Università
Ca'Foscari
Venezia

Master's Degree programme – Second Cycle (*D.M. 270/2004*)

in Language Sciences

Final Thesis

A comparison between Grammatical Development and Non-verbal Language in children with Autistic Spectrum Disorder

Supervisor
Ch. Prof. Monica Banzato

Assistant supervisor
Prof. Francesca Coin
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Graduand
Francesca Marchio
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Introduction

The main goal of this graduation thesis was to analyze the relationship between grammatical development and non-verbal language in children with moderate autistic spectrum disorder and to observe if children with lower grammatical abilities tend to use gestures and facial expressions (non-verbal language) as a compensatory method to communicate with others.

I have always been interested in language impairments, the topic which has been at the basis of my studies in Ca'Foscary University of Venice, and with time I realized that studying the non-verbal language in children with linguistic difficulties could prove really useful.

Therefore, in 2015 I decided to attend a Master in Scientific Analysis of Non-verbal Language in the scientific laboratory "NeuroComScience" in Gorizia, which gave me the opportunity to become a non-verbal language analyst.

During my researches I realized that this topic has not been deeply analyzed yet, and that is why I got really involved with this task.

The results of my studies and researches are explained and analyzed in this document which is divided into four parts: the first three chapters took into consideration the literature and scientific studies already existing while the last one concentrated mainly on my experiment on the children I observed.

The first chapter will explain the concept of Autistic Spectrum Disorder (ASD), which is a neurodevelopmental disorder defined by impairments in social communication, and repetitive behavior (Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, DSM-V).

The term "spectrum" refers to the wide variety of symptoms, skills and levels of functioning, which can vary from moderate to severe.

Nowadays, the ASD includes Asperger syndrome, childhood disintegrative disorder, and Pervasive Developmental Disorders Not Otherwise Specified (PDD-NOS), as part of the spectrum, as opposed to being separate syndromes.

ASD is usually diagnosed at the age of 3, even if symptoms surface at around 18 months.

Early identification and consequently early intervention have significantly positive effect on long-terms outcomes for individuals with ASD.

The early signs of this syndrome are the following: total lack or delay in verbal language, repetitive use of language, deficit in pointing gestures, no eye contact, lack of interest in other people, lack of spontaneous play, poor response to his or her name, deficit in imitation skills and joint attention.

Currently, the cause of ASD is still unknown but scientists believe that genes have a crucial role. Several studies have shown that ASD tends to run in families: among homozygous twins if one baby has ASD the other has 75% of possibilities to be affected from autism. Parents who have the first child with autism have a 2-10% chance of having a second child with the same syndrome.

Autism occurs in all races and socioeconomic groups and it is four times more likely to occur in males than females.

Therefore ASD is a brain-based syndrome, which is not caused by inadequate parenting. However, parents have a crucial role in carrying out strategies and interventions after autism is diagnosed (Lindgren & Doobay, 2011).

The second chapter will analyze the development of verbal and non-verbal language in typically developing children. The first words and the first gestures emerge at the same time, and outcomes in gestures can predict progress in spoken language. Normally developing children of all ethnicity and socioeconomic groups follow the same phases of verbal and non-verbal language acquisition.

At 6 months infants start to produce vowel-syllable combinations, and this phenomenon is called *babbling.* Furthermore, they begin to smile and produce deictic gestures.

At around 12 months children begin to produce the first words and other type of gestures, called representational gestures (Caselli et al., 2005).

The third chapter will focus on the development of verbal and non-verbal language in children with Autistic Spectrum Disorder.

Communication deficits are the central features of autistic subjects. They include the reversals of first and second person pronouns, echolalia, neologisms and atypical intonation.

However, as regards grammatical abilities, there is much consensus in literature about the fact that autistic children grammatical development and utterance structure are similar to those of typically developing children (Shapiro et al., 1974; Bartak et al., 1975; Tager-Flusberg et al. 1990; Fernandes et al., 2011) but they diverge in their functional use of language, for example children with ASD sometimes reply with non-appropriate comments.

Furthermore, in the majority of verbal children with ASD, their grammatical development is delayed compared to that of TD children.

Acquiring language within the fifth year of life, is a valid predictor of positive outcomes in these children (Lord et al., 1996; Tager-Flusberg, 2005).

In normally developing children, verbal and non-verbal language develop in parallel during the first phases of language acquisition, in contrast, in children with ASD these two components develop separately. In fact there are children with ASD who possess restricted non-verbal abilities even if their grammar abilities are intact (Rollins & Snow, 1998).

Much is known about relationship between verbal and non-verbal language in typically developing children (TD), but there are not many studies about this relationship in children with developmental disorders such as autism.

Bernabei (Bernabei et al., 2001) has demonstrated that children with ASD rarely produced non-verbal behaviors in combination with speech.

The fourth chapter is about my explorative research. The main purpose of the present study was to investigate whether children with ASD who possess lower grammatical abilities, use non-verbal language as a compensatory method to communicate with others.

A second purpose was to observe if autistic children grammar follows the same pattern of acquisition of TD children, and whether children with autism use the same non-verbal behavior of normally developing children.

Three preschool children have been analyzed: two children with mild-moderate autism (3;6 and 6;0 years old) and one typically developing child (4;6 years old).

The three participants were videotaped separately while interacting with their teacher in comfortable places.

Taking inspiration from other researches, three production tasks have been elaborated in order to assess verbal and non-verbal skills.

Grammatical abilities were assessed with the Mean Length of Utterance in words (MLUw), which is a non-standardized measure of grammatical proficiency, originally introduced by Brown (Brown, 1973). Non-verbal skills were assessed with the Facial Action Coding System (FACS), which is a protocol for recognizing and labelling facial expressions, designed by Paul Ekman and Wallace Friesen in 1978 (Ekman & Friesen, 1978), and with Body Coding System (BCS) (Legiša, 2013), which is a protocol for recognizing and labelling gestures and body movements.

1. What is Autism?

According to the fourth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV)[1] autism is a developmental disorder of genetic origin characterized by severe deficits in communication, human interaction and by restricted, repetitive and stereotyped interests, behaviors or activities.

Autism begins in infancy or early childhood: symptoms surface between 12 and 18 months, however it is hard to diagnose before 24 months (Lord et al., 2000).

Statistics have revealed that autism is more frequent in males than females, the ratio is 4:1 (male to female) (Rutter, 1978).

During the first year, the majority of the autistic toddlers is unresponsive to the voice of other people, so the initial worry of the parents may be that their child is deaf.

Moreover, autistic child often avoid eye contact, doesn't respond to his or her name or points the finger to an object of interest. He or she also manifests difficulties in imitation play and in non-verbal communication. However, many autistic children's parents are not aware of these first signs of the syndrome, they became worried only when their children do not start speaking at a typical age. Effectively, they often report that the very first sign of the disorder is the total lack of language, that in typically developing children emerges in the second year of life (Tager-Flusberg, 2000).

Meilleur (Meilleur et al., 2009) in her study, has found that 22% of autistic subjects displayed behavior regression: they appeared to develop typically but subsequently they began to loose speech and social abilities.

Parents often report that other subtle behaviors were displayed by their children prior to the onset of regression.

The loss of verbal and non-verbal abilities is often associated with a more severe symptomatology (Meilleur et al., 2009).

Children with autism are not interest in interacting with objects and other people.

Social problems may not be clear in the first years of the autistic toddler's life, they are more

[1]DSM is the manual used by clinicians and researchers to diagnose and classify mental disorders (American Psychiatric Association 2013).

obvious when the other children became more socially sophisticated.

The severity of these deficits varies from one individual to another: autism effectively is a heterogeneous disorder. This great variation in symptoms among autistic patients has led to the concept of Autistic Spectrum Disorders (ASD). The term “spectrum” refers to the great heterogeneity of symptoms, skills and level of disability that individuals with autism can manifest. This variety within autistic population make the task of identifying the exact origin of the syndrome very arduous (Lord et al., 2000).

Despite the presence of dissimilarities between one autistic patient and another, depending on the severity of the disorder, the IQ level, and the age, it’s possible to identify a recurring characteristic: almost all children with ASD lack a theory of mind. These term was coined by Premack and Woodruff in 1978 and it refers to the ability to attribute thoughts, mental states, intentions and emotions to oneself and other people and to comprehend that others can have different beliefs and perspectives. This ability to understand that others can have different mental states is well known as metarepresentation. Typically developing children gain this ability by the time they reach 2 years of age.

The first studies assessing theory of mind in autistic individuals were conducted by Baron-Cohen, Leslie and Frith in 1986 (cited in Douglas, 2012). They tested this ability through a false believe task (illustrated in Figure 1.) which consists of a scenario representing one doll, Sally, which puts a ball in a basket while the other doll called Anna takes away the ball from the basket and places it in a large box. After observing this scene, the experimenter asked of each child “Where will Sally look for the marble?”. Obviously the correct reply is “in the basket” but the researchers noticed that autistic toddlers replied “in the large box”. They had difficulty to understand other people’s perspectives.

Figure 1 shows the Sally-Anna task.

Figure 1. The Sally-Anne task, which tests the ability to attribute false beliefs to other people. Image from: http://wheredidthebirdgo.com/2013/11/sally-anne-false-belief-test/

There are several studies which have revealed that autistic children lack a theory of mind. Baron-Cohen (Baron-Cohen, 1985) has assessed the ability to attribute thoughts and beliefs to others in three different groups: the first was composed by children with ASD, the second by typically developing children (TD) and the third was composed by children with Down Syndrome. The hypothesis was that autistic children are unable to attribute thoughts and beliefs to other people and to predict their behaviors.

The results revealed that children with ASD failed to attribute perspectives and thoughts to others, even if their mental age was higher than that of the other groups.

The lack of a theory of mind is a characteristic unique to autistic population (Baron-Cohen, 1985).

The fact that children with ASD are not able to attribute thoughts to others can clarify the social problems in autistic population but it cannot explain other atypical behaviors such as

limited interests and recurring actions.

The concept of the autistic disorder has repeatedly changed over the years: the revised fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-V), which was published in May 2013, used the term Autistic Spectrum Disorders to describe the clinical cases which in DSM-IV were reunited under the umbrella category of the Pervasive Developmental Disorders (PDD).

ASD now comprehends the syndromes that were earlier classified as autistic disorder, Asperger's disorder, Childhood Disintegrative Disorder (CDD) and Pervasive Neurodevelopment Disorder not Otherwise specified (PDD-NOS).

Nowadays, ASD consists of neurodevelopment disabilities whose symptoms varies from mild to severe manifestation.

In the new DSM-V the three problematic areas in autism are reduced to two, that is social communication and repetitive behavior. In addition, the diagnosis of ASD before the age of 3 has been eliminated because of minimal social requests.

Therefore, ASD is a neurodevelopmental disorder with the first manifestations in early childhood even though the syndrome may not be determined until later in life (Lauritsen, 2013).

Moreover the revised criteria emphasize non-verbal communication, pragmatic deficits, atypical use of gaze, facial expressions and clumsy gestures. Furthermore, they don't put emphasis on the age of syndrome manifestation and language impairments (Lord & Bishop, 2010).

The new DSM-V diagnostic criteria includes three different functioning levels, each of which is determined by the amount of support that an individual requires to function in society. The three levels described in the DSM-V are: severe ASD, mild ASD, and moderate ASD. Individuals with severe ADS require very substantial support; they manifest severe deficits in verbal and non-verbal communication abilities, restricted initiation of social interactions or atypical approaches. They produce few words, and they manifest difficulty coping with change.

Individuals with mild ASD require substantial support; they have clear deficits in verbal and non-verbal communication abilities, impairment in social interaction and atypical responses to social approach from other people. They produce simple sentences, their non-verbal communication is very atypical and they have restricted interests.

In addition, they have problems coping with changes in routines activities.

Children with moderate ASD (or high functioning autism) require support; they have deficits in social communication, difficulty initiating social interactions, and they show atypical responses to social approach from others. They have low interest in social relationship and their attempts to make friends are unsuccessful. They also have difficulty switching between different activities, problems of organization and independence.

However, they are able to express full sentences and they are involved in communication exchanges (American Psychiatric Association, 2013). \

This change in the diagnostic definition from autism to the wider ASD may clarify the explosion in the number of clinical cases in the last decades. In 1960 incidence estimates for autism was 4 per 10.000 while more recent studies estimate 60 per 100,000 (Faras et al., 2010).

1.1 History of Autism

The word “autism” derives from the combination between the Greek word “autos”, meaning self, and the suffix “ismos”, meaning action or state. So the term is used to mean morbid self-admiration[2].

As demonstrated by historical accounts, autistic syndrome has always existed. There are many ancient descriptions of problematic children and adults who would now be diagnosed as having autistic spectrum disorder. One of the most famous cases is that of Victor, “the wild boy of Aveyron”, which was discovered in the mountainous forests of the southern France in 1778.

When Victor was found, at the age of around 12, he was considered a “wolf child” because he was raised by wild animals, he could not speak, he walked on all fours, his look was expressionless, he was not sensible to noises and smells, and he wasn’t capable to imitate others (Wolff, 2004).

Victor was entrusted to a young doctor, Jean Marc Gaspard Itard, who was curious about Victor’s schooling. He worked with the feral child for several years, trying to teach him written and oral language and recording his progresses. However Itard ultimately fails to lead the wild boy of Aveyron into society (Douglas, 2012).

Clinicians had different opinions about the case of the feral boy of Aveyron. According to Harlen Lane (Lane, 1976) he was not affected by autism; Victor’s problems in communication and socialization could be explained by the fact that he had been isolated into the forest for several years (Lane, 1976).

In contrast, Pierre Joseph Bonnaterre, a French naturalist, in his paper published in 1800, asserted that Victor manifested severe deficits in social interaction because he was autistic (Bonnaterre, 1800, cited in Douglas, 2012).

There are a lot of cases similar to the feral boy of Aveyron reported by clinicians, but it remains the most well-documented.

The application of the current knowledge about ASD to the early case descriptions supplies evidence of the long history of this syndrome; however the term “autism” was introduced by

[2] Online etymology dictionary: http://www.etymonline.com

Eugen Bleuler, a German psychiatrist, not before 1911. He originally used this term to describe manifestations of schizophrenia, a term that he had previously coined.

According to Bleuler (Bleuler, 1911) autistic patients had hallucinations and tended to withdraw into fantasy in order to avoid reality.

Autism was not recognized as a disorder until the innovative works of Leo Kanner (1943), an eminent Austrian child psychiatrist and Hans Asperger (1944) an Austrian pediatrician. These two clinicians worked simultaneously but independently to describe this neurodevelopment disorder, and they have both employed the term "autistic" for the children they studied.

First Kanner, in his paper entitled "Autistic Disturbances of Affective Contact" (Kanner, 1943), and then Asperger, in his paper "Die Auttistishen Psychopathen' im Kindersalter" (Aspeger, 1944), produced detailed reports of the disorder. They illustrated a group of children who had a series of behavioral oddities (Douglas, 2012).

Kanner observed 11 children with an unrecognized clinical case. They showed behavioral features different from other psychiatric cases such as delay in speech acquisition, pronominal reversal, lack of imagination, recurring actions and a normal physical aspect. Unlike childhood schizophrenia or other child psychosis, the strange behaviors of these patients were evident in early childhood (Rutter, 1978).

The case descriptions of Kanner and Asperger (Kanner, 1943; Asperger, 1944) revealed several similarities: they both believed that the principal manifestation of the disorder was the inability to relate to other people, and also that autistic subjects lacked of spontaneity and hated loud noises and changes in routine. They also observed that autistic patients were aggressive, lacked of imaginative play and had learning difficulties.

The two clinicians' accounts also present some differences: Kanner noticed that of the 11 children he studied, 3 wasn't capable to speak while 8 produced delayed echolalia (repetition of words uttered by other people).

On the contrary, Asperger observed that children he analyzed spoke fluently, but their non-verbal communicative means were absent and their language had not a communicative purpose.

As regards the relation of autistic toddlers with objects, Kanner observed that there were no evidence of trouble, while Asperger noticed that children didn't consider the objects. Another important difference between the two clinicians concerns the description of motor abilities: Asperger underlined that autistic were awkward in games requiring motor

coordination whereas according to Kanner only a small percentage of the children he analyzed were clumsy in motor abilities.

Regarding the origin of autistic disorder, Kanner, concluded that autism is an inborn syndrome. However he contemplated the possibility that the detachment he observed in highly intelligent parents of autistic toddlers he studied, could contribute to their children's problems. So the tension between environmental and innateness theories remained a problem, for the psychiatrist.

In contrast, Asperger was sure that autism could not derive from external causes, as demonstrated by the fact that some of the autistic toddlers he analyzed, had typically developing brothers and by the fact that the first signs of the syndrome were evident from the beginning.

As regards non-verbal language, both Kanner and Asperger reported several oddities such as lack of gestures, paucity of facial expressions and averted gaze (Douglas, 2012).

They both noticed problems in verbal language ranging from muteness to acquiring the ability to communicate using language in a recurring way.

Kanner was the first to observe that autistic toddlers tend to echo the sentences, words, part of words or phrases uttered by others, using the same intonation. This typical characteristic of autistic communication is well known as delayed echolalia (Tager-Flusberg, 2000).

Another observation made by both clinicians concerns the lack of spontaneity in autistic children behavior. Their activities are characterized by monotony and by obsessional dependence to their objects.

Both Kanner and Asperger noticed that autism affects more males than females.

Unlike Bleuler, Kanner and Asperger did not believe that there was a biological connection between autism and childhood schizophrenia.

At first, Kanner believed that autism was observable from birth, however the increasing cases showing that autistic exhibit a normal behaviors in the first 20 months of their life, have made him change his mind.

On the contrary, Asperger inferred from his first clinical case that the syndrome was clear starting from the second year of life.

The contributions of Leo Kanner and Hans Asperger to the definition of the autism are now fully recognized (Douglas, 2012).

1.2 Autism and its etiology

Given that the Autistic Spectrum Disorder is characterized by a great variety in symptoms, finding its exact cause is very difficult. Currently the cause in still unknown. Most probably, it may occur as a combination between innate and environmental conditions.

Over the last few years, research has made significant progresses, thanks to the innovative neural imagining technologies however identifying the precise area in with the brain is damages is a difficult challenge.

The majority of existing theories suggests that autism has a neurobiological origin; there is no evidence that it is caused by social factors.

Both Kanner and Asperger concluded that autism has a genetic origin but following researches defined autism in psychogenic terms. A very famous theory called "the refrigerator mother" suggestes that an emotionless climate in the very first years of toddler' life can provoke the autistic syndrome. Nevertheless, there are may cases of children exposed to a condition of social deprivation without developing the autistic disorder, and this fact may retort this hypothesis. First among everyone, Leo Kanner (Kanner, 1943) considered the fact that the heartlessness of autistic children parents he studied, contributed to their children's problems. Also statistics prove that a large percentage of autistic individuals came from highly intelligent parents (Douglas, 2012).

However, other studies (Schopler et al., 1979; Wing, 1980) have demonstrated that there is no a connection between social position and autistic spectrum disorder (Schopler et al., 1979; Wing, 1980, cited in Douglas, 2012).

Nowadays, there is no doubt that autism has a genetic origins even though the exact cause is still unknown.

The types of conditions that can cause autism are the following: prenatal or perinatal brain impairment, chromosome abnormalities such as Fragile X syndrome, viral infection such as herpes or rubella and genetic defects (Douglas, 2012).

Messinger (Messinger et al., 2013) has found that the autistic children's siblings are at increased risk for autism outcomes.

The 18,7% of three-year-old high-risk siblings (HR) will develop autistic syndrome (Messinger et al., 2013). These results support the strict relationship between autism and genetic.

Several studies have shown that the autistic individuals' brain is larger than normal. There is evidence of excessive growth involving grey and white matter and evidence of impoverished development in the cerebellum, a brain's area controlling language production, memory, concept formation and motor actions. In addition, there is evidence of an underdeveloped growth of neurons in the limbic system, a set of brain structures supporting a wide variety of functions which include behavior, emotion and motivation.

The advent of innovative technologies such as functional magnetic resonance imaging (fMRI) and magnetic resonance imaging (MRI) has allowed to comprehend how brain is damaged and the autistic individuals' cognitive profile (Douglas, 2012).

According to Williams (Williams et al., 2005) autism is caused by a breakdown in mirror neurons a group of neurons situated in the frontal cortex, having the function to link observed behaviors to the motor cortex. Another important function of these neurons is the recognition of facial expressions.

Mirror neurons are considered one of the most important discoveries over the last few years. They were accidentally identified in the area F5 of the monkey's premotor cortex by a group of Italian neuroscientists composed by G. Rizzolatti, G. di Pellegrino, L. Fadiga, L. Fogassi and V. Gallese at the end of the nineteenth century (Rizzolatti et al,, 1996).

These neurons discharge both when an individual performs a motor act and when he watches others executing the same action.

Researchers are sure that the development of human language derives from a communication system based on identification of facial expressions and hand movements (Rizzolatti et al., 1996).

In order to verify if a malfunction in the mirror neuron system could cause autism, Williams (Williams et al., 2005) has used the fMRI to observe the neural substratum of imitation.

He compared a group of 16 typically developing adolescents with a group of autistic adolescents of the same chronological age.

The results revealed that both imitative and non-imitative actions cause less activation of mirror neurons in autistic subjects than in the control group (Williams, Waiter, Gilchrist, Perret, Murray, Whiten, 2005).

Some autistic children's parents believe that vaccines can cause autism, but the scientific evidence does not support this theory (Lidgreen & Doobai, 2011).

