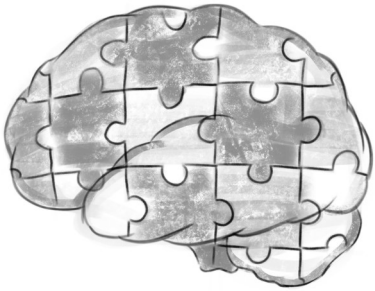

A Semiospheric Interpretation of Pragmatic Difficulties in Autism Spectrum Conditions (ASC)

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Abstract

In recent years, the neurodiversity concept and its coherence with contemporary theories on brain function have reframed perspectives on pragmatic difficulties in Autism Spectrum Conditions (ASC), consequently acknowledging the intersubjective space as a prominent part of the puzzle. In order to concretize the paradigm shift, this thesis takes the subdivided definition of "high-functioning" autism as a paradigm example, reviewing old and new cognitive theories through the neurodiversity paradigm, and examining possible cognitive bases for the pragmatic difficulties which arise in cross-neurotype communication. A baseline of contemporary cognitive theory is established through the predictive-coding hypothesis, which postulates that sensory processing and meaning-making processes of the mind are conducted through cortical means of Bayesian inference. In its framework and contrasted with a neurotypical counterpart, the autistic brain is defined as developing its internal model of the world on a neurologically different foundation of sensory and predictive processing which leaves it in large degrees unable to intuitively adapt to and differentiate between subjectively important sources of stimuli in noisy environments—those self-same environments in which the neurotypical brain thrives in, by virtue of its predictive style being predicated on generalizing sensory information. This foundation is perceived through the notion of the semiosphere, which posits that these differences in mind-world relations permit different systematizations of semiotic information in the semiosphere. From this interpretation, the autistic brain is defined as immersing itself in a semiotic continuum which in large parts is not made for it, thereby being caught in a tug-of-war between constant background acts of translation and more effortful searches for relevance.

Keywords: **Pragmatic difficulties, Autism Spectrum Conditions, neurodiversity paradigm, cross-neurotype communication, predictive-coding hypothesis, the semiosphere .**

Introduction

In a world of spheres, of biospheres and noospheres, of asymmetry, diversity, and complexity, the biocultural niche of language has managed to constitute the minds of humankind into a sphere of semiosis, where meaning exists beyond the individual mind and subsists through patterns of self-organization in communication (Lotman, 1984; Schweitzer & Zimmermann, 2001; Sinha, 2014). Through this, the creation of a symbolically mediated biocultural complex of humankind, with the principles inherent in complex adaptive systems dictating the creation of niches within the semiosphere, has allowed languages and cultures to evolve into the constituent, heterogeneous systems and patterns of meaning that we now know today (Semenko, 2012; Sinha, 2015). It is in this world of translatable values, of semiotic[1], cultural, and neurocognitive diversity, that fluency is a term that denotes both boundaries of communication and efficacy of expression; however, it is a world where the autistic condition and the core tenet of neurodiversity has yet to frame itself and yet to find its place within the larger constitution of semiotics and pragmatics in translation, its place in the foundation of shared meanings, and thus its place in the semiosphere.

The notion that autism denotes a spectrum of conditions is a relatively novel concept. A hundred years ago, the word "autism" was coined in reference to the self-absorbed and introspective symptoms of schizophrenia, in which the inner self dominated over reality (Frith, 2008). It was not until the case studies of Leo Kanner (1943)

[1] **Semiotic :** relating to signs and symbols, which themselves signify a meaning. These signs and symbols remain as vessels or constitutive elements of a meaning, i.e., only conveying the meaning through arbitrary representation (consider how a word signifies a meaning, rather than itself). The sign is composed of the signifier (the form constituting the sign) and the signified (the real-world object represented by the signifier).

and Hans Asperger (1944) on "autistic disturbances" and "autistic psychopathy" in children that the term was used to denote an independent developmental disorder, marked by impairments to social and motoric functions. But even with this description of abnormal behaviour, several radical shifts in concept would occur with the emergence of epidemiological studies, categorizing features of autism into syndromes through deficit-based accounts. Throughout the decades leading up to the 21st century, the hypotheses of Baron-Cohen (1997) and Frith (2008) would classify the root causes of communication troubles and introspective traits to arise from a general mind-blindness and an inability to put information into context. In recent years, autism research has encountered a significant paradigm shift, critiquing previous theories of pathology (Davis & Crompton, 2021; Fletcher-Watson, 2019; Nicolaidis et al., 2019). With its foray into popular literature, and consequently larger masses of people and researchers alike, the scientific literature around autism research has begun to redefine itself through the neurodiversity paradigm (Armstrong, 2010; Rosqvist et al., 2020; Silberman, 2015)—several authors now propose distancing the field of terminology from deficit-based "patient"-versus-"healthy"-dichotomous descriptions of autism by replacing "disorders" with "conditions" (Bolis et al., 2017).

From a linguistic standpoint, this paradigm shift presents an opportunity to study the larger narrative of pragmatics in cross-neurotype interactions, through angles which might not have been possible in a previously more restricted paradigm. Here, the assumption is that the breakdown of mutual pragmatic understanding can be shown to originate from a variable number of differences between relevant interlocutors, namely through their neurological and cognitive differences. Based on the subject matter of the neurodiversity paradigm and its relevant studies, this paper aims to contextualize

these pragmatic difficulties in cross-neurotype communication through the concept of the "semiosphere" to consider how mind-world relational aspects of semiosis and immersion into a semiotic continuum affects a neurodiversity of minds. Autism Spectrum Conditions (ASC) are chosen as the paradigm example to analyze and discuss the literature around neurodiversity, as well as establish contemporary theories on cognition that directly correlate with notions of autistic cognitive function. To alleviate any concerns of romanticizing actual disorders of the mind, this paper chooses to predominantly focus on the high-functioning side of the autistic spectrum, of autistic people who exhibit no intellectual disabilities and whose main symptoms are related to neuronormative attributions of deficits in social communication and emotion recognition, and who have been disenfranchised by a seemingly rampant culture of disability.

Establishing a Neurodiversity Paradigm: Cognitive Theories of Autism

In accordance with the diagnostic requirements described in the World Health Organization's eleventh revision of the International Classification of Diseases (ICD-11) (the equivalent of the DSM-5-TR), the core features of Autism Spectrum Conditions (ASC) consist of life-long persistent abnormalities in areas of social communication, sensory experience, and patterns of behaviour—the latter of which involves inflexible or repetitive behaviours atypical or excessive to the sociocultural context (World Health Organization, 2019). These are measured from the expected range of neurotypical functioning in the specific cultural context, and any additional features which might involve a disorder of intellectual development, a degree of functional language impairment, or speech that lacks substantial prosody and emotional tone. As a classification of diseases, in its effort to characterize mental, behavioural, and neurodevelopmental

disorders, the ICD-11 orients itself on notions of normality; it is neuronormative by design, so as to ensure consistent identification of conditions which limit capacities for sustaining and initiating neurotypical forms of social interaction and social communication—limitations which can prove problematic for its person and the people who surround them, by virtue of their aberrancy.

