UNIVERSITY OF PADOVA

Department of General Psychology

Bachelor's Degree Course in Techniques and Methods in Psychological Sicence

Final dissertation

REDEFINING AUTISM NARRATIVE. GAIA'S RESPONSE IN THE ANTHROPOCENE.

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Academic Year 2023/2024

INDEX

PERSONAL MESSAGE

When four years ago autism forcibly caught my attention, my head was reasoning with a deficit perspective, while my heart was beating for solutions in a silent fight with this condition. Then a long journey started, still ongoing with its unknown ports, where I learnt that there is more than a way in doing things. I thank my professors and my colleagues for having shared the first three years in a stimulating environment, which contributed to opening my eyes.

I thank my mentor for the continuous support and guidance as changing perspective comes at a cost. Above all, as the light shining in my darkest moments, I thank Shams, Ayaan Noah and Ilyas, the three constellations that accompanied me in the long and solitary nights writing this thesis.

ABSTRACT

In the first two parts of this essay history, features, approaches, and current treatments are analysed for the clinical condition defined as autism spectrum disorder. The last part is an intersectional and multidimensional approach with emerging perspectives trying to redefine the dominant narrative on autism. A new embryo proposition, the Ilyas Hypothesis, is introduced as a first step to address research and studies in the future.

INTRODUCTION

The concept of autism was first utilized in the scientific community by psychiatrist Eugen Bleuler in 1911 to describe a severe behavioural withdrawal condition in schizophrenia. The word originates from the ancient Greek language "autós", meaning "self". Only in the 1943 psychiatrist Leo Kanner offered a systematic description of infantile autism within the realm of psychopathology, while in 1944 pediatrician Hans Asperger described a similar condition later named after him (Baron-Cohen, 2015).
In 1967 psychologist Bruno Bettelheim theorized the psychogenesis of autism as the consequence of unloving and/or threatening parents with the introduction of the (disgraced) concept of "refrigerator mother". The perspective was widely shared by main psychoanalysts such as Kanner, Mahler, and Klein. Bad parenting style was seen as the factor causing the child to escape and find shelter into an "empty fortress", in isolation with the surrounding environment and with deleterious developmental consequences (Mitzi M. Waltz, 2015). Since then, the exponential increase in incidence of the condition went side by side with growing attention and consequent research both from the scientific community and clinical professionals. This involved contrasting approaches not free from an intense debate. The same conceptualization of autism evolved over time in diagnostic manuals: in the (American) Diagnostic and Statistical Manual of Mental Disorders (DSM) from its first appearance in its third version (1987), throughout to the fourth edition (1994) and up to the latest fifth version in 2013 autism labelling changed. It is now associated to the notion of spectrum, merging under a common umbrella previously independent conditions (Volkmar & Reichow, 2013). The same path is seen in the International Classification of Diseases (ICD) of the World Health Organization.

At the end of the XX century, the rise of (autistic) advocacy movements lobbied the change of paradigm for autism with the emerging trend of (neuro) "diversity" against "deficit", shaping a more dimensional perspective compared to the biomedical categorial approach.
Two key words are purposely included in the title of this thesis, from the same etymological root of autism:

-***Gaia:*** in the ancient Greek's mythology, it represents the personification of Earth as a living entity, interconnecting all biodiverse entities. The term has been also used scientifically for the Gaia Hypothesis, basically considering Earth as functorial self-regulating system (Boston, 2008).

-***Anthropocene:*** combining the origins of the Greek words "human" and "recent", it characterizes the current age where humans influence, dominate and impact the geology and the eco-system(s) of our planet with catastrophic scenarios on climate change, biodiversity survival, and surface alterations due to pollution, destructive weapons, and resources exploitation (Lewis & Maslin, 2015).

I use interchangeably the wording autism spectrum disorder (ASD), autism, and autistic. The terminology "disorder" is mentioned to refer, explain and discuss the biomedical (and society) approach to the condition, along to reporting the official designation adopted by the diagnostic manuals. At no point the term "disorder" reflects my opinion and conceptual view on autism. I regard at autism as a full potentiality, marked by individual differences in the same features that I can see in the "general population". It is not an innate subjective problematic facet, rather the objective consequence of the dominating systematic mainstream of the society.

PART 1: AUTISM SYMPTOMS, COMORBIDITY, PREVALENCE AND APPROACHES

The Autism Spectrum Disorder is classified as a neurodevelopmental disorder. It is a life-long condition with an early onset, bypassing the previous conception of infantile autism in the '80s. Despite signs can be visible starting from the first six months of life, clinical diagnosis tends to be given from the age of two years and in majority of the cases starting from 36 months. The recent introduction of the umbrella term "spectrum" – at the end of the '90s in the DSM-IV - indicates not only the inclusion of a variety of previously distinct conditions – specifically Autistic Disorder, Asperger Syndrome, Rett Syndrome, Childhood Disintegrative Disorder; Pervasive Developmental Disorder Not Otherwise Specified –, but mainly the recognition of its heterogeneous feature and different multifactorial manifestation across two dimensions: individual differences and lifespan.

In the scientific literature, ableism is often detectable with dehumanizing and objectifying approaches toward the autistic population (Botha & Cage, 2022), which is stigmatized compared to allistic individuals.

The clinical core symptoms of autism are impairments in the dimension of social cognition, specifically social reciprocity, communication, and stereotyped behaviour. Symptoms refer to the following broad categories which can be (or not) concurrent at different levels and degrees:

a) **Communication:** autistics struggle with communication and gaze-contact. While they can manifest even higher levels of eye-contact to an object of interest, they rather tend to avoid gaze-contact in a direct interaction with other people. The acquisition of language abilities is delayed and/or impaired. Throughout life, autistics can remain non-verbal, partially verbal, or even become fluent, but not always in a functional way with the manifestation of repetitions and echolalia. The condition somehow resembles also the Developmental Language Disorder (DLD), but for long the scientific mainstream considered autistics struggling also in implicit communication with limits in recognizing other's thinking and facial expressions.

b) **Behaviour:** individuals in the autistic spectrum exhibit repetitive behaviour and limited interests, referred as rigid. In childhood it encompasses also the developmental learning dimension of abstract playing, usually displayed in non-autistic children from the age of four years, resulting in a deficit for understanding and engaging in simulative games.

c) **Attention:** autistic demonstrate a deficit in sustained and divided attention when interacting with relevant others. This is not referred to self-initiated attention for objects or details, rather to the social dimension and exchange dimension.

d) **Cognition:** the cognitive dimension offers a broad interpretation. The main (cognitive) function that appears compromised is the flexibility, impacting the area of multi-tasking activities. While in the last two decades research pointed out that intellectual disability is highly associated with autism with rates up to 75% (Stoppelbein et al., 2005), autistic people can display exceptional capabilities in specific skills, referred as savant abilities.

e) **Sensory-Motor:** displayed in a variety of degrees and forms, autism is associated with stereotypes in motor manifestations – such as hand-flapping, running in circle or back and forward –, in oral features – humming, echolalia, repetitive questions – and in severe cases of self-injurious actions – like biting and head banging.

Scientific literature reports high concordance rates of comorbidity for individuals within the spectrum compared to the general population (Rasmuson, 2022). The variety of concurrent clinical conditions complicates the heterogeneity nature of autism and increased questions rather than easing answers, both in academic and clinical settings. In a main panoramic overview, autism spectrum disorder is positively associated to ***genetic disorders*** like X Fragile, Duchenne Muscular Dystrophy, and Tuberous Sclerosis Complex; ***neurological conditions*** such as Hydrocephalus, Epilepsy (from adolescence), Cerebral Palsy, Hemicrania; ***physiological constrains*** in Gastrointestinal Anomalies, Metabolic Issues, Sleeping Problems, Diarrhea, Constipation; and ***psychiatric and psychological states*** of Anxiety, Obsessive-Compulsive disorder, and eating disorders (Al-Beltagi, 2021).

Autism is a cross-cultural condition with geographical global incidence (Kang et al., 2023). While some of its manifestations, like shyness, can be differently evaluated in distinct cultural contexts, generally referred as collectivistic or individualistic societies, the initial belief of the ‘50s and ‘60s that it was exclusive to specific ethnic groups (white people) with defined socio-economic background (middle working class) is nowadays widely rejected. Fresh data in the USA showcase broad ethnic incidence also among Hispanic and Black ethnicities (Mandell et al., 2009). Diagnostically It affects more boys than girls in a ratio ranging from 3:1 to 4:1, but the perspective of a male based condition is slowly changing with the emerging consciousness of a previous gender-biased approach that did not recognized the female autistic phenotype (Brickhill et al., 2023).