We can clearly observe that actually researchers do not know the exact origin of autism, but they are investigating several theories. Identifying the cause of this disorder and its role in causing the behavioral oddities continue to be a difficult challenge (Douglas, 2012).

1.3 Diagnosis and treatments

The fact that autism is considered as an heterogenous disorder makes the task of finding an adequate definition and establishing satisfactory diagnostic criteria, very difficult.

In the past, some strict definitions included only the most serious cases under the category of autism. On the contrary, wider definitions took into account of different neurodevelopmental disorders, having several similarities with autistic syndrome such as Rett's syndrome and Childhood Disintegrative Disorder (CDD).

These syndromes and autism have in common the following characteristics: restricted interests, language and social deficits and resistance to changes. However, unlike autism, children with Rett's syndrome or CDD manifest normal behaviors until the second years of life. Rett's syndrome affects exclusively females and includes worsening of motor abilities (Douglas, 2012).

Currently, there are two diagnostic classifications of autistic disorder. The first is contained within the *International Classification of Disease,* eleventh edition (ICD-11), and the second in the *Diagnostic and Statistical Manual of Mental Disorders,* fifth edition (DSM-V).

These new classifications have removed Rett's syndrome and CDD and have grouped autism and other related disorders under the umbrella category of Autistic Spectrum Disorder (Lord & Jones, 2012).

Nowadays, several tools to analyze ASD exist. The Autism Diagnostic Observation Schedule-Generic (ADOS-G) is a broadly used standardized measurement of communication, social interaction, imagination and play, designed for subjects supposed of having autistic syndrome.

The ADOS is composed of four modules thirty minutes long, and each module has different tasks assessing language, social relationship, play and repetitive behaviors.

The modules are designed for different subjects according to their level of development and communication (Lord et al., 1989).

The Diagnostic Interview for Social and Communication Disorders (DISCO) is another measure for autism diagnosis. It creates a description of autistic individual's behaviors in order to help clinicians to consider the specific necessities of each subjects (Douglas, 2012).

The Autistic Diagnostic Interview Revised (ADI-R) is an interview designed for caregivers of children for whom ASD is a possible diagnosis. The ADI-R consists of a two hours interview investigating language, restricted behaviors, and social skills (Lord et al., 1994).

Childhood Autism Rating Scale (CARS) is a tool which assess autism in very young toddler and it distinguishes autism from other neurodevelopmental disorders.

Moreover, the CARS makes a distinction between severe and moderate autism (Schopler et al., 1980).

The revised version, CARS2 contains test's clinical value for Asperger Syndrome and high functioning autism (Douglas, 2012).

As regards treatments for ASD, it is first necessary to specify that currently a cure for autism doesn't exist. However some patients with ASD have shown considerable improvements on account of behavioral and developmental interventions.

There are several treatment models for autism but it will be reported only the two methods used by the children analyzed in this study.

The first method is called Applied Behavior Analysis (ABA) and currently it is the most famous treatment models for autism.

This method, deriving from the principles of learning theory, consists of systematically applying behaviors which improve socially significant behaviors such as communication, motor skills, reading, eating, playing and social skills.

ABA is a valid method to reduce unsuited behaviors, such as self-injury and aggression (May & Dymond, 2014). According to ABA intervention, treatment had to begin at the age of 3, parents may collaborate to the therapy, treatment is intensive, individualized, and it consists in a gradual insertion in natural context.

ABA strategies include explicit instruction, positive reinforcement, prompting, self-monitoring tools and social stories (Ortega, 2010)

Some autistic patients have shown improvements in communication, academic performance and social skills on account of ABA treatment (Leach, 2010).

According to some clinicians, with ABA intervention, autistic individuals have a chance of integrating into society. It can help to reduce antisocial behaviors and teach self-help abilities in order to become more independent.

This type of intervention has significant benefits on account of explicit teaching of language and other abilities (Ortega 2010).

The second method used by the children analyzed in this study, is called Denver Model and Early Start Denver Model (ESDM).

It was designed in in the 80's by Roger and Dawson at the University of Colorado Health Sciences Center, and it is a treatment model for children with autism from 2 to 5 years of age (Rogers et al., 1986).

Denver Model focuses on interpersonal interactions, spontaneous use of imitation, facial expressions and emphasizes verbal and non-verbal communication.

It also focuses on the cognitive aspects of play and the relevance of developing collaboration with the parents.

This method puts emphasis on social relationships and family is part of the program.

Parents are actively involved in the treatment, they have the possibilities to discuss about their child' s progresses with a child psychologist and with a support group meeting composed by other families.

Denver treatment is provided in the autistic children's home by therapists and parents during play activities and daily routines in order to improve all domains and decrease the atypical behaviors of these children.

ESDM promotes social-emotional abilities, cognitive and language skills (Wagner et al., 2014).

However, as there is no a universal manifestation of the disorder, there is no a unique intervention strategy which can be used with all autistic subjects.

What is certain is that treatment had to begin as soon as possible and focus on the individual's necessities, strengths and fragilities.

According to some clinicians, patients with ASD could benefit from psychoactive drugs such as risperidone[3].

They believe that this drug could limit misfit behaviors, but this hypothesis is currently being examined.

Nowadays, the most of clinical interventions consist in family support, functional communication and positively oriented behaviors (Lord, Cook, Leventhal & Amaral, 2000).

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[3] Risperidone is an antipsychotic drug. It changes the effects of chemicals in the brain. This drug is utilized to the treatment of schizophrenia and bipolar disorder and also with autistic children in order to control the irritability (http://www.drugs.com/risperidone.html)

2. The acquisition of Verbal and Non-Verbal language in typically developing children

Language does not start with the first words; it begins with social processes that orient the infant to other people.

From the first cry, humans communicate with people and the world around them.

Babies communicate thought two different modalities: with sound (cooing and crying) and body language (gestures and facial expressions).

Between 8 and 18 months of age, infants begin to use words to express their thinkings and necessities. The words that they use are symbolic representations, which permit to share meaning with others.

So, verbal language can be defined as a complex system of symbols, used to communicate with people.

But how children learn language? According to Bandura (Bandura, 1977) children learn language by imitation as shown by in fact that they acquire the language that they hear and not other languages.

While, Ferster and Skinner (Fester & Skinner, 1957) thought that toddlers learn language by reinforcements.

When parents reply to they baby's babbling with vocalization and facial expressions, the baby babble more and more. If parents reply to a request for biscuits, the child will use the word "biscuits" the next time he desires a biscuit.

So, the more parents reply to their babies' requests, the sooner their babies start to learn language.

According to Noam Chomsky (Chomsky, 1968) the human brain is innately wired to develop language.

He believes that infants have a grammatical structure for language even before they hear language. Chomsky called this structure *universal grammar.*

He thinks that when a child hears language, the grammatical structure becomes active.

This theory can explain the fact that humans are able to use construction that they have never heard before (Chomsky, 1968).

Typically developing infants, independently of culture, begin to babble at the age of 6 months, produce the first word at 10 to 12 months, combine two words at 18 to 20 months, and acquire syntax at 48 to 60 months. (McNeil, 1967).

Another theory about language development is the theory of *"Interactionism"* which integrates the ideas of both nativism (Chomsky's theory) and behaviorism (Bandura's theory). According to this third theory, a child develops a language on account of both biological readiness to learn language and their social experiences.

Children learn language also because parents tend to simplify their linguistic structure in order to permit to their children to understand what they say (Levine & Munsch, 2010).

"In addition, adults often repeat what children say but recast it into more advanced grammar. For example, a child might say, *More cookie* and the adult might respond, *Oh, do you want more cookies?* In this way, adult is modeling a slightly higher level of language proficiency, which the child can then imitate. The child in this example might then say, *Want more cookies*" (Levine & Munsch, 2010, p. 302).

Regarding non-verbal language, typically developing infants are responsive to facial expressions and vocal sounds, due to genetic factors and neural preadaptations. Electrophysiological researches have found that in human's brain there are specific mechanisms devoted to the elaboration of facial expressions and vocal sounds (Tranel, Damasio & Damasio, 1988).

In normally developing children, verbal and non-verbal language develop in parallel during the early phases of their language acquisition.

The first words and the first gestures emerge at the same time, and outcomes in non-verbal language can predict progress in spoken language.

Pointing gesture is considered as a predictor of the emergence of the first words, while the gesture-word combination which has the function to convey two pieces of information, is a predictor of the appearance of two-word speech.

The first part of this chapter will focus on the infant's social use of communication.

In the very first months, typically developing infants are concentrated upon their bodies and they start to respond to facial expressions, gestures and sounds.

Subsequently, at around 6 months, infants start to focus on world around them, and parents begin to speak about what their infants observe. This is the road which conduct to language development (Tommasello & Farar, 1986).

The second part will focus on the development of gestures and facial expressions in typically developing infants.

Initially, the gestures and the facial expressions that babies produce, permit them to maintain social interactions, and to express their needs since they are not able to communicate verbally. Subsequently non-verbal language become more complex and infants begin to combine it with spoken language (Levine & Munsch, 2010).

The last part of this chapter will concentrated upon the development of grammatical abilities and language more generally.

At the age of 6 months babies begin to produce vowels-syllables combination such as *dada, papa,* this phenomenon is called babbling.

At around 13 months children begins to produce the first words, while at 1 year and 1/2, they begin to combine two or more words. This represents the beginning of grammatical development (Caselli et al., 2005).

2.1 Social use of communication in normally developing children

"Language development does not begin with the child's first efforts to learn material that is linguistic, it rather begins with processes that orient the infant to the behavior of talking people, and bias the infant to attend and respond to certain aspects of such behavior"
(Locke, 1997, p. 268).

Crying is the first form of communication, in fact infants cry as soon as they born.
However it is a reflexive behavior rather than an intentional form of communication.
Crying become intentional only when infants learn that it can be a signal to express loneliness, hunger and discomfort.

Between 2 and 4 months, infants produce more pleasant sounds, and they also start to laugh. Infants at this phase take part in a paralanguage conversation with caregiver: they coo, caregiver talks to them, infants look and laugh to caregiver who smiles and talks.
In this manner, infants learn how to use communication before they are able to use spoken language.
During these first months, infants are only concentrated upon their bodies and upon the interaction with others.

At the age of 6 months, infants begin to focus on events and objects around them, and parents begin to talk about what their children observe. Both parents and infants direct the gaze to the same object and event.
If parents respond to their children's interests by naming what they are observing, the children acquire language more quickly.
Parents who often share the focus of attention with their children and label the objects and events they observe, foster their language development successfully.
So, by the time infants start to produce verbal language, they have already fixed with their parents social communicative routines. These non-verbal interactions are considered the precursors of verbal language.
The interactions with the mother provide the infants a context that makes the non-verbal language meaningful. The mechanism underlying these mother-child interactions is called joint attention.
Given that infants do not have linguistic systems to establish the joint attention, the non-

verbal language help the toddler to capture adult's attention (Tommasello & Farar, 1986).

Joint attention plays a fundamental role in infant's early language acquisition.

If parents are cooperative as regards joint attention, children's language acquisition proceed faster (Baldwin, 1995).

Tommasello and Todd (Tommasello & Todd, 1983) have investigated the differences in the way mothers and infants regulate their attentional states.

The two experimenters have observed that, by the time infants begin to use productive language, they have already fixed with their parents a variety of social-communicative routines.

They videotaped mother-child interactions for six months and they found that the amount of time spent in joint attentional episodes was related to the infants' vocabulary size.

The way mother and child regulate their attention can predict the child's early language development.

In another study (Snow, 1989, cited in Locke, 1989) emerged that there is a strict relationship between vocal imitation at 14 months and the number of verbs, nouns and the productive vocabulary at 20 months.

Joint Attention is important to language development in two different ways: extended episodes of joint attention can give an non-verbal scaffold for the infant's early language interactions and they are important for the acquisition of language.

Within these joint attention episodes, it is very fundamental that the mother talks about the object on which his child is focused on. During joint attentional episodes the child is more attentive and motivated to understand the meaning of his mother's words.

All these operations are considered the precursors of spoken language (Tommasello & Todd, 1983).

2.2 The development of non-verbal language in typically developing children

Normally developing children, in the first year of their lives, begin to use non-verbal language such as gaze, vocalizations, smiles and gestures.

The toddler's responsiveness to facial expressions, sounds and gestures, depends on genetic factors, early experience and specific neural systems.

Several electrophysiological researches have proven that humans possess a mechanism which process facial expressions (Locke, 1997).

According to Paul Ekman (Ekman, 1994) facial expressions are universal and they are not determined by culture. So they have biological and not biosocial origins.

Ekman and Friesen (Ekman & Friesen, 1978) have designed a tool for objectively measuring of facial movements, called the Facial Action Coding System (FACS).

Oster (Oster, 1993) has designed a version of FACS applicable to baby and young children called Baby Facial Action Coding System (BabyFACS).

Facial expressions, such as smile and grimace, surface in early infancy. They often attain intense emotions in infant's caregivers and play a crucial role in establishing interactive patterns which condition later development.

Understanding the connection between infants' facial expressions and their emotions is not easy because infants are not able to use words or phrases to express their emotions. In addition, it is difficult to decode discrete negative facial expression such as expression of sadness, anger, and distress in infants, due to the fact that they are often combined. Effectively, when infants cry, they tend to alternate anger and distress facial expressions.

On the contrary, smiles are more easily recognized as discrete facial expression of happiness (Messinger, 2002).

Initially, the gestures and facial expressions that infants produce, permit them to express needs, informations that they cannot communicate verbally, and to maintain social interactions. When children begin to use gestures instead of crying to express what they wants, it can reduce frustration for them and their parents (Levine & Munsch, 2010).

Subsequently, non-verbal language become more complex and children start to combine it with verbal speech.

Therefore, infants use gestures and facial expressions to communicate with others several months before they use verbal language, but even after the emergence of verbal language infants continue to use gestures in combination with words (e.g. pointing a ball saying "ball"). These gestures in combination with words precede the production of two-word combinations. Pointing gestures, such as point a ball, give children a tool for referring to objects before they start to use verbal language. Furthermore, gestures in combination with words offer children a tool to communicate two information using a single word utterance before they are able to express two-word utterances (e.g. point a ball saying "mine").

So gestures permit infants to express information that they may have difficulty to communicate verbally and have the facilitating function for language development.

Iverson and Goldin-Meadow (Iverson & Goldin-Meadow, 2005) have examined the relationship between the production of gestures and the development of lexical and syntactic development in the first phases of language development.

They have tested if "children's use of gesture to refer to specific objects is related to the emergence of verbal labels for those objects and whether children's production of gesture-plus-word combinations is related to the emergence of two-word utterances" (Iverson & Goldin-Meadow 2005, p.367).

The results have revealed that gestures precede and are related to language development.

The two experimenters have observed that items found initially in infants' gestural repertoires later surface in their verbal lexicons.

Moreover, they observed that the onset of gestures-words combination which conveyed two elements, predicted the onset of two-word combinations.

So, this study has revealed that gestures play a facilitating role in early language development (Iverson & Goldin-Meadow, 2005).

Caselli (Caselli et al., 2005) has described the development of non-verbal language:

In the first six months of infants' life, they are involved in social interactions and smiles are very frequent during these interactions.

Between 9 and 12 months, children begin to show evidence of word comprehension and they start to use *deictic gestures* (e.g. giving, pointing, showing, and ritualized requests) (Bates & Dick 2002). Of the four deictic gestures, pointing seems to be the most relate with later language acquisition.

Between 12 and 16 months children start to produce another type of gestures, called *representational gestures.* Some representational gestures are conventional and culturally defined (e.g. clapping hand and gesture of greeting) while others reproduce short actions (e.g. bringing the hand to the mouth for "eat"), or they are actions associated with specific objects (e.g. bringing the hand to the ear for "telephone"). Unlike deictic gestures, representational gestures convey a sense that can be understand without direct reference to context.

In the first phase of language development, the majority of the meanings produced by children's gestures are similar to those conveyed by the first words (e.g. infants say "palla" while they are playing with it). The first words and gestures produced by infants seem to follow a similar process of decontextualization.

At around 12 months, there is an equivalence between vocal and gestural modes. Infants at around 1 year, tend to make equal use of both gesture and words. However, this correlation between word production and gestures is limited to a restricted period of time in children development (between 12 to 18 months). This positive correlation disappear in the second year of the infants' life but it sometimes turn into negative correlation later in life (e.g. in some children with language impairment there is a persistence of gestures).

It is necessary to say that the children's use of gestures and words depends on contexts. For example during images description tasks children tend to use more words than gestures, while they use more gestures for requiring an object (pointing or showing gestures).

Parents tend to interpret words as more communicative than gestures, so they reinforce words rather than gestures. Consequently, children gradually reduce the use of gestures, preferring vocal channel (Caselli et al., 2005).

Iverson (Iverson et al.,1994) has explored the relationship between gestures and words in 12 typically developing Italian children at 16 and 20 months of age. For each children, two examination were made: the first at 16 months and the second at 20 months. Each examination lasted fourty-five minutes, during which mothers played with their children.

The results have shown that, at 16 months, 5 children tended to use more gestures than words, 6 children used more words than gestures, and only one subject used the same number of words and gestures.On the contrary, at 20 months, children used more words than gestures. These results suggest that gestures were gradually leaved in favor of their verbal counterparts.

2.3 The acquisition of Grammar in typically developing children

As previously mentioned, there are different socially cognitive operations which seem to facilitate early word production, such as toddler's disposition to (a) take part in vocal turns with his communicative partner, (b) mimic prosody, (c) use gesture in a communicative way, (d) assimilate phonetic patterns and (e) develop a theory of mind, which permit to interpret the other people's state of mind, thoughts and perspectives.

These operations permit children to get by in their language, to communicate with others even when their linguistic ability are still immature.

Therefore, the toddler's socially cognitive operations contribute to the development of the first phases of language acquisition (Locke, 1997).

But when children start to acquire verbal language?

Babies obviously do not speak before they are born, however, language acquisition begin before birth.

In the last trimester of gestation the fetus hears the voice of his mother as demonstrated by changes in his heart beating when the mother speaks.

This prenatal auditory experience can explain the postnatal preferences for his own mother's voice to that of other people (Levine & Munsch, 2010).

In a study conducted by DeCasper and Spence (DeCasper & Spence, 1986) a group of pregnant women have recited a passage during their last six weeks of pregnancy.

After the infants were born, those who had listened the passage sucked a pacifier in a different way when the mother read the same passage compared to other passages that they had never heard before.

At 4 months, babies start to produce one-syllable sounds such as *da* or *ba,* while *at six months* they combine these sounds (*dada, baba).* This phenomenon is called babbling.

During this period, parents are very happy because they think that babies mean *mamma (mum)* when they say *mama* or *papà (dad)* when they say *papa.*

At first these vocalizations have no meaning for babies, but they begin to understand their meaning because their parents reply to these vocalization with smiles and recompenses.

It seems that deaf babies who are acquiring sign language go through the same stages of language acquisition but in this case babbling is produced with hands instead of vocalizations.

Adults play a crucial role in fostering infant's language acquisition. So, it is very important that parents talk to their babies even when they are not able to understand the meaning of the words.

Usually parents tend to act as if babies understand the dialogue, taking turn with whatever the infants reply. These conversational exchanges provide the infants with an early experience of spoken dialogue.

Adults tend to talk to babies in a special way which is called *motherese.* This term refers to behaviors such as talking with a higher voice and using up and down tone. It has been proven that infants pay more attention when adults use *motherese.*

Babbling usually leads to the first words because the vocalization such as *mama* and *papa* may become the first words that the children say.

During the interactions with parents, babies associate words with objects and events. However, infants do not transfer a word to other objects or people, they thought that *mamma* refers to their mothers not other women.

At 9 months a baby starts to comprehend words but he begins to produce them at 13 months.

The comprehension of language comes first the production of that language.

The first words may not correspond to adult words, for example an Italian baby can say *bau (woof)* to refers to a dog (Miller & Ervin, 1964).

In the first phase of language acquisition, children tend to use words representing objects, events or people, only when they are interacting with them (e.g. they say: *palla/ball* when they are playing with it).

In a second moment, children use words in order to anticipate or recall events, people or objects (e.g. they say *palla* before starting to play with it).

Subsequently, children use words in order to categorize objects (Caselli et al., 2005).

At 1 year, normally developing infants produce few words, but at 2 years they produce from 200 to 500 words (Miller & Ervin, 1964).

According to Caselli (Caselli et al., 2005):

- *Between 12 and 15 months* of age children acquire 5 new words every months.
- *At 16 months* they produce 22 different words.
- *From 18 to 20 months* children acquire 20 new words every months and are able to produce 100 different words.
- *Between 21 and 26 months* children acquire 50 new words every months and are able to produce 278 different words.
- At 36 months children are able to produce from 300 different words to 660 (Caselli et al. 2005).

However, the acquisition of new words, for some infants, explodes around 2 years of age and this phenomenon is called *vocabulary burst,* while for other children the acquisition of new words is slower (Miller & Ervin, 1964).

After the vocabulary burst, the number of words referring to common nouns (e.g. *mamma/ mum, micio/kitty, mella*[4]), remain unvaried, while the use of social words (e.g. *bau/woof, ciao/ hello, più/more, nonno/grandfather*) tend to decrease.

Social words represent 60% of total words used by a child when he posses restricted lexical abilities (less than 50 words).

Caselli (Caselli et al., 2005) has divided the vocabulary development in four phases:

- *Routines and Word Games:* in this phase children produce less than 10 words. The words produced in this phase are onomatopoeias (*tutù*[5] *coccodè/cluck cluck*).
- *Reference:* in this phase children produce 200 words, and 50% of these words are nouns.
- *Predication:* during this phase children start to produce more verbs and predicate
- *Grammar:* during this phase children produce 400 different words and start to acquire grammatical functors (articles, auxiliary verbs, adverbs, prepositions ecc.)

