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BILINGUALISM AND AUTISM SPECTRUM DISORDER

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ABSTRACT

Bilingualism has been widely studied in the last decade and it has been found to enhance the individual's cognitive and social skills. Despite initial skepticism from teachers and caregivers, bilingualism is no longer a phenomenon associated with language minorities only as it has achieved consensus in many Eastern and Western societies. The advantages of bilingualism have been studied in relation to several disorders such as Down syndrome and SLI but not many research studies have examined the effect of bilingualism on Autism Spectrum disorder (ASD). This research aims to fill this gap and analyses the consequences of raising an autistic child in a multilingual environment. To do so, strengths and weaknesses of bilinguals in the spectrum will be examined in relation to the five language dimensions and the executive functions. Overall, literature findings show that bilingualism does not further impair the language and cognitive development of individuals with ASD, instead it boots it in certain cases.

INTRODUCTION

My interest in the subject has developed after working for several years as an ABA therapist treating ASD children in a special school in England. Considering that the majority of my clients had at least one parent with immigrant backgrounds, I have started to wonder whether and how the language spoken at home may influence the ASD child's development, and whether growing in a multilingual family would have a different effect on the ASD child's language and cognitive development as compared to growing in a monolingual family. At the school where I worked, I noticed that several high functioning autistic children were able to speak more than one language fluently similar to their non autistic peers. Nevertheless, since the research on the effect of bilingualism on ASD was yet scarce, it was hard to find supporting evidence to generalize those trends. This paper aims to investigate the relationship between bilingualism and Autism spectrum disorder (ASD). More specifically, the effect of raising a child with ASD in a bilingual household will be examined in comparison to raising a child with ASD in a monolingual household. There will be a focus on the benefits of bilingualism on an heterogeneous disorder such as ASD, analyzing research studies in support of this statement and those against it. The references used are taken from books, online journal articles and manuals. The dissertation is divided into four chapters. The first chapter will focus on describing the phenomenon of bilingualism. Existing research literature has long debated over the advantages and disadvantages of growing in a bilingual world. My aim is to define bilingualism and examine the main language acquisition theories associated with bilingualism, along with the biological, social, psychological and linguistic effects that bilingualism has on human development. The influential factors affecting language acquisition will be discussed and the advantages and disadvantages of bilingualism will be outlined in relation to the five dimensions of language and executive functions such as shifting, inhibition and working memory. Last, as the immigration rates have grown in Italy and so has the occurrence of language minorities in schools, the first chapter will analyze how the process of learning Italian as a second language occurs in schools in Italy.

The second chapter will focus on Autism Spectrum disorder (ASD) and attempt to define this disorder referring to the well-known DSM. Moreover, an insight will be given into the change in definition criteria of ASD occurred throughout the years, from its first appearance in the DSM-3 to its latest updated version in the DSM-5-RV. A number of different hypotheses about the etiology of ASD will be examined and strengths and weaknesses of ASD will be discussed with regards to the main language dimensions and cognitive functions. Last, the main ASD interventions and treatments applied in school and at home will be exploited with a mention to the most recommended and efficient treatment therapies used world wide. The third chapter aims to investigate the effect that bilingualism has on Autism spectrum disorder. To do so, the most recent research on bilingualism in relation to autism and other neurocognitive disorders will be evaluated in order to find answers to a growing parent's concern of raising a child with ASD in a multilingual environment. Therefore, the benefits and downsides of bilingualism in relation to the core language domains and cognitive abilities will be outlined. In specific, the most relevant studies will be reviewed in order to evaluate the performance of bilingual children with ASD on tasks involving semantics, morphosyntax, phonology and pragmatics highlighting the benefits of bilingualism. Last, recent studies conducted on ASD parents' language choice will be outlined with a focus on the social advantage of bilingualism on autism spectrum disorder. The fourth and last chapter will summarize the conclusive findings of this research which highlight the non deleterious effect of bilingualism on children in the spectrum, with some studies depicting a positive effect on the cognitive, social and linguistic development of ASD individuals. Family, clinical, educational and theoretical implications will be considered and a final paragraph will take into consideration limitations and recommendations for future research. Despite the scientific community having made progress in enhancing our understanding of the effect of bilingualism on neurodivergent individuals, more research evaluating the effect of languages on autism spectrum disorder is needed. Thus, this paper aims to fill this gap in literature by reviewing the most relevant studies of bilingual children with ASD and by exposing the advantages and disadvantages of bilingualism in relation to autism spectrum disorder. Because of this, the rationale of the research is whether raising a child with ASD in a bilingual family results in any deleterious effect in the child development. To do so, the bilingual advantage will be analyzed in relation to autism, which is a less studied topic in linguistics. Several valid theories

will be reported and compared. Limitations and implications for future research will also be addressed. In line with previous research, two main questions are:

1. Are ASD children able to learn a second language?

2. Does bilingualism have any deleterious effect on ASD children's cognitive and linguistic development?

CHAPTER 1

BILINGUALISM

1.1 Definition

Given the wide speculation of definitions of bilingualism and the consequent lack of a universally accepted terminology to describe the subject, it is hard to define a heterogeneous phenomenon such as bilingualism. According to Ellis (2008), the term bilingualism refers to a person or a community able to speak two languages. Individuals who cannot communicate efficiently in either L1 or L2 , are defined as "semi lingual" (Escamilla, 2006). In the past definitions of bilingualism had a strong monolingual bias, in fact being bilinguals meant to have native-like control of two languages. Therefore, the difficulty was in determining when bilinguals had native-like skills in their second language (L2). However these early explanations were too vague and did not take into account nonlinguistic dimensions of language. More recently the definition of bilingualism has become more inclusive and refers to anyone who has minimal competence in one of the four skills (speaking, listening, reading, and writing) in a language that is not their mother-tongue. Because of this, bilingualism is seen as a continuum rather than a category and contextual factors such as cultural, economical and social status of the individual are taken into consideration in defining bilingualism (Wei, Dewaele, & Housen, 2002). To qualify as bilinguals, individuals do not have to be equally fluent in both their languages, as they may use their languages for different reasons and purposes. (Grosjean ,2010) In line with this, it has been argued that multilingual individuals develop a "multi-competence," which goes beyond linguistic domains and affects their cognitive representation of grammatical and lexical categories involving languages that possess very different categories. As a consequence, bilinguals may categorize objects differently from monolinguals in their L1 and L2 (Cook & Bassetti, 2010). Recent research found that categorizing bilinguals according to the number of languages they speak is not enough and it can lead to over-qualify or under-qualify them. For instance a multilingual speaking 5 or more languages with limited

knowledge of two of his languages would be considered more multilingual than a multilingual speaking 3 languages at a proficient level. Although the trilingual can speak fewer languages, the fact that they know their languages at a higher level makes that individual a stronger multilingual. Therefore knowing and using two, three or more languages does not necessarily make a speaker multilingual. On this matter, Dewaele and Stavans (2014) designed two global measures of multilingualism, collecting participants' information on frequency of language use and self-perceived oral and written proficiency in their languages. The sum of scores on oral and written proficiency of the languages spoken by the individual gives the proficiency measure which is a more valid measure of oral and written skills in their languages than the mere number of languages learnt by the individual. Recent research has found that typically developing (TD) bilingual children follow similar developmental trajectories to monolingual children and the majority of them are able to keep pace with their language abilities, at least in their dominant language (Beauchamp & McLeod, 2022). Even if bilingual subjects possess smaller vocabularies in one language, when both languages are taken into consideration, these differences could vanish (Pearson et al., 1997). In contrast, typically developing bilingual children are able to develop specific aspects of language at a higher speed than monolingual children, due to their ability to use knowledge from one language to aid acquisition of the other language (Yip & Matthews, 2000). Although it is common for bilinguals to be dominant and more capable in one language over the other, bilinguals can also achieve high proficiency in both their languages (Gathercole & Thomas, 2009). In line with this, Roch, Florit and Levorato (2016) reported that L1 dominance over L2, gradually disappears after one year of formal schooling in preschool and school bilingual children performance on narrative production indicating a reduction in L1 supremacy. Thus, it is important to study the language profiles of bilingual children to identify what the contributing factors to the development in L1 and L2 are and what can be done to support the development and inclusion of this group of individuals that is often understudied.

1.2 Types of bilingualism and contributing factors

Literature reports eight types of bilingualism depending on the way, time and context the bilingual has acquired their two or more languages. Depending on the time of acquisition, simultaneous bilingualism refers to a person mastering two languages in different conditions (e.g. home and school). Instead, sequential bilingualism is when the two languages are learnt at two different stages in life (L1 early in life and L2 after the age of 3). There has been an ongoing debate on whether simultaneous bilinguals can reach a monolingual level of proficiency. On this matter, a number of findings have reported that simultaneous bilinguals did not perform as efficiently as monolingual (Giguere & Hoff.,2022) while others did not find any difference between proficiency levels (Bylund et al., 2023). In addition, recent findings on sequential bilinguals suggested that bilinguals' scores were lower than monolingual scores on vocabulary and working memory-related tasks but more studies are needed to support those results. (Barbosa, Jiang & Nicoladis, 2017) Another type of bilingualism which refers to the modality of language acquisition is the additive bilingualism that occurs when the first languages is reinforced while the second language is learnt, with results showing an advantage in the phonological loop of working memory for additive bilinguals as compared to other bilinguals groups (Kudo & Swanson, 2014). Differently, subtractive bilingualism refers to a child learning a second language without reinforcing the first one which slowly gets forgotten. On this matter, teachers may recommend to parents to quit talking their native language at home and instead focus on speaking the school language with their children, which sometimes may lead to parents being unable to communicate with their children efficiently (Lightbown & Spada, 2013). In addition, receptive bilingualism refers to people that understand a second language but are not capable of actively using it. This may occur when parents do not care which language their children speak at home but also when parents put great effort into bilingual child rearing. In fact, a study by Smith-Christmas (2016) found out that active bilingualism cannot be guaranteed by parents' consistency in language use or involvement in activities regarding their children such as for example writing and reading, indicating that there are other factors that influence language acquisition which will be examined later on. One more type of bilingualism that literature has identified is subordinate bilingualism

which refers to an individual learning a second language through their first language later in life. In addition, when context is taken into account, two types of bilingualism may be pinpointed: compound bilinguals which refers to learning two languages in the same context (for example both languages are used at home or in school) and coordinate bilingualism when language learning occurs in two separate environments. On this matter, Osgood et al. (1954) suggested that compound and coordinate bilingualism can be measured by the individuals' semantic meaning of words which will indicate how they process information on both languages and the way they learnt a language, as such, compound bilingualism occurs when individuals have two sets of linguistic codes which are stored in one meaning unit. In other words, compound bilinguals have one system of meaning for words which is used for both L1 and L2. In this case, the compound bilingual is likely to learn both languages in a fused context where L1 and L2 are used alternatively. Conversely, in the coordinate bilingualism each linguistic sign has its own set of representational processes, therefore this type of bilingual does not interchange the two languages (Larsen & Grava, 1994). Recent studies have investigated whether the bilingual advantage is due to superior cognitive skills, or whether it is caused by external factors. On this matter, It was found that elements such as cultural background, educational experience, age acquisition of the languages (Johnson & Newport, 1989) language exposure, language switching habits and whether the language is a majority or minority language (MacLeod et al., 2018) affect the bilingual child' proficiency in each of their languages. In specific, relevant studies on cross-cultural differences, have shown that monolingual chinese students living in China performed better than monolingual american students living in the US on tasks on Executive functions, suggesting that the cultural values, school environment, and teaching practices of some cultures strengthens EF better than bilingualism. (Sabbagh et al., 2006) Similar results were found in a study on Asian and American monolingual children in which Asian children scored higher on EF than American children (Oh & Lewis, 2008). This unclear relationship between cultural influence and bilingualism has been studied by Bialystock and Barac (2012) who tested Spanish or Chinese bilinguals whose second language was English and English monolinguals. Their findings demonstrated that all of the bilingual participants performed better than their monolingual peers, suggesting that the bilingual advantages on EF exist independently of factors such as languages, cultural values, educational practice and

experience. Another contributing factor to language acquisition is Family SES (Social Educational Status) in which SES refers to the combination of family income, parents' education level, and job status. As argued by August & Shanahan (2017) despite great SES variability within a society, such as the latino community in the US ranging from well-off families to low income families, often a language spoken by a minority population with low SES is treated as a "lower status" language. This in turn leads to those with low proficiency in the higher status language (for example english) being denied access to better jobs and educational opportunities that could improve their SES. On this matter, in the US, SES has been shown to be a predictor of a child's language and school outcomes in bilinguals (August & Shanahan, 2017) in which high income and high status jobs can lead to gain accessibility to better educational resources and experiences. Additionally, in some Asian countries, greater financial resources may also involve the hiring of private tutors to improve children's performance in one or two languages (Jason , 2009). Parents' education, especially mother's education is another indicator of SES. Hoff (2003) in his study on monolingual children observed that mothers with higher education were more likely to use wider vocabularies, engage in richer mother-son activities such as reading books, and talk with their children more than mothers with lower education. Oller and Eilers (2002) found that among Spanish–English bilinguals in North America, high SES children scored better than low SES children on English vocabulary tests, but the opposite occurred in Spanish vocabulary tasks. Similarly, in Italy, bilinguals from lower education levels' families presented poorer academic results, lower scores at INVALSI tests and higher rates of school drop out than students from higher education level's families. (MIUR, 2020) Socioeconomic status (SES) has also been studied in relation to EF in studies comparing monolingual and bilingual participants. On this matter, a correlation between SES and Executive Function has been widely reported so that individuals with high SES presented better scores in EF tasks (e.g. Noble, Norman, & Farah, 2005) Some studies were conducted to compare EF scores on bilinguals from immigrant low SES families, bilinguals from higher SES families and monolinguals with good household income (Carlson & Meltzoff, 2008). Results reported that all the three groups scored similarly on the EF tasks of the advanced DCCS suggesting that bilingualism may have enhanced the low income bilingual group executive function skills to allow them to perform comparably to the other more economically advantaged groups. These findings

could be explained by the fact that being exposed since birth to two languages could have developed the necessary executive functions skills which could be enough to compensate for the weaker EF normally associated with low SES but further significant results are needed to generalize these assumptions. One more indicator of SES is the amount of language exposure to both languages (L1 and L2). Frequency of exposure to a certain language influences the amount of vocabulary bilinguals acquire, as the more a bilingual child is exposed to a word, the more likely it is for the word to get stored into the child's retrievable vocabulary (Gathercole et al. 2008). In fact, the amount of input in a particular language is strongly linked to a bilingual proficiency in that language; in other words, greater length of exposure leads to better knowledge of a language on vocabulary, reading and writing tasks(Scheele et al. 2010). Candilas (2016) conducted a study on Filipino students and observed that the exposure to L2 at home and school environment had a positive impact on the students' learning of the second language, english. Interesting findings from Scheele et al. (2010) indicated that the greater the exposure to dutch from immigrant families (Moroccan and Turkish), the wider the vocabulary in dutch of the children, in contrast when the exposure was greater in the ethnic language which was either Berber or Turkish, the child's vocabulary of the ethnic language was higher. Roch and Florit (2013) tested 78 immigrant children and noticed that linguistic stimulation at home can enhance L2 acquisition therefore the amount of second language exposure enhanced bilinguals' narrative production and linguistic development (As cited in the book by Levorato and Marini, 2019). Moreover, Dicataldo and Roch (2020) observed that variations in length and daily exposure as well as SES are related independently to individual differences in linguistic and cognitive abilities in bilingual children. Overall, the cognitive bilingual appears to exist regardless of cultural influences, educational practices, different SES and languages spoken. Certainly, balanced bilinguals, who are similarly or equally skilled in L1 and L2, are more likely to demonstrate a cognitive advantage. (Bialystock, 2008)

1.3 Aspects of bilingualism

As previously mentioned, since bilingualism is a multifaceted phenomenon made of different types and classifications, it is hard for researchers to agree on one single definition. Therefore, the main aspects of language development such as biological, psychological, social and linguistic aspects will be examined not as individual processes but as interconnected elements that affect language acquisition.

