

Agrippina Campisi

PhD Student Neural and Cognitive Science,
XL Cicle

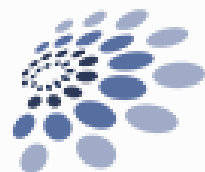
University of Trieste

Mapping Autism's Complexity

*Heterogeneity, Early Signs, and
Developmental Trajectories*



**UNIVERSITÀ
DEGLI STUDI
DI TRIESTE**

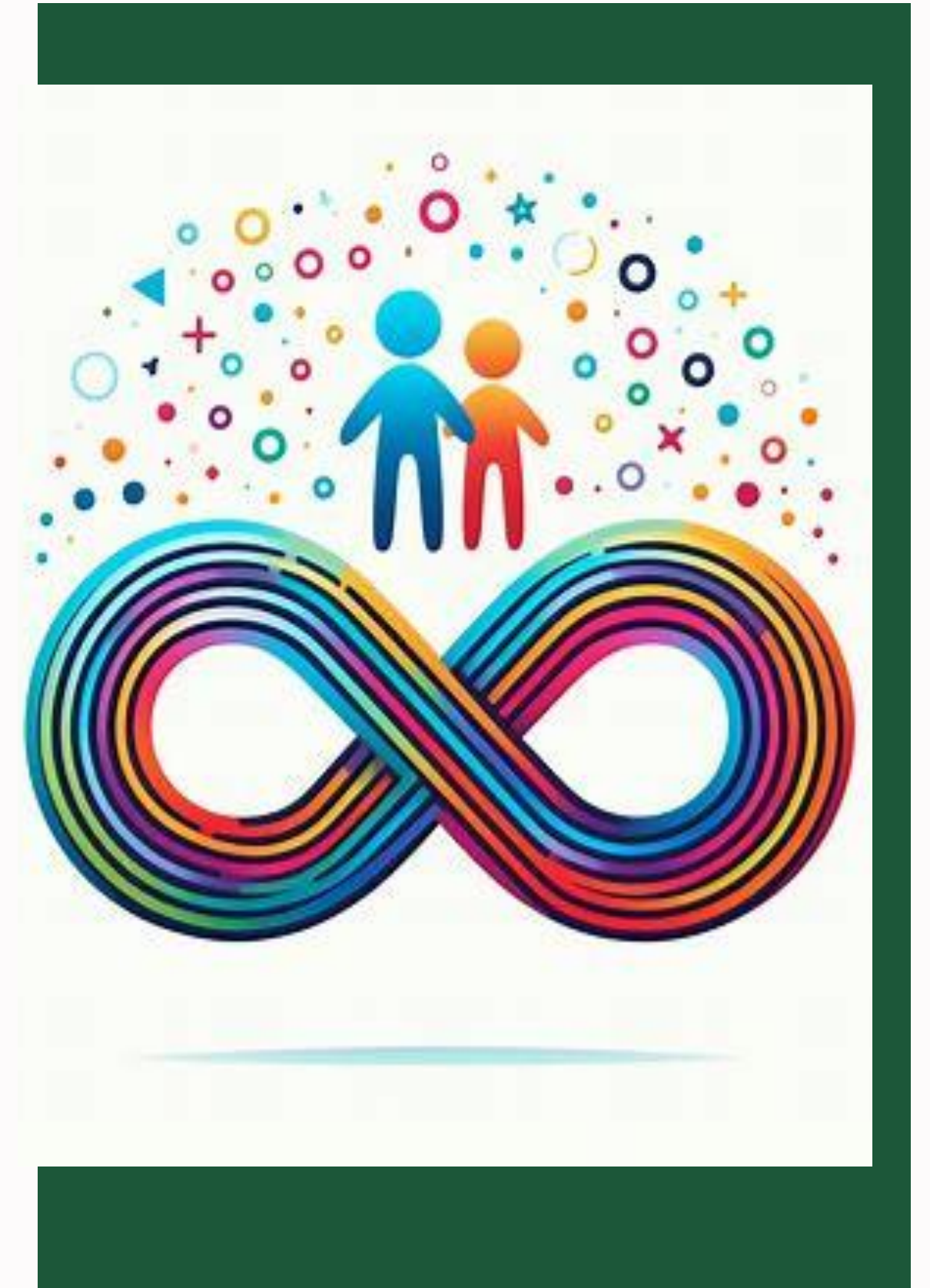


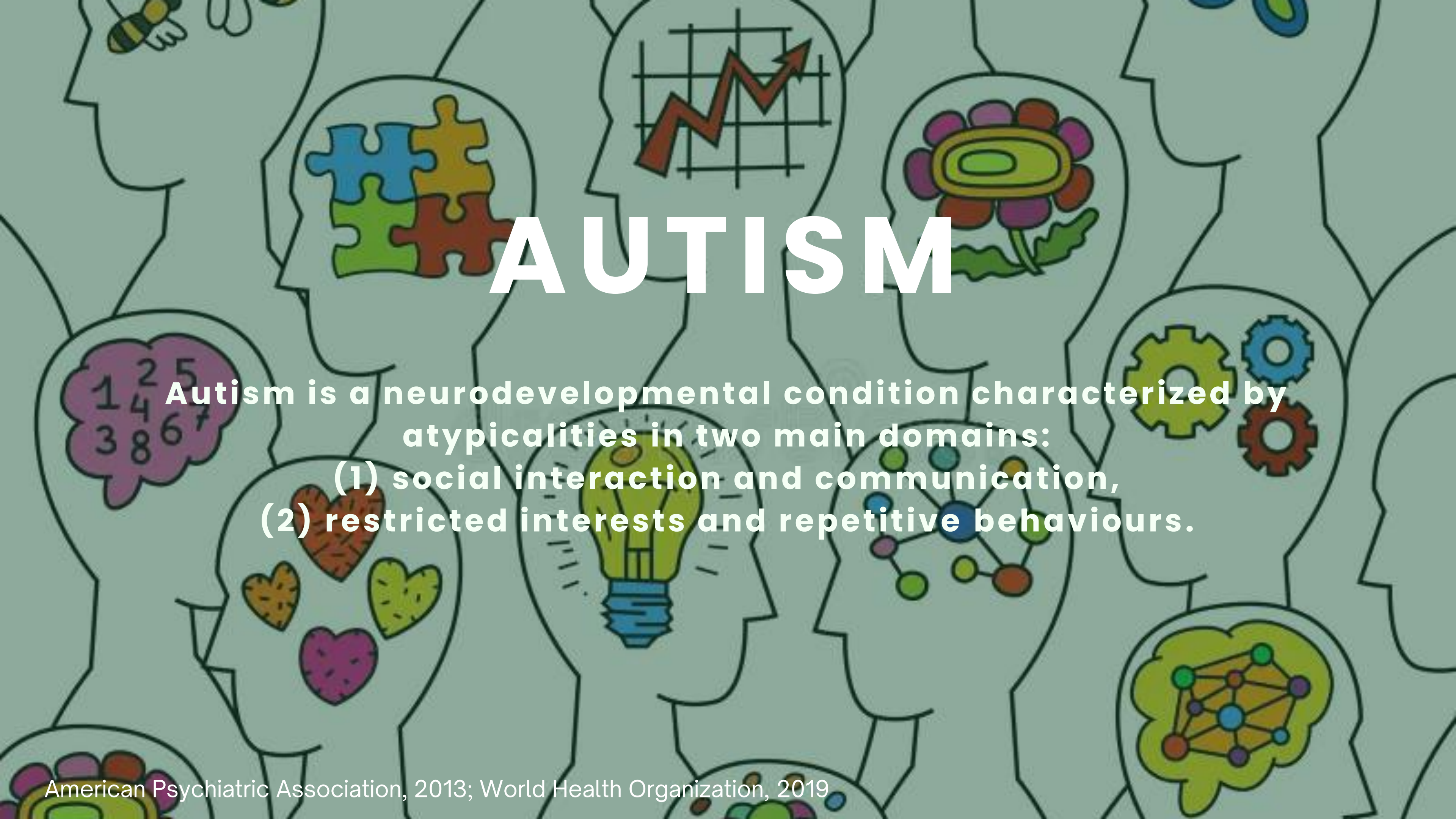
Dipartimento di
Scienze della Vita



Agenda

- 01 Rethinking autism-s: let's draw a tree!
- 02 How to explore heterogeneity.
- 03 Autism 3-D.
- 04 Research approach to explore autisms.
- 05 Early signs of autism.