The interesting point is the prevalence. If Autism was considered a rare disorder up to the '80s, affecting approximately 4/100,000 children, in just a decade ('90s) statistical data reported an increase to approximately 60/100,000, spreading the fear of an autism epidemic (Graf et al., 2017). According to the US Autism and Developmental Disabilities Monitoring (ADMM) of the CDC network (Centers for Disease and Control and Prevention), a US public organization collecting scientific data on health-related topics, the prevalence in the USA for Autism Spectrum Disorder diagnoses jumped from 1/150 children in 2000 to a staggering 1/36 children in 2020 (www.cdc.org ; Surveillance Summaries, Autism Data & Statistics, 2023). The World Health Organization in 2023 estimated that 1/100 children have autism worldwide (www.who.int ; Autist Spectrum Disorder). Worldwide statistical data differs based on the source and the year; however it is clear the higher prevalence in developed western countries, with the United Kingdom topping the list. Arabian Gulf states (Qatar, Saudi Arabia, and the United Arab Emirates) exhibit a substantial increase in diagnosis, making them among the highest countries in the ratio citizens/diagnosis. Developing countries reports least numbers, in all probability due to the lack of resources. Remarkable as a global example with the highest living standards for autistics is the case of Taiwan, a collectivistic developed country, reporting among the lowest autism rates in the world: in 2015 the country introduced an ad hoc legislation with regular screening for all preschool children and, in the presence of core symptoms, the provision of evidence-based interventions and inclusive policies. The global "burden" of autism with a narrow approach is believed to stand at 168 million (www.wisevoter.com; country rankings/ autism rates by country). Tracking country-prevalence data is by default biased for three main reasons:

1) Lack of standard criteria and procedure for diagnosis, based on clinical observation
2) Lack of standard equal and available resources among countries
3) Lack of data centers in many (developing) countries

It is widely recognized that higher public awareness, the widening of the diagnostic criteria in health systems, better facilities and higher availability of clinicians contributed to the increase of autism diagnosis (www.autismspeaks.org) – especially in the so-called developed part of the world. Nonetheless, the "dramatic" increase and the collective financial burden for social systems may lead to different interpretations.
Over the decades, the scientific community clustered itself in the historical debate between nature and nurture in the etiology of autism. While symptoms have been widely agreed, a clear identification on what causes autism is still unknown. The main thesis is that it is developed in pre-natal and early peri-natal critical periods. Alongside the biomedical genetic approach that led the research trajectory throughout, a variety of other research-lines are still under attentive lens:

1) **Genetic approach:** investigation in this realm has been important, but without any definite and concrete achievement. Research focused on twin and family studies. Examination of monozygotic twins diagnosed with autism reported concordance rates of up to 90%, but only considering a wide definition of the condition, while reporting much lower concordance rate with a narrower interpretation (36%). Concordance for dizygotic twins in comparison is at 10% in the wider spectrum angle and drops close to zero with a stricter approach. Family studies focusing on siblings report a range between 2% to 6%, which is still approximately ten times higher compared to the general population. Despite the time and funds allocated to the genetic research, the effort to identify a specific gene responsible for the onset of autism proved unsuccessful up to now, with only a time-limited optimism on the chromosomes 2q, 7q,15q (Frith & Happé, 2005). The current dominant perspective, as in other conditions, is that a network of genes (polygenes) co-occur in the genetic predisposition to the autism spectrum.

2) **Anatomical approach:** the focus on brain origins led to some important findings with strong positive association rates in the size and weight of the brain, which is bigger and heavier in autistic individuals compared to general population. The weak part of the approach is that this condition appears not to be exclusively linked to autism and that the difference is not at birth, but rather developed during childhood. The resulting emerging consensus is that the larger and heavier brain could be due to a deficit in the pruning process of neuronal connections during critical periods from late adolescence.

3) **Biological Approach:** it directed its attention to the roles of main neurotransmitters (Gaba, Glutamate, Dopamine) and neuromodulators with focus on the mesolimbic dopamine system, the endogenous opioid system and the role of Oxytocin and Serotonin in the association of autism with affective disorders (Rapin, 1997). An important parallel environmentally oriented research pointed on teratogens, responsible for the chemical and/or physical alteration of developmental processes (Arndt et al., 2005). In this specific area of epidemiological studies, it is relevant the action and influence of five specific environmental toxic agents in specific critical timeframes of embryogenesis and perinatal period, which is generally identified from the twentieth week of gestation up to the fourth week of infancy. These teratogens are Maternal Rubella infection (Chess, 1971), Ethanol (Nanson, 1992), Misoprostol (Bandim et al., 2003), Thalidomide (Strömland et al., 1994), and the Valproic Acid (Moore et al., 2000) that has been widely used in animal models with rodents and proved its toxicity for mental development (Lotufo Denucci et al., 2021). The environmental approach included also the role of influenza viruses and substance abuse during pregnancy.

4) **Neurological Approach:** the advance in neuroimaging techniques permitted to identify integrity and interconnectedness of brain areas relevant to social cognition. In particular, the network of the medial prefrontal cortex, the temporal poles and the superior temporal sulcus, through functional imaging (fMRI), highlighted lower arousal in individuals diagnosed with autism in comparison to control groups. The findings led to the hypothesis of hypo or hyper connectivity issues in autism in the left-brain hemisphere involved in language and communication proficiency. These considerations have been supported also by structural imaging (X-rays and MRI) in the presence of larger brain size, that could validate the double-face abnormality in autism with specific cognitive strengths and wide weaknesses. The neurological approach focused also on the mirror neuron system, reporting lower firing levels in autistics with direct consequences on imitation-learning systems and deficits in empathy and social cognition. The neural network connectivity dimension is currently regarded as a valid and supporting element in explaining the heterogenic manifestation in autism (Vivanti & Rogers, 2014).

The different approaches testimony the existing debate in addressing genetic or environmental triggers, a tendency not limited to the etiology of autism. The "silent explosion" in autism incidence challenged the historically dominant genetic-paradigm (*Michael Szpir, 2006*), and the consensus is moving toward a mixed-approach integrating genetic predisposition and the environmental dimension. The Thimerosal Hypothesis, addressing the roles of vaccines as cause of autism for the presence of the mercury derivate, is still a quite complicated issue, radicalized by public debate and media cover: scientific research tends to discharge the direct association of thimerosal to autism (Hurley et al., 2010), nevertheless mercury and lead are regarded as human teratogens and current policies refrain their use in new vaccines.

A substantial contribution in the relationship brain-behavior in autism and its inner mechanisms is given by the (neuro) cognitive approach, with three main theories – the Theory of Mind, the Theory of Central Coherence, and the Theory of Executive Dysfunction (Hill & Frith, 2003). Their approach to autism moves beyond anatomical and genetic perspectives: they are built on the development of neurosciences supported by technical and methodological improvements. The three theories are not mutually exclusive (Kimhi et al., 2024) and introduce the potential existence of a broader cognitive phenotype in autism features extended to relatives of diagnosed individuals (Bailey et al., n.d.). One of the main characteristics of autism, as previously mentioned, is the heterogeneity of the disorder. Not only Individuals display differently types and intensity of symptoms, but behavioral criteria evolve in the same individual over lifespan, with a current lack of large longitudinal cohorts in scientific literature. A brief overview of the theories' main concept is offered hereby:

- **The Theory of Mind (TOM)** was initially introduced by Premack and Woodruff in 1978 and it developed subsequentially to address the deficit of social cognition in autism. Social cognition is regarded as the composition of two main distinctive features, the hot processes (emotion recognition and empathy) and the cold processes (understanding other's mental states, the proper theory of mind). Baron-Cohen designed the Sally-Anne test (Baron-Cohen et al., 1985) adding later in 1997 – and revised in 2011 - the Reading the Mind in the Eyes test (RMET) (Baron-Cohen et al., 2001). Adopting neuroimaging techniques, he proved evidence for less activation of brain regions involved in mentalization in autistic individuals compared to a control group. The theory is also referred as mind-blindness and mentalization-failure to indicate the struggle of autism in understanding other's mental states from implicit bodily cues. The lack of activation of specific brain regions is interpreted as a lack of interest in social cues, or a resting state in socially dedicated brain networks. Baron-Cohen developed a second theory to address the non-social features of autism such as narrow interests and repetitive behaviors. The two-factors theory named Systemizing-Empathizing Theory pointed at the autistic brain's drive to recognize and relate to predictable patters rather than uncertainty, with specific and enhanced attention to details. The theory links to the "male-condition" of autism conceptualized by the Extreme Male Brain Theory, differentiating the female brain as performing better in empathizing compared to the male brain based on a systemizing approach (Baron-Cohen, 2009).

