ROCHESTER RESEARCH ROUNDUP

CHILDREN WITH ADHD PROCESS SPEECH DIFFERENTLY IN NOISY ENVIRONMENTS

WHAT did you study?

- Neuroscientists are trying to learn more about **how children with ADHD understand speech in noisy places**, like cafeterias or classrooms, where lots of people may be talking at once.
- To study this they looked at something called **audiovisual integration**: how the brain uses **lip movements** to help understand what someone is saying.
- Researchers were curious **whether children with ADHD pay attention to people's lip movements**, and whether watching those lip movements helps them understand speech better.

HOW did you study it?

- **Children ages 7–12**, with and without ADHD, wore a Virtual Reality (VR) headset. In VR, they saw three characters.
- The characters said short words like "bag" or "hug." Sometimes **only the person in the middle** spoke, and sometimes **all three people spoke** at once**.** The children were asked to press a button **ONLY when the middle character** said the target word. **The twist was** that researchers manipulated whether the kids could **both hear and see the characters, only hear them, or only watch their lip movements.**
- Each character also had a **unique flickering pattern.** We tracked the **brain responses** to these patterns using an **EEG** (a test that detects activity in your brain by attaching small, metal discs to the top of the head). This helped us to see **where the kids focused their attention during the task.**

WHAT did you find?

- Children with ADHD didn't show the same improvement in accuracy from watching the speaker's face as typically developing children did. They had a harder time using **visual cues**, like **lip movements**, to help them understand what the **target person** was saying.
- The brains of children with ADHD also **didn't focus their attention on the speaker** as well as the brains of typically developing children.
- Children with ADHD showed **a weaker brain response to the target character**, suggesting **they were less focused on the main speaker**. They spread their attention more evenly across all three characters.

Conducted by the Spectrum Brain Lab

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SPECTRUM BRAIN LAB

WHY does it matter?

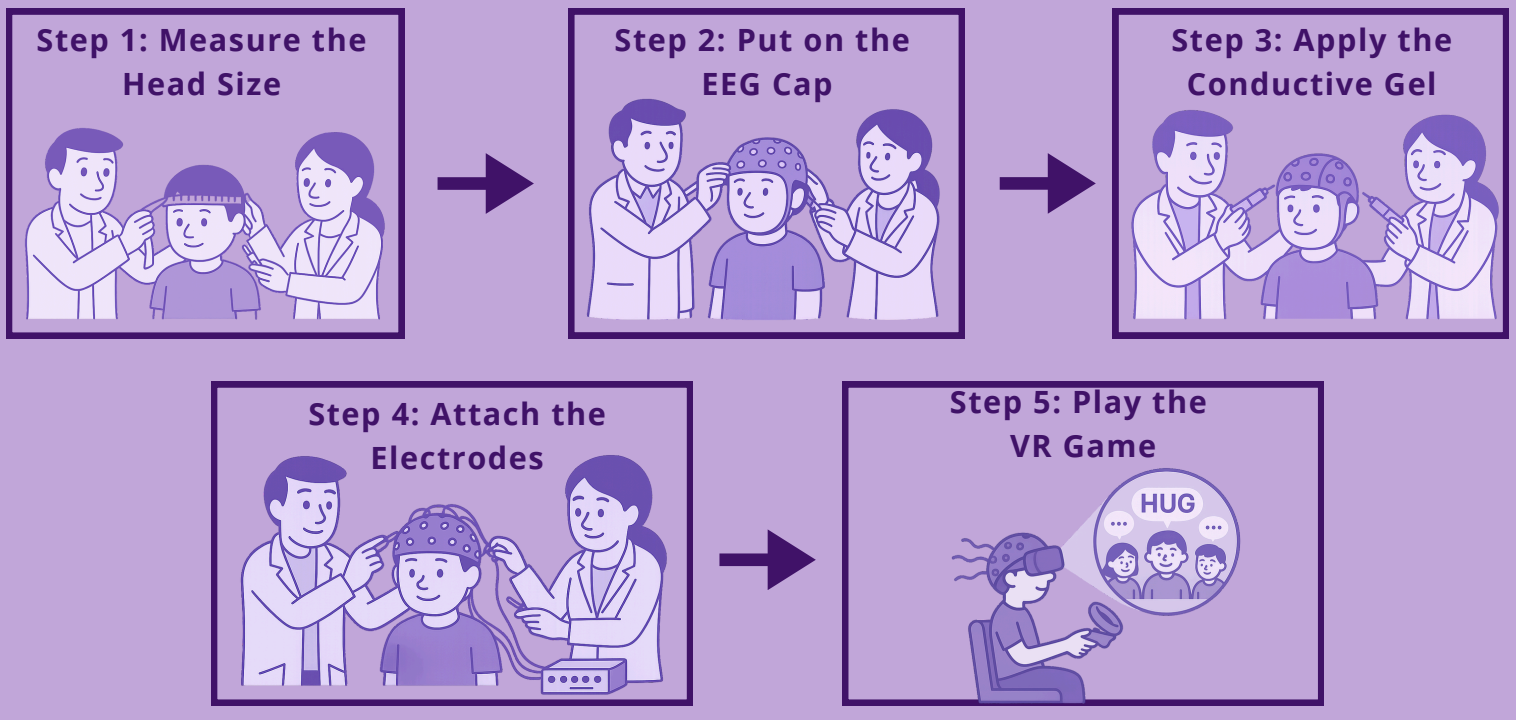
- Many children with ADHD **struggle to understand speech in noisy environments.**
- Even when **visual cues** are available, they may not benefit from them the way we expect. **This may affect learning and classroom participation.**
- Understanding how children with ADHD **focus their attention** and **use visual information** can help us **design better ways to support them** at school and in social situations.

