

Developmental Neuropsychology Lab

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Advancing Autism Research

Thank you for your interest in the Developmental Neuropsychology Lab!

Our research focuses on improving the understanding, diagnosis, and treatment of autism and other developmental disabilities. In our lab, we study how children understand and relate to the world around them. We are interested in how children learn to think, communicate, move, and even use senses such as vision, hearing, taste, and

smell. Research plays an important role in daily life. As research is conducted,



advances are made that impact the way children and adults are diagnosed and receive treatment for various disorders.

An improvement in the quality of diagnoses and treatments means an improvement in the quality of everyday life for people all around the world. Advances in research are linked directly to people who share their ideas and volunteer their time to participate in local research studies. Without these wonderful volunteers, research would not be possible!

Examples of some of our recent research findings:

Read My Lips: Audiovisual Speech in Autism

When we listen to another person talk, we combine information from the person's voice and lips. This is especially important in noisy environments, like social settings and classrooms. Individuals with autism often have a hard time taking several different kinds of information and combining them to enhance understanding. In this study, we investigated whether children

and adolescents with autism were able to combine information from a speaker's voice (auditory) and lips (visual) when trying to understand speech in noisy environments. We found that they had significant difficulty integrating the auditory and visual streams of information. When speech was harder to hear, the participants with autism were less able than their



peers to benefit from seeing the speaker's lips to understand what she was saying. The implication of this finding is that when individuals with autism are listening to someone talk in noisy environments, they may understand less than their peers without autism.

This study has been published in the *Journal of Child Psychology and Psychiatry*.



Setting The Tone (of Voice): Prosody Comprehension in Autism

When we talk to each other, we automatically pay attention to (and use) a great deal of information without even realizing it. One example is the rhythm and tone of speech (otherwise known as prosody). By adjusting the volume, rate, or tone of our voice we can communicate emotions, questions, or even just the basic meaning

of a sentence. Difference in prosody during speaking (expressive prosody) tends to be an identifying feature of autism. But we were also interested in whether children with autism could *understand* the prosody in others' speech. In one part of this study, we investigated how children used a speaker's prosody to figure

out what the speaker was saying. We found that children with autism had difficulty using prosody to determine the meaning of a sentence when the words were ambiguous, but the prosody gave the correct answer. By contrast, if the words said exactly what to do, the children with autism did just as well as children without autism.

This study has been published in the journal *Brain and Language*.

Talking Hands: Speech and Gesture Comprehension in Autism

When we communicate with each other, we use more than just words. Visual cues from our eyes, faces, bodies, and hands convey a great deal of information that helps a listener understand what we say. Individuals with autism are often described as having difficulty reading "body language," yet little was known about how this might contribute to their understanding of language. In this study, we investigated how children and adolescents with high-functioning autism used a speaker's hand and arm gestures to improve their understanding of what the person was saying. The

participants watched videos of a woman describing something with speech and gestures, and then selected the picture of what she was describing. We used a technique called eye-tracking, which allows us to evaluate (in milliseconds) what the participants thought the correct answer was, even before they clicked on it with their mouse. We found that peers without autism used the speaker's gestures to help them process the meaning of her speech more quickly compared to a condition in which they saw her speak without gesturing. Children

and adolescents with autism showed a very different pattern of information processing. Seeing the speaker's gestures did not speed up their processing of language. In fact, it took them *longer* to understand the meaning of her speech when she was gesturing compared to when she was only speaking. This suggests that individuals with autism have trouble integrating what they see with what they hear, and that this may negatively impact their comprehension of people's speech. These findings have important implications for how we talk to and teach individuals with autism both at home and at school.

"When we communicate with each other, we use more than just words."

The Nose Knows (so does the tongue): Sensory processing and food choices in autism

Many individuals with autism have unusual responses to sensory input. This can include being more or less sensitive to stimulations like sound, touch, movement, or light, to name just a few. Although it is not one of the official diagnostic symptoms of autism, difficulty related to sensory processing can have a huge impact on everyday life. We have recently been investigating the senses of taste and smell in

autism. Although there has previously been very little research on this topic, we were struck by how often parents brought up concerns about taste and smell, particularly as they related to their children's eating habits. In this study, we found that children and adolescents with autism had significant difficulty identifying basic tastes and smells compared to their peers without autism.