- **The Central Coherence Theory** was introduced by Uta Frith in 1989, in her famous book "Autism: Explaining the Enigma". It centers on the ability of an individual to assign a general overall meaning to a series of details available in the surrounding environment. In a strong coherence status, an individual would look at the main feature or integrator with a global processing, while in a weak coherence – associated with autism – the attention would be more on the singular and minimal components with emphasis on local processing (Ferderer, 2012). The theory aims at explaining the savant abilities, found in 10% of the autistic population, but also exclusive domain of autistics. Since the time of Leo Kanner, the symptom described as "insistence of sameness", recognized also the potential of exceptional factual knowledge and attention to details in autistics. The underlying concept is linked to the bottom-up and top-down attention-module: in individuals with strong coherence the top-down voluntary input influences the environmental stimuli by creating a general meaning or "gist". In the weak coherence condition, the bottom-up elements are more salient than the global shape.

- **The Theory of Executive Dysfunction**, proposed in 1996 by Pennington and Ozonoff, addresses the rigidity and perseverative behavioral traits in autism in terms of deficit in the initiation of new behavior and abstract thinking. Executive functions is an umbrella term comprising cognitive skills such as

planning, inhibition, multi-tasking (shifting set) believed to be originating in the prefrontal cortex (Hill, 2004). The approach is based on neuropsychological tests for neurodevelopmental disorders to support its arguments, such as The Tower of London developed by Shallice for rigidity, and the Wisconsin Card Sorting Test by Grant for perseveration. The weakness point of the theory is that deficits in executive functions are common also to other clinical conditions within and beyond neurodevelopmental disorders, like in the presence of brain injuries.

The current ongoing debate on autism treatments took shape in the 90s, in combination with the higher incidence rate of the condition, the increased public awareness, and the contrasting perspective to regard autism as a disorder or a (neurological) difference (Rudy, 2023).

While the effort to understand the etiology of autism has not provided any definite clarification, research on core symptoms developed a multimodality of treatments mostly to "influence" second symptoms. These approaches, sometimes without clear distinctions, have been proposed focusing on a variety of aspects and targeting separately - or in combination - the physiological and psychological spheres of autism. An overview on diagnostical practices and autism treatment interventions is treated in the second part of this thesis.

PART 2: AUTISM DIAGNOSTIC PROCESS AND TREATMENTS

Autism is a non-reversable condition throughout life, but with different outcomes based on environmental and protective factors (Provenzi et al., 2023). Despite the term "cure" is still widely used in academic and clinical settings often just as a "habit", my personal position is in line with the main proposition of the autism advocacy movements and the (slowly) public emerging trend: a treatment does not exist in the perspective of changing "divergency" into "normality", and a cure in literal meaning is not needed because autism is not an illness (www.autisticadvocacy.org) .

Autism is characterized by a lack of a standardized diagnostic process for healthcare professionals. The norms for the evaluation of the three core dimensions affected in the autism spectrum disorder - communication, behaviour, and sociality as reported in the DSM and ICD manuals - are not supported by a standardized clinical approach with shared clinical tests and procedures. In developed countries, at an intra-regional and socio-economic level, and in developing countries, at a nation-wide level, caregivers still face limitations such as the lack of trained clinicians and specialized infrastructures (Samadi, 2022). Further burdens are the lack of financial aid for costly one-to-one treatments and the cultural differences in the dimension of sociality, which is regarded differently in the classical artificial dichotomy "collectivistic East – individualistic West", still undeterred by the globalization process (Bernier et al., 2010).

The nosology of autism is at discretion of the clinician in the specific context, and the process is even more difficult in the early onset, when the communicative barrier challenges the direct patient-practitioner relationship requiring the involvement of relevant others (Fisch, 2012). A (good) recommended practice referred as "developmental surveillance" (Blenner et al., 2011) consists in understanding the developmental history of the child in the environment, inclusive of educational, family and peer-settings. Background information is analysed through:

- Medical history: to pinpoint the presence of any comorbidity.
- Family history: to recognize genetic &/or environmental connections.
- Educational history: to evaluate the performance and sociability of the child.

In the absence of a unified protocol, ***physiological screening*** - including head size measurement with neuroimaging techniques (if available) – and, most importantly, the **behavioural observation** of core symptoms accounts for the screening of the condition. Within 30 months of age, important features are language fluency, vocabulary comprehension, gaze-contact, behavioural repertoire, and the pretend

dimension. The entire process is better optimized in sustaining the child holistically when an interactive and communicating multidisciplinary team is involved, with the triad formed by the clinical component (infantile neuropsychiatric, pediatrician, psychologist, and therapists), caregivers, and educational professionals (pedagogists, teachers). The role of the caregiver(s) is central and of primary importance in mediating among the dimensions of the child, acting as connector and stimulator, two essential ingredients in addressing social cognition. Multiple screening tests are used to picture the cognitive heterogeneous condition of the individual with no test having a definite diagnostic value. They are rather used in support of a diagnosis either prior or post formalization. Criticism about tests pointed at reliability for the lack of updated normative data, and validity in terms of cross-cultural adaptation, sensitivity, specificity, and accuracy (Hus & Segal, 2021). The test selection is usually the combined result of patient age, culture, environment, and practitioner's knowledge. The methodology involves specific activities, sometimes time-framed, based on (old) normative data and/or just self-report questionnaires to caregivers and, when effective, to the patient. The preponderance of a toddlers-centric nature among the evaluative tests originates from the co-occurrence of different justifications such as the recent development of assessment parameters, the neoteric spread of public awareness, the developmental nature of autism, and the tendency of adults to mask autistic traits to avoid stigmatization. Despite a potential cultural-bias, the following tests are among the most used and with higher replicative validity (Thabtah & Peebles, 2019):

- ITC: **Infant Toddler Checklist** (Wetherby & Prizant, 2002). It is questionnaire for caregivers of children between 6 to 24 months. Part of a battery of tests targeting also symbolic behaviour, it focuses on the communicative dimension, not exclusively for autism.

- CHAT: **Checklist for Autism in Toddlers,** later modified in M-Chat, (Robins et al., 2012). It is a questionnaire focusing more on the psychological dimension and the risk factors of autism. It is for children aged 18 to 24 months and the answers are filled by caregivers and a healthcare professional following the child.

- STAT: **Screening Tool for Autism in Toddlers and Young Children** (Stone et al., 2000). It is an interactive set of twelve activities for children between 24 and 36 months of age. It is based on the analysis of empirical data screening the play dimension, the communication and the imitation.

- SCQ: **Social Communication Questionnaire,** originally known as ASQ – Autism Screening Questionnaire when developed in 2003 by Rutter, Bailey & Lord (Snow, 2013) . It can be applied to children from the age of four years and above, including adulthood. It is a 40-items questionnaire

covering communicative skills in social setting and it has two versions: the Current focusing on the 3 months prior to the test, and the Lifetime version. It can be filled in a yes/no response format by the caregiver or the patient.

Synthesizing in pills the methodological and management parameters of autism in terms of diagnosis, it can be highlighted:

1) Earlier diagnosis and intervention is a supporting factor in the prognosis.
2) Intensive, structured and personalized treatment is positively associated to better outcomes.
3) Low ratio therapist/patient improves advantages in achieving targets.
4) The Importance of coordination over life-settings (family/education/clinical)
5) Loving, solicitous, and responsible caregivers make the difference.

Detecting the most suitable treatment is a difficult step for (conscious) caregivers, involving an intersectional combination of more variables: effectiveness (based on autism heterogeneity), length, intensity, cost, side effects and availability of practitioners in the specific context (Ozsahin et al., 2021). When interacting with an autistic, there are some blueprints that have been identified positive for the development of social and communicative abilities, both explicit and implicit (www.autismspeaks.org):

- Interaction is in any dimension and with any activity, from playing to sociality and traveling.
- Imitation and modelling approaches of the positive interests/behaviors (non-verbal communication).
- Sustaining direct eye-contact, in space and time, as a form of communication.
- Simplicity and clarity in verbal communication opportunities.

It is important to follow the autistic interest and to engage in the type of communicative narrative initiated, rather than forcefully manipulating it. With the continuous advancement in information technology communication (ITC), assistive devices for augmentative and alternative communication (AAC) should not be underestimated, mostly in the presence of non-verbal autism: they do not replace verbal communication, they rather support the development of new skills, motivation, sustained and shared attention (Syriopoulou-Delli & Gkiolnta, 2022). Meanwhile historically the dominant perspective was to classify autism as a medical condition, majority of symptomatology treatments are based on educational techniques, while medication is limited to the management of secondary co-occurrent symptoms. Educational treatments target behavioral and cognitive abilities of autistic individuals. There are multiple not mutually exclusive approaches, sharing the objective of improving functionality and quality of life. Core symptoms are usually treated in structured environments with systematic activity planning and a methodology involving data collection. It is possible to combine different treatments across the variety of contexts involving child (home, community and educational

setting). Despite some intervention can be parent-mediated, the availability of highly trained and dedicated therapists acting under the supervision of a psychologist is a key value.