What's NEXT?

- Researchers need to continue this work using **VR headsets with built-in eye tracking** to learn more about where kids are looking while trying to follow speech.
- They are also interested in whether these patterns show up in other developmental disabilities, like in children with **Autism Spectrum Disorder (ASD).**
- They are currently **building an engaging VR game** that helps train kids to focus their attention, to see if this can **improve real-life listening.**
- Lastly, by **using sounds and visuals that aren't speech**, researchers can figure out whether children with ADHD have **trouble paying attention to sensory information** in general, or only when someone is talking.

Summary created by: Noam Zigdon, Undergraduate Research Assistant

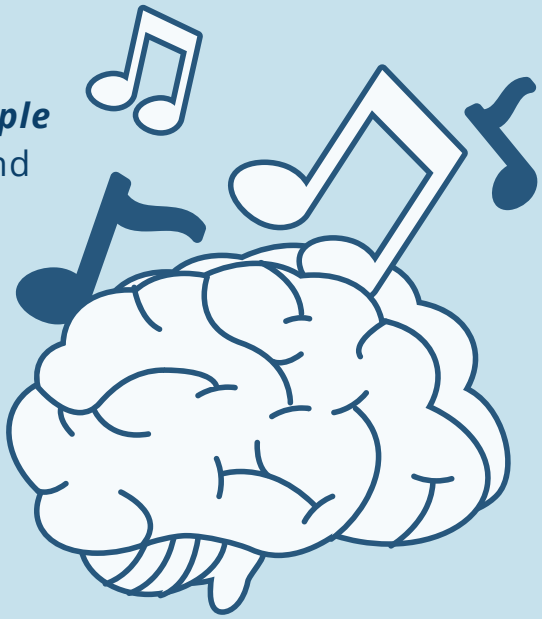
What's it like being in an EEG Study?



ROCHESTER RESEARCH ROUNDUP

AUDITORY PROCESSING OF SOUND PATTERNS IN INDIVIDUALS WITH AUTISM SPECTRUM DISORDER

WHAT did you study?



- ***Neuroscientists are trying to understand how people with autism process sounds in the environment*** and how this might relate to their social and repetitive behaviors.
- Many scientists have suggested that ***people with autism might have different responses to unexpected sounds*** than people without autism. They wonder if this is why people with autism may have more difficulty with communication and prefer predictable environments.

HOW did you study it?

- ***Researchers used an EEG*** (a test that detects activity in your brain by attaching small, metal discs to the top of the head) to ***measure brain waves*** while individuals with and without autism (age 6 to 21 years old) listened to patterns of beeps. Sometimes, they would *"surprise"* the brain by playing a beep at the wrong time in the pattern.
- Participants also completed measures about ***language, communication, repetitive behavior, attention, and anxiety.***

WHAT did you find?

