ASD and TD individuals show increased cortical responses to shift in sound source during a spatial hearing task

Sergio Osorio[1,2], Jasmine Tan[1,2], Grace Levine[1,2], Seppo P Ahlfors[1,2], Steven Graham[2], Fahimeh Mamashli[1,2,3], Sheraz Khan[1,3], Robert M Joseph[4], Ainsley Losh[2], Stephanie Pawlyszyn[2], Nicole McGuiggan[2], Matti S Hämäläinen[1,3], Hari Bharadwaj[5,6], Tal Kenet[1,2`]

[1] Athinoula A. Martinos Center for Biomedical Imaging, Massachusetts General Hospital, Charlestown, MA, USA
[2] Department of Neurology, Harvard Medical School, Massachusetts General Hospital, Boston, MA, USA
[3] Department of Radiology, Harvard Medical School, Massachusetts General Hospital, Boston, MA, USA
[4] Department of Anatomy and Neurobiology, Boston University School of Medicine, Boston, MA, USA
[5] Department of Communication Science and Disorders, University of Pittsburgh, Pittsburgh, PA, USA
[6] Department of Speech, Language, and Hearing Sciences, Purdue University, West Lafayette, IN, USA

Abnormalities in auditory processing have been documented across a wide range of stimuli in individuals with autism spectrum disorder (ASD). However, relatively few studies have investigated spatial hearing in ASD. Spatial hearing, i.e., the correct localization of sound sources and ability to track changes in location is a critical component of social interactions, and therefore merits further attention. Here, we investigated MEG responses in ASD (n = 21, mean = 13.55, SD = 2.69) and TD (n=28, mean = 13.07, SD = 3.43) to ~1000ms to auditory stimuli presented to either left or right ear (*stay* condition) vs stimuli shifting to the contralateral ear at ~550ms (*jump* condition), where the "stay" condition corresponds to no change in auditory source location, whereas the "jump" condition corresponds to a perceived change in source location. sLORETA source modeling was used to extract responses from subject-specific labels within cortical temporal regions corresponding to the peak activation to jump events. Preliminary results show evoked responses aligned with the onset of sound shift with an average peak at around 750ms in right (TD: mean latency = 754ms, SD = 0.033) and left (TD: mean latency = 750ms, SD = 0.029) hemispheres for the TD group. For both groups, activation was higher for jump relative to stay events in left hemisphere (TD_{jump}: mean = 4.05, SD = 2.06 vs. TD_{stay}: mean = 3.24, SD = 1.69; ASD_{jump}: mean = 3.51, SD = 1.14 vs. ASD_{stay}: mean = 3.00, SD = 1.75) versus right (TD_{jump}: mean = 4.13, SD = 2.25 vs TD_{stay}: mean = 2.43, SD =2.11; ASD_{jump}: mean = 4.08, SD = 2.03 vs. ASD_{stay}: mean = 2.95, SD = 2.18). A linear mixed effect model for group, hemisphere and condition as fixed effects and subject and group as random intercepts shows a significant contribution of condition (*stay*: b = -0.68, p = 0.028, SE = 0.31) in predicting lower amplitude cortical responses, but no significant effect for group, hemisphere, or the group-by-hemisphere and group-by-condition interactions. While no differences were observed across groups, most likely due to very high observed variability, qualitative differences in early-latency negative deflections and ASD-specific latencies for activation peaks that might reveal more subtle across-group differences.