Neurodiversity and autism

between disability and difference, science and ideology

Neurodiversité et autisme

entre handicap et différence, science et idéologie

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ABSTRACT

The concept of neurodiversity has been developing for more than twenty years from a socio-political angle. Since then, it has been strongly criticized for its lack of scientificity, its blurred boundaries, its emphasis a certain conception of autism, its problems associated with intellectual disability, its inability to support the theory of a non-disabling difference, and its excessive alignment with either the medical model of disability or the social model of disability. Furthermore, neurodiversity is considered from different angles, depending on disciplines, research and individuals: the medical model of disability, based on an individual problem; the social model of disability, based on a societal problem; the neurodiversity combining innate, acquired, neurodevelopment and psychology in opposition to a norm; and the cognitive diversity, highlighting the existence of different cognitions and neurophenotypes outside of psychopathology and the healthy-pathological opposition. This article thus proposes using the case of autism to explore these two challenges of neurodiversity: its terminology and its scientific foundations. The development of a neurobiological and genetic pan in neurodiversity, and a more thorough work on the definition and conception of autism could place neurodiversity in a scientific field free of political and partisan ideologies.

KEYWORDS

Neurodiversity, Neurodivergence, Disability, Difference, Autism, Science, Ideology

RÉSUMÉ

Le concept de neurodiversité se développe depuis plus de vingt ans sous un angle sociopolitique. Or, il est depuis vivement critiqué pour son manque de scientificité, le flou de ses frontières, la mise en lumière d'une certaine conception de l'autisme, les problématiques liées à la déficience intellectuelle, l'incapacité à étayer la théorie d'une différence non handicapante ainsi que le trop grand alignement tantôt sur le modèle médical du handicap et tantôt sur le modèle social du handicap. Par ailleurs, la neurodiversité est considérée sous différents angles selon les disciplines, les chercheurs et le grand public : le modèle médical du handicap basé sur un problème de personne; le modèle social du handicap basé sur un problème de société, la neurodivergence mêlant inné, acquis, neurodéveloppement et psychologie en opposition à une norme, et; la diversité cognitive mettant un exergue l'existence de différentes cognitions et neurophénotypes en dehors de la psychopathologie et de l'opposition sain-pathologique. Cet article propose ainsi d'explorer ces deux défis de la neurodiversité — la question de la terminologie et celle de ses fondements scientifiques — en utilisant le cas de l'autisme. Il suggère que le développement d'un pan neurobiologique et génétique dans la neurodiversité et d'un travail plus approfondi sur la définition et la conception de l'autisme pourraient permettre d'inscrire la neurodiversité dans un champ scientifique hors des idéologies politiques et partisanes.

MOTS-CLÉS

Neurodiversité, Neurodivergence, Handicap, Différence, Autisme, Science, Idéologie

INTRODUCTION

The notion of neurodiversity is primarily discussed in the social sciences today (Muskat, 2017; Runswick-Cole, 2014). It could thus be considered more as political activism rather than a genuine scientific field of study extending beyond the social sciences. Furthermore, due to the plurality of definitions and the various disciplines interested in the subject, neurodiversity does not achieve consensus (Chapman, 2020; Milton, 2019).

The idea of non-pathological neurodiversity and cognitive diversity is not new. As early as the 1930s, Schröder (1938), a professor of psychiatry and neurology, argued that psychopathy should be understood from a characterological perspective. According to him, it involves psychological variations of considerable magnitude and human beings with a character structure outside the norm, exhibiting a wider range of mental differences that exist among all human beings, which are neither qualitatively new nor pathological. Scheepers (2021) considers neurodevelopmental disorders as individual variations, and Plomin (2018) asserts that what is abnormal is normal, and

the distinction between the two is artificial. According to him, the use of the spectrum concept to discuss autism is a nod to the dimensional quantitative approach. Quantitative genetics studies the genetic variations underlying phenotypic variability among individuals, with a primary focus on traits that exhibit a continuous range of values (Barton *et al.*, 2002).