- 06 Into research: Explorations of gestures and multimodality in young autistics.
- 07 Take home messages.





AUTISM

**Autism is a neurodevelopmental condition characterized by atypicalities in two main domains:
(1) social interaction and communication,
(2) restricted interests and repetitive behaviours.**

Core features

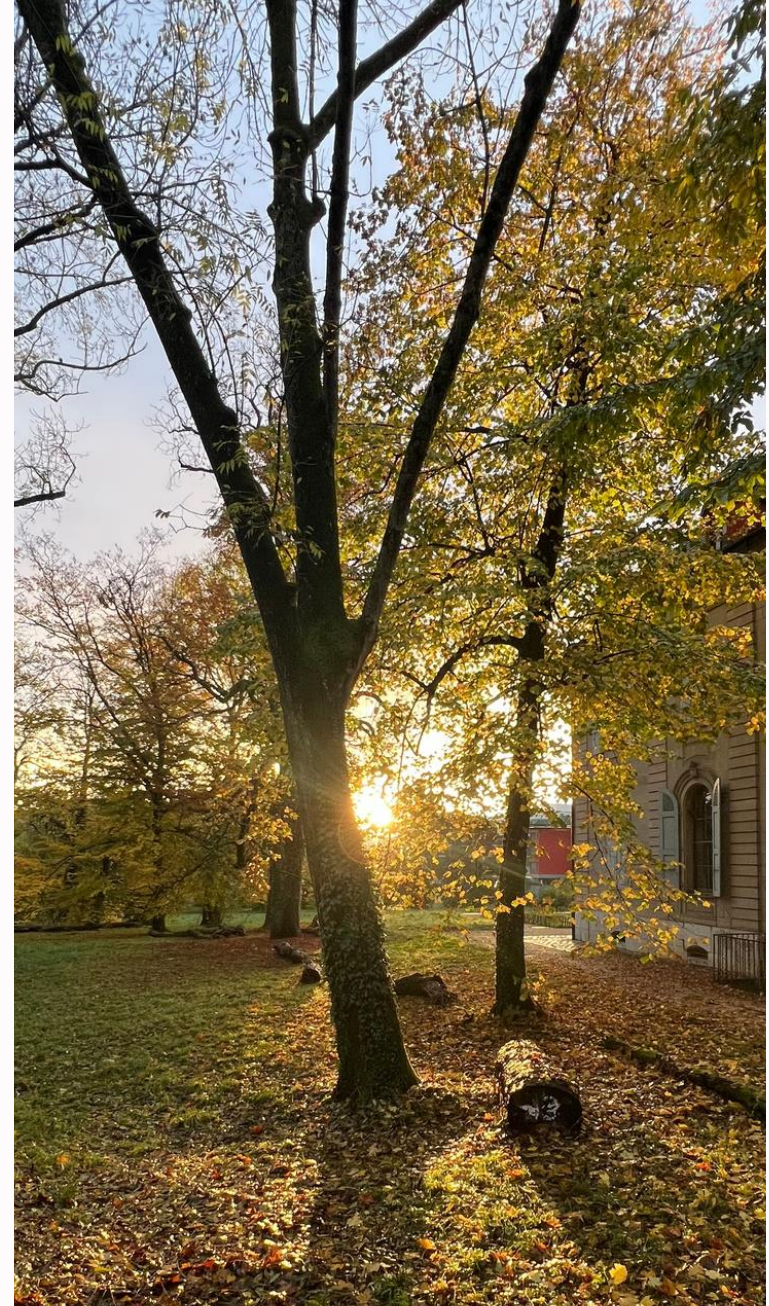
- Autism is a lifelong condition, characterized by heterogeneity in clinical presentation, developmental trajectories and outcomes.
- Autism is diagnosed in early childhood by early developmental difficulties.