The main ***educational treatments*** are:

- **ABA – Applied Behavioral Analysis** is an intensive, highly structured, behavioral approach, varying in terms weekly hours and length. It targets behavioral and learning skills, identifying the antecedent and the consequence of a specific behavior. The focus is to expand from limited and repetitive behaviors, supporting the desired outcome with positive reinforcements selected based on individual preferences. The technique gratifies the attainment of a specific target with a personalized token economy (rewarding system). ABA is a strictly based scientific approach with the collection and analysis of data. It is performed in two settings: the first, referred as Discrete Trial Setting (DTT), involves at home or in clinic table-based activities, which are broken in simple parts with step-by-step instructions; while the second is called Pivotal Response Training (PRT), or simply Natural Environment Teaching (NET), providing an intervention in a less structured context of real-life settings, also outdoor where existing pivotal skills in behavior and sociality are developed into new acquisitions. The two methodologies can be combined and depend on the personalized approach. Evidence favors an initial consistency of DTT, followed by generalization in NET. ABA is currently the most validated approach with long-term benefits (Tiura et al., 2017), mostly when started at an early age with a minimum of six hours per week for at least two years.

- **CBT – Cognitive Behavioral Therapy** builds on the behavioral approach adding the cognitive component in emphasizing the relationship between the therapist and the patient to improve functionality and quality of life. It is a more psychological approach, requiring the presence of patient communication skills and cognitive maturity usually achieved in adolescence. It cannot be implemented in the most severe non-verbal cases of autism. CBT proves positive results also for the co-occurring psychiatric conditions of depression and anxiety with the practitioner's guidance in re-appraising the thinking process.

- **TEACCH – Treatment and Education of Autistic and Communication Handicapped Children** is an educational approach of structured teaching, conceived for the classroom-style setting. The fundamental idea is that autistic children excel in consistency and visual learning. The methodology is to guide educators in the setting of the learning environment to achieve better outcomes, enhancing the displaying of written lists &/or activity-drawings. Visual signs are combined with verbal

instructions to bridge the gap of verbal and non-verbal abilities, favoring the acquisition of new skills in a more inclusive environment.

- **ESDM - Early Start Denver Model** is a technique conceived for the first stage of the developmental approach, directed at children in the range of 12 to 48 months. It is based on the behavioral principles of ABA, where relevant others – caregivers, therapists and teachers –utilize play and social exchanges to improve shared attention, reducing gaps in communication and sociability. It is usually but not exclusively in natural settings.

- **SLT – Speech and Language Therapy** targets the second stage of the developmental approach when the child grows. It accentuates the areas of comprehension and the use of personalized communication tools, either verbal or non-verbal such as signs, gestures, picture exchange communication system, and tailor-made communication devices.

- **OT - Occupational Therapy** represents the third and last stage of the developmental approach targeting adulthood everyday skills for adequate, qualitative and independent living such as dressing, eating, bathing and relating to people. OT includes the Sensory Integration Theory for disruptive sensory inputs, largely experienced in autism and the Physical Therapy (PT) directed at more physical skills of fine movements and body coordination.

- **SRT - Social Relations Treatments** are a group of techniques focusing on social skills and emotional bonds, usually involving parents and peer-mentors. The principle is to improve the collective dimension of autism. The Floor-Time (FT) is a relationship-based approach prioritizing the individual interest and stimulating communicative opportunities. The Relationship Development Intervention (RDI**)** is a model based on favorite activities to motivate participative interest in social interactions. Other techniques are Social Stories and Social Skills Groups, where (respectively) the participant is provided with descriptions and notions on what to expect from social interactions, alongside opportunities to practice social skills in structured group environments.

In the last two decades, the surge in autism diagnosis and public awareness, led to the introduction of wide and new approaches to autism, expanding beyond existing categories. They are generally referred as **Complimentary & Alternative Medicines (CAMs**) for children and adults alike. These methods range across a variety of dimensions, from sport to relaxation techniques, casein-free and ketogenic diets, swim-therapy, and treatments with natural or biological products. Specific therapies such as music therapy and keta

therapy play a role in reducing problematic and repetitive behaviors: a specific experiment (Bahrami et al., 2012) put forward that the autistic child uses self-stimulation as compensatory way to restore sensory homeostasis. The practice of structured activities involving movement - such as keta techniques in martial arts, but also playing musical instruments - provide enough arousal to replace endogenous stimulation. Another study in autistic children (Zoccante et al., 2021) highlights the beneficial effect in improving adaptive behavior and motor functioning in equine-assisted activities and therapies (EAAT), but simultaneously highlights the lack of effect in reducing parental distress. The growing interest surrounding these new approaches encounters the precautionary openness of healthcare professionals when combining them with educational treatments. It is anyway always suggested to include CAMs following medical consultation, specifically when involving the intaking or refraining of specific dietary products.

The proper medical treatment consists in the doctoral prescription and supervision of ***drug treatments***, targeting mainly non-core autism symptoms related to co-occurring conditions such as anxiety, seizures, depression, and dysregulation in circadian rhythms. They are never prescribed before adolescence, and they serve the functional objective of inhibiting self-harming behaviors improving mood and energy levels. While healthcare professionals highly suggest early educational treatments for all autistic individuals, the heterogeneity of symptoms manifestation increases adaptability struggles making pharmaceutical approaches limited to a part of the autistic population. In addition, placebo effects need to be monitored in the caregivers' perception with cascading consequences on their behavior and on the behavior of the autistic patient (Sandler, 2005). Only in the last two decades, the Food and Drug Administration (FDA), the authority in charge of the public health in the USA, authorized the use of two antipsychotic drugs of second-generation – which did not improve side effects manifested in medicines of the first generation:

1- **Risperidone** has been introduced since 2006 to treat aggressiveness, hyperactivity, and irritability. It blocks dopamine and serotonin receptors in brain circuits. Risperidone is regarded as a safe medication, but it also leads to a range of adverse side effects such as weight gain, fatigue, dizziness, constipation, and diarrhea.

2- **Aripiprazole** has been added in 2009 and it acts atypically as agonist at pre and postsynaptic dopamine receptors (D2) and serotonin receptors (5HT1A), and as antagonist for serotonin receptors 5HT2A. Its efficacy is on irritability and hyperactivity, but studies demonstrated (Zhang & Stackman, 2015) mild improvements in speech and sociality due to the action on the widely distributed serotonin receptors, essential for learning and social cognition. Aripiprazole is not free from negative side effects, similarly to Risperidone, and can cause somnolence, sedation, weight gain, vomiting, and diarrhea.

3- **Methylphenidate** and **Atomoxetine**, already in used for Attention-Deficit/Hyperactivity Disorder (ADHD), have been introduced in treating specific autism effects like inattention, hyperactivity, impulsivity, and repetitive movements with positive results, mostly for Methylphenidate (L Eugene Arnold, 2012). They do anyway present also adverse side effects manifested in combination or at singular level like decreased appetite, anorexia, abdominal pain, insomnia, and headache (Khalili et al., 2014).

Moving away from the old belief that autism is an exclusive human feature, an interesting contemporary line of research is interested on pre-clinical animal models (Ornoy et al., 2019), focusing on the promising role of Agmatine, Anandamide, and the increasing attention on peptides (Lotufo Denucci et al., 2021):

- **Agmatine**, applied on mice models, has been suggested as a potential treatment in core symptoms, differently from previously introduced pharmaceutical approaches. As hyperserotonemia is regarded as an autism's endophenotype characteristic, restricting tryptophan, a precursor of serotonin, results in improvements of sociality. Agmatine acts as antagonist for the excitatory glutamate NMDA receptor, normalizing the Excitatory-Inhibitory (E-I) imbalance and therefore preventing overexcitability which can cause seizures and socio-cognitive deficits.

- **Anandamide** has been measured in lower density levels of the Endocannabinoid System (ECS) in autistic individuals, contributing to the pathogenesis of the disorder. By inhibiting its reuptake, higher levels of Anandamide influence core symptoms like social reward and social behavior with positive effects on self-mutilation, language, and interaction (Silva Junior et al., 2022).

- **Peptides** constitutes a novel medical approach for different medical conditions. They are short polymers of amino acids chains (2-100 amino acids long) and the building block of proteins. Peptides present many advantages as they are more tissue-penetrating, less immunogenic and they provide better activity per unit mass. Compared to other small molecules, peptides are more selective, efficient, and specific, with fewer toxicity. On the other side, their disadvantage is that they are quickly cleared from blood circulation (impacting the duration effect), they have low bioavailability and poor metabolic stability.