More recently, in her bachelor's dissertation, Singer presented neurodiversity as a policy considered ‘’a new addition to the familiar political categories of class, sex, and race’’ to ‘’enrich knowledge of the social model of disability’’ (2018, p. 13). She also presented this concept as a ‘’new social movement’’ — particularly in the context of autism — in opposition to the medical view of disability (2017, p. 38). On her blog, she indicates that the concept of neurodiversity also refers to the ‘’practically infinite neurocognitive variability within the human population on Earth’’ and that this concept ‘’highlights the fact that every human possesses a unique nervous system, with a unique combination of abilities and needs’‘(Singer, 2019). However, she does not delve deeply into this question in her 1998 thesis or her 2017 book and clearly states on her blog in 2019 that it is not a scientific term but a political term that was ‘’never intended‘‘ to be scientific (Singer, 2019).

Thus, neurodiversity is a relatively recent concept in history, both in terms of public awareness and scientific discussions. Given the growing media and scientific interest, an examination of the different uses and contexts of this term appears necessary to provide a comprehensive perspective on the subject. The main objective of this work is to identify publications discussing the concept of neurodiversity, its boundaries, implications, and limitations. I conducted research in five English and French databases: PubMed, CAIRN, OpenEdition, Google Scholar, and theses.fr. I excluded all articles that used the terms ‘’neurodiversité‘‘ and ‘’neurodiversity‘‘ without discussing them. As of December 31, 2022, PubMed listed 305 results, including 218 in the last two years; CAIRN presented 95 results, including 55 in scientific journals; OpenEdition yielded 57 results, including 17 articles, and Google Scholar provided 343 results for the term ‘’neurodiversité‘‘ and 16,000 for ‘’neurodiversity.‘‘ Moreover, the French website theses.fr recorded only 10 theses with the keyword ‘’neurodiversité.‘‘ Beyond the interest outside the academic field for this issue, Francophone research has not fully embraced this question, and numerous debates and disagreements are emerging, such as the limits of the neurodiversity spectrum (e.g., inclusion of personality disorders or personality traits) or the primary discipline in which to discuss this new paradigm (e.g., philosophy, sociology, medicine).

The analysis of the selected articles in this article focuses on neurodiversity around two elements that shed light on the two debates mentioned in the previous paragraph: the terminologies used to refer to it and the debates surrounding its scientific nature and boundaries. Finally, I will conclude this article with a discussion on emerging implications and perspectives. Additionally, autism has been chosen as the neurodevelopmental condition that best illustrates these elements, as Judy Singer and the majority of the selected articles primarily used the concept of neurodiversity in relation to autism. Furthermore, the ‘’autism spectrum disorder‘‘ has been defined as a highly

heterogeneous spectrum (Georgiades *et al*., 2013; Mottron & Bzdok, 2020), thus reinforcing the previous debates.

1. Neurodiversity and Autism: The Challenge of Terminology

The concept of neurodiversity is invoked within different theoretical frameworks with various interpretations. Among these frameworks, I have chosen to select four: the medical disability model, the social disability model, neurodivergence, and cognitive diversity.

1. 1 Medical Disability and Social Disability

1. 1. 1 Current Classifications

The two successive classifications by the World Health Organization (WHO) reflect two visions and models of disability: the medical model and the social model. In the medical model, disability is perceived ‘‘as a problem of the individual, a direct consequence of a disease, injury, or other health condition that requires medical care’‘ (WHO, 2001, p. 21). Its treatment aims at ‘‘curing or adapting the individual or changing their behavior’‘ (WHO, 2001, p. 21). Thus, the WHO emphasizes that the primary concern lies in medical care, while at the political level, it is about ‘‘modifying or reforming health policies’‘ (WHO, 2001, p. 21). In contrast, in the social model, disability is perceived ‘‘as primarily a problem created by society and a matter of full integration of individuals into society’‘ and it is not ‘‘an attribute of the individual but rather a complex set of circumstances, many of which are created by the social environment’‘ (WHO, 2001, p. 21). The solution lies in ‘‘the collective responsibility of society as a whole to bring about the necessary environmental changes that enable disabled individuals to participate fully in all aspects of social life’‘ (WHO, 2001, p. 21). Thus, the WHO clarifies that disability is a political issue and is situated at the level of ideology or attitudes, and ‘‘requires social change, which at the political level translates into terms of human rights’‘ (WHO, 2001, p. 21).