SC
Social
Communication

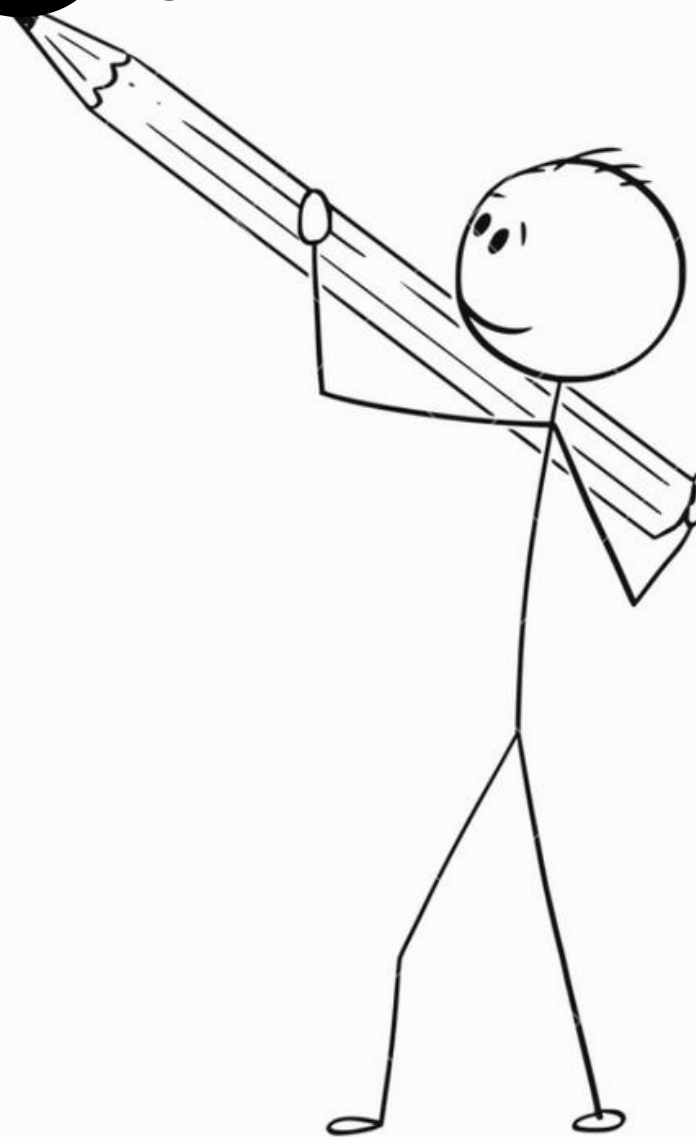
RRB
Restricted and
repetitive behaviors



Think outside the box



**Let's draw
a tree!**



Autism-s

#1

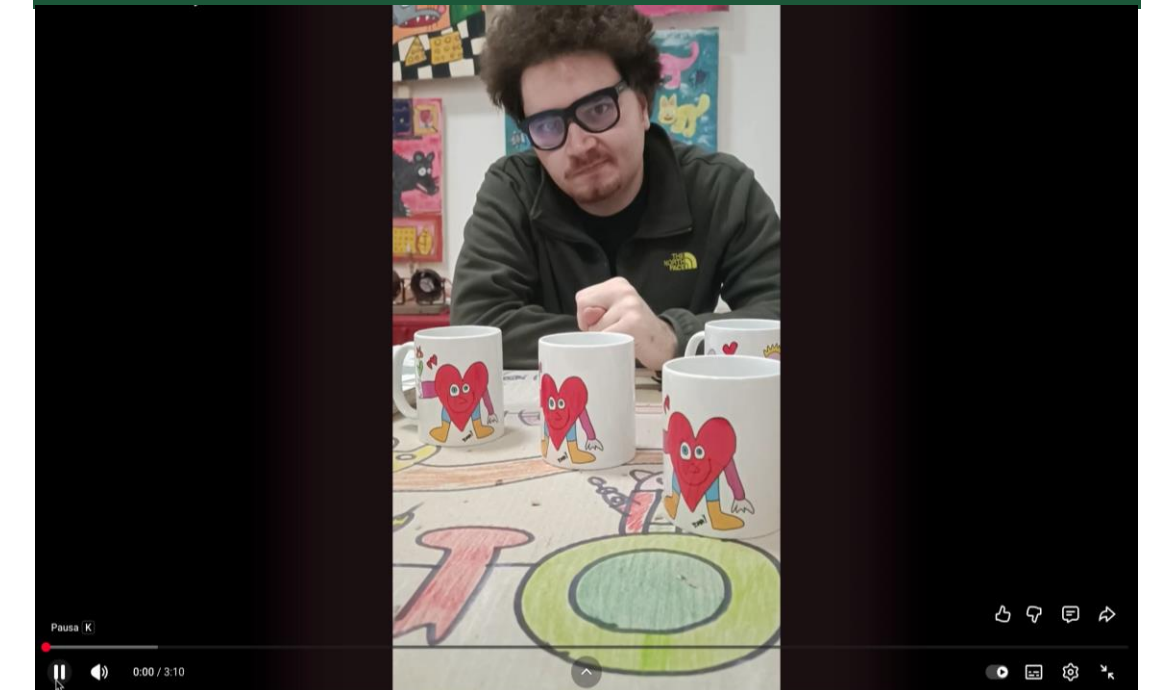
Deficits in understanding, maintaining
and developing relationships