1.3.1 Biological Aspects

In contrast to other mammals that present the larynx (or Adam's apple) in a higher position, humans have a longer lower pharynx which amplifies the speech sounds emitted by the larynx. The round shape of their tongue and palate, allows humans to produce a wide variety of sounds compared to the other animals. The gradual changes in the human anatomy involving mouth and throat occurred together with a gradual enlargement of the human brain (Iacoboni et al., 1999). Thanks to the complex human brain, language acquisition was possible, with abilities that involve storing, producing and processing any human language. Studies on the brain have found that two areas in the left brain are responsible for the language processing and production in humans and are not present in animal' brain: Broca's area in the left frontal lobe and Wernicke's area in the temporal lobe (Iacoboni et al., 1999). One of the pioneers of Linguist Noam Chomsky (1965) suggested that all infants have the ability to acquire any language from birth. He argued that languages are ruled out by the properties of Universal Grammar (UG), a basic template for all languages, which is innate and embedded in our genes, hard-wiring human brains. Moreover, it is widely accepted that all TD infants have an innate ability to acquire the languages used in their environment. As such, independently from any formal instruction, young children can acquire the sounds, words, grammatical rules and languages around them. TD children normally acquire the basic language functions by the age of 3 and the same happens for children learning sign languages. This is confirmed by the various studies on children language development, starting from babbling around 6

months, to learning their mother tongue to a lateralisation process in which bilingual children specialize in the language spoken in their surrounding. Because of this, if an infant is not surrounded by people using a language, that infant will gradually lose the ability to learn language naturally (as reported by Levorate & Marino, 2019). In the rare cases in which deprivation continues until puberty, the individual will no longer be biologically able to obtain native fluency in any language, despite they may be able to reach some limited competency. This phenomenon is called the Critical Language Hypothesis (Burrill, 1985) which was observed in abused or neglected children who were isolated from birth and struggled to learn a language later on in life. An example comes from the story of Genie, a young girl, confined to her room until the age of 14, with very little verbal interaction and that once freed never achieved language despite 5 years of intense language training, or Victor of Aveyron, the feral child found in the woods at the age of 12 who never fully acquired language despite being a healthy child. These examples confirm the hypothesis that children will gradually lose the ability to acquire language naturally and without effort, if they are not exposed to a language until past critical period (Penfield, 1959) of development around the age of puberty. This also applies to the acquisition of a second language. A second language learner who starts studying their second language after puberty will not easily reach native fluency, expecially in pronunciation. Studies have often focused on second language acquisition which have outlined that second language learning is more successful and faster in children than adults, despite the former being less cognitively sophisticated than the latter (Krashen, Scarcella, & Long, 1982). On this matter, neuroplasticity was found to play an important role in language acquisition where plasticity stands for the ability of the brain to change and adapt its structure based on the experiences the individual undergoes. Neuroplasticity is characterized by a "critical period" (Penfield, 1959) during which experience interacts with biological processes to determine behavioral and cognitive outcomes (Birdsong, 2018). Despite the fact that the human brain continues to grow and change across the lifespan, the first 8 years are crucial as they build the foundation for future development (Voss et al., 2017) and the same applies to language development. Thus, the critical time period is a time window during which the neurocognitive mechanisms are at their highest degree of activation to enhance acquisition processes and boost development (Hensch, 2004). This period goes from the first year of life up to puberty. If sensory experience is absent

during this time, it may have negative effects on sensory representations in adulthood, causing problems with adaptations that may prevent the acquisition of certain skills later on in life (Singh et al., 2018). Likewise, research has shown that there is a specific time window during childhood for learning a second language and developing native-like pronunciation (Granena & Long, 2013). After this critical period, research has shown that adults use different learning mechanisms than children (Paradis, 2009). Moreover, child and adult learnings are often described as implicit and explicit respectively. Children's L1 learning is believed to happen implicitly and unintentionally while adult's L2 learning happens consciously and requires greater effort (Bley-Vroman, 1990). Lamendella (1977) pointed out that the assumptions about the critical period were overstated and introduced the term "sensitive period" to highlight the fact that language acquisition is more efficient during early childhood but is not impossible at later ages. Robust set of literacy has studied whether the critical period also happens in second language acquisition, arguing that there has been a misinterpretation and over generalization of results on critical period on L2 acquisition, that do not demonstrate evidence for an association between adults L2 poor performance and their age, and others that do not consider high proficient L2 adult learners. Similarly, other findings have shown that older learners initially acquire a new language more rapidly than younger learners (Krashen,Long, & Scarcella, 1979). On the same page, Bialystok and Hakuta (1994) found decrease in adults' proficiency only after the age of 20, much later than puberty. Lenneberg (1967) stated that the lateralization affects L2 learning as the specialization of the left hemisphere slows down plasticity and the acquisition of a new language. In a similar way, Hurford (1991) and Pinker (1994) designed the "Use it then lose model" which argues that the neural circuits that are not used over time begins to degrade, therefore if a language is not practiced or studied for a while, our capacity to master it will decrease. In light of this, since literature portrays that students are biologically less capable of reaching proficiency levels in a new language, they should not be graded in comparison to native speakers and teaching methodology should be modified to promote limited proficiency, for example allowing for a greater number of errors in language related tasks. Furthermore, schools and educational settings in Italy should introduce foreign languages (e.g English) earlier, for example in nursery schools and should introduce policies to accelerate the exposure to Italian of immigrant children. Lastly, the critical period

for second language acquisition should be taken into consideration when planning a L2 teaching and should be equally relevant to policy and practice in education.

1.3.2 Psychological aspects

Besides biological aspects, it is important to address the psychological aspects of bilingualism which have deep personal and relational consequences on the individual (Balboni, 1998). It has long argued whether bilinguals have a "double personality" which does not refer to a pathological personality split but to a two ways of seeing and perceiving life, as two are the languages. On this matter, Grosjean (1996) collected data from bilinguals' perception when speaking their two languages, and participants reported feeling different in terms of personality and behavior when they speak L1 and L2. Similarly, Ervin-Tripp (1968) found that bilinguals "change" personality when they switch to a different language. However, relevant research has argued that the "change" is not caused by the language per se, but it is the context that influences the individual perception of their personality (Grosjean, 1996). Pavlenko (2005) has observed that participants often report that emotions are perceived as less intense in their L2 rather than in their L1. This reduced emotion resonance in L2 contexts may be explained by constructionism (Barrett, 2016) which focuses on differences in how emotion concepts are associated with emotion words in first or second language. Because of this, if emotion words and their concepts are used when people build their emotional experiences, it is likely that a reduction in emotional resonance in L2 is caused by a weak association between L2 emotion words and their emotion concepts. As such bilinguals are required to translate L2 emotion words into L1 emotion words to access the emotion concept associated with that L1 emotion word. This also applies to the advanced emotional resonance in L2-proficiency bilinguals who do not need to translate the emotion word from L2 to L1 or when they do, the translation process is more rapid. Milazzo (2015) has carried out a study on the association between personality construct (affective states and personal identity) and languages spoken, in which L2 was italian. Interestingly, all italian learners reported using a more enhanced body language and gestures when speaking italian. In Milazzo (2015)'s study, participants reported using body language

only when speaking Italian and not when speaking their first language in which gestures are almost absent. They also reported greater closeness and intimacy to the listener when speaking Italian compared to their L1. These findings confirm previous studies which demonstrated that bilinguals respond differently to personality measures in their 2 languages, indicating a change in personality as they switch between their 2 languages (Ramirez-Esparza et al, 2006). In specific, it was found that language context can lead to a cultural frame shift in bilinguals so that they adapt their attitude and behavior to the culture of the language context (Panayiotou, 2004). According to personality psychology (Goldberg, 1993) similar concepts may have different connotations across cultures, as emotional reactivity to emotional stimuli (e.g. taboo words) may produce higher reactivity levels in L1 than in L2 because of cultural and social norms and not just language per se (Gawinkowska, Paradowski & Bilewicz, 2013). Despite the numerous studies on big 5 personality traits, further research involving the effect of language and culture on personality as two inter tangled but also separated entities is needed to explain the differences in personality associated with bilinguals L1 and L2.

1.3.3 Social aspects

The societal language is the language spoken by the majority of the population whereas the languages spoken only by a certain ethnic group that forms a small portion of society are called ethnic or minority languages. Therefore for minority groups speaking, for example, immigrant languages it is hard to keep those languages a dominant language in countries in which the societal language is dominant. For instance, Sarkar et al., (2013) found that the Quebec innuit community struggled to cope with the educational needs of not only one but two societal languages (French and English) and novel pedagogical strategies had to be put in place to support the indigenous children. Moreover, bilingual children in the Spanish-English community of Miami, USA, reported a preference for English language (societal language), regardless of their family language preference or language taught in school (Oller & Eilers 2002) which may be an example of how the need of being integrated in the society leads individuals to choose the language

"chosen" by the society they live in. As previously mentioned, the cultural context is crucial for language acquisition. According to Grosjean (1996), the individual learns and acquires skills through the experience in the outer world. The first experiences are shaped through the child relationship with the parents who will determine the language input and child exposure to those languages. Interestingly, exposure to a language does not predict the individual's language proficiency, as there seems to be a direct relationship between the two factors up to a certain point, also called "critical mass," after which, more exposure does not matter (Gathercole & Hoff, 2007). This explains why monolingual children do not always outperform bilingual children, despite their 100% exposure to their language versus a partial exposure to either L1 or L2 of bilinguals. Family is the first contact of the child with a language, which is followed by peers relationship in school, in which the child learns the societal language. Beside the language acquisition, the child learns about the family and society culture, therefore they will acquire two languages and two cultures, a phenomenon called biculturalism. (Berry, 1997) This phenomenon involves not only the acquisition of the heritage and receiving languages and cultures but relationships with peers from both cultural backgrounds, as well as practice, values and identifications from both contexts. In line with this, Benet, Martinez, Leu, Lee & Morris (2002) have defined biculturalism as the integration of the two cultures into a unique and personalized blend. Thus, the cultural context is also important to determine our personality and identity. Identity includes ethnic or national identity and language is intertwined with these different types of identity. Through language, children establish a connection to a specific cultural group, shaping their cultural and personal identity. Bilingual children present a multifaceted identity as they have the ability to express themselves in different ways, experience in various social environments, and engage with diverse cultural experiences. In fact, bilinguals may present a hybrid identity which combines aspects of their two or more cultures or may switch between languages depending on the social context (Ward et al., 2018). Subsequently, LaFromboise, Coleman, and Gerton (2013) proposed two bicultural modes: alternation and fusion. Alternation involves individuals to "alternate" or shift between their two cultures depending on the situation, whereas on fuse mode individuals deal with a "fused" or emergent third culture generated by mixing their two cultures. The biculturalism could explain the double personality hypothesis described in the previous paragraph confirmed by the construct proposed by

Benet-Martínez et al. (2002) named the Bicultural Identity Integration (BII) which aims to analyze how a bicultural individual perceives their two identities and whether they are oppositional or compatible. More recently, Benet-Martínez and Haritatos (2005) argued that BII is not a unitary construct, but that it encloses two independent components: cultural overlap against cultural dissociation between the two cultural contexts; and cultural harmony against cultural conflict perceived between the two cultures. The higher the BII level, the stronger is the compatibility between the two cultures, the lower is the BII level, the stronger are the tensions between the cultures. Parents fear an incompatibility between the child's two cultures, which can cause frustration and adaptation problems if a balance between the two identities is not found. The cultural identity involves a complex cultural integration process of the various cultures that the child experiences (family culture and society culture). Therefore the difficulty for a bilingual individual is to merge the two identities into a third new identity which takes up from both cultures. In line with this, educational approaches are gradually shifting towards bilingual schooling. This could be the result of a belief that being bilingual may have certain economic and social advantages and it is in line with the entry requirements of most school and work settings. This is why if in the past being bilingual was mostly linked to minority groups, nowadays speaking more than one language is associated with higher status people.

1.3.4 Linguistic aspects

In the previous paragraphs psychological, social and biological factors were described, in this paragraph, language factors will be explored for the important role they play in bilingual development. Several language processes occur in bilingual individuals as two languages interplay and are co-hosted within the same person. The first and most well known phenomenon is code-switching which takes place when bilinguals switch from one language to the other alternatively. As such, the individual has the capacity to choose the language that suits best with the setting, the listener or the topic of the conversation (Meisel, 1994). Moreover, bilinguals are able to switch languages without breaking any grammar rules. Several types of code

switching have been analyzed in linguistic, two of the most used ones are the situational code-switching which occur when the languages used change according to the setting or situation, and the metaphorical code-switching (or non situational code-switching) which occurs when there is no apparent change of setting or people but there is a change in the psychological distance between the conversers, therefore the code-switching happens as a metaphor of the change in the interpersonal relationship (eg. when a teacher during a lecture switches from the official national language to the local dialect) (Gumperz, 1984). Another phenomenon in bilingualism is language mixing. Language mixing happens when bilinguals use two languages as if they were one language. This happens often in young children before they differentiate and separate their two languages. The mixing is unintentional and is used by the individual without regard to their interlocutor's understanding of both languages (Arnberg, 1987). Therefore language mixing occurs when L1 and L2 are not spoken with degrees of proficiency and bilingual is not able to choose the correct language code to use in a certain situation (Tedeschi, 2017). In addition, code-mixing is the simultaneous use of both languages, in which morphemes and lexemes from L1 and L2 are used in the same sentence. In this case, the mixed utterances is caused by the dominance of L1 over L2. Myers-Scotton (1993) designed the Matrix Language Frame (MFL), which refers to the fact that one language acts as a matrix or dominant language and the other as the subordinate or embedded language. Both, language mixing and code-mixing, are stages of development that every bilingual child goes through until they are able to distinguish between their two languages and code switch intentionally between their languages. Moreover, a common process in bilinguals is attrition, which is a non-pathological partial decrease of a language which has previously acquired which also involves an increase of competition with L2 competence (Kopke & Schmid, 2004). In specific, it has been noticed that bilinguals who abandon their native language (L1) before puberty are likely to experience higher levels of attrition. However various aspects of L2 can affect attrition in L1, involving different domains (eg phonology, lexicon, semantics etc) and different language pair combinations such as English-German (Altenberg, 1991) and English- Italian (Kasparian & Steinhauer, 2017) All the above mentioned language processes demonstrate the variety of phenomenon in bilingual children, which can be adaptive and part of the natural development or a temporary incorrect use of a language.

1.4 Advantages of bilingualism

It has been observed that L2 vocabulary in bilingual children develop slower than L1 vocabulary because of a lexical gap which makes lexical retrieval more difficult in semantic and denomination tasks (Altman et al., 2017). Research on bilinguals' cognitive performance typically focuses on 5 dimensions of language: phonology, syntax, morphology, semantics and pragmatics. Many studies have analyzed the phonological processing in bilinguals and monolinguals and the results have demonstrated that bilinguals show a delay in acquisition of phonological systems (20 months instead of 17 months) along with a narrower vocabulary. Bilingual language development is quantitatively different and more varied as compared to monolingual development and this is due to the interference of the second language. On this matter, Hambly at al (2013) have found two separate but nonautonomous phonological systems in bilinguals, with cross linguistic transfer involving preferential transfer from L1 to L2 or opposite directional language from L2 to L1. Meta-analysis on syntactic phenomena indicated poorer syntactic performance by simultaneous bilinguals as compared to monolinguals (Li & Hartshorne, 2022). Grounding evidence has demonstrated that there is influence on syntax across bilingual individuals' languages (Serratrice, 2013). On this matter, Serratrice, Sorace and Paoli (2004) reported that unidirectional crosslinguistic influence might take place for the English–Italian speaking participants with regard to pronominal subject. In particular, they noticed that in Italian, bilingual children used overt pronominal subjects in contexts where monolinguals would use a null subject, and used postverbal strong object pronouns instead of preverbal weak pronominal clitics. Results of other studies indicate that syntax does not involve one specific brain region but a network of areas including Broca's area (Caplan, 2006). Similar studies reported that age of acquisition mainly affected the cortical representation of grammatical processes and that the grammatical processing is more vulnerable to changes in early experience than semantic processing. (Golestani et al 2006) Another study found that bilinguals performed better on the comprehension of grammar and tense morphology and less accurately on the acquisition of vocabulary and (complex) morpho-syntax (Chondrogianni & Marinis, 2011). Similarly, bilinguals' morphological awareness in one language positively affects their literacy acquisition

in the second language (Wang, Lin & Yang, 2014). Paradis and Genesee (1996) believed in the interdependency of development in which grammatical phenomena may emerge earlier in bilinguals than monolinguals and the development of grammatical devices in one language boosts the acquisition in the second language in bilingual children. While morphosyntax and phonological processing differ across languages, meanings and concepts are mostly shared and lexical processing happens in parallel across languages (Costa et al, 2005). Recent evidence has shown than bilingual and monolingual toddlers acquire semantic information at a similar rate at 16-22 months (De Anda et al., 2018) Similarly, early bilinguals semantic systems was found to develop at an equal speed than monolinguals (Styles & Plunkett, 2009), although in the majority of studies, monolinguals outperformed bilinguals on semantic related tasks in particular on low frequency words on associative tasks (Johns et al, 2016). The advantage of bilingualism was also explained by examining differences between monolinguals and bilinguals' performances on tasks on metalinguistic awareness and socio-pragmatic abilities (Schroeder, 2018). Results indicated that bilinguals performed similarly to monolinguals on measures of narrative, social, and pragmatic language skills. Consistent with this, previous studies have found that bilingualism enhances the development of theory of mind (Diaz & farrar, 2017). Dicataldo and Roch (2020) noticed that higher ToM is associated with a condition of higher SES and greater exposure to the language of context, indicating a potential bilingual advantage boosted by better living conditions and language exposure. A large amount of literature on interlanguage pragmatics focuses on the development of pragmatic skills in L2 as if pragmatic competence in L1 and L2 were separate processings. Recent evidence suggests that there is interdependency between L1 and L2 skills (Kecskes, 2017) which may mean that there is one pragmatic competence that is modified depending on the length of exposure to different languages, the individual preferences and so on. If monolingual and bilingual children normally report vocabulary differences when compared, bilingual children were observed to have an advantage on complex non-verbal tasks regarding executive control functions (Bialystok, Craik & Luk, 2012). More specifically, bilingualism researchers have inquired into the specific set of executive function skills, such as response suppression and self-regulation, that are affected by bilingualism. Although research on executive control is wide and offers conflicting findings, a well-known model

(Miyake et al., 2000) identifies inhibition, updating, and switching as its relevant components. Evidence from such a linguistic field has indicated that bilingualism does not seem to influence all domains of executive function but mainly on 'conflict' related tasks (Carlson & Meltzoff, 2008). Conflict tasks normally require individuals to make a novel response while inhibiting a conflicting, but more salient, response (Carlson & Meltzoff, 2008). Tasks such as the DCCS and the Simon task are examples of conflict tasks as they require individuals to select a response and suppress other more prominent stimuli . As such, these tasks display the cognitive advantage in bilinguals only when a perceptual attribute, such as shape or color, is involved rather than a conceptual one, such as a lexical-semantic item (Bialystok & Martin, 2004). In the Simon task, subjects watch a screen and are meant to press either a red button or a blue button on a response box placed in front of them with a blue or red button. Participants then watch the screen and see a series of squares appear in front of them, which will be either blue or red. They are asked to press the button every time they see a square and the button must correspond to the color of the shape on the screen. Some of the trials are congruent meaning that the square appears on the same side on the screen as its corresponding button while others are incongruent trials in which the square appears on the opposite side of the screen as its corresponding button . During incongruent trials, children must ignore the button that corresponds with the side on which the square appears and instead focus only on the color of the square. Generally, bilinguals show a smaller 'Simon effect' when compared to their monolingual peers (Bialystock, 2008) which stands for the increased length of time participants need with incongruent stimuli (Simon, 1969). As such, bilinguals tend to perform faster with incongruent trials compared to monolinguals. Further findings indicated that bilinguals showed faster RTs with both incongruent and congruent trials in the Simon Task (Bialystok, 2008). In the color-shape DCCS, participants are asked to sort cards based on one perceptual attribute, which normally is either color or shape. Once the cards have been sorted, children are asked to re-sort the cards based on the opposite dimension. In this trial, participants must ignore the information which was previously relevant and instead focus on a different attribute. The function-location task is a variation of the DCCS where participants are instructed to sort cards based on conceptual attributes, such as lexical-semantic information. To do so, the cards show pictures that contain both a functional property (e.g. objects to write with and objects to cook with) and a location

property (e.g. objects that belong in school and objects that belong at home). In the first round, children are asked to sort the cards by their function. In the second round, children are asked to re-sort the cards, by their location. Although on perceptually-based tasks bilinguals have demonstrated an advantage as compared to monolinguals (Bialystok, 2008), different results have been observed on conceptually-based tasks which are thought to rely on areas of executive function other than attentional control and trigger cognitive processes that are not involved in the bilingual advantage. The Simon task and the DCCS are used on different age groups participants: The DCCS is more appropriate for individuals below the age of 5 since older children may reach ceiling levels on this task (Bialystok & Martin, 2004). The Simon task is normally used with school-age children and adult populations. Other executive functions that do not show bilingual advantage include tasks on the delay of gratification, which requires response suppression (Carlson & Meltzoff, 2008). Evidence coming from a systematic review based on the PRISMA method demonstrated that the bilingual benefit occurs when assessing inhibition and cognitive flexibility, but does not when working memory is considered (Giovannoli et al., 2020). In fact, on tests of verbal memory (short term and working memory), bilinguals are reported to perform similarly to their monolingual peers and only outperform them when tested in the dominant language (Delcenserie & Genesee, 2017). Bilingual advantage on EF will be further examined in relation to autism later on in the following chapters of the paper.

