

NEURODIVERSITY CAN EXPLAIN DIFFERENCES IN HOW PEOPLE EXPERIENCE EVERYDAY LIFE

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Neurodiversity means that all people's brains process information differently from each other. In other words, people think and learn in a variety of ways. Being neurodivergent means that the way a person's brain processes information might be quite distinctive, or even rare—and in some cases this difference might have a name, like ADHD, autism, or dyslexia. About one person in every five is neurodivergent: maybe you are neurodivergent yourself! In this article, we discuss the ways that neurodiversity can affect how people experience day-to-day life. We explain some of the research that has explored how neurodivergent people process information. We also share some on-going research that focuses on making places like schools and hospitals more comfortable for neurodivergent people. When we all understand what neurodiversity is, it is easier

for everyone to be themselves, no matter how they think, feel and learn.

NEURODIVERSITY

Neurodiversity means that everyone's brains process information differently! In other words, people think and learn in a variety of ways.

NEUROTYPICAL

Neurotypical people's brains process information in a similar way. Because most people are neurotypical, the way they process information is often considered "normal".

NEURODIVERGENT

Neurodivergent people process information differently to neurotypical people. There are lots of ways to be neurodivergent! About one in five people are neurodivergent.

DYSLEXIA

A learning difficulty that makes reading, spelling, and understanding written words challenging. People with dyslexia may mix up letters or struggle with reading speed, but it does not affect intelligence.

ATTENTION DEFICIT HYPERACTIVITY DISORDER (ADHD)

A brain condition that makes it hard to focus, stay still, or control impulses. People with ADHD may find it difficult to finish tasks or stay organized.

WHAT IS NEURODIVERSITY?

Would you rather have to do homework next to a pile of stinky socks, or while wearing a scratchy jumper? Would you rather live at the North Pole or in a desert? Would you rather be able to speak any language in the world, or speak to any animal? Imagine we asked these questions to everyone who lives on your street. We would get lots of different answers, and many different reasons for people's choices! This is because everyone is different in the way their brains work. Information from the world around you, and from inside your own body, goes to your brain. Then your brain processes that information and decides what to do. Everyone's brain is unique in how it does this processing.

Neurodiversity is the word used to describe this uniqueness. The word "neurodiversity" can be broken down into two parts: "neuro", which means it is about brains, and "diversity", which means differences within a group of people, such as all the students in a classroom.

Most people are **neurotypical**. Because neurotypical people seem to make up the largest group of people in the world, the way they process information is often thought of as "normal". About one in five people are **neurodivergent**. Their brains process information differently from neurotypical people. There are loads of different types of neurodivergence: the brain processes so many types of information, so there are lots of ways that people can process it differently! **Figure 1** illustrates a neurodiverse group of neurotypical and neurodivergent people.

Some neurodivergent people might be part of a group of people who process information in roughly the same way as each other—we often give these groups names. For example, people with **dyslexia** might find their brains handle reading and writing very differently from most other people. There are other neurodivergent groups that have been given names, like **attention deficit hyperactivity disorder (ADHD)**, **autism**, **dyscalculia**, and **dyspraxia**. People within each group are similar to each other in how they process information, but not exactly the same. Some people might be a member of multiple groups: for example, a person can be autistic and dyslexic. Not every neurodivergent person is part of one of these groups—some neurodivergent people might not have a name to describe how their brains process information or may not want to use one, and that is what makes "neurodivergent" such a useful word.

Knowing about neurodiversity can help us understand why everyone processes and experiences things differently—and there is no "right"

Figure 1

There are many ways to be neurodivergent. About one in five people are neurodivergent. If there are 25 students in your classroom, about 5 of them might be neurodivergent. In a group of 100 people, about 20 would likely be neurodivergent.