1. 1. 2 History

In 1980, the WHO published a manual titled ‘‘International Classification of Impairments, Disabilities, and Handicaps: A Manual of Classification of the Consequences of Disease.’‘ The WHO explained that they chose this title because the concept of disability alone is confusing and that it broadly encompasses impairments, disabilities, and handicaps. Thus, a change occurred in the classifications, and the ‘‘disability axis’‘ was renamed the ‘‘handicap axis’‘ (WHO, 1988, p. 1). These three levels of classification—impairments, disabilities, and handicaps—refer to ‘‘specific levels of the consequences of diseases’‘ (WHO, 1988, p. 10). Impairments refer to ‘‘any loss or abnormality of psychological, physiological, or anatomical structure or function’‘ and constitute the ‘‘manifestations of dysfunction at the organ level’‘ (WHO, 1988, p. 10). Impairments relate to the ‘‘consequences of impairments in terms of the individual's functional activity’‘ and represent ‘‘disturbances at the level of the individual’‘ (WHO, 1998, p. 10). Finally, handicaps refer to the

‘‘disadvantages resulting from impairments or disabilities for the individual’‘ and reflect ‘‘the individual's adaptation and the interaction between the individual and their environment.’‘ Among impairments, we can mention ‘‘severe communication impairment,’‘ which includes ‘‘central speech and visual disorders resulting in severe communication impairment,’‘ including ‘‘autism’‘ (WHO, 1988, p. 64).

In 2001, the World Health Organization (WHO) updated its previous manual and published a new one called the ‘‘International Classification of Functioning, Disability and Health’‘ (ICF) (WHO, 2001). The aim of this manual was to provide a standardized language and framework for describing health states and related conditions (WHO, 2001, p. 3). In this manual, the focus is on the functioning of the individual, which includes their organic functions, activities, and ‘‘participation in society’‘ (WHO, 2001, p. 3). The concept of disability in this context refers to impairments, activity limitations, and participation restrictions. Through this manual, the WHO aimed to move away from a classification based on the ‘‘consequences of disease’‘ and towards a ‘‘classification of health components’‘ (WHO, 2001, p. 4). Additionally, the ICF and the International Classification of Diseases (ICD-10) consider impairments within the framework of anatomical structures and organic functions related to a pathological process. However, while impairment is referred to as a ‘‘problem of functioning and structure related to a health condition’‘ (WHO, 2001, p. 4) in the ICF, it is an integral component of a disease with signs and symptoms in the ICD-10. An impairment is an ‘‘abnormality, deficiency, loss, or other significant deviation from generally accepted population norms’‘ at the level of anatomical structures (WHO, 2001, p. 12). Finally, activity limitations refer to the ‘‘difficulties an individual may have in executing activities,’‘ participation restrictions relate to the ‘‘problems an individual may experience in involvement in real-life situations,’‘ and environmental factors refer to the ‘‘physical, social, and attitudinal environment in which people live and conduct their lives’‘ (WHO, 2001, p. 10). This can include factors such as sex, race, age, lifestyle, habits, level of education, social origin, profession, and psychological traits, among others. Furthermore, activities refer to elements such as mobility, domestic activities, communication, and interpersonal relationships, among others. The manual specifies that impairments are ‘‘defined in terms of current knowledge at the tissue or cellular level, and at the subcellular or molecular level’‘ (WHO, 2001, p. 12) and that they represent deviations from generally accepted norms of the biomedical state of the body and its functions (WHO, 2001, p. 13). Thus, in this classification, the components of impairment ‘‘rely primarily on the judgment of individuals competent to assess physical and mental functioning against generally recognized norms’‘ (WHO, 2001, p. 14). Unlike the 1980 version where autism appeared under central speech and visual disorders, it is now included under ‘‘global psychosocial functions’‘ that develop throughout life and are ‘‘necessary for understanding and constructively integrating the mental functions involved in the formation of reciprocal social relationships that enable social interactions’‘ (WHO, 2001, p. 50).

1. 1. 3 Limits

One of the problems concerning WHO classifications relates to the definition and components of impairment derived from human judgments, which themselves are based on relatively arbitrary norms that, for example, led to classifying homosexuality as an impairment. Frances (2014), the chair of the group responsible for overseeing and revising the fourth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM), notes that dictionaries cannot provide a satisfactory definition of normality because statisticians and psychologists struggle to grasp its essence, while doctors are busy pushing its boundaries. This can be partially explained by philosophical, political, and financial reasons. According to Canguilhem (1972), the definition of what is considered normal refers to socio-cultural norms in a given society and era, aiming to include and exclude to control certain behaviors and beliefs. Additionally, Cosgrove and Krismsky (2012) report that three-quarters of the workgroups for DSM-IV and DSM-5 have financial ties to the pharmaceutical industry, some of which favor pharmacological treatment as the first-line intervention, particularly for mood disorders, sleep disorders, and psychotic disorders.