- In general, both people with and without autism had the ***same brain responses to these beeps***, even the surprising ones.
- People with stronger brain responses to the surprising beeps tended to have ***better language understanding,*** but there was no relationship between a person's brain response to the beeps and their social communication, repetitive behaviors, attention, or anxiety.

Conducted by the Cognitive Neurophysiology Lab

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WHY does it matter?

- This research study suggests that ***people with and without autism may show some similarities in the way they process sounds***. Brain responses to simple sounds may be able to give us some information about the ***building blocks for how people understand language.***

- By understanding how people with autism experience the world, researchers can work toward important goals like making a diagnosis earlier or designing new therapies.

What's NEXT?

- Researchers need to continue this work with more people who have a ***wider range of intelligence and language abilities***.

- We also want to study ***other types of sound and language processing*** to look for where there are differences, what these differences mean, and how they change with age and intervention.

THE FULL ARTICLE CAN BE FOUND THROUGH THE FOLLOWING CITATION:

Knight, E.J., Oakes, L., Hyman, S.L., Freedman, E.G. and Foxe, J.J. (2020), Individuals With Autism Have No Detectable Deficit in Neural Markers of Prediction Error When Presented With Auditory Rhythms of Varied Temporal Complexity. Autism Research. https://doi.org/10.1002/aur.2362

This work was funded by the Ernest J. Del Monte Institute for Neuroscience Pilot Program for 2019 via the Harry T. Mangurian Foundation

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https://www.urmc.rochester.edu/del-monte-neuroscience/intellectual-developmental-disabilities-research.aspx

https://www.urmc.rochester.edu/labs/cognitive-neurophysiology.aspx

ROCHESTER RESEARCH ROUNDUP

BIOLOGICAL MOTION PROCESSING IN INDIVIDUALS WITH AUTISM SPECTRUM DISORDER

WHAT did you study?

- Neuroscientists are trying to learn more about how the brain processes body movements, because body language is an important part of how we communicate with other people. This may be important for people on the autism spectrum who sometimes interpret social information differently than people without autism.
- This study asked ***whether children on the autism spectrum have differences in how their brains process people moving.*** We also asked whether paying special attention to body movement makes the brain better at processing it.

HOW did you study it?

- Children with and without autism (6 - 16 years old) participated in the study. The children saw videos of moving dots that looked like a person doing actions such as running, kicking, or jumping.

- The videos were shown to the children right-side up, upside down, or with the dots jumbled so they didn't look like a moving person anymore.
- Researchers used EEG to measure brain waves by collecting electrical signals though the scalp.
- **The study had two parts:**
  - **Part 1:** We asked the children to watch the videos but focus only on the color of the dots. The EEG told us if their brains recognized body movement even though the children were focused on the colors.
  - **Part 2:** We told the children some of the videos showed people and asked them to press a button to say whether they thought each video "moved like a person" or "did not move like a person."

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THE FREDERICK J. AND MARION A. SCHINDLER COGNITIVE NEUROPHYSIOLOGY LABORATORY

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WHAT did you find?

- Children with and without autism were all able to recognize when the video moved like a person, but the EEG told us that ***children on the autism spectrum were processing the videos differently.***
  - The brains of typically developing children automatically noticed when the videos moved like people even when they were focused on the dot color.
  - The brains of autistic children seemed to only notice when the videos moved like people if they were paying special attention to that question, but not when they were focused on the dot color.
- ***Children who had stronger brain responses to the videos of moving people had better social skills.***

WHY does it matter?

- This study suggests when children with autism are distracted by something else, their brains process the movements of others differently than their peers.
- Body language helps people communicate. If the brains of children with autism process body movements less, they might have a harder time understanding other people. They may have to pay special attention in order to see what other people notice automatically.

What's NEXT?

- Researchers need to continue this work with more people across the spectrum and with children who have both autism and ADHD.
- By understanding how people with autism experience the world, researchers can work toward important goals like diagnosing autism earlier and finding new ways to support autistic people.