Relative to their respective time periods, the conception and development of cognitive theories of autism have always followed a through-line of representing the then-current ideals and knowledge of human cognitive function. As the most recent iteration, the ICD-11 takes care to mention the cultural variation of norms, and how the social abnormalities of ASC can border on normality in certain cultures. Yet, despite its apparent congruence with the neurodiversity paradigm on this aspect, and by virtue of its statistically-determined design affirming contemporary cognitive theories, the language through which it describes autistic people as the source of pragmatic failure lends credence to the deficit view of autism which had domineered past paradigms of autism research. This is due in part to Leo Kanner's influential account of early infantile autism, which led autism definition and research down a path in which the main focus was on ensuring early identification and treatment (Kanner, 1943); it therefore stereotyped autism, and its eventual extension to a spectrum, to early childhood behaviour. This meant that the deficit-based foundational studies were largely non-inclusive and limited to a neuronormative perspective of neurocognitive diversity, which eventually cascaded into rampant deficit-focused studies, where the empirical failures of the previous paradigm were owed to an absence of restraint with regards to conjecture formed from a solely neurotypical frame of reference. As pragmatic difficulties would belong to the autistic person, with the non-autistic person not beholden to any mis-

understandings which arose from intersubjective communicative gaps with mentally disordered individuals, autism research of the previous paradigm found itself concluding on matters such as mind-blindness (a lack of empathy and inability to mentalize) and weak central coherence (impaired holistic processing) as core deficiencies of autistic cognition itself (Baron-Cohen, 1997; Frith, 2008). Which, despite ongoing criticism and rejection on the grounds of non-replicability and methodological error sources (Gernsbacher & Yergeau, 2019; López & Leekam, 2003), these paradigms remained influential sources of publicly available information on account of confirming the stereotypical assumptions of autistic behaviour.

The Theory of Mind (ToM) deficit hypothesis assumes that coherent empathic behaviour in social interaction is reliant on the ability to make inferences about the unobservable mental states of those around us, and that autistic people are delayed in developing this system of putting oneself into another's shoes. This description of the matter ostensibly refers to the "mindreading" system as being orchestrated through four pre-packaged brain modules, each mechanism in tandem with each quadrant producing the detection and envisioning of another person's mental state: one involving a mechanism for detecting intentionality, another for eye direction, a third for the detection of shared attention, and lastly one mechanism responsible for unifying relevant possibilities into a coherent theory of mind (Baron-Cohen, 1997). While this review and investigation of autistic children adopts the perspective of autistic cognitive development being markedly different from that of normal children, it extrapolates this mind-blind condition of the autistic brain from their consistent failure to display these mechanisms either at all or in tandem with each other, from experimental set-ups designed to instigate ToM-relevant behaviours. In these experiments, autistic children are shown to have a

limited or delayed capacity for engaging with joint attention, pretend play, and emotion recognition through various neurotypical socio-emotional loci.

Uta Frith, in her theory of a Weak Central Coherence (WCC), extrapolates from observations and descriptions of autistic sensory-perceptual tendencies that there is an inherent inability to orchestrate "big picture" coherence during information-processing, and consequently pragmatic context in social interaction (Frith, 2008). While the neurotypical brain is understood as being intuitively excellent at generalizing and removing unimportant details in the processing of directly visual or socially pragmatic information (i.e., seeing the forest but not necessarily noticing the trees), the autistic brain seems to be detail-oriented in its mind-world relation (i.e., seeing the trees, the leaves, the bark, the bushes, and then, if ever, noticing the forest). Although this notion still runs throughout the current neurodiversity paradigm, it has been redefined as a cognitive style, rather than a deficit—a recognition of effort being part of the equation for capacity, as a generalizing mind-world relation will be biased to its default approach, while a detail-oriented one would be equally biased to its preferred style, but both can be prompted to overcome its bias and diverge to a reversely-focused approach (Gernsbacher & Yergeau, 2019; López & Leekam, 2003).

As mentioned in the introduction, contemporary research posits less so an image of autism constituting a disability, but rather a focus on the two-way mismatch of salience between people on the autism spectrum and those of typical neurological functioning (Bolis et al., 2017). From the retrospective position of recent findings in autism research, the ToM deficit hypothesis and its constituent readings of autistic phenomena can be disputed as fragmented accounts of a greater whole: The notion of a Double-Empathy Problem (DEP) re-

lates the bidirectional nature of empathy to a mutual mindblindness rather than belonging to one or the other. This, in turn, clarifies the pathologization of autism as a consequence of neurotypical dominance (DeThorne, 2020; Milton, 2012). DEP is the result of shifting focus from the individual to the intersubjective space, recognizing certain aspects of social dysfunction as being harboured between interlocutors rather than belonging to one or the other. In this, DEP mainly deals with the topic of empathy and the incongruence of shared socio-emotional information; this occurs when two or more people in interaction do not share the same parameters for emotion recognition, as both parts of the interaction have trouble understanding the motives and experiences of the other. This is also no less relevant to the suggestions of the WCC theory, as it could be considered a narrow description of a perceptual-cognitive style, acting as a forerunner to broader interpretations of autistic brain function: namely, the predictive-coding theory of brain function.

The Brain as a Probabilistic Prediction Machine

Predictive-coding, or the Bayesian brain hypothesis, is a neuroscientific theory of cognitive function and a philosophical conjecture of mind-world relation, which depicts the brain as a probabilistic prediction machine continuously organizing and maintaining an internal generative model of the outside world (Clark, 2013). The notions of predictive processes are ascribed to this theory through the inherent imperative to compensate for the skull-bound brain being unable to interpret its exterior environment, other than through various means of sensory input (Paton et al., 2013). To minimize the amount of information that needs explicit processing, the internal model is updated on the principle of predictive error minimization (PEM). Through perceivable regularities in its data, the brain is able to implicitly predict upcoming sensory input and maintain the model

through that lens, all while updating the model on the basis of prediction errors, which occur when there is a dissonance between predicted and actual sensory input. This process of prediction error minimization is considered to be "precision-weighted", where prediction errors are hierarchically inferred on account of their precision or certainty: On a spectrum of evaluated precision of input, lower values are more likely to be regarded as statistical noise and thus ignored, while higher values denote importance and therefore demand a correction of the internal model (Arnaud, 2020; Clark, 2013).

Now entering an almost decade-long association with autism spectrum conditions, the predictive-coding theory has acted as an umbrella body for a cluster of symptoms. Certain perceptual and sensorimotoric abnormalities of autism, together with their unique perceptual experience ostensibly described as ToM deficits or WCC, are addressed through the PEM-centric implication that the autistic brain, in its predictive framework, carries an inherent inability to differentiate between high and low values of precision (Pellicano & Burr, 2012; Van de Cruys et al., 2014). This aberrant precision account of autism implies predictive processes of autistic minds essentially functioning without a "noise-filter" (Finnemann, 2019).