Majority of peptides have been acquired from wasp venom with positive effects on motor coordination. A

great therapeutic potential for all neurodevelopmental conditions is offered by the neuropeptide **Oxytocin,** which was the first peptide hormone to be biochemically synthesized. It has been defined as "natural medicine" influencing the arousal of the amygdala leading to positive social experiences. It is context-dependent and it acts on both the autonomous nervous system and the immune system (Carter et al., 2020). Oxytocin is an intranasal treatment, tested on mice animal models, with a daily dose over a month. It cannot be found freely in the market and requires a medical prescription.

The debate around autism has been further advanced in recent decades when it has been suggested the existence of a **broader autistic phenotype (BAP),** beyond those individuals with a diagnosis (Piven, 2001). The new terminology made its debut in scientific research, supported by the Assortative Mating Theory (Baron-Cohen, 2005) which illustrates how biological relatives – mostly fathers – of autism diagnosed individuals showcase more autistic traits than the general population. BAP traits correlate in different characteristics, including sensory sensitivity, career-path preferences (science and technology subjects), and the ability to read implicit communication cues. It became clear that the spectrum of autism is not only heterogeneous in the life-path condition of the same individual, but it varies among individuals who range from higher externalizing patters – therefore easier to be diagnosed – to those with more internalizing expressions. This set of more internalized observable traits in the core dimensions of autism – relations, communications and repetitive behaviours – result from the interaction of the genotype with the environment in a less intense, somehow mild, subclinical way that does not rise the need of a formal diagnosis. A parallel research-line of the phenotype approach interestingly added lens also on what is perceived to be an historical gender-based approach which regarded autism almost as a male-brain exclusivity, while, in females, symptoms were mostly going unnoticed by clinicians. The current prevailing standpoint is that autism may manifest differently in girls and women.

But throughout the systematic evaluation of autism symptomatology in clinical manuals and the broad range of treatment types, what is the position of the autistic community?
What is the emerging trend in autism?

Is there a different narrative worth considering changing the autism paradigm?

Thoughts, ideas, facts and statements to consider autism multidimensionally and under a different perspective is given in the third part of this thesis.

PART 3: EMERGING TREND.

Differently from other conditions, autism has not experienced a linear approach from its initial description. From a form of "child schizophrenia" right through the consequence of cold parenting styles, and up to the classification of a neurodevelopmental spectrum dimension, changing perspectives and deviations characterized its evolution in research and clinical practices (Zeldovich, 2018). A convergence of compelling factors lay at the basis of the alternative argumentations, above all the failure of the genetic approach, the dramatic increase in diagnosis, and the irreversibility of the condition.

It is important to add a short temporal and geographical excursus. While diagnosis of autism is relatively recent, certain features of the core symptoms of autism can be traced back in history and space. Folktales can be found in nearly every culture about individuals with unusual behavior and a literal interpretation of the world. Adopting a cultural anthropological approach, it can be highlighted how autism symptoms, rather than abnormal behavior, have also been regarded as "divine" and "spiritual gifts" in south-east Asia, in the Indian sub-continent, and in the pre-Islamic and Islamic Arabian Peninsula within the "jinn mythology" and sometimes called "gifts of Allah". Still nowadays, for the arctic and subarctic Inuit's communities, the shamans (angakkuit) are believed to possess the ability to communicate with the spirit of the earth. For the Navajo's culture in Arizona and New Mexico, individuals with neurodiverse traits are called "two-spirits" (nadleehi) as those "who transform" by being connected to the spiritual realm of the nature. In the Amazon, indigenous communities like the Yanomami, the Yawanawà, and the Huni Kuin (Kaxinawà) consider people externalizing neurodiversity characteristics as connectors between the real and the spiritual world, the closest creatures to the spiritual dimension. Even spiritual figures in the three main monotheistic religions – Moses, Jesus and Muhammad (Peace Be Upon Them) – were described as people spending long periods in loneliness, with reference in some storytelling to a personality diverging from the surrounding environment, and sometimes negatively perceived or even contrasted in their own communities at specific points of their life. Recently, in an opposing perspective, the increased secularity in Europe and higher incidence in the autistic condition raised the concept of an "Atheist Autism", stating that the specific mentalizing cognitive skill is an essential feature of spirituality, despite some autistic individuals reporting a rich imaginary world with benevolent invisible minds (Kéri, 2023). The "blueprint point" I want to highlight is that there can be different viewpoints in space and time, different ways to meet and dialog with diversity. The tendency to practice a stigmatizing narrative can be therefore not only culturally rooted, but also culturally biased.

The pathological paradigm built on biomedical lens which sees autism as a deficit is, in recent years, (slowly) changing and being replaced by a new growing viewpoint which supports the **neurodiversity paradigm**. Autistic self-advocacy movements started already in Sweden since the 1960s and developed further in the US

in the 1990s. Interestingly, their spread has been facilitated by the technological progress of the web that supported the birth of the first organization run by autistic people – the Autism Network International (ANI) and the development of many more (Solomon & Bagatell, 2010). Autistic organizations are far from sharing a unified perspective – it could be hilariously stated that thinking differently is the founding stone of diversity -, but they tend to agree on one important concept: autism is not a deficit, rather a unique and special way to experience the world.

Diversity in this perspective is an insight and outsight condition, in thinking and behaving, with strengths and difficulties. It tends to contrast the previous stand of a clear split line between neurotypicals and neurodivergence, and it supports the psychological dimensional approach of a continuum of competences. Neurodiversity emphasizes an inclusive approach for the diversity of human neurological characteristics across the entire continuum, including those referred as neurotypicals and those with neurodevelopmental differences.

Thomas Armstrong, educator and neurodiversity advocate, supports the argumentation that the difficulties experienced by autistics, rather than originating from the condition of autism, are the consequence of the pain and hardship imposed by the dominant society (Armstrong, 2011). This approach resembles the position of the Critical Psychology, a prominent school originated in Berlin under the leadership of Holzkamp, which does not trigger the individual (mental) deficit from internal factors, rather as the consequence of an external dominant society that marginalizes non-conforming individuals. The cause of the difficulty is therefore the lack of social justice, the practice of discrimination and stigmatization by the ruling system.

Autistics live delegitimized of their experience in a society which imposes its rigid standards, disenfranchising whoever does not fit in the governing scheme. This is an evolutionary process applied in all dimensions and, to cite a comparison, that Johannes Fabian defined as “denial of coevalness” when referring to the way the dominant and sophisticated West regards other subordinate cultures. It is somehow also a parallel application of the In-group Social Theory, where members of the same group regard positively their members, while developing prejudice for out-members. But, despite the ruling system does not always express most of the population, the increasing incidence of an opposing view is destined to challenge its supremacy. In a multidisciplinary historical thinking, our world witnessed a shifting balance of power in biology, anthropology, economics, and international relations. The key point here is how this power shifting will occur, weather harmoniously or disruptively. The former head of the American Psychological Association (APA), Martin Seligman, already suggested in 2000 that Psychology spent too long in researching what is wrong in the brain (life-depleting or weaknesses), proposing a new movement focusing on the positive side of humanity (life-giving or strengths), referred as Positive Psychology (Ackerman, 2018). Analyzing the different treatments of autism, one common denominator characterizes all approaches: it is a way, sometimes intrusive, to adapt the autistic to the society, while much little effort is done in the reverse perspective.

It does not surprise therefore the opponent stand of the neurodiversity self-advocacy movement, contrary to the "***deficit curative approach***" regarded as abusive and coercive, labelling, for example, the evidence-based ABA (Leaf et al., 2022), specifically in its original versions, as a prompt-oriented and traumatizing experience imposing an outward perspective.
The inclusive neurodiversity approach supports a "***coping strategy***", valuing the different world experiences, and it aims at identifying bridges with the mainstream society. It does not have to be confused with contrasting ways to ease the life of autistics in the society, in the meaning that the opposition is not at therapies or treatments, rather at the biomedical "alteration approach".