During the second year of infants' life, they comprehend that words are symbolic representation which stand for events or objects.

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[4] Translation not available, it is a contraction of the Italian word caramella-candy

[5] The sound of a busy telephone

Afterwards infants have learned a certain number of words, they manifest a rapid syntactic and semantic development (Miller & Ervin, 1964).

At 1 year and 1/2, they begin to combine two or more words such as *gatto mangia/cat eat* (Caselli et al., 2005).

This represents the beginning of the development of grammatical abilities.

Infants in all the

All infants use language in the same manner: initially they tend to include only the most relevant informations in their discourse (Miller & Ervin, 1964). For example they are not able to produce *Sto mangiando una mela/I'm eating an apple,* so they rather say *Mangio mela/me eat apple.*

When infants combine three or more words they tend to use the easier combination of the words to express a meaning. This type of speech is called telegraphic speech.

Telegraphic speech is characterized by the omission of prepositions, articles and pronouns (e.g. *arrivo stazione 11/arrive station 11*) and also by the omission of verb (e.g. *orsetto latte/ bear milk*), or object (e.g. *orsetto beve/bear drinks*) (Caselli et al., 2005).

When infants start to combine three or more words the order of words is correct even though the grammar of the sentences they produced is different to that of adults.

"It is often striking that one can provide a translation of children's utterances into adult utterances by the addition of function words and inflectional affixes" (Miller & Ervin, 1964 p. 13).

A child who produces speech in a telegraphic manner shows that he has a full conception of sentence structure, even if it is not realized in his discourse (Miller & Ervin, 1964).

At around 3 years, children combine multiword sentences. However, they use the basic information to form a sentence, for example they say *voglio il gelato che mi piace tanto/ I want the ice-cream which I really like.*

Children also begin to use coordination (e.g.. *il bimbo prende il gelato e fa la torre/the child takes the ice-cream and creates the tower),* and subordination (e.g.. *quando è sera si va nel lettino/I go to bed when it is afternoon)* (Caselli et al., 2005).

As regards the contents of sentences, at first normally developing children begin to use requests for action (e.g. *prendi etto/take this*), and requests for information (e.g.. *dov'è papà?/where is dad?*).

Then they start to produce objects and events descriptions (e.g.. *quello è il lego/this is Lego*), actions descriptions (e.g. *butto 'a palla/I throw th' ball)*, desires (e.g. *voglio fare giochino/I want to play*).

Subsequently, they begin to use expressions of possession (e.g. *è mia la torre/the tower is mine)*, opinions (e.g. *sono grande/I'm old*).

Finally, they produce general principles (e.g. *non si dicono le parolacce/you must not say bad words*), and past or future events (e.g. *si dopo la mangio/yes, then I'll eat it*; *cane mordeva/ dog bit*).

As it is evident, at the end of language development, children tend to speak about external situations and events.

Nelli (Nelli, 1996) has analyzed the development of grammar of an Italian child called Benedetta from 18 to 30 months.

Italian is considered an SVO (Subject-Verb-Object) language which possess a very rich system of verb morphology. In addition, Italian, unlike English, is considered as a prodrop[6] language, in which the subject can be omitted.

Nelli has observed that from the age of 18 to 21 months, Benedetta had been using pronominal protoforms having the function of articles (e.g. *ebabo/'thdad*= il babbo/the dad; *ecotto/'thbiscuit* = il biscotto/the biscuits; ecasa/*'thhome*=la casa/the home, *abbacca/'thship*=la barca/the ship).

From the age of 22 months, the child started to use the article.The first article that she used was *la*[7].

As regards clitics, the child started to use them at the age of 22 months[8]. Before that age, she tended to use protoform having the function of clitics (e.g. *ebutto*=lo butto, *emetti*=lo metti)[9].

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[6]Pro-drop languages are languages that allow the sentence's subject to be left out, such as Italian and Spanish e.g.. (Io) Sono di Torino

[7]However, even if the protoform has been used by the child until the age of 30 months, they were present to a lesser extent. The second article that she started to use at the age of 22 was *lo.*
At the age of 25 months she began to utilize the articles *l'* and *le,* while at the age of 30 months she began to use the article *i*.

[8]The first clitic that she used was *lo* (i.e *lo butto qui/I throw it here*). She begin to use *lo* at the age of 21 months. From 22 to 24 months, Benedetta started to use three clitic pronouns: *la, me, mi.* She also used *si* (impersonal and reflexive), and *ci, ce, ti, te.* After 24 months she begin to use *ne, gli, li.*

[9]Translation not available: the first sentences is a contraction of *I throw it*, whereas the second is a contraction of *I put it*.

Regarding prepositions, before the age of 22 months Benedetta tended to use protoforms having the function of prepositions (e.g. *apotto*= a posto)[10]. After that age she began to use a wide number of prepositions.

With respect to auxiliaries, she started to use them at the age 22 months, and the first auxiliaries that she began to use was *be*.

However, when she started to use the auxiliary *have*, she produced exclusively sentences with *have*[11].

She started to use the copula at the age of 20 months (e.g. *chetto è lallo*=questo è il cavallo)[12].

As it is evident, the child's grammatical development is characterized by the presence of protoforms which precede the development of lexical elements (Nelli, 1996).

Caselli and Nelli (Casellli et al., 2005; Nelli, 1996) have described language acquisition starting from 18 months, but according to Locke (Locke, 1997) language acquisition begin before birth. He has described the stages of language acquisition accurately.

"Early perceptual experience and discontinuities in linguistic development suggest that language develops in four phases that occur in a fixed, interdependent sequence. In each phase of language, a unique ontogenetic function is accomplished. These functions have proprietary neural systems that vary in their degree of specialization. Of particular interest is an analytical mechanism that is responsible for linguistic grammar. This mechanism is time-locked and can only be turned on in the third phase. Confirming evidence is provided by children who are delayed in the second phase of the language learning process" (Locke, 1997, p. 265).

The four phases of language development described by Locke are the following:

- *Vocal learning (Prenatal-5 months):* in the final trimester of gestation the infants become more responsive to prosodic signals in their mother's voice.

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10 Contraction of *in place*

11 She used have in combination with the clitic pronouns l' in order to produce the past time (i.e io l'ho aggiustato/ I fixed it, l'ha comprato la nonna/The granddaughter has bought it, l'ha pigiato il canino).
She used *be* almost exclusively in error contexts (i.e "dov'è messo quell'altro?").
In respect to copula, she began to use protoforms having the function of copula (i.e eecaldo=è caldo, oomia=è mia).

12 Contraction of *this is horse*

This prenatal exposure to maternal prosody can explain the postnatal preference for the voice of the mother.

In the very first months of the infants' life, they react differentially to variation in vocal sounds and prefers the sound of his language compared to that of a foreign language.

The infants also become able to imitate intonation, distinguish between different voices and regulate social behaviors (Locke, 1997).

During this phase the babies are mainly oriented to human voice and face (Hammer 2010).

- *Utterance Acquisition (5-20 months):* typically developing infants between 7 and 10 months produce repeated consonant-vowel segments defined as babbling, such as *papapa, bababa, mamama* (Petitto & Marentette, 2005).

  Subsequently infants produce the first recognizable words and combines them to form telegraphic utterances (Hammer, 2010).

  The utterances produced by the infants during this phase are usually a rote copy of the utterances produced by others even though infants reproduce them inaccurately.

  The words produced during this phase are considered holistic, that is phrases which not required a grammatical analysis (Locke, 1997)

  This first single-word utterances produced by infants convey complex ideas: for example the word *ball* does not mean merely an object but it means that the child wants a ball.

  The single words that infants produce in this phase correspond to the full utterances of adult grammar. The children have exactly in mind the full utterance, however they produce a single word (McNeill, 1970).

  "The significance of this second phase is that it gives infants a set of "starter" utterances that can be used appropriately in restricted contexts, and provides infants with the opportunity to participate in adult-like social interactions" (Locke, 1970, p.273).

  This phase is also defined as affective and social (Hammer, 2010).

- *Structure Analysis and Computation* (20-37 months): in the third phase the stored utterances are decomposed and subsequently analyzed. This phase relies on the acquisitions in the previous stage.

  During this phase neural systems analyze and detect recurring patterns within the utterances, so the infant acquires the rules by which utterances are synthesized and analyzed (Locke, 1997).

  Infants, in this stage, also improve their syntactic and lexical abilities (Hammer, 2010).

- *Integration and Elaboration (>3 years):* after that computational and analytical abilities are acquired, it is possible to extend the lexicon. Also syntactic processing becomes automatic during this phase.

  In the fourth stage the changes affect not only language and communication, but also social cognition.

  The children begin to comprehend that others possess different mental activity, thoughts, believes and perspectives. This progress is strictly correlated with language abilities (Locke, 1997).

  Figure 2 represents the four different phases in language acquisition according to Locke (Locke, 1997).

Phases and Processing Systems, and Neural and Cognitive Mechanisms, Associated with the Development of Linguistic Capacity, along with the Corresponding Areas of Language

Age of onset	Developmental phases and systems	Neurocognitive mechanisms	Linguistic domains
Prenatal	Vocal learning	Specialization in social cognition	Prosody and sound segments
5–7 months	Utterance acquisition	Specialization in social cognition	Stereotyped utterances
20–37 months	Analysis and computation	Grammatical analysis mechanism	Morphology Syntax Phonology
3+ years	Integration and elaboration	Social cognition and grammatical analysis	Expanded lexicon, automatized operations

Figure 2. The four phases of language development described by Locke (Locke, 1997).
Reproduced from Hammer (2010) in *The acquisition of verbal morphology in cochlear-implanted and specific language impaired children* (Netherlands: LOT).

2.3.1 A sensitive period for language acquisition

According to Locke (Locke, 1997) the development of language begins before birth. But does it exist a critical period for language acquisition?

Lenneberg (Lenneberg et al., 1967) thought that, between the age of 3 and 10 years children are particularly sensitive to developing language. This phase is called *the critical period*.

In a ten-year-old child, first language acquisition seems to be difficult due to the fact that the brain has reached its full maturity (Lenneberg et al., 1967).

Lenneberg proposed that language abilities which are not acquired within this sensitive period, with the exception of articulation, remain impaired for life (Hammer, 2010).

In literature there are several cases which proves the existence of a critical period.

There are cases of individuals who have lived in social isolation, such as Genie, a girl who was victim of abuse and social deprivation and the case of Victor, who was mentioned in the previous chapter.

Genie was hospitalized in 1970, at the age of 13. She was malnourished, emotionally disturbed, antisocial and she wasn't able to speak.

Clinicians discovered that the girl had been isolated in a room from the age of 20 months to the age of 13. The windows and the door of the room were closed, there were no radio or TV in her house. Genie was physically punished by her father and the mother rarely took care of her. It seems that Genie was a normal girl and that the problems observed at the time of the hospitalization were provoked only by social and sensory deprivation.

There were no evidence supporting the diagnosis of autism or other developmental syndrome.

These cases of social isolation have captured the interest of scientists of different disciplines who have wondered if these strange children could catch up totally or only partially.

They concluded that it depends on several factors such as the duration and the intensity of the social deprivation and the developmental stage reached before the isolation (Krashen & Curtiss, 1974).

"In addition, the ability of such recuperation is closely tied to whether there is a critical period beyond which learning cannot take place. The concept of a critical period during which certain innately determined faculties can develop derived from experimental embryology. It is

hypothesized that should the necessary internal or external conditions be absent during this period, certain developmental abilities will be impossible" (Fromkin et. al, 1974, p.83).

According to Locke every stage in language acquisition possesses its critical period which occurs in a fixed sequence.

He also thought that an early exposure to auditory stimuli can influence the future language abilities (Locke, 1997).

3. The acquisition of Verbal and Non-verbal language in children with Autistic Spectrum Disorder

The previous chapter has focused on the acquisition of verbal and non-verbal language in normally developing children, whereas the present chapter will concentrate upon the acquisition of these two abilities in children with autistic spectrum disorder.

Deficit in communication is considered one of the central features of the autistic individuals.

Linguistic deficits in children with autism include reversals of first and second person pronouns, echolalia, neologisms, atypical intonation and primitive syntax.

However, in the last few years, new diagnostic criteria have mainly focused on pragmatic deficits in this population (Douglas, 2012).

Pragmatic concerns the use of language in social interactions. It includes linguistic components, such as register, negotiation of turn-taking, the selection of referential expression, and non-linguistic components such as gestures, facial expressions and eye contact (Eigsti, 2011).

Pragmatic abilities emerge before grammar and these two components develop separately, as demonstrated by the fact that some children with autism possess restricted pragmatic abilities even if their grammatical abilities are intact (Rollins & Snow, 1998).

As mentioned in the previous chapter, in normally developing children verbal language and gestures develop in parallel during the first phases of language acquisition.

In typically developing infants, the first words and the first gestures surface in the same period, and achievements in gestures can predict the language skills.

For example, the onset of showing and pointing can predict the emergence of first words and the combination of gestures-words predict the appearance of two-word speech.

Even though much is known about relationship between verbal and non-verbal language in normally developing children, there are fewer studies about the relationship of these two components in children with developmental disorders such as autism (Bernabei et al., 2001).

It has been shown that children with ASD use a restricted number of non-verbal behaviors and they rarely produce complex combination of non-verbal behaviors such as gestures in combination with vocalizations.

They tend to use vocalizations and gestures in order to express their needs, whereas they don't use these signals to share experiences and intentions.

Some of communication competences are absent or impaired in the first years of autistic children's life, however these competences may be acquired later (Bernabei et al., 2001).

Bernabei (Bernabei et al., 2001) has compared verbal language with non-verbal language in a group composed by 27 children with mild-severe autism and a group of 27 children with mental retardation (MR), matched on chronological and developmental age.

Within the two group, the children have been divided into three subgroups according to their cognitive impairment and developmental age: 7 of 27 children possessed a developmental age ranging from 6 to 11 months, while 11 displayed a development age from 12 to 17 months, and 9 have a development age from 18 to 24 months.

All 54 participants had mild-severe cognitive deficits.

Subjects with ASD possessed a chronological age ranging from 21 and 64 months (mean age: 42.7), while the chronological age of subjects with mental retardation ranging from 23 to 86 months (mean age: 40.9).

In order to assessed communication abilities, it has been used a questionnaire including question about routines contexts and play. It also included a list of 15 words and 15 referential gestures, and parents had to indicate what gestures and words were used by their children.

The results have revealed that, between 6 and 11 months, both groups have used the same primitive forms of communication, such as crying and vocalization, and they have manifested solitary behaviors.

Between 12 and 17 months, both groups addressed to adults in order to communicate their needs, however, unlike children with mental retardation, children with ASD addressed to others using almost exclusively contact gestures rather than distal gestures such as pointing or showing, and they avoid eye contact.

There were no significant differences between two groups in the use of words, phrases and also in motor abilities. In both groups these three components have been increasing significantly with increasing age.

Between 18 and 24 months, the two groups have used the same communicative gestures, however children with mental retardation have used a higher number of communicative gestures than children with ASD.

So children with autism manifest a communicative development partially different from that of children with mental retardation.

Children with MR have gradually acquired communicative abilities, between the second and third years of age, whereas communicative development in children with ASD has broken down between 2 and 3 years (Bernabei et al., 2001).

Loveland and Landry (Loveland & Landry, 1986) in their study, have analyzed the relationship between gestural joint attention behaviors and communication skills in a group of autistic children and a group of children with developmental language delay (DLD).

The autistic group was composed of 11 children with a diagnosis of Autism according to DSM-III criteria. The mean mental age for these children was 5;8, while the mean chronological age was 8;6 months.

The two group, matched for MLU, were compared on measures of personal pronouns usage, spontaneous communicative behaviors and joint attention.

The results have shown that DLD children respond to joint attention interaction more often than children with ASD. Moreover, DLS children's spontaneous gestures were more communicative than the other group.

DLD group did not have particular impairment in joint attention, while children with ASD manifested deficit in joint attention abilities in addition to language impairment.

The first part of this third chapter will focus on social use of communication in autistic children.

Children with ASD lack of a theory of mind and have deficits in joint attention.

These deficits cause problem in language and communication because at the root of communication there is the intent of understand other people's thoughts, perspectives and believes.

Toddlers with ASD manifest difficulties in pointing, showing an object and following the pointing gestures of others. Moreover they rarely use eye contact (Stone, 1999).

The second part will concentrate upon the development of nonverbal communication in these populations.

In the previous chapter it has been explained that, normally developing children, within the first year of their lives, start to use non-verbal language such as gaze, vocalizations, smiles and gestures.

The babies' responsiveness to facial expressions and gestures depends on specific neural systems.

Psychologists have always been fascinated by the phenomenon of automatic mimicry and how simply watching another person's facial expression or gesture can elicit the same behavior in the observer.

It has been proved that automatic mimicry facilitates social functioning and understanding other people's minds (McIntosh, 2006).

According to Rogers social deficits in children with ASD may be caused by deficit in motor imitation (Rogers 1999).

McIntosh (McIntosh, 2006) in his study, has analyzed automatic and voluntary mimicry in children with ASD using the method of facial electromyography (EMG), which register electrical changes in muscles activities.

When typically developing babies observe facial expressions, they spontaneously activate congruent facial muscles, facilitating social interaction.

On the contrary, voluntarily mimicry is effortful and slow, and involves different neuronal systems.

The results have revealed that participants with ASD did not automatically mimic facial expressions, while normally developing participants did.

However, both individuals with ASD and normal participants were able to mimic facial expressions voluntarily.

Mimicry involve a "mirror circuit" in which neurons discharge both when typical individuals make an action, and when they observe the same action.

On the contrary, children with autism seem to have a mirror-circuit dysfunction.

The last part will focus on the grammatical development in this population.

In studies on grammatical abilities and Mean Length of Utterance (MLU, autistic individuals' utterance structure and morphology were similar to those of DLD group.

However the two groups diverged in their functional use of language, in other words the autistic children express fewer spontaneous comments (Bartak et al., 1975).

Shapiro (Shapiro et al. 1974) has found that the utterances produced by children with ASD can be formally correct but they can appear in a not appropriate context.

Children with ASD fail to respond adequately to questions and comments (Shapiro et al., 1974).

3.1 Social use of communication in children with ASD

In the previous chapter, it has been explained that, in typically developing children there are cognitive mechanism that orient them toward speech and people who are speaking (Creutzfeldt et al.,1989).

The cognitive and social operations supporting speech production and vocal learning are the following: toddlers' propensity to take conversational turns with an interlocutors, varied prosody, communicative gestures, detect mental states of their partner on account of the formation of a "theory of mind" (Locke, 1997).

"With relevant perceptual experience and motor development, these operations allow infants to "get by" in their native language, to pass as speakers when their linguistic capacity is still immature. The infant's socially cognitive operations therefore contribute to the first few essential phases in the development of linguistic capacity" (Locke, 1997, p. 269).

However, little is know about predictors of language acquisition in children with ASD, even if this type of information would be very important for understanding the phases of language development in this population, and for organizing an intervention plan (Prizant, 1996).

Osterling and Dawson (Osterling and Dawson, 1994) in their study have proven the existence of some precursors of language by comparing 11 autistic children with 11 normally developing children during their first year birthday parties in order to analyze their affective, social, communicative behaviors and joint attention.

Seven of the 11 autistic participants fulfilled DSM III criteria for autistic syndrome and one child was diagnosed as having PDD-NOS (Pervasive Developmental Disorder-Not Otherwise specified).

Three children were diagnosed with an interdisciplinary assessment called TEACCH[13], and one of these children received a marginally autistic score of 29[14], while the other two received scores on the CARS in the autistic range.

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[13] The Treatment and Education of Autistic and Communication Handicapped Children (TEACCH) is a clinical service which includes diagnostic evaluations, parent training, parent support groups, and individual counseling (Schopler 1972).

[14] CARS scores range from 15 to 60. Children with a score ranging from 15 to 30 are categorized as being normal children, children with a score ranging from 30 to 37 are categorized as being moderately autistic, while children with a score ranging from 37 to 60 are categorized as being severely autistic (Schopler 1980)

4 of the 10 children with autism manifested cognitive delays, whereas the other 6 had a IQ scores above 75.

The results have shown that autistic children manifested less social behaviors and joint attention than the other children. Furthermore children with autism did not point or show object and look at others (Osterling & Dawson, 1994).

As emerged from these studies, impairment in joint attention is one of the principal features of autistic syndrome.

Children with ASD do not direct the attention of others to objects and do not follow the pointing gestures of their communicative partners (Keen, 2014)

Joint attention interactions, such as pointing or showing an object, are significant to the acquisition of conversational abilities. Deficits in joint attention have been associated to lower language abilities (Keen, 2014).

Moreover, the development of joint attention is significant to the acquisition of normal language usage and personal pronouns (Loveland & Landri, 1986).

"Furthermore, the responsiveness of caregivers to a child's focus of attention has also been associated with later language outcomes for children with and without disabilities" (Keen, 2014, p.13).

As previously mentioned, Tommasello (Tommasello et al., 1986) has studied the relationship between joint attention and the acquisition of language in normally developing children.

The results have revealed that there is a positive correlation between the child's focus of attention to objects at 15 months and the extent of expressive vocabulary at 21 months (Tommasello et al., 1986).

In normally developing children, joint attention and language abilities begin at the age of 9-12 months.

Children with autism who are more responsive to bids for joint attention by their caregivers have much possibilities to develop language skills than children with ASD who are less responsive to bids for joint attention (Siller & Sigman, 2002).