1.5 Language acquisition

1.5.1 Single System Hypothesis

Early studies on bilingualism attempted to understand the phonological, lexical, morphological and syntactic systems that children use when processing two languages. Leopold (1970) designed the "One hybrid system" interpretation which states that an initial processing of two languages input as one hybrid system.

Although this theory has taken into account all the basic levels of language functioning (e.g. phonology, syntax etc), in the "one hybrid system" it became crucial to describe just how bilingual children manage to differentiate between their two languages (Arnberg & Arnberg, 1992). Following this first theory, Volterra and Taeschner (1978), argued that bilingual children apply the same rules to both their languages. In fact, children are not able to separate their linguistic systems and this leads to a "fusion" of the two systems. In particular, Volterra and Taeschner (1978) affirmed that language development in bilinguals is divided into stages: starting from one single lexical system (stage 1), going through the separation of lexical systems but using one syntactic system (stage 2), until the lexical and syntactic systems split when the individuals reach the age of 3 (stage 3). This theory was confirmed in a study conducted on bilingual children between the age of 1 and 3. At the beginning the researchers noticed the presence of one " mixed utterance" due to the interaction of the two languages (Italian and German) which confirmed the idea of one lexical system. Later, the participants were noticed to use the premodifiers in both their languages even if it is used in the German language only and the use of negative form before verbs in both languages, even if it is typical of the Italian language only. Studies from Vihman (1985) also support this theory. The Single System Theory states that bilinguals use the same lexical elements in both their languages, creating "mixing utterances" sentences, due to a fused system. However, new contrasting theories have been developed, as displayed in the following paragraphs.

1.5.2. Transfer Theory

The transfer theory was first theorized by De Houwer (1990) which stated that "any morphosyntactic device belonging to input system A will be used in the child's speech production in utterances which contain only lexical items from language B and vice versa" (De Houwer, 1990). The transfer theory consists of a real transfer of several linguistic characteristics of one language to another. This theory is supported also by Slobin (1973) who argues that bilinguals are constantly required to make a comparison between the different structures of the languages involved. As such, the transfer occurs only if the morphosyntax of language A is less complex than

morphosyntax of language B. Differently from the single system theory in which a mere fusion between two languages is discussed, the transfer theory affirms that there is awareness in choosing the language structure to use. Neither version of the transfer theory explains how bilingual children reach the ability to combine lexical items with morphosyntactic features of the same language. So far, not many studies have shown clear evidence in support of the transfer theory. For children learning their second language early in life, a process of transfer may appear in one of their languages once they are beyond the silent stage (Tabors, 1987). Preschoolers learning L2 after the age of 3, may produce utterances from their second language and structural features from their first language (Pfaff,1994) , however their language production is quite different to what is reported of bilinguals with exposure from birth. A study conducted by Roch, Florit and Levorato (2016) as reported in the book by Levorato and Marini (2019) reported that linguistic competence is transferred across L1 and L2 in school bilingual children but is independent in preschool bilingual children, indicating that cross linguistic transfer may begin with schooling, at least as far as narrative competence is concerned.

1.5.3. Separate Development Hypothesis

In contrast with the previous theories, the Separate Development Hypothesis (SDH), gives a fresh idea about bilingual language systems. Although bilinguals often show mixed-language sentences, they are able to distinguish between their two languages' lexical systems. On this matter, Pye (1986) analyzed the results provided by Vihman (1985) on a research carried out on his son Raivo, and noticed that the bilingual child had the ability to distinguish between the two language systems and used his two languages in the right context. In light of this, Pye (1986) stated that language mixing is a natural step that every child has to go through. In addition, Meisel (1989) critiqued the single system theory by Volterra and Taeschner (1978), arguing that previous findings on bilingual language systems were not reliable. In fact, he believed that the adjective-noun observed in the Italian-German participants occurred because the adjective production in italian does not appear before the age of 3 (age of participants in the study) which is the age that marks the beginning of

the phase 3 in which children acquire language-specific roles. Similarly, as far as the negative particles used in the task are concerned, in the italian language "non" has to be always placed before the verb whereas in German, "nicht" can be used either before or after the verb. Because of this, Meisel (1989) suggested that researchers should only take into examinations the linguistic structures that differ greatly in the two languages. Moreover, bilingual children use different grammar structures to express the same semantic and pragmatic functions in both languages, demonstrating that they are able to distinguish between the two language systems. (Sinka & Schelletter, 1998). De Houwer (1990) noticed that young bilinguals are able to use the correct morphosyntactic structures of L1 and L2 without mixing them. In favor of the SDH, a lead-lag competence of one of the two languages, and therefore more advanced skills in one of the languages spoken by the individual demonstrates that the two languages develop separately and independently. There are not many studies against the SDH, however further research is needed to explore young bilinguals' language development under mixed conditions, in which the majority of people speak two languages to the child.

1.5.4 Full UG Access Hypothesis

Language acquisition in bilingual children follows the same trajectory than monolingual children despite researchers argue that bilingual development is slower and more complex due to the two language systems involved (Hambly et al., 2013). This explains why bilinguals often are linguistically confused and learn their languages at a slower pace. Interestingly, research has shown that bilingual language development is the same as the monolingual language development as far as all the language aspects are involved: phonetic, lexical, morphology and syntax. Like the monolingual development, the bilingual development begins from simple grammar and phonetic structures and evolves into more complex structures (Bialystock, 2008). The process is gradual and greatly influenced by psychological, social and environmental aspects that may delay or boost language acquisition. Bilingual children may show differences in the development of their 2 languages as one may develop faster and better than the other language, certain language skills

may overlap or separate and they may be more proficient in one language or both. Therefore, the difference between children speaking one language only and children speaking more than one language is given by the fact that bilinguals need to develop two language codes simultaneously, which requires double effort and the ability of the bilinguals to be aware of their two independent language systems. This is particularly obvious when code-switching and mixed utterances occur. These phenomenon demonstrate that the child is gaining awareness by gradually experiencing the two languages and "mixing" is part of the process. The Full Transfer and Full Access Model (Schwartz & Sprouse, 1996) also known as FT&FA model is based on two assumptions about the initial state of L2 acquisition and the following development of the interlanguage. About the initial state, this theory affirms that the grammatical knowledge the individual has from their L1 sets up the initial state of L2 acquisition (Full Transfer). At the beginning of L2 acquisition, individuals already have a well developed speech system in their L1. In other words, L2 acquisition is mediated by the Universal Grammar that resets the parameters of L2. In fact, L1 grammar is part of the initial state of L2 acquisition (full transfer), but L2 learners have full access to UG at all times during the acquisition process (full access). More specifically, the learner has to access UG if the input of the L2 is incompatible with the mental grammar transferred from the L1 into the initial state of the L2. This theory derives from The Second Language acquisition Theory designed by Krashen (1982), which points out that acquisition is an intentional process based on oneself implicit knowledge which leads to explicit understanding of L2 grammar rules. Krashen (1982) suggests that the two language systems are independent and inter-independent as L1 grammar enhances L2 grammar acquisition. It is safe to say that a bilingual brain is made of two independent language systems that support each other, allowing the child to acquire both languages. In particular, L1, which is normally more developed, supports L2 acquisition. Criticism has focused on the downsides of the full access UG theory arguing that the study offered an empirically low level of documentation since data from only one of the participants were considered. The second aspect criticized is the choice of the data. In fact the materials used to collect data were film retellings and conversation data which are difficult to compare to the utterance structures from film retellings. Therefore higher variability of data should be used to compare the development of L2 acquisition in a wider sample size. In addition, both qualitative and quantitative data should be

involved and longitudinal studies could also be helpful in analyzing language development across time.

1.6 Italian acquisition as L2

In the last twenty years, many more people have migrated to Italy, with the majority of migrants coming from East European countries such as Albania, Romania, or Africa such as Morocco, Camerun and Asia including China, India and Bangladesh (MIUR, 2018). This phenomenon has contributed to the spread of Italian as a second language and more families speaking more than one language at home. Those children learn Italian in school and often speak a foreign language with their parents. Therefore the two languages learnt by the immigrant child are acquired in two different contexts. In fact, their mother-tongue or L1 is learnt from birth throughout the child's interaction with their parents, whereas their L2, in this case Italian, is taught in school and used with peers. If at the beginning, the parents' language is L1, as time goes by, their L2, Italian, will become their dominant language. This is due to the fact that children will get integrated in the host country (Italy) and will feel more and more part of it. There are cases in which the immigrant parents, in order to support the child's language development may only speak Italian at home, displaying poor language competences and therefore negatively affecting the child's learning. On the contrary, it is recommended to parents to speak their native language at home, especially when the child is young. The Italian constitution promotes a free and linguistically democratic education, as shown in the article n.3 of the Constitution which argues that language discrimination is not accepted and all obstacles to a free use of language should be removed (Giscel, 2007). In line with this, schools in Italy must respect the linguistic minorities within their community to make sure that every student is included in their class and is not discriminated for their social and linguistic background. Nowadays, in Italy, little attention is given to preschool education, which is still partially private and not available to everyone. In nursery schools, there is not a real language teaching strategy for "Italian as a second language" children. Children are thought to be able to learn Italian through a full immersion in the environment and learning by imitating, which could represent

helpful strategies but cannot ensure a correct language acquisition. Real educational and language interventions are needed in school to support the child communication skills of their L2. Also, it is necessary to plan and organize the class curricula and behavioral habits to include and support each and every student within their class (Nepi, 2017). Teachers' role is to provide a supportive and enriched environment, in which students are surrounded by target language input and their learning is constantly monitored. The recommended activities should reinforce the skills that students already have and stimulate the child's learning which will follow the natural learning pathway, as in L1. Sensory experiences and multidimensional approaches should be priorities to support children's cognitive development (Nepi, 2017). Games and fun language experiences such as creative tasks and practical activities may be effective tools to make language learning interesting and motivating. Small practical targets could be set to observe the language progress throughout the learning process.

CHAPTER 2

AUTISM SPECTRUM DISORDER (ASD)

2.1 Definitions and classification criteria

Autism spectrum disorder (ASD) refers to a neurodevelopmental disorder characterized by high heterogeneity and variability across profiles which results in a complex understanding of this disorder (Bishop & Norbury, 2002). Nowadays the majority of the countries in the world, including Italy, use the 5th Diagnostic and Statistical Manual of Mental Disorders revised (DSM-5-TR) which is the last edition of the DSM released by the American Psychiatric Association (APA). According to the DSM-5-TR (APA, 2022), individuals with ASD are characterized by an impaired social interaction, problems in communication, restricted interests and stereotyped behavior. Previous editions of DSM had highlighted and included different criteria for diagnosis. In fact, general awareness of autism spectrum disorder has greatly shifted since the first time ASD was described in the 1940s. Over the years, there has been a change in the number of behaviors and diagnostic criteria associated with this disorder and many of these have been taken out from the most recent classifications. As a result, in the past decades the rates of ASD diagnoses have gone up which does not imply an increase in occurrence but rather a growth in professionals and individual's awareness. The pioneer of autism was a pediatrician called Kanner who named this disorder the "Autistic disturbances of affective contact" after observing children who showed lack of communication skills, sensitivity to stimuli and difficulty at understanding others (Kanner,1943). In 1944, the child psychiatrist Asperger (Asperger,1944) noticed that some young individuals displayed "autistic psychopathology" which was characterized by similar symptoms to the ones described by Kanner but had fewer communication deficits and higher cognitive and social skills. Therefore their condition was a mild "version of autism" and is what doctors later have named "Asperger's syndrome". In the following years, autism was considered an early manifestation of schizophrenia deriving from the child relationship with their parents, thus, no official definition for this disorder was

available yet. In 1980 autism was included in the DSM-3 (APA,1980) by the name of "Infantile autism" within a new class of conditions, "the pervasive developmental disorder" which included children who showed symptoms such as lack of social responsiveness, trouble to understand others and altered sensitivity to stimuli. At the time, autism appeared to be a very rare disorder with a rate of 3 in 10000 (Treffert,1970) and it was more likely to be diagnosed in males than females (Fombonne, 1999). Despite the official recognition that DSM-3 has provided for infantile autism, some limitations have been addressed. Firstly the definition of infantile autism was monothetic and not very flexible, as such all the criteria had to be met to qualify for the diagnoses. Secondly, the criteria was child oriented, and lacked a developmental orientation which could also represent adults with autism. Last, the disorder onset was not clearly stated. Because of these limitations, several important changes were made in the DSM-3-R (APA,1987). For example, the term "infantile autism" was modified to "autistic disorder" which allowed a more flexible and developmentally-oriented approach that would include individuals from different age groups and developmental levels (Siegel et al.1988). In this manual, the criteria were organized into 3 main domains of dysfunctions which included deficits in reciprocal social interaction, delays in communication and restricted interests. To qualify for the diagnosis, an individual had to meet 8 criteria, two from the social domain and at least one from each of the other two categories (Rosen, Lord & Volkmar, 2021). The 10th edition of World Health Organization's international classification of Diseases (ICD-10, WHO 1992) used a different diagnoses approach which comprised two manuals, one for the clinical work and one for research. The ICD-10 recognised other disorders such as Asperger syndrome and Rett's disorder. Therefore the differences in criteria between the DSM (used mainly in America) and the ICD-10 (used in Europe) made cross countries comparison and collaborations hard. This is why a further DSM revision was undertaken which involved literature reviews and data reanalysis in conjunction with the ICS-10 work group with the purpose of narrowing the overly broad DSM- 3-R (Rosen, Lord & Volkman, 2021).

 In the 4th edition of the DSM (APA,2000) the three category model was confirmed but the final set of criteria was less numerous and detailed. As such, in the DSM-IV autism was referred to as pervasive developmental disorders (PDDs) which is an umbrella term embodying disorders characterized by pervasive impairments in communication, social reciprocity and repetitive and ritualistic patterns of behavior

and interests. Asperger and Rett's disorders obtained a separate category and were the reason for particular controversy amongst the commission. The revision of the diagnostic and statistical manual of mental disorders in the 5th edition (APA, 2013) rejected the classification of these disorders into distinct categories and suggested a unitary approach based on multiple dimensions in which autistic disorder (AD), Asperger's disorder, Rett's disorder, childhood disintegrative disorder and pervasive developmental disorder-not otherwise specified (PDD-NOS) are merged into autism spectrum disorder (ASD). Therefore the previous symptomatology is condensed into a two-domain symptom model which includes social and communication deficits and restricted and repetitive patterns of behavior, interests, or activities. The symptoms must be present in the early developmental period, although they may be masked by learning strategies in later years. Language is commonly impaired or absent, usually in conjunction with low IQ or cognitive deficits. Additional impairments, for instance, related to sensory–perceptual or motor skills, are typical. It is unclear what the implications of these changes were in the following diagnosis of PDD, although some studies (Gibbs et al., 2012) suggested that some subjects with a diagnosis of PDD did no longer meet the new criteria. Likewise, ICS-11 has also adopted an umbrella term which categories individuals along a spectrum of different levels. However, while both manuals unify the classification of symptoms, the DSM-5 provides symptoms severity according to the level of support the individual needs whereas the ICD-11 uses a multicategorical system to differentiate individuals according to their cognitive and language abilities. More specifically, in the DSM-V (APA, 2013) severity is worked out taking into account social communication deficits and restricted and repetitive behavior. Either way severity is categorized according to 3 levels: level 3 in which the individual requires very substantial support, level 2 in which they require substantial support and level 1 in which they require support. (APA, 2013).

2.2 Types of autism

Given that autism may affect development in different ways and in different aspects, several types and diagnoses of autism were once in use. Nowadays, ASD is described as a spectrum that embodies the severity of symptoms once considered to

be different types of autism. In fact, in the last DSM edition, the types of ASD with different names do not exist anymore, however a number of individuals still use terms that in the past were autism "subtypes."