In parallel, the fifth edition of the DSM explains that ‘‘mental disorders are defined taking into account cultural, social, and familial norms and values’‘ (American Psychiatric Association, 2013, p. 14), and several issues are still debated, including diagnostic criteria and conflicts of interest with pharmaceutical companies. It is observed that, even though the social model shifts the question of disability into the political domain, disability is still based on impairments and therefore does not seem to fully align with the concept of neurocognitive variability in neurodiversity. It relies on judgments, sometimes moral judgments, and constantly evolving medical and scientific knowledge. This can result in a potentially distorted view of the true nature of certain characteristics or conditions such as autism (Hyman, 2021). History has shown several examples of pathologizing differences based on limited scientific knowledge, where mere differences have been categorized as disabilities or mental disorders, as was the case with homosexuality. Therefore, it is important to question the concepts of neurodivergence and cognitive diversity, which are more closely related to the notion of difference than the concepts of disability and disorder.

1. 2 Neurodivergence and Cognitive Diversity

The term ‘‘neurodivergence’‘ is often attributed to an autistic activist named Kassiane Asasumasu (The University of Edinburgh, 2020). It refers to all neurological and/or psychocognitive variations or at least discrepancies from what is considered ‘‘normal’‘ neurological or psychocognitive functioning. This concept may seem vague, but it opposes what is proposed by the social model of disability, which defines impairment based on sociocultural norms, similar to the definition of a mental disorder in the DSM. Unlike the concept of neurodiversity, the concept of neurodivergence encompasses all differences, whether they are innate or acquired, neurodevelopmental or psychological, and it includes autism as well as personality disorders, intellectual disabilities, or

even depression. This concept appears to be even more political than the concept of neurodiversity and can serve as a basis for philosophical and social discussions on public policies regarding difference and disability.

Here, I propose another level of discussion based on the idea of a ‘‘neurophenotype’‘ and ‘‘cognitive diversity’‘ (Horn, 1989), which Stich (1988, p. 391) defines as ‘‘different ways of thinking,’‘ and I define as a plurality of mental processes and cognitive functioning (e.g., language, perception, information processing, creativity). We can observe this, for example, in autism with the question of double empathy—a theory suggesting that neurological differences can lead to differences in social interaction but not social deficits (Milton, 2012)—and the fact that communication issues are reciprocal between autistic and non-autistic individuals (Crompton, 2019; Crompton *et al.*, 2020). This concept, which is different from learning styles (Newton *et al.*, 2021), already exists in the scientific field of intelligence, such as in the case of multiple intelligences (Gray & Viens, 1994) or autism (Mottron, 2004). It is a concept that complements the idea of neurodiversity because it refers to the study of neurological differences, whereas neurodiversity was originally conceived as a political concept that can be considered the study of the sociocultural consequences of cognitive diversity with the goal of promoting greater inclusion in society. This concept of cognitive diversity could be considered a scientific paradigm (e.g., studied in genetics, psychology, neurology) that still needs further discussion to define its boundaries. It would also have implications in ergonomics, education, work and organizational psychology, management, and public social policies.

One can observe that, in the context of autism, the true debate revolves around the pathological nature of this condition and how it is perceived, be it from a moral, philosophical, neurobiological, social, or political standpoint. For instance, research indicates that individuals with autism can demonstrate equal or even higher levels of intelligence (Courchesne *et al.*, 2015; Courchesne *et al.*, 2019; Nader *et al.*, 2015, Nader *et al.*, 2016), creativity (Best *et al.*, 2015; Hetzroni *et al.*, 2019; Kasirer and Mashal, 2014; Kasirer *et al.*, 2020), and rationality (Brosnan and Ashwin, 2022; Rozenkrantz *et al.*, 2021) compared to non-autistic individuals.