There are three modalities whereby parents may respond to their child's joint attention: non-linguistic contingent responses, linguistic contingent responses to the child's focus of attention, and linguistic contingent responses to the child's communicative acts.

As regards the first modality (non-linguistic contingent responses) it consists in the acknowledge of children's behaviors by the imitation of children's plays, facial expressions,

and vocalizations. These responses add information to the children's behaviors and facilitate the development of the successive stages in language acquisition.

The second modality (linguistic contingent responses to the child' s focus of attention) consists in commenting about children's focus attention. This response helps noun usage.

Concerning the third type of response (linguistic contingent responses to the child's communicative acts) consists in interpreting what the children might mean.

Siller and Sigman (Siller & Sigman, 2002) have analyzed the behaviors of autistic children's caregivers during play interaction.

The results have shown that the caregivers' behaviors were synchronized with their children's focus of attention and that the caregivers who displayed synchronization had children who developed a better language ability and joint attention than the children of caregivers who did not display synchronization.

These achievements show that the caregivers' attention to their autistic children is very important to the future development of their communicative skills, and for this reason it is necessary to design interventions that focus not only on the children's language and communication but also on the responsiveness of the caregivers.

3.2 The development of Non-Verbal language in children with ASD

As previously mentioned, normally developing children, within the first year of their lives, start to use non-verbal language such as gaze, vocalizations, smiles and gestures.

These behaviors have some important functions: they serve to maintain social relationship, convey emotional experiences and express their necessities.

Over time, non-verbal language become more complex, for example infants begin to coordinate gesture with sounds.

On the contrary, children with autism show deficits in the use and understanding of non-verbal language. They use less frequent eye contact, pointing and showing gestures than normal children.

Furthermore, certain non-verbal behaviors are assembled with specific communicative purposes, for example children with ASD use pointing for requesting rather than showing interest for an object (Stone et al. 1997).

Bernabei (Bernabei et al., 2001) has analyzed non-verbal language in a group of 27 mild-severe functioning autistic children and a group of 27 children with mental retardation (MR).

*Between 6 and 11 month*s, the two groups have utilized the same primitive forms of communication, such as crying and vocalization.

Between 12 and 17 months, both groups tended to address to others with the purpose of communicate their necessities.

However, unlike children with MR, autistic children addressed to adults using contact gestures rather than distal gestures, such as pointing or showing.

Between 18 and 24 months, both group used the same communicative gestures, but children with MR used a higher number of these gestures compared to children with ASD.

So children with autism manifest a non-verbal language development partially different from that of children with mental retardation (Bernabei et al., 2001).

In another study, Mundy (Mundy et al., 1986) has compared a group of children with ASD with a control group composed by typically developing children and with a group composed by mentally retarded children, in order to verify whether autistic children use different non-verbal behaviors.

He observed that, in the social interaction category, children with ASD were involved in shorter turn-taking sequences than the other group, and replied more rarely to invitations than mentally retarded group.

However, autistic children did not manifest deficits in frequency of eye contact and reacted more actively to ticking than the control group.

As regards requesting category, children with ASD looked into the eyes of experimenter less often than the typically developing children and pointed less frequently when a toy was out of their reach than the other two groups.

These results show that problems in indicating skills is a significant characteristic of preschool children with ASD.

In normally developing children these abilities emerge in the first two years of their life.

The indicating abilities include showing, pointing or making eye contact while grasping a toy.

One difficulty of such behaviors is to coordinate one's own attention to a toy with the attention of another person. The attentional request is triadic because the children had to divide the attention between self, another person and an object.

Problems in indicating abilities is due to the fact that autistic children fail to develop the concept of others as individuals who possess different states of mind (Mundy et al.,1986).

These studies have proven that, children with ASD, unlike normal children, tend to utilize different non-verbal behaviors to communicate.

They express similar behaviors to communicate for the purpose of requesting objects but they communicate rarely for the purpose of commenting and establishing joint attention (i.e directing communicative partner's attention toward objects to manifest interest) (Stone et al., 1997).

Other studies have found that children with ASD tend to use less complex combinations of non-verbal behaviors to communicate with other people.

For example, Wetherby (Wheterby, 1988 cited in Stone et al., 1997) has shown that the communicative acts of children with ASD include more isolated gestures and fewer gestures combined with vocalizations than typically developing infants.

In normally developing children the competence of coordinate gestures and vocalization enhance with increasing age and this coordination increase the comprehension of the communication and also enhance the probability of maternal responsiveness to child's requests.

Stone (Stone et al., 1997) in his research has identified deficits in non-verbal communication in a group of autistic children.

He has tested a group composed by 14 children with ASD which obtained scores within the autistic range (from 30.5 to 42.5) on the CARS, and 14 children with developmental delay (DD) or language impairment (LI).

The results have revealed that children with ASD manifest different non-verbal acts to communicate with others compared to children with DD and LI.

Children with ASD tended to request objects but they were less likely to comment activities and to direct the adult's attention to an event or an object compared to control group.

Commenting represent one third of acts displayed by DD and LI children whereas it represent only 1% of acts displayed in children with ASD.

This study has also revealed that the two group of children used distinct forms of non-verbal acts.

Autistic children displayed fewer gestures combined with comments (i.e. pointing and showing objects and events), fewer acts implying eye contact, and smaller behaviors manifesting an higher level of difficulty, such as combining eye gaze, vocalization and gestures.

According to Stone (Stone et al., 1997) the reduced use of eye contact in autistic children is a consequence of the fewer use of complex levels of communication, such as combining gestures with eye contact and vocalization.

The study of Stone has shown that the rates of eye contact in autistic group were different from the other group, while the rates of vocalization were not.

As previously confirmed by other researches, this study showed that eye contact was employed more often in children with ASD for requesting acts than for commenting.

Reduced eye contact and fewer commenting acts in children with ASD are due to the fact that these children have a deficit in monitoring the attention of the communicative partner.

Monitoring the attention of adults imply shifting one's own attention between an objects or events and a communicative partner.

The wider usage of direct motor gestures such as manipulating the adult's hand in children with ASD could be considered as a compensatory gesture for deficits in sharing attention between adult and objects (Stone et al., 1997).

The results obtained in this study are similar to those obtained in previous researches (Bernabei et al., 2001, Wetherby et al., 1989 and Mundy et al., 1990).

In all these studies children with ASD have used less comments and acts associated with commenting, such as distal points.

In addiction, these researches has expanded previous studies by showing that non-verbal deficits are visible and also measurable in two/three-years-old children.

There are little studies about the communication of autistic infants ranging from 2 to 3 years old. Analyzing the communication of these young children would be very helpful not only to comprehend the social communicative problems in these population, but also to an early identification of the syndrome and consequently to an early social-communication intervention strategy.

The majority of researches have focused merely on autistic children's use of communication, consequently clinicians know perfectly communication deficits of children with ASD but they do not understand how these population express their necessities and wishes.

Clinicians, analyzing not conventional forms of communication used by these children, may comprehend the ways through which children with ASD have learned to communicate.

These not conventional forms of communication are called Potential Communicative Acts (PCAs). It is not clear if they use PCAs intentionally, in order to communicate with others, however a listener may interpret these acts as a form of communication.

Communicating through these informal tools is very helpful for children with ASD who present serious communication impairments.

Keen (Keen, 2001) in his study, has demonstrated the advantages of a teacher intervention package created to substitute prelinguistic behaviors in autistic children with functional communication.

First of all, the research has identified prelinguistic behaviors that the children used to communicate, such as pointing to reach an object, informal gestures, facial expressions, vocalization and body movements.

Then, autistic children's teachers have received training about how to promote conventional and symbolic communication.

During the study, prelinguistic behaviors decreased while replacement forms tended to increase.

Typically developing children also use similar type of prelinguistic acts in the first years of life prior to the appearance of symbolic communication, such as formal discourse and gestures.

In contrast, children with autism, are not able to develop symbolic communication in the absence of specific teaching.

These results confirm that with an appropriate intervention, some autistic children can replace prelinguistic behaviors with a conventional and symbolic communication.

Even if the prelinguistic forms used by the children were not problematic, they resulted unusual and so they were subject to misinterpretation. Consequently, when a child's communication effort is misinterpreted, the child may start to crying. Therefore, the recognition of the PCAs permits to understand the child's favorite means of communication, to avoid the misinterpretations and to strengthen a suitable intervention.

Using symbolic communication as an alternative way to communicate with others could improve the life of the autistic children and their parents (Keen, 2001).

Until now, it has been described the development of gestures in children with autism, but how these children learn to imitate facial expressions?

Normally developing children within the first year of life, begin to smiles and react to adult's facial expressions. The toddlers' responsiveness to facial expressions and gestures rely on specific neural systems.

It has been shown that automatic mimicry facilitates social functioning and understanding other people's minds.

When typically developing babies observe facial expressions, they spontaneously activate congruent facial muscles, facilitating social interaction (McIntosh, 2006).

According to Rogers (Rogers 1999) social deficits in children with ASD may be provoked by deficits in motor imitation.

McIntosh (McIntosh, 2006) in his study, has analyzed voluntary and automatic mimicry of facial expressions in a group of adults and a group of adolescents with ASD and then he has compared the results with a control group matched on age.

The first task consisted in watching the pictures of angry and happy expressions on the screen while their mimicry were monitored with facial electromyography (EMG).

The results have revealed that children with autism did not automatically mimic facial expressions while normally developing group did.

The second task assessed voluntary mimicry. Children were forced to imitate the facial expressions, and in this case, both groups displayed a successful voluntary mimicry.

Mimicry involve a "mirror circuit" in which neurons discharge both when typical individuals make an action and when they observe the same action performed by others.

On the contrary, children with autism seem to have a mirror-circuit dysfunction.

Cassel (Cassel et al., 2007) has analyzed autistic infants at risk for ASD (ASD-sibs) with older normal siblings (TD-sibs) in order to assess their social and emotional functioning in the first year and a half of their lives.

The smiles and cry-faces during face-to-face interaction were coded by coders certifies in the Facial Action Coding System (FACS) (Ekman & Friesen, 1978).

At 6 months of age, ASD-sibs smiled for a lower portion of time during face-to-face interaction compared to TD-sibs.

At 15 months ASD-sibs were engaged in lower rates of initiating joint attention episodes than TD-sibs.

At 18 months infants with ASD responded to fewer joint attention bids than TD-sibs.

So these results suggested that children with ASD have difficulties with referential communication. These include deficits in pointing a desired object, difficulties in joint attention, and deficits in conventional requests (Cassel et al., 2007).

Dawson (Dawson et al., 1990) has analyzed 16 children with ASD from 30 to 70 months of age, and 16 normally developing children.

Autistic children's scores on the CARS ranges from 35 to 60.

The participants were videotaped while they were interacting with their mothers during three different situations: face-to-face interaction, free-play and a more structured task.

Researchers observed that in all these situations children with autism did not differ to normal children in the duration of gaze directed to their mothers.

However, children with ASD tended to combine smiles with eye contact in a singular act less frequently than normal children.

The two groups did not differ in the number of smiles they showed in social and nonsocial events. But when autistic children's responses to their mothers' smiles were analyzed, the researchers observed that these children smiled less often than control group.

Lastly, the researchers have observed that the mothers of children with ASD express fewer smiles and were less responsive to the smiles of their children compared with the mother of the control group.

These results suggest that the atypical behaviors of children with autism affect negatively the behaviors of their mothers

Currently, there are no accounts before 12 months regarding differences in smiling during toddler-parents social interaction between autistic children and normally developing children (Lambert-Brown et al., 2015).

Celani (Celani et al., 1999) has analyzed the facial expression in a group of 10 autistic individuals (mean age 12;7), a group of 10 individuals with Down Syndrome (mean age: 12;3) and a control group composed by normal children (mean age: 6;3), matched for verbal mental age.

The first task consisted in pairing different faces according to emotions they expressed or according to other characteristics such as sex, age, type of hat, aspect.

The results have revealed that autistic children paired figures on the basis of aspects and other characteristics rather than emotional features. In contrast, children with Down Syndrome matched the figures according to the facial expressions.

However, when all the children were obligated to pair figures on the basis of emotional features, the autistic group's peformances were better than the "free sort" situation.

It means that, even if children with ASD prefer to match figures according to non-emotional characteristics, they do not exhibit difficulties in processing facial expressions.

Legiša (Legiša et al. 2012) has analyzed facial expressions in response to pleasant and unpleasant odors in 8 children with high-functioning autism ranging from 8 to 14 years and 8 typically developing children matched on chronological age and gender.

The results have shown that autistic children's facial expressions in response to pleasant and unpleasant odors were similar to control group.

Facial expressions of disgust were more recurring during the presentation of unpleasant odors, whereas facial expression of happiness were more frequent during pleasant stimuli.

Even if children with ASD manifested a relatively intact emotional response to stimuli, the two group have subtle differences in facial expressions.

As regards autistic group, it has been found fewer muscle movements in the lower part of their faces and a lower intensity and duration of muscle movements in their mouths and eyes zone.

There were no difference between the two groups when they had to judge pleasant odors such as vanilla, rose and mint but normal children were more likely to judge grass, chlorine, feces and cheese as unpleasant odors compared to autistic group.

Furthermore, 90% of normal children's verbal states were congruent with their facial reactions to stimuli, in contrast only 55% of autistic children's verbal responses were coherent with their reactions.

This study suggests that autistic individual possess a relatively intact facial responsiveness to stimuli but they have deficits in reporting their' own emotional reactions.

Children with ASD might have "an impairment in the connectivity between amygdala and functionally associated cortical areas" (Legiša et al., 2012).

In other words, impairment in cortical regions such as prefrontal cortex may be the cause of these differences between facial responsiveness to stimuli and verbal states (Legiša et al., 2012).

Typically developing individual automatically mimic a variety of facial expressions, gestures and behaviors. This ability facilitates social functions such as understanding the mind of other people and establishment of interpersonal relationship. It seems to be impaired in autistic individuals.

3.3 Communication and grammatical development in children with ASD

According to Prizant (Prizant, 1996) 50% of children with ASD never acquire verbal language as a primary tool to communicate with others.

In contrast, more recent studies have shown that only 25% of autistic children are non-verbal (Tager-Flusberg, 2005).

The exact origin of communication deficits in these population is still unknown, particularly due to the great variations of symptoms.

Most of the autistic children's parents start to be concerned about their children's development because of delays in communication.

However some children with ASD show language development identical to that of normally developing children. They rather exhibit deficits in pragmatic skills such as misunderstanding metaphors, irony, and difficulties modifying communicative stiles according to different contexts (Fernandes et al., 2011).

Even if autism is frequently identified because of language impairments, delays in expressive language in the first years of a child's life are not exclusively to autistic syndrome.

Expressive language level at age 5 is an important factor to discriminate between high-functioning or low-functioning autism. Asperger syndrome is a form of autism characterized by the absence of impairments in language and cognition but characterized by deficits in social interaction.

This syndrome suggests that, even if language impairment is considered one of the principal feature of ASD, delays in language development can not be considered a sufficient criterion for a diagnosis of autistic syndrome (Tager-Flusberg, 2005).

Over the years, the attention to the aspects of autistic language and communication has changed substantially. When the syndrome was identified, communication deficit was considered one of the principal features of autism.

On the contrary, in the last few years, new diagnostic manual such as DSM-V and ICD-11 have put emphasis on non-verbal language and pragmatic deficits. However communication impairment is still considered one of the principal criteria for the diagnosis of ASD (Tager-Flusberg, 2000).

As previously mentioned, there is a great variety in terms of timing and patterns of acquisition of linguistic abilities within autistic population.

A small number of children with ASD do not exhibit any deficits in language development, while the majority start to develop language later than normal children (Tager-Flusberg, 2005). Generally, if a child with autism acquires language before the fifth years of his life, it can be considered as a valid predictor of a positive result in autistic syndrome (Tager-Flusberg 2000).

Little is known about language in young children with autism because this syndrome is often diagnosed when the child is three years old. However, several researches have observed that the autistic symptoms surface before three age: a one-year-toddler with ASD is less responsive to his names, and to his mothers' voice (Tager-Flusberg 2005).

In a study conducted by Lord & Pickles (Lord & Pickles, 1996) two-years-old autistic children were analyzed. They possessed expressive and receptive language abilities comparable to a nine-months child, whereas other abilities falling between 16 and 21 months. Their expressive language continued to develop slower than normal children until the age of five years.

About 25% of autistic children's parents report that their children produce some words at 12 months but subsequently they lose these words before words explosion. This type of language regression is a feature unique to autistic syndrome. Researches have shown only a very small connection between language loss in autism and successive prognosis. In order to analyze the language acquisition in children with ASD, clinicians confide in parental account (Tager-Flusberg, 2005).

Lord (Lord et al., 1994) has designed a diagnostic interview called Autism Diagnostic Interview-Revised (ADI-R) which includes opening questions about communication and about the age of the first words and utterances.

Charman (Charman et al., 2003) has found that especially joint attention and imitation are considered longitudinal predictors of later language outcome in children with ASD.

He has analyzed non-verbal abilities at 12 months in a group of autistic children, and language outcome was assessed at 42 months in the same group of children.

They found that language at 42 months was correlated with performance in joint attention and imitation, but not with play abilities at 12 months.

So, joint attention and imitation skills may be considered as important goals for early intervention in children with ASD.

The majority of two and three-year-olds children with autism possess little language skills, so

the assessment of these early social skills may represent a valid prognostic indicator.

There are evidences that caregivers' social responsiveness to their children with ASD may have an effect on their social-communication abilities.

As previously outlined, Siller and Sigman (Siller & Sigman 2002) in their study, have shown that the parents of children with ASD who displayed verbal and non-verbal synchronization during joint attention episodes had children who developed better language abilities than children of parents who did not display synchronization.

These results suggest that there is a connection between parental sensitivity and the children's successive development of language abilities in children with ASD.

Kjelgaard and Tager-Flusberg (Kjelgaard & Tager-Flusberg, 2001) have found that there is a significant correlation between IQ and language outcome in children with ASD. Only the autistic children who possessed an higher IQ were capable to complete the language tests. However, it is important to observe that some autistic children with lower IQ possessed language abilities within the normal range, while some children who had a higher IQ manifested language impairments.

The results have shown that language abilities rarely can be independent from IQ in autistic population.

Tager-Flusberg (Tager-Flusberg et al., 1990) has conducted a longitudinal study on language acquisition in verbal children with ASD. She has analyzed six children with ASD and six children with Down syndrome, matched on MLU and age, interacting with their mothers.

She has collected 100 spontaneous utterances and subsequently they were analyzed using MLU, lexical diversity, and Index of Productive Syntax[15].

The results have shown that the autistic children's language followed a similar acquisition pattern of the children with Down syndrome and typically developing children as reported in literature. The fact that the majority of these children with ASD didn't show a different pattern of grammatical and lexical acquisition compared to other children suggests that autistic syndrome is not characterized by significant deficits in language development.

Bernabei (Bernabei et al., 2001) has analyzed 27 Italian children with ASD (mean age: 42.7 months) and 27 children with mental retardation (mean age 40.9 months)

In order to assess linguistic abilities, a questionnaire about communication and linguistic development in the second years of life was employed.

The parents had to reply to some questions about their children's communication in six

[15]Index of Productive Syntax (IPSyn) is a measure for evaluating and quantifying the grammatical complexity of children's spontaneous language samples (Miller, 1981).

different contexts.

The results have shown that both autistic and down syndrome subjects use crying as first modality to communicate and subsequently they use vocalizations.

No significant differences were found between the two groups as regards the the utilize of utterances and the use of words as communicative mean.

In both groups the number of words utilized increased with increasing age.

Tager-Flusberg and Sullivan (Tager-Flusberg & Sullivan, 1990) have asked to 27 children with autism, 27 mentally retarder and 17 normal subjects to describe a story depicted on a book. During their spontaneous speech, the research asked some questions about the charters' feelings. The results have shown that there are no differences between children with autism and the other two groups on measures of grammatical development (Mean Length of Utterance[16]).

However, the autistic and mentally retarded individuals had more difficulties explaining the characters' feeling than the normal subjects.

Another study (Bartak et al., 1975) has compared the grammatical development of a group of autistic children with a group of children with developmental language delay (DLD).

Results have shown that autistic children's morphology, MLU, and phrase structures presented several similarities to those of DLD group. However, the two groups showed differences in the functional use of language, in other words the utterances produced by autistic children were often formally exact but the children used them in a not adequate context and they tended to echo and repeat the sentences. So, the children with autism have a more deviant language abilities, a more serious deficit in comprehension and more problems in the social usage of language than DLD group.

As reported by these studies, the grammatical development in children with ASD follow the same patterns of normal children but it is delayed.

Although children with autism produce utterances which are formally correct they use language in atypical ways. For example, they tend to repeat part of words, words and phrases produced by other people, using the same intonation. This atypical peculiarity of autistic language is best known as echolalia.

This phenomenon is more frequent in subjects who have difficulty in producing spontaneous discourses.

When Leo Kanner described autism in 1943, echolalia was considered as a dysfunctional

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[16] Mean Length of Utterance is a measure of grammatical development in children. It is traditionally calculated by collecting 50 or 100 utterances produced by a child and dividing the number of total morphemes by the number of total utterances. A higher MLU means a higher level of language development (Brown, 1975).

feature. However more recent studies have shown that it has specific communicative, cognitive and social functions for autistic children.

They use echolalia as a mean of maintaining a role in the social contact and conversational turn taking when they not understand the topic and are not capable to respond correctly.

This atypical phenomenon in autism makes difficult to examine language acquisition in these disorder (Tager-Flusberg et al., 1990).

