Sur le spectre
Number 16
Fall 2023
The Montreal Cognitive Neuroscience Autism Research Group

02

Predictors of Intelligence in Autism:

The role of perceptual skills and behaviors and interests during the preschool period

Sur le spectre

Number 16 – **FALL 2023**

SUMMARY

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Official magazine of the The Montreal Cognitive Neuroscience Autism Research Group

The Montreal Cognitive Neuroscience Autism Research Group focuses on brain function, auditory and visual perception, exceptional skills and interventions in autism.

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Editorial Committee

Sur le spectre :

More news from Sur le Spectre:

For this 16th issue of Sur le Spectre magazine, a new series of articles has been launched: *Opinion*. We'll be featuring opinion pieces from people with autism, as well as researchers and clinicians in the field. For the first edition of this *Opinion* series, Antoine Ouellette, a loyal reader of the magazine, autistic person, musician, and author, offers you his point of view on the repercussions of the heterogeneity of diagnosis and terminology used in autism.

In this issue, you'll also find the results of a recent study by our research group that investigated the role of perceptual skills and behaviors, and interests as predictors of school-age intelligence in autism. Next, you'll discover a comic strip written by Catherina Lacelle and designed by Stéphanie Milot, which illustrates the unfolding of the Montreal game situation, one of the tools used in the previous study, but also in several articles that have been featured in the magazine in the past. Next, an article summarizes what the literature tells us about the language profile of children with autism. Finally, the last article in the issue presents the results of two recent studies on the neurofunctional basis of visuospatial skills in adults with autism

This 16th issue of the magazine is once again possible thanks to the students, researchers and collaborators with autism who give up their time to write and revise the articles, and make the content of this high-quality magazine. We would like to acknowledge the ongoing support of the Marcel and Rolande Gosselin Research Chair in Fundamental and Applied Cognitive Neuroscience of the Autism Spectrum at the Université de Montréal, which make the production of this magazine possible.

We'd also like to take this opportunity to remind you that the Sur le Spectre podcast has been available on various platforms (Youtube, Spotify, Amazon Music, Deezer) since last spring, and that three new animated videos have also been published on our YouTube channel. These videos deal with sleep, myths and realities, and preferred interests in autism. We invite you to subscribe to our channel and listen to this media content to learn more about autism. By listening to and sharing our content, you are directly supporting the project and helping us to continue creating this content with the help of funds and grants.

As Managing Editors, replacing Valérie Courchesne for this issue, we wish you happy reading and listening!

Alexia and Janie

Chief editor

Alexia Ostrolenk

Janie Degré-Pelletier

This 16th issue of the magazine is once again possible thanks to the students, researchers and collaborators with autism who give up their time to write and revise the articles, and make the content of this high-quality magazine.

Indeed, research groups that have conducted longitudinal studies have shown that autistic children present highly varied developmental trajectories

Projet de recherche longitudinal
UNE AUTRE INTELLIGENCE
Les prédicteurs et corrélats de l'intelligence autistique

Predictors of Intelligence in Autism:

The role of perceptual skills and behaviors and interests during the preschool period

By ÈVE PICARD

At the time of diagnosis of autism in preschool, parents of autistic children frequently wonder how their child will develop intellectually. They want to know what the future holds for their child. Yet, even today, it remains difficult to answer this question, as studies show great variability in the intellectual development of autistic children. Indeed, research groups that have conducted longitudinal studies have shown that

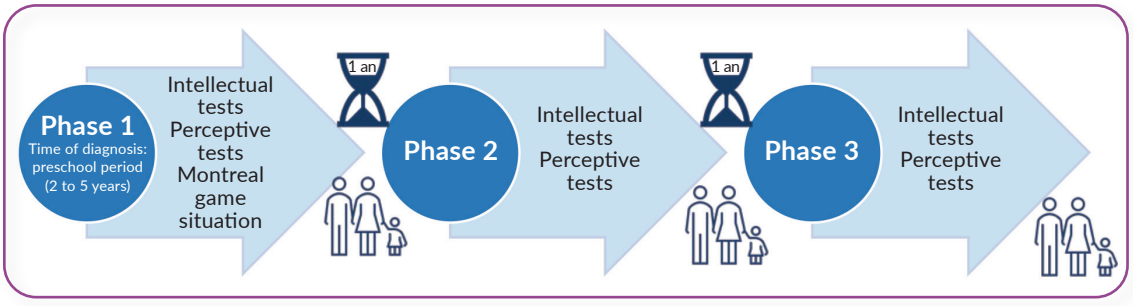
autistic children present highly varied developmental trajectories: while the intelligence test scores of some autistic children remain stable as they grow up, they seem to increase or decrease considerably for others. This "unpredictability" in assessing the intelligence of autistic children has often been associated with the difficulty of conducting a valid intellectual assessment at such a young age . Indeed, during the preschool period, assessments are accompanied by numerous challenges that can undermine the validity of their results. While some challenges are present with most young children (e.g., limited attention span, needing several pauses, loss of interest in the task, etc.), others are more specific to children with autism (e.g., language delays). As a result, at the time of diagnosis in preschool, it can be difficult to conduct a valid assessment, and thus reveal the true intellectual potential of autistic children. Predictors of intelligence in autism remain to be discovered.