THE FULL ARTICLE CAN BE FOUND THROUGH THE FOLLOWING CITATION:

Knight, E.J., Krakowski A., Molholm, S., Freedman, E.G., Butler, J.S., Foxe, J.J. (under review). Attentional Influences on Neural Processing of Biological Motion in Typically Developing Children and Those on the Autism Spectrum Preprint: doi: https://doi.org/10.21203/rs.3.rs-992031/v1

This work was funded by NIMH RO1 MH065350 and MH085322 (PI Foxe, Molholm), NICHD U54 HD090260 (Phenotyping) and City University of New York Graduate Science Fellowship

Summary created by: Jiashu (Coco) Wang, University of Rochester Undergraduate Program

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ROCHESTER RESEARCH ROUNDUP

SEVERELY ATTENUATED VISUAL PROCESSING IN CHILDREN ON THE AUTISM SPECTRUM

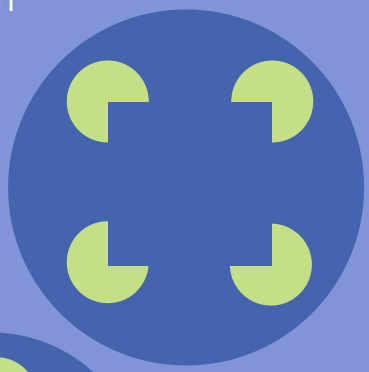
WHAT did you study?

- Neuroscientists are trying to learn more about how the brain understands what we see, especially illusions, which try to trick our brains. This may help scientists understand how brains with autism understand the world they see around them differently than brains without autism.
- This study asked whether the ***brains of children on the autism spectrum see a visual illusion differently***. This will help tell us whether they make sense of what they see in the same way as people without autism.

HOW did you study it?

- Children with and without autism (7 - 17 years old) participated in the study. The children looked at a red dot in the middle of the screen and were asked to press a button when the dot turned green.
- Around the dot, on the screen, other pictures would appear and sometimes form the illusion of a shape, called an ***"illusory contour"***.

"Illusory contours" are Pac-man-shaped pictures, that when put together create the illusion of a shape in the empty space between them.



- The empty space between the Pac-man shaped pictures show a triangle and a square in the middle
- The children were told to pay attention to the dot and ignore the other pictures. This lets scientists study the ***brain's automatic response*** to seeing the illusions.
- Researchers used EEG to measure brain waves by collecting electrical signals through the scalp. This helped them see how the brain "fills in" missing pieces to see a shape even when it isn't really there.

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WHAT did you find?

- The EEG told us that the ***brains of children with autism didn't seem to be automatically noticing and processing the illusory shapes as well as children without autism***. This may mean that autistic brains process things we see differently.
- A person notices the shapes in the illusions because brain is trying to "fill in" missing pieces. This means that when a brain doesn't see the shape inside, ***it might not be able to do the same predicting and filling-in that other brains do***.

WHY does it matter?

- This study suggests the brains of children with autism may tend to ***focus more on individual details of what they see instead of automatically filling in missing pieces to see the whole picture***. If autistic brains don't predict and fill in what they see in the world, they may be seeing the world a bit differently.

What's NEXT?

- Researchers need to continue this work with people with a wider range of abilities.
- By understanding how people with autism experience the world, researchers can work toward important goals like diagnosing autism earlier and finding new ways to support autistic people.

Summary created by: Jiashu (Coco) Wang, University of Rochester Undergraduate Program

THE FULL ARTICLE CAN BE FOUND THROUGH THE FOLLOWING CITATION:

1. Foxe, J.J., Knight, E.J., Freedman, E.G., Myers, E.J., Berruti, S.B., Oakes, L.A., Cao, C.Z., Molholm, S, Foxe, J.J. (under review). The strength of feedback processing is associated with resistance to visual backward masking during illusory contour processing in adult humans.

This work was funded by the Ernest J. Del Monte Institute for Neuroscience Pilot Program with funding from the Kilian J. and Caroline F. Schmitt Foundation, P50 HD103536 (phenotyping) ,P50 HD105352 (recruitment and phenotyping), NIH T32 EY007125 and Kyle Family Fellowship (trainee support)

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