2.2.1 Asperger's syndrome

As previously mentioned, Asperger's syndrome took its name after Hans Asperger who documented many patients with similar symptoms. Asperger's syndrome is a developmental disorder that in the past was recognized as a separate disorder from autism. With DSM-V, Asperger's was merged into a broader category of ASD, along with other developmental disorders. Since Asperger's has been classified as a separate disorder from autism for a long time, still now specialists may occasionally refer to Asperger to signify a milder form of autism or as an alternative they use the term HFA (high functioning autism). In fact, individuals with Asperger's were usually able to function in daily life independently without the need for any medical support or aid, but their behavior would occasionally introduce challenges particularly as far as unforeseen circumstances would take place. A person diagnosed with Asperger's would, in the past, have been considered very "eccentric" or "introverted." They would show strong interest for a certain topic or subject in which they may exceed, and zero tolerance to uninteresting topics (Atwood, 2006). Moreover, Asperger's individuals may show great problem solving and mathematical skills but inflexibility and lack of considering alternative ways of doing things as well as problems with converting thoughts into words. These individuals are normally good at spotting details and not as good at looking at the bigger picture, an ability called " weak central coherence" (Happe, 1995). Differently from the other types of autism, Asperger's did not require a language delay, in fact individuals diagnosed with this subtypes of autism had normal to high language skills, despite a delay in pragmatic skills and an unconventional use of speech (Atwood, 2006).

2.2.2 Rett Syndrome

In 1954, Andreas Rett, a pediatric neurologist in Vienna, first recognized the characteristic features of the syndrome which later came to bear his name. Rett

Syndrome is a neurodevelopmental disorder that affects mainly girls. Individuals with Rett Syndrome often show symptoms similar to autism such as loss of communication and social skills (Rett, 1966). However, since this disorder involves many physical symptoms not present in ASD, it was removed from the DSM-V and is no longer part of the ASD umbrella. The etiology of Rett Syndrome is known and is linked to the mutation of the MECP2 gene. Although the causes are genetic, only less than 1% of cases are inherited since the majority of cases derive from spontaneous mutations, although families of individuals with Rett Syndrome might have asymptomatic female carriers of the mutation (Smeets , Pelc & Dan, 2012). Rett Syndrome development is characterized by 4 stages (as cited in the study by Smeets , Pelc & Dan, 2012) however pace of occurrence and severity of symptoms are different in every individual. The first stage refers to the early onset stagnation period which occurs between 6 months to 1 year and 6 months of age in which there is a sudden negative shift in the child's interactive behavior, normally with their parents. The second stage is the rapid developmental regression period between 1 and 4 years of age, in which the child is affected by a rapid regression of the acquired abilities. The third stage involves the pseudo stationary stage which starts when the regression stage is over and normally involves a sort of stabilization of previously acquired abilities. In this stage, which can last for many years, girls can still learn effectively new skills despite some physical stereotypes and abnormalities typical of this disorder such as epilepsy are displayed. The fourth stage is the late motor deterioration which begins when walking ceases and the individual becomes wheelchair-dependent. The second part of stage 4 involves severe neurological impairment, however the individual can still communicate with visual contact and eye pointing. Some of the typical symptoms of the Rett syndrome are: growth delays, loss of motor control, repetitive movements, abnormal walk, seizures, strange and puzzling behavior, hypotonia and language and social difficulties (Smeets, Pelc & Dan, 2012).

2.2.3 Childhood Disintegrative Disorder (CDD)

Childhood Disintegrative Disorder (CDD) is a rare and severe developmental disorder that was incorporated into the ASD umbrella in the DSM-5 (APA, 2013). Its

prevalence rate is 1.7 in 100,000 children. CDD is affected by regression in language and social abilities after a period of pseudo normal development until approximately the age of 2 years (Mehra et al., 2019). The developmental and communication regression is also typical in autism but the late age of regression onset is what differentiates CDD from autism. Although the speed of onset of regression in CDD is different in every individual, studies often categorize between 'acute' onset (which occurs in only days or weeks) and 'insidious' onset (occurring in weeks or months). Interestingly, the corresponding term 'other childhood disintegrative disorder' was still used in the ICD-10. However ICD-11 incorporated CDD into a broader ASD category likewise DSM-5 (WHO, 2019). Mehra et al. (2019) argued that the fact that DMS-5 failed to include a diagnostic 'marker' for regression, will make future research on this disorder more challenging. Differently, the ICD-11 has listed "loss of previously acquired skills" as a marker (Ellis et al., 2022). Studies on CDD indicate that there are no previous signs of atypical development in CDD individuals before the onset of regression symptoms, whereas atypical development is more typical in classic autism (Mehra et al., 2019). Additionally, a number of distinctive characteristics of CDD have been highlighted including: high rates of eye-contact (Gupta et al. 2019), high degrees of fearfulness, (Westphal et al., 2013), occurrence of epilepsy (Rosman & Bergia, 2013) and regression of bowel and bladder control (Mehra et al., 2019). Symptoms that are similar to the ones that ASD present include sleep problems and self-harm (Mehra et al., 2019).

2.2.4 Pervasive developmental disorder-not otherwise specified (PDD-NOS)

The pervasive developmental disorder not otherwise specified is a developmental disorder that, alongside the other subtypes of autism, was merged into the single diagnosis of autism spectrum disorder (ASD) with the publication of the DSM-5 (AAPA,2013). To qualify for a PDD-NOS individuals had similar symptoms to ASD but did not fully meet the criteria for another type of autism. Similar to the other types of autism, PDD-NOS individuals show a range of abilities and symptoms, however their main deficits are related to social and language development. (Hassan & Perry , 2011) As such, PDD-NOS individuals present some but not all characteristics of

autism, for example they may have symptoms in the social domain but no symptoms in the repetitive behavior domain. Since the PDD-NOS diagnosis is recent, professionals may often be unfamiliar with the term or use it improperly. Some relevant studies have grouped PDD-NOS into three subgroups: the first group includes 25 percent of patients belonging to the high-functioning group and their symptoms are similar to Asperger syndrome, but while the former involves speech or cognitive delay, the latter does not (Hassan & Perry, 2011). The second group represents 25 percent of patients and their symptoms are very closely related to the autistic disorder, but as previously mentioned, they do not fully meet all its diagnostic symptoms. The third group represents 50 percent of cases that meet all the diagnostic criteria for ASD but their repetitive behaviors are significantly mild. (Carbone & Dell'Aquila, 2023)

2.3 Etiology of ASD

The review on ASD is large and contradictory and studies on this matter suggest several different conclusions. One is that autism is a heterogeneous disorder and is likely to have multiple possible etiologies: as such it is thought that the immediate cause of language impairments in ASD is biological and therefore the individual is born with it, although the difficulty can be worsened by adverse environmental conditions (Boucher, 2003); another explanation pinpoints a variety of diffuse anatomical differences, indicating an early developmental change in the growth of neural tissue, rather than localized abnormalities. Some studies conducted using neuroimaging have observed differences in brain shape and structures in the right hemisphere in ASD children compared to their non ASD peers. This suggests that a possible explanation may be an abnormal structure of the brain. However, Miles (2011) found out that only 25% of this population show brain abnormality and since no biomarkers have been found (Sauer, Stanton, Hans & Grabrucker, 2021), it is hard to assume such a causal relationship. In addition, numerous investigations supported the genetic basis as similar disabilities and abnormalities have been noticed in ASD individual family members (Taylor et al., 2020). Despite a strong

belief that the diagnosis is affected more by genetic predisposition and environmental factors, no gene responsible for ASD has been found. However, results have reported irregular segments called microexon in the ASD individual's genetic code that have most likely been inherited. The microexons are responsible for encoding proteins and were found to be particularly irregular in people with ASD. Moreover, research on ASD found dysfunctional microexons within genes that had previously been associated with intellectual disability (Geschwind, 2011). Furthermore, Genovese and Butler (2020) identified between 70 and 90 percent of heritability of cromosomic, DNA and mitochondrial related anomalies. The wide percentage difference is due to high heterogeneity of the disorder and because of this, it is easy to assume that several different genetic, epigenetic and environmental factors may play a role in the etiology of ASD. On this matter, another hypothesis on the causes of autism points out that the comorbid conditions that have been observed in individuals with ASD are underlying causes that may have intensified the ASD condition. As an alternative, a dysfunction in the genes impairing the brain's normal development may be causing an atypical structure in the brain. Nevertheless, Taylor et al. (2020) conducted a study on twins with ASD and concluded that genetic factors play a significantly larger role than environmental factors and environmental factors alone are unlikely to be the cause of the growth in prevalence rate of ASD cases. These results were confirmed by other studies on twins in the spectrum, such as a Japanese research conducted by Taniai et al. (2008). Further research also examined the effect of some chemical products such as mercury and an inability to process certain toxic substances in ASD individuals. On this matter, Kern (2016) conducted a review based on 91 studies from 1991 to 2016 that examined the potential relationship between mercury and Autism spectrum disorder. Results indicated that 74% of studies found that mercury is a risk factor for ASD indicating that mercury exposure may be the cause or a contributing factor in ASD (Kern, 2016). Another hypothesis taken into account over the last decades has been that deficits in language acquisition are caused by the social and emotional impairments which prevent people with autism from developing a 'theory of mind' (Hobson, 1993). This explanation is supported by statements that claim that the theory of mind is necessary to develop the ability to use symbols, such as words or sign language. However, this theory does not explain why some individuals with ASD acquire language, even when the theory of mind skills are absent (Carpenter, Pennington &

Rogers, 2001). Another hypothesis on the etiology of language impairment in autism argued that there is a delay in the ability to process sequential stimuli, including stimuli with a temporal dimension, such as speech or manual signing (Tanguay, 1984). On this matter, Boucher,(2003) has argued that the main cause for language impairment is a delay in time processing mechanism or "time parsing mechanisms" which refers to the socio-emotional and socio-cognitive deficits associated with impaired theory of mind. Boucher (2003)'s study highlighted that all individuals with ASD have difficulties with processing long duration events such as conversation and that contributes to pragmatic impairment that ASD often presents. Overall, numerous relevant studies have been conducted on the etiology of Autism Spectrum disorder but no evidence of a unique cause has been provided therefore the causes of this heterogeneous disorder are still unclear.

2.4 Strengths and weaknesses of ASD

Early research on ASD has focused mainly on the difficulties related to this disorder such as social communication deficits and language impairment. Recent studies have also analyzed the strengths and advantages of autism in order to ameliorate the work and social conditions of people in the spectrum and reduce stigma connected with it (Courchesne et al., 2020). The pioneer studies on the advantages of ASD, focused on savant skills, including ability to perform mental mathematical calculations, or draw detailed scenes using their memory (Wing, 1996). These abilities are very rare and only a very small portion of ASD individuals with high functioning skills possess them, therefore more recent studies have focused on the strengths of a wider population of ASD. On this matter , Mottron et al. (2006) in their study noticed that ASD individuals show enhanced local processing skills compared to their TD peers, meaning that they are good at focusing their attention on small details before elaborating the bigger picture. In addition, it was found that people in the spectrum are typically reliable, with a strong sense of social justice and integrity, creative in problem solving, and honest, in particular when they are high functioning autistic individuals (Attwood, 2015). Furthermore, in individuals with high functioning autism, which refers to individuals with autism whose IQs are close to or above 100

(Baron-Cohen et al., 2006), usually vocabulary is an area of strength, as is evidenced through high scores on 4 standardized vocabulary assessments in a study conducted by Tager-Flusberg et al. (2005). Moreover, a study on 24 autistic participants investigated about the advantages that ASD has, in a self-rating interview and results indicated that the main strengths indicated were good attention to detail, a strong sense of morality, superior cognitive skills, ability to hyperfocus, efficient memory, loyalty and empathy for animals or other ASD people (Russell et al., 2019). On this matter, the research by Cope and Remington (2022) highlighted that people with ASD show many employment-related advantages that should be taken into account by caregivers and employers (Cope & Remington, 2022). Despite these promising findings, research does not often take into account the autistic individuals' viewpoint but mostly involves their caregiver or employers. Instead, to make future research more inclusive and emancipatory for people with disabilities (Happè & Charlton, 2011), it is crucial to involve ASD individuals in the research by analyzing their perspective. Many studies focused on the weaknesses that ASD people show. A common deficit in ASD is related to communication. In fact, individuals with autism often show impairment in social interaction and language which is likely to be used for instrumental rather than social purposes. Thus, the content of what is said is normally egocentric and repetitive (echolalia) and conversations are non reciprocal and often involve poor pragmatic abilities (Gernsbacher, Morson & Grace, 2015). The ASD language impairment does not only refer to the ability of acquiring spoken language, but to the ability of acquiring signed language as well. In some cases, signing may have an advantage over speech in those individuals who have additional problems such as hearing loss or oral dyspraxia, and it may be easier to teach sign language to low functioning autism (LFA) children. Often, pictures are used rather than signs to communicate with very severe LFA individuals (Jolliffe, Lansdown & Robinson, 1992), through the AAC (augmentative, alternative communication) system which can act either as a supplement (augment) to their existing speech or as their primary (alternative) method of expressive communication (Iacono, Trembath & Erickson, 2016). Despite the growing use of AAC , there is a need for more well-designed studies as for many years studies have failed to demonstrate generalization and social validity (Schlosser, 1999). Since then, a number of systematic reviews have been conducted with a clear focus on AAC but there is still a lack of evidence for the role of AAC in

comprehensive intervention programs (Rogers, Dawson & Early, 2010). In addition, Individuals with HFA or LFA have impaired processing of short duration events such as sentences, and this adds semantic and syntactic deficits to their pragmatic impairments. Individuals with LFA often show additional impairments at the level of words and morphemes, adding the semantic and grammatical impairments to the impairments mentioned above. Moreover, LFA individuals have even further additional deficits in processing syllables and phonemes which prevents any language acquisition. This hypothesis may help explain why some but not all children with autism have language impairments. Other studies address the sensory–perceptual anomalies in autism which affect language but also behavioral skills (Hobson, Lee & Brown, 1999). An example comes from the studies on hypo- and hyper-sensitivity of some ASD individuals to sound or light (Rosenhall et al., 1999). While overall lexical knowledge may be a relative strength in ASD, the acquisition of concepts and meaning and socio-emotional terms are usually impaired in individuals with this disorder. (Tager-Flusberg et al., 2005). Additionally, in typically developing subjects, joint attention usually begins around the age of 9 months and it is not until the age of 12 months that it is well developed (Brooks & Meltzoff, 2002) and what is thought to contribute to the development of joint attention is the interactions with available parents. According to recent research joint attention skills shown in the second year of life are correlated with higher social skills in the future (Charman et al., 2000). Findings outlined that children with good joint attention skills are more likely to have better language skills by the age of 4. Also, imitation skills are strictly linked to the development of social interaction and socialization has been found to boost language skills later in life (Charman et al., 2000). The connection between language development and social skills is strong and it seems that language development is a result of social developmental processes in the first year of life. As previously mentioned, one of the most common symptoms in the majority of ASD children is related to social communication and deficit in verbal and nonverbal communication. This language impairment is a common feature of autism and is often the cause for referral and later diagnoses of ASD. Moreover, evidence from longitudinal studies of subjects with ASD and without ASD outlines that those with deficits in verbal skills are at increased risk for less favorable outcomes later in life (Vogindroukas et al., 2022). In line with this, the development of early language skills predicts social functioning, academic

achievement, and psychiatric outcome in late childhood and adulthood. Furthermore, speech difficulties in ASD children are often linked to speech production, oral movement, fluency and speech programing. An example is disordered prosody that refers to deficits in communication and involve phrasing, intonation, and rhythm (Bourgondien & Woods, 1992). Moreover, motor function plays a key role for the development of areas such as language, social interaction, and learning (Maski, Jeste & Spence,2011) which ASD individuals normally have impaired, especially when it comes to imitation and advanced gestures. Consistent with this, relevant results comes from neuroscience studies that have investigated the mirror neuron theory in ASD people (Perkins, Stokes, McGillivray, Bittar, 2010). Mirror neurons (MNs) are visuomotor neurons which activate both when performing and observing a goal directed action and have a role in imitation, empathy, theory of mind and language. Evidence from functional MRI and EEG indicate that MNs are dysfunctional in individuals with ASD. On this matter, Belmonte et al. (2013) indicated that motor skills which include fine motor skills, gross motor skills and oral motor skills, are correlated with speech acquisition, so that the more severe the motor skills impairment, the slower the speech and language acquisition. In particular, poor oral motor skills which are linked to language acquisition affect expressive language skills, instead receptive language skills are often stronger. In a study it was found that ASD children showed impaired oral movement and poor complex syllable production tasks. Specifically, children with ASD struggled to lift their tongue and to pucker their lips (Vogindroukas et al., 2022) which are movements used to speak fluently and express facial emotions. These findings are hard to generalize since there is clinical heterogeneity of ASD individuals in terms of motor function and ability to produce speech. If the strengths that may be associated with being autistic in their social context are understood, ASD children may be able to identify their own strengths in school or outside school. This in turn may facilitate ASD people in finding activities and jobs that they may enjoy and are good at. Future research should also focus on how teachers and employers could support individuals with ASD by making changes to teaching practice, interview processes and class conditions, and seeking out relevant training on ASD (e.g. ABA training) when needed.