In autism, perception seems to play a more important role than in neurotypical (without developmental particularities) individuals, both cognitively and behaviorally. Cognitively, compared with their neurotypical peers, children and adults with autism often perform better on perceptual tests, and their perceptual skills are more strongly associated with their general intellectual skills (stronger positive relationship). Behaviorally, the restricted and repetitive behaviors and interests that are central to the diagnosis of autism frequently have a strong perceptual component (e.g., lateral or close gazes, exploration of visual objects with perceptual features, interests in letters and numbers, etc.). These perceptual peculiarities suggest that the predictors of intelligence in autistic children may differ from those in neurotypical children, with a more important role for perception in autistic individuals.

To fill this gap in scientific knowledge, researchers at the Centre de Recherche, d''Évaluation et d'Intervention en Autisme (CREIA) conducted a longitudinal study at Hôpital Rivière-des-Prairies to determine whether measures other than conventional intelligence tests at preschool age could be used as predictors of intellectual level at school age. Specifically, the researchers tested: 1) whether perceptual skills and behaviours, and interests identified at preschool age could predict school-age intellectual level and the trajectory of intellectual development in children with autism; and 2) whether these perceptual predictors were specific to autism or shared with neurotypical children.

Methodology: Another Intelligence Project

In order to elucidate the question of predictors of intelligence in autism, the researchers set up a longitudinal study following a cohort of 41 autistic and 57 neurotypical children, all aged 2 to 5 years old, i.e. during the preschool period. The autistic children were recruited from Hôpital Rivière-des-Prairies as soon as they were diagnosed with autism, and the neurotypical children from nearby daycare centers. All children were assessed using intelligence tests (the Wechsler Intelligence Scale (WPPSI-IV) and the Raven Colored Progressive Matrices (RCPM)), and perceptual tests (a Visual Search Task (VS) and a Figure Entanglement Task (CEFT)) on three occasions during their development, with a one-year gap between each assessment. The children also took part in the Montreal play situation (SSM1) at the time of their 1st assessment at preschool age. The Montreal play situation consists of a filmed play period lasting around 30 minutes, during which an experimenter presents the child with some 40 toys specially chosen for their perceptual properties (e.g., toys with lights, toys that turn, etc.). This allows us to document the frequency of perceptual behaviors and interests, i.e., behaviors that are atypical either in nature (e.g. sideways glances) or intensity (e.g. alignment of objects), and have a perceptual component.



In autism, perception seems to play a more important role than in neurotypical (without developmental particularities) individuals, both cognitively and behaviorally.

Main references:

1- For more details on the assessment of preschool-aged children with autism, see the article: Early Childhood Assessment: The importance of a multi-method and multi-perspective approach

2- Fore more details on the play situation (SSM1), see the article: Are repetitive behaviours and object exploration in young autistic children compatible?

3- For an illustration of SSM1, please refer to the comic strip on page 11 of this magazine.

Unlike conventional intelligence tests, perceptual tests have the advantage of being easier to use with young children with autism, since they do not require the use of language and are based on the perceptual strengths frequently observed in autism.

Brief description of the intelligence and perceptual tests used in the Another Intelligence project

The **Wechsler Intelligence Scale (WPPSI-IV)** is a conventional intelligence test requiring a good level of language on the part of the child (verbal instructions and verbal responses). The **Raven Colored Progressive Matrices (RCPM)** also measures intelligence. Unlike the Wechsler intelligence scale, it does not require a high level of language to be completed. The **Visual Search Task (VS)** and the **Figure Entanglement Task (CEFT)** measure perceptual skills. The first involves finding a target letter (e.g., red X) among other letters as quickly as possible (see Figure 1), and the second involves finding a geometric shape (e.g., triangle) hidden in a global image as quickly as possible (see Figure 2). Compared with other intelligence tests, perceptual tasks are more concrete and rely less on language, and seem to better represent the cognitive style of autistic people (perceptual and visual).

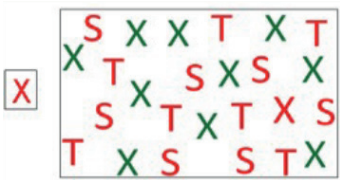


Figure 1. Visual search task (VS).

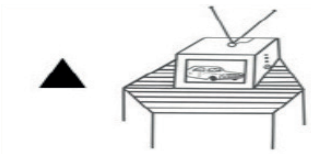


Figure 2. Entangled figures task (CEFT).