Throughout different periods and cultural contexts, it has been observed that the understanding of disability (both in medical and social terms) has varied, and this theme has sometimes shifted towards the question of social dominance rather than anatomical impairment (Botha and Frost, 2018). The concept of cognitive diversity (Rebecchi, 2022) becomes crucial to explore, as it represents the neurobiological aspect of neurodiversity (a sociopolitical concept related to discrimination), whereas cognitive diversity relates to how differences are considered (without moral judgment, comparison to a norm, or questions of impairment).

Several questions arise from this first part: in the case of autism, is the concept of neurodiversity more or less coherent than that of social disability? Should autism be regarded as a disorder, a disability, a difference, an illness, or something in-between? Are the restrictions on participation

and limitations in activities for individuals with autism related to the environment, anatomical impairments, or both? However, the primary question here is as follows: is the concept of neurodiversity a scientific field or a political activism movement?

2. Neurodiversity and Autism: The Challenge of Scientificity

Due to a growing number of collectives and associations claiming to represent neurodiversity and conceptual ambiguities in scientific literature, I have decided to address the question of the scientificity of neurodiversity through its sociopolitical aspect, critiques, and the highlighting of scientific perspectives.

2. 1 The Sociopolitical Movement of Neurodiversity

Chamak (2009) has studied activism in the field of autism and has traced the history of the movement, starting from the creation of Autism Network International in the United States in 1991. She notes that some individuals with autism feel they are more objective, rational, and less driven by emotions than non-autistic individuals. She also reports statements from Michelle Dawson, an autistic researcher at the Developmental Disorders Laboratory of Rivière-des-Prairies Hospital in Montreal, who suggests that autism is no more a disease than homosexuality was (Chamak, 2009). Chamak (2010a, 2010b, 2010c) highlights the differences between certain international movements that ‘‘redefine autism as another mode of cognitive functioning’‘ (2010a, p. 103) and French movements that integrate ‘‘the notion of disability and adopt a cooperative attitude with the authorities rather than resistance to the medical model of autism’‘ (2010a, p. 103). On the international forum ‘‘Aspies for Freedom,’‘ messages are ‘‘oriented towards promoting a positive representation of autism and an activist mobilization that fights against the medical model of autism,’‘ while on the French-speaking forum ‘‘Spectre Autistique, troubles envahissants du développement — International (SAtedI),’‘ members seem to have ‘‘integrated the notion of disability’‘ (Chamak and Bonniau, 2014, p. 229).

Furthermore, Chamak points out that although the neurodiversity movement allows for some destigmatization, the heterogeneity of the autism spectrum leads to misunderstandings for parents with children who have severe developmental delays and behavioral problems (Chamak, 2015). This explains why certain behavioral methods are rejected by some individuals with autism due to their lack of effectiveness and ethical concerns but are still advocated by these parents (Chamak, 2013). Chamak also highlights the lobbying behavior of certain associations that ‘‘derive benefits (financial, networking, or prestige) and discredit other groups that do not align with their orientation’‘ (2018a, p. 286). Finally, she explains that the ‘‘positive representations and increased media attention given to individuals with Asperger's syndrome result in a lack of interest in those who do not have their skills’‘ (Chamak, 2018b, p. 63). The question of Hans Asperger's descriptions of autism is likely at the heart of the neurodiversity debate on the distinction between pathology, disability, and difference. In his final writing (Rebecchi, 2023a), Asperger described characteristics

that were quite different from the autism spectrum disorder described in the DSM-5. It is also worth noting that what Lorna Wing referred to as ‘‘Asperger’s syndrome‘‘ was different from Hans Asperger's autistic psychopathy (Rebecchi, 2023b) and, by extension, from what the World Health Organization (WHO) classifies as a disability.

Thus, it is clear that neurodiversity is primarily embedded within a sociopolitical movement with various demands. Nugent notes that certain subgroups of autistic individuals work ‘‘for the recognition of their neurological identity’‘ through a ‘‘militant social movement‘‘ (2017, p. 38). Speranza (2020) suggests applying certain philosophical reflections on intelligence and neurodiversity in the context of educating children and training adults. Mottron expresses his desire to ‘‘establish the foundations of what would constitute a pedagogy for autistic children that starts from their specificity, making the most of their intelligence and interests‘‘ (2010, p. 46). Ortega discusses the opposition between autism self-advocates, parents of autistic children, and professionals seeking a cure for autism, and explores the emergence of autistic cultures and identities linked to ‘‘neurological self-awareness‘‘ and a rejection of psychological interpretations (2009, p. 425).

