# Temporal Coupling of the Left and Right M100: Speech Sound Processing in Children with Autism Disorder, their Siblings and Typically Developing Controls

**G105**

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**also see G95**

## Sound Processing in Autism

Neural synchrony coupled with the exquisite timing of the auditory system play a critical role in the development of language. However, little work has been done to characterize hemispheric asymmetries in the auditory evoked response in typically developing (TD) children. Our previous studies of auditory function in TD children show adult-like patterns of modulation by place of articulation and voice onset time. Here we investigate maturation of the M100 by comparing the magnitude and direction of TD hemisphere latency offsets to mature adult responses.

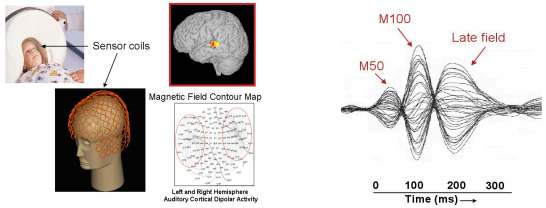
Autism disorder is marked by sound reactivity and language impairment motivating an investigation of the temporal coupling of cortical responses across the hemispheres. In previous studies using MEG, we provided evidence for abnormalities in auditory cortical processes underlying feature extraction in children with autism disorder for both speech and non-speech sounds.

In adults, the auditory evoked M100 component detected by MEG peaks within a narrow (~20ms) time window across left (LH) and right (RH) hemispheres, with the LH typically peaking later across a wide variety of stimulus categories. Although the neural basis of the hemispheric asymmetries (L>R) seen in adults are not fully understood, they are highly replicable and generally stable across stimulus conditions (Salajegheh et al, 2004).

In this ongoing investigation we use MEG to evaluate synchrony in cortical responses as measured by the M100 peak latency offset between hemispheres in processing complex (speech) sounds in age matched typically developing controls, AD their siblings. Adult data reported here include in part modified presentation of the data reported in Poeppel et al. 1996.

## Measures of Cortical Sound Processing -- Magnetoencephalography (MEG)

The neuromagnetic evoked field detected by MEG reflects the synchronized cortical activity of populations of neurons time locked to stimulus onset. MEG thus offers a unique and non-invasive technique with which to study signal processing in the brain.




**Sample: Typically developing (TD), AD, and their Siblings 7-13 years**

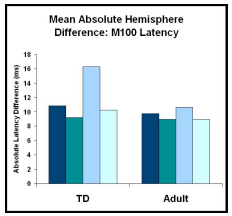
**Controls:** N=8 (boys) Mean age = 9 years 11 months
**Siblings:** N = 8 (3 girls) Mean age = 10 years
**Autism:** N=13 (boys) Mean age = 10 years 8 months
All AD children met research criteria based on ADOS and ADI-R testing
Siblings tested did not meet ADOS and ADI-R research criteria

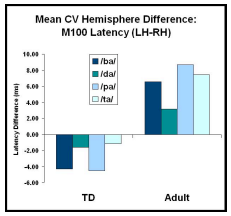
**Stimuli: Random interleaved presentation with an ITI jittered around 1 second**

**Consonant-vowel syllables (CVs): natural tokens of /ba/, /da/, /pa/, and /ta/**

## Synchrony in Cortical Responses in Neurotypical Subjects

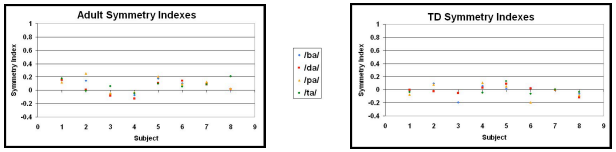
Similar magnitude in M100 peak offset in TD children and neurotypical adults.



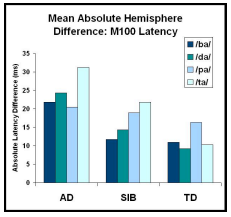




Differences in latency of the M100 time to peak between hemispheres in TD children: right hemisphere peaks later than left.

**Individual Symmetry Index (SI) results: SI = (2*(LH-RH))/(LH+RH)**




## Synchrony in Cortical Responses in AD and their Siblings

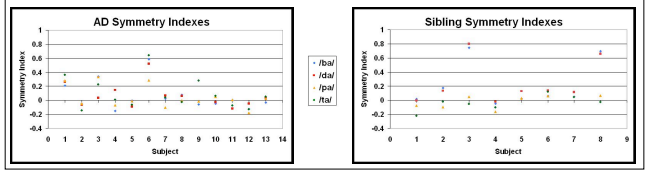



**Magnitude** of latency offset

The absolute magnitude of Left and Right Hemisphere temporal offsets were greatest in the AD group and smallest in the TD group, with the Siblings representing an intermediate effect.

**Individual Symmetry Index results: shown below for AD and their Siblings.**

**SI = (2*(LH-RH))/(LH+RH)**



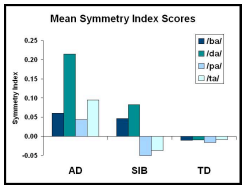

## Mean Symmetry Index in TD, AD and their Siblings

**Direction** of mean M100 latency peak offset differs across groups.

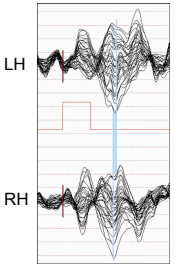
**AD results:** later left hemisphere latency peaks for speech (complex) sounds.

**Sibling results:** later left hemisphere latency peaks for voiced speech (complex) sounds only, later right hemisphere latency peaks for unvoiced stimuli.

**TD results:** later right hemisphere latency peaks for speech (complex) sounds

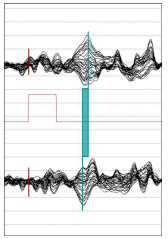


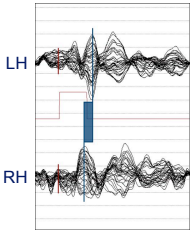

## Hemisphere Peak Offset Differences to CV Syllable




TD: shaded region shows M100 latency peak offset (LH-RH: 6ms), for a characteristic control child (male, 9yrs).

Sibling: shaded region shows M100 latency peak offset (LH-RH: 11ms), for a characteristic sibling (female, 10yrs).




AD: shaded region shows M100 latency peak offset (LH-RH: 35ms), for a characteristic AD child (male, 9yrs).

## Conclusions

In adults the M100 component peaks similarly in time across the hemispheres, with the left typically peaking slightly later. Here we report differences in magnitude and direction in the peak latency difference between hemispheres for TD, AD and their Siblings. Magnitude findings similar to adults are seen in TD. The direction of the hemisphere offset varies by group, differentiating unaffected siblings responses from both the TD and AD groups. Additional work is needed to explore the maturational implications and neuronal basis of the hemisphere differences seen in the peak latency of the M100.

**Acknowledgements**

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