Main results

The results suggest that perceptual skills on the VS and CEFT at preschool age predict later intellectual level on the WPPSI-IV for both autistic and neurotypical children. In other words, autistic and neurotypical children who demonstrated better VS and CEFT skills at preschool age had higher WPPSI-IV performance at school age. Similarly, in autistic children, better perceptual skills on the VS and CEFT at preschool age predicted later intellectual level on the RCPM. However, in neurotypical children, only CEFT performance is related to RCPM. In summary, the results suggest that perceptual skills measured at preschool may be useful in estimating intellectual potential at school age, particularly in children with autism.

In preschool-aged children with autism, the frequency of perceptual behaviors and interests in the SSM1 is a good predictor of later intellectual level on the RCPM only, and not on the WPPSI-IV. Thus, children with autism who showed more perceptual behaviors and interests generally performed better on the MPRC at school age. However, in neurotypical children, the frequency of perceptual behaviors and interests is not related to later intellectual level (WPPSI-IV and RCPM). Thus, the predictive role of perceptual behaviors and interests at preschool age seems specific to autism!

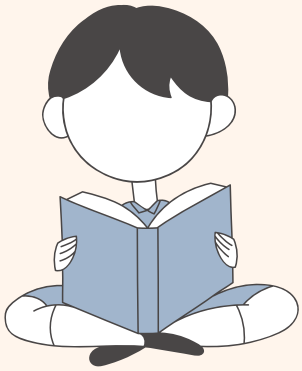
Conclusion and relevance of the study

In conclusion, this study suggests that perceptual skills and perceptual behaviors and interests at preschool age are good predictors of later intellectual level in autism. These findings are of great clinical importance, because as previously discussed, at the time of diagnosis at preschool age, it can be difficult to conduct a valid intellectual assessment. Unlike conventional intelligence tests, perceptual tests have the advantage of being easier to use with young children with autism, since they do not require the use of language and are based on the perceptual strengths frequently observed in autism. Although perceptual tests and the observation of the frequency of perceptual behaviours and interests do not replace a complete intellectual assessment, they are interesting and complementary avenues to explore in order to better estimate the intellectual potential of children with autism. Ultimately, the findings of this study have important clinical significance, as they may contribute to improving assessment methods with preschool-aged children with autism.

ÉLÈVES AUTISTES D'ÂGE SCOLAIRE RECHERCHÉS POUR UNE ÉTUDE!

Centre intégré universitaire de santé et de services sociaux du Nord-de-l'Île-de-Montréal
UQÀM
Québec

Cette étude vise à documenter les profils d'habiletés scolaires des élèves autistes.



Critères d'égibilité :
- Être âgé entre 6 et 12 ans
- Diagnostic d'autisme

Participation attendue :
- 2 séances de 1h30

Compensation :
- 30$ par séance (total 60$)

Lieu :
- Hôpital Rivière-des-Prairies **ou** Pavillon Adrien-Pinard, UQÀM

Pour participer, contactez Ève Picard au :

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Approuvé par le comité éthique du CIUSSS NIM, #2023-2639.

Article of number 15 pages 2 to 5.

Heterogeneity:

autism adrift

By ANTOINE OUELLETTE

Antoine Ouellette is one of Sur le Spectre's loyal readers, he's also autistic, a musician, and an author of the book *Musique autiste*.

"Is there a universally accepted term for autism?". To this question, an article in Sur le Spectre (#15, Spring 2023, pages 2 to 5) offered the following food for thought: "*Autism, is autistic, neurological/brain difference, neurodivergent, challenges, and neurotypical*" are among the terms most commonly used to distinguish autistic and non-autistic individuals. There is therefore no universally accepted way of referring to autism, neither for people who are autistic, nor for the scientific community. This finding is what a study published in November 2022 in the very serious journal *Autism Research* revealed. The study documented the linguistic preferences of more than 650 English-speaking autistic adults worldwide when referring to their condition.

I wasn't surprised by this conclusion, because I myself have the same problem when it comes to describing my condition! Personally, I call myself Asperger's autistic, or simply Asperger's. I've kept the name because it's the profile that suits me best. I don't see anything offensive about this naming. But this name, that best describes me, in autism is gone!

This designation has disappeared because it seems that, for the same person, the diagnosis of Asperger's was given or a diagnosis of autism (in this case, high-functioning, even if the diagnosis of high-functioning autism never appeared in the DSM). The clinicians agreed that the two disorders belonged to the same family, but it was difficult for them to agree on the distinction between Autistic and Asperger. As a result, there were disparities in diagnosis depending on the person and the country.