First among everyone, Itard in 1825, observed that Victor, the wild boy of Aveyron, described in the first chapter, produced verbal echoing.

This phenomenon has also been observed in other intellectual disabilities, dementia senilis, and aphasia.

In autism literature it has been reported two different types of echolalia: exact echolalia and mitigated echolalia. The former is described as the most automatic form of echolalia. It consists in a rapid repetition of the phrases uttered by others. The child does not manifest sign of comprehension of the phrases he repeats. This type of echolalia produced without a specific function is considered as a form of pre-categorical imitation and can be used to mark a conversational turn.

The latter refers to the imitation and modification of the speech. The autistic child who uses this type of echolalia tends to utilize the first person singular within the repeated sentence and to add an answer or an order. An example of the echoed sentence with the introduction of the first person singular is the following: “Where did you sleep?” is repeated as “I sleep”.

While an example of the modification of speech is “Where did you sleep” which becomes “I sleep!” (Roberts, 2014).

Another atypical feature of autistic individual’s language is the reversal of first and second person pronouns, in other words they often use the pronoun “you” to refer to themselves and the pronoun “I” to refer to their listener. This phenomenon is not unique to ASD even though it is more recurring in autism than in other syndromes.

The reversal of pronouns is linked to the difficulty in understanding the concept of self and others (Bone, 2012).

Leo Kanner (Kanner, 1943) observed that children with autism also tend to employ idiosyncratic lexical terms or neologism.

Another common feature of autistic communication is a breakdown in pragmatic abilities. Children with autism do not respond to communication efforts of others and this deficits may be provoked by severe problems in comprehension.

Even when autistic children respond to others, they have difficulties in maintaining the discourse topic and tend to reply with inappropriate comments.

According to Bone (Bone, 2012) another characteristic of autistic communication is atypical prosody. They tend to use exaggerated and monotonous intonation, a different accent, slow rhythm, inappropriate stress and an abnormal volume compared to typically developing children.

All these atypical phenomena in autism (echolalia, the reversal of pronoun, pragmatic deficits and atypical prosody) make difficult to examine language acquisition in this population (Tager-Flusberg, 1990).

However, as previously mentioned, there are some children with ASD who possess articulatory skills and grammatical abilities which fall into a normal range even if they acquire language later than normal children. Whereas other children with ASD are non-verbal (Tager-Flusberg, 2000).

As reported in the previous chapter, when typically developing child moves through prelinguistic stage of development, he relies on non-verbal behaviors, such as gesture and vocalizations, to express their needs. However, these behaviors are difficult to understand.

As language abilities increase, child starts to use symbolic communication which is simpler to interpret.

When language efforts are misinterpret by adults, normally developing child tends to repair language breakdowns through two different modalities: by modifying their first signal or by repeating it.

This capability to repair communication breakdowns depend on the ability to comprehend that a breakdown has verified and to comprehend the necessities of a communicative partner.

These competences in normally developing children surface at around 12 months of age. Within this period of time, vocalizations, gestures and combination of these two non-verbal behaviors are utilized to substitute a first communicative effort that has failed or to repeat it.

Contrary to normal children, autistic children are more likely to run into language breakdowns because of their deficits in joint attention.

Joint attentional behaviors involve the coordination of attention between an object and a communicative partner.

Communication breakdowns may occur when a child is not able to direct adult's attention toward an object or event through the use of gestures, vocalizations, and eye contact.

Given that, 25% of children with autism failing to acquire language, they rely on non-verbal means of communications (Keen, 2005).

However, non-verbal communicative forms used by normally developing children, such as the use of eye contact and pointing gestures, may be missing in autistic children.

Some children with ASD use informal gestures, self-injury, manipulation of adult's hand and aggression.

Since these forms lack of symbolic codes, the risk that the children's messages may be misinterpreted increases. The risk of a breakdown increases when the children use these forms of communication with a stranger.

Children with ASD tend to use not conventional forms of non-verbal behaviors compared to normal children (Keen, 2003).

Keen (Keen, 2005) in her study has analyzed the repair strategies used by 6 children with ASD ranging from 2 to 5 years and with fewer than 10 words or signs.

These children were videotaped while interacting with their mother.

All the participants were at the prelinguistic stage of language acquisition as demonstrated by the Communication and Symbolic Behavior Scales (CSBS)[17].

The tasks consisted in presenting to the children eight situations created to facilitate language production (e.g. placing objects out of reach so the children are forced to ask for help) and in observing two or three picture books.

Keen analyzed the number of words and signs produced by the children during these tasks.

Subsequently the clinician has conducted naturalistic observations in the children's home. She videotaped children while interacting with their mother and she coded communication breakdowns, repair strategy used by the children, atypical behaviors and changes in prosody.

The results have shown that four of children with ASD tended to change prosody and increase gestures when they repair communication breakdowns.

The majority of the participants made frequent breakdowns in communication but they tended to repair them utilizing several repair strategies.

What is interesting, is that substitutions strategies have been considered as a signal of more advanced language abilities than repetition strategy.

[17] The Communication and Symbolic Behavior Scales (CSBS) is a measure of language development in children from eight to twenty-four months, designed by Wetherby and Prizant in 1993. It is a standardized measure which use parent interviews.

Understanding what types of communication strategies are used by autistic children may provide a useful tool to early intervention. Development of these strategies may decrease frustration for the children (Keen, 2005).

Assessment and intervention may be more efficient if they concentrate upon reducing the risk of misinterpreted the communication efforts and if they teach repair strategies (Keen, 2003).

In literature, the use of such repair strategies in children with autism has received little attention.

According to Keen there is a strict correlation between communicative breakdown and the emergence of atypical behaviors in autistic children.

In another study, Keen has analyzed teacher-intervention package created to replace prelinguistic forms of communication with functional communication.

Teachers have received advices on how to promote replacement forms, and at the end of this study, children with ASD have replaced prelinguistic behaviors with functional communication.

So this study has revealed that it is possible to substitute subtle behaviors, which are frequently misinterpreted, with more conventional and symbolic forms of communication (Keen, 2001).

4. The study

This study has investigated the relationship between non-verbal language and grammatical proficiency in two preschool children with Autistic Spectrum Disorders (ASD) and one Typically Developing preschool child (TD).

The research has wondered whether children with high functioning autism who possess lower grammatical abilities tend to compensate them with non-verbal language (gestures and facial expressions).

Furthermore, the potential differences in the relationship between verbal and non-verbal language between the two children with ASD and the TD child have been investigated.

In literature, there are numerous descriptions about relationship between verbal and non-verbal language in TD children (Bates & Dick, 2002; Iverson & Goldin-Meadow, 2005; Caselli et al., 2005; Iverson et al.; 1994; Butcher & Goldin-Meadow, 2000; Church & Goldin-Meadow, 1986; Gibert & Prieto, 2014; Goldin-Meadow 2010, Iverson & Thelen, 1999; Tommasello et al., 1986).

In contrast there are fewer studies about these relationship in autistic populations (Rollins & Snow, 1998; Bernabei et al. 2001; Charman, 2003; Siller & Sigman, 2002).

There are even fewer studies about the non-verbal repair strategies used by children with ASD in order to compensate their lower verbal abilities (Keen, 2003; Keen, 2005).

Contrary to typically developing children, children with ASD are more likely to run into language breakdowns because of their deficits in joint attention behaviors, which includes the coordination of attention between an object or event and a communicative partner.

Communication breakdowns happen when a child with ASD is not able to direct other people's attention toward objects through the use of facial expressions, gestures, eye contact and vocalizations.

The study of Keen (Keen, 2005) has analyzed the repair strategies used by children in order to avoid breakdowns in communication, such as atypical behaviors and changes in prosody.

She has found that the majority of children with ASD tended to change prosody and increase gestures when they tried to repair communication breakdowns.

Understanding what types of repair strategies are utilized by children with ASD is a useful tool to early intervention and it may reduce frustration for the children.

Keen (Keen, 2005) thought that there is a very strict relationship between communicative breakdowns and the appearance of atypical behaviors in children with ASD.

So, the aim of this present study was to understand if children with ASD who possess lower grammatical abilities try to compensate them with non-verbal repair strategies such as different prosody, facial expressions, gestures and vocalizations.

As proposed by Keen, understanding these strategies is very useful to parents and teachers of children with ASD, in order to decrease frustration in the children.

The choice of conduct Explorative Case Studies[18] was dictated by few facts. The syndrome is rare enough to make it difficult to find a large homogeneous group of the same age and the same diagnosis, also the lack of cooperation from the educational facilities and from the parents of children with ASD, which tend not to disclose personal information, have lead me to this choice.

Even though the Case Studies lack a large group of participants, it allowed to collect more personal information from the parents which it would have not been possible in a larger scenario.

This qualitative research method provides the basis for the future application of ideas and extension of methods (Yin, 1994).

[18] The Case Study is a detailed study of one person, group or event. In a case study every aspect of the participants' life is analyzed to seek patterns and causes of behaviors. The hope is that the results obtained by a case study can be generalized to a larger population. Exploratory case study is considered as a prelude to social research (Yin, 1994).

4.1 Description of tools

4.1.2 The Mean Length of Utterance (MLU)

The videotapes were coded in order to assess the grammatical and non-verbal language in the three children.

To the assessment of grammatical development, the Mean Length of Utterance in words (MLUw) was employed.

The Mean Length of Utterance was originally introduced by Brown in 1973 and can be calculated in morphemes (MLUm) or words (MLUw).

MLU is traditionally calculated by collecting 50 or 100 spontaneous utterances and by dividing the total number of morphemes or words by the total number of utterances.

In a study conducted with Italian children, Devescovi and Pizzuto (Pizzuto & Devescovi 1995, cited in Orsolini 2000) have suggested to use MLU in words because they thought that MLU in morphemes might overestimate the grammatical abilities, since Italian possess a more complex verbal morphology than English.

In order to calculate MLUw they have included free morphemes such as articles, prepositions, pronouns, copula and auxiliaries.

They observed that MLU in words is very useful to assess the grammatical development of preschool children, while it is less suitable for older children. Even if two sentences possess the same length, they can have different complexities. For example the sentence a *totta potta bimba*=la bimba porta la torta[19] is less complex than the sentence *bimba picca aduta*=la bimba piccola è caduta[20].

Cipriani (Cipriani, 1993) has analyzed spontaneous speeches of six Italian children between the age of 19 and 39 months and they have identified four phase of sentence development:

- *Pre-syntactic phase (19-36 months, MLU: 1.2-1.6)*: during this phase the sentences correspond to telegraphic speeches composed by a succession of single words.

[19]Translation not available, it is a mispronunciation of the baby brings the cake

[20] Translaction not available, it is a contraction of the sentence "*the little baby has fallen down"*

In this phase children omit the verb (*pappa più/more foods*, *etto scimmione*[21]) or articles, clitic pronouns, prepositions (i.e. *bimbo dà/baby gives*).

- *Early syntactic phase (20-29 months, MLU: 1.6-2.8):* during this phase children begin to produce the first incomplete utterances (i.e. *bimbo prende cucchiaio mangia minestra/the baby takes spoon and eats the soup*), and they tend to omit phrasal connectors and also free morphemes such as articles and prepositions.
- *Nuclear phrases* (*24-33 months, MLU: 1.9-3.00):* during this phase children start to produce utterances with verbs and free morphemes (i.e. *il bambino mangia col cucchiaio/ the baby eats with spoon*).

  Children also produce coordinative and subordinative utterances (*il bambino prende il cucchiaio e mangia la minestra/the baby takes the spoon and eats the soup*).
- *Consolidation and Generalization of rules in complex structure (>27 months, MLU: >2,9):* children start to produce complex utterances with phrasal connectors (i.e. *dopo/ then, allora/, invece/meanwhile, perchè/why, sennò, anche/also, però/but*).

They also begin to use relative clauses (i.e. *ho sentito il campanello che suonava/I heard the ball which was ranging*).

Moreover Devescovi (Devescovi et al. 2005 cited in Caselli et al., 2005) has analyzed the relationship between grammatical and lexical development in English and Italian in normally developing children aged between 1;6 and 2;6.

The results have suggested that vocabulary size showed a significant contribution for MLU, reflecting an increased performance in Italian children.

So vocabulary size can be considered a powerful predictor of MLU in both English and Italian even if the grammar may get off the ground earlier in a richly inflected language such as Italian compared to poorly inflected language such as English.

On the basis of these considerations, the vocabulary size of each children has been analyzed, by counting the number of different words used by the three child.

[21] Translaction not available, it is a contraction of the sentence *"this monkey"*

As previously mentioned, Caselli (Caselli et al., 2005) has divided the vocabulary development in four phases:

- *Routines and Word Games:* in this phase children produce less than 10 words. The words produced in this phase are onomatopoeias (*tutù, coccodè/cluck cluck*).
- *Reference:* in this phase children produce 200 words, and 50% of these words are nouns.
- *Predication:* during this phase children start to produce more verbs and predicate
- *Grammar:* during this phase children produce 400 different words and start to acquire grammatical functors (articles, auxiliary verbs, adverbs, prepositions ecc.)

4.1.3 Facial Action Coding System (FACS) and Body Coding System (BCS)

In order to analyze facial expressions and gestures, the Facial Action Coding System (FACS) (Ekman & Friesen 1978) and Body Coding System (BCS) (Legisa 2013) were used.

FACS is a protocol for recognizing and labelling facial expressions, designed by Paul Ekman and Wallace Friesen in 1978.

Previous coding systems chose a subjective approach, focusing on the emotional interpretation (i.e. he is happy or sad) whereas FACS have standardized systems for defining the emotional state.

Therefore, this systems offer an objective measurement system, describing facial movements instead of interpreting the emotion that the expression is conveying.

FACS breaks down facial expressions into their smallest movements that Ekman and Friesen have called *Action Units* (AU).

Each AU produce a different change in facial appearance (Ekman & Friesen 1978).

The first version of FACS comprehended 46 AU whereas in the last version they have been reduced to 41. Moreover, the last version comprehends 14 AU in the head and gaze and others unrefined movements (i.e. showing the tongue) (Legisa, 2015).

Figure 4 shows an example of FACS analysis (for a further analysis see Appendix 2).

Figure 3: an example of FACS analysis. The man in figure 4 produces four different action units (AU 6+7+12+25) which express happiness. Source: NeuroComScience

FACS is a coding tool, while for the purpose of decoding nonverbal language the Interpretation System of Facial Expressions (ISFE), designed by Legisa, has been used (Legiša, 2013).

This tool is similar to the Emotional Facial Action Coding System (EMFACS) designed by Friesen and Ekaman (Friesen & Ekman, 1983), Legiša (Legiša, 2013) has added the manipulators and illustrators (for a further analysis see Appendix 3).

Manipulators are body movements of facial expressions having the function of reducing the intensity of an emotion.However it is not possible to understand which types of emotion they try to reduce. The more frequent types of manipulators are licking the lips (AD 19), or rolling the lips (AU 28). Manipulators has been often associated with anxiety.

Illustrators are body movements or facial expressions which are synchronized with the voice and have the function of emphasizing the verbal expressions. The more famous illustrators are the inner brow raiser, the outer brow raiser (AU 1+ AU 2) and the brow lowerer (AU 4) or lid tightener (AU 7).

In order to analyze body movements, the Body Coding Systems (BCS) has been used.

It is a protocol for recognizing and labelling gestures and body movements.

Similarly to FACS, BCS breaks down gestures into Action Units, and each AU correspond to different body movements. Figure 5 shows an example of BCS analysis.

Figure 4: an example of BCS analysis. This hands' position (AU 16) express anger. Source: NeuroComScience

All gestures and facial expressions were coded using ELAN[22], a professional software for the creation of annotations on video and audio files (Koster, 1974).

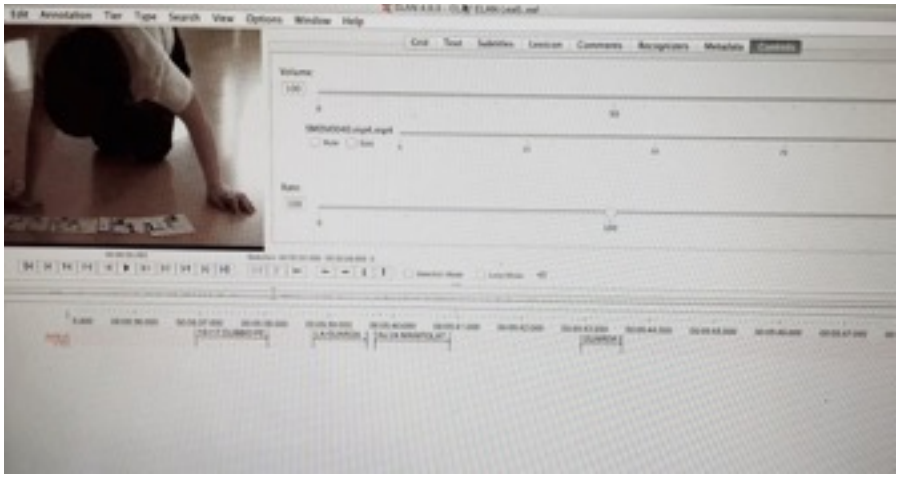


Figure 5: it shows the software ELAN (Koster, 1974), used for the analysis of the nonverbal language

[22] ELAN stands for EUDICO Linguistic Annotator. It was developed at the Max Planck Institute for Psycholinguistics in Nijmegen, The Netherlands. ELAN is available for all major operating systems (Windows, Mac OS, Linux) (Koster 1974).

4.2 Procedure

One child with ASD was recruited from a nursery school in North-East Italy, whereas two children (one child with ASD and one TD child) were recruited from a dance school in North-East Italy.

Both children with ASD have received a diagnosis of moderate autism according to DSM-V. The two children with ASD had different chronological ages (3;6, 6;0), due to the unavailability of educational facilities and parents of children with ASD.

The TD child was chosen because her age was halfway between the ages of the other two children (4;6).

The different ages of the two children with ASD has allowed researchers to observe how language in children with moderate autism evolves, and how children with moderate autism who possess lower grammatical abilities due to the lower age (autistic language is delayed compared to TD children) use repair strategies in order to compensate their communicative breakdowns.

The three children are all preschool age, which is the best age when using MLU to assess grammatical abilities. It is less suitable for older children.

The younger child with ASD was videotaped in his nursery school while interacting with his assistant teacher through a series of tasks.The other two children were videotaped in their dance school while interacting with their dance teacher through the same tasks of the other child.

The choice of videotaping the children in a nursery school and in a dance school was motivated by the fact that those were comfortable places for the participants.

Before starting the experiment, parents were asked to sign an informed consent and were informed about the type and the duration of experiment.

A few days before the experiment the assistant teacher and the dance teacher had been instructed regarding how to submit the different tasks and lead the conversation.

The experiment was conducted in two different silent rooms (one room in the nursery school and another in the dance school). In the rooms were the teacher, child and myself with a videocamera.

There were three tasks consisting in: (1) images descriptions, (2) questions about school, family and friends, (3) drawing.

The first tasks consisted of a figure and a little story description taken from P.F.L.I (Prove per

la valutazione Fonologica del Linguaggio Infantile/Test for phonological assessment in children's language) (Bortolini 1995).

The choice of using images taken from P.F.L.I is motivated by the fact that other linguistic tests such as TROG (Test for Reception of Grammar) (Bishop 1982), TCGB (Test di Comprensione Grammaticale per Bambini/Test for grammatical comprehension in children) (Cipriani & Chilosi 2006) and TVL (Test di Valutazione del Linguaggio/Test for language assessment) (Cianchetti & Fancello 1997) include simpler images (i.e. a dog who run after a cat) which do not allow wide descriptions.

The figure and the little story were presented by the teacher asking children to observe them carefully and subsequently to illustrate what they represented.

When the children didn't describe them spontaneously the teacher could ask some questions in order to stimulate conversation such as "Who are you seeing in this image?", "What are they doing?".

Figure 2 represent the first figure presented to the children.

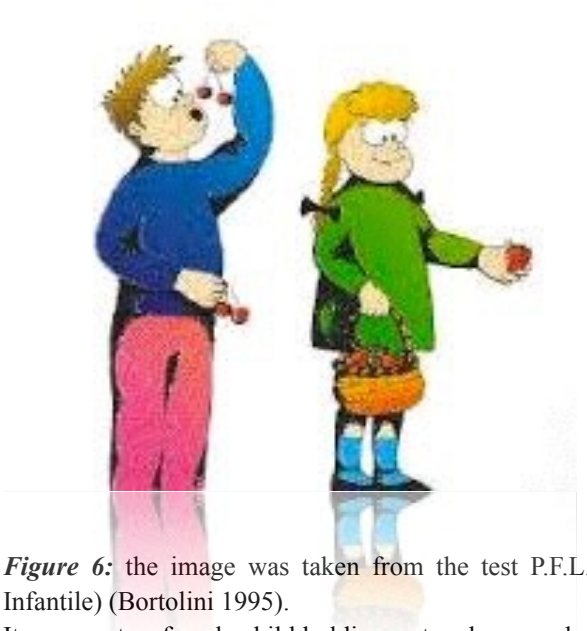


Figure 6: the image was taken from the test P.F.L.I (Prove per la valutazione Fonologica del Linguaggio Infantile) (Bortolini 1995). It
It represents a female child holding a strawberry and a basket full of strawberries and an older man holding two cherries and also eating two cherries.

After that, the teacher submitted to the children a little story composed by four different images and asked the children to put the images into order after observing it carefully and then to describe the little story.

The children were free to choose the order they prefer because the target was not to assess the cognitive abilities of the three children but the language capabilities.

