



# Interaural Asymmetry Using Dichotic Filtered Words in Children with Suspected Auditory Processing Disorder: Preliminary Findings

Lisa Huston, B.A. Keiko Gibson, B.A. Jason Kwan, B.A. Jeffrey Martin, Ph.D.  
The University of Texas at Dallas, School of Behavioral and Brain Sciences, Richardson, Texas



## SPECIFIC AIM OF STUDY

Contrast behavioral performances from school-aged children with and without signs and symptoms of auditory processing disorder (APD) using an experimental dichotic listening paradigm composed of low-pass filtered speech presented under divided-attention (DIV) and directed-attention (DIR) listening modes.

## BACKGROUND

- The direction and magnitude of interaural asymmetry (IA) on dichotic listening tests is often evaluated during diagnostic assessment for APD, with excessive IA (e.g., left-ear deficit) often taken as a sign of the disorder.<sup>1</sup>
- It is worthwhile to consider that clinical decisions about IA might be improved when the dichotic test itself generates meaningful amounts of asymmetry in the non-clinical population, but without introducing extra-auditory factors on test performance.
- In this regard, a recent study<sup>2</sup> evaluated performances to dichotic low-pass filtered speech (dichotic filtered words, DFWs) presented under DIV and DIR test modes in healthy young adults with normal hearing. Previous studies have suggested that the combined utility of DIV and DIR modes may help discern the relatively contributions of perceptual (bottom-up) versus cognitive (top-down) processing biases underlying IA.<sup>3,4</sup> Results showed that larger values of IA (e.g., REA) were produced using DFW as compared to traditional non-filtered stimuli. The magnitude of IA for DFWs was similar between test modes.
- The purpose of this study was to further evaluate the DFW paradigm in a sample of school-aged children with and without symptoms of APD.***

## PRODUCTION OF DICHOTIC FILTERED WORDS (DFW) STIMULI

- Sixty DFW trials were constructed from 120 digitally recorded monosyllabic words selected with regard to age of acquisition, familiarity, concreteness, and imageability
- DFWs were produced using a low-pass Butterworth digital filter and cutoff frequency of 1500 Hz (-60dB/octave) applied to both channels.
- Individual words constituting each DFW trial were equated for duration and intensity (RMS)
- Care was taken to ensure that individual DFW trials were constructed from words showing similar onsets/offsets and no obvious semantic or phonological relationships (e.g., rhyming words)
- Three test lists incorporating 20 DFW trials each were assembled and transferred to compact disc for testing.

## PARTICIPANTS

- Two groups of children over 8 to 13 years were tested: (1) fifteen children ( $M=10.6$  years) served as control listeners, and (2) five children ( $M=10.7$  years) suspected of having APD (susAPD) based on parent report (CHAPS) and/or prior diagnostic testing served as experimental participants.
- All participants were right-handed by questionnaire, demonstrated normal peripheral hearing sensitivity, middle-ear function, reported English as the primary language learned, and reported no history of neurological or brain trauma.