These combined theories of autistic perception possess the explanatory power to address several key details of autism definition: their hyper- or hypo-sensitivity to visual and auditory stimuli, the tendency (or preference) for locally-oriented perception and detailed local processing, the lack of coherence in certain contexts of speech and perception, the inflexible behaviour in socio-emotional environments, and the tendency towards developing special interests (Asperger, 1944; Baron-Cohen & Bolton, 1993; Kanner, 1943; Bogdashina, 2004; Van de Cruys, 2014). These notions of a significant cognitive difference have inspired the integration of individual and

collective levels of analysis, through the recognition of psychopathology encompassing not only the disordered function of individuals, but the interpersonal dynamics of autistic-neurotypical dyads and their respective styles of interaction (Bolis et al., 2017). The Dialectical Misattunement Hypothesis (DMH) posits that larger differences in individual predictive processes and interaction styles cause communication misalignments and weak interpersonal coupling in social interactions. This interpretation of a dialectical misattunement between interlocutors, coupled with emergent notions of cross-neurotype communication and neurodivergent well-being in neurodiversity studies, has pioneered intersubjectivity as a crucial component for substantiating accountability of neurotypical populations (Rosqvist et al., 2020; Bolis et al., 2017).

The Neurodiversity Paradigm

The neurodiversity paradigm is an inherently reformative perspective of existing conditions of human cognitive normativity, which takes the notion of diversity being an undeniable fact of nature and describes the continuum of human neurocognitive variations as being part of a naturally-induced diversity of the human brain (Armstrong, 2010). Emerging through social movements of autism awareness and autistic self-advocacy, the introduction of the term neurodiversity and its terminological underpinnings in the 1990s sought to de-pathologize and re-theorize the medical diagnostic models of neurodevelopmental disorders: most notably amongst them, autism spectrum conditions and the realm of comorbid conditions associated with it.

As the new decade of the 21st century sets in, and the paradigm has shifted in accordance with an increasingly inclusive field of autism research, further developments have accompanied the aforementioned cognitive theories on the two-way nature of interaction,

prompting the emergence of a new field of inquiry: neurodiversity studies. In their introduction to their book of the same name, Rosqvist et al. (2020) describe the domain as a "new theorization of conditions that are understood as impacting on the individual's sense of identity" (p. 2) that has "aims to problematize neurotypical domination of the institutions and practices of academic knowledge, by questioning the boundaries between the predominant neurotypes and their others" (p. 2).

The subdivisions of neurotypes, and what constitutes a neurodivergence and neurotypicality, has yet to be definitively regulated in its terminology. In the case of this paper, the terminology will be a conjecture of the subject matter of Rosqvist et al. (2020), specifically derived from Chapter 6: Neurodiversity and cross-cultural communication by Hillary (2020), where neurotype is described as a "cluster of similar neurological and cognitive ways of being" (Hillary, 2020, p. 92), which also recognizes that there can be overlaps between people of different neurotypes. Neurodiversity encompasses all neurotypes, while neurodivergence is the term used for notable divisions from the predominant "typical" neurotype.

It is under these conditions that the neurodiversity paradigm has inclined towards the disposition of regarding neurodivergent individuals as being minorities in a neuronormative [2] organization of society which favours the majority neurotype, designated as the neurotypical population (Armstrong, 2010; Rosqvist et al., 2020). On a mental health account, its reinterpretation of several disorders of the mind being "components on a broader continuum of sensory, affectual, and cognitive processing" (Crompton et al., 2020a, p. 1446) has provided new possible frameworks for inquiry, which help establish

[2] **Neuronormative :** of, relating to, or based on the attitude that neurotypicality is the only normal and natural mode of brain functioning (based on heteronormative).

neurotype inequality and minority stressors as main factors of neurodivergent difficulty and ill-being (Rosqvist et al., 2020).

A Social-Emotional Salience Account

Although recent findings of contemporary autism research and neurodiversity studies have taken to depositing unprecedented value towards the recognition of a misalignment in the two-way nature of social interaction, there is a need to focus on what exactly is divergent in the neurodivergent condition of autism in order to properly navigate the concept of the semiosphere.

Several accounts of autistic behaviour imply not so much a mind-blindness or a lack of sociality, but rather a need to explicitly and consciously process social and emotional stimuli in the ocean of statistical noise that the typical social environment is imbued with (Arnaud, 2020).

[Routine formulae] are expressions whose occurrence is tied to particular, highly predictable situations, whose meaning is pragmatically conditioned and whose usage is motivated by the relevant characteristics of social situations. (House, 1996, p. 225)

The specialized niche of the neurotypical social environment, expressed by routine formulae, highly rewards tuned down precision due to how a multiplicity of accidental properties are expected to be regarded as uninformative and of low precision, by virtue of meta-learned social rules that determine relevance and irrelevance. These neurotypical social interactions are most often reliant on exchanges of high-level predictions, reducing complexity through a salience for social cues, which dictates the neurotypical social environment towards an intuitive preference for social and emotional information in focused areas of attention: "By being salient, social and emotional stimuli will become more fluent and familiar for neurotypical people" (Arnaud, 2020, p. 12).

With the recognition of a highly mediated and specific complexity of neurotypical social environments, the social-emotional salience account of autism addresses the seemingly unsociable and dismissive behaviour of autistic individuals through the aberrant precision account; because the autistic mind processes virtually everything in subequal amounts by default, due to an aberrant encoding of precision, social-emotional salience is evidently hard to develop and is therefore instinctively absent in most cases. Thus, the autistic mind has to process the neurotypical social sphere of information as they would with any novel input (Arnaud, 2020). This consequently means that there is not so much an integration into the experience of social interaction as much as there is an alienation from it—without implicit processing of social cues, fluency and participation in a neurotypical social world is inhibited by the need to consciously detect and process relevant social information.

In the social environment of neurotypical majorities, the framework of autistic predictive processing is constantly presented a dilemma of either deviating from their neutral cognitive mode and hypothesizing what their fellow humans deem salient, or be socially alienated; they have to engage in a different mind-world relation, acquiring fluency at the cost of their prediction and interaction style (Livingston et al., 2019). The existence of autistic fatigue (or burnout), which is where autistic people experience chronic exhaustion, loss of skills, and reduced tolerance to stimulus, implies that constantly deviating from the thresholds of their interaction style, and circumventing the principles of minimalization in their prediction style through intellect, exhausts their neural energy supply (Raymaker et al., 2020; Wang et al., 2017). Furthermore, adaptation via intellect to neurotypical spheres of communication can occur throughout different temporal scales and multiple exposures; e.g., repeated observa-

tions and experiences and consciously learned experience can be achieved through the span of a dialogue encounter or the lifespans of individual relationships, but these never constitute a complete fluency as it is effectively the development and maintenance of a "mask" (Bolis et al., 2017; Hull et al., 2017; Pearson & Rose, 2021).

An equally significant aspect of neurodivergence relates to the contemporary notion of a two-fold social disfluency, where non-autistic people have trouble understanding autistic people. This is the basis for the Double-Empathy Problem (DEP) which, in line with social-emotional salience, denotes a bidirectional misunderstanding of feelings and perspectives (DeThorne, 2020). This notion of mismatched salience in cross-neurotype social interaction has challenged the traditional ToM-deficit view of autism by conferring breakdown in pragmatic understanding as a symptom of cognitive and perceptual differences being at odds with each other, causing a communicative gap.