However, Dvck and Russell (2020) note that the concept of neurodiversity avoids the pitfalls of diagnostic language that distinguishes between the healthy and the unhealthy, but the movement surrounding it still co-opts medical language to avoid being associated with the anti-psychiatry movement. This was highlighted by Foucault (1972) in France and Szasz (1973) in the United States, with the latter considering psychiatry as sometimes harmful to patients and emphasizing the lack of solid foundations in different diagnostic categories. Frances (2004) and First (cited by Greenberg, 2013) make similar observations today (Scheepers, cited by van Hintum, 2021). More than the concept of neurodiversity itself, it is this movement and its sociopolitical essence that attract numerous criticisms.

2. 2 Criticisms of neurodiversity

Forest analyzes the rejection of the autism-as-disease model as ‘’institutionalized sectarianism masquerading as science’’ (2022, p. S 156). According to him, neurodiversity refers to ‘‘a state of scientific knowledge (…) linking autism and the brain‘‘ that ‘‘emerges on the margins of science‘‘ through a ‘‘reappropriation of research findings‘‘ (2016, p. 413). He presents it as a set of hypothetical psychological mechanisms based on no theory that achieves consensus, with no ‘‘clear distinction between what in the brain would function poorly and what would function differently‘‘ (2016, p. 414). Forest explains that neurodiversity neglects what scientific consensus acknowledges, namely the autism spectrum ‘‘where difficulties, disabilities, and peculiarities can exist to varying degrees‘‘ (2016, p. 415). Additionally, Nelson believes that neurodiversity fails ‘‘to provide compelling arguments for its conceptual assertion that neurodiversity is merely a difference rather than a disorder‘‘ (2020, p. 345). Hughes observes that neurodiversity struggles to break free from the notion of an autistic disorder because it encompasses ‘‘ways of being autistic

that are harmful in ways that cannot be wholly attributed to discrimination or unjust social arrangements'' (2020, p. 47), and it fails to separate ''high-functioning autism from low-functioning autism'' and ''autism from co-occurring conditions'' (2020, p. 47). Moreover, it is noted that psychoanalysts seize on the notion of neurodiversity, presenting it as a new controversy to criticize psychiatry by placing the critiques of Hans Asperger and those of Bruno Bettelheim on the same level (Hochmann, 2020). Some of these criticisms appear to be well-founded, while others are less so, and they are merely the result of the ambiguity surrounding the concept of neurodiversity and its scientific basis.

The boundaries of what is considered neurodivergent and what is not remain obscure (Dwyers, 2022; Russell, 2020), and there is a clear contradiction in including ''people with a medical diagnosis who are opposed to the idea of medical disability'' (2020, p. 287). The neurodiversity concept also raises questions about intellectual disabilities and neurodegenerative conditions (such as Parkinson's and Alzheimer's diseases). Milton (2019) reports the sometimes contradictory critiques of neurodiversity, such as excessive alignment with either the medical model or the social model, the inability to apply this concept to intellectual disabilities, the stifling of autism research, and the downplaying of disability. Barn and Dierickx note the ''enormous lack of research information on the medical and social implications of neurodiversity'' (2021, p. 2). They state that neurodiversity is a subject of ''great debate and controversy'' (2021, p. 2) and that a better understanding of neurodivergences could improve the lives of those affected through a reconceptualization of the concepts of disease, impairment, and disability, which could facilitate better communication with clinicians and encourage increased participatory research. These critiques primarily focus on the sociopolitical aspect of neurodiversity and do not seem to reference its less highlighted neurobiological and genetic aspects.

2. 3 Scientific Perspectives on Neurodiversity

Armstrong emphasizes that there could be an evolutionary explanation for neuroatypical individuals who have many strengths and abilities, and that ''a more judicious approach to treating mental disorders would be to replace the paradigm of 'disability' or 'illness' with a perspective of 'diversity' that takes into account strengths and weaknesses'' (2015, p. 349). Georgieff notes that although there is a ''consensual scientific and political discourse'' that ''predominates in defining autism'' (2017, p. 308), contemporary neuroscience and cognitive literature reveal three models ''supported by clinical and experimental data'' (2017, p. 308): the deficit model, the over-functioning model, and the difference model. According to Mottron, the neurodiversity movement views autism ''as a human variation, involving adaptive advantages and disadvantages, sometimes extreme'' (2016, p. 423), and it stems from the fact that individuals with autism can perform specifically human tasks in ways that are sometimes equivalent to or even superior to neurotypical individuals (2016, p. 423). This aligns with Ortega's observation regarding the dominance of the neurodiversity movement by autistic individuals who believe that their condition is not a disease to

be treated and cured, but rather a human specificity (like sex or race) that should be equally respected (2009, p. 425).