In other words, the way they perceive these sensations may be quite different from how others perceive them. These findings have important implications for understanding children's eating habits (such as picky eating). Furthermore, understanding patterns of taste and smell processing gives us clues about underlying brain functioning in autism.



This study has been published in the journal *Biological Psychiatry*.

Seeing the Trees or the Forest: Visual Processing and Social Functioning in Autism and Down Syndrome



Some people tend to focus on details in the world around them, while others are more likely to pay attention to the big picture. In this study, we investigated how a detailed or a global, big picture processing style related to children's social interactions. This was of particular interest to us since children with autism are generally more detail-focused in their processing of information. In this study, we worked with

children with autism, children with Down syndrome, and children with no diagnoses. We found that while the children with autism were generally more focused on the details in their world, the children with Down syndrome were more focused on the big picture. We also found contrasting patterns of social functioning; the children with autism showed greater difficulty with social functioning than the children with Down syndrome and children with no diagnoses.

Overall, this study suggests that strengths in detail-focused processing in children with autism appear to be paired with greater difficulty in social functioning. In contrast, stronger big picture processing in children with Down syndrome was present with less social difficulty. We hope that by understanding different patterns of strengths and weaknesses we can help to improve areas of greater difficulty for children with autism and other developmental disabilities.

Our current research projects↓

The Family Dinner: Sensory Processing and Food Preferences in Children with Autism & their Families

In our previous work, we found that individuals with autism process tastes and smells differently from their peers.

Furthermore, these differences may be related to their likes and dislikes of certain foods. In this study, we are building on these findings to



better understand sensory functions in children with autism spectrum disorders and their families. We hope this study will

help to advance autism research and clinical practice in several ways. First, it is extremely important to document and describe sensory sensitivities in autism. Although they are not part of the autism diagnosis, they are a very real problem for many children and can greatly affect learning, behavior, and overall well-being. Second, many

parents report that their children with autism are picky eaters. The consequences of picky eating can range from minor challenges in meal planning to very significant health risks. We hope that a better understanding of how sensory processing relates to food choices will improve intervention efforts in this area. Finally, many taste and smell processing abilities run in families. In this study, we will also work with parents and siblings of children with autism. By understanding how specific sensory abilities and food preferences are shared within families, this project will also help us identify genes that may be important in this aspect of autism.

This study is being funded by the National Institutes of Health (NIH).

Listening to What you See: Brain Activity During Speech Comprehension in Autism

Recent research suggests that people with autism have difficulty integrating information from multiple sensory inputs. Our previous studies showed that children with autism have difficulty using visual information, such as lip movements and gestures, to help with language comprehension. The current study builds on these findings by examining brain activity associated with auditory and visual processing in autism. We are exploring how the brain processes what we see and hear and how we

integrate speech and gestures to understand others. This will help us better understand how nonverbal information influences language comprehension in children with autism. We will also study a part of the brain called the mirror neuron system, which is considered to be important in understanding the meaning of others' actions. In this study, we will be looking at changes in brain activity during language comprehension tasks using a noninvasive tool called magnetic resonance imaging (MRI). This shows us which brain areas are



important during speech and gesture comprehension, and will help us figure out whether some regions work in different ways in children with autism.

This study is being funded by Autism Speaks.

Getting the timing right: Temporal Synchrony and Speech Perception in Autism

Have you ever noticed how difficult it is to watch television when the auditory and visual information are out of sync? Our brains use temporal cues to link information coming from different sources. Individuals with autism often have difficulty combining information from different sources, and part of this difficulty may come from problems using temporal

information. Among other things, difficulties in this area can have a significant impact on communication (e.g., quickly picking up on which person in a group is talking to you). This study investigates whether children and adolescents with autism are able to use temporal information in the lips and voice to locate and identify different sounds. In addition, we will measure

EEGs (a noninvasive way of looking at neural activity) to look at how temporal processing of speech is represented in the brain in individuals with autism and their peers without autism.



This study is being funded by the National Institutes of Health (NIH).

Our research team:

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.....and many undergraduate research assistants!

Previous members of our research team:

Dr. Laura Silverman (Div. of Neurodevelopmental & Behavioral Pediatrics, University of Rochester Medical Center)

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