Building on the neurodiversity, inclusive, and heterogenous approach to autism and departing from a world designed in a neurotypical cage, the **first step** is to initiate an exercise of **re-alignment**. While the theory preaches heterogeneity in manifestation, the general practice is to view all autistics overreacting to stimuli, misinterpreting cues, and avoiding social interactions. This is not only a stereotyping attitude, but also a serious problem. The bias lies at the core of the existing research, that studied autism only at an individual level, neglecting its interactive and interpersonal dynamics (Axbey et al., 2023). As reported in the book "Autism" of Sue Fletcher-Watson and Francesca Happè in 2019, autistic writers in this sense prefer the term "**constellation**" rather than spectrum, as autism "does not only move along one line, rather it circles in many spheres". Autistics should be seen in the same way of the general population, a rich variety of individual differences, with strengths and difficulties, and not under socially constructed categories with rigid labels.
The **second step** is to recognize the **strengths** in autism, which are the weaknesses read with different lens. Kanner's "insistence of sameness", categorized in the clinical manuals as "repetitive behaviors", and called "stimming" or "routines" in clinical language, can be seen as hyperfocus, attention to detail, and expertise. It is, in addition, a valid technique reducing anxiety and depression, two conditions widely present also within the neurotypicality realm. An article in Evolutionary Psychology in 2011 proposed a new hypothesis named The Solitary Forager Hypothesis (Reser, 2011), that essentially describes some genes associated to autistic traits – including savant skills in memory and spatial abilities - as naturally selected in the ancestral environment to allow self-sufficiency survival in a more solitary environment. The "logic thinking" and "black & white thinking" features of autism, viewed as lack of flexibility and abstract thinking, taking a different standpoint represent the development of clear rules, honesty, integrity and strong social justice attitude (Lucy Russel, 2024). In the Theory of Mind, the hot processes component of emotions recognition and empathy mislead in interpretation as it states the lack of empathy in autistic individuals, supported by neuroimaging techniques that showcase less activation in specific brain areas. But a more recent study (Peterson & Wellman, 2022) demonstrated that it is inaccurate to underestimate the development of socio-moral reasoning in autistic

people, as more non-autistic children displayed hypocrisy (74%) than autistic children (41%), while both having similar levels of selfless altruism. Hypocrisy is nevertheless associated to less mirror neuron activity in the brain contrasting the TOM's brain activation principle. In this perspective people with autism can read emotions (Brewer & Murphy, 2016), and in some cases are reported to "experience excessive empathy".

Neurodivergence links also to the concept of creativity, an important component of survival. While imitation is an important feature in learning, creativity is innovation in art, music, and knowledge. It leads to adaptation in the unpredictability of a world experiencing unforeseen circumstances like natural, economic and climate challenges. Creativity in a group trumps ability while diversity outperforms homogeneity, concepts stated also by Michigan's University professor Scott E. Page. It does not come as a surprise therefore that savant abilities are developed within autism, and it is remarkable that some commercial enterprises are starting to note the underlying added value of neurodiversity: Danish social innovator company Specialisterne, for example, exported worldwide a model empowering people with autism using their competitive advantage.

Instead of a deficit in communication and social interactions, the frame of reference should be a different system at work: the information technology progress with the web, interactive games, and virtual social channels are a testament on the capacity of autistic people to communicate and socialize in other forms. Studies have shown that autistic children do have interaction among them, but this is not regulated by the verbal dimension. The turning component is behavioral, and behavior is the first form of communication (Paldam, 2021). A study highlighted same level of joint attention by autistics with caregivers in natural setting (Yurkovic-Harding et al., 2022) compared to general population, where the distinctive factor is the lack of socially constructed communicative demands. A tentative ecological approach which aimed at unifying different perspectives about autism is the Intense World Theory (Markram & Markram, 2010), which locates the central pathological origin of autism in the neocortex and the amygdala. It views the autistic brain as an over functioning box, with neural hyper-activity and hyper-plasticity, leading to increased levels of perception, attention, memory, and emotionality. The overactivation is the reason behind the impairment in holistic processing and in parallel the higher capabilities in specific interests. The theory differentiates also the (perceived) lack of empathy in autism in terms of withdrawal from over-stimulation, differently from the lack of empathy, for example, that it is encountered in other conditions such as psychopathy personality trait where callousness, shallow emotions, and absence of guilt reveal a proper absence of activation in specific brain regions.

The **third step** is to practice what philosopher and scholar Mikhail Bakhtin referred as "exotopy" (outsideness) in the meaning of going beyond empathy when considering the "other" and recognizing the importance of understanding distinct viewpoints. A parallel supportive concept to enact is well explained by the German word "umwendung', meaning turning around to our fears, hopes, and beliefs. These two concepts are mutually supporting when aiming at a **culture of encounter**. Individuals belonging to the same group tend to judge

others without realizing their own stereotypes. Autism is viewed as a withdrawal from social interactions, but in 2020 a study (Davis & Crompton, 2021) identified a negative interaction loop between autistic and non-autistic people. Allistics, considering themselves socially capable, struggle in identifying autistic facial expressions, over-estimating autistic egocentricity, and are less favorable to interact socially with them. The aspect is quite evident in daily routines, where autistic children may fail to interact in gaze and communication interactions with non-autistic children, but they do not flee the situation and do not display symptomatology of social phobia. On the other side, neurotypicals, in the lack of corresponded interaction, tend to withdraw situations with autistic people. The autistic communication deficit can be therefore seen as constructed by the neurotypical bias in autism research. This perspective bolsters what theorized in 2012 by Damian Milton's Double Empathy Theory, which raises the bidirectional mutual lack of understanding and mismatch between the two conditions, rather than the failure of one side only.

Mainstream approach tends to link the increasing incidence of autism as the result of higher public awareness and expanded diagnostical parameters. It is an explanatory component, but rather a cofounding variable in my view. The narrowness of this approach is the blindness caused by the discouraging results in the identification of its etiology. Despite billions of dollars and years spent in research, the perspective was never changed. A recent study (Cakir et al., 2020) estimates that the lifetime social cost of autism - just in the United States of America - will be of 11.5 trillion dollars by 2029 with current prevalence rates, but 15 trillion dollars if we apply the past increasing prevalence levels. The economic scenario is even worse when potentially hypothesizing higher increasing exponential growth (178% increase in the US since 2000, www.crossrivertherapy.com). For health systems is simply not sustainable.

Along with supporting the neurodiversity paradigm as a need – or bitterly stated as a necessity - for economic and inclusive reasons, I advocate a new "superstructural" approach to reframe autism in the context of global changes and human evolution. Hereby I introduce a new perspective, which I call the ***ILYAS Hypothesis***. Its underpinning concept is that autism is simultaneously the Earth's evolutionary response to save humanity from itself and to save the globe from humanity. The word ILYAS is an acronym to highlight this complex relationship and it represents:

- ***Interconnectedness*** highlighting the importance of biodiversity in the Anthropocene; with autism as a balancing mechanism.

- ***Liminality,*** as introduced by Van Gennep and Turner (Babcock, 2001), refers to the concept of transitional state (threshold), where autism is the compromising boundary between Earth and human impact.

- ***Yearning*** representing the desire of harmony on the planet, with autism as the expression of this equilibrium.

- ***Altruism*** identifying the potential of autism with its unique perspectives and sensitivities; fostering tolerance and social justice.

- ***Symbiosis*** emphasizing the concept of relationship between humans and the environment, with autism as the complex outcome interaction between humans and the changing environment.

The hypothesis is an educated guess ((Ellis, 2023), born out of intuition (Kump, 2022) and observations in my research journey specifically about autism and generally about neurodevelopment. The idea links to the Gaia Hypothesis and propose autism as environmental feedback genetically incorporated over generations. Current limitations on the scientific testing of the hypothesis are the instruments and channels to collect data on a global level with the variety of different criteria in diagnostical process across places, but also the availability and consistency of global data in a temporal and geographical timeframe. Autism diagnosis data are available in the US, intermittently, only since 2000, while they are not available for most countries in the world. Ilyas is a complex hypothesis, which anticipates including soon also global data for natural disasters, biodiversity changes, casualties in wars and adverse events. At the current stage, for this specific research, it tests the correlation of only two variables, therefore taking an empirical approach, but incorporates also logic features and a deductive methodology. The Ilyas Hypothesis aims at being the embryo of a theory that time, energies, conditions, technologies, and resources will impact its development and reliability. It is a novel perspective, viewing the condition not as a disorder but as a natural adaptation, at first instance provocative in its intention to redefine the narrative on autism.
I proceed with a contextualization, followed by the analysis of available data and considerations.

3.1 - The Ilyas Hypothesis

Human beings are the leading and dominating species on Earth. Some argue this process started approximately 50,000 years ago in the Pleistocene epoch, while others establish the incipit approximately 5000 years ago with the introduction of agriculture. The Earth's surface is all discovered, despite not being all inhabited. Only the deepest oceans, covering 70% of the global surface remains largely inaccessible. Humans do not have physical abilities exceeding those of other predators. Logical ability in the brain's neocortex is what differentiate humans from other species. The human brain is also the result of an evolutionary development process from its initial ancestors. Homo sapiens excelled in groups when creating communities and developing a shared language, a tool with no equivalency in any other species. In our conceptualization, language is the general category of communication that developed differently across cultures, playing a more important role than our genes in the last 200,000 years (Pagel, 2017).