The children were expected to describe a little spontaneously and in order to elicit conversation the teacher would initiate by asking some questions as “What is happening in the first image?”, “Who are you seeing in the first image?”.

The little story is represented in figure 3.

Figure 7: this little story was taken from the test P.F.L.I (Prove per la valutazione Fonologica del Linguaggio Infantile) (Bortolini 1995).

The second task consisted in a series of questions about school, friends and family.

The teachers were instructed to ask open questions (i.e. “Describe your mother!”, “Which activities do you like to do at nursery school?”) in order to collect wide speech samples rather than single words.

The third task consisted in make a drawing. The teachers submitted a blank sheet, asking the children to draw a picture and subsequently to describe it.

The choice of using images descriptions, open questions and drawing rather playing with toys or other activities is motivated by the fact that children with ASD have difficulties to share attention between toys and adults and tend to withdraw with toys and refuse to talk with adults.

4.2.1 Participants

Participants in this study were three preschool children: two males with high-functioning autism (HFA) and one typically developing female (TD).

All names have been invented in order to ensure the privacy of the three participants.

Marco, the first child with ASD who was analyzed, was 3.6 years old.

He was recruited at a nursery school in North-East Italy.

In 2015, at the age of 2.6, *Marco* was diagnosed as having ASD according to DSM-V criteria. The diagnosis was performed by neuropsychiatricians.

The degree of functioning (high, mild, low functioning) was assessed by CARS (Childhood Autism Rating Scale): he received a score of 32.5.

According to Schopler (Schopler, 1980) children with a score ranging from 30 to 37 are categorized as being moderately autistic.

After receiving the diagnosis of high functioning autism, Marco started to follow Denver and ABA therapies, which have helped him to socialize with other. He began to go to speech therapist who has helped him to enhance his language abilities.

His mother has reported that she started to become concerned about her child's development because at the age of 2.6 he still didn't talk. Marco tended to cry in order to grab people's attention instead of looking in the eyes.

His mother has reported that her child was displaying a normal development until 18 months. *Marco*, at 16 months, produced some words, such as *mamma/mum* and *barca/ship*, he ate pasta with meatballs and looked in the eyes. After 18 months of age, he stopped speaking, he began to eat only minced meat and small pasta and he began to avoid eye contact.

When *Marco* began to attend nursery school, he was afraid of other children and he refused to play anyone. After receiving several treatments *Marco* began to interact with them.

According to Marco's mother, he sometimes imitates other cartoon's behaviors, for example when he watches his favorite cartoon "*Masha e Orso"* he tends to imitate the protagonists' interjections such as "ahi ahi ahi!". She also reported that Marco often use facial expressions and gestures as a compensatory methods to express his needs.

The other child with ASD, *Simone,* was 6 years old. He was recruited at a dance school.

Simone was diagnosed in 2013, at the age of 3, as having PDD-NOS (Pervasive Developmental Disorder-Not Otherwise Specified) according to DSM-IV, which now corresponds to high functioning autism according to the new DSM-V diagnostic criteria.

Simone's mother has revealed that his child's deficits were not immediately obvious in early infancy, they became more evident as other children became more socially sophisticated, at around 2 years of age.

At first, Simone's social abilities seemed to be normal: his mother has reported that, from 10 to 18 months, *Simone* was interested and playful with other toddler at a baby park facility.

He began to say the first words at 18 months such as *papà/dad*, however his language was delayed until the age of 3. Unlike Marco, he didn't display language regression.

After receiving the diagnosis, Simone began to follow ABA method, which did improve his social skills, combined with session of speech therapy to enhance his language abilities.

When *Simone* started to attended nursery school he refused to interact with other children, he rather prefer to socialize with adults. After receiving treatment he began to interact with his peers.

According to *Simone*'s mother he looks in the eyes very frequently, and he is also involved in episodes of joint attention. She describes him as a brilliant child, she report that he is able to read, speak and understand different languages. He loves music and dancing, in fact he currently attends a dance class.

Giorgia, the typically developing child, was 4;6 years old at the time of my study.

She was recruited in the same dance school of Simone. Giorgia didn't have any social or language deficits.

Her mother has reported that she began to say the first words within the first year of her life.

Characteristics of three children are listed in table 1.

Subjects	Degree of Functioning	Chronological Age	Gender	CARS scores
Marco	HFA	3.6	M	32.5
Simone	HFA	6.0	M	/
Giorgia	TD	4.6	F	/

Table 1. Characteristics of three children. M= male; F= female; HFA= high functioning autism; TD= typically developing child; CARS= Chlidhood Autism Rating Scale score; / = Score of Childhood Autism Rating Scale (CARS) is not available

4.3 Results

4.3.1 Grammatical proficiency:

Table 2 shows the characteristics of the three participants, their MLUw scores and the MLU' s reference points proposed by Caselli (Caselli et al., 2005).

Table 3 shows the number of total words, the number of total unique words produced by each child.

Table 4 illustrates the number of different parts of speech produced by each child.

Subjects	Degree of functioning	Chronological Age	Gender	MLUw scores	Reference Points
Marco	HFA	3.6	M	1,21	> 2.9
Simone	HFA	6.0	M	4,05	> 2.9
Giorgia	TD	4.6	F	3,02	> 2.9

Table 2: Characteristics of the three children and their MLU scores. HFA= high functioning autism; TD= typically developing child;M= male; F= female; MLUw scores= The Mean Length of Utterance in words' scores

Subjects	MLUw scores	Total words	Total unique words	Time interval
Marco	1,21	121	39	00.33:00
Simone	4,05	405	181	00:13:50
Giorgia	3,02	302	128	00:19:31

Table 3: it show the MLUw scores of each child, the number of total words, the number of total unique words produced by the children, and the time interval during which the children express 100 utterances.

P	N	V	Adj	Art	Aux	Pron	Conj	Prep	Adv
Marco	74	13	18	7	0	0	0	0	9
Simone	82	86	60	46	6	21	44	19	41
Giorgia	69	37	26	38	2	22	29	21	58

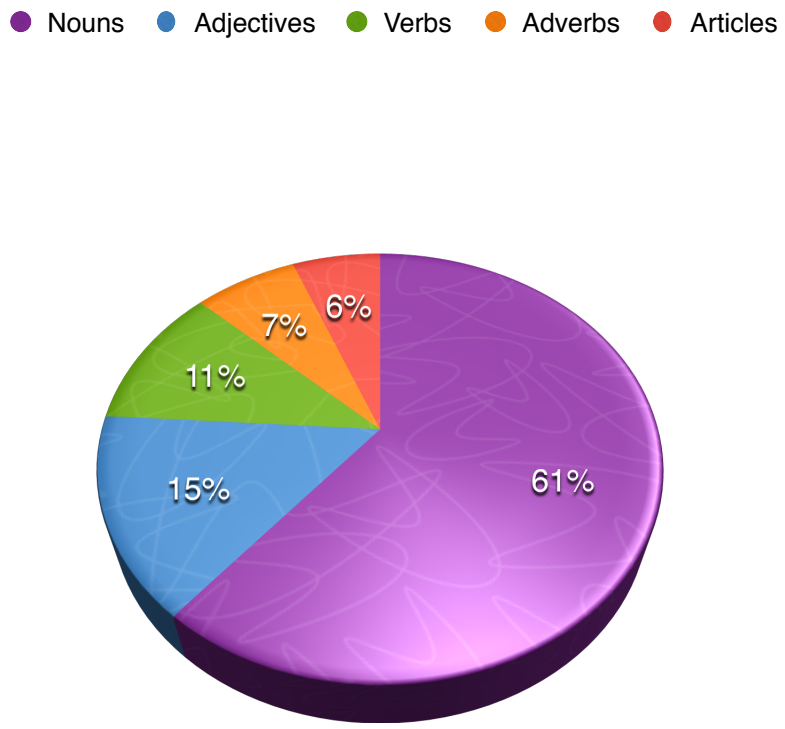
Table 4: The number of different parts of speech produced by three participants. N=Nouns; V=Verbs; Adj=Adjectives; Art= Articles; Aux=Auxiliaries; Pron= Pronouns; Conj= Conjunctions; Prep=Prepositions; Adv= Adverbs.

Marco:

The results revealed that *Marco* is still in the Pre-syntactic phase of sentence's development (19-36 months, MLU: 1.2-1.6) as suggested by Caselli et al. (Caselli et al. 2005).
He has obtained a MLU scores of 1.21.
During the Pre-syntactic phase the sentences correspond to telegraphic speeches, composed by a succession of single words (*Marco: mi mamma*=mia mamma/*m' mum*=my mommy).
In this phase children tend to omit the verb (*Marco: la rota*=voglio la ruota/ *the heel*=I want the wheel), or articles, prepositions, and clitic pronouns (*Marco: voio mamma!*want mommy/ *api*=apri/*'pen*=open).
According to Caselli (Caselli et al., 2005) a three-years-old child must produce complex utterances with phrasal connectors (e.g. dopo/then, invece/whereas, perchè/because, però/but, anche/also, allora/so, sennò/otherwise) and relative clauses (e.g. la mamma che abbraccia sua figlia/the mother who hugs her daughter).
This phase is called consolidation and generalization of rules in complex structure (MLU>2,9), and it is the last phase of sentence development.
Therefore, *Marco's* grammatical proficiency is different from that of typically developing child of the same chronological age.
The longest utterance produced by Marco was composed by three words (*Marco: voio la mamma!*/want my mommy!).
The words produced by Marco did not always correspond to those of adults, for example he said *bau/woof* to refers to a dog, and *ih-oh* to refers to a donkey.
Marco' s single-word utterances conveyed complex ideas: for example he said *mamma/mum,* but it meant that Marco wanted his mother.
As regards the number of different words produced by Marco, the results have revealed that Marco has produced 121 total words in 33 minutes and 39 unique words.
More than 50% of words produced by Marco were nouns (61%) (Marco: *mamma/mum, lallo*=cavallo; *bina*=bambina; *pita*=pista; *none*=Simone; *rota*=ruota/*nino*=paperino)[23].
So, as proposed by Caselli (Caselli et al., 2005) it means that Marco is still in the second phase of vocabulary development (Reference).

[23]Mispronunciations of *horse, female child, track, track and Donald Duck.*

The 15% of words produced by Marco were adjectives (*Marco: giaggio*=giallo;*bela*=bella; *gande*=grande)[24], 11% were verbs (*Marco: api*=apri, *gila*=gira, *dami*=dammi)[25], 7% were adverbs of affirmations or negations (*Marco: si*/yes; *no*/no), 6% were articles, even if he used protoforms having the function of the article *la* (*Marco*: ***l****mamma*= la mamma*,* ***e****mamma*=la mamma)[26].



Graphic 1: it shows the percentages of the different parts of speech produced by Marco.

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[24] Mispronunciations of words yellow, nice, big

[25] Mispronunciations of words open, turn, give me

[26] Contraction of *the mother*

Simone:

Simone obtained a MLU scores of 4.05, so it means that he is in the last phase of sentence development as proposed by Caselli (Caselli et al., 2005).

Simone has produced 15 complex utterances with phrasal connectors *(Simone: devi prendere il pallone e **poi** dire il colore preferito!/you must bring the ball and then say your favorite colour ; se la mangiano e **poi** se ne comprano un' altra/they eat it and **then** they buy another one)* and one relative clause (*Simone: il vento **che** soffia perché è autunno/the wind **that** blows because it is autumn).*

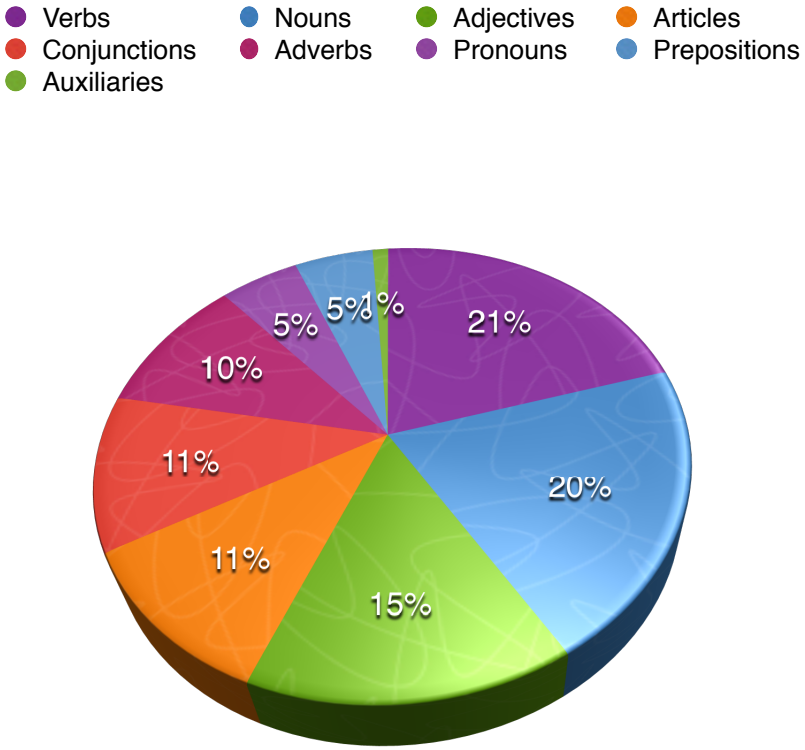
The longest utterance produced by *Simone* was composed by 13 words (*Simone: trovo mia mamma ma non c'è mio papà perché lavora tutto il giorno/I found my mum but there is no my dad because he works all day long).*

As regards vocabulary size, Simone has produced 405 total words in 13 minutes and 181 unique words.

He has produced a wide number of grammatical functors (articles, auxiliary verbs, adverbs, prepositions ecc.), so it means that he is in the last phase of vocabulary development (Grammar) as proposed by Caselli (Caselli et al. 2005).

The 21% of words produced by Simone were verbs (*Simone: **posso** anche **fare** l'erba*!/*I can also paint the grass, bene **continuiamo** altre sequenze/well, let' s continue other sequences*), 20% were nouns (Simone: *la mia **mamma**/my mum*; *no! in questa stanza con la **maestra Monica** e la **maestra Francesca/** no!In this room with teacher Monica and teacher Francesca)*, 15% were adjectives (*Simone: la mela così molto **rossa** molto **gialla** e **graziosa/** the apple so much red, much yellow and nice*), 11% were articles (*Simone: devo descrive **la** mamma e **il** papà/I must describe the mum and the dad*), 11% were conjunctions (*Simone:Possiamo giocare con la palla e dire il nostro colore preferito?/Can we play with the ball and say our favorite color?*).

The 10% were adverbs (*Simone: il mio frutto preferito è la mela gialla perché è **molto** buona/ My favorite fruit is the yellow apple because it is **very** good*), 5% were pronouns (*Simone: dai che poi **lo** prenderai!/come on! youl'll catch it!*), 5% were prepositions (*Simone: lo lancio **alla** maestra Monica e **alla** maestra Francesca/ I throw it to teacher Monica and teacher Francesca*), 1% were auxiliaries (*Simone: c'è solo azzurro **hai** detto/ there is only blu you have said*).



Graphic 2: it shows the percentages of the different parts of speech produced by Simone.

Giorgia:

Giorgia obtained a MLU scores of 3,02 which means that she is in the last phase of sentence development as suggested by Caselli (Caselli et. al, 2005).

She has produced complex utterances with phrasal connectors (2) (*Giorgia: vado a pranzo e* ***dopo*** *a colazione/I go for lunch and then for breakfast*) *and only one relative clause* (*Giorgia: sono amici* ***che*** *sono nuovi/they are friends who are new*).

The longest utterance produced by Giorgia was composed by 12 words (*Giorgia: c'è il vento e alla bambina le volava via il cappello/there is a wind and the hat flies away from the child*).

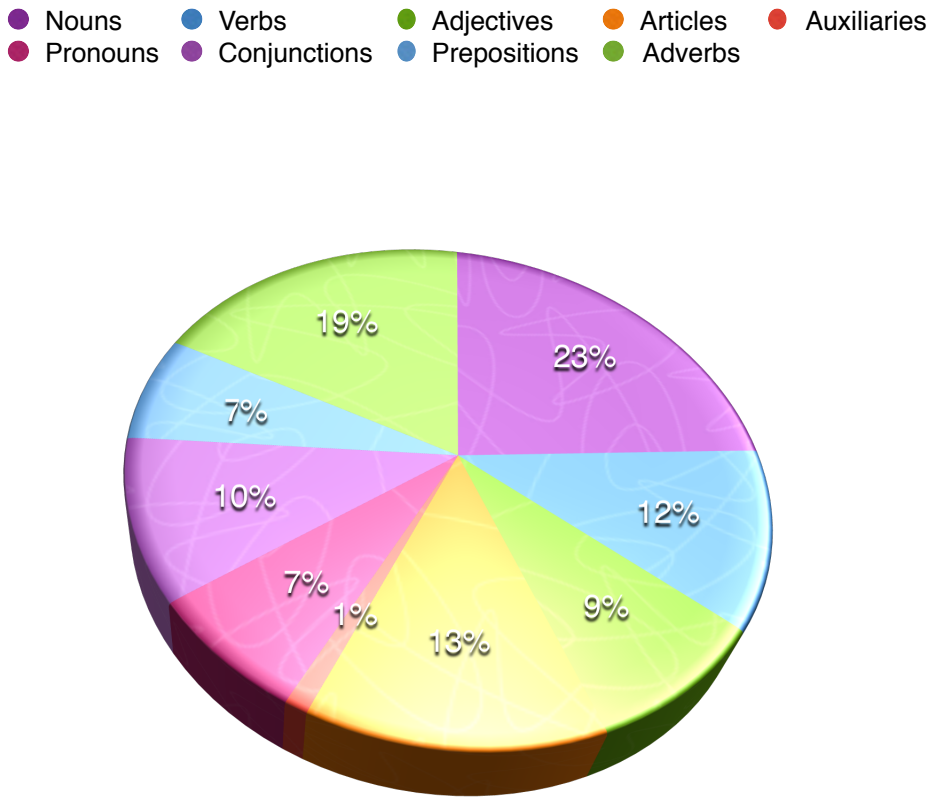
Regarding vocabulary size, she has produced 302 total words and 128 unique words in 19 minutes.

Giorgia has produced a large number of grammatical functors (articles, auxiliary verbs, adverbs, prepositions*),* so it means that she is in the last phase of vocabulary development (Grammar) as proposed by Caselli (Caselli et al., 2005).

The 23% of words produced by Giorgia were nouns (*Giorgia: Guido e nonna Tuia/Guido and grandmother Tuia; mangiavano le* ***ciliegie*** *e la* ***fragola****/they ate cherries and strawberries*), 19% were adverbs (*Giorgia: e vado a pranzo e* ***dopo*** *a colazione/and I have lunch and* ***then*** *breakfast*), 13% were articles (*e* ***la*** *mamma e* ***la*** *bambina/the mother and the daughter*), 12% were verbs (*Giorgia: mia nonna* ***attacca*** *tutto sul frigo/my grandmother attaches everything on the fridge*).

The 10% of words were conjunctions (*Giorgia: gioco* ***e*** *disegno/I play and draw*), 9% were adjectives (*Giorgia:* ***quetti***[27] *sono delle bombe/*these are the bombs) 7% prepositions (*Giorgia: una mia amica* ***del*** *mio asilo/ a my friend from my kindergarden*), 7% pronouns and 1 % were auxiliaries (*Giorgia: e alla bambina le* ***è*** *volato via il cappello/and to the girl the hat flew away*).

[27]Spelling and phonetic distortion of *these*



Graphic 3: it shows the percentages of the different parts of speech produced by Giorgia.

4.3.2 Non-verbal language

Marco:

During the first part of the experiment (images description) Marco didn't pay attention to the images and he didn't show interest in interacting with his assistant teacher.

He rather preferred to look around and he avoided eye contact.

He payed attention to the image only for few seconds, and he indicated the child on the picture without saying anything.

After some minutes Marco tried to run away from the teacher and he started to cry, showing sadness through the Unit Actions 1 + 4 (inner brow raiser and brow lowerer).

He indicated the door very frequently while shouting "mamma"/mum.

The teacher tried to stop him and he didn't show resistance.

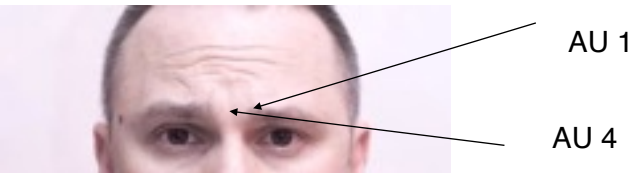


Figure 8: it shows the Action Units 1 (inner brow) and 4 (brow lowerer) which express sadness according to Paul Ekman (Ekman & Friesen 1978).
Source: NeuroComScience

When the teacher changed the task, Marco stopped to crying immediately. The second task consisted in drawing a picture.

He showed difficulties in fine motor skills, in fact he wasn't able to open and close the cap for the pen.

Marco tended to use manipulators very frequently, he often licked his hand and touched his noise.

When the teacher saw that Marco was quite, she tried to propose again the first task (images description). At first, Marco expressed interest through the AU 3[28] + AU 4 and he indicated the images, however after few minutes he started to cry again.

[28] According to Baby FACS (Oster, 1993) the Action Unit 3 express concentration or interest (swelling in the central part of the brows).

So, the teacher changed the task again (drawing) and Marco stopped to cry.

During the drawing task, Marco didn't express any facial expression, he didn't interact with the teacher except for making a request (Marco: api!=apri il pennarello!/open!).

Marco tended to draw keeping two different colors in his hands.