In practice, the word autism has come to designate an amalgam of very diverse conditions, causes and presentations, with no links to each other than a set of increasingly imprecise behavioral or personality traits. It ranges from an adult with a vocabulary of about twenty words who is not self-sufficient, even in basic daily tasks, to a person who collects doctorates in cutting-edge scientific disciplines! In my opinion,

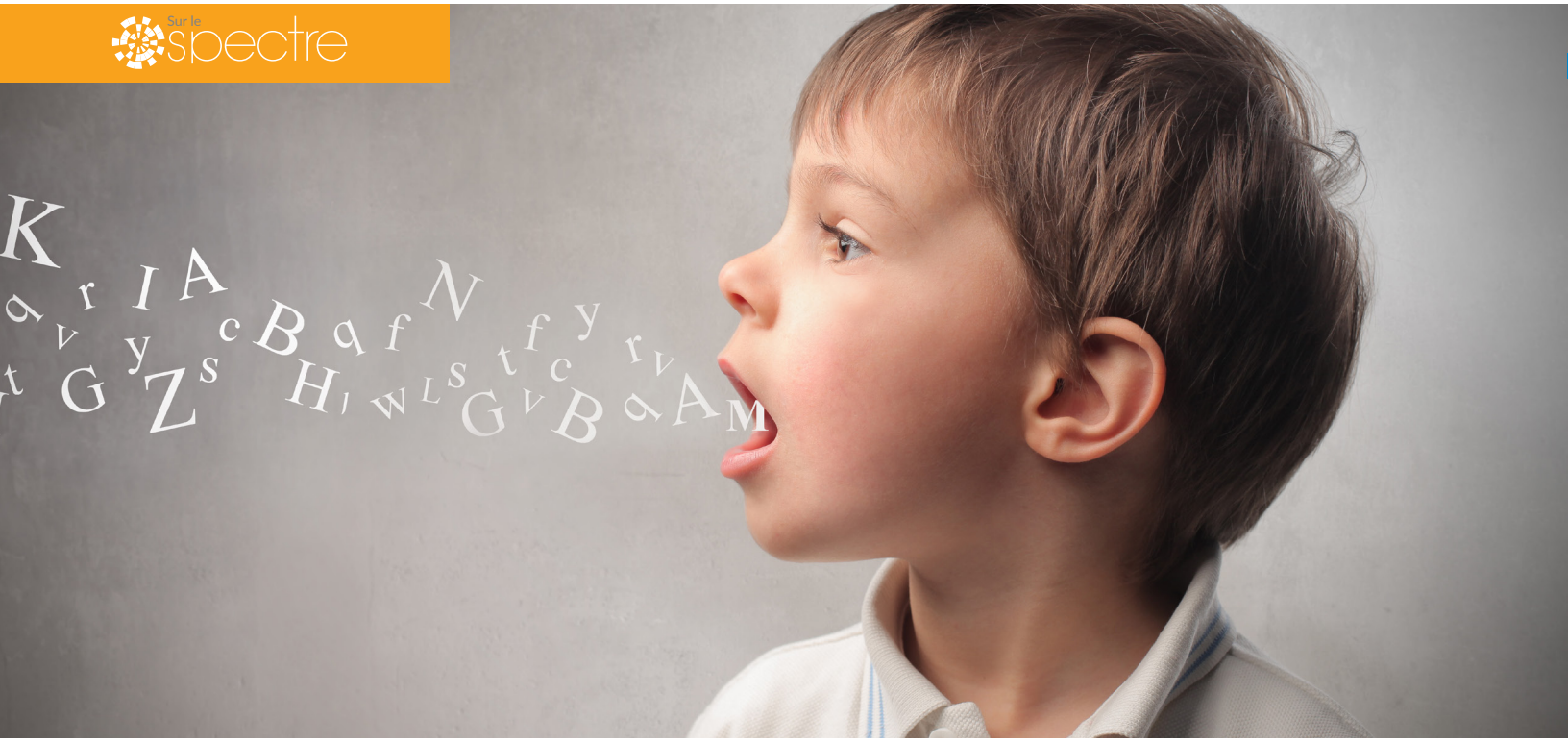
this is insane. This slippage makes it impossible to say anything at the scientific level that is true for all people designated as "autistic". Conceptual flexibility isn't bad in itself, but if you stretch it too far, the elastic breaks: here we are, with a broken elastic.

Inevitably, the fact that one and the same word is used to designate such divergent realities creates tensions and misunderstandings between people. For example, I've been told that the specialists who diagnosed me are "incompetent", because my reality doesn't match that of a family member with the same diagnosis! For my part, I find it impossible to identify with certain autistic profiles, although I may have some similar behavioral traits. I have more in common with neurotypicals than with a non-verbal autistic individual or an individual with a genetic condition. And yet, according to the DSM-5, I am indeed autistic! This confusion has very real human repercussions where in the end, nobody wins.

Tests are available to pinpoint the diagnosis of *secondary autism* (also known as "syndromic"): the diagnosis is then no longer "autism" but, for example, "Angelman syndrome with secondary autism", or "Fragile X with secondary autism". Of these syndromes, which are numerous, the genetic causes are known, but they resemble me even less than I resemble a non-verbal autistic person without comorbidity. I think it's necessary to clarify the diagnosis, otherwise the word "*autism*" becomes a "*melting pot*" - which, in fact, it has become to a large extent. This poses a major problem for research, because in a cohort of people diagnosed with autism for the purpose of conducting a study, there may be many different conditions. How then can valid conclusions be reached?