## PROCEDURE

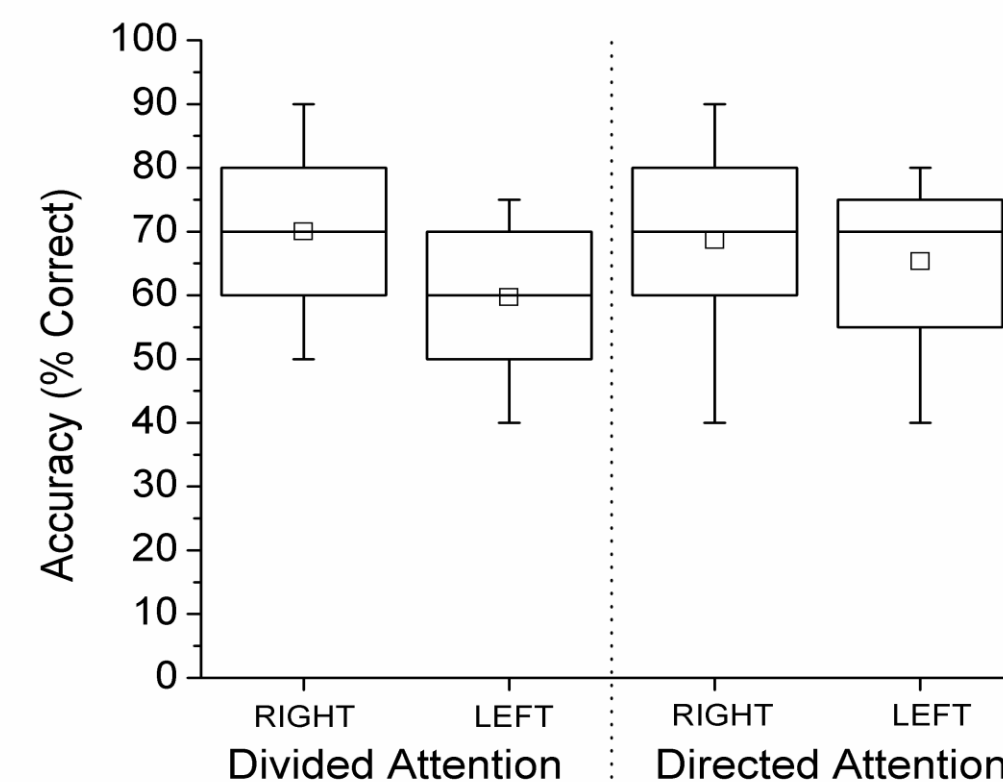
- Participants were presented DFW stimuli at a comfortable listening level (60 dBHL) using insert headphones in an audiometric booth.
- Participants responded to stimuli under three instructional (task) modes:
  - DIV or free report (i.e., “report both words”)
  - DIR with focus on right ear (i.e., “report only the right side”)
  - DIR with focus on left ear (i.e., “report only the left side”)
- Listening mode was counterbalanced across participants.

## ANALYSES

- For the group of control listeners, response accuracy (percent correct scores) was evaluated using a repeated measures ANOVA with ear (2) and listening mode (3) serving as experimental variables.
- Performance from each susAPD individual was compared to that of the control group.