AUTISM

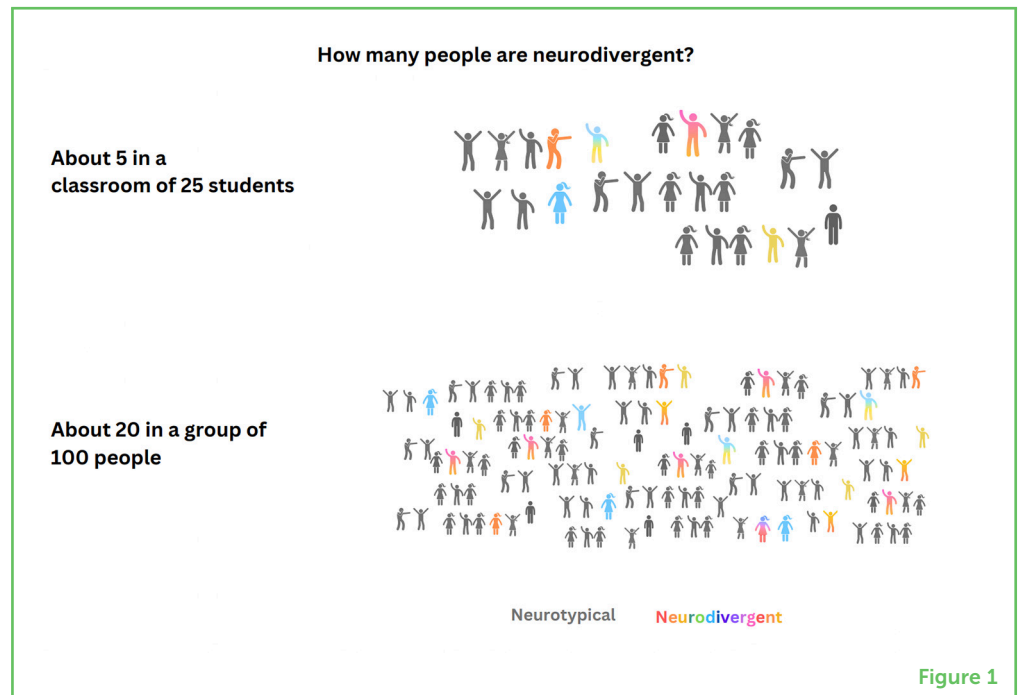
A developmental condition in which people experience the world differently, often affecting communication, social interactions, and processing of sensory information. Everyone with autism is unique in their abilities and needs.

DYSCALCULIA

A learning difficulty that makes it hard to understand numbers, perform math tasks, or grasp concepts like time or measurement. It can affect both simple and complex math skills.

DYSPRAXIA/ DEVELOPMENTAL COORDINATION DISORDER

A condition that affects coordination and movement, making tasks like writing, using a knife and fork, or playing sports harder. It can also impact speech and planning daily activities.



way! Here are two examples of people having very different experiences in daily life because of how they process information.

Alex and Rosie have a test in their maths class today. They both want to concentrate and do their best. Alex is quiet and still, so all his attention is on the questions. Rosie listens to music and uses a fidget toy to help her focus. They both ace their tests, using completely different strategies.

Jamal and Rachel each went shopping to get the ingredients to bake a cake, but forgot their shopping lists. Jamal tried to remember which ingredients were needed but found it hard to hold the recipe in his mind. He decided to take his time walking down every aisle, looking at all the groceries. He could not remember the list, but he could recognize what he needed when he saw it. Rachel also felt stuck without her list. For her, the sounds, lights, and smells of the supermarket made her feel very anxious. She decided to go outside and sit quietly, remembering the shopping list in her head. When she was ready, she went back in and did her shopping as fast as possible. They both bought the ingredients for a delicious cake, but they solved the “no shopping list” problem using very different strategies. Jamal’s memory was not so helpful, but he was able to relax, take his time, and recognize what he needed. The sensory environment caused Rachel some initial difficulty, but she used her memory and got her shopping done quickly, before the sounds and lights got overwhelming.

These stories show how neurodiversity means people approach the world in different ways. Everyone faces different challenges and

comes up with different solutions depending on how their brains process information.

Though being neurodivergent is common, it can make daily life hard because many rules and spaces are designed for neurotypical people. For example, you might find it easier to do well in school if, like Alex, you want to be still and quiet during a test. Your teacher might not expect you to listen to music and move your body, like Rosie—you could even find yourself getting in trouble. Sometimes the world around neurodivergent people has to change a bit (or even a lot!) to make sure that they also get what they need to flourish.

WHAT HAS RESEARCH TOLD US ABOUT NEURODIVERSITY?

Researchers have learned about neurodiversity by studying the different ways that people process information. For example, some researchers have been investigating how people with ADHD focus. Have you ever found something so interesting that you forget about everything else going on around you? Maybe you have been reading a book or painting a picture and become so focused on it that you did not realize that it was dinner time! This is called hyperfocus. One research team asked over 600 people about when they hyperfocused and found that people with ADHD often hyperfocus during their hobbies, when doing homework, and during classes at school [1]. People with ADHD might find it hard to sit still and concentrate—but this survey showed that focusing is a part of ADHD, too! When you are focused, you can get a lot done, so it can be a very useful skill.

A different study showed that autistic people process sounds differently from non-autistic people. Participants listened to a busy sound recording of four people preparing to throw a party (talking, making drinks, and wrapping presents). However, only some participants noticed a fifth character saying “I’m a gorilla” repeatedly for 19 seconds—and those participants were mostly autistic (Figure 2). The authors explained that this result suggests autistic people are particularly good at detecting sounds in their environments, especially unexpected sounds [2]. This can be helpful for autistic people, but not all the time. For example, it could also be hard to tune out distracting or upsetting noises.

