Neural correlates of audio-visual speech processing: Implications for children diagnosed with autism spectrum disorder

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BACKGROUND

Perceptual studies of children with autism spectrum disorders (ASD) strongly implicate deficits in processing of audiovisual (AV) speech. Previous research with AV stimuli has typically been conducted in the context of auditory noise or with mismatched auditory and visual ("McGurk") stimuli. Although both types of stimuli are well-established methods for testing typically developing (TD) participants, they may create additional processing problems for children with ASD.
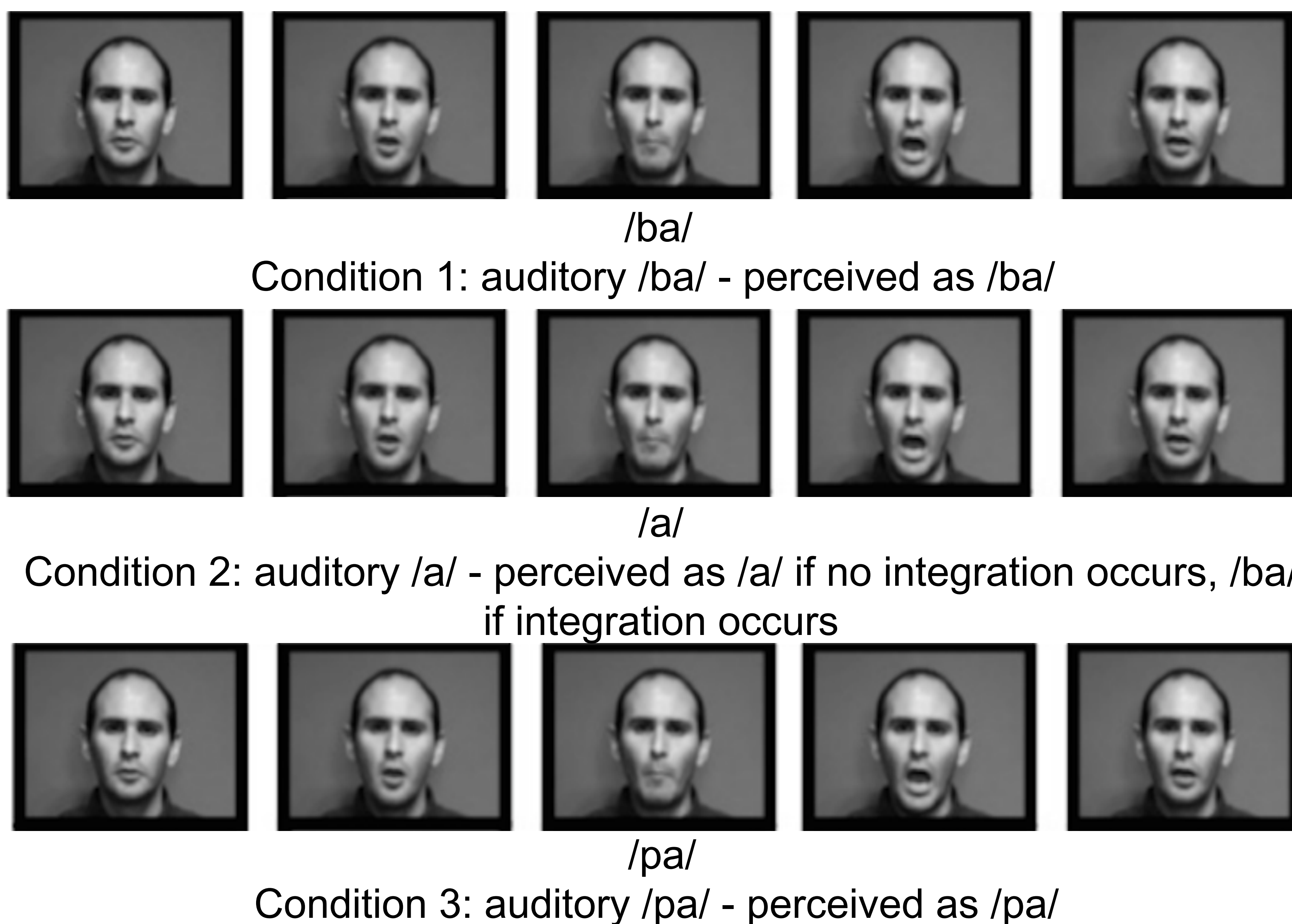
To more precisely examine audiovisual (AV) speech perception in children with ASD, we developed a novel measure of AV processing that involves neither noise nor AV cross-category conflict.

PARADIGM FOR ASSESSING AV INTEGRATION

The speech stimuli include clear exemplars of the syllable /ba/ and /pa/ and a modified version of /ba/ in which the consonant is substantially weakened so that the syllable is heard as "/a/ ". These are dubbed with a video of the speaker saying /ba/. The same video is used for all stimuli and only the acoustic stimulus varies. For an auditory-only (AO) baseline condition, the mouth and jaw are pixelated (PX) to remove all articulatory information.

For the AV "/a/" stimulus, audiovisual integration should result in the visual information effectively "restoring" the weakened auditory cues so that the stimulus is perceived as /ba/.

AV STIMULI

/ba/
Condition 1: auditory /ba/ - perceived as /ba/

/a/
Condition 2: auditory /a/ - perceived as /a/ if no integration occurs, /ba/ if integration occurs

/pa/
Condition 3: auditory /pa/ - perceived as /pa/

PARTICIPANTS

8 Typically Developing Adults (ages 21-32, mean=26.5)
16 Typically Developing Children (ages 6-12, mean=9.3)

- No history of developmental disability
- Normal hearing, normal or corrected-to-normal vision
- Monolingual, native speakers of American English

EEG DATA ANALYSIS

EEG data were band pass filtered from 1 to 30hz and segmented by condition, 100ms pre-stimulus to 850ms post-stimulus. Only participants with 20 artifact-free usable trials per condition were included for analysis. Plotted waveforms show grand averaged ERPs by condition. Shading represents the standard deviation from the grand mean at each time point.

EVENT RELATED POTENTIAL DATA

PRELIMINARY FINDINGS & NEXT STEPS

- Evidence for visual interference on auditory perception in the AV condition in which the mouth is visible:
  - The /a/ deviant was more difficult to discriminate than the the /pa/ deviant in the AV condition, indexed by increased amplitude.
  - Latency differences between deviants in the AV condition but not in the control condition when the mouth is pixelated.

- The P2 will be analyzed as an earlier marker of stimulus evaluation and categorization.

- Analysis of eye tracking data to evaluate gaze to face.

- Data from children with ASD currently being collected.

ACKNOWLEDGMENTS