2.5 Home and school interventions

Since individuals in the spectrum of autism vary widely in terms of symptoms and severity, the interventions to be effective should also vary. The growth of ASD prevalence rate, the high heterogeneity of the disorder and its financial demand, require valid interventions targeting a wide range of adaptive behavior and pinpoint the need to strengthen family and school support service (Lord et al., 2018). Early interventions are thought to be crucial to improve ASD patient's condition particularly with young children. On this matter, studies on family interventions analyzed the effect of four home visits done using an ASD developed resource kit. Results indicated that participants were 29 mothers who at the end of the treatment reported being less stressed when dealing with their ASD child and improvements in their child's interaction and play. (McConkey, 2024). Similarly, Tellegen and Sanders (2014) conducted an individualized parenting program on 64 ASD children and parents indicated feeling more confident, less stressed and having a better relationship with their children. Equally, Zand eat al. (2018) planned a four session parenting program on parents of newly diagnosed children with ASD and results showed significant improvements on abnormal behavior and family dynamics. Overall, the majority of parent-based interventions have been conducted using small samples which often consist of well-off families rather than involving a wider population of families and children with ASD. In fact, lower income families may benefit greatly from home therapies since research has shown that the highest drop out of ASD therapy comes from low SES families (Carr & Lord, 2016). As previously mentioned, individuals in the spectrum with absent or low verbal skills may benefit from using the Picture Exchange Card System (PECS) as well as other alternative, augmentative communications systems (AAC) (Iacono, Trembath & Erickson, 2016). However, those types of intervention systems usually are not appropriate for highly verbal and HFA individuals who instead may benefit from other types of training such as on social skills or cognitive behavioral interventions. Evidence-based practices (EBPs) for Autism Spectrum disorder stands for educational and behavioral interventions that have been proven to be effective for people with ASD in school and at home after being analyzed in numerous, peer-reviewed studies. Since research is a continuous process that changes over the years, the research in ASD

is evaluated by a team of experts in education and in specific in ASD. Several approaches have been studied and only a limited number of them had the characteristics to qualify for meta-analyses and systematic reviews. On this matter, a number of meta-analyses have been carried out on interventions related to applied behavior analysis (ABA), (an example comes from Virues-Ortega, 2010) whereas systematic reviews were based on picture Exchange Communication System (Filippin, Reszka & Watson, 2010). Furthermore, the target of behavioral interventions in autism is to raise the level of ASD autonomy and independence. Amongst the behavior interventions, the most applied nowadays is Applied Behavior Analysis (ABA) (Lovaas, 1961). ABA refers to the science of analyzing how the environment in which an individual lives influences their behavior (Lovaas, 1961) and it aims to find ways to change their abnormal behavior. ABA originates and takes after "operant conditioning" (Skinner, 1971) and is used to moderate challenging behavior and to reinforce and generalize desired behavior. This is done through the use of systematic reinforcement (Schultze, 2017). Generally speaking, ABA-related strategies are used to reinforce specific adaptive behaviors such as toilet training, whereas comprehensive ABA-based interventions refer to strategies that begin in early childhood, (around 3 years of age), take between 20 to 40 hours a week, are customized to the need of the ASD child, target many skills at once and use a combination of behavior intervention strategies (Schultze, 2017). Furthermore, comprehensive ABA-based interventions require therapist-parents partnership and aim to generalize the child's behavior from a one to one format to group naturalistic settings (Virués-Ortega, 2010). Research on ABA interventions has indicated four interventions amongst the most valid: EIBI (early intensive Behavioral interventions), ABA-VB (the verbal behavior approach), NDBI (Naturalistic Developmental behavioral interventions) and ESDM (early Start Denver Model). All those interventions display high efficacy in relevant meta-analyses as cited by Eckes et al. (2023). Comprehensive ABA-based interventions are seen as the most efficacious treatments for ASD in the US and they are used daily in educational settings. In Europe, ABA-based strategies have become established whereas comprehensive ABA-based programs are rarely used as some professionals argue that they are not grounded in evidence (Eckes et al., 2023) and studies on this approach show many limitations such as poor methodological quality, small samples and a high risk of bias (Reichow, Hume , Barton & Boyd, 2018). Moreover, in some poor countries it is not

easy to apply comprehensive ABA-based treatments as they are cost consuming and raise ethical concerns especially as far as the use of reinforcement is concerned (Leaf et al., 2021). Regardless of skepticism that ABA methods have raised in some countries, comprehensive ABA-based interventions are evidence-based and provide relevant results for future research (Eckes et al., 2023). Furthermore, another treatment that has provided evidence and interest of researchers is the TEACCH program (Treatment and Education of Autistic and Related Communication Handicapped Children), (Mesibov & Shea, 2010). The TEACCH is a program that focuses on the close relationship between parents and therapists, uses structured teaching practices and is shaped on the needs of the ASD individual (Van Bourgondien & Schopler, 1996). During TEACCH, the child's skills are assessed through standardized tests and the results are used to develop a curriculum that will be in line with the ASD child's needs (Mesibov, 1997). The specialist uses structured teaching procedures to enhance the acquisition of the learning objectives that are part of the client's curriculum. In structured teaching the environment and activities are planned and organized to facilitate learning and prevent frustration that is typical of ASD. As such, the environment needs to be arranged in a way to prevent child's distractions and overstimulation, the activities need to be planned in a predictable fashion through the use of timetables and visuals to support the routine and materials and tasks are used to boost independence from adult prompts through a fading technique (Virues-Ortega, Julio & Pastor-Barriuso, 2013). TEACCH has been reported to be used by over 30 percent of families in a multi-national survey conducted by Green et al. (2006) in America. In a similar way in Finland, an epidemiological survey was carried out by Kielinen, Linna & Moilanen (2002) and its findings showed that over 40% of ASD children were treated with TEACCH. Overall, investigations on TEACCH have shown high variability of study designs and participants characteristics in terms of age, intensity and duration of treatments (Virues -Ortega, Julio & Pastor-Barriuso, 2013). This heterogeneity may affect the treatment efficacy and generalization of significant results due to the fact that they do not use standard methods to analyze data (Moher, 2009). However, in very recent years, a decent number of valid studies on TEACCH were conducted using a consistent methodology which granted a meta-analysis with sufficient power.

2.6 ASD in Italy

As of today, the prevalence rate of ASD is 1 every 54 individuals in the USA, 1 every 160 in Denmark and Sweden and 1 every 100 individuals in England (ISTAT, 2023). In spite of this, cross culture estimates need to be taken with caution as different methodologies and diagnostic assessments have been used to collect data. In Italy the rate of ASD is 1 every 77 individuals with over 600,000 people with ASD including 100,000 under the age of 18 years and with higher rate in boys which are 4.4 times more likely to be affected by ASD than girls (Narzisi et al., 2020). The Ministry of Education data revealed 9.8 per 1000 certified ASD children in the north, 12.2 in the central, and 10.3 in the south of Italy (ISTAT, 2023). In Italy, the Ministry of Health (MOH) has come to an agreement with the regions, named IAAP (Conferenza Unificata, 2018) which together with the Italian law on ASD (Law n. 134/2015) address strategies to support ASD health care, with the purpose of promoting efficient protocols for ASD diagnosis and evidence-based treatments. In accord with the suggestions provided at national and international level, IAAP has identified, as one of the top priorities, to raise awareness on services provided in each region to individuals with ASD, so as to support and meet the needs of ASD people and their families across the country. In Italy, the neurodevelopmental disorders such as ASD, are taken care of in specific Child and Adolescent Mental Health units (CAMHs), which are situated in local health services, and hospitals (Scattoni et al., 2023). On a study conducted by Scattoni at al. (2023) on the quality of service provided across the different Italian regions, such as Human Resources in health care for ASD and service provided to ASD patients, findings highlighted that only 11 regions out of 20 (55%) have supplied formal advices for ASD patients and follow the IAAP's guidelines. Also, 70 percent of regions have reported at least one ASD funded action plan between the 2010 and 2015. Moreover, results indicated high cross regional variability as far as intervention services and human resources are concerned. Thus, CAMHs in the Northern regions showed higher service capacity than the South and in the same way, the North seemed to use more digital technology to manage data than the rest of Italy. Overall, exception being made for Northern Italy, the financial investment and amount of resources is limited particularly

regarding staff training. On this matter, ADOS and ADI-R which are the most valid and reliable diagnostic assessment for ASD are cost consuming in terms of price and training (Atwood, 2015) which can become a challenge to diagnosis in the South of Italy. Because of this, it is clear that service provided by ASD care centers needs to be reinforced with the aim of meeting the needs and requirements of ASD patients, particularly severe cases that need high degrees of support (Thabrew & Eggleston, 2018). Moreover, it needs to be pointed out the fact that funds and financial support for staff training and ASD related support are crucial to ensure a high quality workforce (Thabrew & Eggleston, 2018). This can be challenged by the fact that in Italy, regions have partial political autonomy since they can decide independently how their health systems should be organized, following a broader national framework. Because of this, Italy is affected by high geographic variability and inequalities, which may prevent national harmonization (OECD, 2019). The cross-regional gap could be overcome if Italy implements a collaborative network between family, schools and educational agencies, health care providers and ASD individuals throughout their life, from the initial diagnosis through school up to adulthood in order to ensure the patient's wellbeing and independent lifestyle.

CHAPTER 3

BILINGUALISM AND AUTISM SPECTRUM DISORDER

3.1 Effects of Bilingualism on ASD

In light of recent research evidence on language development, bilingualism does not seem to negatively affect children development, although the majority of significant studies have been carried out on typically developing bilingual children (Bialystok et al., (2010). Despite initial skepticism on whether or not to encourage bilingualism in a child with disability, current findings support biliteracy and bilingualism does not seem to deteriorate the development of children with cognitive difficulties such as SLI or Down Syndrome (Hulme et al., 2012). Moreover, recent studies on bilingual individuals with pathologies have been conducted to analyze the difference between their performance and their TD peers' performance. For example, Hulme et al., (2012) noticed that the predictors of individual differences in reading skills in children with DS seem to be different from the predictors in TD children. In fact, TD children learn to read in an alphabetic system (eg italian), and their word-level reading skills are predicted by letter knowledge and phoneme awareness, whereas broader oral language skills (e.g., vocabulary and grammar) predict their reading comprehension (Hulme et al., 2012). Since phoneme awareness is a weakness in individuals with DS, vocabulary and grammar, and not phoneme awareness, would predict word reading acquisition in DS children (Hulme et al., 2012). Differently, the predictors of reading comprehension are the same in children with and without DS, in fact difficulties to understand what is being read are associated with deficits in language and verbal memory in both DS and TD children (Nash & Heath, 2011). In spite of this, no difference has been found between the monolingual and bilingual groups with DS on any of the first language measures, indicating that bilingualism in DS does not have a detrimental effect on language skills. In line with these results, Cleave et al., (2014) observed that bilinguals with DS performed similarly to monolinguals with DS on a fast-mapping task that required the pairing of novel

phonological representations (new names) with semantic referents, even if they were only tested in their first language. With these findings as a backdrop, Edgin et al., (2011) tested 13 DS children who had frequent exposure from a family member to a second language (Spanish) and results reported no significant differences when the DS group was compared to the 28 monolinguals on measures of English language skills or on EF related tasks. Interesting studies on language development on individuals with disabilities have reported that bilingual children with Down Syndrome performed similarly to their monolingual peers with Down Syndrome, on vocabulary tasks and standardized language tests (Kay-Raining et al., 2005). Equally, studies on bilingual children with language difficulties (SLI) demonstrate that those children show similar deficits as their monolingual peers. (Gutierrez-Clellen, Simon-Cereijido & Wagner, 2008). Nevertheless, research on bilinguals with disabilities comes with some obstacles. For example, it is difficult to select homogeneous groups of bilingual children because of their different social status (e.g., immigrant, more or less privileged minorities), differences in age (early or late acquisition of L2), family size, language acquisition order (simultaneous vs sequential), level of exposure to L1 and L2 and acquisition contexts (home, family, from one or two parents), (Meisel, 2007) . In fact, these aspects may affect the bilingual level of proficiency and language acquisition of L1 and L2. Identifying children with language difficulties and differentiate their diagnoses within this heterogeneity is an even bigger challenge, since for instance specific language impairments has a primary deficit in linguistic abilities (Bishop & van der Lely, 2000) and autism spectrum disorder often involves severe language impairments. Additionally Peña et al, (2018) argued that when a child struggles to learn a language, they will be likely to struggle to learn another language as well but this will not be harder. Therefore, bilingualism does not seem to worsen pre-existing language deficits but actually bilinguals with learning difficulties may be advantaged compared to monolinguals on some language domains including morphosyntax and semantics (Peña et al., 2018). Furthermore, inclusion criteria make the population with ASD very heterogeneous, and this in turn generates confusion about which linguistic aspects are affected and to what extent. As such, ASD is manifested at different linguistic levels (Boucher era al., 2012) but not all language skills are equally impaired in every ASD individual, regardless of how many languages they speak. To date there is only a limited amount of published research that has analyzed the effect of bilingualism on ASD children. One of the pioneer

study conducted by Seung et al., (2006) on the impact of bilingualism on ASD, did not compare the development of a bilingual with ASD with that of a monolingual with ASD but tested the effect of a bilingual speech-language intervention program on a child with ASD. The research involved a Korean language only therapy for a year and a gradual introduction of a language therapy in English in the following months (Seung et al., 2006). In order to prepare the child for school, the last six months of treatment were only in English. After two years of intervention, the child demonstrated progress in both languages on receptive and productive skills and a decrease of challenging behaviors. Other studies have examined the bilingual effect in the development of children with ASD. For example, the research from Ohashi et al, (2012) studied the performance of French-English bilingual children and English monolingual children (aged between 2 and 5) on language related tests. The findings of this study did not report any substantial difference in the performance across the two groups, indicating that bilingual exposure does not prevent or deteriorate the acquisition of a second language in individuals with ASD. These findings were supported by an investigation carried out by Hambly and Fombonne (2012). In their study, sequential and simultaneous French- English bilinguals were included along with English monolinguals. Their results have shown that regardless of the amount of language or the type of bilingualism, speaking more than one language does not have a negative effect on the language development of children in the spectrum. More specifically, findings in literature indicate that bilingualism does not cause or worsen a disability (ie ASD) and that children with disabilities as well as TD children are able to acquire two or more languages (Paradis, 2011). Despite the significant results, most studies used a small sample size in the language-impaired bilingual exposure groups, and only enrolled participants who had 'intensive' exposure of L1 and L2 and productive expressive bilingual abilities. As such, these investigations show that some children with disabilities and bilingual exposure acquire language to the same level as monolinguals, but do not prove that all bilingual children with disabilities do. Despite the limitations, these findings confirm the hypothesis that likewise TD children, monolinguals and bilinguals with disabilities are similar in regards to the quality, rate and process of their language development (Paradis et al., 2011) and because of this, bilingualism does not seem to exacerbate language development above and beyond the effects of disability (Genesee, 2006). Taken together, the results from studies of bilingual children with DS and ASD suggest that

individuals with language impairments can live in a bilingual environment without experiencing a negative effect on their language skills. Nevertheless, most studies on bilingualism and children with disabilities have tested mainly participants who speak their first language for educational purposes and their second language at home. Therefore, it would be crucial to extend the research to participants from similar bilingual contexts so as to compare matching data and avoid potential confounding variables.

3.2 Areas of language

To gain further insight into the relationship between ASD and bilingualism, the next paragraph will explore the core dimensions of language in bilingual children with ASD including semantics, morphosyntax, phonology, and pragmatics. In a typically developing child, nonverbal communication and functional communication begin when the individual turns 12 months, which is when the first words are usually voiced out (Tager-Flusberg et al., 2005). Infants begin to combine words to create two-word phrases around 20 months (Fenson et al., 1994) while, semantic and syntax usually develop in later years (Tager-Flusberg et al., 2005).

A lot of children with ASD experience communication challenges across all language subsystems including pragmatics, grammar, semantics, syntax, phonology, and morphology in both oral and written language, while some children with autism demonstrate exceptional language skills. Problems in communication stretch on a continuum of severity that goes from verbal, to non-verbal ASD individuals. The diversity of profiles in speech and communication skills vary from the presence of comorbid factors, typical symptoms of ASD without comorbidity or both. Gilhuber et al., (2023) analyzed 22 studies which focused on the five areas of language and they found that the majority of the studies used a variety of assessment tools, but, only seven of the 22 studies tested their participants in both their languages. On this matter the authors suggested that testing bilingual participants only in their L1 or L2 may lead to misrepresentation of the language skills. This is supported by the assumption that single language measures are not appropriate for multilingual children (Core et al., 2013). Future studies should

include language scores in the dominant and societal language in order to create the most accurate bilingual language skills assessment method.