Intra-species clash is a common and non-human exclusive feature for survival, supremacy and reproduction. The biodiversity endless cycle of predators and preys is a multidimensional reality, but no one species except of humans developed hatred and engaged in distant and proxy wars for non-basic reasons. Ideologies of all types – political, spiritual, economic, racial - and what we refer as in-group and out-group dynamics on a planetary scale are exclusivity of humans. Conflict is recurrent throughout human history, the difference being only in the development of ever-growing destructive power. Since the industrial revolution in the XVII century and the growing exploitation of natural resources championed by imperialistic policies, humanity enacted a war with the world and with itself. The current scenario is unsustainable: pollution is overwhelming, climate change effects are real (Molina et al., 2014), conflict and violence are on the rise (www.un.org, UN75 – 2020 and beyond), with future conflicts estimated to raise from water and food scarcity.

The Anthropocene Working Group (AWG), an interdisciplinary research group established in 2009, agreed to differentiate the Anthropocene from the Holocene after the start of the atomic era in the year 1950, identifying this date with the dramatic effect of human activity to the future of Earth. Natural disasters like droughts, earthquakes, extreme temperatures, floods, fogs, landslides, glacial outbursts, storms, volcanic activity, and wildfire increased from 26 registered events in 1950 to 410 in 2023 (www.ourworldindata.org, EM-DAT, CRED/UC Louvain - 2024). It is generally recognized in the scientific community and public debate that the reference to natural hazard does not hide that natural disasters are due to effects linked to human action or inaction.

Since the 1960s chemist James Lovelock and then in the 1970s with microbiologist Lynn Margulis conceptualized the Gaia Hypothesis, referred later also as Gaia Theory and named after the Greek goddess. The Gaia's perspective posits how the earth is a complex and self-regulating system acting for its own survival.

In 2001 in what is referred as the “Declaration of Amsterdam”, the European Geophysical Union stated that the earth system has “physical, chemical, biological, and human components”.
The Ilyas Hypothesis builds on the Gaia’s approach, with specific attention to the role of autism. While neurodevelopmental research insistently positioned itself in a dichotomic alternative between nature and nurture, only recently agreeing on a vague interaction of genes-environment when trying to address the autistic core features, the Ilyas Hypothesis promotes a completely new perspective. It argues that Nature, like seen throughout the planet’s history (Grant et al., 2017), enacts an evolutionary stand to guarantee the salvation and survival of the world itself, with all its biodiversity components. In doing so, it acts on the traits that made humanity prevailing on others and reach its destructive path, precisely the sociality and the socially constructed type of communication. Autism is therefore an environmental feed, becoming genetic incorporated across generations. It finds supportive evidence in the mainstream scientific concept of the autistic phenotype.

But the natural response, or Gaia’s response, did not develop a prototype that cannot stand with other human beings, rather individuals which are more inwardly projected, but also more capable to be outwardly adaptive. In this perspective autism, rather than being seen as a stereotyped condition utilizing the biomedical approach, it is a status or a personality trait that develops individuals with no stereotypes for others. A stereotype is an artificial cultural and social construct and the fundamental nucleus of prejudice. Autism can be seen as an antidote to racism, hatred, discrimination, and therefore an antagonist to violence and wars. If I observe the behavior of an autistic child, when enacting social withdrawal, the reason is not associated to racial, ethnic, or religious characteristic of the surrounding others. The same does not always apply to neurotypicals, where the cultural stereotyped impact is more salient.

Autism therefore can teach to the society tolerance and diversity coexistence, maintaining the sphere of savant abilities which allowed humanity to develop fine arts such as music, figurative art, and attention to details, which are the real distinctive and positive features brought by humanity in this world. Language, as a script-tool in the perpetuation of stigma, is directly targeted by autism, but not eliminated, as autistics can be non-verbal but are not mute.
The Ilyas Hypothesis connects autism to the environment in an environmentally prompted genetic linkage, making autism the natural proposition to reconnect humanity to the Gaia’s system. The perspective supports the recent declaration made by pro-environment activist Greta Thunberg that autism is a “psychological gift”, but it does not enter the debate that led subsequent studies dissociating autistic traits from pro-environment activism (Taylor et al., 2021) because activism is a socially constructed action, totally different from the frame of reference of natural predisposition.

In support of my emerging viewpoint, at an initial stage, I analyze the correlation between the emissions of Global Carbon Dioxide (CO2) from fossil fuels and industry and the number of autistic diagnoses in the USA for individuals aged 3-21 years and covered by the Individuals with Disabilities Education Act (IDEA). The narrower approach is due to the absence of global autism diagnostic data, and the partial portion of autistic population in the country of reference – as it excludes people outside the age category and those not covered by the IDEA. Autism diagnosis data for the (American) states of the federation are available only since 2000, except of 2001, 2002, and 2003. In our correlation research, autism diagnosis figures for the years 1950 and 1980 are not official, but the number is estimated from the disposition of two data: total American population (158,864,396 in 1950 and 226,500,000 in 1980) and US autism prevalence of 1/25000 in 1950 and 1/2500 in 1980 (Jacques Duff, 2021).

YEAR	**CO2 Global Emissions*** In billion metric gigatons (Gt)	**US Autism diagnosis**** In thousands
1950	**5.93**	**(Estimated) 6**
1980	**19.48**	**(Estimated) 90**
2000	25.5	94
2004	28.62	191
2005	29.55	223
2006	30.61	258
2007	31.5	296
2008	32.04	336
2009	31.49	378
2010	33.31	417
2011	34.44	455
2012	34.94	498
2013	35.23	538
2014	35.47	576
2015	35.46	617
2016	35.46	661
2017	36.03	710
2018	36.77	762
2019	37.04	803
2020	35.01	828
2021	36.82	882

*Source www.statista.com figures released by Ian Tiseo on 12/04/2024. Cross-checked with International Energy Agency www.iea.org

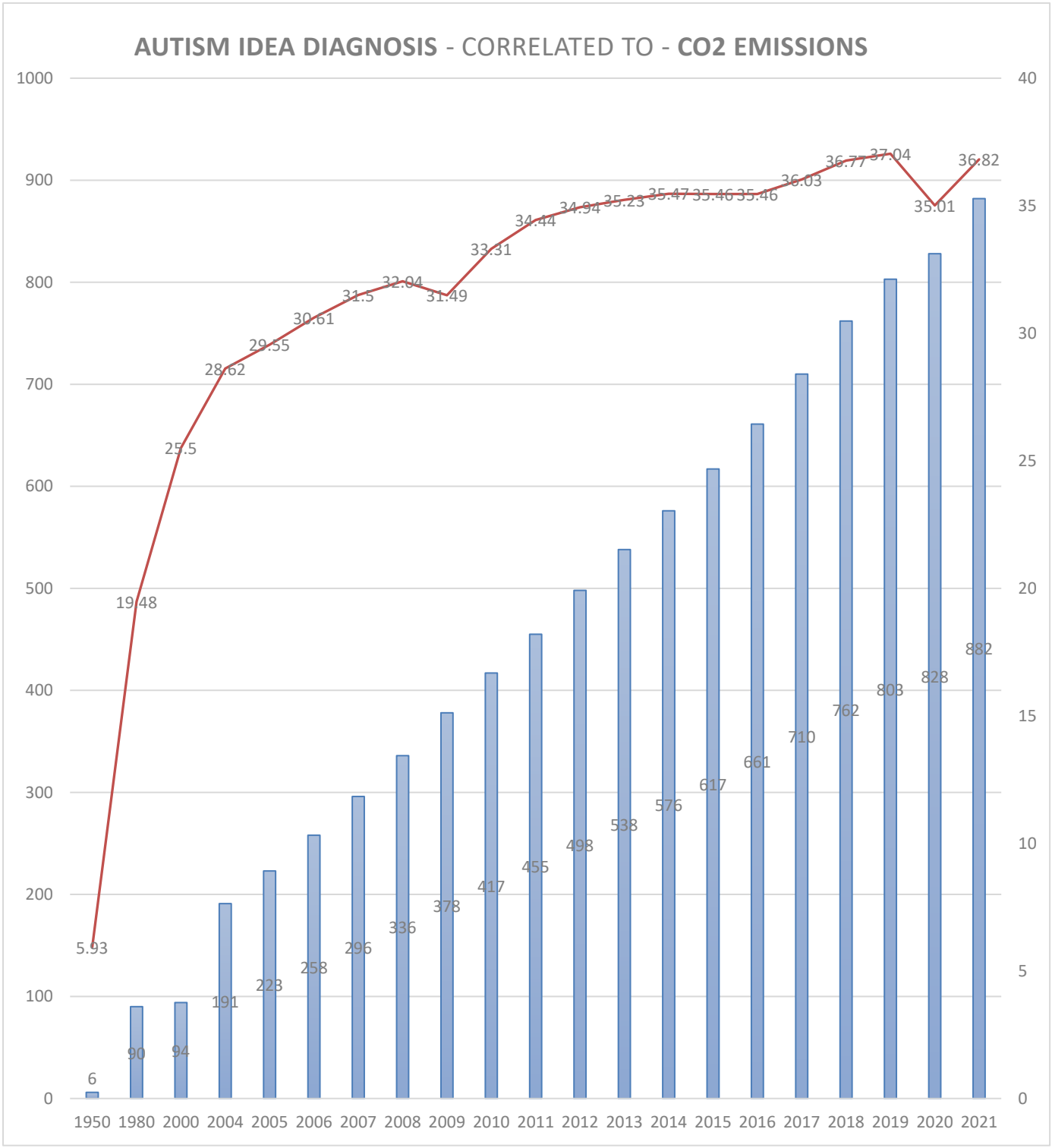
** Source www.statista.com figures released by Vera Korhonen on 07/11/2023.