Although the predictive-coding account of autism, together with notions of neurodiversity, has helped to further induce a paradigm shift, the notion of autistic individuals relying on intellect to progress socially is not so much a novel concept as it has been one of the main identified consequences of the condition. It goes as far back as to the conception of the autistic condition by Hans Asperger:

Normal children acquire the necessary social habits without being consciously aware of them, they learn instinctively. It is these instinctive relations that are disturbed in autistic children. To put it bluntly, these individuals are intelligent automata. Social adaptation has to proceed via the intellect. In fact, they have to learn everything via the intellect. (Asperger, 1944, p. 58)

Of course, certain aspects of this reading have been revised throughout the decades, such as with the notion of an intelligent au-

tomata: The autistic condition is no longer psychopathic in its definition, as signified by numerous accounts of there being a full range of emotions and the presence of cognitive, as well as affective, empathy—albeit with inhibited or different forms of expression (Berthoz & Hill, 2005; Brewer et al., 2016). Emotion recognition is present in autistic cognition, albeit functionalized by explicitly controlling for details rather than their predictive processes intuitively accounting for it (DeThorne, 2020), which further manifests itself as inflexibility in volatile socio-emotional environments, as their predictive style needs a higher level of certainty before proceeding to a stable processing stage (Latinus et al., 2019). This can be recognized as a paradigm of social interaction in and of itself, as it constitutes the autistic sphere of social-emotional recognition and processing. As evidenced by studies on autistic peer-to-peer information transfer and friendship quality, without the ramifications of neurotypical social dominance, autistic groups of people are able to essentially reach a level of social comfortability and identity not otherwise possible as when they are in neurotypical social spheres (Crompton et al., 2020a; 2020b).

Defining a Sphere: Neurodiversity, Cultures & Shared Meaning

It is through the introduction of separable niches of relative informational efficiency and social comfortability on the basis of their neurotype that the analysis of human social communication and experience is allowed a neurological dimension. While group membership and social identity is variable on the basis of many different factors, the key principle of similarity-based interpersonal attraction has been widely regarded as a pertinent factor in the formation and cohesiveness of a social relationship or group (Hogg et al., 1995; Triandis, 1960). It is within this similarity hypothesis that the predictive-

coding perspective of autism can be utilized to regard dissimilarities in neurologically grounded mind-world relations as key catalysts for communicative gaps in social communication.

To make meaning out of the world and successfully engage with the environment requires the ability to perceive sensory information from the world and integrate that information in meaningful ways into states of consciousness which then thrusts the individual into the world with appropriate actions.(Mueller & Tronick, 2020, p. 255)

The paradigm shift has solidified the notion of empathic difficulty being present on both sides due to a mismatch of mind-world relations, as well as different predictive styles garnering different interaction styles, certain existent meanings in a semiotic niche might not be salient in another interlocutor's world of meaning, per the social-emotional salience account. In relation to autism, these fundamental differences in sensory processing and meaning-making compound into atypical meanings and deviant experiences of events (Mueller & Tronick, 2020).

As such, with pragmatic language being reliant on an equivalent perception of context between interlocutors (Horton, 2012)—in such a way that their predictive processes account for the same details in a semiotic niche, the dearth of reliable empathy, and the jarring effects of incongruous interaction styles between autistic and non-autistic people, presents a higher likelihood of a breakdown in social communication (Williams et al., 2021). It is within this theme of dialectical misattunement on the basis of neurocognitive differences, that this main body of the paper intends to clarify the relevant communicative aspects of the neurodiversity paradigm, and further yet, contextualize the mind-world relational implications of divergent minds creating divergent environments through the comparison to the principles of culture and the semiosphere.

Cross-Neurotype Communication and its Implications

Diversity begets complexity, and in the case of human societies and its constituent phenomena, inter alia, communication, and meaning-making, the interacting adaptive entities (human beings) produce patterns and structures of behaviour, upon which principles of self-organization effectuates the development of social niches (Ashby, 1962; Graham, 2015; Page, 2010). It is in this ordering of types through their circumstances that it becomes relevant to compare the separate elements of aggregate ways of being; so far, this paper has only concerned itself with neurocognitive diversity in relation to the ways in which pragmatic information acquires its context in social communication.

It is through the neurodiversity paradigm that it is possible to infer that since neurotypes in their diversity can constitute wholly different spheres of experiences of the world and its meanings, it allows for a comparison to cultural diversity, upon which the ordering of effects in cross-neurotype communication would follow along the same principles as cross-cultural communication (Rosqvist et al., 2020). In both circumstances of communicating across significant differences, whether on the basis of neurocognitive or cultural diversity, pragmatic difficulties occur because of context-specific misalignments of mind-world relations, whether it is in their use of language, the values and morals they ascribe to themselves as well as the world, or the customs of life upon which their interaction styles are predicated (Hillary, 2020). What the subject matter of DEP and DMH suggests in this correlation is that while the neurodiversity paradigm has helped contextualize theories on cognition and social communi-

[3] In reference to a lesson on subtlety in cross-cultural communication, in which the examples listed by the teacher were presumed to only be applicable to cultural differences, but were equally applicable to examples of cross-neurotype communication, yet were not recognized as such because of their neuronormative orientation.

cation to core characteristics of autism spectrum conditions, the frames of understanding which acknowledge the existence and prevalence of not only functionally different minds, but also fundamentally distinct styles of social interaction, is a much more accepted aspect of cross-cultural communication versus cross-neurotype communication (Crompton et al., 2020c).

It was the same meaning – almost the same words. It was the same bluntness – even the same confusion. I claim a cultural difference: Autistic and Neuronormative, [which is] denied. They claim a cultural difference: American and Chinese, [which is] a known issue. (Hillary, 2020, p. 91)[3]

While there is a different conversation to be had on the status of neurobigotry, the more important implication of this observation is: The circumstances of interactions in which neurotype difference is the main precedent for pragmatic and empathic failure most often lack the basis for bridging communicative gaps through stories and context, in analogous reference to cross-cultural communication; and cultures have historical context, upon which the differences between interlocutors can be attributed to the external source of their cultural-societal roots (Hillary, 2020; Bolis et al., 2017). In the case of cross-neurotype communication, the communicative gap is most often owed to the assumed disability of the individual, such as an autistic condition, as an invasive insistence, as the non-autistic person would be used to most interactions going as according to neuronormative expectations (Milton, 2012).

The Notion of the Semiosphere

Boundaries seem to shape around neurotypes and cultures, wherein meanings, whether constituted by the formal systems of signs in their

[4] Or meaning-world, as per the Danish interpretation of the semiosphere : "betydningsverden" (meaning + world).

language or by shared understanding of pragmatic meanings, seem to be apprehensible only to constituent members of the relative niche. Any attempt to communicate across mind-world relational differences is subject to potentially turbulent exchanges of half-meanings, which are only mitigated by similarities in other spheres of meaning; which is to say that interaction tuning is possible, only as long as there is some shared baseline that allows for translation or explanation of misunderstood facets (Bolis et al., 2017).

The great assumption of neurodiversity is, despite a neuroplasticity of the adaptive brain allowing adjustments to new environments through changes in its neurocognitive architecture, there are some forms of social communication which seem to depend on the foundational type and anatomy of the brain—neurodiverse conditions are more potentially vulnerable to this definition as socio-cognitive inflexibility interrelates with accounts of aberrant precision and fundamental differences in neurological and cognitive functioning (Chamberlain et al., 2020; Timberlake, 2019; Voss et al., 2017). It is within this assumption, in keeping with this trend of describing concepts that have yet to obtain an unambiguous definition, that the semiosphere is a potently relevant term, as it functions as a semiotic framework upon which conversations about the existence of borders and translation in complex interactions between different worlds of meaning[4] are made possible.