3.2.1 Semantics

One of the dimensions of language development is semantics which refers to the study of meaning in a language that can be applied to the single word or the entire text. It needs to be clarified the difference between knowledge of words in a spoken language which stands for lexical and capability of fully understanding language in context which is what semantic is. On this matter, ASD individuals tend to begin to talk later and learn their language at a slower pace than their TD peers, however their development of lexical domain often appears to be similar to that of TD children (Vogindroukas et al., 2022). In general, it has been observed that vocabulary appears to be an area of strength for children with ASD, compared to other language domains (Tager-Flusberg, 2000). However, vocabulary profiles of ASD children show high variability, thus some children may acquire a limited number of words, while others present an advanced and rich vocabulary, often about an area of interest (Frith & Happé, 1994). About semantic skills, Hani, Gonzalez-Barrero, & Nadig, (2013) observed that children in the spectrum are capable of mapping words to novel objects, outlining a positive verbal fluency of bilingualism on ASD children similar to that of the non autistic children. Similarly, findings from literature have shown typical features of ASD children regarding their lexical profile, such as the use of idiosyncratic words, neologisms and pedantic speech (Ghaziuddin & Gerstein, 1996). Common difficulties of ASD children related to vocabulary involve the use of pronouns. In the past the incorrect use of pronouns in children in the spectrum was thought to be caused by echolalia, which refers to a meaningless reproduction of utterances (APA, 2013). In recent years, pronouns reversal has been associated to difficulties in using deixis which are pointers that allow people to identify time and space (for example now is a temporal deixis and here is a spatial deixis) and the difficulty for ASD children lies in associating the vocabulary with their semantic processing (Tager-Flusberg et al., 2005). Therefore, even when the meaning of a word is acquired, the difficulty is in applying the lexicon in context. Research studies

on semantic skills of children in the spectrum present heterogenous profiles, with some investigations reporting intact lexical semantic skills (an example comes from Cantiani et al., 2016) while other investigations report highly impaired lexical semantic skills (as displayed by Alghazo et al.,2023). On this matter, Vogindroukas et al. (2022) observed that bilingual children with ASD, similar to monolingual children with ASD, have been found to use bizarre or idiosyncratic discourse that makes little sense to others, as well as they name objects inappropriately and use nonsensical terms in alteration to common sense terms. The abnormal discourse in ASD bilinguals and ASD monolinguals children may occur because the individuals with this disorder are not able to represent in their mind the meaning they want to communicate, or in some cases, they may be unsure on how to answer a certain question (Vogindroukas et al., 2022). For example, when compared to typically developing children, young children with HFA (Saalasti et al., 2008) have difficulties in understanding complex semantic concepts, such as identifying shapes or colors or using concepts and categories. Results revealed that while bilingual and monolingual children with ASD scored similarly in vocabulary production in English, bilinguals with ASD produced higher vocabulary comprehension scores than monolinguals with ASD (Petersen, 2010). Petersen, Marinova-Todd, and Mirenda (2012) observed the performance of English monolingual and English-Chinese bilingual children with ASD in the lexical comprehension and production skills. Bilingual children were also tested in Chinese. The results have shown that bilingual children with ASD performed better than their monolingual peers in the vocabulary inventory as well as in the conceptual vocabulary test. Hambly and Fombonne (2012) tested 30 bilingual and 35 monolingual children with ASD and their results reported that the total conceptual vocabulary and words recalled did not differ across groups. The authors concluded that the similar scores signified that bilingualism was not a reason for additional language delay in ASD children. Equally, Petersen, Marinova-Todd, and Mirenda (2012) reported similar performance on the vocabulary scale between Chinese-English bilinguals in the spectrum and English monolinguals in the spectrum. Despite this, some limitations were addressed as the results of this study indicated significant differences on NVIQ variables across groups, which was higher for bilingual children with ASD. Therefore it is crucial to match participants on this variable since NVIQ has been found to be a strong predictor of language skills in ASD individuals (Thurm, Lord, Lee, & Newschaffer, 2007). Taylor and Mailick,

(2014) in their study, deducted that language processes are independent from the development of other aspects of ASD therefore the development of language is not associated to the severity of ASD symptoms. This may explain the conflicting research results and the variety of ASD profile and characteristics. So far no single theory has been able to explain the difficulties of people in the spectrum, in particular when they are also bilingual. In fact there is great variability in ASD bilingual children as far as semantic abilities are concerned and can vary from very limited to proficient with some HFA bilingual children showing high performance on semantic tasks. In addition, other aspects of ASD may affect the individual performance on semantic tasks which could be caused by language impairments typical of ASD or by other language disorders in comorbidity with ASD.

3.2.2 Morphosyntax

Morphology refers to the meaning of internal structures of words whereas syntax refers to the grammar rules and structures of phrases and sentences. Previous studies argued that TD bilinguals show lower syntactic skills compared to TD monolingual children, as measured by sentence repetition tasks (Meir., 2018). The poor performance of bilinguals on sentence repetition tasks is attributed to smaller vocabulary sizes but the negative effect disappears when vocabulary scores are controlled for (Meir., 2018). Similarly, children with ASD have shown difficulties with morphosyntax, in particular with the comprehension and production of clitics, producing noun phrases in focus structures, non-words repetition and verbal inflection (Terzi et al., 2014). On this matter, the deficits in understanding pronominal objects ciclits (eg. Ci, gli, la, le in italian) in focused structures is associated with the difficulties with acknowledging prominent items in speech and deficits with using certain intonation with particular discourses. Clearly, in HFA individuals, difficulties with morphosyntax are not severe or always present. It is not clear whether the difficulties on morphosyntax are caused by the deficit in the morphosyntax per se or by the link of morphosyntax with other domains such as semantics or the pragmatics and prosody, because clitics interact with all these 3 areas (Terzi et al., 2016). Not

many studies investigated morphosyntax alone and morphosyntax that involve pragmatics and prosody on ASD children, but the limited available research suggests that on language impaired children, difficulties are outside syntax and are due to pragmatic and prosody whereas on high functioning ASD children, difficulties lie on syntax alone (Terzi et al., 2016). In bilinguals with ASD a study from Gonzalez-Barrero and Nadig (2018) portrayed that numerous bilingual children with ASD show intact syntax, while others show impaired syntax. In their study bilingual groups scored lower than monolinguals and ASD groups scored lower than TD groups on syntactic related tasks. However they noticed that while the effect of bilingualism could be explained by the small vocabulary size and therefore it could be controlled for while the negative effect of ASD could not disappear as it's not caused by the reduced lexical abilities alone. Because of this, poor lexical skills can not explain deficits in syntactic skills (Gonzalez-Barrero and Nadig, 2018). The explanations of the heterogeneous results in literature may be due to the fact that in some cases bilingualism works as a compensatory mechanism for children with ASD (Engel de Abreu et al., 2012) since the acquisition of L1 may enhance the acquisition of L2 (Paradis, 2010). Another possible explanation refers to the inappropriate use of monolingual assessments and norms when testing bilingual children which could lead to bilinguals' poorer performance and their consequent wrong and unnecessary referral to special educational needs programs (Meir & Novogrodsky, 2019). Another study from Gonzalez-Barrero and Nadig conducted in 2018 on morphology and vocabulary skills in bilingual and monolingual children with ASD, indicated high variability in the morphological ability scores due to the amount of exposure, age and working memory of the participants. As such, these factors are an important predictor of morphology skills as the higher the degrees of any of those factors , the higher is the score on morphology related tasks.

Furthermore, impaired joint attention skills may have a negative impact on receptive and expressive language delays in bilingual children. Individuals on the spectrum normally present impaired joint attention including referential pointing and eye gaze that is needed to 'map' word labels to the appropriate referent (Parish-Morris et al., 2007). Thus, besides the mapping related tasks that all individuals have to perform, bilingual children have to recognize that two or more different words can map to a single or various concepts across languages. For instance, the second person plural pronoun "you" in English, maps to both "tu" and "voi" (second person plural) in

Italian. As such, receptive and expressive vocabulary skills could be delayed in both languages if word mapping is lagged in bilingual children with ASD and difficulties with grammar may be caused by further inconsistencies in grammatical systems across languages.

Overall, multilingual ASD children share a similar deficit with their ASD monolingual peers including morphological and syntactic skills (Meir & Novogrodsky, 2019). However some aspects of syntactic skills have not been assessed in bilingual children in the spectrum. An example is echolalia, the typical utterance repetition of ASD individuals which has not yet been analyzed in relation to bilingualism despite sentence repetition has often been used to assess syntactic skills. Other syntactic aspects include syntactic parsing which has been studied in bilingualism but not in bilingualism in relation to ASD (Dussias & Sagarra, 2007).

3.2.3 Phonology

Phonology stands for the way in which sounds of a language and their production are distributed and used within a specific language. On this matter, bilingual children have shown to perform better than monolinguals on tasks on metalinguistic awareness; which refers to the cognitive skills that enables people to identify and change language structures, such as individual sounds, words and morphosyntactic rules (Tunmer, Herriman, & Nesdale, 1988). An example of Metalinguistic awareness comes from phonological awareness (PA), which takes place when individuals are able to manipulate phonemes and syllabic structure (Nagy, 2007). Studies on PA demonstrate positive results for bilingual children and this advantage is thought to be enhanced by the fact that bilingual children are more aware of language processes due to the differences between their first and second language (Bialystok, 2001). In support of this, Marinova-Todd et al., (2010) observed that bilingual children perform better than monolingual children on PA tasks, involving elision and alliteration. Moreover, evidence has outlined that a PA advantage is more likely to appear in children who speak two languages that share similar phonological structures and alphabetic orthography as compared to children whose languages are very different (Bialystok et al., 2003).

Despite the general consensus on bilingual children's advantage on PA tasks, previous literature on phonological awareness of autistic children have shown that this population typically performs worse than their TD peers (Gabig, 2010). Studies on ASD performance on phonological related tasks highlighted that HFA children scored below average on PA tasks (for example Gabig, 2010), but limitations on the sample size and the possible presence of hyperlexia in the ASD participants made generalisability of the results hard (Newman et al, 2007).

In a study on the PA of children in the spectrum, Westerveld ed al., (2017) compared their performance to the expected developmental ranges for matching age TD children and results have shown that the majority of ASD participants performed greater than expected range. This led to unexpected conclusions that PA was an area of strength in children in the spectrum. Different results came from a study from Dynia et al. (2014) which found out that performance of ASD children on PA related tasks was significantly poorer than their TD peers. Similarly, Hudson et al. (2017) observed that children with ASD were over one and a half standard deviations below the mean on PA tasks.

These findings were confirmed by the investigation by Gabig (2010) which demonstrated that children with ASD performed significantly lower than their TD peers on both blending and elision tasks (Gabig, 2010).

Despite the previous findings, the majority of the participants in Gabig's (2010) study (both monolingual and bilingual) performed quite well on all of the PA tasks, particularly the rhyme and sound matching tasks. However the task used was found to be relatively easy for the age group and therefore a more age appropriate measure in future research may be needed to confirm the validity of the results (Pereda, 2013). Furthermore, Weikum et al., (2007) realized that ASD individuals do not pay attention to facial movements during speech which are crucial cues for understanding a language. This impairment can impact the development of phonological competences. Findings on this matter have reported that TD bilingual infants perform slower than their monolingual peers when it comes to encoding and retrieving the phonetic details that are needed to make novel object-word associations (Fennell et al., 2007). However, a scarce number of studies has focused on how bilingualism and ASD relate as far as phonological processing are concerned, therefore further research should address this gap in literature.

3.2.4 Pragmatics

Pragmatic skills refer to how people use a language within their cultural contexts (Gleason, 2017). Social pragmatics go beyond verbal skills and involves nonverbal and preverbal skills such as eye contact, gestures and body language (Smith et al., 2018). Although this area of language development is typically impaired in ASD individuals, there is only a very limited number of investigations on the effect of bilingualism on pragmatic skills in ASD children. The main ASD deficit related to pragmatics lies on the difficulty of children in the spectrum to be aware and take into account the listener's point of view during a conversation (Tager-Flusberg, 1995). This difficulty in turn affects their ability to describe events or characters during storytelling which makes the narrative hard for the listener to understand. An example comes from studies on pragmatic skills on children in the spectrum which outlined shorter and simpler narratives of the ASD children compared to their TD peers and peers with other intellectual disabilities (Tager-Flusberg, 1995) In addition, the ASD participants were found to use higher numbers of atypical elements in their stories compared to the control groups (Loveland, McEvoy, & Tunali, 1990). Regarding bilingual children with ASD, speaking two or more languages has been found to lead to benefits in acquiring pragmatic skills in later years compared to speaking one language only. A study that compared English monolingual toddlers with ASD and English-Spanish bilingual toddlers with ASD demonstrated that bilingual children presented higher frequency of cooing, pointing to objects, and gesturing suggesting that the bilingual group was more socially interactive compared to their monolingual group which could lead to more language exposure and develop pragmatics more (Valicenti-McDermott et al., 2013). Thus, the higher use of pretend play, the better imitative skills in bilingual infants with ASD, which in turn may enhance pragmatics skills (Stephens & Matthews, 2014). A relevant study on narratives of bilinguals and monolinguals with ASD demonstrated that bilingualism did not have a negative effect on the performance on narratives (Yang, 2011). The study took into account the aspects of global and local linguistic structure, and evaluative comments in narratives obtained using an image-only picture book and no significant difference was found

between the 13 English monolingual children and the 10 chinese-English bilingual children, both groups with ASD. A recent study carried out in China also observed the effects of bilingual exposure on children with ASD with a focus on the pragmatic aspects of language (Reetzke et al., 2015). The study compared monolingual Chinese children with ASD and bilingual children whose second language was either Cantonese or Mandarin and an unintelligible Chinese language. The results examined all the structural language competences and demonstrated that bilingual children with ASD are comparable to monolingual peers on pragmatic related performance (Reetzke et al., 2015). Overall, the most understudied language dimensions are phonology and pragmatic skills, in particular nonverbal and preverbal communication skills. Since pragmatic-related skills are a deficitary area for children with ASD, this gap in research should be filled.

3.3 Theory of Mind

Theory of Mind (ToM) also called "mentalizing skills" stands for the ability to attribute cognitive states such as beliefs, intentions and emotions to both oneself and others and to predict their behaviors (Nguyen & Astington, 2014). ToM has been found to be a key skill for successful social interactions (Derksen et al., 2018). Children on the spectrum often show deficits in ToM which can be seen in their dysfunctional social situations (Schuh & Eigsti, 2012). ToM is believed to be affected negatively by deficits in Executive functions. Similarly, language difficulties have been found to have an impact on ToM in ASD (Solomon et al., 2009).

The research dilemma raises the question whether bilinguals with ASD can compensate for ToM impairments typical of ASD because of an Executive function advantage provided by bilingualism or whether low syntactic skills remain strong obstacles to succeeding at ToM tasks. On this matter, recent studies on the relationship between ToM and grammar point out that grammatical knowledge is crucial in ToM development (De Villiers & De Villiers, 2007). As such embedded clause understanding is thought to correspond to incorporating someone else's point of view into one's own (Tager-Flusberg & Kasari, 2013).

Moreover, false belief attribution tasks are normally perceived as challenging from children diagnosed with ASD. These tasks require the ability to understand the world from another person's perspective and perceiver is expected to embed other individuals' mental representations into their own meta-representations (Li & Leung, 2020). Importantly, Durrleman et al. (2016), found that ASD children's false belief skills tested in a nonverbal ToM task was related to the understanding of complement clauses and EF such as inhibition and planning which seem to worsen ASD performance (Joseph & Tager-Flusberg, 2004). Because of this, performance does not seem to be associated only to the performance of verbal ToM tasks. In fact, ToM uses tasks that require high cognitive demands such as working memory which is a weak aspect in ASD children, regardless of their ToM skills (Bull et al., 2008).

On this matter, children in the spectrum normally display executive dysfunction which may explain their social-communication impairments (Leung et al,. 2016). In particular, response inhibition, working memory, and mental flexibility are often impaired in ASD (Gardiner & Iarocci, 2018). Peristeri et al, (2020) suggested that bilingual children with ASD showed better attention shift skills on oral narration due to their less detailed processing style compared to their monolingual peers. Their recent study reported that bilingual children with ASD outperformed monolingual children with ASD in the low-verbal ToM task, in a sentence repetition task with syntactically complex sentences (adverbials and relatives) and findings pointed out different processing mechanisms between ToM and EF. Interestingly, the monolingual group with ASD used syntax when performing a verbal ToM task, whereas the bilingual group with ASD used EF and adverbial clause repetition in both verbal and low-verbal ToM tasks. Finding an explanation to how EF and adverbials are associated with ToM skills in bilingual children with ASD is hard, as the low-verbal ToM task only required limited language skills. In line with previous results, the ASD monolingual group was better at using lexical concepts requested for the belief attribution task of the verbal ToM stage. Conversely, the ASD bilingual group performed better than the monolingual children in nonverbal situations, in which language requests were kept to a minimum (Andreou et al., 2020). Moreover, bilingual individuals were more capable at using adverbial clauses in comparison to their TD monolingual peers and not very capable at using complement clauses. This is due to the fact that complement clauses involve grammar processes and depend

on language-specific rules which are a weakness in bilinguals whereas adverbial clauses are an index of cohesion and are more transferable across languages.

Despite a strong consistency on studies reporting an association between ToM reasoning and EF in individuals with ASD, the reason behind the association is yet not clear. A large number of studies declared that EFs are correlated to the skills used in ToM tasks when they involve high cognitive demands. This is due to a potential common cognitive processing between complex ToM reasoning and Executive Functions (White et al., 2017). Others suggest that metacognition links toM and EF by allowing individuals to detach from a particular state-of-mind in order to adapt to a new situation. Therefore, it has been hypothesized that ASD individuals are better at reflecting on another individual's mental states if they present flexible metacognitive skills. Leung et al., (2016) found that stronger metacognitive abilities in working memory, planning, organization, and monitoring in a group of children with ASD were associated with less social deficits in individuals with ASD which suggests that there may be a link between metacognitive processes and social functioning in ASD. Despite the fact that both EF and mentalizing skills may be better in autistic bilinguals compared to their monolingual peers as confirmed by a recent study on false belief attribution tasks by Balsimtsi et al., 2020, there is little research testing these aspects on monolingual and bilingual children with ASD.

3.4 Executive functions (EF)

Cognitive flexibility of bilinguals has widely been examined. In particular, it was found that executive functions (EF) such as set-shifting skills, may be enhanced by bilingualism. Set shifting is the EF domain which normally ASD children have more impaired, compared to TD children and children with other disabilities (Gioia et al., 2002). Although set shifting skills are not included in the diagnostic criteria for ASD, their impairment is connected with the symptomatology of restricted interests and stereotyped behaviors (American Psychiatric Association, 2013). Typical symptoms that ASD experience in the cognitive flexibility domain are characterized by difficulty with changes and transitions, inflexible and predictable routines, narrowness of focus, fixation on activities, need for sameness in the environment and life (Leekam,

Prior,& Uljarevic, 2011). More specifically, set-shifti(Miyake et al., 2000). On this matter, Leung and Zakzanis (2014) conducted a review on ASD adults and children, with over 2,000 participants with ASD and over 2,000 TD participants on 19 set-shifting tests. The overall results indicated that TD participants outperformed ASD participants, which outlined the deficit ASD individuals have on set-shifting, despite the variability in performance across studies. The high variability could be due to the fact that in many cases testing methods between ASD individuals and TD individuals are different. In light of this, children with ASD were found to perform better on computerized rather than live administration tasks whereas TD children seemed to perform similarly in both modalities. This has been attributed to less social demands in completing the computerized task for children in the spectrum while TD children may benefit from social motivation that comes from interacting with the experimenter (Kenworthy et al., 2008). Another explanation of the different results may lie in the high heterogeneity among ASD participants regarding their nonverbal IQ and language skills, which requires the use of appropriate matching procedures with control groups (Russo et al.,2007). Overall set-shifting ability appears to be consistently impaired in ASD children, whereas other EF domains, such as verbal working memory, have shown to be untouched when it comes to simple verbal working memory tasks, such as word recall and digit recall (Williams, Gold-stein, & Minshew, 2006) In contrast , individuals in the spectrum show difficulties with complex working memory tasks that involve high processing demands (Minshew & Goldstein,2001). Despite strong evidence mentioned in the previous paragraph of a bilingual advantage on EF compared to monolingual children, it is unclear if the benefits on EF found on bilingual children is also present in bilingual children who are later diagnosed with ASD.