These problems will persist as long as people identified with "*pure*" autism (the cause of which is unknown) are lumped together on the same "*spectrum*" with people presenting a wide variety of conditions (some of which can be precisely identified), thus forming a very heterogeneous population. I confess I don't know of any other field where this is done. Here, it's as if we were using the term "*sneeze*", once precise and well-defined, to also designate coughing, sighing, throat clearing, and whistling. Can we really believe that this is progress?!

Inevitably, the fact that one and the same word is used to designate such divergent realities creates tensions and misunderstandings between people.



Language evolves with great variability within the autistic population, making it difficult to predict the level of language ultimately attained.

Understanding your Child's Language Profile

By FLORENCE LAJEUNESSE, AUDREY CÔTÉ and MARIE-PIER LESSARD

A baby's first words: what an important step! Children's language development is closely monitored by parents and professionals alike, and sometimes it doesn't follow the typical trajectory as described in textbooks. Whether it's a simple late-onset development, a developmental language disorder (DLD), or a language disorder associated with another condition, it's important to learn about the different possibilities and untangle them from one another. In children with autism, an associated language disorder can sometimes be observed. One of the elements that can cause confusion when trying to differentiate it from DLD is the impairment in conventions used in language (such as turn-taking and non-verbal information) that can be present in DLD[1]. Difficulties in this sphere, known as pragmatics, and the impact of expressive and comprehensive difficulties on social participation, can create a profile similar to that seen in autism. So, since language tends to evolve differently depending on the condition in which the disorder occurs, it's important to differentiate between DLD and autism-associated language disorder.

What is developmental language disorder?

Developmental language disorder (DLD) is a neurodevelopmental condition characterized by persistent language difficulties with functional impacts on a child's life[2]. It is present in 7.5% of the population[1] where difficulties that characterize this disorder cannot be associated with or acquired through other medical conditions. It is therefore not possible to have a diagnosis of DLD in the presence of autism, instead it would be a language disorder associated with autism.

Before the age of 3 years old, it is difficult to identify which children with late language development (11-18% of children) will have long-term language difficulties. Since many children who start speaking late catch up with the norm around age 3, it's not possible to conclude that they'll have DLD before this age[3]. At age 5, if language difficulties are still significant and not part of a broader condition, they will most likely persist throughout life. Contrary to what we might think, the age of first words is less of a good

predictor of DLD compared to the age of first word combinations (e.g., "want cake"). An assessment should therefore be considered if the child does not combine 2 words by 24 months[4]. To identify early-onset DLD, it is important to consider not only the language produced by the child, but also their communicative behaviors (gestures and imitation of body movements) and comprehension skills, as good skills in these areas are predictors of better language development and less persistence of difficulties.

When autism becomes involved

In autism, we can observe similar profiles, but the evolution of language is quite different from that of children with DLD[5]. Indeed, language evolves with great variability within the autistic population, making it difficult to predict the level of language ultimately attained. The appearance of the first words, the first sentences, the rate of development, and the final level of language are all aspects of language in autism that will vary enormously from one child to the next. What's more, major changes in language can occur after the age of 3, which is rarer in typical language development[2]. In autism, expressive language may not even emerge before age 3, and the high variability may continue until around age 9[6]. Aside from its great variability, language development also tends to occur rather late in autism. On average, an autistic child will say their first words at 38 months and form their first complete sentences at around 52 months, as opposed to 11-14 months for the first words and 36 months for the first complete sentences in neurotypical children.

Language progression in autism is often discontinuous, and there are very few reliable variables to guide professionals in discussing prognosis[2]. Research has, however, provided us with some clues. The main potential predictor is non-verbal intelligence quotient (IQ), which is the ability to reason and understand the world without the use of words. Other indicators also suggest that language development will take a favorable turn in later years. For example, most children with autism have fluent language by the age of 8 when they have no intellectual disability. An improvement in comprehension or expressive abilities at 2 ½ years, being verbal at 5 years, and acquiring a functional level of language at school age are also good clues[4]. It's important to remember, however, that the presence of these indicators is not necessarily a guarantee of success, nor does their absence mean that an autistic child's language will never improve.

About language regression

A phenomenon strongly associated with autism, language regression, is present in 10% to 50% of the autistic population[6]. This is a plateau lasting from several months to several years, during which language development stops or even regresses. In many cases, language regression occurs in children who had spoken their first words at a very early age. The presence and timing of regression affect the duration of the plateau, but not the child's chances of recovery, which are often good. Indeed, even if the plateau delays the attainment of fluent speech, language regression is not synonymous with a poor prognosis[1]. So we can't approach language in autism in the same way as with DLD: in autism, language difficulties are much less predictable! However, a less clear prognosis does not prevent professionals from being able to intervene with families and have an impact on the day-to-day functioning of autistic children.

And speech therapy?