Juri Lotman's concept of the semiosphere was moderately framed in 1984 as both an abstract analogy and semiocentric continuation of Vladimir Vernadsky's biosphere, denoting it as the all-encompassing semiotic continuum comprised of "multi-variant semiotic models situated at a range of hierarchical levels" (Lotman,

[5] Multiple worlds and truths, in reference to how the brain only perceives whatever it deems salient, and that different senses of salience would produce different answers (see: gestalt, dialectics, socratic method, ideologies).

1984, p. 206). It had the underlying function of defining the duplex nature of the individual human organism as a constituent to not only its biological niche in the larger biosphere, but also its immersion into the self-constructed symbolic dimension of the human biocultural complex (Sinha, 2014). As much as the biosphere is defined as a biological membrane of the Earth, wherein the multiplicity of living beings all exist and are constituent members of various ecosystems and ecological niches, the primary semiosphere is both a semiotic space within which the totality of all semiotic acts exist, and simultaneously the fundament upon which all interconnected semiotic systems and products of semiosis are built upon (Nöth, 2006).

It has since then been developed and reinterpreted through several domains of research, most arguably gaining definition through its influential role in the development of cultural semiotics and otherwise through constituent niches of semiotic research: inter alia, theosemiotics, and biosemiotics (Kotov & Kull, 2011; Põder, 2021). The terms of "the semiosphere", "multiple semiospheres", and "semiotic space" have since then acquired a polysemous characteristic in terminology, wherein their meanings are dependent on the angle and field of research (Kull, 2005; Torop, 2005). In the case of this paper, we are dealing with pragmatic difficulties and capabilities in communication: As such, the primary semiosphere will be most relevantly defined as the world of shared meanings, a network of sign relations, and multiple worlds of meaning [5] (Kull, 2005; Nöth, 2006). Through this, languages are definable as systems of meaning, the corollary being that cultures are systems of shared understanding or historically transmitted patterns of meaning. A semiotic space would then denote the space of meaning delineated by a semiosphere, akin to the albumen and yolk of the egg, while a semiosphere emphasizes the existence of a shell, a boundary—which brings to mind the con-

cept of semiospheres within semiospheres, borders within borders.

The Semiotic Space in Relation to Autism

An inherent feature of the semiosphere is that it is constituted by several smaller semiotic spaces; parallel to biodiversity in a biosphere, the diversity of semiotic systems effectuates niche construction in its complexity, of which interconnected participants of the semiosphere delineate themselves into peripheral semiotic niches of the primary semiosphere (Sinha, 2014). Termed secondary semiospheres, or simply "semiospheres", these patterns of meaning are supplementary superstructures upon the core of the primary semiosphere (this core being comprised of the most logical structure of meaning: natural language), where the systems of the core "permeate almost all semiospheric levels" throughout the superstructural niches of meaning-making (Nöth, 2006; Semenko, 2012, pp. 114-115). This is where the diversities of culture reside, and at the intersection of their peripheries, cross-cultural communication occurs: the connections through which pragmatic meanings become relevant, and in turn, fluency in different kinds of communication other than natural language. In comparison to hindrances in the conveyance of meaning in cross-linguistic interactions, where poor or non-existent comprehension has more of a basis in the componential values of the primary sign (the signifier and the signified) not yet gaining coherence in the mind of the individual (McGregor, 2015), the pragmatic difficulties of cross-cultural communication involve mismatches in the respective patterns of meaning, represented by how each individual acquits himself in the semiosphere.

As it stands, pragmatic failure in the realm of cross-neurotype communication seems to deal with a more primary level of meaning, one in which understanding is much more dependent on its neurological foundation, where a specific type of mind-world relation en-

sures fluency in a specific semiotic space. It is here that it should be important to address the smallest unit in the equation of the semiosphere: the concept of Umwelt coined by theoretical biologist Jakob von Uexküll (1864-1944) as the self-centred world of meanings and ostensibly described as the individual semiosphere (Semenko, 2012). Here, the Umwelt is essentially congenial to the internal model of the Bayesian brain, insofar as it "includes all the meaningful aspects of the world for a particular organism" (Kull, 1998, p. 304). In reference to aforementioned theories on cognition, the Umwelt as an individual semiosphere would be an interpretative model of the "true" world, restricted and filtered by their sensory systems, through their predictive-coding framework and parameters of precision. This consequently means that unknown semiotic values, by virtue of a different sense of salience and relevance, would not be perceived, unless through extrapolation of half-known patterns and systems of meaning (McGregor, 2015; Semenko, 2012); we are in multiple worlds of the semiosphere at all times and it is only through half-meanings, the so-called peripheries of the semiotic spaces we are immersed in, that we can engage with other semiospheres (Kull, 2005).

A man receives only what he is ready to receive, whether physically or intellectually or morally, as animals conceive at certain seasons their kind only. We hear and apprehend only what we already half know. If there is something that does not concern me, which is out of my line, which by experience or by genius my attention is not drawn to, however novel and remarkable it may be, if it is spoken, we hear it not, if it is written, we read it not, or if we read it, it does not detain us. (Thoreau, 1961, pp. 212–213)

A neurotype is, by definition, a statistical fact of human neurological functioning in which the person is observationally grouped together with people of the same neurotype. There is no inherent communion

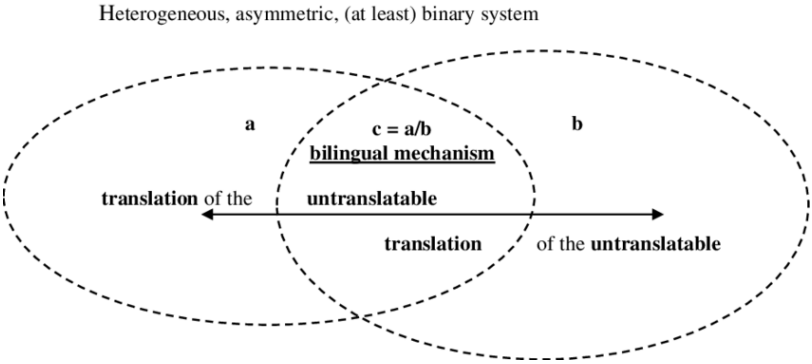

Figure 1: *Diagram of translation in cases of untranslatability (Monticelli, 2019, p. 396). The semiotic spaces of a intersects with that of b, where c represents the various peripheries of intersecting semiospheres between a and b, which in turn makes it possible to engage in the act of translation of the untranslatable.*

of minds in the diagnosis of a neurodivergent condition, wherefore a neurotype can be considered a hierarchical classification of similar Umwelten on the basis of residual signs that pertain to certain neurological and cognitive ways of being. Consequently, neurodivergent individuals seem to assimilate certain aspects of semiospheres differently from their neurotypical counterparts, with some more patently definable than others (such as with dyslexia) (Rosqvist et al., 2020), while the high-functioning region of the autistic spectrum of minds paradoxically has a more subtle difference in assimilation of core systems of the semiosphere (natural languages), yet a wholly different semiotic preference for systematic representations of meaning in a multiplicity of neurotypical-centric semiospheres (Tebartz van Elst et al., 2013). And if this interpretation is ordered on the principles of neurodiversity, where semiospheres are neurodiverse in their multiplicity, the definition would rather be one which signifies that the autistic mind has a semiotic preference for autistic systematic representations of meaning.