Furthermore, Baron-Cohen highlights that when examining the definitions of the word ‘‘disorder,’‘ ‘‘none of them seem appropriate to describe autism’‘ (2017, p. 744). Moreover, given that there is ‘‘ample evidence that the autistic brain is different from the typical brain, it would be difficult to identify an example of brain disorder in autism’‘ (2017, p. 744), as it would rather be signs showing ‘‘that the autistic brain develops differently from the typical brain - and not direct evidence of neuropathology’‘ (2017, p. 744). According to him, the main argument against the idea of a disorder for autism is that ‘‘in an autism-friendly environment, the person can not only function well but sometimes even at a higher level than a typical individual’‘ (2017, p. 746). Thus, the term ‘‘disorder’‘ should be used ‘‘when there is nothing positive about the person's condition, or when, despite attempts at different environmental modifications, the person is still unable to function’‘ (2017, p. 746); the term ‘‘illness’‘ when ‘‘the biomedical and mechanistic cause of a disorder is known, perhaps through medical tests or scientific research’‘ (2017, p. 746); the term ‘‘disability’‘ when ‘‘the person is functioning below an average level in one or more psychological or physical functions, and requires support or intervention’‘ (2017, p. 746); and the term ‘‘difference’‘ when ‘‘the person is simply atypical, for biological reasons, compared to a population norm, but this difference does not necessarily affect functioning or well-being’‘ (2017, p. 746). However, he believes that different forms of autism should be distinguished, and some may be considered disorders while others are differences.

Thus, the scientific perspectives on neurodiversity may primarily lie outside the realm of disability and within the disciplines of evolutionary psychology, cognitive psychology, genetics, and neurobiology. All these disciplines could explain the origins and boundaries of individual variations, such as in the case of autism.

DISCUSSION

The discussion will focus on three elements: the potential pitfalls resulting from the terminological and scientific ambiguity of neurodiversity, the questioning of its scientific nature, and the issue related to the nature, conception, and definition of autism. Finally, I will propose some scientific and social implications for the genuine development of the neurobiological and genetic aspects of the neurodiversity field.

3. 1 Pitfalls resulting from terminological and scientific ambiguity

The first consequence of the terminological and scientific ambiguity surrounding the concept of neurodiversity is the inability to theorize difference, leading to conceptual pitfalls. The medical world, which dichotomizes reality into healthy and pathological, leaves a large number of individuals who fall on the border to embrace concepts (sometimes pseudoscientific) such as ‘‘zebras’‘ (Siaud-Facchin, 2008), ‘‘philo-cognitives’‘ (Nusbaum *et al.*, 2017), or ‘‘hypersensitives’‘

and ‘‘emotionally gifted’‘ individuals (Aron, 2017). These concepts, at the very least, provide a path for objectifying experiences, which science is currently unable to do. Thus, while the scientific community appears to be the solution for addressing the concept of difference and cognitive diversity, it can also be seen as one of the causes of these pitfalls.

3. 2 A sociopolitical movement falsely claiming to be based on science?

It is observed that the concept of neurodiversity refers to various things: the medical model of disability, the social model of disability, something in between, a sociopolitical movement, or even a scientific field situated between neurobiology, genetics, and cognitive psychology (Rebecchi, 2022). If we stick to what Judy Singer's ‘‘neurodiversity’‘ represents, it should rather be called ‘‘The Movement for the Recognition and Defense of the Rights of Disabled, Discriminated, and/or Dominated Individuals’‘ and not ‘‘neurodiversity,’‘ which implies it is a scientific concept. Judy Singer herself states on her blog (2019) that it is a political term, not a scientific one. However, it is likely due to this ambiguity that many debates and numerous criticisms have emerged, some of which may be justified. As a result, many books published on neurodiversity rely almost exclusively on the social sciences (Rosqvist *et al.*, 2022; Silberman, 2015; Singer, 2017) or focus on the world of work (Bruyère et Colella, 2022; Wood *et al.*, 2022), reinforcing the perception of a field outside of science or sociopolitical activism. However, is neurodiversity an ideology or a scientific field? Moreover, do some individuals not use the terms ‘‘neuroatypical,’‘ ‘‘neurodiversity,’‘ or ‘‘neurodivergence’‘ as euphemisms for the notion of disability, thereby causing misunderstanding and anger among parents of severely disabled children?