Research found that monolingual infants use different learning mechanisms to acquire words than their bilingual peers (an example is the study conducted by Werker et al., 2009). One of the possible explanations states that perceptual abilities and word-learning strategies may differ depending on whether a child with ASD was exposed to only one or more languages during their first years of life. For instance, it is not known if children in the spectrum learn L2 vocabulary faster than L2 phonology, morphology, or syntax, but to become bilinguals, acquisition of all these language domains is necessary. Overall, despite little is known about bilingual processing or pace of learning in ASD bilinguals, literature reviews suggest that

there is no language delay caused by bilingual exposure for children with ASDs regardless of the timing of language exposure. TD bilingual children often present lower vocabulary and syntactic skills , but they tend to show advantages in executive functions (Bialystock, 2015). Differently, when comprehension and production vocabulary tasks are taken into account, bilinguals do not necessarily perform worse than their monolingual peers (Hoff et al., 2012). Overall, children with ASD display different profiles as far as their EF are concerned, with deficits on set-shifting skills and partially preserved verbal working memory for simple tasks. In a study conducted in 2012, Hambly and Fombonne, discovered that bilingual children in the spectrum do not experience additional impairments in language development compared to their monolingual peers in the spectrum. In addition, the bilingual group exposed to L2 in infancy did not significantly differ in the performance compared to the group that was exposed later on in early years. Furthermore, the authors have suggested that children with ASD may be affected by bilingualism in a different way than children with language difficulties like Down Syndrome, as different areas of learning are impaired across the disorders. However, it seems that children with ASD possess similar language skills independently of the number of languages they know, indicating that bilingualism does not deteriorate the ASD child's skills. Despite the promising results and the decent number of participants, this study shows some limitations including the recruitment method for which participants (and their families) took part as volunteers, and the low number of words used as stimuli (50) which have probably affected the performance. In line with the idea of a bilingual advantage, recent investigations portray that bilingualism acts as a protective factor for some impairments in EF in individuals with neurodevelopmental disorders such as ASD (Bialystok et al., 2016), but further studies are needed to confirm this theory. Although several studies found bilingual advantage in bilingual children with ASD including set shifting tasks, some did not find similar results (Bialystok, 2009). Therefore, it should be further investigated whether bilingualism provides benefits for this specific EF in children with ASD, as it occurs in TD children (Carlson & Meltzoff,2008) and if speaking two or more languages could reduce the set-shifting related deficits typical of ASD children. Finally, other EF domains should be investigated, including planning and inhibition which are typically deficitary in ASD individuals to analyze whether bilingualism has any effect on those functions or not.

3.5 Parents' concern

Besides the impact that bilingualism has demonstrated to have on language and cognition, another relevant aspect to examine is the social advantage of bilingualism on ASD children. A common concern for parents of children with ASD is whether their children should be raised in a multilingual or a monolingual environment (Yu, 2013). Despite parents would like their children to be raised bilingual for cultural, academical and practical reasons (for example moving to another country with better future opportunities or being connected to their cultural heritage), they are also concerned about the fact that exposing their ASD children to more languages may further impair their already deficitary language development, following advices from practitioners to raise their child in a monolingual environment to avoid language confusion (Yu, 2013). The confusion is often associated with the fact that bilingual children show reduced vocabulary in their L1, even though often their overall vocabulary across languages is similar to that of their monolingual counterparts. Studies on this matter have shown that bilingual children from minority language speaking families benefit from closer family connections and these benefits may lead to social and emotional well-being (Yu, 2013). Other studies reported the experience of adults with ASD and found many benefits of bilingualism in relation to autism. For instance, Howard, Gibson & Katsos (2021) indicated that bilingual adults in the spectrum living in a multilingual context were more positive about being bilingual compared to their monolingual peers living in a monolingual context. This was associated with the fact that bilingualism has helped them with relationships and to access educational and employment opportunities. Other benefits of ASD individuals enhanced by bilingualism included increased self-efficacy and self-confidence (Uljarevic et al., 2016). Additionally, research on life contentment has indicated that when asked to rate their life satisfaction on different domains in a questionnaire, ASD adults gave the lowest score to the social domain while non-ASD adults rated all the domains equally satisfying (Lin & Huang, 2019). Moreover, adults with ASD rated their social life significantly less satisfying as compared to TD adults (Vincent, 2019). Findings of this research reported that adults with ASD showed the need for personalized aid adapted to their autistic needs and hoped for their colleagues to be better informed about the needs of individuals with ASD. As social life has been

found to be a positive predictor of general life quality for individuals with ASD (Mason et al., 2018), it is crucial to understand the factors contributing to a better quality of life in autism. One aspect could be living in a multi-language context. On this matter a research has focused on studying the impact of bilingualism on cultural context, school, family and relationships of bilingual children in the spectrum. Findings indicate that speaking two or more languages allows TD children as well as children with disabilities to take part in the social life of their community and to be connected with people from different backgrounds, including their family heritage, especially when one of their parents speaks a different language at home (Kohnert, et al., 2005). Therefore, acquiring proficiency skills in their second language which sometimes is also their home language is crucial for numerous children with ASD, since this allows them to be fully part of their family life (Kremer-Sadlik, 2005). If on one hand, it is important for the bilingual child with ASD to learn their societal language as it is the language they will most likely use in school and at work, (Arreaga-Mayer et al. 2003), on the other hand maintaining their home language increase opportunities to practice and strengthen social communication skills with their family group, preventing potential social exclusion (Anderson, 2012). In a study conducted by Kremer–Sadilik (2005) immigrant parents of ASD children were interviewed and the results indicated that parents speaking only English to their ASD child reported a decline in the parent-child interaction and in the child's participation in family activities compared to parents speaking two languages. Similarly, Hampton et al. (2017) found that when parents were using their native language and not the official language of the country they were living in, their bond with their children was stronger especially with children with ASD. In fact, often parents feel obliged to speak to their ASD child using their non-native language, to provide a monolingual environment to them but this could lead to negative effect on family integration, even more so when the parents speak one language to the autistic child and two or more languages to their other family members. Given these results, being exposed to minority language at home could have not only linguistic benefits but also socio-emotional advantages, particularly for autistic children (Paradis et al., 2011). Moreover, it was observed that the quality of social life was higher for the multilingual individuals compared to bilingual individuals. Taken together, these results indicate a possible relation between language proficiency and quality of life, so that the higher language knowledge the higher social life quality. However, a

number of limitations have been found to this statement. Firstly, There was no evidence that speaking many languages is directly associated with even higher satisfaction with social life, also because the multilingual participants tested are a relatively small group. Furthermore, older autistic people were found to report less favorable social life (Mason et al., 2018). Despite a recent meta-analysis finding no significant relation between age and quality of life in ASD, other aspects, such as coexisting conditions or family support (Vincent, 2018) seem to have an effect on quality life.

Studies claimed that ASD participants can acquire new languages in a bilingual household but also later in life. In fact, people in the spectrum are capable of learning more languages from early childhood as well as acquiring a third language during adolescence for example in school. However the language experience involving learning a second or third language in a school setting has not yet been analyzed in ASD research. In fact, the majority of studies on bilinguals with ASD has focused mainly on either simultaneous bilinguals with ASD raised in a multilingual household or on ASD self-taught polyglots (Hyltenstam, 2018) and thus this sample is not representative of the whole ASD population and it does not considerate variability of language profiles. Despite this, most available investigations demonstrate that likewise non-autistic individuals, autistic individuals are able to learn two or more languages, with some studies reporting positive effects of bilingualism on EF, ToM and social interactions (Digard et al., 2022). Overall, in the western society, monolingualism has been found to be the norm and bilingualism is usually part of an elitary community of expats or minority groups. Conversely, in many developing countries (including African countries) multilingualism is the norm thus more studies in those places would help outline a clearer picture of the effect of bilingualism on a heterogenous populations such as ASD individuals.

CHAPTER 4

CONCLUSIONS

4.1 Implications

Some of the main difficulties of ASD bilingual children refer to barriers in educational and clinical settings. However, often governmental policies do not provide financial support and adequate training to professionals and educators working with ASD children. Suitable policies should be developed by national institutions to find solutions related to family, clinical and educational settings. To start with, practitioners working with bilinguals in the spectrums should share some linguistic or cultural experience with them, either due to a similar background or from linguistically adapted training to better support autistic bilinguals. In order to ensure equal opportunities to ASD as well as non-ASD students, school policies should aim for a change which will encourage dual language learning for every student. This will in turn develop a more inclusive environment which will remove environmental and social barriers, enhancing greater independence and equal access to every aspect of life.

4.1.1 Family implications

At home, families of children with autism are often affected by misinformation about bilingualism and autism spectrum disorder which may mean that parents choose a monolingual over a bilingual environment because of a fear of confusion generated by other languages. Parents' concern about their ASD child's language environment could be solved if they receive suitable information about the advantages of bilingualism and the effect of this on autism spectrum disorder. In the first place, stigma surrounding ASD could be reduced by increasing parent's awareness of

autism. On this matter Jones et al., (2021) suggested using short videos to teach TD adults about ASD in order to reduce stigma and increase positive beliefs of this disorder. As such, accessible resources could support parents of ASD children with recommendations from current research regarding knowledge of ASD with relevant findings on bilingualism. Moreover, information that parents receive about the effect of language on autistic children, should not only focus on cognitive development but also on social development , inclusion and family dynamics. In addition to this, it would be crucial to involve the child's point of view within the parents language choice as children should be asked (when possible) their opinion about their cultural and linguistic identity and resources should be also based on the child's perspective. To date, there are no investigations about ASD children's perspective of their cultural identity, feeling of inclusion and relationships with peers. Future research should address this subject to provide valid resources to parents of ASD children.

4.1.2 Clinical implications

Nowadays, one of the main issues with assessing bilingual children involves the lack of appropriate measures as many standardized tools are not appropriate for culturally diverse populations (Mdlalo et al., 2019). Although practitioners must respect and maintain equality when testing children, often therapists lack confidence and knowledge in the tools they use, especially when these are language related tools (Mdlalo et al., 2019). When it comes to diagnosing bilingual children with ASD, the challenges grow, as behaviors that are part of cultural norms may be wrongly attributed to ASD specific traits. For example, in some Asian cultures, children are taught to not eye contact or point directly to adults as this is culturally inappropriate but these behaviors are generally interpreted as ASD traits (Zhang et al., 2006). Similarly, some cultures teach children to show emotions in a different way or use toys that are not typical in western countries. Because of this, assessing linguistically diverse children using those methods may not be beneficial. As a result, children from diverse cultures and languages could be misdiagnosed or diagnosed later than children from mainstream culture. Oxley et al. (2019) have found that Practitioners responsible for testing ASD bilingual children do not feel confident to test culturally

diverse populations as the tools they have are not appropriate for these populations. Similarly, David et al (2020) reported that speech and language therapists feel the necessity of accessing additional language and cultural training to keep up to date but that often these training are not easily accessible. Therefore, in line with recent findings and professionals' perspectives, new bilingual-specific tools should be made available (for example bilingual versions of ADOS and ADI-R) so that autistic bilingual children as well as bilingual children with other conditions would be fairly assessed on all their languages. In order to support families and practitioners, relevant ongoing training and accessible information should be made available and easy to access. This may support parents in choosing a bilingual environment rather than a monolingual one just because practitioners are not able to provide a multilingual service. Clinicians and therapists should be provided with a wide range of culturally and linguistically appropriate tools which can be applied on a heterogenous disorder such as autism. On this matter, a number of ASD screening tools have been created to use in different countries in their home language as well as English. An example is the bilingual ASD tools developed by Wang et al. (2020). Results from this study have shown that a linguistically adapted tool is crucial for assessing a bilingual patient with ASD. In addition, Harris, Barton and Albert (2014) argued that practitioners should use a checklist for assessments to analyze the efficaciousness of the measures they use. To prove this, they cheated a checklist for four of the most known screenings for bilingual children with ASD. The results highlighted that some measures were more appropriate than others. Studies in the future should analyze checklists and make them available to professionals. Some limitations regarding the resources and services provided make the multilingual autistic child's life harder. In fact, since disability service and language related services are often not coordinated, parents of ASD children have to choose which one between the language center and the disability service is more appropriate for their child. Moreover, recent investigations show that difficulties in accessing medical resources in multiple languages affect the bilingual ASD child's opportunity and display the inequalities in the education as well as the health care system. These downsides in the current system should be addressed to better support multilingual ASD families.

4.1.3 Educational implications

Nowadays, as a consequence of immigration, each school has several additional language students. In specific, in the UK approximately one every five students has English as an additional language, and this is gradually growing (Leung, 2010). Although several studies reported a positive opinion of teachers about biliteracy, their views are different when it comes to ASD students. As such, Howard et al., (2021) noticed that the majority of teachers encouraged bilingualism in families of HFA students and were less prone to suggest bilingualism to LFA or little verbally ASD students because they were concerned that more languages would raise confusion in the child. Overall, special needs teachers and educators affirmed that they had difficulty in understanding the needs of ASD bilingual children and this makes it an even bigger challenge for those children in mainstream schools. As mentioned in the previous chapters, there is no evidence for a deleterious effect of bilingualism on autism, however several professionals do not advise ASD pupils to learn a second language. This can impact their social, emotional and cognitive development and lead to exclusion. (Yu, 2013) These beliefs derive from the lack of information about autistic individuals' skills and needs. In particular, monolingual practitioners, raised in monolingual environments, may underestimate the positive effect that bilingualism has on relationships and inclusion, thus higher levels of linguistic diversity amongst professionals may help them understand the needs and conditions of their bilingual students in the spectrum (Yu, 2013). Moreover, teachers and professionals around bilingual children with ASD should receive ongoing training on how to fully support those students in a mainstream school and encourage inclusion. Therefore, despite the demanding role that those practitioners carry, developing suitable tools is a priority for adults supporting autistic children speaking more than one language and those tools could also be used to non autistic bilingual children and monolingual desiring to acquire a new language. Clearly, current literature provides a very limited amount of studies on how to support multilingual students in the spectrum. However, there are relevant studies that introduce foreign languages into classrooms with ASD students. An example comes from a study conducted by Lumsden and autism unit (2009) in which through the TEACCH system, teachers gradually introduced the second language (french) by establishing commonality to French and French culture. In fact, students were helped to buy French food at the grocery shop, had visuals in

French and experienced everyday life situations with references to France. The teaching program ended with a trip to Paris which reinforced the students' knowledge of French. The program demonstrated to be a success and future studies should be conducted using other languages to see if results are feasible (Lumsden & Unit, 2009). In addition, Dillon (2016) suggested further implications for classroom practice taking into account children's preference for group work, despite the difficulties that ASD children may have with social interaction and maintaining friendships. In light of this, collaborative learning tasks may be very crucial opportunities to enhance ASD children social and communication skills and bond with their peers. In addition, using technology and smart devices in the classroom may be an effective strategy to engage these children in their learning, but should be used together with other resources to avoid technology addiction or fixation and also prevent sensory overload. Overall, more specialized ASD training for language teachers should be implemented to best support autistic bilingual students. Students from high numbers of additional language students schools show to have higher positive views than those in monolingual schools (Liu & Evan, 2016) because of this, bilingual children in schools with low numbers of bilingual students should be encouraged to evolve their linguistic identities. This is even more crucial for children in the spectrum, who will be more likely to be biased by the "mainstream language" of the school (Bracken, 2017). The misbelief that raising an autistic child in a bilingual environment would be detrimental to their learning should be removed and disproved to clinicians, parents and also teachers in school so as to promote multilingual classes and target inclusion not only in regards to the disability but the language background too.

4.1.4 Theoretical implications

The literature examining the impacts of bilingualism on human development is vast and controversial, and the majority of it studies whether bilinguals' abilities outweigh monolinguals' abilities (Bialystock et al., 2008). A robust growing number of studies are now examining the impact of bilingualism on autism spectrum disorder in specific. My research aims to find evidence from literature to provide further

evidence material for future studies. The first reason for this research refers to providing evidence on how language may develop in ASD children in a bilingual environment. Despite parents and practitioners often worrying that exposing their child in the spectrum to more than one language may be confusing (Yu, 2013), concerns about a delay in language development due to bilingualism have so far not been confirmed by literature. In fact, no significant differences have been observed between monolingual and bilingual ASD children on parents report results regarding receptive and expressive vocabulary (Hambly & Fombonne, 2012) or language related tasks (Meir & Novogrodsky, 2019). Moreover, a number of systematic reviews, testing several language domains support this statement (e.g. Beauchamp & MacLeod, 2022). Therefore, since there is no evidence suggesting to limit ASD children's language exposure, autistic children should be exposed to their parents' language, even when this is not the official language. Another reason for this study is justified by previous literature studies which highlight that cognitive and developmental domains are affected positively by bilingualism and negatively by autism spectrum disorder. Interestingly, pointing and a greater use of gesture and body language is associated with bilingualism (Nicoladis et al., 2009) while people with autism normally show reduced body language. Studies on gestures in bilinguals with autism show that this population indicates a higher use of gesture (Valicenti-McDermott et al., 2013). Additionally, bilingualism is also associated with advantages in aspects of pragmatic language, executive functions and theory of mind (Siegal et al., 2009). A third reason for studying ASD in relation to bilingualism may lay on the effects that the former has on the latter as far as social domains are concerned. As such, children in the spectrum have a right to their cultural heritage, which often includes different languages (David et al., 2020). Studies show that children from family speaking minority languages benefit from the close familial connections and parents are found to may feel more able to connect emotionally with their child in their native language (Kremer-Sadlik, 2005). Therefore speaking the official language at the expense of the family language may have negative implications on the family well-being. Although this research aimed to fill the gaps in literature regarding the effect of bilingualism on autism, highlighting the positive impact that bilingualism has on some language and cognitive domains on children with ASD, it does not suggest that exposure to more than one language should be used as an intervention. Instead, it points out the necessity to further analyze the

potential positive impact of bilingualism on some language difficulties of ASD and how common difficulties between bilingualism and ASD interact with each other. These aspects underlie the importance of understanding individual language differences within the ASD population which is very high in variability due to different language exposure. Giving an insight into the heterogeneity of ASD may help practitioners and clinicians detach from old approaches which categorize autistic people as equally or similarly impaired in language and instead focus on the potential that each individual has. In light of this, if bilingual children with ASD outperform monolingual children with ASD on certain language or social domains, this disproves the notion that all children with ASD normally present social related deficits. Moreover, the same example may demonstrate that bilingualism does not deteriorate but in some cases may compensate for the delay caused by ASD.