The intriguing character of high-functioning autism and neurodiversity as a whole on semiospheric terms is that a neurotype con-

stitutes a mind-world relational preference for specific facets of semiotic spaces, inhabiting a specific sort of semiosphere in its engagement with the interconnected participants of the primary semiosphere. If most of the established patterns of meaning are neurotypically inclined by virtue of predominance, then autistic individuals are constantly engaging with the generic social world through "background acts of translation" and decidedly "more effortful searches for relevance" (Williams, 2020, p. 17). This is where the principal notion of the semiospheric interpretation reveals itself in how it defines cross-neurotype communication as heterogeneous, asymmetric interactions of mind-world relations.

The difference between autistic and non-autistic individuals is much less a dualism between two minds, but more so a "multiplicity of boundaries creating intersecting spaces" (Nöth, 2015, p. 20). The resulting description of a bilingual mechanism in autistic interactions with neurotypical spheres of meaning is more so a recognition of how "it is invariably autistic people who are the ones expected to function according to ways of organizing (and perceiving) concepts that do not necessarily come naturally to them" (Williams, 2020, p. 17). Despite a reciprocity in untranslatable spaces, the autistic person bears the brunt of neuronormative expectations, as the neurotypical will inevitably be accustomed to mutual experiences of semiotic spaces, consequently possessing less incentive to engage in a translational process of possible unknowns (Hillary, 2020; Davis & Crompton, 2021; Milton, 2012).

The Relevance of an Autistic Semiosphere

There is a constitutive explanatory value in establishing a neurological dimension to the semiosphere as well as the semiosphere reinforcing the contemporary idea of multiple interrelating mind-world

[6] See : The sorites paradox

relations in the neurodiversity of humankind. Although the potential curriculum of neurodiversity will inevitably be tied to the motifs of identity and de-pathologization, the semiospheric interpretation presents itself as a conceptual framework upon which dualistic notions of neurodiverse-neurotypical dichotomies can be contested in favour of the more fundamental concept of neurodiversity: that every human being is part of the diversity of neurological and cognitive functioning, and that the continuum of neurocognitive variations does not denote wholly different mind-world relations, but a multivariable continuance with other constituent members of the semiosphere through the intersecting spaces of our mind-world relations, with the ones denotable as neurodivergent essentially existing on the peripheries of normative systematic representations of meaning in the sharing of Umwelten. With this in mind, it is also possible to envision a future use case of the semiospheric interpretation beyond solely identifying pertinent differences between autistic and neurotypical mind-world relations, but also concretizing the terminology embedded in the neurodiversity concept by exploring where exactly the boundaries lie between what phenomenologically constitutes these categories of mind-world relations – recognizing the paradox of vagueness which exists in a phenomenological approach to pragmatic difficulties in ASC and how neurotypes would be categorized against each other.[6]

This semiospheric interpretation also challenges the notion behind humans sharing a foundation of basic psychological processes, and that what is consequently perceived as a "process commonality" (Berry, 2004) might be more nuanced in its diversity than what has been previously assumed; neurodiversity posits the idea that behavioural variability is not just a result of cultural shaping, but also variable foundations of neurological and cognitive styles of meaning-

making and sensory processing.

Consequently, it also reinforces the idea that at this point in time, "we know more about autism than we've ever known, [yet] what we know is very little, and what we know is decidedly non-autistic" (Yergeau, 2018, p. 11). This is why inclusive research, wherein a research group consists of a decent amount of autistic researchers, has been so vital in properly defining the facets of cross-neurotype communication. The neurodiversity paradigm has allowed the centring of the neurodiverse sensory experience, thereby recognizing translation as a core aspect of autistic existence and allowing for more autism research from a predominantly autistic point of view, instead of relying on predominantly neurotypical descriptions of untranslatable semiotic values. Through the subject matter of neurodiversity, of DEP and DMH, and its referential interpretation through the semiosphere, the argument that translation should be more relevant, if not equally so, for the neurotypical population has been reinforced.

Nevertheless, the potential intrinsic harmfulness in an ill-considered application of neurodiversity should also be recognized when attempting to clarify the characteristics of abnormality and dysfunction. The idea of neurodiversity should not romanticize the whole field of neurominorities and mental illnesses; precautionary measures should be considered in the attempt to clarify and depathologize a spectrum of developmental conditions because a considerable amount of autistic people will be disabled, with the low-functioning parts of the spectrum falling under the flag of disability (Hughes 2021) as the symptoms of autism can become so severe that the person in question is unable to live without assistance (American Psychiatric Association, 2013; Armstrong, 2010; Rosqvist et al., 2020). Further yet, while neurodiversity studies and constituent ef-

forts towards instituting the findings of DEP and DMH into diagnostic and treatment procedures of autism, the rest of the world (namely workplaces and school settings) have yet to formally adjust to the paradigm shift. If society in its neuronormative state does not alleviate possible difficulties of being of a different mind-world relation, in the levels as described in this paper, then there is still a concept of social disability to consider (Ruesch & Brodsky, 1968; Shakespeare, 2017). As such, the importance of sensitive periods and early identification of autism should not be ignored, even under the idea of a neurodiversity of humankind (Mueller & Tronick, 2020).

Conclusion

In this paper, the purpose of aligning neurodiversity and its constituent phenomenon of cross-neurotype communication with the fundamental concept of the semiosphere was to properly recognize the ties it had to cross-cultural communication, and in turn clarify the disposition of ASC, together with relevant cognitive theories of mind-world relations, in the larger narrative of a semiotic continuum. In the frame of neurodiversity, previous theories of autistic cognition are inferable as fragmented accounts of a greater whole, presenting components of these theories in a more complete manner through contemporary hypotheses of dialectical misattunement and a double-empathy problem between interlocutors. This is all made possible by the foundation of the predictive-coding hypothesis, which accentuates the autistic brain as having a different sense of salience in the semiotic spaces of the symbolic biocultural complex by virtue of a different sensory system. Through this, the semiospheric interpretation suggests that the autistic mind immerses itself in a generically neurotypical semiotic continuum which, to a large extent, is not suitable to the different systematization of meaning inherent in its predictive style. On the basis of the similarity hypothesis, this has reper-

cussions for the membership into social niches, as pragmatic elements of a social interaction rely on the continuity of equivalent perception and mutual understanding of context. The discontinuity between autistic and non-autistic predictive and interaction styles creates a self-sustaining communicative gap, which is further worsened by a generally neuronormative orientation of society encouraged by previous deficit-based accounts of autism research. The autistic individual has to adapt, translate, and search for relevance in a mind-world relation that does not come naturally to them. All this culminates into the recognition of neurodiversity as a still-developing perspective and paradigm that has yet to substantially change the current situation of neuronormativity. But nevertheless, a paradigm in which the concept of the semiosphere can help delineate the borders between disability and interpersonal mismatches of asymmetrically equal minds. It can contribute to the expanding literature of neurodiversity in tandem with autism, such that even at this conceptual stage, it can be an informational tool for substantiating intersubjectivity and accountability of neurotypical populations in the bridging of communicative gaps.