3. 3 The problem related to the nature, conception, and definition of autism

Similar to neurodiversity, the concept of autism is used to refer to completely different situations. To address the terminological and scientific problems of neurodiversity, it would be necessary to try to better conceptualize autism. Contrary to what Forest (2016) claims, there is no real scientific consensus on the idea of a spectrum or on the work of Wing, which was based on an epidemiological study that identified primarily intellectually disabled children (Wing, 1981, 1986). In autism, children who are predominantly intellectually disabled should not necessarily be diagnosed as autistic if their symptoms can be explained by intellectual disability or global developmental delay (Thurm *et al.*, 2019). It would be appropriate to separate autism from intellectual disability and exclude the latter from the neurobiological and genetic realm of neurodiversity, similar to how high intellectual potential is not included. Thus, a person could have a difference like autism and a disability like intellectual disability, language disorder, or executive functioning impairment. The problem arises when autism is categorized by levels. To this day, there is no widely accepted definition of autism. According to Waterhouse (2009), it is a ‘‘portmanteau syndrome’‘ (i.e., one that presents a large number of behavioral expression patterns, genetic mutations, and neurological peculiarities). Mottron (2021) suggests returning to prototypical autism, which can be defined as a clinical profile that illustrates the average variations observed

within a category of autistic individuals, similar to Kanner's autism (Gastgeb *et al.*, 2009; Mottron & Gagnon, 2023).

Furthermore, there is no single etiology for autism. On the contrary, autism shares an etiology—namely, numerous phenotypic and genetic overlaps—with most other neurodevelopmental conditions (such as attention-deficit/hyperactivity disorder, dyslexia, and the schizophrenia spectrum) (Brainstorm Consortium *et al.*, 2018; Cabana-Domínguez *et al.*, 2022). Additionally, the medical characteristics of autism correspond to arbitrary cultural choices (Hyman, 2021) rather than neurobiological or genetic characterizations. To date, the autism spectrum exhibits great heterogeneity, and Waterhouse and Mottron (2023) emphasize that ‘‘no single cause or pathophysiology has been found’‘ and that the ‘‘current diagnostic criteria are related to nearly two hundred genetic and environmental causes’‘ (p. 1).

All these arguments lead to the question: can the claim that a person is autistic be contradicted by an empirical test such as the ADOS-2? The answer is obviously no, as some individuals outside the autistic spectrum obtain higher scores than autistic individuals themselves (Maddox *et al.*, 2017; Trevisan *et al.*, 2020), and the tests are not sensitive enough for women or individuals with high intelligence (Lai and Baron-Cohen, 2015; Rynkiewicz *et al.*, 2016). Additionally, the nosologies of autism, such as the DSM, evolve over time and vary the framework of autism, leading to the broadening or narrowing of the spectrum, thus causing individuals to enter or exit the diagnosis of autism (Smith *et al.*, 2015). Therefore, as long as the definition of autism remains unclear, it will be difficult for neurodiversity to be seen as a fully scientific field.

3. 4 Limitations and Implications

The analysis of scientific literature on neurodiversity has not followed the guidelines of systematic reviews, so it is possible that relevant articles may be missing. Additionally, the groups and collectives within the autism and neurodiversity communities are highly heterogeneous and have not been fully highlighted here. Furthermore, this article has focused on the example of autism and has not emphasized the various debates related to other neurodevelopmental conditions.

However, developing the neurobiological and genetic aspects of the scientific field of neurodiversity through the creation of applied neurobiology to autism (Abrahams & Geschwind, 2008) could lead to better recognition in society. This would have implications for healthcare (by developing respectful approaches that align with the physiological characteristics of individuals with autism), education, and the professional world (by creating pedagogies, autistic-friendly methods, and environments accessible to everyone), as well as society at large (by integrating the concept of cognitive diversity into elements that can lead to discrimination in the French Penal Code and the Canadian Criminal Code in Quebec).

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