Lack of facial expressions

#2



#3



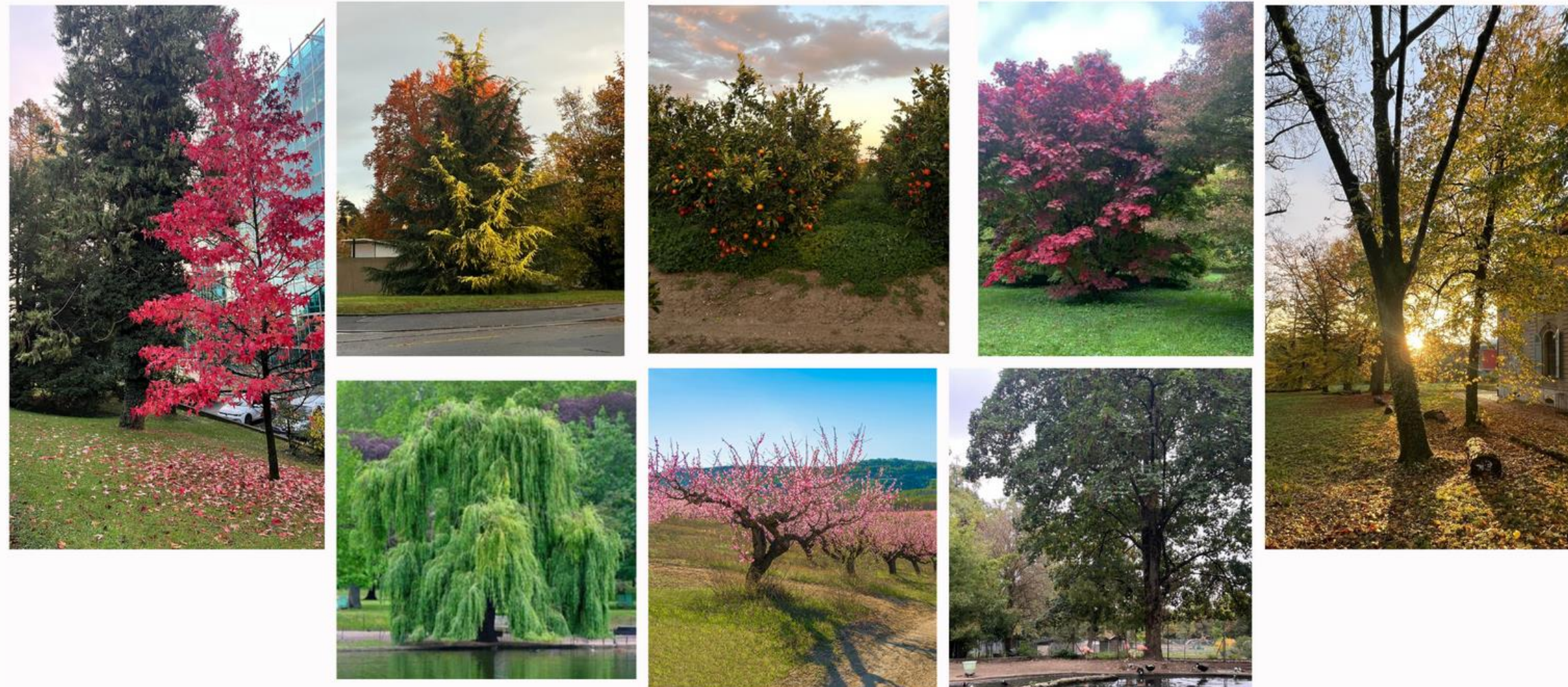
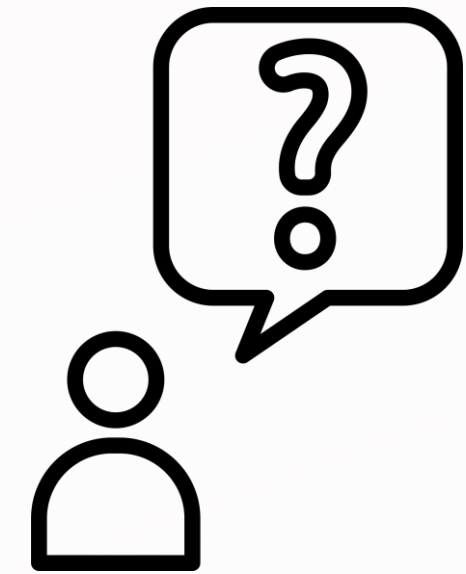
Disorder or
disability

From disorder
or disability to
neurodiversity

From AUTISM
to AUTISM-S

Rethinking autism: what is a tree?

1. Made mostly of woody substance.
2. Has an erect, self-supporting, single unbranched trunk, or stem.
3. Growth is perennial (throughout the year).
4. Has a crown or branches.