References

American Psychiatric Association. (2013). Diagnostic and statistical manual of mental disorders (5th ed.). Washington, D.C.: American Psychiatric Publishing.

Armstrong, Thomas. (2010). Neurodiversity: discovering the extraordinary gifts of autism, ADHD, dyslexia, and other brain differences. *Cambridge: Da Capo Lifelong.*

Arnaud, Sarah. (2020). A social–emotional salience account of emotion recognition in autism: Moving beyond theory of mind. *Journal of Theoretical and Philosophical Psychology, 42(1),* 3-18.

Ashby, W. R. (1962). Principles of the self-organizing system. Principles of Self Organization: Transactions of the University of Illinois Symposium (H. Von Foerster & G. W. Zopf, Eds.). *London: Pergamon Press,* 255-278.

Asperger, Hans. (1944). "Autistiche Psychopathen" im Kindesalter. Translated and edited by Uta Frith. (1991). *Autism and Asperger syndrome*, 37-92. Cambridge: Cambridge University Press.

Baron-Cohen, S. (1997). Mindblindness: An essay on autism and theory of mind. Cambridge, MA: MIT Press.

Baron-Cohen, Simon & Bolton, Simon. (1993). Autism: The facts. Oxford: Oxford University Press.

Berry J. W. (2004). Psychology of group relations: cultural and social dimensions. *Aviation, Space, and Environmental Medicine, 75 (7),* 52-57.

Berthoz, Sylvie & Hill, Elisabeth L. (2005). The validity of using self-reports to assess emotion regulation abilities in adults with autism spectrum disorder. *European psychiatry: the journal of the Association of European Psychiatrists, 20(3),* 291–298.

Bogdashina, Olga. (2004). Communication Issues in Autism and Asperger Syndrome: Do We Speak the Same Language?. London: Jessica Kingsley Publishers.

Bolis, D., Balsters, J., Wenderoth, N., Becchio, C., & Schilbach, L. (2017). Beyond Autism: Introducing the Dialectical Misattunement Hypothesis and a Bayesian Account of Intersubjectivity. *Psychopathology, 50 (6),* 355–372.

Brewer, R., Biotti, F., Catmur, C., Press, C., Happé, F., Cook, R., & Bird, G. (2016). Can Neurotypical Individuals Read Autistic Facial Expressions? Atypical Production of Emotional Facial Expressions in Autism Spectrum Disorders. *Autism research: official journal of the International Society for Autism Research, 9(2),* 262–271.

Chamberlain, S. R., Solly, J. E., Hook, R. W., Vaghi, M. M., & Robbins, T. W.(2021). Cognitive Inflexibility in OCD and Related Disorders. Current topics in behavioral neurosciences, 49, 125–145.

Clark, Andy. (2013). Whatever next? Predictive brains, situated agents, and the future of cognitive science. *The Behavioral and Brain Sciences, 36(3),* 181-204.

Crompton, C. J., Hallett, S., Ropar, D., Flynn, E., & Fletcher-Watson, S. (2020a). 'I never realised everybody felt as happy as I do when I am around autistic people': A thematic analysis of autistic adults' relationships with autistic and neurotypical friends and family. *Autism: the international journal of research and practice. [Online] 24 (6),* 1438–1448.

Crompton, C. J., Ropar, D., Evans-Williams, C. V., Flynn, E. G., & Fletcher Watson, S. (2020b). Autistic peer-to-peer information transfer is highly effective. *Autism: the international journal of research and practice. [Online] 24(7),* 1704–1712.

Crompton, C. J., Sharp, M, Axbey, H., Fletcher-Watson, S., Flynn, E. G., & Ropar, D. (2020c). Neurotype-Matching, but Not Being Autistic, Influences Self and Observer Ratings of Interpersonal Rapport. *Frontiers in psychology. [Online] 11,* 586171.

Davis, Rachael & Crompton, Catherine. (2021). What Do New Findings About Social Interaction in Autistic Adults Mean for Neurodevelopmental Research? *Perspectives on psychological science. [Online] 16 (3),* 649–653.

DeThorne, Laura. (2020). Revealing the Double Empathy Problem: It's not that autistic* people lack empathy. *Rather, their different neurotypes and experiences may make it harder for nonautisic people to understand them—and vice versa. The ASHA Leader, 25,* 58-65.

Finnemann, Johanna J. S. (2019). Investigating Sensory Prediction in Autism Spectrum Conditions. PhD thesis. University of Cambridge: Cambridge, England. Retrieved from: *https://www.repository.cam.ac.uk/handle/1810/297678.*

Fletcher-Watson, S., Adams, J., Brook, K., Charman, T., Crane, L., Cusack, J., Leekam, S., Milton, D., Parr, J. R., & Pellicano, E. (2019). Making the future together: Shaping autism research through meaningful participation. *Autism: the international journal of research and practice. [Online] 23 (4),* 943–953.

Fletcher-Watson, S., Brook, K., Hallett, S., Murray, F., & Crompton, C. (2021). Inclusive Practices for Neurodevelopmental Research. *Current developmental disorders reports. [Online] 8 (2),* 88–97.

Frith, Uta. (2008). Autism: A Very Short Introduction. Oxford: Oxford University Press.

Gernsbacher, Morton A. & Yergeau, Melanie. (2019). Empirical Failures of the Claim That Autistic People Lack a Theory of Mind. *Archives of Scientific Psychology, 7(1),* 102–118.

Green, A. R., Carrillo, J. E., & Betancourt, J. R. (2002). Why the disease-based model of medicine fails our patients. *The Western journal of medicine, 176(2),* 141–143.

Hillary, Alyssa. (2020). Neurodiversity and cross-cultural communication. *Neurodiversity Studies: A New Critical Paradigm (Hanna Bertilsdotter Rosqvist, Nick Chown & Anna Stenning, eds.).* Milton: Taylor and Francis, 91 107.

Hogg, M. A., Hardie, E. A., & Reynolds, K. J. (1995). Prototypical similarity, self categorization, and depersonalized attraction: A perspective on group cohesiveness. *European journal of social psychology. [Online] 25(2),* 159–177.

Horton, William S. (2012). Shared knowledge, mutual understanding and meaning negotiation. Cognitive Pragmatics (Hans-Jörg Schmid, ed.). Berlin, Boston: De Gruyter Mouton, 375-404.

House, Juliane. (1996). Developing Pragmatic Fluency in English as a Foreign Language: Routines and Metapragmatic Awareness. *Studies in Second Language Acquisition, 18(2),* 225–252.

Hughes, Jonathan A. (2021). Does the heterogeneity of autism undermine the neurodiversity paradigm?. *Bioethics, 35(1),* 47– 60.

Hull, L., Petrides, K.V., Allison, C., Smith, P., Baron-Cohen, S., Lai, M., & Mandy, W. (2017). "Putting on My Best Normal": Social Camouflaging in Adults with Autism Spectrum Conditions. *Journal of Autism and Developmental Disorders, 47,* 2519–2534.

Kanner, Leo. (1943). Autistic disturbances of affective contact. *Nervous Child, 2,* 217-250.

Kotov, Kaie & Kull, Kalevi. (2011). Semiosphere Is the Relational Biosphere. Towards a semiotic biology: life is the action of signs (Claus Emmeche & Kalevi Kull, Eds.). London: Imperial College Press, 179-194.

