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| 13. SUPPLEMENTARY NOTES                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                  |                                 |                                      |                                                     |                                            |
| 14. ABSTRACT<br>The modern household can be a chaotic place, full of noise from radios, televisions, family members. The ability to separate speech from background noise is a critical skill for understanding spoken language in such environments. Recent studies suggest that adults with Autism Spectrum Disorders have particular difficulty recognizing speech in acoustically-hostile environments (e.g., Alcantara et al. 2004), but an underlying cause for this deficit remains unknown. This proposal tests our hypotheses that children with ASD will find it more difficult to separate the speech of different talkers than do their typically-developing peers. We also predict that they will fail to exploit visual cues on a talker's face to help in this task, further limiting their ability to process input and learn language on a typical schedule. Since we are only one year into this pilot proposal, we have not yet tested sufficient children with ASD to confirm or deny our predictions; we can state that typical children (as expected) are better able to recognize speech in quiet than in noise in our task, and show better recognition when they can see the face of the person instructing them vs. when there is no visual speech information present. |                  |                                 |                                      |                                                     |                                            |
| 15. SUBJECT TERMS<br>Autism, Listening in Noise                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                  |                                 |                                      |                                                     |                                            |
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## **INTRODUCTION:**

Much of the language input that children receive occurs in the presence of background noise, including noise from other talkers (Barker & Newman, 2004; van de Weijer, 1998). Studies suggest that adults with Autism Spectrum Disorders (ASD) may have particular difficulty recognizing speech in these types of acoustically-hostile environments (e.g., Alcántara, Weisblatt, Moore, & Bolton, 2004), but an underlying cause for this deficit remains unknown. If children with ASD are likewise less adept at separating speech from distractors, they may be unable to learn language from many settings in which children are typically placed. In addition, one of the cues that typically-developing listeners use to help separate streams of speech is coordinated visual information from a talker's face, but children with autism have been reported to show abnormal visual processing for facial information (e.g. Klin et al., 1999; Wolf et al., 2008) and atypical visual scan patterns of faces (e.g., Klin, Jones, Schultz, Volkmar, & Cohen, 2002), and adults with autism have been shown to have difficulty using facial information to assist them in interpreting speech in difficult listening environments (Smith & Bennetto, 2007). The current proposal compares children with autism spectrum disorders (ASD) to typically-developing chronologically age-matched (CA) and mental-age matched (MA) peers on the ability to understand speech that occurs in the presence of background noise (a distractor voice). We also examine their ability to exploit visual cues to assist in listening in noise, by testing the groups' speech recognition both when a face is visible and when it is not. We hypothesize that children with ASD will find both these tasks more difficult than will typically-developing children. Knowing whether toddlers with ASD have difficulties processing speech in the presence of acoustic distraction has the potential to greatly inform our understanding of the causes of language delay/disorder in this population, and will have vital implications for child-care and interventional practices (e.g., noise levels in home- and center-based treatment settings, &/or employing methods of enhancing the signal).

## **BODY:**

The approved Statement of Work listed 6 tasks; only the first few of these were expected to be complete by this point in the grant process. Below we describe each task in our statement of work, and where we stand with regards to its completion.

### Task 1, human subjects approval, months 1-4

The beginning portion of the grant proposal was geared towards developing the necessary consent forms and recruitment documents for this proposal, and obtaining regulatory approval. This task was completed during this first year of the proposal.

### Task 2, stimulus development, months 2-4

Our next task was to create the video and audio stimuli necessary for this experiment. This has likewise been completed. Pilot testing suggested that some of our stimuli needed alterations to maintain the attention of younger participants and those with ASD, and these stimulus changes have also been completed; the experiment is now fully operational and testing has begun.

### Task 3, ADOS training & reliability, months 1-5

As part of this study, we need to ensure that the children in our experimental group do indeed have a diagnosis on the autism spectrum. Although our department includes several clinical faculty with significant experience working with this population, none had previously had research training in conducting ADOS assessments. Thus our third task involved sending one grant staff member to receive training in these assessments, and conduct reliability measures. Unfortunately, the training component of this was far more time-intensive than our original estimations; training had to be completed separately for conducting clinical ADOS assessments and conducting research assessments, and the two training sessions were quite separate in time. Moreover, passing reliability requires having an additional individual who is research certified in the region check ones assessments. This has substantially slowed progress on this particular task beyond original estimates. However, Ms. Sisskin has completed all training, and expects to be certified for research reliability by the end of the calendar year.

### Task 4, recruitment, months 5-20

### Task 5, testing participants, months 6-24

### Task 6, coding and analysis (coding of primary experiment will be complete by month 24; coding of secondary parent-child interactions is expected to continue beyond the end of the granting period).

These three tasks are ones that we had expected to have begun by this point in the grant process, but not to have completed, and that is exactly the stage at which we are at. We have actively begun recruiting children with Autism, and are attending the Autism Speaks walks in Washington, D.C. this fall. We have created posters and brochures for recruitment, and have been distributing these posters at various locations in the community.

We have trained laboratory personnel to conduct the various aspects of this study, including testing participants in the primary study, testing children on the Mullen Scales of Early Learning, setting up and recording a parent-child interaction, coding looking behavior, and coding clinical assessments.

To date we have tested 3 children with autism, and 18 control participants. Coding has focused on the control participants, as a means of ensuring that our stimuli are appropriate and providing the expected results when presented with a typical population. Looking time measures have been completely coded for 10 of these participants, and results are entirely as expected: these typically-developing children show better word recognition when the stimuli are presented in quiet

than in noise, and show better performance when they can observe the person speaking to them than when they can hear her voice but not see her face. This pattern of results suggests that our stimuli and experiment work as expected, and sets the stage for testing children with autism, which we have now begun

We have another 5 children with autism who are potentially interested, and whom we are currently working to schedule sessions with, as well as 3 children currently scheduled.

In addition to the action items listed in the statement of work, we have also worked on ensuring that our data would be in a format acceptable for submission to NDAR at the study's conclusion.

### **KEY RESEARCH ACCOMPLISHMENTS:**

As noted above, this research project was not expected to be completed in this first year; our key accomplishments have been:

- Finalization of, and approval of, plan for testing
- Creation and pilot testing of all stimuli/research design
- Training of relevant staff on the project
- Testing of initial 20 participants, ensuring adequate procedures for testing and coding
- The most significant research accomplishment is that we confirmed our a priori hypotheses in sample of 18 TD children. This is partially a replication of previous work but also adds a novel component with the addition of the speaker's face as a visual cue. This success allows us to use this paradigm to investigate speech processing in children with autism over the next year.

### **REPORTABLE OUTCOMES:**

As we are only 12 months into this pilot project, we do not yet have any reportable outcomes.

### **CONCLUSION:**

As we are only halfway through the timeline for this study, we do not yet have any research-based conclusions that we can provide. However, we feel we are on track for having a successful study at the end of the grant timeline. As we have now piloted sufficient typically-developing children to ensure that our stimuli and task are working as expected, we are actively engaged in recruiting children with autism, and have a number that are currently scheduled.

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