Given the above-mentioned framework, I hypothesized a positive correlation between Pollution and Autism Diagnosis. I arrive to the following results:

Correlation Type	Strength/Value CO2/Autism (IDEA certified)	Note
Pearson's r	0.787	-all tests one tailed
p-value	<.001	
Spearman's rho	0.953	
p-value	<.001	
Kendall's tau B	0.880	
p-value	<.001	

I am aware that available data is limited in terms of completeness for a comprehensive evaluation, nevertheless my observation reports a strong correlation. The directionality problem can be waived with the logical assumption that autism does not influence/cause pollution, while the presence of third variables is unknown also in the mainstream genetic, anatomical, biological, and neurological approach described in the first part of this thesis. The correlation analysis aims at opening a new dimension of future discussion and research, a step prior comprehensive experimental research when global data for autism diagnosis will be possibly available. I report three values, the Pearson for a linear relationship, while the Spearman's rho and Kendall's tau B for the monotonic relationship between the two variables to better address my outliers, being the estimated value in 1950 and 1980, and the limited sample of data. In all the three analyses, I obtain a result indicating a strong positive correlation, with a p value below significance levels ($p\ 0.001 < p\ 0.05$) allowing the rejection of the Null Hypothesis and eliminating the false positive Type 1 Error (rejecting a true Null Hypothesis).

Graphically, the strong positive relationship of the two variables is identified as following:


AUTISM IDEA DIAGNOSIS - CORRELATED TO - CO2 EMISSIONS
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1950 1980 2000 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021
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CONCLUSIONS

In this thesis I combined the mainstream changing approaches on autism under all its perspectives and components with the introduction of a new hypothesis, still in its infancy, that has the generative power to open new macro and micro scenarios on the topic.

The main take away message is the importance of individual differences, which should not be invalidated in mass categorizations. The proposition does not equate autistics to prophets and does not ignore the sufferings that can be encountered, but simultaneously it does not discriminate the potential of individuals in any condition, including those referred as neuro-typicals. Autistics are not outliers of an allistic society: both groups belong to the same population, each with individuals encompassing unique strengths and/or challenges.

I build on the paradigm of neurodiversity, exploring an intriguing systematic perspective that correlates nature to evolution, hypothesizing the interaction of environment and genetics in a new dimension. Future research can keep the mainstream approach and delve deeper the association between the variables of pollution and autism, focusing on bottom-up analysis in terms of neuroinflammation, oxidative stress, epigenic modifications, disruptions on brain development, and dysregulation of the immune system. Science can explore neurodiversity as an environmental response, genetically incorporated across generations, which is in line with existing literature demonstrating that autism is highly inheritable, yet still not fully understood in terms of inheritance.

But my thesis argues on the need of distancing from mainstream biomedical approach, focusing on the importance of changing narrative as a sign of adaptation, a way to challenge our beliefs and expand our horizons. Humanity is questioned in terms of coexistence and survival of future generations. Positive aspects of globalization, technological progress, and connectivity should not obscure existing and increasing threats of climate change, violence, isolation, and inequalities.

At no point the thesis supports a deterministic path, undermining the humanity of autistic people and reducing them to mere components of an ecological response. It is rather a novel and creative interdisciplinary approach that strengthens positive aspects of autism, often marginalized by a deficit-focused narrative. Linking my research to the Gaia Theory is a robust theoretical foundation, but I recognize the Ilyas hypothesis being a starting point that will require further empirical evidence and that will benefit from wider global dataset of autism diagnosis, combined with longitudinal studies to test broader applicability.

Inclusion policies became a politically correct social message, but the reality is that inclusion practices are an immediate need and the minimum worth scenario avoiding major violent disruptions. Pointing at the increase rates of autism due to the expansion of the diagnostical parameters is a limited explanation, because it comes at a financial cost that in the middle to long term welfare and health system will not sustain. Taking an economic stance, the lack of inclusion will not only be a cost for the society, but a loss of input resource resulting in less productivity. The increase in autism prevalence – 1 in 36 children currently in the US – parallelly means also that neurodivergent individuals are becoming less of a minority. Without inclusive ways, the traditional system that marginalizes will face escalating pressure. History provides numerous examples where dominant cultural, geopolitical, and economic systems were disrupted or overthrown when they failed to adapt to changing demographics and/or societal needs.

In the XVI century the University of Padua allowed academic freedom to mathematics' professor Galileo Galilei, who pioneered discoveries that constitute the groundwork of modern physics and astronomy. When he moved to Florence, the religious persecution led to his accusation. Galileo's story offers a profound illustration on how mainstream perspectives can subjugate and blind researchers, even despite evidence.
A clear wishful hope is addressed to Psychology, that must remember its essence and not simply follow medicine's physical and categorical approaches. While being embraced as a scientific discipline, Psychology should integrate insights from all other fields, embracing a holistic approach that requires multidimensional intersecting components. It must acknowledge that the brain is an unexplored universe that will continue to evolve, and thus, the quest for understanding should not be limited by restrictive labels.

Without intuition, creativity, and diversity in thinking styles most of what we know and accept today would be foolish. Nature's capacity for evolution and adaptation is evident in countless examples throughout history. Birds, for instance, are the descendants of ancient dinosaurs, having evolved over millions of years to take to the skies. Similarly, seals once roamed the land as terrestrial mammals before adapting to life in the water, undergoing significant physiological transformations to survive in their new environment. These examples demonstrate Gaia's profound ability to influence life on Earth, guiding species through remarkable changes to ensure survival and ecological balance. Autism might therefore represent an evolutionary response to the challenges of the Anthropocene, calling for new ways of thinking and interacting in our environment, equipping humanity with tools needed to navigate and mitigate the impacts of human actions on the planet.
The Ilyas Hypothesis is an Earthmover's approach, fostering the autistic potentials of tolerance, social justice, innovative thinking and collaborative morality, rather than symptomatizing systemically produced challenging outcomes.

Brazilian educator and philosopher Paulo Freire conceptualized “conscientization” as the processing move toward critical consciousness and awareness, where each subject, through dialogue, becomes an active element to change the oppressed world (Freire, 1970). To ensure a resilient future I therefore argue to embrace the neurodiverse cognitive perspective to enhance problem-solving and innovation in a more moral approach. Comprehensive approaches are crucial to address global challenges with the cultural enrichment enhanced in depth and variety by the input of neurodivergent individuals. Social cohesion should not be confused with social communication and a cohesive inclusive practice must not discriminate among diverse social cognition skills. It is a way forward with an ethical stance, but also an adaptive demographic approach. The steps must be taken at all levels of the society, in education, workplace, communities, and at a policy-making dimension, because inclusion is a bidirectional process and not a one sense pathway. The imperative of inclusivity is a call for action now. Delaying sustainability and cohesiveness will not only just miss out benefits but escalate dangerous scenarios.

The world needs as many Einstein and Newtons as possible: how many geniuses have we lost due to marginalization and oppression?

Science and research are essential in their drive to analyze, find patterns, recognize pathways, but a great role of bridging connector should be played by what is referred as the autism phenotype. Parents and relatives of autistics serve as vital connecting middle dimension between neurodivergent community and the broader society. Their unique position allows them to advocate for inclusion, understanding and bridging the gap between different perspectives and experiences. These bridging connectors are often the most passionate and informed advocates for their loved ones. They play a crucial role in promoting a nuanced understanding of neurodiversity at all levels, from general public awareness to policy making initiatives. As visible models of inclusive practice, important others of autistics can lead by example in demonstrating the benefits of neurodiversity, inspiring and generalizing their personal-environment dimension into the general society. Parents and relatives are the first catalysts of broader societal change with the power of dismantling the marginalizing dominant system, building on a more equitable framework.

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