NON-CORE LIMA features

Language

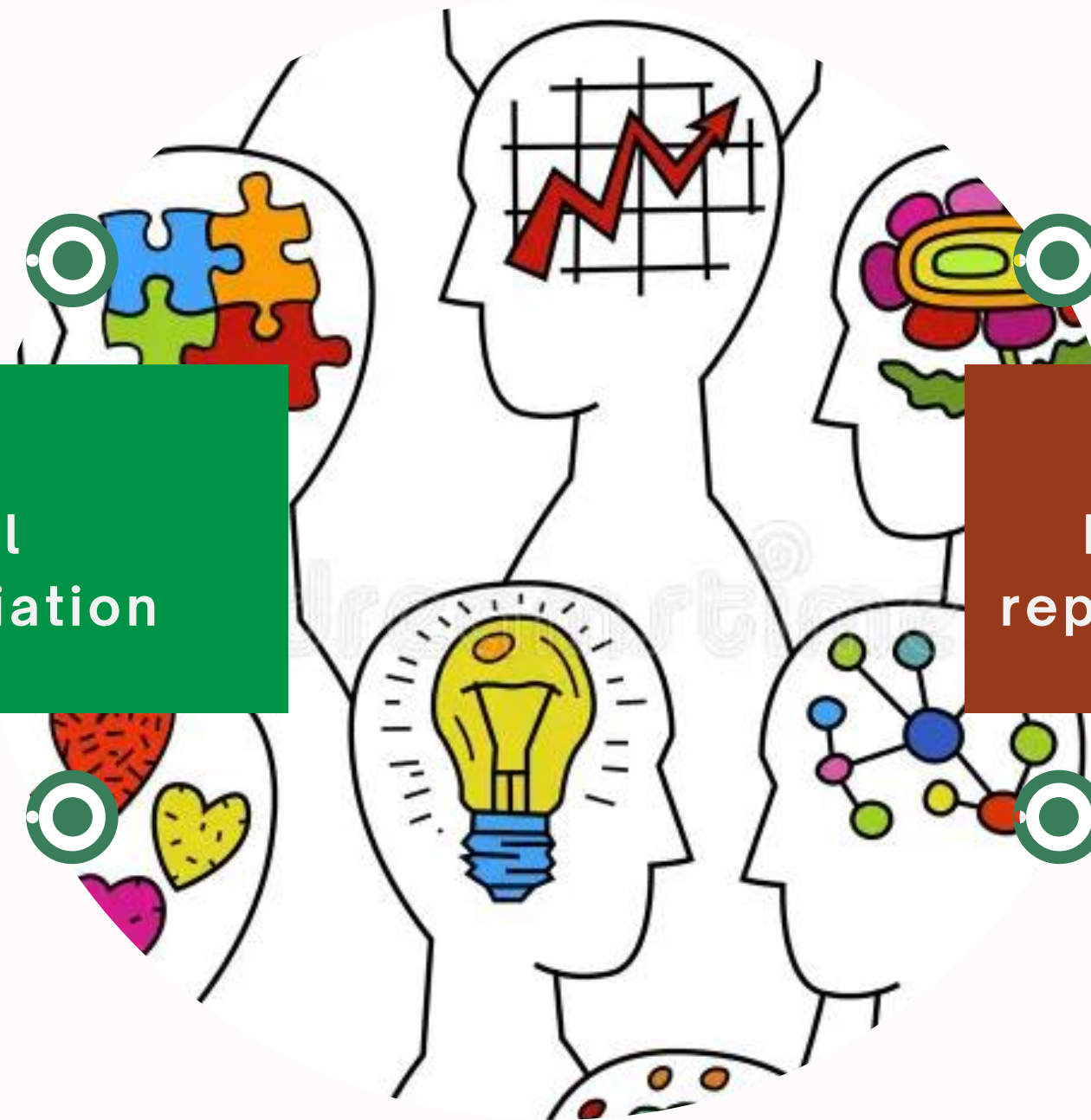
*Intellectual
functioning*

SC
Social
Communciation

RRB
Restricted and
repetitive behaviors

Motor

*Adaptive
functioning*



Autism-3D

Disability versus
difference over
development



Istituto
Italiano di
Tecnologia
Trento

<https://www.autism-insar.org/page/INSAR2025AnnualMeetingArchives>

**First-level split, in early
development, in two
types.**



Mandelli et al. *Molecular Autism* (2024) 15:41
<https://doi.org/10.1186/s13229-024-00613-5>

Molecular Autism

RESEARCH

Open Access

A 3D approach to understanding heterogeneity in early developing autisms

Veronica Mandelli^{1†}, Ines Severino^{1,2†}, Lisa Eyler^{3,4}, Karen Pierce⁵, Eric Courchesne⁵ and Michael V. Lombardo^{1*}

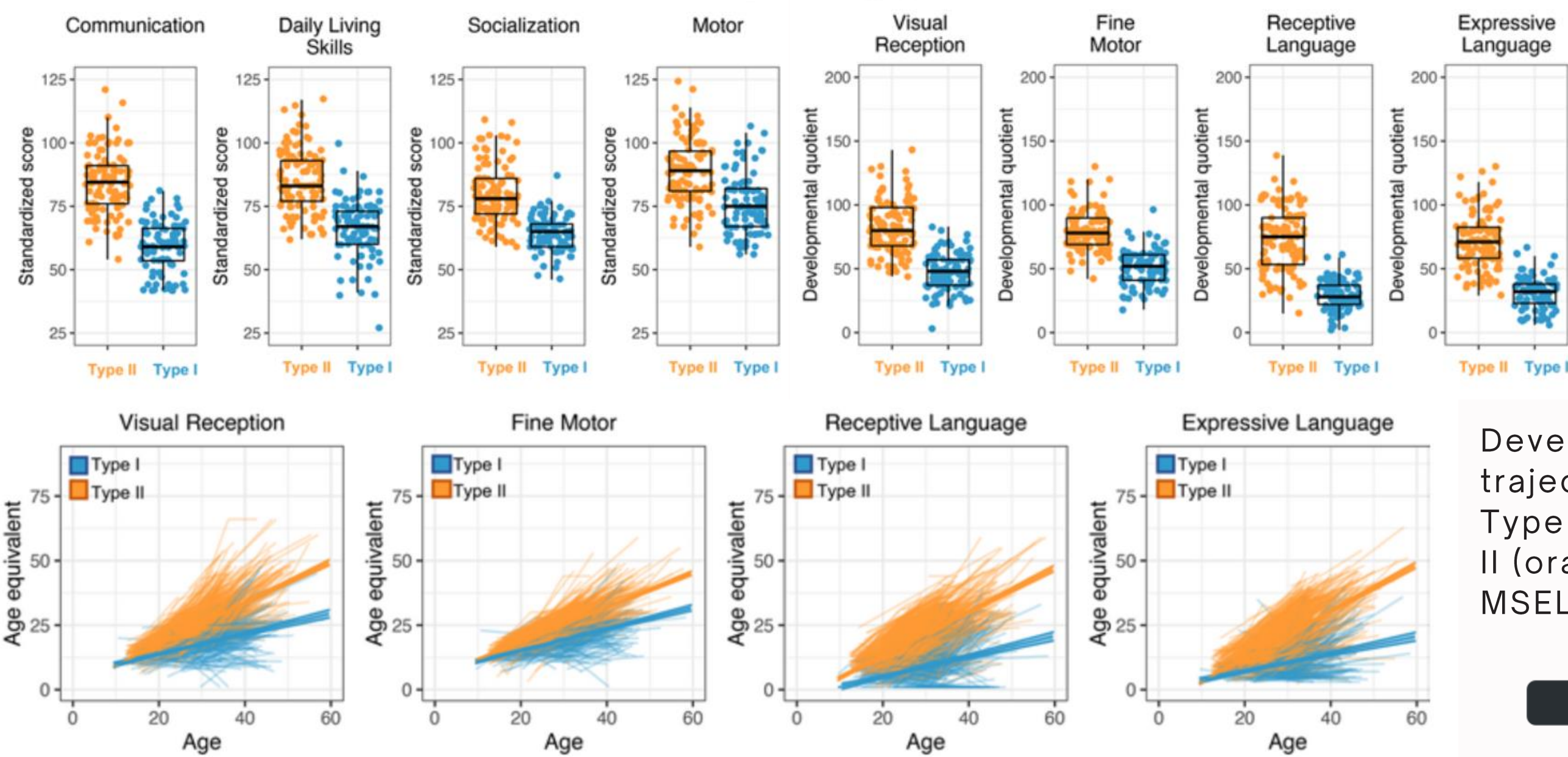




Methods

Unsupervised data-driven subtypes were identified using stability-based relative clustering validation on publicly available Mullen Scales of Early Learning (MSEL) and Vineland Adaptive Behavior Scales (VABS) data (n = 615; age = 24–68 months) from the National Institute of Mental Health Data Archive (NDA).

Results



The subtypes can be described as Type I versus Type II autisms differentiated by relatively high versus low scores on LIMA features.

Developmental trajectories for the Type I (blue) and Type II (orange) autism on MSEL scales.