Researchers have also explored how well neurodivergent and neurotypical people work together on group tasks. This study put students into groups of three and asked them to solve a problem together. Some of the groups had three neurotypical students, and some of the groups had two neurotypical students and one neurodivergent student [3]. 88% of the groups that included a neurodivergent student solved the problem, compared with 17% of the groups in which everyone was neurotypical. This shows that a

Figure 2

When listening to a scene of people getting ready for a party, autistic people were better at detecting an unexpected phrase about a gorilla than non-autistic people were (data from [2]).

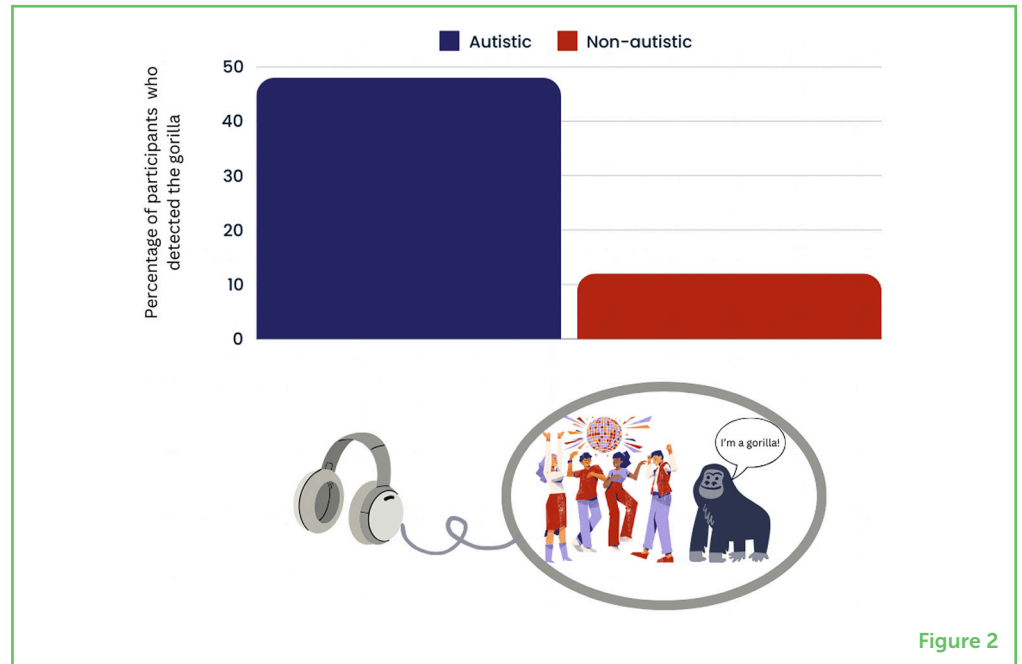


Figure 2

group that includes people who think differently to one another can be really helpful.

WHAT ARE RESEARCHERS DOING NOW?

Research helps us to describe and measure processing differences, such as counting how many people can hear “I’m a gorilla.” Researchers can also measure whether changes that we make in the real world help to meet neurodivergent people’s needs. We need to make changes because everyone has the right to thrive in their environment, but so far not everyone can.

Lots of places like schools, shops, and hospitals are designed to best suit neurotypical people. If you are neurodivergent, it can be difficult to fit into these places and do everything you want to do. For example, schools involve a lot of sitting down, quietly listening, and reading, which not everyone finds easy. Other neurodivergent people may not be able to go to some places at all, because of noise, lights, or crowds. When 1 person in 5 is neurodivergent, that means important everyday locations and activities may be inaccessible to a lot of people.

Researchers are now focusing on how we can improve these places for neurodivergent people. For example, a place for neurodivergent students to hang out together at school can be relaxing and welcoming, as well as being an opportunity to swap ideas for how to make the school better [4]. Helping everybody in the class learn about what neurodiversity is might also make schools a better place for neurodivergent students [5].

Remember we said that not every neurodivergent person is in a group with a name (like dyspraxia or ADHD)? One important challenge for research is to try to include more neurodivergent people in studies. We need to keep making new discoveries about all neurodivergent people so we can understand information processing better, and understand what changes might be helpful. One of the biggest changes we need to make is changing what people know and believe about neurodiversity and neurodivergent people. Everyone deserves to be respected and valued, but neurodivergent people often face discrimination and are told that their differences are wrong. Whether we are old or young, we can all learn and change our beliefs. How will you talk about people's differences in the future, or act when you meet someone who thinks differently to you? We can also encourage others to change. What do you want other people to know about neurodiversity?

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We are middle school students from New Haven, CT and the surrounding area. With help from our Yale OpenLab mentors and Pathways to Science, we had the opportunity to review *Frontiers for Young Minds* articles! We took on the challenge of learning about neuroscience and psychology topics, and working together made it a lot of fun. Our curiosity drove us to get hands-on with the peer-review process, and we really enjoyed the experience!



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