Few studies to date support the efficacy of speech therapy interventions in promoting language development in children with autism. Most studies have focused on specific measures of language development, such as performance on a vocabulary task. However, the acquisition of functional communication does not lie solely in the number of new words acquired by the child, or in his or her ability to conjugate verbs! Acquiring functional communication also means that those around the child understand their difficulties in detail, and adapt to them to better convey a message[2]. It also means that the child becomes aware of some of their own challenges, and becomes more autonomous and precise in their requests for clarification. It's also a family made aware of the sometimes atypical way their child communicates a message. Wouldn't it be more representative, then, to measure the effectiveness of speech therapy interventions by the reduction in the number of outbursts made by the child because they are not being understood? Or the quality of the parent-child relationship when communication is less of an obstacle? Or the level of child anxiety generated by the simple fact of functioning in an environment where verbal interaction is omnipresent? Speech therapy is much more than words

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PARTICIPANTS RECHERCHÉS

Étude

Un milieu de vie adapté aux besoins des adultes autistes !

Objectif de l'étude : Connaitre les caractéristiques importantes du milieu de vie pour le bien-être des personnes autistes (p.ex. quartier de résidence, disposition des espaces de vie, cohabitation, etc.).

Profil des participants recherchés :

- Personnes autistes âgés de 21 ans et plus
- Résidant dans différents types de milieux de vie (domicile familial, ressource résidentielle, appartement, etc.).

En quoi ça consiste ?

- Un entretien individuel d'environ 1 heure
- Connaitre les préférences de la personne autiste par rapport à son milieu de vie
- Rencontre en visioconférence (Zoom), au domicile ou à l'hôpital Rivière-des-Prairies
- Compensation : 40$

Pour des questions ou pour participer à l'étude, contactez Anne-Marie Nader :

anne.marie.nader.cnmtl@ssss.gouv.qc.ca 514-323-7260, poste 2292

Projet mené par Roger Godbout, PhD, professeur, département de psychiatrie de l'Université de Montréal et Anne-Marie Nader, PhD, professeure, département de psychologie de l'Université de Montréal
(approbation du CER du CIUSSS-NIM no 2023-2406)

Fonds de recherche INCLUSION SOCIALE

Savoirs partagés RECHERCHE CIUSSS NÎM

Université de Montréal

Comic strip

Comic strip by Stéphanie Milot, B.A. bd, story by Catherina Lacelle, undergraduate student in psychology produced with the support of a research initiation grant from the Fond de Recherche du Québec - Société et Culture (FRQSC).

Context setting: As part of the broader project "Une autre intelligence", preschool children (aged 3 to 6), both autistic and typically developing, are presented with the Montreal stimulating play situation. The children are videotaped to enable analysis of toys exploration and manifestation of repetitive behaviors over four play periods. In the first period, Free Play 1, the child can explore the toys of his choice. In the second period, Semi-Free Play, the child can play with the toys of his choice, and the experimenter activates the toys or copies the child's actions. In the third period, Semi-Structured Play, the experimenter introduces new toys in a predetermined order. Finally, in the last period, Free Play 2, the child can play with all the toys in the room. In this story, you'll follow Jordan, an autistic child, through the four phases of the play situation.

Lien vers l'article : Jacques, C., Courchesne, V., Meilleur, A. A. S., Mineau, S., Ferguson, S., Cousineau, D., Labbe, A., Dawson, M. & Mottron, L. (2018). What interests young autistic children ? An exploratory study of object exploration and repetitive behavior. *PloS one*, *13*(12), e0209251.

Calendar calculator needed for a study!

What day of the week was
May 19, 2007?

If you can answer these types of questions, you're just the person we're looking for! Minor or adult, with or without a diagnosis.

Study aim:
To better understand the skill of calendar calculation by conducting case studies.

To participate or obtain information on the project, contact Jade Desrosiers:

jade.desrosiers.1@umontreal.ca
514-323-7260, ext. 2165

Centre intégré universitaire de santé et de services sociaux du Nord-de-l'Île-de-Montréal
Québec

Université de Montréal

This study is led by Dr Laurent Mottron (UdeM and CIUSSS NIM). The project has been accepted by the CIUSSS NIM research ethics committee (2022-2437).

Does the Brain Work the Same Way

for All Autistic People?

By SOPHIA DRAAOUI

Visual Perception in People with Autism

Visuospatial skills are a person's ability to perceive and analyze the objects and environment around them, in both two- and three-dimensions. For example, we use these skills when drawing or parallel parking. In fact, they are considered an important component of human intelligence.

Numerous studies have shown that autistic people have visuospatial skills superior to neurotypical people. Autistic people often perform better in tasks requiring them to mentally manipulate an image, find a hidden target element among distractors, locate a hidden figure in a complex image, or reproduce a model using blocks. People with autism are also more likely to perceive the details that make up an image first, before analyzing the overall image, unlike neurotypicals, who usually perceive the overall image first. This prioritization of detail perception by autistic people could help explain their superior performance on visuospatial tasks.