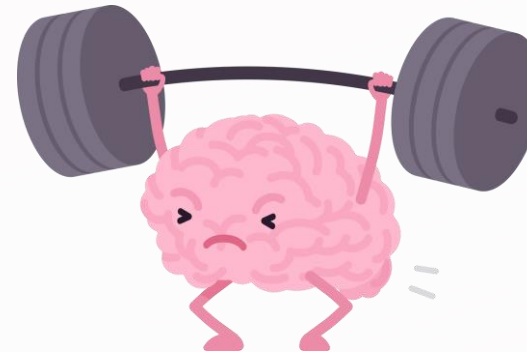
SOON

Differences in response to ESDM and other interventions in type 1 and type 2.

TAKE HOME MESSAGES



Autism as autism-s.



Take into account the LIMA
feutres do determine the
individual profile of autistic
person.



Predictions of autism

- Autism can be reliably diagnosed in children by age 18–24 months.
- Behavioral features of infants later diagnosed with autism include differences in attention, vocalizations, gestures, social engagement and social affect, sensory processing, and motor abilities.
- Studies that use neurophysiological measures, have identified differences in brain development in infants later diagnosed with autism compared with infants without autism.
- Prospective longitudinal studies of infants aged 1 year and younger who are later diagnosed with autism are elucidating the early developmental course of autism and identifying ways of predicting autism before diagnosis is possible.



Earlier is better.

Dawson, 2023.



Early behavioral signs of autism



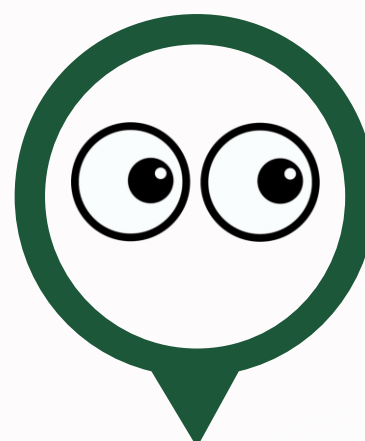
Sensory
sensitivity



Motoric
abilities



Play
development



Attention



Social affect

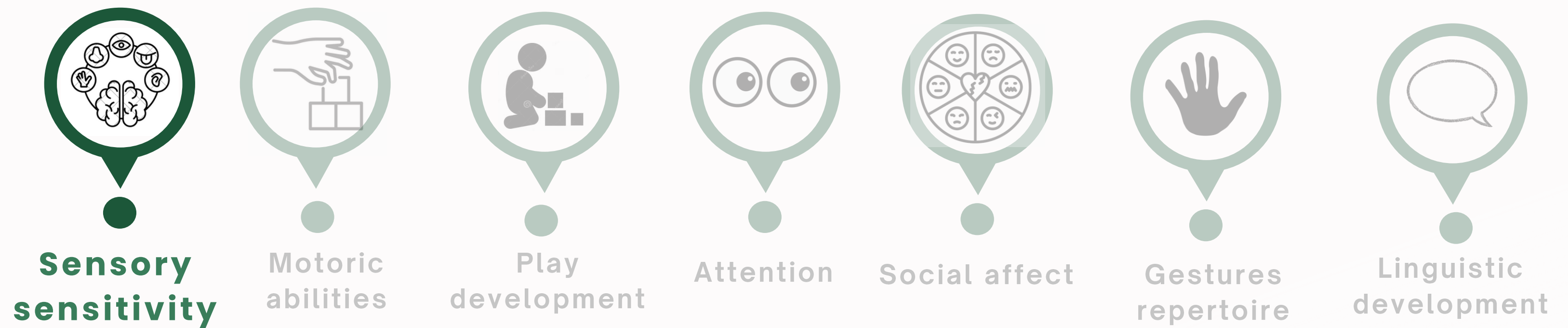


Gestures
repertoire



Linguistic
development





- In the diagnostic criteria for autism of the DSM-5, differences in sensory responses and interests fall into the domain of restricted interests and repetitive behaviours.
- Such differences can appear as either hyposensitivity to repeated stimuli or hypersensitivity (increased response to a novel stimulus), or as reduced or increased sensory exploration of the environment



Detected from 8-10 months, more strongly predictive of ASC diagnosis between age 12-24 months.



Sensory
sensitivity



**Motor
abilities**



Play
development



Attention



Social affect



Gestures
repertoire



Linguistic
development

- By age 6–9 months, delayed sitting, pull-to-sit, reach-to-grasp, and goal-directed reaching have been observed in infants with later autism.
- Fine and gross motor delays are evident by age 6 months and older and predict later language abilities.
- Difficulties in postural control can appear by age 6 months (eg, delayed sitting) and are persistent.

**Toy
play**

**Restricted and repetitive
behaviours**



Sensory
sensitivity



Motor
abilities



Play development



Attention



Social affect



Gestures
repertoire



Linguistic
development

Neurotypical Development

Early signs of Autism

Exploratory/sensorimotor play

Engages with toys using multiple senses (touch, look, mouth, shake).

Repetitive manipulation (spinning wheels, lining up toys).

Functional play

Uses objects according to their function (e.g., pushes a car, feeds a doll).

Limited or absent functional use; may focus on parts of toys (e.g., wheels, buttons).

Symbolic/imaginative play

Pretends (e.g., “feeds” a doll, “drives” a car, uses objects symbolically).

Rare or absent pretend play; may prefer functional play or repetitive actions.

Social/interactive play

Engages in shared play, turn-taking, joint attention.

Limited joint attention; tends to play alone or parallel without sharing focus or enjoyment.



Sensory
sensitivity



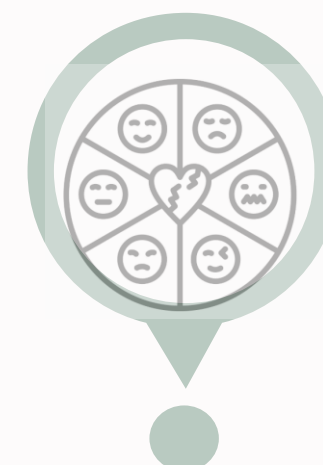
Motor
abilities



Play
development



Attention



Social affect



Gestures
repertoire



Linguistic
development

Early reduced attention to social stimuli, such as faces, voices, and gestures, has been observed in toddlers diagnosed with autism, has been hypothesised to have downstream effects on social development.