After some minutes, Marco sat down, and he clenched the fists in order to express angry.

Subsequently, the teacher presented to Marco some toys (a car, a dog, a donkey and Donald Duck) in order to grab his attention.

Marco started to play with the car manifesting interest through the AD 19 (showing the tongue).

When Marco played with the toys he used an atypical prosody (Marco: ca-ne!/do-g; po-ta=porta/do-or) in combination with echolalic speech (i.e. Teacher: Cane!/dog Marco: ca-ne/ do-g; Teacher: porta!/door; Marco: po-ta!/do-or).

When Marco played with Donald Duck he expressed joy through the AU 6+7+12+25.

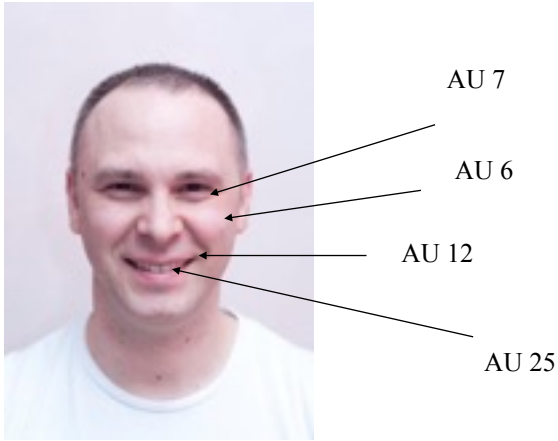


Figure 9: it shows the AUs 6 (cheek raiser) + 7 + (Lid Tightener) +12 (lip corner puller) + 25 (lips part) which express happiness. Source: NeuroComScience

Marco showed deficits in joint attention, in fact, during play activities he didn't show an interest interacting with his assistant teacher, he did not direct the attention of the teacher to objects and he avoided eye contact.

During the third task, consisting in questions about family and school, MArco did not show interest so the teacher interrupted the experiment.

At the end, the teacher started to count on her fingers and Marco was interested to it, in fact he touched the teacher's hand expressing happiness through the AU 6+12+25 and he looked her into the eyes for few seconds.

Simone:

The first task that the teacher submitted to Simone was the drawing task.

He started to draw three hearts but he didn't focus completely on the task, he interacted with the teacher and he tended to be distracted from different stimuli such as noises (Simone: Cos'è questo rumore?/What is this noise?) or video camera (Simone: non vedi c'è scritto Samsung!/it is written Samsung).

When Simone saw the video camera he expresses happiness through the AU 6+12.

Subsequently he resumed to draw and he tended to use manipulators very frequently such as scratching his head.

Simone often used echolalic speeches (Teacher: che cosa hai disegnato?/What did you draw?, Simone: disegnato!/draw; Teacher: è la palestra accanto/it is the next door gym; Teacher: cos'è la prima cosa che fai al mattino?/What is the first thing you do in the morning?, Simone: la prima cosa al mattino..mattino!/the first thing in the morning is..morning!).

When Simone used echolalia also his prosody was atypical: Simone's tone of voice sometimes sounded robotic and he has problems producing changes in tone of voice.

However, when he didn't use echolalia also his prosody was typical, and he produced changes in tone of voice, for example when he said "Noo i pennarelli/noo the markers" his voice expressed sadness.

When the teacher submitted the second task, consisting in images descriptions, Simone expressed interest through the AU 1+2 (inner brow raiser and outer brow raiser), AU 4 (brow lowerer), and AU 56 (head tilted to the right).

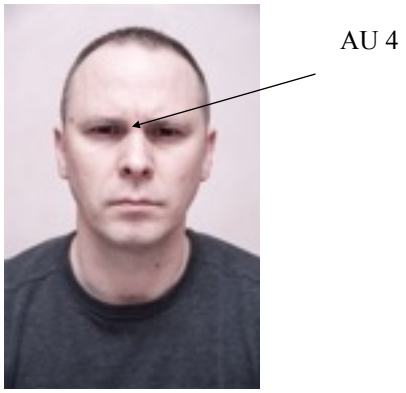


Figure 10: it shows the AU 4 (brow lowerer) which express interest

During the second task, Simone was not distracted by other stimuli in the room, he remained composed and focused on the task.

Moreover, Simone had an inclination to take conversational turns with his interlocutor, and he did not display deficits in joint attention. In fact during images description he showed interest interacting with his teacher and he directed the attention of the teacher to the images.

Simone often looked his interlocutor in the eyes in order to receive a feedback.

Simone's body movements were not fluid, they were often rapid and nervous.

During the last task (questions about family and school) Simone showed less interest. He replied to questions but he started to roll over, in order to express disinterest.

During this last task Simone asked the teacher to describe other stories or images, looking her into the eyes (*Simone: bene continuamo altre sequenze!/well, we describe other stories!*).

The teacher refused to submit other stories, and Simone expressed sadness through both verbal language (*Simone: Noo prendiamo la storia!/Noo we take the story!*) and nonverbal language (tone of voice and AU 1+4+15[29]+17[30]).

Subsequently he showed interest to different stimuli in the room through the AU 1+2 and AU 4, he avoided eye contact and he turned his back to his interlocutor.

Only one question captured Simone's attention (*Teacher: Cosa fai alla sera?/What types of activities do you usually do in the evening?*) in fact he replied showing happiness through the AU 6+7+12 (*Simone: guardo sulle righe, righe belle=legge i sottotitoli in inglese[31]/I look the lines*).

During other questions about family and school Simone turned the back to his interlocutor showing rejection and suggested to play with the ball, showing happiness through AU 6+12 (*Simone: possiamo giocare con la palla e dire il nostro colore preferito?/Can we play with ball and say our favorite color?*).

The teacher refused his request and he started to implore her through both verbal language (*Simone: và a prendere il pallone dai!/Take the ball come on!;dai che proviamo!/Come on we try!*) and nonverbal language (the tone of voice), looking her in the eyes.

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[29] Lip Corner Depressor

[30] Chin Raiser

[31] Simone's mother has reported that his son really like to read English subtitle.

When the teacher asked him to talk about his favorite dance's exercise he replied expressing happiness with non verbal language (AU 6+7[32]+12, arms up and tone of voice).

Figure 11: it shows the drawing realized by Simone, the older children with ASD (6;0). It represents three hearts, the green line represent the grass, the other lines (brown, orange, blu, purple and red) represent dogs.

[32] Lid Tightener

Giorgia:

During the first task (images description) Giorgia remained fixed and focused on task, she expressed interest through the AU 56 (head tilted to the right), however she expressed anxiety through the AU 17 and subsequently fear with the AU SP (3).

Figure 12: it shows the AU 17 which express anxiety

Figure 13: it shows the AU SP (3) which express fear

Her body movements were fluid and she altered her voice tone in order to convey different meanings.

She showed interest interacting with her interlocutor and she was well focused on the task.

She was able to share the attention between the task and the teacher, and she looked the interlocutor in the eyes very frequently.

In addition she used several pointing gestures to get the attention of the teacher in order to share the experience with her.

For the first part of the experiment she continued to express fear and anxiety through the AU 17 and moving her shoulders and head from left to right.

When the teacher submitted the second task (drawing), Giorgia immediately started to draw, remaining focused on this task until she concluded the drawing.

During the last task (questions about family and school) she expressed embarrassed smiles through the AU 6+7+12+15+24[33].

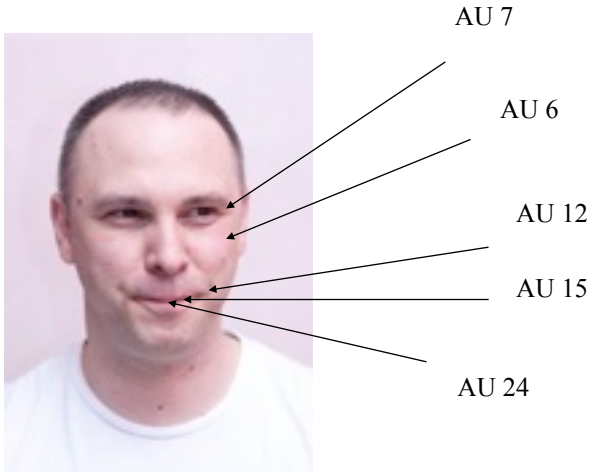


Figure 14: this figure shows the AUs 6 + 7 + 12 + 15 + 24 which express embarassed smile

[33] Lip pressor

4.4 Discussion

Grammatical proficiency

Regarding grammatical abilities the results have revealed that Simone, the older child with ASD, has achieved the same grammatical proficiency of Giorgia, the TD child, as shown by the MLUw scores obtained by the two children (Simone MLUw: 4,05; Giorgia MLUw: 3,02). They are both in the last phase of grammatical development (Consolidation and Generalization of rules in complex structure) as suggested by Caselli (Caselli et al. 2005).

During this last phase, the MLUw is greater than 2,9 and the children start to produce complex utterances with phrasal connectors (Simone: devi prendere il pallone e **poi** dire il colore preferito/you must bring the ball and then say your favorite colour*;* Giorgia: vado a pranzo e **dopo** a colazione/I go for lunch and then for breakfast), and relative clauses (Simone: il vento **che** soffia perché è autunno/the wind that blows because it is autumn; Giorgia: sono amici **che** sono nuovi/they are friends who are new).

The longest utterance produced by the two children was composed by almost the same number of words (Simone 13 words vs Giorgia 12).

The two children produced 100 utterances in a similar time interval (Simone 13 minutes vs Giorgia 19 minutes), whereas Marco, produced the same number of utterance in 33 minutes.

The results have also revealed that there is a strict relationship between MLUw scores and vocabulary size in all of the three participants, confirming the previous results obtained by Devescovi (Devescovi et al., 2005 cited in Caselli et al., 2005).

Simone, who obtained the highest MLU scores produced the highest number of total unique words. In contrast Marco obtained the lowest MLUw scores and also the lowest number of total unique words (Simone: 4,05 MLUw; 181 total number of unique words/ Giorgia: 3,02 MLUw; 128 total number of unique words/ Marco: 1,21 MLUw; 39 total number of unique words).

Both Simone and Giorgia produced a large number of grammatical functors (articles, auxilary, prepositions, adverbs, etc.) meaning that they are in the last phase of vocabulary development (Grammar) according to Caselli (Caselli et al., 2005).

The results revealed that both Marco and Giorgia tend to use more nouns compared to the other parts of speech (Giorgia 23% ; Marco 61%), whereas Simone tend to use more verbs, even if the difference between Simone's use of nouns and verbs is not significant (Verbs: 21%; Nouns: 20%).

All participants tend to use fewer auxiliary verbs compared to the other parts of speech (Marco: 0%; Simone: 1%; Giorgia: 1%).

Marco and Simone use a higher number of adjectives (Marco 15%; Simone 15%) and a fewer number of adverbs (Marco: 7%; Simone: 10%), whereas Giorgia tends to use more adverbs (19%) and fewer adjectives (9%).

Simone and Giorgia use a wide number of articles (Simone 11%; Giorgia 38), whereas Marco uses a very restricted number of articles (Marco: 6%).

Marco uses a protoform having the function of the article *la* (Marco: ***l****mamma= la* mamma,* ***e****mamma=la* mamma).*

Also Nelli (Nelli, 1998) analyzing the language development of Benedetta (see chapter 2.3) has observed that the first article that she used was *la* and that the she used protoforms having the function of this article.

Benedetta started to produce this article at the age of 22 months, so it is possible to observe that as regards articles, *Marco* was following the same pattern of normally developing children, even if his language develops at different times.

Simone and Giorgia have used almost the same number of pronouns (Simone: 5%; Giorgia: 7%), whereas Marco did not produce pronouns.

The majority of pronouns that Simone produced was clitics *(*Simone: *dai che poi* ***lo*** *prenderai/then you'll bring* ***it;*** *no io me* ***lo*** *lancio!/ no I will throw* ***it*** *to me*)*,* whereas Giorgia has used almost exclusively personal pronouns (*Giorgia: non so,* ***io*** *ho il film però!/ I don't know, but I have the film!; a* ***voi****!/to yours!*)

Simone has produced the highest number of conjunctions compared to the other children (Simone 11%; Giorgia 10%; Marco 0).

Simone has also used two conjunctions in the same utterance (*Simone: trovo mia mamma* ***ma*** *non c'è papà* ***perché*** *lavora tutto il giorno/ I find my mother* ***but*** *there is no my father* ***because*** *he works all day long*).

Simone and *Giorgia* have used almost the same number of prepositions (Simone 5%, Giorgia 7%) (*Simone: lo lancio* ***alla*** *maestra Monica e* ***alla*** *maestra Francesca/ I throw it* ***to*** *teacher*

Monica and ***to*** *teacher Francesca; Giorgia: no!* ***con*** *la maestra di piscina!/ no!* ***with*** *swimming instructor!*) whereas Marco did not produce prepositions.

So it is possible to affirm that Simone' s grammatical proficiency is similar to Giorgia, whereas Marco's grammar develops at different times.

Simone's mother revealed that her son showed grammatical impairments until he reached the age of 5 years.

Similar results have been obtained in a study conducted by Lord (Lord et. al 1996, cited in Tager-Flusberg, 2005), in which they have revealed that the expressive language in HF children continued to develop slower than TD children, until the age of 5 years.

Generally speaking, if a child with ASD is able to talk before the fifth years of his life, can be considered as a sign of a positive outcome (Tager-Flusberg, 2005).

So, it is possible to suppose that the Marco's grammar development shows a delay in acquisition but it also shows to follow the same pattern as the TD children.

The only difference between Simone and Marco's grammar abilities is due to the difference in age. Simone is 2.5 years older than Marco and the difference in language abilities is just due to an older child versus a younger one.

The two children had rather problems in pragmatic skills, such as register, negotiation of turn-taking, body movements and eye contact.

They both used an atypical prosody, their tone of voice sometimes sounded robotic, they use exaggerated and monotonous intonation, slow rhythm and inappropriate stress.

Prosody is used to carry social information beyond that expressed by the syntax of the utterances. It conveys the hierarchy of information within the sentences and the speaker's intentions.

Stress, for example, can be used to highlight elements within utterances in order to capture the listener's attention (Shriberg et al., 2001).

Both Marco and Simone have used echolalic speeches when they were not able to reply correctly (Teacher: cos'è la prima cosa che fai al mattino?/What is the first thing you do in the morning?, Simone: la prima cosa al mattino..mattino!/the first thing in the morning..morning!; Teacher: dov'è la mamma?/Where is your mum?/Marco: mamma!/ mum!).

Echolalia is a tool used by children with ASD in order to maintain a role in conversational turn taking, when they not understand the topic (Tager-Flusberg et al. 1990).

These results confirm the previous researches, which have shown that pragmatic abilities and grammar develop separately, as demonstrated by the fact that some children with ASD possess limited pragmatic skills even if their grammar is intacted (Shapiro et al, 1974; Tager-Flusberg et al., 1990; Rollins & Snow, 1998; Fernandes et al., 2011).

Douglas (Douglas, 2012) in her study, has calculated the MLU in five children with high functioning autism, and three out of five had the same chronological age of the three children analyzed in the present study.

As it possible to observe from table 6 the results obtained by Douglas are similar to those obtained in this study. Children with HF autism under the age of five, obtained MLU scores, which was under the reference values, whereas children over the age of 5 obtained MLU scores within the normal range.

Table 6 shows the MLU scores obtained by Douglas in her study. It has been reported only the scores obtained by the three children having a similar chronological age of Simone, Marco and Giorgia in order to compare the MLU scores.

Child	Age	MLU scores
Stuart	3;4	1,17
Rick	4;7	1,73
Brett	5;8	3,74

Table 5: it shows the chronological ages and the MLU scores of the three children with HF analyzed by Douglas in her study.

Graphic 4 shows the comparison between Stuart (3;4) and Marco (3;6), Rick (4;7) and Giorgia (4;6), Brett (5;8) and Simone (6;0).

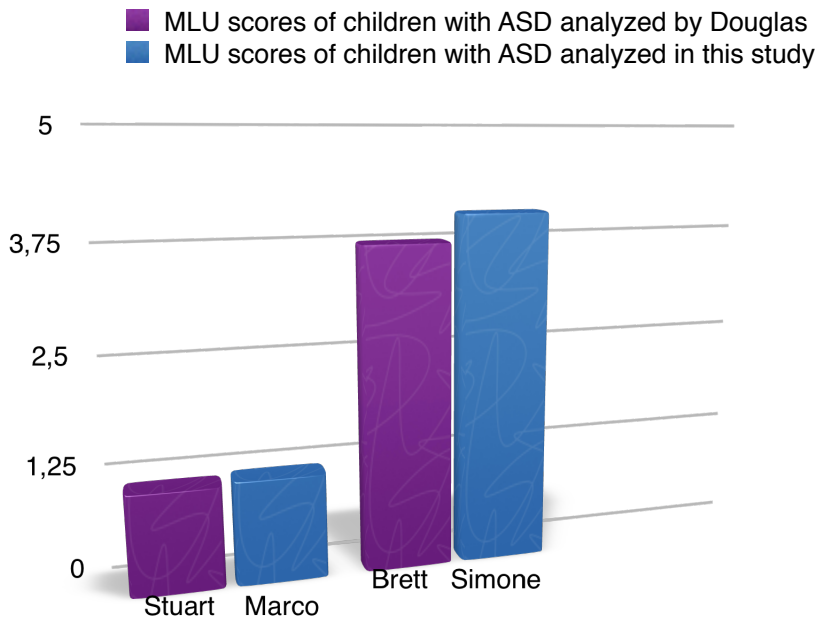
As it possible to observe, Stuart and Marco reached a similar MLU scores (Stuart: 1,17 vs Marco: 1,21), so they are both under the reference values for their ages (MLU: >2,9).

Also Simone and Brett reached a similar MLU scores (Brett: 3,74 vs Simone: 4,05), so they are both within the normal range (MLU: > 2,9).

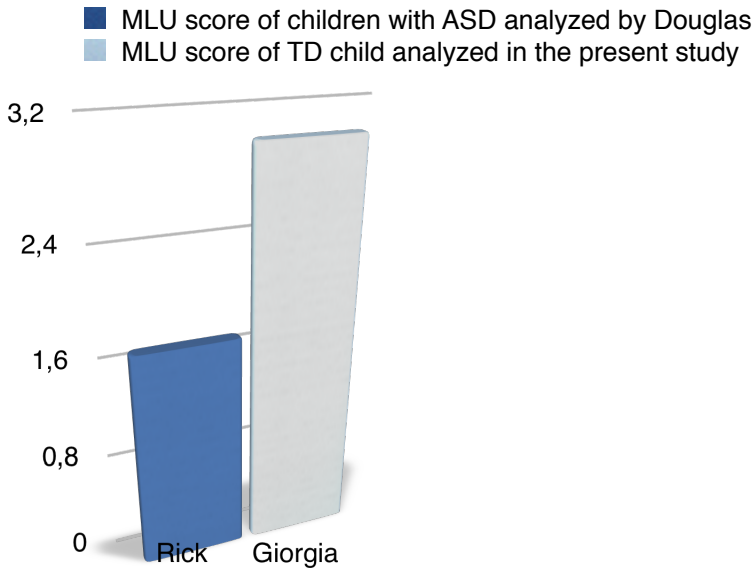
On the contrary, Giorgia's MLU score is higher than Rick (Rick: 1,73, Giorgia: 3,02), as shown by Graphic 5.

Rick is under the reference values for his age (MLU>2,9) whereas Giorgia is within the normal range.

These outcomes confirm the previous results obtained by Lord (Lord et. al 1996, cited in Tager-Flusberg, 2005), who has revealed that the expressive language of children with HF autism is delayed until the age of 5 years.



Graphic 4: it shows the comparison between the MLU scores of two children with ASD analyzed by Douglas (Douglas, 2012) and the MLU scores of the two children analyzed in the present study.



Graphic 5: it shows the comparison between the MLU score of children with ASD with the same chronological age of Giorgia, analyzed in the study of Douglas (Douglas, 2012), and the MLU score of Giorgia, the TD child analyzed in the present study.

Nonverbal language

As regard nonverbal language, it has been observed that Simone and Giorgia used both verbal and nonverbal language to communicate with their interlocutor.

Whereas Marco mainly used non verbal language to express his needs, since his grammatical abilities were still delayed.

For example Marco used and increased tone of voice, number of gestures, facial expressions and vocalizations with increased emphasis in order to request for an objects or a person, such as his mother (i.e. Marco shouted the words mother with an increased emphasis and tone of voice, while expressing sadness through the AUs 1+4 and while using pointing gestures in order to demand to see his mother).

On the contrary, Simone, the child with ASD who possessed higher grammatical abilities relied on utterances repetition or substitutions in order to require something (i.e Simone: Possiamo giocare con la palla e dire il nostro colore preferito?/Can we play with ball and say our favorite color?, Devi prendere il pallone e poi dire il colore preferito/you must take the ball and then say the favorite colour!, Prendi il pallone e dire il colore preferito/Take the ball and say the favorite colour!).

Similar results have been obtained by Keen in her study (Keen, 2005). She observed that four out of six children with HF autism aged 2 to 5 years who possessed lower grammatical abilities showed increased gestural and vocal prosody when they experienced breakdowns in communication with their mothers.

They often tried to repair this communication breakdown using a variety of strategies because of their limited verbal language abilities.

Profiling each autistic child's repair strategies may help to decrease frustration for the child and avoid the escalation of problematic behavior.

During the presentation of the three tasks, Giorgia and Simone were more interested to them, compared to Marco.

Giorgia expressed interest through the AU 56 (head tilted to the right), whereas Simone expressed interest through the AUs 1+2, AU 4 and AD 19 (showing the tongue).

