**'More' may be 'less': Deficient dichotic listening performance in autism is associated with hyperactivation of bilateral language brain regions.**

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**Introduction:** Impairments in language development constitute a key cognitive deficiency in autism spectrum disorder (ASD) (DSM IV, p.60). Specifically, ASD language impairment has been associated with an observed reversal of left ear (LE) rather than normal right ear (RE) advantage demonstrated by use of a dichotic listening (DL) paradigm (C-scan) which has clinically been interpreted as indicating abnormal right hemisphere language processing in ASD subjects. Here we use fMRI and a DL paradigm to test the hypothesis that the LE advantage observed in ASD subjects represents reversal of the language processing centers to the right hemisphere (RH) instead of the normal left hemisphere.

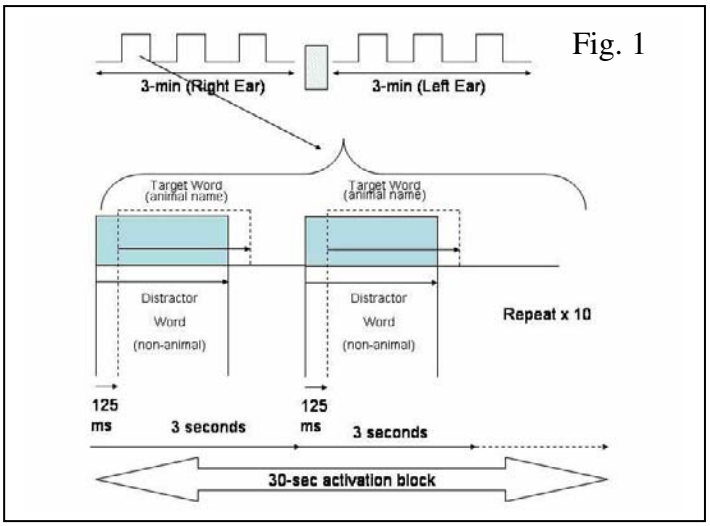
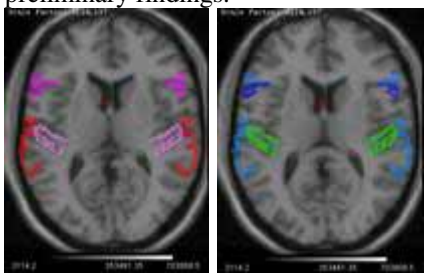


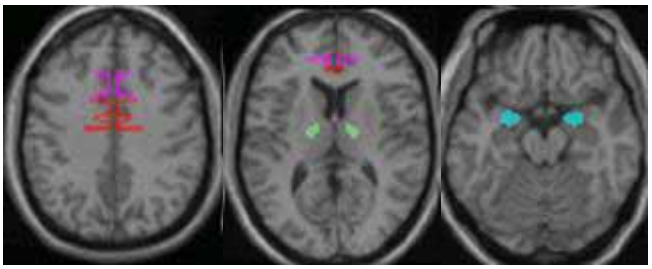

Fig. 1

**Methods:** Seven high-functioning autistic children (ages 6-11) and seven normal controls were scanned on a 4 T whole-body MRI scanner, using a single-shot gradient-echo EPI sequence (TE/TR 20/1500ms). Task performance and subject motion were monitored in real-time during fMRI, to assure accuracy. The subjects were scanned while performing a DL task in which they were required to identify target animal words that were presented in either the RE or LE with a distractor non-animal word presented almost simultaneously in the other ear (cf. Fig.1). An autoROI data analysis (Wang et al., 2001) was used to compare fMRI activation between the ASD and normal groups.

**Results:** Preliminary behavioral pilot data analysis from analysis of a subgroup of the recruited subjects (we are in the process of completing the entire group analysis) confirmed the expected reversed and deficient LE advantage in the ASD subjects. However, contrary to the anticipated abnormal RH lateralization of language processing (as evidenced by increased fMRI activity in the right Broca's, Wernicke's and primary auditory cortex regions), our autoROI fMRI analysis revealed a *leftward* lateralized activation of these regions within the ASD group. Moreover, a direct comparison of the fMRI activation pattern of the language-related brain regions between the ASD and normal groups indicated *hyperactivation* of the language areas in the ASD group (Fig. A1) relative to the controls (Fig. A2) in both hemispheres. We also observed that the normal controls' better DL cognitive performance was accompanied by greater activation in attentional and social communication related brain regions such as the amygdala, Brodman areas 32, 33, and 24 (Fig. B) which could explain our preliminary findings.



**A1** **A2**



**B**

**Discussion:** Our preliminary results indicating left hemisphere (LH) language activation in the ASD group is in disagreement with the current clinical interpretation which assumes reversed right hemisphere language processing in ASD. Additionally, the association between an *increased* activation of the language areas in the ASD subjects (relative to controls) and their functional deficiency in the DL cognitive task may suggest that language impairment in ASD is associated with an inefficient linguistic processing accompanied by insufficient attentional and social-communication processing of information (Castelli et al., 2002). The final group analysis will be presented and discussed with the behavioral data.

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