However, other studies have also shown that autistic people perform similarly or less well than neurotypicals on visuospatial tasks. These divergent results could be explained by the heterogeneity of autistic people's profiles. **Nearly half of all people with autism demonstrate a visuospatial strength**, which could explain the lack of consistency between the results of the studies. Moreover, autistic people who have these visuospatial strengths often present a distinct profile: they represent a subgroup among autistic people who have had language delay, or atypical language development in early childhood.

Study Description

To better understand the brain function associated with superior visuospatial skills, Véronique D. Thérien and her colleagues set out **to compare the performance of three groups of adults on visuospatial tasks: two groups of men with autism, who differ in their visuospatial skills, and one group of neurotypical men**. To form the two groups of autistic people, the researchers measured their intelligence quotient (IQ) using the Wechsler Intelligence Scales. This test includes the Block subtest, which requires the reproduction of images using blocks. Autistic people who

People with autism are also more likely to perceive the details that make up an image first, before analyzing the overall image.

Across the two tasks, several differences were observed between the three groups in the activation of brain regions and the connectivity between these regions.

had exhibited a peak of performance on this task, i.e., their performance was significantly higher compared to their performance on the other subtests in the intelligence scale (personal strength), formed one group, and autistic people who scored lower formed a second group.

To compare the three groups of participants, the researchers **measured functional connectivity and brain activation during two tasks involving different visuospatial skills**. Functional connectivity refers to the simultaneous activation of different brain regions during the performance of a task. The first task was a mental rotation task: participants were shown several pairs of images of three-dimensional objects and asked to indicate whether the objects were identical or mirrored. The objects were rotated by 0°, 70°, 140° or 180°, which informed the level of difficulty (see image "Task 1: Mental rotation"). In the second task, participants had to mentally sort images with different levels of perceptual coherence. An image with high perceptual coherence represents a pattern that can be easily identified by participants, such as a cross or zigzags. An image with low perceptual coherence does not represent an easily identifiable pattern (see image "Task 2: Blocks").

To measure brain connectivity and activation, the researchers used functional magnetic resonance imaging (fMRI), a type of imaging that allows us to observe which brain regions are activated during task performance.

Main Results

Across the two tasks, **several differences were observed between the three groups in the activation of brain regions and the connectivity between these regions.**

In terms of brain activation, both autistic groups showed greater activation in posterior regions (occipital and parietal) than the neurotypical group. Additionally, the autistic group with a visuospatial peak showed greater activation of regions specialized in visual perception, located in the posterior part of the brain, compared to the autistic group without a peak.

When the complexity of the tasks was increased (by increasing the angle of rotation or the level of perceptual coherence), the researchers observed very little effect in the brain regions used by autistic people with a visuospatial peak. They used more or less the same regions specialized in visual perception for the most complex tasks, suggesting that they utilise more perceptive processes. Conversely, for participants in the other two groups (autistic persons without a peak and neurotypicals), the brain regions involved were much more extensive, further involving frontal regions, as the complexity of tasks increased.

Regarding connectivity between regions, the researchers observed greater connectivity between regions specialized in visual perception in autistic people with visual perception compared with the other two groups. However, in autistic participants with a visuospatial peak, the posterior regions were less connected with the frontal regions during the tasks compared to those autistic participants without a peak and neurotypicals.

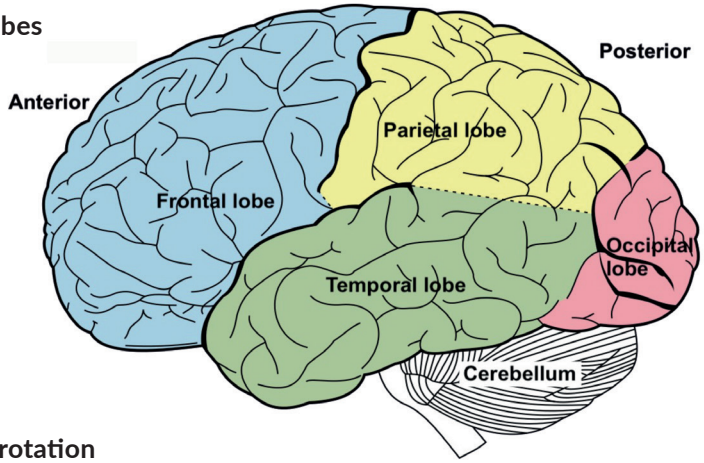
What does it mean?

The work of Véronique D. Thérien and colleagues shows that when performing visuospatial tasks, **there are differences in the activation and connectivity of brain regions not only between autistic and neurotypical people, but also between autistic people** with different visuospatial skills. Notably, autistic people with a visuospatial peak appear to use a more specialized brain connectivity network than participants in other groups, with greater activation specifically in regions specialized in visual perception. The brain network of autistic participants with a visuospatial peak also appears to be more autonomous, with greater connectivity between posterior regions, but less connectivity between posterior and frontal regions, compared with the other groups. These distinctions observed in the autistic group with a visuospatial peak compared to the other participants could explain their strength at visuospatial level.

