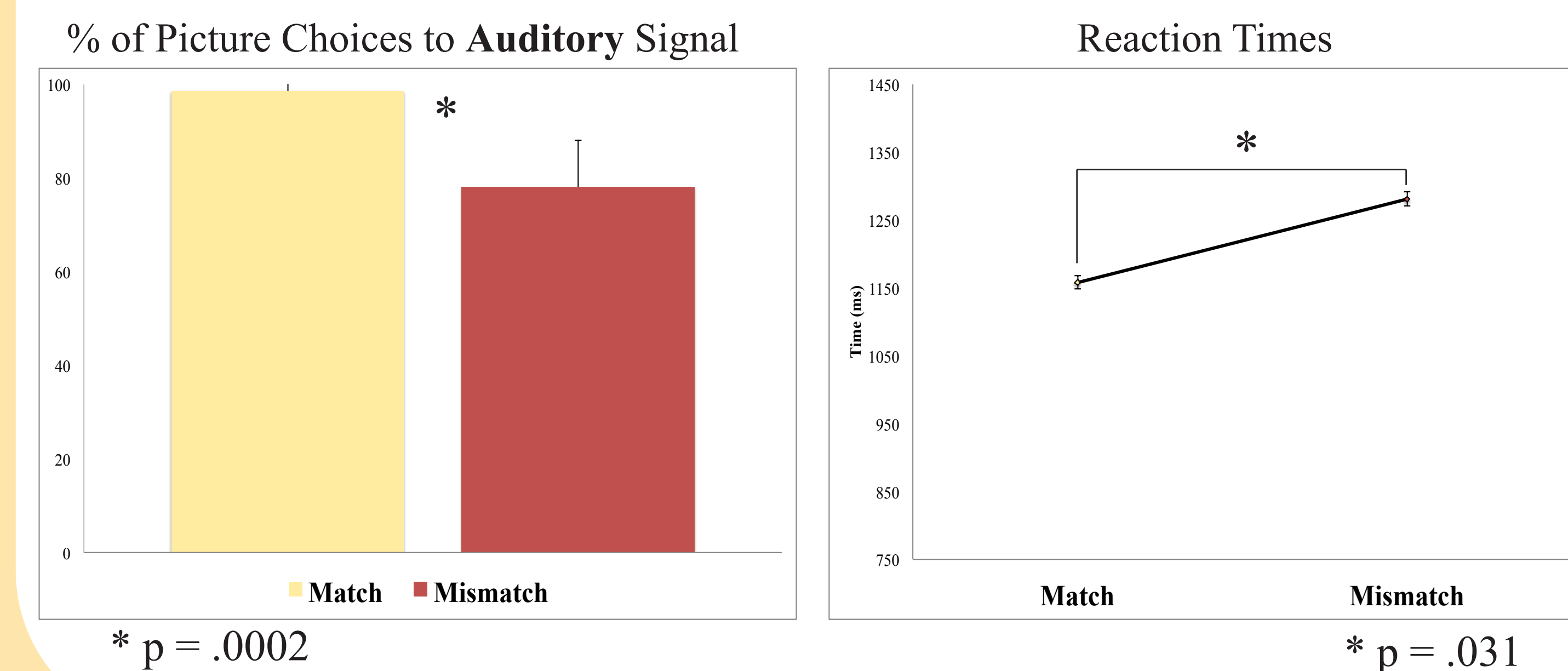


RESULTS

Children with SLI



TD Children



SUMMARY

- 1) Typically developing children showed evidence of disruption of speech processing when visual speech cues were inconsistent with auditory speech on both picture choice and reaction time measures.
 - Chose the picture that matched the auditory signal significantly less often during the mismatch condition as compared to the match condition
 - Reaction times were significantly slower during the mismatch condition as compared to the match condition.
- 2) These preliminary findings suggest that the pattern of picture choice for children with SLI may be qualitatively different from typically developing children. Children with SLI chose the picture that matched the auditory signal regardless of condition.
- 3) This experimental paradigm appears sensitive to the ability to process auditory and visual speech cues in typically developing school-age children and may also be sensitive to this ability in children with SLI.
- 4) If the pattern remains, then these findings suggest that children with SLI are less influenced by visual speech information as compared to typically developing peers.