Reduced
responding
to name

9
months



Reduced
responding
to joint
attention

12
months



Lower
frequency of
initiating joint
attention
behaviours

14
months



Sensory
sensitivity



Motor
abilities



Play
development



Attention



Social affect



Gestures
repertoire



Linguistic
development



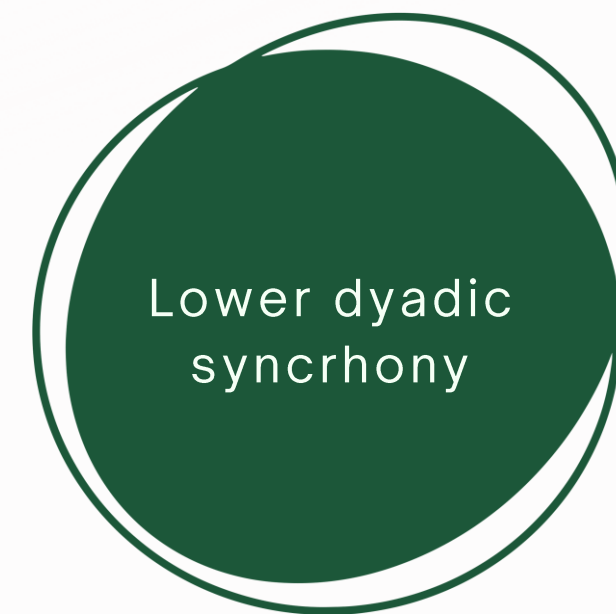
6-9
months



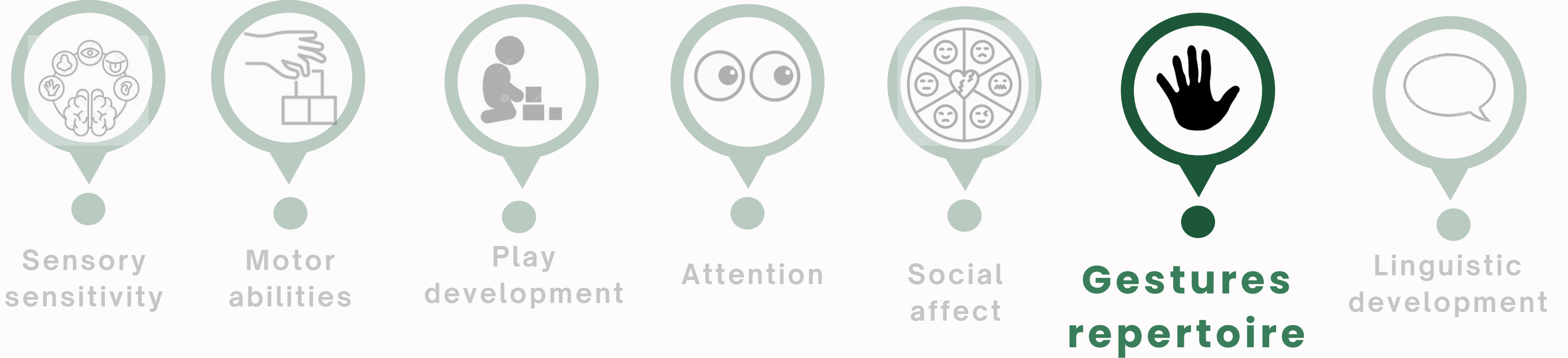
12-18
months



12-18
months



12-18
months



- From age 8–14 months, infants later diagnosed with autism exhibit reduced use of gestures, particularly deictic gestures (eg, pointing) and gestural–vocal coordination, which distinguished them from neurotypical children, infant siblings without autism, and children with language delay.
- Gesture use at age 12 months is predictive of a diagnosis of autism and associated with expressive language abilities at age 12 months as well as with later language abilities.



12 months



8-14 months

Dawson, 2023.



Sensory
sensitivity



Motor
abilities



Play
development



Attention



Social
affect



Gestures
repertoire



**Linguistic
development**

- By age 9–12 months, infants later diagnosed with autism produce fewer vocalisations, particularly canonical (speech-like) vocalisations, and more frequent non-canonical (nonspeech-like) vocalisations.
- Atypical vocalisation patterns, especially reduced rates of canonical babbling, have been observed in infants with later autism and in those without autism but with later language delay.



Fewer
vocalizations



Higher
proportion of
non-canonical
vocalizations



Less frequent
use of socially
directed
vocalisations

9-12 months



The ability to **integrate** in synchrony **speech, gestures, and gaze** into a single communicative act supports social and linguistic development."



Multimodal communication

Gesture-language integration not only **precedes** but also **predicts** lexical and syntactic development in both neurotypical and autistic children (Iverson & Goldin-Meadow, 2005).

Research indicates that the acquisition of gesture-language integration predicts the onset of **two-word combinations** in **autistic** children, as observed in **neurotypical** children (Choi et al., 2019; Heymann et al., 2018; Özçalışkan et al., 2018; Paradé & Iverson, 2015; Talbott et al., 2018).



Background

➤ J Am Acad Child Adolesc Psychiatry. 2010 Mar;49(3):256-66.e1-2.

A prospective study of the emergence of early behavioral signs of autism

Sally Ozonoff ¹, Ana-Maria Iosif, Fam Baguio, Ian C Cook, Monique Moore Hill, Ted Hutman, Sally J Rogers, Agata Rozga, Sarabjit Sangha, Marian Sigman, Mary Beth Steinfeld, Gregory S Young

- EL vs LL children (6-12-18-24-36 months).
- Frequency of co-occurrences of gaze to partner and social smile, and gaze to partner and vocalizations.
- Mullen Scales of Early Learning (MSEL).
- EL (ASC) redcted coordianted communicative behaviour (from 12/18 months).

➤ J Autism Dev Disord. 2014 Jun;44(6):1414-24. doi: 10.1007/s10803-013-2002-9.

Joint attention initiation with and without positive affect: risk group differences and associations with ASD symptoms

Devon N Gangi ¹, Lisa V Ibañez, Daniel S Messinger

- EL VS LL children (8-10-12 months).
- Early Social Communication Scale (JA).
- Analysis of gaze-smile coordinations during joint attencion.
- EL children shown less gaze-smiles coordinations during joint attention.

➤ Int J Lang Commun Disord. 2018 Sep;53(5):1007-1020. doi: 10.1111/1460-6984.12418. Epub 2018 Aug 5.