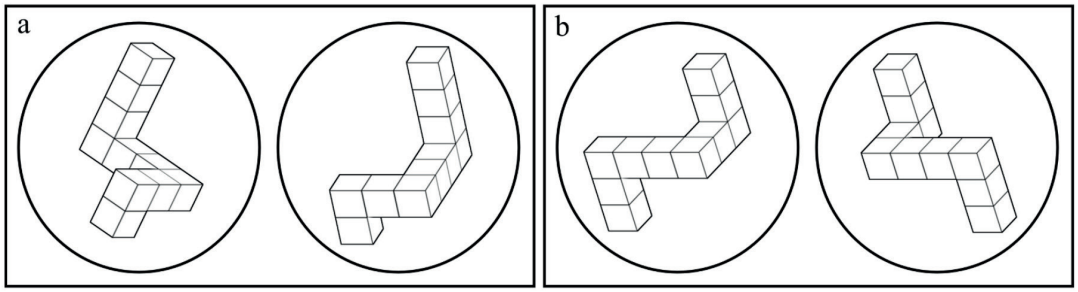
These results reveal the importance of taking into account the diversity of profiles of autistic people, not only in research to better understand the brain functioning of this population, but also in clinical and educational fields to better support autistic people.

However, further studies on this subject are needed. The participants in the study presented in this article were all adult males. In the future, it would be interesting to see whether similar (or different!) results could be obtained with adult women, or with participants across other age categories.

Human brain lobes

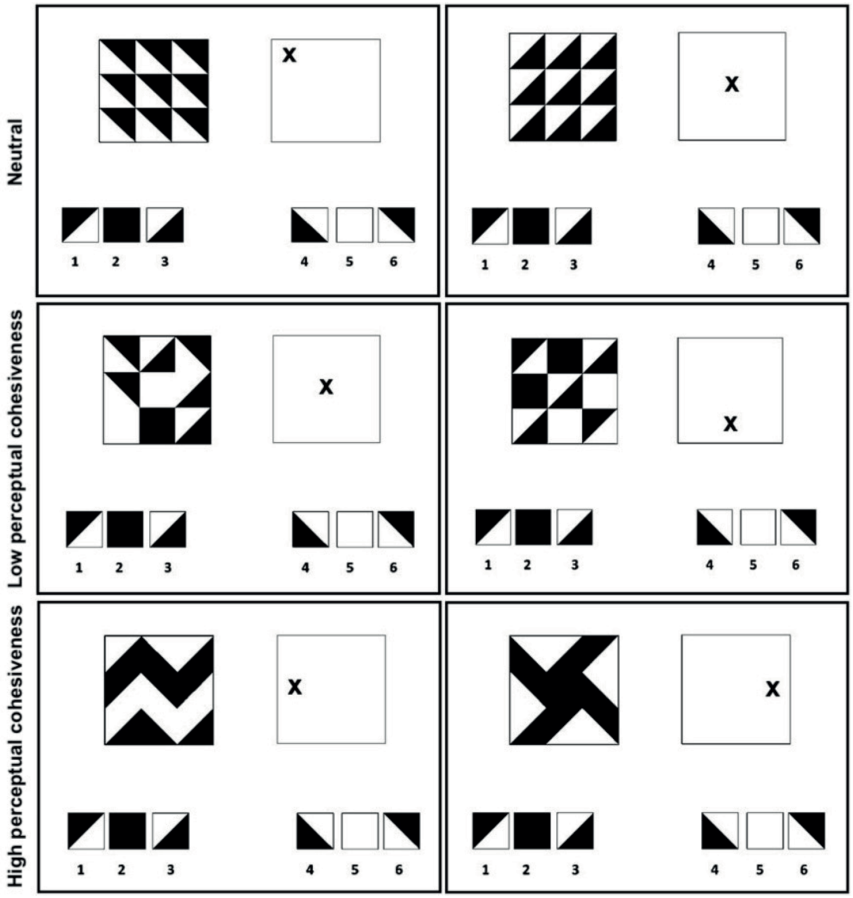


Task 1: Mental rotation



Examples of trials: (a) displays identical figures at 70-degree; (b) displays mirror figures at 0-degree.

Task 2: Blocks



There are differences in the activation and connectivity of brain regions not only between autistic and neurotypical people, but also between autistic people with different visuospatial skills.

References:

Thérien, V. D., Degré-Pelletier, J., Barbeau, E. B., Samson, F. et Soulières, I. (2023). Different levels of visuo-spatial abilities linked to differential brain correlates underlying visual mental segmentation processes in autism. *Cerebral Cortex*, 33(14), 9186-9211. https://doi.org/10.1093/cercor/bhad195

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Images:

Human brain lobes (source image : Wikipedia, https://en.wikipedia.org/wiki/Frontal_lobe#/media/File:Lobes_of_the_brain_NL.svg)