Kull, Kalevi. (1998). On semiosis, Umwelt, and semiosphere. Semiotica, *120(3-4),* 299-310.

Kull, Kalevi. (2005). Semiosphere and a dual ecology: Paradoxes of communication. *Sign Systems studies, 33(1),* 175-189.

Latinus, M., Cléry, H., Andersson, F., Bonnet-Brilhault, F., Fonlupt, P., & Gomot, M. (2019). Inflexibility in Autism Spectrum Disorder: Need for certainty and atypical emotion processing share the blame. *Brain and Cognition, 136,* 103599.

Livingston, L. A., Colvert, E., , Bolton, P., & Happé, F. (2019). Good social skills despite poor theory of mind: exploring compensation in autism spectrum disorder. *Journal of Child Psychology and Psychiatry, 60(1),* 102-110.

López, Beatriz & Leekam, Susan R. (2003). Do children with autism fail to process information in context?. *Journal of child psychology and psychiatry, and allied disciplines, 44(2),* 285–300.

Lotman, Juri M. (1984). On the semiosphere. Translated and edited by Wilma Clark. (2005). *Sign Systems Studies, 33(1),* 205–229.

McGregor, William B. (2015). Linguistics: An Introduction (2nd Edition). London; New York: Bloomsbury Academic.

Milton, Damian E. M. (2012). On the ontological status of autism: the 'double empathy problem'. *Disability & Society, 27(6),* 883-887.

Monticelli, Daniele. (2019). Borders and translation: Revisiting Juri Lotman's semiosphere. *Semiotica, 2019(230),* 389-406.

Mueller, Isabelle & Tronick, Ed. (2020). Chapter 14 – Sensory processing and meaning-making in autism spectrum disorder. Autism 360 ° (Undurti Das, Neophytos Papaneophytou & Tatyana El-Kour, Eds.). London: Academic Press, 255-267.

Nicolaidis, C., Milton, D., Sasson, N. J., Sheppard, E., & Yergeau, M. (2019). *An Expert Discussion on Autism and Empathy. Autism in Adulthood, 1 (1),* 4-11.

Nöth, Winfried. (2006). Yuri Lotman on metaphors and culture as self-referential semiospheres. *Semiotica, 2006(161),* 249-263.

Page, Scott E. (2010). Diversity and Complexity. Princeton: Princeton University Press.

Paton, B., Skewes, J., Frith, C., & Hohwy, J. (2013). Skull-bound perception and precision optimization through culture. *The Behavioral and Brain Sciences, 36(3),* 222–222.

Pearson, Amy & Rose, Kieran. (2021). A Conceptual Analysis of Autistic Masking: Understanding the Narrative of Stigma and the Illusion of Choice. *Autism in Adulthood. [Online]. 3(1),* 52-60.

Pellicano, Elizabeth & Burr, David. (2012). When the world becomes 'too real': a Bayesian explanation of autistic perception. *Trends in Cognitive Sciences, 16(10),* 504-10.

Pöder, Thomas-Andreas. (2021). Religion in the semiosphere: Theosemiotics in dialogue with Juri Lotman. Sign, Method and the Sacred: New Directions in Semiotic Methodologies for the Study of Religion (Jason Cronbach Van Boom & Thomas -Andreas Pöder, Eds.). Berlin, Boston: De Gruyter, 29-52.

Rosqvist, H. B., Chown, N., & Stenning, A. (2020). Neurodiversity Studies: A New Critical Paradigm. Milton: Taylor and Francis.

Ruesch, Jurgen & Brodsky, Carroll M. (1968). *The Concept of Social Disability. Arch Gen Psychiatry, 19(4),* 394-403.

Sack, Graham. (2015). Culture as a complex system [Powerpoint presentation]. Glocomnet: Human Complexity and Uncertainty. Available at: https://d1rz56ot08aua0.cloudfront.net/attachments/library_files/128/original-.pdf?1443800048 (Accessed: 7 February 2022).

Schweitzer, Frank & Zimmermann, Joerg. (2001). Communication and Self Organisation. Complex Systems: A Basic Approach (M. M. Fischer & J. Fröhlich, Eds.). Berling: Springer, 275-296.

Semenko, Aleksei. (2012). The Texture of Culture: An Introduction to Yuri Lotman's Semiotic Theory. New York: Palgrave Macmillan.

Shakespeare, Tom. (2017). The Social Model of Disability. The Disability Studies Reader (5th Edition). (Lennard J. Davis, Ed.). New York: Routledge, 195-218.

Silberman, Steve. (2015). NeuroTribes: The Legacy of Autism and the Future of Neurodiversity. New York: Avery Publishing.

Sinha, Chris. (2014). Niche construction and semiosis: biocultural and social dynamics. The Social Origins of Language (Daniel Dor, Chris Knight & Jerome Lewis, Eds.). Oxford: Oxford University Press, 31-46.

Sinha, Chris. (2015). Language and other artifacts: socio-cultural dynamics of niche construction. Frontiers in Psychology, 6, 1601.

Tebartz van Elst, L., Pick, M., Biscaldi-Schäfer, M., Fangmeier, T., & Riedel, A. (2013). High-functioning autism spectrum disorder as a basic disorder in adult psychiatry and psychotherapy: Psychopathological presentation, clinical relevance and therapeutic concepts. *European Archives of Psychiatry and Clinical Neuroscience, 263(2),* 189-196.

Thoreau, Henry David. (1961). The Heart of Thoreau's Journals. (Odell Shepard, Ed.). New York: Dover Publications.

Timberlake, Howard. (2019). Why there is no such thing as a 'normal' brain. BBC Future. [Online]. October 10.

Torop, Peeter. (2005). Semiosphere and/as the research object of semiotics of culture. *Sign Systems Studies. [Online]. 33(1),* 159–173.

Triandis, Harry C. (1960). Cognitive Similarity and Communication in a Dyad. *Human relations. [Online]. 13(2),* 175–183.

Van de Cruys, S., Evers, K., Van der Hallen, R., Van Eylen, L., Boets, B., de-Wit, L., & Wagemans, J. (2014). Precise minds in uncertain worlds: Predictive coding in autism. *Psychological Review, 121,* 649-675.

Voss, P., Thomas, M. E., Cisneros-Franco, J. M., & de Villers-Sidani, É. (2017). Dynamic Brains and the Changing Rules of Neuroplasticity: Implications for Learning and Recovery. *Frontiers in Psychology, 8,* 1657.

Williams, G. L., Wharton, T., & Jagoe, C. (2021). Mutual (Mis)understanding: Reframing Autistic Pragmatic "Impairments" Using Relevance Theory. *Frontiers in Psychology, 12,* 616664.

Williams, Gemma L. (2020). Talking together at the edge of meaning: Mutual(mis)understanding between autistic and non-autistic speakers. PhD thesis. University of Brighton: Cambridge, England. Retrieved from: https://cris.brighton.ac.uk/ws/portalfiles/portal/30794840/Gemma_L._Williams-_PhD_Thesis_October_2020_WITH_APPENDICES.pdf.

World Health Organization. (2019). *International Statistical Classification of Diseases and Related Health Problems, 11th Revision. Geneva: World Health Organization.*