Coordination is key: Joint attention and vocalisation in infant siblings of children with Autism Spectrum Disorder

Perrine Heymann ¹, Jessie B Northrup ¹, Kelsey L West ¹, Meaghan V Parladé ², Nina B Leezenbaum ³, Jana M Iverson ¹

- 50 EL children, aged 14-18-24 months (EL-ASC, EL-no ASC).
- Joint attention behaviors (pointing, showing, eye contact), speech and speech-joint attention coordnations.
- EL-ASC children shown less joint attencion behaviors and less coordnations with vocalizations than EL-noASC children.



Background

> [Dev Psychol.](#) 2013 Oct;49(10):1931-42. doi: 10.1037/a0031061. Epub 2012 Dec 10.

Spontaneous initiation of communication in infants at low and heightened risk for autism spectrum disorders

Breanna M Winder ¹, Robert H Wozniak, Meaghan V Parladé, Jana M Iverson

- 15 EL children vs 15 LL children (13-18 months).
- Naturalistic interactions at home.
- Gesture-speech integrations.
- EL children shown less gesture-vocalization integrations than LL children and less gesture-word integrations at 18 months.

> [J Autism Dev Disord.](#) 2015 Jul;45(7):2218-34. doi: 10.1007/s10803-015-2391-z.

The Development of Coordinated Communication in Infants at Heightened Risk for Autism Spectrum Disorder

Meaghan V Parladé ¹, Jana M Iverson

- 9 EL-ASC, 13 EL-LD, 28 EL without diagnosis.
- Naturalistic play interactions at home (from 8 to 18 months).
- Gestures, speech, gaze to partner, smiles and their coordinations.
- EL-ASC children develop the ability to coordinate gestures and speech more slowly compared to the EL-DD group and the undiagnosed EL group.
- EL-ASC developmental trajectory diverges increasingly from that of undiagnosed EL children starting at 12 months.

Background

➤ [J Autism Dev Disord](#). 2021 May;51(5):1528-1539. doi: 10.1007/s10803-020-04637-7.

Multimodal Communication in Children with Autism Spectrum Disorder and Different Linguistic Development

Eva Murillo ¹, Lourdes Camacho ², Ignacio Montero ³

- 11 ASC (28-79 months) vs 11 NT (12-30 months) (matching: expressive vocabularies).
- Semi-structured interactions with examiner.
- Analysis of gestures, speech, eye contact and their combinations.
- ASC and NT children with same language profile don't diverge for gesture-speech integrations, but for gesture-gaze integrations.
- ASC children coordinate 3 modalities less frequently than NT children.

➤ [Autism Dev Lang Impair](#). 2022 Sep 1;7:23969415221121089. doi: 10.1177/23969415221121089. eCollection 2022 Jan-Dec.

Coordinated social communication in toddlers with and without autism spectrum disorder during a home observation

Abigail Delehanty ¹, Amy M Wetherby ²

- 211 children: ASC vs DD and NT (mean age: 20.3 months)
- Communication and symbolic behavior scales behavior sample (CSBS).
- gestures, speech and gesture-speech combinations.
- ASC and DD produce less overall communicative acts than NT.
- ASC children show less speech and less gesture-vocalization integrations than NT and DD.
- ASC and DD children show less gesture-words and gesture-phrase combinations than NT.

➤ [Autism Res](#). 2010 Dec;3(6):311-22. doi: 10.1002/aur.159. Epub 2010 Dec 9.

Conversational gestures in autism spectrum disorders: asynchrony but not decreased frequency

Ashley de Marchena ¹, Inge-Marie Eigsti

- 15 ASC vs 15 NT (mean age: 15 years).
- Temporal synchrony between gestures and speech during narrative task.
- Gestures in ASC group are less synchronized with speech than in NT group.

Research gap



Explore multimodal communication in young diagnosed autistic children.



Investigate experimentally multimodal behavior in naturalistic interactions with micro-analytic methods.

Goals

To explore the **integration of gesture with gaze and speech** and their **temporal dynamics** among very young **autistic** children compared to **neurotypical** peers during **naturalistic parent–child interactions.**



Method

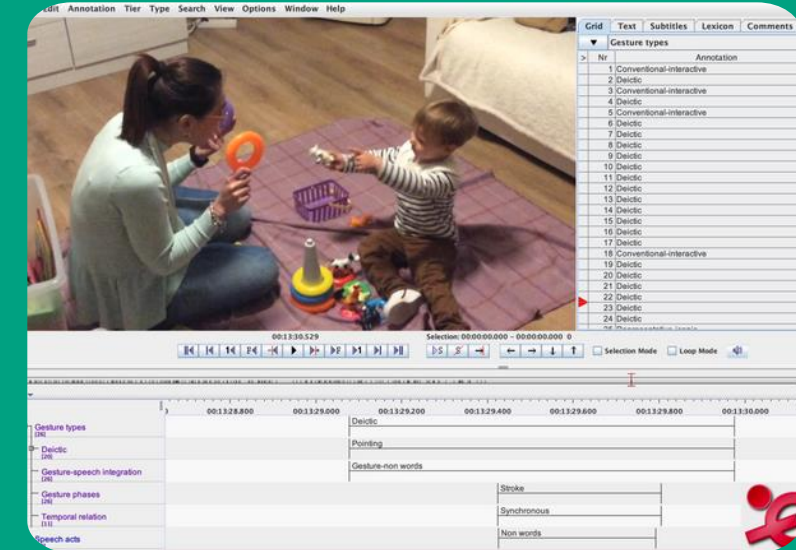


30 Autistic
28 Neurotypical

ASC Mean Mental Age
21.4 months
NT Mean chronological age
20.3 months



Parent Child
Interactions



Digital manual
coding

Results...

STAY TUNED!



Take home messages



**Timely
detection**



**Peculiarities in
communication
profile**



**Neurodivergent
approach to
interventions**

Take home messages

Safari File Edit View History Bookmarks Window Help

https://www.instagram.com/reel/DPLPKRpkxoM/?igsh=NnFxandmYzZ4MDFm

Favourites

Apple iCloud Yahoo Bing Google Wikipedia Facebook Twitter LinkedIn The Weather Channel Yelp TripAdvisor

Suggestions

Fogli Google
docs.google.com
10 months ago

Privacy Report

Last 30 days

Trackers prevented from profiling you
1

Websites that contacted trackers
50%

Most contacted tracker
googleadservices.com was prevented from profiling you on one website

Show More Edit

Safari prevents trackers from profiling you.



**Thank's for
your attention!**

agrippina.campisi@phd.units.it