4.2 Limitations and future research

Literature reviews are seen as a rigorous approach to summarize evidence across studies; in fact they focus on evidence-based methods with the purpose of providing rigor and preventing susceptibility to bias. One of the advantages of the literature review method refers to summarizing and synthesizing previous findings, highlighting strengths and weaknesses of previous work and demonstrating a good insight into available information (Dar & Sakthivel, 2022). In contrast, amongst the weaknesses of the literature review method there is the possible misinterpretation of data and high susceptibility to bias (King et al., 2020). Alternative research methods may be experimental design reports which extend past research adding new data and whose results are easy to either replicate or dispute. Therefore future studies on this subject may be conducted using experimental research.

To date, literature studies on bilingualism and ASD is scarce and often contradictory, since it is substantially based on observations or parents' reports and includes small samples of participants. Because of this, the yet limited amount of evidence may imply a negative view of bilingualism rather than an advantage (Bialystock, 2009). Extending the research on bilingual children with ASD may support families, clinicians and teachers receive relevant information on how to live and work with

ASD children from bilingual households. In specific, experiments should focus on comparing the effects of therapy conducted in both the societal and home language on ASD child' language development. Findings on these studies may support the planning of bilingual special education programs for children in the spectrum. Further studies should also explore how language factors affect elements such as age of language acquisition, age of diagnosis, languages spoken, class environment and peers' relationship, access to medical service and resources. Longitudinal studies are also needed to check how autistic bilinguals' language development changes across time. Future investigations should control for language backgrounds of bilingual children when comparing language skills, to analyze If certain combinations of languages affect the development of ASD children. This may provide evidence-based information to parents of children with ASD when making decisions about the language spoken at home and encourage bilingual environments (Yu, 2013).

As Park (2014) stated, the responsibility to help bilingual ASD children relies on practitioners and SEN teachers who work hand in hand with these children, and their aim is to introduce these populations within the society and get them fully integrated and independent.

4.3 Conclusions

So far there is no single definition of bilingualism due to its heterogeneous nature. Despite bilinguals seeming to possess different skills as compared to their monolingual peers, (Pearson et al., 1997) several investigations argue that the developmental trajectories of bilingual and monolingual children's first language are similar (Beauchamp & McLeod,2022).

In this paper eight types of bilingualism have been identified depending on the modality, time and context the bilingual has acquired their two or more languages, including simultaneous and sequential bilingualism, additive and subtractive bilingualism, receptive and subordinate bilingualism, compound and coordinate bilingualism. Recent findings pinpoint a number of external factors that may influence the individual's language acquisition such as cultural backgrounds, educational

experience, age acquisition, language exposure, language switching habits, family SES and whether the language learnt is a majority or minority language (MacLeod et al., 1989). Since bilingualism is a miscellaneous phenomenon made of different types and classifications, the main aspects of language development such as biological, psychological, social and linguistic aspects have been examined not as individual processes but as interconnected elements that affect language acquisition. The main language theories have been explained including Single System Hypothesis, Transfer theory, Separate Development Hypothesis and the most recent Full UG Access Hypothesis. Many advantages have been addressed to bilingualism. On this matter, relevant research on bilingualism cognitive performance has been explored in relation to the five core dimensions of languages such as semantics, syntax, morphology, phonology and pragmatics. In bilingual children, L2 vocabulary develops slower than L1 vocabulary possibly because of a lexical gap that makes lexical retrieval hard in semantic tasks. (Altman et al., 2017) Similarly, bilingual children show a poorer performance than monolinguals on semantic related tasks such as low frequency words on associative tasks (Johns et al., 2016) Despite a narrower vocabulary and difficulty with complex semantic and morphosyntactic tasks (Li & Hartshorne, 2022), bilinguals seem to outperform monolinguals on meta linguistic awareness and pragmatic-related task.

Moreover,bilingual children demonstrate to have an advantage on complex non verbal tasks regarding executive control functions (Byalistock, Craik & Luk, 2012). Although research on executive control is wide and offers conflicting findings, in most cases bilingualism does not appear to influence all the domains of executive function (EF) but 'conflict' related tasks only (Carlson & Meltzoff, 2008).

Moreover, the bilingual advantage is noticed on non perceptually based tasks, but not on conceptually based tasks which rely on areas of EF other than attentional control. Overall, bilingualism seems to have an advantage on inhibition and cognitive flexibility but does not show any benefit on delay of gratification and working memory (Carlson and Meltzoff , 2008).

In relation to bilingualism, this paper analyzed Autism Spectrum disorder. The DSM-V-TR defines ASD as a very heterogeneous neurodevelopmental disorder characterized by impaired social interaction, problems in communication, restricted interest and stereotyped behavior. (APA, 2022). In recent years there has been a change in the number of diagnoses for ASD which does not imply a growth in

occurrence but rather in professionals' and individuals' awareness. Different types of ASD had been identified in the previous versions of the DSM which have then been merged into Autism spectrum disorder in the DSM- 5 (APA,2013) including Asperger's syndrome, Rett syndrome, child disintegrative disorder (CDD) and pervasive developmental disorder not otherwise specified (PDD-NOS). Multiple possible etiologies are found as the cause of ASD; it is believed that the main cause of ASD is biological as the individual is born with it (Boucher et al., 2003) and that the environment only worsens pre existing difficulties. Despite a stronger belief that ASD is mainly caused by genetic factors, a responsible gene has yet not been found. Therefore although the causes are still unclear, it is easy to assume that different epigenetic, genetic and environmental factors may play a role in the etiology of ASD. Amongst the strengths of ASD people, people in the spectrum are believed to be reliable, honest, to possess a strong sense of social justice and good vocabulary and problem solving skills, particularly when they are high functioning autistic people (Atwood, 2015). The main weakness linked to ASD refer to social and communication impairments, with deficits in reciprocity and turn taking and communication is not used to socially interact with others but rather with instrumental purposes (Gernsbacher, Morson & Grace, 2015). Children with low functioning autism are often non verbal and benefit from interventions using PECS (pictures exchange card system) as well as other alternative Augmentative communication systems (AAC) (Iacono, Trembath & Erickson, 2016). However these types of intervention are often not appropriate for high functioning autistic children who typically present good verbal skills and may benefit from social and behavioral intervention therapies. One of the most well-known behavioral approach is the Applied behavioral analysis (ABA) approach (Lovaas, 1961) which presents four variations: EIBI (early intensive behavioral interventions) ABA-VR (the verbal behavior approach), NDBI (naturalistic developmental behavioral interventions) and ESDM (Early Start Denver Model). Another valid behavioral approach internationally recognised is TEACCH (treatment and education of autistic and related communication handicapped children) (Van Bourgondien & Schopler, 1996). The rate of occurrence of ASD in Italy has increased over the past decades with 1 of 77 people with ASD. There is variability about the resources and ASD interventions applied across Italy, with northern Italy providing more staff training and better services as compared to the rest of Italy (Scattoni et al., 2023). A collaborative

network between regions may even out the variability and ensure decent service to families of individuals with ASD.

Recent research has shown that bilingualism does not deteriorate the individual's development, despite the majority of studies having been conducted on typically developing children (Bialystock et al., 2010). Findings of studies on bilingual Down syndrome (DS) children (Hulme et al., 2012) and bilingual specific language impairments (SLI) children (Gutierrez- Clellen, Simon-Cerejido & Wagner, 2008) have reported that bilingualism does not negatively impact individuals' language development. To date there is only a very limited amount of published research on the effect of bilingualism on ASD. In addition to this, the high heterogeneity of autism spectrum disorder makes it hard to generalize which language areas are impaired in ASD individuals and how severely (Boucher et al., 2012). However, a robust body of literature displays that the pre existing impairments of ASD are not further impaired by bilingualism and in some cases improvements in the ASD individuals' development have been attributed to bilingualism (Peristeri et al., 2020).

The main areas of language have been explored in ASD in relation to bilingualism including semantics, morphosyntax, phonology and pragmatics. Studies on vocabulary related tasks indicated that in ASD children vocabulary is an area of strength while for TD bilingual children is a weakness compared to other language domains. In line with this, high variability of results is found in vocabulary tests for bilingual ASD children, with some LFA children displaying poor results and HFA children displaying advanced skills (Frith and Happè, 1994). Semantics in bilingual children in the spectrum seem to be similar to that of monolingual children and non autistic children (Gonzalez-Barrera & Nadig, 2013). The main semantic related difficulty for ASD children speaking more than one language relies on the use of pronouns. While in the past this deficit was associated with echolalia, nowadays pronoun reversal is thought to be caused by difficulty using deixis which identifies time and space which is very impaired in the majority of ASD children (Tager-Flusberg et al., 2005). Therefore, the difficulty for ASD children lies in applying the lexicon in context, despite how often the meaning of it has been acquired. Thus, similar scores on semantic tests demonstrated that the semantic related difficulties found in autistic children is not worsened by bilingualism but may possibly be compensated by the acquisition of two or more languages (Hambly & Fonbonne, 2012). Morphosyntax is normally a weakness in TD bilingual children as

well as ASD children. In bilinguals children deficits in morphosyntax are attributed to smaller vocabulary size than monolingual children (Meir, 2017) whereas in ASD children difficulties in this domain refer to the production of pronominal object ciclits (ci, li, le …) in focused structures (Terzi et al., 2016). In this case, it is not clear whether the morphosyntax related impairment is caused by difficulties in morphosyntax per se or difficulties linked to other domains such as semantics or pragmatics and prosody, because ciclits interact with all these domains (Terzi et al., 2016). The little available research on this subject highlights that on language impaired ASD children, difficulties in morphosyntax are caused by morphosyntax alone whereas on HFA children they are caused by difficulties in pragmatics and prosody (Terzi et al., 2016). Multilingual ASD children share similar morphosyntax related deficits as their monolingual ASD peers, despite some areas of morphosyntax have yet to be explored including echolalia and syntactic parsing (Meir & Novogrodsky, 2019). Phonology and pragmatics are the least explored dimensions of language in bilinguals with ASD. In specific, TD bilingual children often demonstrate to outperform TD monolingual children in phonology related tasks, possibly due to their advanced phonological awareness enhanced by speaking two or more languages. Differently, ASD children seem to be deficitary on phonological related tasks and typically perform poorer on this domain, in particular when blending and elision tasks are involved (I.e Gabig, 2010). Moving on, as demonstrated by several studies, pragmatics appear to be very impaired in ASD children, due to their difficulty to understand the listener's point of view and take it into their own which makes the conversation hard to follow and often one-sided (Tager-Flusberg, 1995). Differently, TD bilingual children normally show good pragmatics skills, which are the same or better than those of their TD monolingual peers. Results from the limited studies on bilingual children with ASD affirm that bilingualism may have a positive compensating effect on ASD, since bilingual children in the spectrum outperform monolingual children in the spectrum in tasks involving pragmatic skills and similarly ASD bilingual infants tend to show higher levels of coping, gazing and social skills compared to their ASD monolingual peers (Valicenti-McDermott et al., 2013). To sum up, bilingualism has demonstrated to not negatively affect any of the language domains of ASD children and to be beneficial in some cases, despite the studies available to date are still scarce. Similarly, studies analyzing the potential impact of bilingualism on theory of mind and executive functions of ASD children seem

promising. As such, theory of mind seems to be dysfunctional in ASD individuals as their ability to embed one's point of view is poor as well as their understanding of oneself and others' emotions. This is probably due to an abnormality in the activation of the mirror neurons which normally fire when we see an action in others and also when we recreate that same action ourselves. Being this a weakness in autism, people affected by ASD struggle to understand others' behavior, beliefs and points of view as their neurons do not fire the same way they do on TD people. This could explain their difficulties with false beliefs tasks in which they must infer that other people do not possess the same information they possess and with pragmatics skills in general. In contrast, bilingual children seem to outperform monolinguals in theory of mind tests like Sally-Anne tests (Baron-Cohen et al., 1985) and show greater cognitive flexibility in many other EF related tasks. Interestingly, in bilingual children diagnosed with ASD, performance is better than that of monolingual children with ASD, indicating that the difficulties in theory of mind tasks typical of ASD individuals may be ameliorated by bilingualism. However the bilinguals with ASD appear to be better at nonverbal tasks where language is kept to a minimum, as expected from bilingual people, whereas monolinguals with ASD are better at using lexicons in verbal tasks (Andreou & Tsimpli, 2020). Moreover, bilinguals appear to have better set shifting skills when compared to their monolingual counterparts, which may be due to their constant switching back and forth between languages (Bialystock, 2009). Differently, set-shifting is very impaired in the majority of ASD individuals, regardless of their IQ level, driven by restrictive and repetitive interests and behaviors. Limits to set shifting can be observed also in areas where deficits on cognitive flexibility take action including sticking to predictable places and situations, structured routine, selectivity and sameness in relation to food, action, interests and behaviors, narrowness of focus, rigidity about life and environment. Surprisingly, studies on ASD bilingual children outline that bilingualism does not compromise their performance on set shifting tasks in relation to ASD monolingual children as results were similar, in some cases they were even superior. It is not clear whether this advantage is due purely to the effect of bilingualism or other confounding factors such as individuals' NVIQ, age of exposure, languages spoken, methods used to test participants play a crucial role. What is sure is that no deleterious effect of languages has been addressed on autism, with some studies highlighting a protective role of bilingualism on ASD (Bialystock et al.,2016).

Amongst the disadvantages that can be associated with bilingualism, confusion due to speaking two languages is probably the main one. As such, multilingual people have to deal with more than one language at the same time which involves taking time to one language to dedicate it to another language. This competitive relation between first and second language is cause of concern for parents and practitioners especially in the case of substantive bilingualism which is when acquiring L2 affects L1. Despite the positive benefits of bilingualism on human cognition, parents of children with autism are concerned about the fact that exposing their children to other languages may impair their already deficitary language development and therefore decide to raise them in a monolingual environment at their own expense. In fact, when one of the two parents is from a foreign background is typical for the parent to speak their own language at home, in the case of families with ASD children, the foreign parent may choose to speak the dominant language with their ASD child, even when they speak their own native language to the rest of the family (Yu, 2013). This will obviously have an effect on the autistic child's inclusiveness in the family as well as on their difficulty in communicating with their foreign parent's heritage. The reason parents decide to raise their autistic children in a monolingual household is often connected to the concern and advice that practitioners and therapists offer, due to their lack of information about bilingualism or bilingualism in relation to ASD. If on one hand it is important for the ASD child to learn their societal language, it is also crucial for them to learn their L2 which is typically used at home, in order for them to feel closely connected to their family dynamics and prevent potential social exclusion (Anderson, 2012). In fact, it seems that parents of children in the spectrum speaking their native language have a stronger bond than parents speaking the official language to their ASD child. Similarly, bilingual adults with autism seem to have a more positive quality of life compared to monolingual adults with autism, highlighting a social advantage of bilingualism (Hampton et al., 2017). Overall, despite a general concern about the development of autistic children when it comes to speaking a second language, most literature results point in the same directions. Thus, exposing an ASD child to more than one language does not deteriorate their development, but in some cases it boosts it, especially when it comes to cognitive skills such as EF , metalinguistic awareness and pragmatics skills and also as far as their social and emotional skills are concerned. Despite this, the impact of bilingualism is not uniform, with most results being positive or neutral and

some negative, depending on the skills examined. Because of this, the advice to limit the exposure of an ASD child to one language only, due to concern about the impact of bilingualism on the child's development does not have empirical support. Therefore, since the languages spoken at home and the environment in which ASD children live have an impact on their personality and identity, the choice of language used should be made by the child and their parents, prioritizing the family language in the household over the societal language, which the child will eventually learn in school. To conclude, the aim of this study was to analyze the effect of bilingualism on Autism Spectrum disorder. To do so, the main aspects of bilingualism have been described, followed by the definition and core elements of ASD. In the final chapter bilingualism and ASD were compared to observe how the two elements relate with each other and if the former has any affect on the latter. The main research questions of this study were:

- Are ASD children able to learn a second language ?
- Does bilingualism have any deleterious effect on ASD children's cognitive and linguistics development?

Results from this paper outlined that children with ASD are able to acquire and speak two or more languages, especially when they are high functioning children and exposed to a second language since early years. Certainly, the level of proficiency they will reach, will not only depend on their cognitive abilities but also on the amount of exposure to their two languages. The answer to the second question has been recently investigated in literature which states that bilingualism does not have any negative effect on ASD individuals' cognitive and language development, therefore when possible it should be encouraged.

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