In contrast, Marco expressed interest for the tasks only for few seconds, through the AUs 3+4.

Moreover Marco refused to collaborate with his teacher during all the three tasks, showing sadness through the AU 1+ 4. So the teacher was forced to change the tasks (she submitted some toys to Marco).

During this play activities Marco expressed happiness though the AUs 6+12 and interest through the AD 19.

In contrast, Simone was interest to the majority of the tasks, and when he was interest to the tasks his nonverbal language was similar to the TD child Giorgia.

On the contrary, when Simone was not interest to the task (i.e questions about family and school) and when the teacher had a break between one task and another, Simone' s nonverbal language was similar to that of Marco.

During these moments, Simone tended to turn his back on teacher, avoid eye contact and rolling around for the room, showing indifference for the task.

Giorgia, the TD child, showed interest for all the three tasks submitted by the teacher, even if she expressed anxiety through the AU 17 (one hand over the other hand), fear through the AU SP (3) (shoulder forward) and embarrassment through the AUs 6+7+12+15+24.

The other two children with ASD did not show embarrassment maybe because it is a secondary emotion[34]. It is more complex than primary emotion such as sadness and happiness, and deals with social interaction, so children with ASD may have difficulties to express it.

The body movements of the two children with ASD were not fluid, they were rapid and nerves compared to the TD child.

This rapid body movement may irritate the communicative partner, because he may interpret it as expression of anxiety; instead it is a typical feature of the autistic syndrome.

Both children with ASD utilized more manipulators (Marco often licked his hand and touched his noise, Simone often scratched his head and AU 28[35]) compared to Giorgia.

Simone and Marco used a lot of pointing gestures (i.e. Marco indicated out of the door while shouting *mamma/mum*, whereas Simone indicated the wall while saying *come quella parete la/just like that wall),* almost the same number of pointing gestures used by Giorgia.

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[34] According to Paul Ekman (Ekman et al., 1972) exists six primary emotion: happiness, angry, sadness, disgust, fear and surprise. They are universal and not determined by culture. The secondary emotions, are socially determined, and are emotional reactions to primary emotions. For example a person may feel ashamed as a result of becoming anxious, and in this case anxiety is the primary emotion whereas shame is the secondary emotion (Greenberg & Paivio, 2000).

[35] Lip Suck

As regards eye contact, Simone tended to look his interlocutor in the eyes almost with the same frequency of Giorgia, the TD child, whereas Marco avoided eye contact for the entire duration of the experiment.

Furthermore, Simone showed a lot of joint attentional behaviors; he was able to share the attention between the tasks and the teacher, on the contrary Marco did not show joint attention episodes, maybe because he was younger than Simone.

In fact as reported by Simone's mother, his son was not able to speak fluently until the age of five, and in parallel he was not able to interact with other people.

Comparing the present results with a study conducted by Legiša (Legiša et al., 2012) which has used Facial Action Coding Systems (FACS) with a group of children with high functioning autism (HF) and then compared the facial actions used by these children with a group of typically developing children (TD), it is possible to observe that there are some similarities.

Legiša (Legiša et al., 2012) has observed that children with HF autism produced fewer Action Units than TD children in the lower part of the face (mouth and chin).

Also the two children analyzed in the present study has expresser fewer AUs in the lower part of the face compared to Giorgia, the TD child.

The results have shown that Marco mainly produced AUs 1+4 (inner brow raiser and brow lowerer) and AUs 3+4 (brow lowerer), whereas Simone mainly produced AUs 1+2 (inner brow raiser and outer brow raiser) and AU 4 (Brow Lowerer).

However, Simone produced a wider number of AUs in the lower part of the face compared to Marco.

Giorgia, the TD child, produced mainly AUs 6+7+12+15+24 (cheek raiser, lid tightener, lip corner puller, lip corner depressor, lips part).

Furthermore, Legiša (Legiša et al., 2012) has found that all children with HF autism produced less AUs expressing embarrassment than TD children. Similar results have been obtained in the present study, in fact only Giorgia produced AUs 6+7+12+15+24 which express embarrassed smile.

Methodological limitations of the study

Some of the limitations of the present study, include the number of participants which is too small. Consequently it is difficult to find a significant relationship from the data.

Statistical tests require a larger sample to be considered a representative group of people, whom results can be generalized to the entire population.

Another limitation of the study is the lack of homogenous groups of the same chronological age. Autistic syndrome is rare enough to make it difficult to find large and homogeneous groups of the same diagnosis and ages.

Furthermore, the lack of cooperation from the parents of children with ASD, which tend not to disclose personal information, and from the educational facilities make the task even more difficult.

The lack of substantial numbers of prior researches on this topic is another limitation for the present study, but it can be also considered as an opportunity to identify a lack in the literature and to suggest further researches.

Only Deb Keen (Keen, 2003; Keen, 2005; Keen, 2014) has conducted similar researches, focusing on the repair strategies used by autistic children who possess verbal abilities, such as vocalizations, gestures and prosody.

The impossibility to devote years to studying the development of verbal and non-verbal language in autistic children, in order to measure change or stability over time is another limitations of this study. Affirming that autistic language follows the same pattern of language acquisition of typically developing children is based on previous findings in literature, and on informations collected by the mother of the older child with ASD.

All these limitations (lack of homogeneous group, lack of collaboration from parents and schools, rareness of the syndrome) have led me to the choice of conduct Explorative Cases Study. As suggested by Yin (Yin, 1994), exploratory case studies are considered as a prelude to research.

Cases Study lack of a large group of participants, but it allowed to collect more informations from the caregivers of children with ASD and to analyze in detail the participants, which it would has not been possible in a larger scenario.

Case Studies are qualitative research methods, which provide the basis for the future application of ideas (Yin, 1994).

Conclusions

This explorative research is aimed at investigating two main topics:

1. Do autistic children with lower grammatical abilities use non-verbal language as a compensatory method to communicate with others?
2. Does autistic children's grammatical and non-verbal development follow the same pattern of acquisition of typically developing children?

As regards for the first question, the results have shown that Simone, the older child with ASD (6;0 years old) used verbal and non-verbal language to communicate with his interlocutor in the same way.

He did not use non-verbal language as a compensatory method to express his needs because his grammatical abilities were not impaired or delayed. Similar results have been obtained by Giorgia (4;6 years old), the typically developing child.

On the contrary, Marco, the younger child with ASD (3;6 years old), mainly used non-verbal language to communicate with his interlocutor since his grammatical abilities were still delayed.

Marco used an increased tone of voice, number of gestures, facial expressions and vocalizations with increased emphasis in order to ask for objects or people.

Similar results were obtained by Keen in her study (Keen, 2005). She observed that four out of six children with HF autism aged 2 to 5 years who possessed lower grammatical abilities showed increased gestural and vocal prosody when they experienced breakdowns in communication with their mothers.

Marco did not use intentionally gestures and facial expressions as a compensatory method to express his needs and communicate with his interlocutor.

Although these behaviors may appear communicative, they are not used by the child with any intent to communicate.

Regarding the second question, the results have revealed that, Simone, possessed Giorgia's similar grammatical skills, as shown by the MLUw scores obtained by the two children (Simone's MLUw scores: 4,05 ; Giorgia's MLUw scores: 3,02). Both children were in the last

phase of grammatical acquisition (Consolidation and Generalization of rules in complex structure) as suggested by Caselli (Caselli et al., 2005).

On the contrary, Marco, the younger child with ASD (3;6 years old) obtained a MLUw score under the reference values for his age (Marco's MLUw scores: 1,21 vs MLUw score at 3;6 years > 2,9) as proposed by Caselli (Caselli et al., 2005), meaning that he was in the first phase of grammatical acquisition (Pre-syntactic phase).

However, the mother of the older child with ASD reported that the grammatical abilities of his son were delayed until the age of 5.

Comparing my results with other studies (Lord et al., 1996, Tager-Flusberg, 2005, Douglas, 2012) it can be concluded that the grammatical abilities of children with moderate autism follow the same pattern of acquisition of the typically developing children even if they are delayed until the age of 5.

Lord (Lord et al., 1996) has revealed that the expressive language in high functioning autism continued to develop slower than TD children until the age of 5.

Also Douglas (Douglas, 2012), analyzing five preschool children with moderate autism, found that the MLU scores obtained by the children under the age of 5 were under the reference values for their age. On the contrary, the children with ASD over the age of 5, obtained MLU scores within the normal range.

Therefore, Simone and Marco's grammatical abilities were very different due to the fact that Simone was older than Marco.

On the contrary their non-verbal language presented some similarities. Both children with ASD repeated words or sentences (echolalia), avoided eye contact, used an atypical prosody, and sometimes replied with non-appropriate comments. In addition, their movements were rapid and nervous.

Comparing Marco's and Simone's non-verbal behavior with that of Giorgia, it has been possible to observe several differences. Giorgia showed interest for all the three tasks submitted by the teacher, she looked into her interlocutor's eyes very frequently, she varied her tone of voice according to the situations and her body movements were fluid.

These results are similar to those obtained by other studies (Shapiro et al., 1974; Bartak et al., 1975; Tager-Flusberg et al. 1990; Fernandes et al., 2011) which have revealed that autistic children grammatical development and utterance structure are similar to those of typically developing children, but they diverge in pragmatic abilities.

Moving on the first topic investigated (the use of non-verbal language as a compensatory method to communicate with others) it is possible to conclude that recognizing these not intentional forms of communication could be very useful for teachers and parents of children with ASD in order to decrease frustration for the children and avoid the development of problematic behaviors. These non-verbal behaviors may be codified only through specific tools such as Facial Action Coding System (FACS) and Body Coding System (BCS).

Furthermore, it would be beneficial developing gestures and facial expressions into effective forms of communication and it could become a focus of communication intervention for children with ASD who are at the early phases of grammatical development.

It would be preferable to adopt this type of communication intervention before the age of 5, because as emerged from literature (Lord et al., 1996; Tager-Flusberg, 2005), acquiring language within this period of time can be considered a valid predictor of positive outcomes.

However, the chances of recovery depend on several factors: level of functioning, treatments and family environment.

Open educational considerations

Regarding treatments, currently there are several treatment options and educational approaches which can address some of the challenges associated with autism.

The most widely types of intervention, after the correct diagnosis is made and supported by evidence, are Applied Behavior Analysis (ABA) and Denver Model.

Within the types of interventions supported by significant evidence, the most widely used are: Applied Behavior Analysis (ABA) and Denver Model.

As mentioned in the first chapter, "ABA is defined as the process of applying behavioral principles to change specific behaviors and simultaneously evaluating the effectiveness of the intervention" (Lindgren & Doobay, 2001, p. 12)

This method emphasizes prevention and remediation of problematic behaviors.

ABA intervention gives attention to the social environments and to the antecedent conditions that cause the atypical behavior.

There are several studies which have documented the effectiveness of these methods with subjects with ASD. Clinicians suggest that the best outcomes occur when this treatment starts early in infancy, preferably prior to 5 years of age.

According to ABA treatment, parents may collaborate to the therapy. It is fundamental for the ABA method that caregivers are trained to provide the treatment at home.

This intervention can reduce atypical behaviors and improve social communication in children with ASD.

Denver Model uses a combined ABA developmental model, and it produces positive outcomes for young children with ASD (Lindgren & Doobay, 2011).

This treatment model, designed by Rogers (Rogers et al., 1986), focuses on the cognitive aspects of play. Play activities permit to develop social and emotional abilities.

Denver Model emphasizes social relationships and communication. Parents are actively involved in the program (Cottini & Vivanti, 2013).

Another type of intervention supported by scientific evidence is the TEACCH program (Treatment and Education of Autistic and Communication Handicapped Children).

This program is based on a collaboration between parents and operators, and it is individualized and used according the child's neurodevelopmental level.

Farci (Farci, 2008) in this article has reported an example of TEACCH application in a public school. The idea behind this project was the integration of children with ASD at school.

The treatment began after a careful assessment to determine every single child strengths and needs. Subsequently an Individualized Education Program (IEP) was drawn up in order to meet the children learning needs.

Parents were actively engaged in the program, because according to Schopler (Schopler, 1998) they are the real experts of their children.

This public school regularly met autistic children's parents in order to collect all the necessary information about their children (Farci, 2008).

Finding an adequate intervention is very difficult since ASD is considered a heterogeneous deficit.

There are two types of effective communication interventions for ASD: Picture Exchange Communication System (PECS) and Augmentative and Alternative Communication (AAC).

The first method, PECS, in an augmentative communication strategy for subjects with expressive language impairments.

Subjects are trained to exchange picture cards to ask for a desired object or event, and subsequently the therapist pairs with a verbal label for the object or event.

PECS also reinforces attempts to start social contact in individuals with expressive language impairments. This strategy can increase functional communication, especially when used as part of ABA treatment.

The second method, AAC, is a tool which helps to compensate expressive language impairments. This strategy ranges from the use of sign language to picture systems or complex electronic devices. AAC can enhance language abilities in children with ASD who do not develop functional speech (Lindgren & Doobay, 2011).

Other types of communication strategy are Modeling, which consists in using video technology to record actions for review, Visual Support, which includes the use of schedules and structured tasks present visually, and Computer-Aided Instruction, which can assist autistic subjects in learning academic abilities.

Another social communication intervention suggested by Lawton & Kasari (2012) is the Joint Attention and Symbolic Play/Engagement and Regulation treatment (JASP/ER).

Clinicians agree that autism intervention should target initiating joint attention (IJA), the main deficit of autistic syndrome. IJA refers to the way children with ASD use nonverbal language, such as pointing to share interest about objects, people or events. The IJA problems are related to the emergence of later language skills in these children.

According to Lawton & Kasari (2012), teachers should improve IJA of children with ASD in a public preschool context using the validated JASP/ER intervention.

- First of all, the teacher should choose appropriate and motivating toys and sitting in front of the child.
- Subsequently, she should play with the toy the child chooses or is looking at. If the child does not choose or look any toy, the teacher should stay within the child's attentional focus (objects or activities that the child looks for 3 or more seconds) in order to help him to engage with a toy.
- When the child performs a meaningful play act, she should imitate the same act within the child's attentional focus, and if the child does not perform any act, she should encourage to produce a meaningful play act within the child's attentional focus, for example by moving the toy closer to the child
- This teacher-child dyad collaborates to create a sequence of play events, which are predicable, repeatable and marked at the child's language level
- After a certain number of times the teacher should expect that the child initiates joint attention and asks for helps
- The teacher should talk about toys the child plays with, looking into the child's eyes and she should hold objects close to the child in a natural manner

As it is possible to observe, currently there are several treatments to enhance communication and gestural skills. On the contrary, there are fewer treatments to enhance the displaying of facial expressions.

I came to this conclusion after my research about treatments to enhance the using of facial expressions in autistic children. What I have found about this topic is that there are several researches which have tried to enhance facial expressions comprehension in children with ASD (Baron-Cohen et al., 2009; Golan et al., 2010; Golan & Baron-Cohen, S. 2006; Tanaka et al., 2010; Silver et al., 2001; Faja et al., 2007; Bölte, 2002; Lacava et al., 2007 etc.) but there are not any studies or methods that can teach how to use facial expressions consciously to compensate some language difficulties in autistic children.

The use of repair strategies in children with autism has received little attention. Only Keen (Keen, 2001) in his study has demonstrated the advantages of a teacher intervention package created to substitute prelinguistic behaviors in autistic children with functional communication.

First of all, the research has identified prelinguistic behaviors that the children used to communicate, such as pointing to reach an object, informal gestures, facial expressions, vocalization and body movements. Then, autistic children's teachers have received training about how to promote conventional and symbolic communication. During the study, prelinguistic behaviors decreased while replacement forms tended to increase.

These results confirm that with an appropriate intervention, some autistic children can replace prelinguistic behaviors with a conventional and symbolic communication.

Even if the prelinguistic forms used by the children were not problematic, they resulted unusual and so they were subject to misinterpretation. Consequently, when a child's communication effort is misinterpreted, the child may start to crying. Therefore, the recognition of conventional forms of non-verbal language permits to understand the child's favorite means of communication and to avoid the misinterpretations.

Using symbolic communication as an alternative way to communicate with others could improve the life of the autistic children and their parents (Keen, 2001).

I believe that concentrating on this aspect could be useful for defining new communication intervention strategies.

Autistic children caregivers should translate facial expressions into intentional forms of communication, teach children how to use them in order to interact with the external world when their verbal abilities are not enough develop to express their feelings and necessities. Developing facial expressions into effective forms of communication could become effective not only for children with ASD but also with any other developmental disability, such as hearing impairment[36].

As a first step, it should be recommendable for caregivers to have a proper training in recognizing and analyzing facial expressions in order to teach them to the children with ASD. Certainly, scientifically based strategies are recommended, but other types of intervention like the one that I have just suggested may also be useful for children with ASD.

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[36] This reflection arose out during a conversation about educational treatments with my assistant supervisor and supervisor

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Appendix 1

The rules for segmenting utterances

1. A sentence is an utterance: Daddy will go to the shop yester... tomorrow = 1 utterance.
2. A command is an utterance: Go home! = 1 utterance.
3. Run-on sentence with *and* should contain no more than one and joining clauses. Sentences with more than one *and* should be separated into additional utterances: We went on the car and we got to the zoo and we saw lots of animals and we ate chocolate = We went on the car and we got to the zoo /(and) we saw lots of animals /(and) we ate chocolate.
4. Other complex and compound sentences are treated as one utterance: She was sad because her daddy yelled at her because she broke the cup and spilled the baby's food.
5. Pauses, inhalations, and falling intonation mark the ends of one utterance: Eat (drop in intonation; pause)... oatmeal cookie - 2 utterances: Eat. Oatmeal cookie.

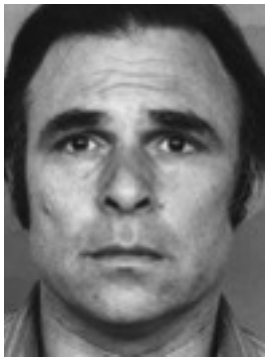
Table 7: It shows the rules for segmenting utterances according to Paul & Norbury (Paul & Norbury 2012).

Appendix 2

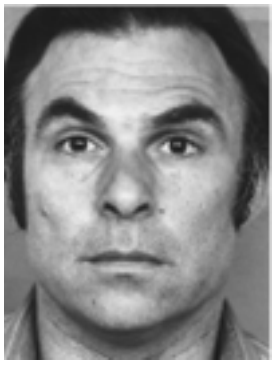
Facial Action Coding System (FACS) (Ekman & Friesen, 1978)

These are some of the Action Units labelled by Ekman and Friesen in 1978.

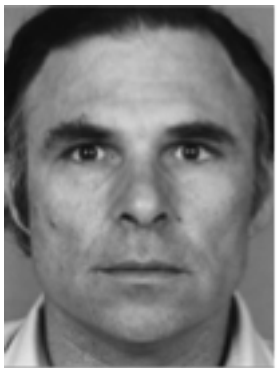
AU 4-Brow Lowerer



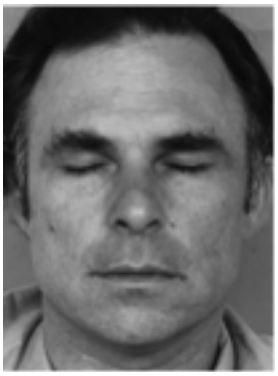
AU1-Inner Brow Raiser



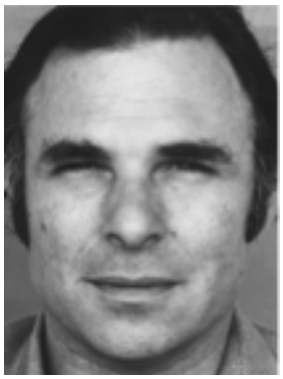
AU 3-Outer Brow Raiser



AU 5-Upper Lid Raiser



AU 43-Eyes Closed



AU 6- Cheek Raiser

Source: NeuroComScience

Additional AU

AU 38: dilated naris
AU 39: compressed naris

Descriptive Actions

AD 19: showing the tongue
AD 21: compressed neck
AD 29: jaw draw out
AD 30: lateral jaw
AD 31: chewing
AD 32: bite the lips
AD 33: blowing
AD 34: inflate the cheeks
AD 35: suck the cheeks
AD 36: tongue places on cheecks
AD 37: lick the lips

Head orientation

51: head turn left
52: head turn right
53: head up
54: head down
55: head tilt left
56: head tilt right
57: head forward
58: head back
59: head up and down
60: head turn left and right

Eyes orientation

61: eyes turn left
62: eyes turn right
63: eyes up
64: eyes down

Unrefined movements

40: smell
50: when the subject speaks
80: swallow
81: chew
82: shrug the shoulder
84: shake the head from backward to forward
85: shake the head from up to down

Appendix 3

Interpretation System of Facial Expressions (ISFE) (Legiša, 2013)

Some of the primary and second emotions labelled by ISFE:

Primary emotions:

Disgust

AU 9 + 17

AU 10

Anger

AU 10 + 23

AU 10 + 16 + 23

AU 4 + 5 + 7

Fear

AU 1 + 2 + 4 + 5 + 7

AU 20

Secondary emotions:

Disdain

AU R14

Embarassment

AU 6 + 7 + 12 + 15 + 24

Source: NeuroComScience

Appendix 4:

Body Coding System (BCS) (Legiša, 2013).

These are some of body movements labelled by BCS.

SP (3)

SP (4)

SP (5)

SP (6)

B (1+5)

B (2+5)

B (5)

AB(1)

The interpretation of some body movements labelled by BCS:

Disdain




Fear