## RESULTS: CONTROL GROUP

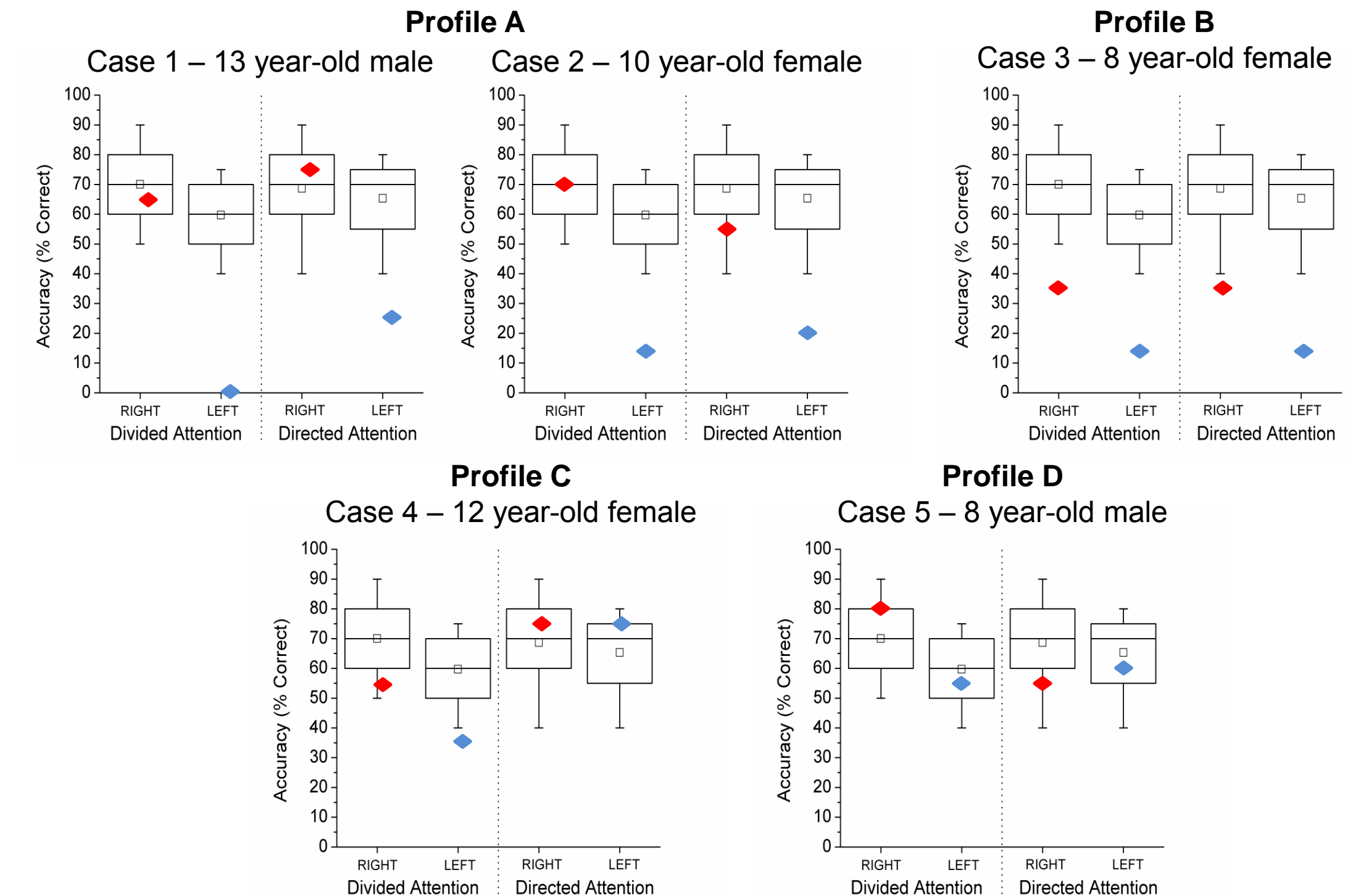
**Figure 1.** Group results to DFW stimuli presented under DIV and DIR modes. The maximum and minimum score, interquartile range (75% and 25%), median score, and mean score are denoted by the whiskers, large box, line, and small square, respectively.



ANOVA indicated that control listeners had an overall right-ear advantage ( $p = 0.008$ ) as expected. There was no significant main effect of listening mode ( $p = 0.421$ ) or interaction between mode and ear, indicating that the size of REA was comparable between modes.

## RESULTS: SUSPECTED APD GROUP

**Figure 2:** Performance profiles for five children with suspected APD compared to controls



Profile A (Case 1 & 2): Excessive IA (REA) during DIV and DIR; normal accuracy on right ear.  
Profile B (Case 3): Overall poor accuracy during DIV and DIR but normal IA (REA).  
Profile C (Case 4): Poorer accuracy on left ear during DIV; normal accuracy and IA for DIR.  
Profile D (Case 5): Accuracy and degree of IA are within expected values.

## CONCLUSIONS AND FUTURE DIRECTIONS

The DFW technique may be helpful in increasing task difficulty while producing meaningful IA in children without APD. The paradigm may also highlight different patterns of performance in children with suspected APD.

Profiles of atypical performance could potentially delineate between different weaknesses in dichotic listening. Profile A may suggest deficits within the central auditory domain whereas Profiles B and C potentially reflect contributions of supramodal (cognitive) factors.

## REFERENCES

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